# Instrumentation and Communications Officer (INCO) Console Handbook

# Space Transportation Vehicle Division

**Avionics Branch** 

Rev G, PCN-6 August 3, 2007



National Aeronautics and Space Administration

Lyndon B. Johnson Space Center Houston, Texas

DUTIES AND RESPONSIBILITIES	1
CONSOLE DATA BASE	2
COMMAND PROCEDURES	3
COMMAND MALSOPs	4
NON-COMMAND PROCEDURES	5
NON-COMMAND MALSOPs	6
DISPLAY BRIEFS	7
MISCELLANEOUS DATA	8
WORKSTATION PROCEDURES	9
ACRONYMS	Α

#### MISSION OPERATIONS DIRECTORATE

### INSTRUMENTATION AND COMMUNICATIONS OFFICER (INCO) CONSOLE HANDBOOK

REV G, PCN-6

August 3, 2007

Prepared by

Original approval obtained

David N. Miller

Communications Group

Approved by

Original approval obtained

Munish P. Patel Lead, Communications Systems Group

Original approval obtained

Jerry P. Jason Chief, Avionics Branch

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS

## INSTRUMENTATION AND COMMUNICATIONS OFFICER (INCO) CONSOLE HANDBOOK

REV G, PCN-6 August 3, 2007

#### PAGE CHANGE INSTRUCTION SHEET

Remove and replace the following:

Cover Signoff Table of Contents, iii-vii

SCP 2.2 SCP 3.3 SCP 5.5 SCP 7.23

**Distribution List** 

Delete the following: N/A

Add the following: SCP 3.10

#### **CONTENTS**

Section		Page
1.0	DUTIES AND RESPONSIBILITIES	
1.1	INSTRUMENTATION AND COMMUNICATIONS OFFICER (INCO)	
1.2	RF COMMUNICATIONS OFFICER	
1.3	INSTRUMENTATION OFFICER (INST)	
1.4	LEAD INCO DUTIES AND RESPONSIBILITIES	1.4-1
1.5	LEAD RF COMMUNICATION OFFICER DUTIES AND	
	RESPONSIBILITIES	1.5-1
1.6	LEAD INSTRUMENTATION OFFICER DUTIES AND	
	RESPONSIBILITIES	1.6-1
1.7	DATA COMMUNICATIONS OFFICER	1.7-1
1.8	COMMUNICATIONS PLANNING MEMORANDUM DEVELOPMENT	
	AND DISTRIBUTION	
1.9	CONSOLE CUE CARDS	
1.10	FLIGHT SOFTWARE CR REVIEW PROCESS	1.10-1
2.0	CONSOLE DATA BASE	
2.1	CONSOLE DOCUMENTATION AND LOG KEEPING	
2.2	PARAMETER DEFINITION AND RELATED SOURCE MATERIAL	2.2-1
3.0	PROCEDURES IN COMMAND PROCEDURES HANDBOOK	
3.1	COMMAND	
3.2	INCO OMI/PRELAUNCH PROCEDURES	
3.3	GENERAL INCO ASCENT/ENTRY PROCEDURES	
3.4	ASCENT/ENTRY COMM MALFUNCTION ACTIONS	
3.5	INCO A/E INCLINATION-SPECIFIC PROCEDURES	
3.6	ON-ORBIT TDRSS/GROUND OPERATION PROCEDURES	3.6-1
3.7	ANTENNA MANAGEMENT: COMM LINK HANDOVER	
	COMMAND PROCEDURES	3.7-1
3.8	LOSS OF S-BD U/L DUE TO TDRS CARRIER ONLY	
	DOPPLER TRACKING	
3.9	COMMAND SYSTEM: TFL/DFL BUILD & UPLINK	
3.10	METERED RTC UPLINK	
3.11	CREW ALERT	
3.12	TIME EXECUTE COMMAND BUILD PROCEDURES	-
3.13	CONTINGENCY RTC'S FOR EECOM/THERMAL	
3.14	COMMAND SYSTEM: SPARE RTC BUILD	
3.15	COMMAND SYSTEM: (MRTC'S/SPC'S/MSPC'S)	3.15-1
3.16	COMMAND SYSTEM: TABLE MAINTENANCE BLOCK UPLINK	
	COMMAND PROCEDURE	3.16-1
3.17	TBS	
3.18	USE OF THE GENERIC COMMAND BUILD TOOL	3.18-1
3.19	TBS	
3.20	COMMAND SAFING PROCEDURES	
3.21	MADS ACTIVATION/DEACTIVATION AND OPERATION	
3.22	SSR 1(2) CMD CONTROL PROCEDURES	
3.23	ORBITER INTERFACE UNIT (OIU) ACTIVATION/DEACTIVATION	3.23-1

Section		Page
3.24	ORBITER INTERFACE UNIT (OIU) CONFIGURATION CONTROL	3.24-1
3.25	OIU TO SSOR ENCRYPTION KEY COMMANDS	
3.26	PAYLOAD SIGNAL PROCESSOR CONFIGURATION	
	MESSAGE UPDATE TO THE SM GPC	3.26-1
3.27	PAYLOAD SYSTEM COMMANDS VIA GCIL	
3.28	PAYLOAD DATA LOAD AND PAYLOAD THROUGHPUT LOAD	0.2.
0.20	GENERATION	3 28-1
3.29	CCTV CAMERA POWER STATUS WITHOUT TV DOWNLINK	
3.30	CCTV CAMERA POSITIONING	
3.31	LOSS OF VOICE PROCEDURE	
3.32	S-BAND AND KU-BAND RADIATION MANAGEMENT DURING	0.01-1
0.02	PAYLOAD AND EVA OPERATIONS	3 32_1
3.33	KU-BAND PROTECTION BOX	
3.34	GPC MEMORY DUMPS (PLAYBACK OR REAL TIME)	
3.35	PAYLOAD INTERROGATOR AND S-BAND PM/FM FREQUENCY	J.J <del>4</del> -1
3.35		2.25.4
0.00	CONSTRAINTSS-BAND REAL-TIME DOWNLINK DATA RECOVERY	3.35-1
3.36		0.00.4
0.07	USING FM SYSTEM	3.36-1
3.37	COMMAND PLAN FOR CONTINGENCY SHUTTLE CREW SUPPORT	0.07.4
	(CSCS)	
3.38	COMMAND PLAN FOR UNMANNED UNDOCK FROM ISS	
3.39	ENHANCED LAUNCH VEHICLE IMAGING SYSTEM (ELVIS) OPS	
3.40	ORBITER BOOM SENSOR SYSTEM (OBSS) OPS	3.40-1
4.0	COMMUNICATION MALSOPS IN COMMAND PROCEDURES HANDBOO	K
4.1	TBS	
4.2	CTANDADD COMMANAL FUNCTION DECONFIGURATION	
	STANDARD COMM MALFUNCTION RECONFIGURATION	
	PROCEDURES	4.2-1
4.3	PROCEDURESTBS	4.2-1
4.3 4.4	PROCEDURES	4.2-1 4.4-1
	PROCEDURESTBS	
4.4	PROCEDURES TBS GCIL CONFIG PARAMETER EQUALS PNL	4.4-1
4.4 4.5	PROCEDURES TBS GCIL CONFIG PARAMETER EQUALS PNL LOSS OF NSP 2 BIT/FRAME SYNC (RCVR LOCK OK) S-BD D/L VOICE	4.4-1 4.5-1 4.6-1
4.4 4.5 4.6 4.7	PROCEDURES TBS GCIL CONFIG PARAMETER EQUALS PNL LOSS OF NSP 2 BIT/FRAME SYNC (RCVR LOCK OK) S-BD D/L VOICE LOSS OF S-BD MOD	4.4-1 4.5-1 4.6-1 4.7-1
4.4 4.5 4.6	PROCEDURES TBS GCIL CONFIG PARAMETER EQUALS PNL LOSS OF NSP 2 BIT/FRAME SYNC (RCVR LOCK OK) S-BD D/L VOICE	4.4-1 4.5-1 4.6-1 4.7-1
4.4 4.5 4.6 4.7 4.8	PROCEDURES TBS GCIL CONFIG PARAMETER EQUALS PNL LOSS OF NSP 2 BIT/FRAME SYNC (RCVR LOCK OK) S-BD D/L VOICE LOSS OF S-BD MOD LOSS OF S-BAND U/L VOICE AND/OR CMD LOSS OF PM CARRIER	4.4-1 4.5-1 4.6-1 4.7-1 4.8-1
4.4 4.5 4.6 4.7 4.8 4.9 4.10	PROCEDURES TBS GCIL CONFIG PARAMETER EQUALS PNL LOSS OF NSP 2 BIT/FRAME SYNC (RCVR LOCK OK) S-BD D/L VOICE LOSS OF S-BD MOD LOSS OF S-BAND U/L VOICE AND/OR CMD LOSS OF PM CARRIER ANT FAULT MSG	4.4-1 4.5-1 4.6-1 4.7-1 4.8-1 4.9-1
4.4 4.5 4.6 4.7 4.8 4.9	PROCEDURES	4.4-1 4.5-1 4.6-1 4.7-1 4.8-1 4.9-1 4.10-1
4.4 4.5 4.6 4.7 4.8 4.9 4.10 4.11 4.12	PROCEDURES TBS GCIL CONFIG PARAMETER EQUALS PNL LOSS OF NSP 2 BIT/FRAME SYNC (RCVR LOCK OK). S-BD D/L VOICE LOSS OF S-BD MOD LOSS OF S-BAND U/L VOICE AND/OR CMD LOSS OF PM CARRIER ANT FAULT MSG FM PROBLEM NO DOWNLINK VIDEO	4.4-1 4.5-1 4.6-1 4.7-1 4.8-1 4.9-1 4.10-1 4.11-1
4.4 4.5 4.6 4.7 4.8 4.9 4.10 4.11 4.12 4.13	PROCEDURES TBS GCIL CONFIG PARAMETER EQUALS PNL LOSS OF NSP 2 BIT/FRAME SYNC (RCVR LOCK OK) S-BD D/L VOICE LOSS OF S-BD MOD LOSS OF S-BAND U/L VOICE AND/OR CMD LOSS OF PM CARRIER ANT FAULT MSG. FM PROBLEM. NO DOWNLINK VIDEO LOSS OF CMD TO CCTV	4.4-1 4.5-1 4.6-1 4.7-1 4.8-1 4.9-1 4.10-1 4.11-1 4.12-1 4.13-1
4.4 4.5 4.6 4.7 4.8 4.9 4.10 4.11 4.12 4.13 4.14	PROCEDURES TBS GCIL CONFIG PARAMETER EQUALS PNL LOSS OF NSP 2 BIT/FRAME SYNC (RCVR LOCK OK) S-BD D/L VOICE LOSS OF S-BD MOD LOSS OF S-BAND U/L VOICE AND/OR CMD LOSS OF PM CARRIER ANT FAULT MSG FM PROBLEM NO DOWNLINK VIDEO LOSS OF CMD TO CCTV MADS RECORDER DOES NOT RESPOND TO A RECORD COMMAND	4.4-1 4.5-1 4.6-1 4.7-1 4.8-1 4.9-1 4.10-1 4.11-1 4.12-1 4.13-1 4.14-1
4.4 4.5 4.6 4.7 4.8 4.9 4.10 4.11 4.12 4.13 4.14 4.15	PROCEDURES	4.4-1 4.5-1 4.6-1 4.7-1 4.8-1 4.9-1 4.10-1 4.11-1 4.12-1 4.13-1 4.14-1 4.15-1
4.4 4.5 4.6 4.7 4.8 4.9 4.10 4.11 4.12 4.13 4.14 4.15 4.16	PROCEDURES TBS GCIL CONFIG PARAMETER EQUALS PNL LOSS OF NSP 2 BIT/FRAME SYNC (RCVR LOCK OK) S-BD D/L VOICE LOSS OF S-BD MOD LOSS OF S-BAND U/L VOICE AND/OR CMD LOSS OF PM CARRIER ANT FAULT MSG FM PROBLEM NO DOWNLINK VIDEO LOSS OF CMD TO CCTV MADS RECORDER DOES NOT RESPOND TO A RECORD COMMAND NO SSR PB MODULATION NO KU ACQUISITION	4.4-1 4.5-1 4.6-1 4.7-1 4.8-1 4.10-1 4.11-1 4.12-1 4.13-1 4.14-1 4.15-1 4.16-1
4.4 4.5 4.6 4.7 4.8 4.9 4.10 4.11 4.12 4.13 4.14 4.15 4.16 4.17	PROCEDURES TBS GCIL CONFIG PARAMETER EQUALS PNL LOSS OF NSP 2 BIT/FRAME SYNC (RCVR LOCK OK) S-BD D/L VOICE LOSS OF S-BD MOD LOSS OF S-BAND U/L VOICE AND/OR CMD LOSS OF PM CARRIER ANT FAULT MSG. FM PROBLEM. NO DOWNLINK VIDEO LOSS OF CMD TO CCTV. MADS RECORDER DOES NOT RESPOND TO A RECORD COMMAND. NO SSR PB MODULATION. NO KU ACQUISITION. KU FORWARD LINK PROBLEM	4.4-1 4.5-1 4.6-1 4.7-1 4.8-1 4.9-1 4.11-1 4.12-1 4.13-1 4.14-1 4.15-1 4.16-1 4.17-1
4.4 4.5 4.6 4.7 4.8 4.9 4.10 4.11 4.12 4.13 4.14 4.15 4.16 4.17 4.18	PROCEDURES TBS GCIL CONFIG PARAMETER EQUALS PNL LOSS OF NSP 2 BIT/FRAME SYNC (RCVR LOCK OK) S-BD D/L VOICE LOSS OF S-BD MOD LOSS OF S-BAND U/L VOICE AND/OR CMD LOSS OF PM CARRIER ANT FAULT MSG FM PROBLEM NO DOWNLINK VIDEO LOSS OF CMD TO CCTV MADS RECORDER DOES NOT RESPOND TO A RECORD COMMAND NO SSR PB MODULATION NO KU ACQUISITION KU FORWARD LINK PROBLEM KU RETURN LINK PROBLEM	4.4-1 4.5-1 4.6-1 4.7-1 4.8-1 4.9-1 4.10-1 4.12-1 4.13-1 4.14-1 4.15-1 4.16-1 4.17-1 4.18-1
4.4 4.5 4.6 4.7 4.8 4.9 4.10 4.11 4.12 4.13 4.14 4.15 4.16 4.17 4.18 4.19	PROCEDURES TBS GCIL CONFIG PARAMETER EQUALS PNL LOSS OF NSP 2 BIT/FRAME SYNC (RCVR LOCK OK) S-BD D/L VOICE LOSS OF S-BD MOD LOSS OF S-BAND U/L VOICE AND/OR CMD LOSS OF PM CARRIER ANT FAULT MSG FM PROBLEM NO DOWNLINK VIDEO LOSS OF CMD TO CCTV MADS RECORDER DOES NOT RESPOND TO A RECORD COMMAND NO SSR PB MODULATION NO KU ACQUISITION KU FORWARD LINK PROBLEM KU RETURN LINK PROBLEM OIU FAIL TO COMMAND	4.4-1 4.5-1 4.6-1 4.7-1 4.8-1 4.10-1 4.11-1 4.12-1 4.13-1 4.14-1 4.15-1 4.16-1 4.17-1 4.18-1 4.19-1
4.4 4.5 4.6 4.7 4.8 4.9 4.10 4.11 4.12 4.13 4.14 4.15 4.16 4.17 4.18 4.19 4.20	PROCEDURES TBS GCIL CONFIG PARAMETER EQUALS PNL LOSS OF NSP 2 BIT/FRAME SYNC (RCVR LOCK OK) S-BD D/L VOICE LOSS OF S-BD MOD LOSS OF S-BAND U/L VOICE AND/OR CMD LOSS OF PM CARRIER ANT FAULT MSG. FM PROBLEM. NO DOWNLINK VIDEO LOSS OF CMD TO CCTV MADS RECORDER DOES NOT RESPOND TO A RECORD COMMAND NO SSR PB MODULATION NO KU ACQUISITION KU FORWARD LINK PROBLEM KU RETURN LINK PROBLEM OIU FAIL TO COMMAND STATIC FRAME RECOVERY	4.4-1 4.5-1 4.6-1 4.7-1 4.8-1 4.10-1 4.11-1 4.12-1 4.14-1 4.15-1 4.16-1 4.18-1 4.19-1 4.20-1
4.4 4.5 4.6 4.7 4.8 4.9 4.10 4.11 4.12 4.13 4.14 4.15 4.16 4.17 4.18 4.19 4.20 4.21	PROCEDURES TBS GCIL CONFIG PARAMETER EQUALS PNL LOSS OF NSP 2 BIT/FRAME SYNC (RCVR LOCK OK) S-BD D/L VOICE LOSS OF S-BD MOD LOSS OF S-BAND U/L VOICE AND/OR CMD LOSS OF PM CARRIER ANT FAULT MSG. FM PROBLEM. NO DOWNLINK VIDEO LOSS OF CMD TO CCTV MADS RECORDER DOES NOT RESPOND TO A RECORD COMMAND. NO SSR PB MODULATION. NO KU ACQUISITION. KU FORWARD LINK PROBLEM KU RETURN LINK PROBLEM OIU FAIL TO COMMAND STATIC FRAME RECOVERY NO NSP MODULATION TO THE MMU	4.4-1 4.5-1 4.6-1 4.7-1 4.8-1 4.9-1 4.11-1 4.12-1 4.13-1 4.15-1 4.16-1 4.17-1 4.19-1 4.20-1 4.21-1
4.4 4.5 4.6 4.7 4.8 4.9 4.10 4.11 4.12 4.13 4.14 4.15 4.16 4.17 4.18 4.19 4.20	PROCEDURES TBS GCIL CONFIG PARAMETER EQUALS PNL LOSS OF NSP 2 BIT/FRAME SYNC (RCVR LOCK OK) S-BD D/L VOICE LOSS OF S-BD MOD LOSS OF S-BAND U/L VOICE AND/OR CMD LOSS OF PM CARRIER ANT FAULT MSG. FM PROBLEM. NO DOWNLINK VIDEO LOSS OF CMD TO CCTV MADS RECORDER DOES NOT RESPOND TO A RECORD COMMAND NO SSR PB MODULATION NO KU ACQUISITION KU FORWARD LINK PROBLEM KU RETURN LINK PROBLEM OIU FAIL TO COMMAND STATIC FRAME RECOVERY	4.4-1 4.5-1 4.6-1 4.7-1 4.8-1 4.10-1 4.11-1 4.12-1 4.13-1 4.16-1 4.16-1 4.17-1 4.18-1 4.20-1 4.20-1 4.21-1

Section		Page
5.0	NON-COMMAND PROCEDURES	
5.1	COMMAND SYSTEM: COMMAND APPLICATION	
	INITIALIZATION IN THE MCC	5.1-1
5.2	PCMMU NOTES, PCMMU PGM MODE SELECTION	
	AND AUTO LDR TFL LOAD	
5.3	INTERPRETING PCMMU ELEMENT BYPASS INDICATIONS	
5.4	RECORDER DATA PROTECTION	
5.5	KSC/MCC FLIGHT RECORDER STATUS REPORTING	
5.6	POSTFLIGHT RECORDS	
5.7	SM GPC REASSIGNMENT ACTIONS/CLEANUP	
5.8	ACCU BYPASS	
5.9	SSV CONFIGURATION	
5.10	MULTICALS AND CALIBRATION DATA CHANGES IN THE MCC	5.10-1
5.11	THERMAL PARAMETERS	5.11-1
5.12	TO DETERMINE REDUNDANCY OF AUDIO CONFIGURATION	
	CONTROL DATA	5.12-1
5.13	INTEGRATED LOAD CHECKOUT (ILC) SUPPORT PROCEDURE	
	AND SHUTTLE MISSION SIMULATOR (SMS) - MCC LOAD	
	CHECKOUT	5.13-1
5.14	GPC VARIABLES FOR USE IN INCO/COMM/INST	
	TROUBLESHOOTING	5.14-1
5.15	PARAMETERS LISTED ACCORDING TO MDM AND DSC	5.15-1
5.16	POSTLANDING ANTENNA POINTING TO TDRS	5.16-1
5.17	MINIMUM-RANGE CALCULATIONS FOR RF-SENSITIVE	
	PAYLOADS	5.17-1
5.18	EMCC DOCUMENTATION ENGINEER DUTIES AND	
	RESPONSIBILITIES	5.18-1
5.19	INCO DUTIES AND RESPONSIBILITIES RELATIVE TO EMERGENCY	
	MISSION CONTROL CENTER (EMCC) PREPARATION,	
	ACTIVATION, AND OPERATION	5.19-1
5.20	INCO SYSTEMS POWERDOWN OPTIONS	5.20-1
5.21	DIGITAL TELEVISION SYSTEM RESOURCES ON CONSOLE	5.21-1
5.22	FOCUSED INPSECTION USING SENSOR PACKAGE 2	5.22-1
6.0	NON-COMMAND COMMUNICATION MALSOPS	
6.1	COMM-RELATED ONBOARD FAULT MESSAGES	6.1-1
6.2	SUGGESTED ACTIONS FOR OI MDM AND DSC CARD	
	FAILURES AFFECTING INCO	6.2-1
6.3	COMMUNICATION SYSTEMS POWER REQUIREMENTS AND	
	THERMAL LIMITS	6.3-1
6.4	HOT MIKE ON A/G OR A/A	6.4-1
6.5	PRELAUNCH LOSS OF CDR, PLT, MS2 COMM	6.5-1
6.6	ATU NOISE	6.6-1
6.7	WIRELESS AUDIO PROBLEM	6.7-1
6.8	ENTRY WEIGHT REDUCTION	6.8-1

Section		Page
7.0	DISPLAY BRIEFS	
7.1	WORKSTATION ANTENNA MANAGEMENT SOFTWARE (WAMS)	7.1-1
7.2	A/E EVENT	7.2-1
7.3	NSP BFS CONFIG V1.2	7.3-1
7.4	CLOSED CIRCUIT TELEVISION V1.1	7.4-1
7.5	COMMAND ERRORS V1.0	7.5-1
7.6	COMM EVENTS V1.2	7.6-1
7.7	TBS	
7.8	COMMAND CONFIG V1.1	7.8-1
7.9	COMSEC V1.0	7.9-1
7.10	GNC NSP V1.0	7.10-1
7.11	KU-BAND COMM (SM) V1.8	7.11-1
7.12	KU STOW/DPY V1.1	7.12-1
7.13	KU-BAND RADAR V1.1	7.13-1
7.14	NSP CONFIGURATION V1.1	7.14-1
7.15	S-BAND PM PRE & PWR V1.0	7.15-1
7.16	KU RADAR/COMM STAT V1.2	7.16-1
7.17	S-BAND ANTENNA V1.1	7.17-1
7.18	SM STDN ANTENNA V1.0	7.18-1
7.19	TBS	7.19-1
7.20	S BAND XPNDR V1.2	7.20-1
7.21	TBS	
7.22	BIOMED V1.0	7.22-1
7.23	COMM/INST BYPASS V1.1	7.23-1
7.24	DSC RAW DATA V1.7	7.24-1
7.25	DSC/MDM STATUS V1.2	7.25-1
7.26	S-BAND FM CONFIG V1.0	7.26-1
7.27	TBS	
7.28	TBS	
7.29	OI MDM/DSC V1.4	7.29-1
7.30	PCMMU EVENTS V1.1	7.30-1
7.31	PDI V1.4	7.31-1
7.32	PI V1.0	7.32-1
7.33	PSP V1.2	7.33-1
7.34	TBS	
7.35	ORBITER INTERFACE UNIT (OIU) DISPLAY V1.5	7.35-1
7.36	SSOR V1.3	
7.37	MMU/SSR MANAGEMENT DISPLAY V1.9.8	
7.38	GCIL BIT DISPLAY V1.0	7.38-1
7.39	SSR TEST DISPLAY V1.0	7.39-1
7.40	COMMAND CONFIGURATION DISPLAY (CCUD) V1.8	7.40-1
7.41	UPLINK VERIFY DISPLAY V1.3	7-41-1
7.42	INST COMMAND BUILD DISPLAY V1.4	7-42-1
7.43	RF COMMAND BUILD DISPLAY V2.4	7-43-1
7.44	COMMAND BUFFERS DISPLAY V4.0	7-44-1

Section		Page
8.0	MISCELLANEOUS DATA	
8.1	SHUTTLE AND STATION FREQUENCY AND POWER	
	SPECIFICATIONS AND ANTENNA LOCATIONS	8.1-1
8.2	GROUND SITE USAGE AND CAPABILITIES	8.2-1
9.0	WORKSTATION PROCEDURES	
9.1	GENERAL PROCEDURE FOR CERTIFICATION OF DISPLAYS	
	AND APPLICATIONS IN THE MCC	9.1-1
9.2	COMMAND SYSTEM: HARDWARE PANEL	
	CONFIGURATION MANAGEMENT PROCESS	
9.3	DATA ACQUISITION IN THE MCC	
9.4	DUMP REPORT PROGRAM USER'S GUIDE	
9.5	X WORLD MAP USERS GUIDE (VERSION 2.0)	
9.6	MEWS USERS GUIDE	
9.7	ELOG - EVENT LOGGER	
9.8	BFSANT	
9.9	GCILBIT	9.9-1
9.10	CONFIGURABLE REAL-TIME ANALYSIS SYSTEM (CRANS)	
	USER'S GUIDE	9.10-1
Appendix		
Δ	ACRONYMS AND ABBREVIATIONS	Α-1

INSTRUMENTATION AND COMMUNICATIONS OFFICER (INCO)

#### PRIMARY INTERFACE

Reports to flight director

#### LIST OF DUTIES AND RESPONSIBILITIES

Serves as flight control room (FCR) communications system engineer.

- A. Controls the communications and instrumentation systems via command.
- B. Analyzes and evaluates communications and instrumentation systems performance.
- C. Keeps the flight director abreast of communications and instrumentation systems status and of invocation of Flight Rules and provides him with necessary evaluations and recommendations pertaining to anomalies.
- D. Monitors circuit performance and takes necessary action to ensure adequate circuit quality for the accomplishment of the mission.
- E. Supervises performance of communications and instrumentation systems malfunction procedures and recommends corrective action or alternative action, as required, to include mission termination in accordance with mission rules.
- F. Directs the activities of communications and instrumentation support personnel located in the multipurpose support room (MPSR).
- G. Directs the operations support team (OST) to configure the space tracking and data network (STDN)/tracking and data relay satellite system (TDRSS) sites to keep them compatible with the vehicle communications system.
- H. Monitors and assists in the direction of Mission Control Center (MCC) pad support activities.
- I. Prepares and/or compiles and maintains logs pertaining to communications and instrumentation system performance.

#### RE COMMUNICATIONS OFFICER

#### **PURPOSE**

To define the duties and responsibilities of the RF Comm officer.

#### **GENERAL**

The RF Comm officer is responsible for supporting the FCR INCO in the monitoring, evaluation, and detailed analysis of spacecraft communications system activities for all flight phases.

5/31/2007:

**REV G, PCN-5** 

#### SPECIFIC DUTIES AND RESPONSIBILITIES

- A. Monitors comm systems performance and reports any off-nominal conditions to the INCO immediately. Also, performs all required specialized analysis of comm systems.
- B. Performs trend monitoring of comm systems, mainly Ku-band temperatures, for proper heater cycling verification.
- C. Analyzes and predicts Ku-band and S-band coverage and recommends systems configurations in response to the expected coverage.
- D. Builds command loads (TDRS STATE VECTORS, MRTC's, SPC's, MSPC's, TEC's, and TMBU's), as required for comm systems management.
- E. Interfaces with COMMAND personnel to configure/manage the comm network (STDN/TDRSS/SGLS) and keep it compatible with the vehicle configuration.
- F. Interfaces with customer support personnel (ACO/P/L MPSR, CSR, etc.), as required.
- G. Supplies recommendations to the INCO in response to comm systems degradation or malfunction. This includes flight rule impacts and "next failure" considerations, as well as anomaly inputs and MER CHIT's, as required.
- H. Provides INCO with comm systems "GO/NO GO" recommendations at various predetermined times throughout the mission.
- I. Maintains an accurate mission log (per FCOH standards) of all comm systems activities.
- J. Supports the INCO during execute package generation for all comm related inputs. This includes Failure/Impact/Workaround (F/I/W) inputs and review of the package for uplink.
- K. Provides leadership for the entire INCO Multi-Purpose Support Room (MPSR) team. This includes managing the MPSR in an effective, proper, and appropriate manner.
- L. Participates in vehicle/ground interface compatibility tests, as required.
- M. Provides specific systems expertise for the following:
  - 1. S-band PM, including antennas and the Communications Security (COMSEC) system
  - 2. Data Processing System (DPS), as it affects command capability, antenna selection, and other comm systems operations
  - 3. Ku-band comm and RADAR operations

- C-12829 5/31/2007: REV G, PCN-5
- 4. Ultrahigh frequency (UHF) and Space To Space Communications System (SSCS) including their antennas
- 5. Audio (Audio Central Control Unit (ACCU's), Audio Terminal Unit (ATU's), Wireless Crew Communications System (WCCS), and "loose" comm gear)
- 6. Ground control interface logic (GCIL)
- 7. Closed Circuit Television (CCTV)
- 8. Digital Television System (DTV)
- 9. Wireless Video System (WVS)
- 10. Orbiter Boom Sensor System (OBSS)

9 3/31/2006: REV G, PCN 3

#### **TITLE**

INSTRUMENTATION OFFICER (INST)

#### **PURPOSE**

To define the duties and responsibilities of INST

#### **GENERAL**

The INST is responsible to the INCO for the monitoring, evaluation, and detailed analysis of spacecraft instrumentation system activities during the countdown and flight timeframes. System evaluation is predicated on flightcrew safety and the accomplishment of mission objectives.

#### SPECIFIC DUTIES AND RESPONSIBILITIES

- A. Based on detailed system analysis, recommends appropriate action to the INCO in case of system malfunction or degradation of the operational instrumentation: dedicated signal conditioner (DSC), operational instrumentation (OI) multiplexer/demultiplexers (MDM), pulse code modulation master unit (PCMMU), modular auxiliary data systems (MADS), payload data interleaver (PDI), payload signal processor (PSP), payload interrogator (PI), and the orbiter interface unit (OIU). During specified flights and phases, the INST will also be responsible for the solid state recorders.
- B. Provides spacecraft systems "GO/NO-GO" recommendations to the INCO at various predetermined times throughout the mission.
- C. Reports system deviations from normal operation and mission rule impacts to the INCO.
- D. Provides specialized analysis of all mission operational instrumentation data flow. Is also responsible for the table maintenance block update (TMBU), variable parameters, telemetry format loads (TFL's), decom format loads (DFL's), fetch pointer memory (FPM) updates, and contingency PSP configuration message commands.
- E. Prepares special trend and chart displays for contingency problems.
- F. Prepares mission logs to document the performance of the orbiter instrumentation and payload communications systems.
- G. Participates in alternate flight plan generation from the instrumentation aspect.
- H. Participates in vehicle/ground interface compatibility checkouts.

#### LEAD INCO DUTIES AND RESPONSIBILITIES

#### **GENERAL**

The INCO group lead assigns senior members of the INCO group to plan, organize and document the activities before, during, and after the flight that affect the shuttle communications systems. The following list is a guideline for the lead INCOs to help in their planning for each flight.

**REV G** 

#### PREMISSION DUTIES AND RESPONSIBILITIES

- A. Gather, review, and retain pertinent information describing the unique characteristics and payload manifest for that flight; for example
  - 1. Flight requirements document (FRD) at http://sspweb.jsc.nasa.gov/pils/nsts.cfm

9/1/2004:

- 2. Payload integration plan (PIP) and PIP Annexes at http://sspweb.jsc.nasa.gov/pils/nsts.cfm, interface control documents (ICD's), schematics at http://fs01jscsds.unitedspacealliance.com/, cargo systems manuals, Cargo Integration Review (CIR) drawings, etc., that help describe the payloads and their interfaces with the orbiter communications and data systems.
- B. Coordinate with the lead Flight Director, lead Ground Controller (GC), lead Payloads, lead Flight Activities Officer (FAO), and other lead operators, as required, to resolve:
  - 1. Flight rule questions
  - 2. Comm related detailed test objective (DTO) guestions and procedures
  - 3. TDRS/GSTDN/RTS site support plan
  - 4. Non-standard console operating procedures affecting communications and data flow
  - 5. Ku-band radiation constraints
  - 6. CCTV usage questions
  - 7. Payload communications systems operations and malfunction procedures
  - 8. Joint Operations procedures
- C. Represent the group at flight rule reviews, Payload Operations Working Group (POWG's) (for payloads interfacing with orbiter comm and data systems), Flight Operations Reviews (FOR), Operations and Maintenance Instruction (OMI) reviews, and other meetings requiring INCO participation.
- D. Prepare and input 482's, as required, to ensure that the flight data file (FDF) is current and complete.
- E. Provide flight readiness review (FRR) inputs, including flight-unique launch commit criteria (LCC) to the Division Office on request, per the master procedure located at <a href="http://mod.jsc.nasa.gov/df/masterlist/df07.doc">http://mod.jsc.nasa.gov/df/masterlist/df07.doc</a>. The template file for generating the INCO FRR is located on the <a href="DF TA homepage">DF TA homepage</a>. These inputs include but are not limited to:
  - 1. Anomalies and equipment replacements
  - 2. Significant configuration differences (since last flight)
  - 3. Significant flight data file changes
  - 4. Significant flight rules/LCC changes
  - 5. Significant operational maintenance requirements and specifications document (OMRSD) waivers for the flight

- COMM/JSC-12829 9/1/2004: REV G
- F. Provide Certification of Flight Readiness (CoFR) (template located on the <u>DF TA homepage</u>) inputs to the Division Office on request. These inputs include but are not limited to:
  - 1. MCC team certification status
  - 2. MCC critical processor certifications
  - 3. LCC changes since FRR
  - 4. Mandatory instrumentation list (MIL) changes
  - 5. CIL/Hazard change impacts
  - 6. Assigned level 2 actions
  - 7. Previous flight's anomaly resolutions and impacts
  - 8. Pre-flight anomaly impacts and listing of still open anomalies
  - 9. Operational workarounds or new operations
  - 10. Shuttle/ISS Joint Operations problems that have not been resolved
  - 11. Cargo integration documentation problems that have not been resolved
  - 12. Command procedures problems that have not been resolved
  - 13. Flight requirements document problems that have not been resolved
- G. Coordinate the support for any shuttle mission simulator (SMS) integrated load checkouts (ILC's), flight specific simulations, terminal countdown demonstration tests (TCDT's), end-to-end tests, and other unique interface tests, as required.
- H. Conduct a pre-SIM-start training session to share with the INCO group the features and problems to expect during simulations and flight.
- I. Conduct a Preflight Tag-up with group members and other interested parties, to resolve any open items, ensure a common understanding of console procedures to be used during that flight and review any changes to the INCO planning memo since the final version was published.
- J. Publish the required operations and constraints memo (called INCO Planning Memo) per SCP 1.8

  Preliminary version before L-3 months or before start of flight specific simulations

  Final version before L 2 weeks.
- K. Identify and report any major open issues to the group lead for aid in resolution.
- L. Publish any notes of interest to the group, as required.
- M. Direct the lead COMM and INST assigned to that flight, as required, to assist in completing any of the above tasks. Other team members on that flight may be requested to assist in resolving action items as well. Specifically coordinate the development of flight-unique command loads (e.g., PSP configurations, DFL's, TFL's, etc.), Ku-band beta angles, etc.

#### **MISSION DUTIES AND RESPONSIBILITIES**

- A. Resolve any issues among teams regarding console operations, as appropriate.
- B. Ensure that required data is retained for the postflight records.
- C. Ensure that the group lead is informed of any major systems anomalies.

#### **POSTMISSION DUTIES AND RESPONSIBILITIES**

- A. Publish the postflight report.
- B. Complete the Mission Support Evaluation
- C. Lead a mission debriefing with group members.
- D. Maintain cognizance of the resolution of any INCO in-flight anomalies. Provide data to aid in resolution, as required.
- E. Gather and retain postflight records in accordance with group policy.
- F. Provide a quick look debriefing to the division staff upon request.
- G. Provide lessons learned briefing to DA8 upon request.

LEAD RE COMMUNICATION OFFICER DUTIES AND RESPONSIBILITIES.

#### **PURPOSE**

To define the procedure used by the lead RF Comm to prepare for each mission.

#### **GENERAL**

The RF Comm Officer assigned to the lead flight control team will assume the duties of lead RF Comm to facilitate preflight planning and ensure all required information is available on console. This procedure has been written as a guideline for the lead RF Comm.

9/1/2004: REV G

The RF Comm should attend the Payload Familiarization meeting, Orbiter Flight Techniques Panel (OFTP) meetings, Payload Operations Working Group (POWG) meetings, and any other appropriate meetings to maximize familiarity with the objectives and challenges of the mission. The RF Comm should also participate with the lead INCO in all premission activities.

#### **PROCEDURE**

- A. Obtain the radio frequencies for all payloads. The frequencies for each specific payload can be found in the Payload Integration Plan (PIP) Annex 1 and the Cargo Systems Manual (CSM). A PIP and CSM are created for each payload. The instrumentation or payload officer may also be able to supply frequency data. For help converting the frequency to PI channel, reference SCP 3.35. Use this information along with the cargo radio frequency constraints from the Flight Requirements Document (FRD) to determine the orbiter RF plan (S-band PM, FM and Ku-band).
- B. Check the FRD to see if the following items are manifested.
  - 1. CCTV camera types and locations
  - 2. Orbiter VCR's
  - 3. WCCS
  - 4. Payload recorder
  - 5. SSOR
  - 6. Comm related DTO/DSOs
  - 7. VHF
  - 8. WVS
- C. Review the cargo integration drawings to verify the PDIP connections and the impact to Ku-band interfaces.
- D. Review the OMI for comm activation changes. Notify comm activation team of the changes.
- E. Review the DTO's and DSO's for any comm impacts (Ku-band, PDIP, etc).
- F. Evaluate planned usage of the Ku-band system with regard to published constraints. Pay particular attention to conflicts between Radar and Comm usage and possible violations of any Flight Rules relating to Ku (such as radiation constraints, EVA constraints, etc).
- G. Evaluate the planned usage of the OPS and P/L recorders. Check TDRS S-band coverage to determine OPS recorder record requirements. Also, check Payload recorder record requirements. Check Ku-band coverage to determine Ku dump availability. Use this information to identify any ground site requirements for dump support.
- H. Assist the Lead INCO with coordination of TDRS handover requirements. Work with Payloads, FAO, GC, and Command to determine the plan. Command will submit the preflight TDRS schedule to Goddard about L-2 weeks, at the latest.

I. Evaluate planned TV downlink (PAO events, etc.) and verify no conflicts with Ku usage/coverage, VTR dumps, etc.

**REV G** 

9/1/2004:

- J. Determine if any off-nominal video or audio equipment will be flown (check with Crew Systems, Photo/TV personnel). Verify complete video configuration for the flight. Determine crew audio configuration plan.
- K. Compile the information from blocks A through J into a Comm Summary Sheet for your flight. Give all INCO's and RF's a copy of this sheet. This information will assist the lead INCO with the task of preparing the COMM memo.
- L. Provide the Lead INCO with any specific changes and procedures you want to go into the following documents for his review. Provide this information to the appropriate book manager after INCO's review for inclusion into the earliest possible revision of these books. Ensure that your inputs are properly incorporated. Inputs can be made to FDF (in increasing order of difficulty) verbally before the FOR (~L-4 months), by DN during the FOR, and thereafter by 482 or flight note.
  - 1. Orbit Ops C/L, Flight Supplement
  - 2. Post Insertion C/L

Verify heaters turned on for nonstandard PLB cameras (such as Keel and Truss cameras). Otherwise verify heater callouts removed if they do not apply.

- 3. Contingency D/O Prep
- 4. Rendezvous
- Deorbit Prep
- 6. Deploy C/L (if used)
- 7. Ascent C/L (switch configurations)
- M. Review the following books.
  - 1. Post Insertion Checklist: Verify proper configurations.
  - 2. Flight Rule annex: Verify rules have proper values and rational.
  - 3. Deploy C/L: Verify proper configurations. Do not forget about contingency deploys in this review. Ensure the RF constraints are not violated.
  - 4. Flight Plan: Verify TDRS handovers and proper configurations. Do not forget about contingency deploys in this review. Ensure the RF constraints are not violated.
  - 5. Operations Support Timeline (OST), if available: Same as no. 4.
  - 6. JOIP procedures RF/INCO may be involved in.
- N. Build the following loads on the workstation.
  - 1. Verify the proper BFS antenna management site inhibit TMBU's are built (should be in appropriate directory).
  - 2. Verify the proper SPC's are built (should be in appropriate directory).
  - 3. Verify the proper Ku-band TMBU's are built (only a select few are prebuilt in the CMD SVR).

O. Flight Documentation Checklist. Use this checklist as an aid to ensure you have completed all actions required by this SCP. Completion time: 1 week prior to first sims (~L-3 months), desired, and no later than 1 week prior to flight.

9/1/2004: REV G

- P. Study! You are the RF expert for your mission. Be as prepared as possible and strive to prepare the "RF/INCO team." Arrange for an RF meeting before the sims or flight, if necessary. During the mission, lead the RF team. Ensure that nominal ops are accurately captured in logs and miscellaneous documentation; push troubleshooting, as required. Strive for a thorough, complete, logical, and creative approach to operating and troubleshooting your systems.
- Q. Postflight, compile a list of any RF lessons learned and distribute to the rest of the section. Submit any documentation updates needed. Provide data to the Lead INCO for inclusion in the Post Flight Report.

Document /review	SCP item	Target completion date (L - )	Actual completion date	On-console date	1
CARGO FREQS	Α	4 months		N/A	
FRD CHECK	A,B	3 months			
CARGO INTGR DRWGS	С	6 months		N/A	
OMI/COMM ACT	D	1 months			
TDRS H/O PLAN	Н	1 months			
MAKE RF SUMMARY	K	4 months			
PROCS & MALFS	L	6 months		N/A	
BOOK REVIEW	М	3 months		N/A	
COMMAND LOADS	N	4 months			
DOCUMENTATION UPDATES	Q	Landing + 1 month			

LEAD INSTRUMENTATION OFFICER DUTIES AND RESPONSIBILITIES

#### **PURPOSE**

To define the procedure used by the lead INST to prepare for each mission.

#### **GENERAL**

The Instrumentation Officer assigned to the lead flight control team will assume the duties of lead INST to facilitate preflight planning and to ensure all required information is available on console. This procedure has been written as a guideline for the lead INST.

The INST should attend Orbiter Flight Techniques Panel and Payload Operations Working Group (POWG) meetings to maximize familiarity with the objectives and challenges of the mission. The INST should also participate with the lead INCO in the Flight Operations Review (FOR) process, submitting discrepancy notices (DNs), and discussing and resolving as many issues as possible.

#### **PROCEDURE**

- A. Obtain the entire set of TFL/DFL/FPMs from MAST II, the reconfiguration manager, or the Payload Management (PM) FSR. Based on the information obtained, provide to the lead INCO a first draft of the TFL tables for the Orbit Ops C/L, using the documents tfl\_dfl.doc, dumpcomp.doc, and downlist.doc. located on the file server in the s:..\\df24\forms\fdf\orbt\_ops directory. Use these files and SCP 3.34 to complete the table. Save the changes you make to a file in your own directory. Screen the TFL/DFL information for toggle buffer memory overlap, LDR OI, LDR SM downlist, and LDR GNC downlist. Tables 5-3 and 5-4 of the PM FSR should be referenced for this information. For flights requiring complex TFL plans, document each discipline's requirement. Reference Flight Rule A2-129 for Orbiter On-Orbit High Data Rate Requirements.
- B. Check the Flight Requirements Document (FRD) to see if the following items are manifested.
  - 1. OIU
  - 2. Spare PDI
  - 3. PI
  - 4. ERPCL
  - PGSC interface with OI/PL telemetry
  - 6. INST related DTO/DSOs
- C. Obtain the PI receive and transmit frequencies for all payloads. The frequencies for each specific payload can be found in the Payload Integration Plan (PIP) Annex 1 and the Cargo Systems Manual (CSM). A PIP and CSM are created for each payload. The payload officer may also be able to supply frequency data. For help converting the frequency to PI channel, reference SCP 3.35.
- D. Get the following information from the Command and Data (C&D) Annex (PIP Annex 4), or the PM FSR, for each payload on your flight (including secondary payloads).
  - 1. PSP configuration message(s) (C&D Table 19) sec. 19.0001 (compare with PM FSR table 7.17.1, annotate table with conversion to actual rates and connections, including name of payload for each configuration)
  - 2. Payload telemetry and command data rates (C&D Annex table 7)

SHUTTLE OPS LEAD INST DUTIES INCO/COMM/JSC-12829 9/1/2004: REV G SCP 1.6

E. Using PIP Annex 1, the CSM, the Payload Systems Data and Malfunction FDF, or the applicable source for each payload, make an integrated payload schematic, showing command and telemetry data paths, rates, and troubleshooting information, such as MAL procedures, IFMs, and flight-specific changes.

- F. Compile the information from blocks A through E into an INST memo and an INST summary sheet (cue card) for your flight. Give all INCOs and INSTs a copy of this memo and sheet. This information will assist the lead INCO with the task of preparing the COMM memo. Put documents obtained into notebooks for all simulations and the flight.
  - 1. PM FSRs, SM FSRs, JOIPs, C&D Annexes, PIP annexes, and CSMs have dedicated binders at the console.
  - Include an INST book containing copies of the COMM and INST memos, OEX Plan, FRD, OST, and any flight-specific INST information, such as the PSP configuration table, which was annotated with conversions to actual rates and connections. Helpful diagrams, such as cue cards, integrated payload schematics should also be inserted into the outside cover of the book (under clear plastic).
- G. Provide the lead INCO, the A/E INCO, and the A/E INST with the ascent TFL/DFLs for inclusion in the prelaunch TFL/DFL requirements memo. Make sure the information sent to KSC reflects your desires for TFLs and DFLs from prelaunch through postinsertion because the crew will not be able to reconfigure the PCMMU/PDI until they start into the Post Insertion Checklist. If there are no PDI requirements for ascent, have them load the first on-orbit configuration used.
- H. Provide the lead INCO with the specific TFL/DFL configurations, and any unusual malfs you want to go into the following documents for review. Provide this information to the appropriate book manager after INCO's review for inclusion into the earliest possible revision of these books. Ensure that your inputs are properly incorporated. Inputs can be made to FDF (in increasing order of difficulty) verbally before the FOR (~L 4 months), by DN during the FOR, and thereafter by 482 or flight note.
  - 1. Orbit Ops C/L, Flight Supplement
  - Post Insertion C/L
  - 3. Contingency D/O Prep
  - 4. Deorbit Prep
  - 5. Deploy C/L (if used)
  - 6. Ascent C/L (switch configurations)
  - 7. Payload Ops C/L (for proper payload comm procedures; also, to ensure that the deactivation procedures put the back panel in the Deorbit Prep Entry Switchlist/Verification configuration)
- I. Use the MADS data requirements information from the FRD to create a MADS Operation Plan.
- J. Review the following books.
  - 1. Orbit Ops C/L: Verify TFL/DFL/FPM information.

- 2. Post Insertion Checklist: Ensure the TFL/DFL load procedures are correct.
- 3. Deploy C/L: Ensure the PI, PDI, and PSP procedures are correct.
- 4. Flight Plan: Ensure the activities called out can be supported by the TFL/DFL loaded at the time; for example, FCS C/O in GNC OPS 8 requires a high rate GNC window, as in TFL 161. Do not forget about contingency deploys in this review. Ensure the PI/FM constraints are not violated.
- 5. Operations Support Timeline (OST), if available: Same as no. 4 above.
- 6. JOIP procedures with which INST may be involved.
- K. Review all books that contain INST malfs (the big malf book, any P/L malf books, etc.), and check that all MSIDs or measurement names called out actually come through the MDM/DSC referenced in the malf. Also, look for procedures that may leave the P/L COMM switch in PNL while reconfiguring, including its possible impacts.
- L. Build the following loads, using INST CMD BUILD on the workstation.
  - 1. TFL/DFL loads for the flight (procedure in SCP 3.9)
  - 2. PSP Configuration Messages, with a dummy command load for each configuration (procedure in SCP 3.26)
  - 3. Any required payload throughput loads (procedure in SCP 3.28) which may include OIU
- M. Ensure the following are on console (and know how to use them).
  - 1. Master Measurements List (MML) This is a TFL, DFL, and FPM listing that contains actual listings for TFLs, DFLs, and FPMs. This can be found online on the P51.KSC web site.
  - MAST II database (CD ROM).
  - PCMMU SM Bypass Bit Definitions hard copy and CD ROM. Select Start, select MOD Server Menu, select MOD-Wide Applications, click on DXR
    - a. Select File, click on Open, go to My Computer to see all the drives
    - b. Install CD, with label (e.g., STS-077 FL, PASS, BFS, and MMU); wait until CD drive name updates; e.g., Sts077fl
    - c. Double-click on CD drive, double-click on top folder; e.g., □Sts077fl, double-click on □Pass, verify Files of type = Reports
    - d. Double-click on Smpm.dat, select Page, click on Last Page
    - e. Use tool bar ⇐⇒ arrows to find last page of PCMMU bypass tables and record page number; e.g., 4866, then find first page of PCMMU bypass tables and record page number; e.g., 4847
    - f. Select **File**, click on **Print**, click on **Pages** button, add range of bypass tables; e.g., 4847-4866, click on **OK**

4. Instrumentation Program and Component List (IPCL), vols. I, II, and III

9/1/2004: REV G

- 5. PIP C&D Annex(es)
- 6. MADS Data Plan (from I above)
- 7. PM FSR
- 8. SM FSR
- N. Flight Documentation Checklist. Use this checklist as an aid to ensure that you have all actions required when this SCP is done. Completion time: 1 week prior to first sims is desired, but no later than 1 week prior to flight.
- O. Study! You are the INST expert for your mission. Be as prepared as possible and strive to prepare the "INST team." Arrange for an INST meeting before the sims or flight, if necessary. During the mission, lead the INST team. Ensure that nominal ops are accurately captured in logs and miscellaneous documentation and push troubleshooting, as required. Strive for a thorough, complete, logical, and creative approach to operating and troubleshooting your systems.
- P. Remove old simulation cmdtrk and dump files from the following directories: /users/inco/rw\_common/data/cmdtrk and /users/inco/rw\_common/dump. Be sure not to delete files of commands to the real vehicle; e.g., commands sent during pad test and COMM activation. Use the UNIX command Is -al to list all files in the directory and the dates the files were created. To delete files, use the UNIX command rm, followed by names of files to be deleted, in the following sample format: rm 91cmdtrk.087 91cmdtrk.088 91cmdtrk.089 (to remove all three files). These files should be cleaned out before lift-off.
- Q. Submit a training roster for all INCO teams on completion of the flight. Forward the roster to DT65/Ginger Deans.
- R. Postflight, compile a list of any instrumentation lessons learned and distribute to the rest of the section. Submit any documentation updates needed. Provide data to the lead INCO for inclusion in the Post Flight Report. Remove documentation from console. Give documentation to be archived to the lead INCO and save the documents you feel will be helpful, such as the INST memo.

Document/review	SCP item	Target completion (weeks to launch)	Actual completion date	On-console date	1
PROCS & MALFS INPUTS	Н	24		N/A	
TFLs/DFLs	Α	16		N/A	
FRD CHECK	В	16		N/A	
PI FREQS	С	16		N/A	
C&D ANNEX CHECK	D	16		N/A	
PIP ANNEX 1 CHECK	Е	16		N/A	
MALF BOOK REVIEW	K	16		N/A	
MAKE INST SUMMARY	F	12			
ASC TFL/DFLs TO INCO	G	12		N/A	
BUILD INST LOADS	L	12			

Document/review	SCP item	Target completion (weeks to launch)	Actual completion date	On-console date	1
P/L THRUPUT LOADS	L.3	12			
PCMMU BYP BIT DEF	M.3	12			
MADS PLAN	ı	8		N/A	
MADS PLAN	M.6	8			
MML	M.1	2			
MAST D/B	M.2	2			
IPCL	M.4	1			
C&D ANNEX(ES)	M.5	1			
SCM PROM LISTING	M.7	1			
PM FSR	M.8	1			
SM FSR	M.9	1			
FLIGHT DOCUMENTATION C/L	N	1			
TRAINING ROSTER	Q	Landing + 1			
DOCUMENTATION UPDATES	R	Landing + 4			

DATA COMMUNICATIONS OFFICER

#### PRIMARY INTERFACE

Reports to instrumentation and communications officer (INCO)

3/31/2006:

#### **LIST OF DUTIES AND RESPONSIBILITIES**

The data communications officer (DATA COMM) serves as a flight controller at the DATA COMM console in the multipurpose support room (MPSR) and is responsible to the flight control room (FCR) INCO for monitoring, evaluating, and performing analyses of spacecraft operational recorder system activities during the countdown and the flight. Flight crew safety and accomplishing mission objectives are the primary focus throughout the system analysis. Specific duties and responsibilities are as follows:

**REV G, PCN 3** 

- A. On the basis of detailed system analysis of the solid state operational flight recorders and frequency modulation (FM) system, recommends appropriate action to the INCO in case of system malfunction or degradation.
- B. Provides spacecraft systems GO/NO-GO recommendations to the INCO at various predetermined times throughout the mission.
- C. Reports system deviations from normal operation and mission rule impacts to the INCO.
- D. Provides information to be relayed to the flight crew when systems anomalies affecting the flight occur that are not indicated by the spacecraft displays.
- E. Prepares special trends and chart displays for contingency problems.
- F. Prepares and/or compiles mission logs as they pertain to the performance of spacecraft systems. Also maintains a detailed log on recorder operations that is used by each operator to enable systematic retrieval of recorded data.
- G. Participates in generating alternate flight plan from the recorder systems aspect.
- H. Performs appropriate recorder configuration for all phases of flight. On orbit, data only should be recorded during loss of communications periods, data and voice should be recorded during EVA (check preflight agreement on whether to dump LOS or all data and voice).
  - Solid State Recorders: on ascent, SSR 2 should be configured to record parallel SSME and OD + voice, and SSR 1 should be configured to record parallel MADS PCM and OD + voice. On entry, SSR1 should again be configured to record parallel MADS PCM and OD + voice. Payload data recording, if required, will be addressed in mission specific plans.
- I. Verifies one recorder recording at all times to capture expected and unexpected loss of communication periods.
- J. Plays back (dumps) all data and voice recordings from ascent and entry and all loss of signal data recordings on orbit.

#### COMMUNICATIONS PLANNING MEMORANDUM DEVELOPMENT AND DISTRIBUTION

#### **PURPOSE**

The Communications Planning memorandum is divided into two major components. The first component is a collection of information that is generic to all Space Shuttle flights (section D of this SCP). The second component is a compilation of information gathered from various official documentation for mission-specific requirements levied on the Instrumentation and Communications Officer (INCO) by various parties. It also contains mission-specific information necessary for mission success. As such, it becomes the guideline for the conduct of integrated simulations and real-time flight. The memorandum may be published in several phases, starting with a preliminary version and culminating with a final and a delta, if required, prior to launch.

#### **PROCEDURE**

- A. The lead INCO primarily will gather and compile information from the following documents:
  - 1. Flight Requirements Document (FRD)
  - 2. Payload Integration Plans (PIP) and their attendant annexes
  - 3. Payload Flight Software Requirements document (PL FSR)
  - 4. Systems Management Software Requirements document (SM FSR)
  - 5. Flight Rules (Generic)
  - 6. Flight Rules (Mission Specific Annex)
  - 7. Cargo integration drawings (VD72-200183 and VS72-200183)
  - 8. All generic Flight Data File (FDF) books that have instrumentation and/or communications system requirements
  - 9. All mission-specific FDF books that have instrumentation and/or communications system requirements
  - 10. All Station Operations Data File (SODF) books that have instrumentation and/or communications systems requirements.
  - 11. Attitude Timeline
  - 12. Joint Operation Integration Procedures (JOIP)
  - 13. Launch Commit Criteria (LCC)
  - 14. Network Operations Support Plan (NOSP) and Integrated Support Instruction (ISI) modifications to the NOSP

Note that there are other official documents that may be generic or mission specific that have significant mission information. Listed below are some of these sources.

 All Electronic Systems Test Laboratory (ESTL) reports on mission specific or generic testing

- 2. All engineering evaluations on shuttle avionics capabilities and on mission-specific payload system characteristics and capabilities
- 3. Any special testing performed by outside entities for a mission-specific payload
- B. The lead INCO uses the last Comm memo from the previous flight of a similar payload as the basis for the new memo (e.g., last shuttle-ISS flight). The contents of the memo should contain the information outlined in paragraph C. below. If no similar memo exists, the memo must be created from scratch and should contain the material outlined in paragraph C.
- C. The contents of the INCO communications planning memorandum vary by mission. The following list is the suggested set of information that should be included in the memo. Some of this information may already be included in the generic memo (section D of this SPC) and therefore would not need to be included as part of the mission specific component of the memo.
  - 1. Flight description and crew assignments
  - 2. Mission overview, including payload descriptions
  - 3. Ascent/entry and on-orbit S-band communications configurations
  - 4. Ku-band communications configurations
  - 5. Antenna Management plan
  - 6. Closed circuit TV (CCTV) systems plan
  - 7. Flight-specific panels and equipment (e.g., Computer Interface Panel, etc.)
  - 8. S-band frequency modulation system plan
  - 9. Ultrahigh frequency system and Space to Space Communications System (SSCS) plan
  - 10. Payload command plan and constraints
  - 11. Instrumentation and payload communication system (payload signal processor, and payload interrogator) plan
  - 12. Telemetry format load, decommutator format load, and fetch pointer memory load usage plan
  - 13. Orbiter communications adapter plan
  - 14. Operations, payload, and MADS recorder usage plans
  - 15. Assigned detailed test objectives and detailed supplemental objectives plan
  - 16. Ground site and tracking data relay satellite system (TDRSS) configurations
  - 17. Ground site and TDRSS scheduling
- D. The generic memorandum includes all the information about the Instrumentation and Communications systems that needs to be shared with others as they prepare to support a mission. This information does not change from mission to mission but is needed by customers of INCO services to help them better understand what INCO will provide during the mission. The following is the generic memo (from dashed line to dashed line), which should be attached to each mission specific memo as an appendix.

\_\_\_\_\_\_

#### S-Band Phase-Modulation (PM) System

High data rate uplink (72 KBPS) and downlink (192 KBPS) will be used during all flight phases.

#### **S Band System Configuration**

	Ascent		Orbit		Descent	
Equipment	Active	Pnl A1L	Active	Pnl A1L	Active	Pnl A1L
Transponder	2	1	2	1	2	1
NSP	2	1	2	1	2	1
Antenna Electronics	2	1	2	1	2	1
Power Amp Standby	2	1	2	1	2	1
Power Amp Operate	2	1	2	1	2	1
Preamplifier	2	1	2	1	2	1
Frequency	①	①	①	①	①	①
Uplink Rate	High	High	High	High	High	High
Downlink Rate	High	High	High	High	High	High
Uplink Coding	On	On	On	On	Off	Off
Downlink Coding	Off	Off	On	On	Off	Off
Transponder Mode	STDN HI	STDN HI	TDRS	TDRS	STDN LO	STDN LO
Encryption ②	RCV	RCV	RCV	RCV	RCV	RCV

① - Frequency Selection (High or Low) is a GCIL only (command) function and is mission dependant

#### Ascent

During the ascent phase, the S-Band PM System will be operated in Spacecraft Tracking and Data Network high power mode (STDN HI). System #2 will be active with system #1 providing redundant capability, if activated via the S-Band PM control switch (panel/command) on panel C3.

The uplink will be operated with convolutional coding ON, which enhances site handovers and minimizes the time required for reacquisition. Encryption will be used for uplink protection while the downlink will be unencrypted. The availability of uplink encryption is not a constraint to launch or orbit operations.

Handovers that occur during ascent require no crew action and will cause a brief loss of S-Band PM forward link. UHF is available for voice communication during all S-Band PM handovers. Those handovers that require an onboard communications system reconfiguration will be performed by stored program commands (SPCs). The Tracking and Data Relay Satellite (TDRS) acquisition will be performed with forward link modulation on and spread spectrum off at 7 minutes 30 seconds MET. Spread spectrum will be turned on at 18 minutes MET. This will cause a short dropout of the S-Band PM forward link signal (approximately 40 seconds). The Site Usage Plan for Ascent table outlines the site handover plan for both a nominal ascent and for several contingencies. TDRS-Z will be used on Orbit 1 so that OMS-2 actions can be observed in real-time. The Orbiter will start pointing to TDRS-Z as soon as TDRS-47 sets below horizon, and will start pointing to TDRS-171 as soon as it rises above horizon.

<sup>2 -</sup> Encryption Selection can only be performed via a switch on Panel A1L

#### Site Usage Plan for Ascent (28° inclination)

Site	Nominal, TAL,	TDRS	RTLS	Transponder
	or Engine ↓	↓		Mode <sub>3</sub>
MIL	L/O	L/O	L/O	STDN-HI
PDL	1:00	1:00	1:00	STDN-HI
MIL	2:30	2:30	2:30	STDN-HI
TDRS-47®	7:30	8:30		TDRS
MIL			14:00	STDN-LO
TDRS-47②	18:00	18:00		Spreading ON
TDRS-Z	~39	~39		TDRS
TDRS-171	~50	~50		TDRS

#### Site Usage Plan for Ascent (39° inclination)

Site	Nominal, TAL, or Engine ↓	TDRS ↓	RTLS	Transponder Mode®
MIL	L/O	L/O	L/O	STDN-HI
PDL	1:00	1:00	1:00	STDN-HI
MIL	2:30	2:30	2:30	STDN-HI
WLP		7:30		STDN-HI
TDRS-47®	7:30	09:45		TDRS
MIL			14:00	STDN-LO
TDRS-47@	18:00	18:00		Spreading ON
TDRS-Z	~39	~39		TDRS
TDRS-171	~50	~50		TDRS

#### Site Usage Plan for Ascent (51.6° and greater inclinations)

Site	Nominal, TAL, or Engine ↓	TDRS ↓	RTLS	Transponder Mode®
MIL	L/O	L/O	L/O	STDN-HI
PDL	1:00	1:00	1:00	STDN-HI
MIL	2:30	2:30	2:30	STDN-HI
WLP		7:30		STDN-HI
NHS		10:00		SGLS
TDRS-47®	7:30	11:25		TDRS
MIL			14:00	STDN-LO
TDRS-47@	18:00	18:00		Spreading ON
TDRS-Z	~39	~39		TDRS
TDRS-171	~50	~50		TDRS

 $<sup>\</sup>ensuremath{\mathbb{O}}$  - MIL or WLP to TDRS-47 handover of 10 seconds has voice-only support through WLP UHF.

#### **Ascent Aborts and Contingencies**

RTLS support will use Merritt Island Launch Area site (MILA) through touchdown. The Orbiter S-Band PM system will be reconfigured to STDN LO at 14:00 MET via SPC. East Coast Abort landing (ECAL) support will use TDRS-47 with either the nominal SPC at 7:30 MET or ground commanded handover prior to 7:30 MET, based on MILA antenna elevation. UHF communications will be established with the ECAL control tower with the crew selecting Guard T/R (243 MHz) on panel O6. Trans-oceanic Abort Landing (TAL) support will use TDRS- 47°W following the nominal handover from STDN sites at 7:30 MET. UHF will be available via INMARSAT once the Orbiter is approximately 120 miles (or approximately 130 Kft in altitude) from the TAL site.

② - A 40 second forward link dropout will occur when Spread Spectrum is enabled.

③ - S Band transponder will be operated with ranging off except at MILA.

Should an S-Band PM panel/command be required when outside of ground station coverage, it must be followed by an ITEM 46 on BFS SPEC 51 to configure for TDRS mode. If the BFS SPEC 51 capability is unavailable, PNL A1 must be reconfigured to the TDRS mode prior to the PNL/CMD. Note that the ITEM 46 configures spread spectrum as a function of ops mode (spreading off, OPS 1/6; spreading on, OPS 3). Should TDRS-47 fail after liftoff, TDRS-East will require 15–20 minutes for scheduling prior to use (8-10 minutes to perform logistics of the emergency Scheduling Order (SHO) plus 7 minutes for SHO execution). During the TDRS outage, the S-Band PM link will be managed through WLP, NHS, OTS, and DGS as required. SPC's are available to support through the first ZOE. WLP has predicted masking from 08:37 until 09:00; however, flight data from STS-97 ascent verified that WLP could process solid forward and return links through the keyhole BFS SPEC 51 also has item entries for STDN-HI, STDN-LO, and SGLS (ITEMS 47, 48, and 49 respectively), which are available to the crew if required. Note that items 47 and 48 configure the uplink coding as a function of ops mode of the BFS (uplink coding on, OPS 1/6; uplink coding off, OPS 3). (see table below).

#### **BFS SPEC 51 Item Entries**

ITEM	CMD(s) SENT	RESULT (OPS 1 & 6 only)	RESULT (OPS 3 only)
46	TDRS Salvo, HDR UP, HDR DN,	TDRS	TDRS
	FLTR WIDE <u>+</u>	SS OFF	SS ON
	SS OFF (OPS 1&6 only!)	(nom ascent config)	(nom entry config)
47	STDN-HI Salvo +	STDN HI	STDN HI
	U/L coding ON (OPS 1&6 only!)	U/L CODING ON	UL CODING OFF
		(nom ascent config)	(nom entry config to DFRS)
48	STDN-LO Salvo <u>+</u>	STDN LO	STDN LO
	U/L Coding ON (OPS 1&6 only!)	U/L CODING ON	UL CODING OFF
		(nom RTLS config)	(nom entry config to MILA)
49	SGLS Salvo	SGLS	SGLS

The BFS SPEC 51 ITEM entries send the associated commands to both PF1 and PF2 and are made available to the GCIL for execution. BFS SPEC 51 is not available in OPS 0 as it is a BFS GNC display.

#### **WARNING**

BFS Flight Software Problem: If the FF MDM (FF1/NSP1, FF3/NSP2) that is currently being used for uplink command is bypassed, the BFS will not process the item entries until the bypass is cleared.

The current mode is displayed with an '\*' next to the item and is based on PCMMU provided telemetry. An indication of the forward link to the orbiter is located next to the COMM label. This telemetry will indicate, "LOCK" if either NSP 2(1) FRAME SYNC telemetry points are high ('1'), otherwise it will be blank.

#### **Orbit Operations**

On orbit, the S-Band PM link will be supported by TDRSS. Satellite selection will be based on the Ku-Band requirements. S-Band handovers will normally occur at the same time as those for Ku-Band. The onboard antenna management will be commanded to ensure this support, with the crew providing a backup means if necessary. There are no plans to use any Air Force Remote Tracking Stations (RTS) for two-way support during STS-111. However, they can be requested to fill in for long gaps in TDRS coverage on a case-by-case basis.

#### Deorbit and Entry

During deorbit preparation, the panel A1 switches will be reconfigured to support the STDN LO mode. Once this configuration is completed, if a panel/command is required while outside ground station coverage, then an ITEM 46 must follow it on BFS SPEC 51 to configure for TDRS mode. If the BFS SPEC 51 capability is unavailable, PNL A1L must be reconfigured to the TDRS mode prior to the PNL/CMD (EPCL page 2-2). TDRS-Z or DGS (if on range) will support in order to provide communications during the ZOE, near the time of the deorbit burn. A nominal end-of-mission landing at KSC will be supported by TDRS until MIL AOS rounded up to the next whole minute. A TDRS handover may be performed prior to MILA hand-down so that a lower antenna is not selected for communications while in the Orbiter blackout period. At MILA AOS, rounded up to the next whole minute, an onboard SPC will command the Orbiter to STDN LO mode and two-way support will be transferred to MIL.

9/1/2004: REV G

A landing at Dryden Flight Research Center (DFRC) will be supported by TDRS-171 until the S-Band PM link is handed over to the DFRC ground station at AOS plus 1 minute rounded off to the next whole minute. UHF will be available as soon as the Orbiter is in view of the ground site and the orbiter is less than 130,000 feet altitude. S-Band PM ranging will be commanded off as part of the MSPC to preclude the downlink problems that have been seen during previous landings.

TDRS-171 and the Salinas Peak UHF site will support any landing at the Northrup Landing Facility at White Sands Space Harbor.

Post wheel stop, the MCC will inhibit BFS antenna pointing, ensuring that S-Band PM and frequency modulation (FM) upper antennas are selected for convoy safety. MCC will also perform the operational recorders dump when FM is available.

#### Antenna Management

The antenna management system configuration will be controlled by ground command with the crew backing up the MCC. Real-time changes to this plan will be voiced to the crew.

INCO will nominally perform all TDRS SV management via pre-stored commands based on the TDRS schedule of operations (SHO). Note that only the TDRS SVs that are enabled will show up on the crew display in real-time (IN VIEW status as well as plotted on the AZ/EL plot). Thus, the approach of inhibiting SVs that are not scheduled will generally be utilized as a way to improve the info available to the crew for

#### **Ku-Band System**

The Ku-Band System will be prime for Orbiter Communications Adapter (OCA) activities, television downlink (analog or digital), recorder dumps including the Space Shuttle Main Engine (SSME) data, and possibly payload digital (channel 2) data. As soon as the Ku-Band System has been deployed and activated, the SSME data will be dumped. Once the SSME data has been dumped the ascent operational data and voice will be dumped. Ku-Band (when available) will also be used as the primary operational link during all PAO events.

#### **RF Protect Boxes**

INCO has full command control of all four boxes, however the crew has no insight into them at all.

#### Forward Link Auto Handover

The forward link auto handover function will nominally be enabled the entire mission while Ku-band is operating in comm mode.

#### **Digital Television (DTV)**

The Digital Television (DTV) system includes a Sony DSR-20 VCR, a vertical interval processor (VIP), and downlink multiplexer, or mux. The VCR records in digital DVCAM format, but can also playback mini-DV tapes. The VIP accepts analog video routed from the VSU output "Payload" (decal says DTV/PAYLOAD). The VIP processes the vertical interval data from the payload bay cameras and inserts this data on audio channel 2 and sends it to the VCR. The DSR-20 VCR is used to record video, audio, and vertical interval data onto 184-minute DVCAM tapes. In addition to record and playback, the DSR-20 can throughput the converted (analog-to-digital) video for real-time downlink. The DSR-20 uses a firewire (IEEE-1394) connection to route the digitized video to the downlink mux. The downlink mux provides a constant 48 Mbps signal to the Ku-Band signal processor PL MAX channel. In order to receive digital video in the MCC, the VIP, VCR, and downlink mux must all be powered and configured (cables) for downlink. There is no telemetry available to determine system configuration without a successful Ku-Band Channel 3 downlink from the mux. A web page is available from the MCC PC's to view the DTV and camera telemetry.

#### Shuttle Digital Television (DTV) Equipment

The DTV mux and VTR are powered from AUX PL Main A bus. The VIP is powered from MA73C, AC2 PAYLOAD 3Φ circuit breaker (only phase A is used). The DTV system will not be powered for ascent or entry. A Sony V-10 will be used to record ascent and entry video. The DTV system will be activated in Post Insertion.

#### S-Band FM System

The S-Band FM System will be used to downlink real-time SSME data during ascent. The S-Band FM System will be used to support SSR dumps, real-time TV, and mini-cam entry video (via PL analog). Post-landing at KSC or DFRC, an SSR will be dumped via S-Band FM. There are no Payload constraints on the S-Band FM system.

#### Ultra High Frequency (UHF)/Space-to-Space Orbiter Radio (SSOR)

UHF will be operated using 259.7 MHz as the primary frequency, with 296.8 MHz as the backup frequency. The UHF will be powered off in post-insertion and back on for L-1 day landing checks and again for deorbit preparation/entry. The SSOR will be used during rendezvous, EVA, undocking, and fly-around. The SSOR circuit breakers on panel R14 will be pushed in during post insertion operations and they will be pulled out during deorbit prep. The power amp will be off (panel O6 UHF SPLX/EVA PA PWR – OFF) for the duration of each SSOR activity.

#### **PCMMU**

Data from the operating PCMMU's spare 128K output will be made available to the WinDecom card via ports on panels O5 and MO30F.

#### Recorders

The Solid State Recorders will be operated per standard procedures. The MADS system will be commanded to record ascent and entry data. During orbit phase, the MADS will be turned OFF.

#### **Network Support**

Prime TDRSS support will be from TDRS-171 and TDRS-47 (TDRS-S). TDRS-Z may be scheduled to support via Guam Remote Ground Terminal (GRGT). TDRS-West and TDRS-East may be scheduled at times to resolve conflicts. Ku-Band return link through GRGT (TDRS Z) is limited to Channel 1 and up to 1024 Kbps on Channel 2.

The Space Network and RTS Network will use the IP system for both forward and return link activity. The GSTDN Network will be IP on the return link only and NASCOM 2000 on the forward link. This is

due to the Network Command Processor System (NCPS) at the ground network stations (MIL/DFRC/WPS) which do not care for the "burstiness" of the IP. They will also use the backside of the NASCOM 2000 for a telemetry backup for IP from the GN.

GSFC has requested that we favor the eastern satellites when possible due to user loading. Thus, "Early" TDRS handovers will be requested as much as possible and scheduled unless better comm exists on the West. "MIDPASS" handovers may be scheduled as well. GSFC also requests that STS and ISS try not to schedule three SA antennas at one time and utilize virtual spacecraft for these times as much as possible. The main analysis for virtual spacecraft opportunities rests with the FAO/POINTING/OPS PLANNER teams.

Note that docking/undocking are no longer constrained to occur over Russian ground sites, however it's still a consideration along with lighting conditions, etc. Guam Remote Terminal System (GRTS) that supports TDRS-275 has an equipment limitation that requires that any planned SSR playback be requested at least 15 minutes before the event start. This will give GRTS time to reconfigure to support this request without affecting other users of TDRS-275. Approximately one ground site per rev will be called up if possible to support SSR dumps after Ku band stow. ALL NASA and RTS sites, on range, will be called up to support de-orbit prep through entry.

The following is a list of NASA and DOD S-Band ground stations capabilities currently available:

#### Site Designation UHF Comments<sup>®</sup> Merritt Island Launch Area MIL/MLX/PDL √ SLSS/FM TV Jonathan Dickinson JDI ascent TLM only Wallops Island WLP STDN Dryden **DFR RLDS** Northrup **UHF ONLY** SAL

#### NASA Sites (Transponder - STDN Mode)

#### Notes:

SLSS - Shuttle Launch Support System (two-way TDRS mode support)
 RLDS - Return Link Data System (downlink only TDRS mode support)
 JDI is used for ascent support only as a backup to MILA for return link data only.

#### **Department of Defense Sites (Transponder - SGLS Mode)**

Site (CALL SIGN)	Designation	Comments	
New Hampshire (BOSS)	NHS	single system	
Oak Hangar (LION)	OTS	single system	
Diego Garcia (REEF)	DGS	single system	
Guam (GUAM)	GTS	dual system	
Hawaii (HULA)	HTS	dual system	
Vandenberg (COOK)	VTS	single system	
Colorado (PIKE)	CTS	single system	

LION UHF service is no longer required and has been deleted from the Network Program Requirements Document. It is expected that the RTS network will no longer support Shuttle missions by the end of fiscal year 2002. The network information provided in this document is accurate as of the date of this document. Updates to this information will be available on console for the flight. There are no plans to perform proficiency passes with the RTS during overnight periods.

#### L-1 Comm Checkout Opportunities

L-1 comm checkout opportunities will be identified during the mission. The S-Band PM, S-Band FM

(minicam TV if set up) and UHF will be checked at both MILA and DFRC. The FM TV video may not be shipped back in real-time to JSC for viewing if the satellite transponder used for this purpose is being used for NASA Select broadcasting. A playback of the video may be coordinated as required. If the first pass at each site is successful, the backup opportunity will not be used

#### **Command Safing to Meet Dual Action Criteria**

In order to meet "dual action" command safing requirements, the commands listed in INCO Console Handbook SCP 3.20 will be safed by the prelaunch team then unsafed only for uplink or TEC build, and resafed as soon as practical.

Rationale: The impact of unintentionally radiating an EVA crewman or ISS balanced with minimal operational impact makes it highly desirable that these commands require dual action throughout the window of vulnerability.

-----

#### **PUBLICATION SCHEDULE**

The publication schedule is adjusted for each mission, but generally falls into three publication dates.

- The preliminary memorandum is published between 3 to 4 months prior to launch and contains the information necessary to start integrated simulations.
- The final memorandum is published between 2 to 3 weeks prior to launch.
- From launch minus 2 weeks until launch, any significant changes are published as a delta to the document.

#### **DISTRIBUTION AND DISTRIBUTION LISTS**

The distribution, as far as practical, will be done electronically. Printed copies will only be mailed to those people that specifically request a paper copy. Those people that request paper copies may not receive the deltas to the final document prior to launch. The distribution of the document is performed by the DF24/Comm Group lead in conjunction with the DF2/branch secretary.

There are two types of distribution lists: standard and mission specific. The standard distribution list is as follows: Mission Operations Director, Flight Director Office Chief, DF Systems Division Chief, DF2 Branch Chief, DF24 personnel, GC Group lead, GSFC Network Director, KSC Communications Group lead, KSC Instrumentation Group lead, MILA Site Director, OST Telcom Branch lead, OST Voice/Video Branch lead, and EV4/Avionics Integration personnel. Mission-specific distribution is as follows: mission crewmembers, all assigned Flight Directors, lead payloads officer, FAO officers, and the lead GC. The mission-specific list is supplied by the lead INCO to the group lead who helps the branch secretary distribute the memo.

**CONSOLE CUE CARDS** 

#### **PURPOSE**

To define the console cue cards used by the INCO team.

#### **GENERAL**

The Instrumentation and Communications Officer assigned to the lead flight control team will assume the responsibility for ensuring that only approved cue cards, as defined herein, of the latest issue will be placed under glass on each of the INCO team consoles prior to each flight.

#### **APPROVED CUE CARDS**

- A. Any part of a controlled document of the latest approved issue may be used as a cue card, provided that the document number, revision, and PCN (if any) are clearly marked.
- B. Any part of an uncontrolled document may be used as a cue card, provided that the document number, revision, and PCN (if any) are clearly marked and that the label in Figure 1.9-1 or facsimile thereof is copied or affixed to the cue card.

UNCONTROLLED DOCUMENT
FOR REFERENCE ONLY

Figure 1.9-1. Uncontrolled document label

C. Any part of this SCP may be reproduced and used as a cue card, subject to section A above.

#### **CURRENT CUE CARD CONFIGURATION**

INCO console cue card layout, per Figure 1.9-2 1 3 2 20 8 13 30 18 7 2 5 26 11 9 19 18 21 6 23 14 10 15 12 24

Figure 1.9-2. INCO console current cue card layout

- 1. Flight Data File usage per mission phase SCOM, page 3.5-5
- 2. Parameters Listed According to MDM and DSC, SCP 5.15, pages 1, 2, and 3
- 3. MCC Access Control phone list; updates available from building 30S, room 3306
- 4. Avionics bay comm equipment, Figure 1.9-3
- 5. CTVC (ITVC) Menu Ops Cue Card

0	14	120	1	A .	D			$\hat{}$
IJ	/ 1/	/20	ľ	4:	R	E١	,	u

AV Bay 1	AV Bay 2	AV Bay 3A
ACCU 1&2	PI 1&2	UHF
CIU	PSP 1&2	GCIL
PF1	PF2	COMSEC 1&2
MMU 1/SSR1	MMU 2/SSR2	Ku EA1&EA2
PDI	PI RW SW	FM XMTR 1&2
PCMMU 1	PCMMU 2	FM SPA 1&2*
MDM&DSC OF1	MDM&DSC OF2	MDM&DSC OF3
FF1		FF3
Cabin	AV Bay 3B	NSP 1&2
VSU/RCU/VPU*	KuSP	XPNDR 1&2
MDM OF4*	MTU	PA 1&2
MADS RCDR*		PRE AMP 1&2
ATU (ALL)*		AE 1&2*
TV MON (ALL)*		SW BEAM 1&2*
TV MON (ALL)* PDIP*		SW BEAM 1&2* FM ANT SW 1&2*
` '		

Figure 1.9-3. Avionics bay comm equipment

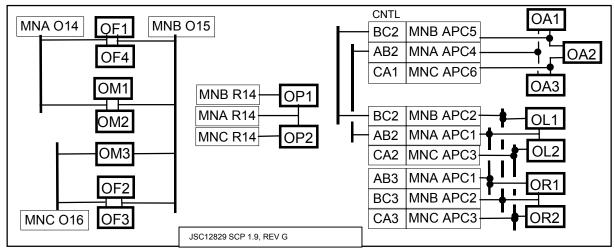


Figure 1.9-4. DSC BITE pattern by bus

- 6. DSC BITE pattern by bus, Figure 1.9-4
- 7. Power bus tables, SCP 6.3, Tables 6.3-2 and 6.3-3
- 8. Orbiter Electrical Bus Loss Matrix, Assy Ops/11A/Fin, p 343
- 9. SSSH dwg. 20.1, sheet 2, panel L5
- 10. SSSH dwg. 20.1, sheet 2, panel R6
- 11. SSSH dwg. 20.1, sheet 4, panel O5
- 12. SSSH dwg. 20.1, sheet 4, panel O9
- 13. SSSH dwg. 20.1, sheet 4, panel O6
- 14. SSSH dwg. 20.1, sheet 2, panel C3
- 15. SSSH dwg. 20.2, sheet 1, panel A1U
- 16. SSSH dwg. 20.2, sheet 1, panel A1L
- 17. SSSH dwg. 20.2, sheet 1, panel A1R
- 18. SSSH dwg. 20.2, sheet 1, panel A2
- 19. SSSH dwg. 20.2, sheet 1, panel A3
- 20. SSSH dwg. 20.1, sheet 3, panel O15
- 21. SSSH dwg. 20.1, sheet 3, panel O14
- 22. SSSH dwg. 20.2, sheet 3, panel R14
- 23. SSSH dwg. 20.1, sheet 3, panel O16
- 24. SSSH dwg. 20.2, sheet 1, panel A6L
- 25. SSSH dwg. 20.2, sheet 1, panel A7U
- 26. SSSH dwg. 20.1, sheet 3, panel O17
- 27. DPS Dictionary, SM 011, Antenna
- 28. DPS Dictionary, SM 076, COMM
- 29. DPS Dictionary, SM 001, DPS Utility
- 30. DPS Dictionary, SM 062, PCMMU/PDI

9/1/2004: REV G

B. COMM Support Console cue card layout, per Figure 1.9-5

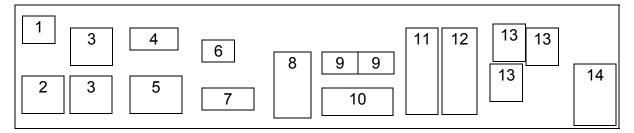


Figure 1.9-5. COMM Support Console cue card layout

- 1. SCAN ZONES, one-of-a-kind hand-drawn graph
- 2. Flight Data File usage per mission phase, Shuttle Crew Operations Manual (SCOM), page 3.5-5
- 3. Power bus allocation, SCP 6.3, Table 6.3-2
- 4. Orbit Pocket Checklist, TOC for COMM
- 5. Scan Zones, SODB, Figure 3.4.5.2-3
- 6. Antenna DSMs, Figure 1.9-6

DSM no. AE1 - AE2	Antenna
4676 - 4692	ULF
4677 - 4693	ULA
4678 - 4694	URF
4679 - 4695	URA
4680 - 4696	LLF
4681 - 4697	LLA
4682 - 4698	LRF
4683 - 4699	LRA
JSC-12829, SCP 1.9, RI	EV G

Figure 1.9-6. Antenna DSMs

- 7. Ku RADAR reference card, per Figure 1.9-7
- 8. Long Form MAL, TOC for COMM
- 9. DPS Dictionary, SM 076, COMM; SM 2011, Antenna
- 10. Ku Self-test Data Blocks to the MDM, SB 10, Table 10-5
- 11. Water Flow Distribution System for INST and COMM equipment, SB 20.2
- 12. AV Bay INST Equipment, SB 20, Figure 20-4 and 20-5
- 13. Parameters listed according to MDM and DSC, SCP 5.15

# 14. INCO phone list

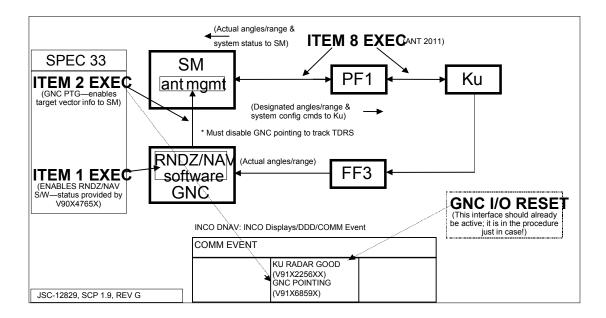


Figure 1.9-7. Ku RADAR reference card

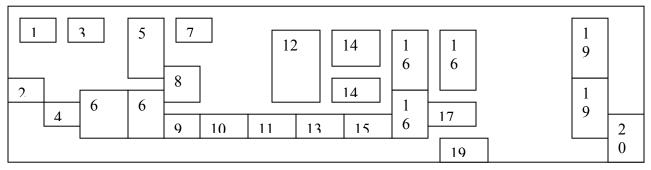


Figure 1.9-8. INST/DATA COMM Console current cue card layout

- C. INST/DATA COMM Console current cue card layout, per Figure 1.9-8
  - 1. DPS Dictionary, SM 062, PCMMU/PDI
  - 2. Avionics Bay Comm Equipment, Figure 1.9-3
  - 3. GPC Dump/TFL Compatibility, SCP 3.34, Table 3.34-1
  - 4. INST Start-Up Actions, per Figure 1.9-9.

# 9/1/2004: REV G

# INST Start- Up Actions isp\_channel (click on "Automatic") Limit Manager (click on "Orbit") Oimon 2 Training Roster

Figure 1.9-9. INST Start-Up Actions

- 5. Long form MAL, TOC for INST
- 6. AV Bay INST Equipment, SB 20, Fig. 20-4, 20-5
- 7. Flight Data File usage per mission phase SCOM, page 3.5-5
- 8. OI Electrical Summary Data, SB 26, Table 26-5
- 9. DSC BITE pattern by bus, Figure 1.9-4
- 10. LCC table from SCP 3.5
- 11. Discipline contacts and loops, per Figure 1.9-10.

DISCIPLINE	FCR LOOP	MPSR LOOP	MPSR POSITIONS
EECOM	MOCR SYS	SSR-1*	THERMAL, LIFE SUPPORT
EGIL	MOCR SYS	SSR-1*	EPS
MMACS	MOCR SYS	IFM COORD*/SSR-1*	IFM, MECHANICAL
PROP	MOCR GNC/PROP	SSR-1*	OREO
PLO	PAYLOADS	INST COORD	PL DATA, PL SYS
BOOSTER	MOCR SPEC	BOOSTER MPSR	ME SUPPORT
DPS	MOCR DPS/CDMS	SSR-1*	DPS SUPPT, CDMS

<sup>\*</sup> Use multi-operator loop for initial contact, meet on INSTR COORD for extended conversation.

JSC-12829, SCP 1.9, REV G

Figure 1.9-10. Discipline contacts and loops

- 12. INST systems power buses, per SCP 6.3, Table 6.3-2.
- 13. DSC location on shuttle, SB 27, Figure 27-2
- 14. Orbiter Electrical Bus Loss Matrix, Assy Ops/11A/Fin, p 343
- 15. MCC Access Control phone list; updates available from building 30S, room 3306
- 16. Parameters Listed According to MDM and DSC, SCP 5.15
- 17. SM VP Slots 4 and 5, Figure 1.9-11.

SM VP Slot 4	YXXX INCO	TMBU SPEC 60	2XXX	
			3XXX	SPEC 60
JSC-12829, St	CP 10 PEV G		AXXX BXXX	ACTIVE

Figure 1.9-11. SM VP slot 4

- 18. BLDG 30 FAX (281) 483-4947
- 19. SSR Information, SCP 3.22, pg 11-12
- 20. Phone list

SHUTTLE OPS INCO/COMM/JSC-12829

9/1/2004: REV G

#### TITLE

#### FLIGHT SOFTWARE CHANGE REQUEST REVIEW PROCESS

#### **PURPOSE**

To define a standard set of procedures to be used during the review of a flight software change request.

#### **GENERAL**

INCO is the author of software changes request (SCR) to the flight software (FSW) for the BFS and SM antenna management applications as well as any changes to PSP or PCMMU/PDI software. A review process is required to prevent errors from being introduced to the flight software. The following is a discussion of this process.

#### **PROCEDURE**

After a change has been deemed necessary, the author will follow the standard procedure for development of a FSW SCR as documented in the SASCB SCR 89051 "SASCB: Space Shuttle Software Change Request (CR) Process". Once this is complete the following procedure is used for review of the change:

- A. A senior member of the INCO group is assigned to review the SCR
- B. The senior member will analyze the need for the change
- C. The senior member will review (see check list) the change looking for errors which may include:
  - a. Requirement conflicts between sections.
  - b. Values that do not match in different places in the SCR
  - c. Areas where SCR 89051 was not followed
  - d. SCR Presentation errors
- D. The reviewer returns the SCR to the author with comments if any
- E. The author makes the appropriate changes as noted by the reviewer
- F. The author has the reviewer verify the changes
- G. The author forwards the SCR to the INCO group lead for review and comment
- H. The INCO group lead forwards the SCR to the Comm and Data Branch Chief for review and comment
- I. Once the group lead has signed off on the SCR, the author passes the SCR to the MOD SASCB rep for formal submittal.

SHUTTLE OPS INCO/COMM/JSC-12829

# SCR REVIEW CHECK LIST

shoul	person reviewing each SCR should use this checklist to help them review the change. d "check" each step of the review process and attach a copy of this check list with the it is forwarded to the INCO group lead for sign off.	
	Analyze the requirement for the need for a change	
	Verify the cover page for the SCR is completely filled out	
	<ul> <li>Number of pages referenced</li> <li>Title</li> <li>SCR Number</li> <li>Software Affected/Requested Release</li> <li>Originator/Org and phone number</li> <li>Date</li> <li>List of documents affected complete</li> <li>Areas affected by the SCR</li> <li>Principal functions affected</li> <li>Change description summary</li> <li>Reason for change</li> </ul>	
	Verify a Mod page is attached with the SCR number on it.	
	Verify that each page in the SCR has the SCR number and a page number at the to hand side of the page	p right
	Check that text deletions in the requirements are properly marked with "This CR" and a country bar on the right side of each page.	hange
	Check that inserts for new requirements are properly marked on the requirements page "This CR" and a change bar on the right side of each page	s with
	Check that information only pages have " FOR INFO ONLY" at the top of each page	
	Analyze the logic in the requirements changed to verify that what is intended to happ happen	en will
	Check values are consistent throughout the SCR	
	Review FSSRs, FSRs and PRDs to be sure that no area related to the SCR was skipped	
	Review the SASCB presentation	
Date	of Review: Reviewed by:	

9/1/2004: REV G

## TITLE

#### CONSOLE DOCUMENTATION AND LOG KEEPING

#### **PURPOSE**

To assure maintenance of adequate console records in order to permit reconstruction of test/mission events if required or to furnish after-the-fact information or reports. The SCP also lists the specific procedural and technical documents to be kept at each console.

**REV G, PCN 2** 

7/1/2005:

#### **PROCEDURE**

- A. Logs will be kept by the instrumentation and communications officer (INCO), communications support officer (RF COMM), instrumentation officer (INST), and data communications officer (DATACOMM) at all times. The logs will be recorded on mission log sheets or electronic flight log (EFLOG) on the PC, and the end of this SCP details the EFLOG setup procedure. Following are examples of entries to be made:
  - 1. All significant console activities.
  - 2. Significant communications events not otherwise recorded.
  - 3. Problems or delays encountered in a test or mission phase.
  - 4. Communication malfunctions, possible causes, action taken, and action pending (MCC/STDN, orbiter, TV).
  - 5. Any time a mission rule is implemented.
  - 6. Space tracking and data network (STDN) status.
  - 7. During countdown operations, record Greenwich mean time (GMT) with occasional T-minus times for reference. During plus-time operations, record GMT with an occasional mission elapsed time (MET) recorded for reference.
- B. A summary of the log will be made in the handover sheet after each day's activity or shift.
- C. The following files will be maintained by INCO/COMM as applicable:
  - 1. Console logs
  - 2. Anomaly logs
  - 3. Handover sheets
  - 4. TV or SSR recorders dump quality reports if abnormal
  - 5. Spacecraft analysis (SPAN) chits
  - 6. Flight plan changes
  - 7. Miscellaneous (command history, flight notes, mission rule changes, etc.)
  - 8. Execute packages

- 7/1/2005: REV G, PCN 2
- D. The duties of the individual assigned the task of updating a given set of documentation are as follows:
  - 1. Verify that all materials indicated in part E. are available at the indicated console.
  - 2. Update documents with PCN's and DCN's in a timely fashion as these changes become available.
  - 3. Ensure that documents and/or binders that are no longer serviceable are replaced.
  - 4. Report to the FDF coordinator any discrepancies found during examinations of the documentation under their care.
- E. The following documents will be available in the locations shown in the following chart.

	FCR	MPSR
INCO/COMM Console Handbook (JSC-12829)	Х	Х
INCO Systems Briefs (JSC-18611)	X	Х
Space Shuttle Systems Handbook (JSC-11174)	X	X
Flight Controller Operational Handbook (JSC-12805)	X	Х
STS Flight Rules (NSTS-12820, Vol. A)	X	Χ
Flight Rule Annexes (NSTS-18308)	X	Х
STS Flight Data File with FS sections	X	Х
OI MDM/DSC Failure Impacts (JSC-16983)	X	Х
Joint Operations Integration Plan (FS)	X	Х
Operations Support Timeline (FS)	X	Х
INCO MEMO	Х	Х
Flight Unique binder	X	Х
Display and control boards	X	Х
INCO LOG binder	X	
RF COMM LOG binder		Х
DATA COMM LOG binder		Х
INST LOG binder		Х
INST Book (FS)		Х
Chit and Anomaly binder		Х
Execute Package binder		Х
Payload Mgmt Level C FSSR (JSC-19478) (FS) (available online)		Х
Payload C & D Annex (JSC-14071) (FS) (available online)		Х
SM Level C FSSR (JSC-19590) (FS) (available online)		Х
PCMMU Bypass Bits (FS CD and hardcopies)		Х
MAST MRL and downlist/downlink products		Х
Command listing (FS)		Х
Cargo Systems Manual (PL and FS)		Х
IPCL		Х
Space Shuttle Telemetered and Recorded Data Format Requirements (JSC-10784)		Х
OMI S0007 (5 volumes) (available online)	Х	Х
OMI S0017 (available online)	Х	Х

**FCR MPSR** OMI V1117 (available online) Χ Χ Launch Commit Criteria Χ Χ NOSP (STDN 601) Χ Χ TDRS NOSP (STDN 602) Χ **NOSP Annexes** Flight Procedures Handbook Χ Flight SW Ops Notes and Waivers (JSC-19320) Χ Χ Shuttle Operational Data Book (available online) Calibration Handbook Χ Calibration Tables Χ

7/1/2005: REV G, PCN 2

# F. EFLOG Setup

- Set Word Macro Security to Medium. To open EFLOG, go to <u>S:\Divisions\DF\Private\DF24\FLTINFO\STS\_FUTR</u> and open the FLIGHT\_LOG.DOT FILE (enable Macros).
- 2. After opening EFLOG, a red box will appear that asks for activity information. Simply enter the appropriate flight number and select the correct activity.
- 3. After starting EFLOG, several macro toolbars should appear on either side of the word template. If they do not appear, go to the *Tools* menu, select *Customize*, and then click the *Toolbars* tab. From this menu, you can select any available toolbar by simply checking the box next to the item.
- 4. After formatting the toolbars, the time must be set up. To do this, go to the *Insert* menu, select *Date and Time*. Next, select the time format you like, and click the *Default* button on the bottom of the menu. Finish by clicking the *OK* button. The HH:MM and HH:MM:SS format are 24-hour format like we use in MCC.
- 5. Before using EFLOG, the user must use the *SETUP* macro on the *Really Cool Buttons* toolbar. This will open a menu asking for three times, all available on console to the user. The *Lift-Off Time* and the *SGMT* are activity specific, and the sim/mission *Local Start Time* are entered when data starts flowing to the console. Liftoff Time is available as GMTR on the ACQMON display.
- 6. Finally, to extend EFLOG for additional log taking, drag your mouse from the middle of the *Time* cell across the page to the right until the mouse is out of the cells. This will select the entire last line of the template. While the line is selected, type *CNTL+C*(copy). Finally, single-click the mouse in the left-most cell on the bottom of the page, and hold down *CNTL+V*(paste) until the needed numbers of cells are pasted into the template.

#### **TITLE**

PARAMETER DEFINITION AND RELATED SOURCE MATERIAL

#### **PURPOSE**

To provide a listing of source documents which contain information relating to space shuttle parameters.

#### **GENERAL**

The shuttle system is monitored through the use of digital parameter data. Various format types are used throughout the data management system. The source documents shown below contain information about the various parameter types.

In the past, differences between onboard and downlisted (D/L) data characteristics have led to confusion within the flight controller community. These differences can be explained by cross referencing the telemetry characteristic documents with the GPC data documents.

#### RESOURCE DOCUMENTS

# **Systems Management**

Level C
Flight Software Requirements
JSC-19590-xxx (xxx = flight number) – look up iin SELS

Information available: This document contains information about GPC parameters and their associated data types. GPC data types and values may differ from their OI downlisted counterparts.

#### **Shuttle Calibration**

JSC-16486 – to be available electronically in September, 2007 Contains Shuttle cal info, will be updated as required.

Information available: This web page contains the coefficients used for the conversion of PCM counts to engineering units (calibration curves). Good source for computing the high and low values of a parameter from its PCM counts, (i.e., off-scale high and low).

# **Shuttle Operational Data Book (SODB)**

NSTS-08934

Web Page: <a href="https://opo.nasa.gov/sodw/">https://opo.nasa.gov/sodw/</a>

Section – 3 Shuttle Constraints and Limitations

Data presented in this section includes operational hardware limitations and constraints for the avionics equipment (3.4.5)

Section – 4 Orbiter Performance and Operational Data

Provides data of the communications and tracking subsystem capabilities (4.5.2), data processing for communications and tracking subsystems (4.5.4), and primary function of the OI data acquisition along with the modular auxiliary data system (MADS) (4.5.5)

# **Program Requirement Document (PRD)**

**Backup System Services** 

MG038101 - look up in SELS

Web Page: <a href="http://p51.ksc.nasa.gov/dept/BFSNET/#ASSOCDOCS">http://p51.ksc.nasa.gov/dept/BFSNET/#ASSOCDOCS</a>

Section - 3 Requirements

PCM Downlist Requirements are described in 3.7. The format criteria for the BFS GPC and the environment in which the BFS downlist data becomes a part of the PCMMU downlink is given in much detail. I/O error handling is discussed in section 3.1.8.

# **Computer Program Development Specification (CPDS)**

SM Functional Level Requirements

USA001547 - look up in SELS

Web Page: http://usa1.unitedspacealliance.com/usahou/orgs/6320/links/index2.htm

Section – 4 SM Basic Functional Processing Definitions

Describes data acquisition/output data processing (4.1), PCMMU telemetry format load (TFL)/downlist rate change (4.5), PDI DECOM format load (DFL) and fetch pointer memory (FPM) load (4.7), payload signal processor (PSP) communication (4.9) and payload uplink processing (4.10)

Section – 5 Display Functions

Describes how system management (SM) processes or changes parametric values used in SM processing (5.1)

#### Downlist/Uplink

USA001548 – look up in SELS

Web Page: <a href="http://usa1.unitedspacealliance.com/usahou/orgs/6320/links/index2.htm">http://usa1.unitedspacealliance.com/usahou/orgs/6320/links/index2.htm</a>

Section – 3 GPC Downlist Processing

Contains the requirements for the general Purpose Computer (GPC) downlist process, downlist format organization (3.1), data word characteristics (3.2), and special data handling (3.3)

Section – 5 Downlist Formats

Defines the requirements for downlist formats, including the organization of the formats (5.1), the output rates (5.2), toggle buffer destination (5.3), initialization (5.4) and header word (5.5)

# **Mission Control Center System Requirements**

Web Page: <a href="http://mod.jsc.nasa.gov/dv/dv2/MCC\_HPAGE/MCCsubpages/Subsystems.cfm">http://mod.jsc.nasa.gov/dv/dv2/MCC\_HPAGE/MCCsubpages/Subsystems.cfm</a>

Select the appropriate subsystem; for example:

Command (command server requirements)

ODRC (Appendix D has the ODRC COMP requirements)

Consolidated Communications Facility (has the FEP requirements)

# **INCO Systems Briefs**

JSC-18611

Web Page: http://stic.jsc.nasa.gov/dbase/dis/jsc/incosystembriefs.pdf

Section 29 - Pulse Code Modulation Master Unit

Gathers data from all shuttle subsystems and interleaves it according to format instructions within the PCMMU and outputs it to recorders, ground support equipment and for downlink

Section 49 – Telemetry Processing in the MCC

Gives an understanding of what happens to telemetry once it is down linked to the ground and received in the MCC

# Flight Controller Operational Handbook (FCOH)

JSC-26843

Web Page: http://mod.jsc.nasa.gov/Da8/FCOH/index.htm

Section 4 – Telemetry

Provides knowledge in telemetry process, FEP calibration changes, variable parameter downlist usage, just to name a couple

# **Master Measurement List**

Web Page: http://p51.ksc.nasa.gov/aps/mml

Information available: This document contains all MSID's with channelization and format

information.

# **Instrumentation Program Components List (IPCL)**

Copy in INCO library and copy in MPSR cabinet, CD in EMCC binder.

Web Page:

http://www.usa1.unitedspacealliance.com/hq/menu/sub\_page.cfm?Description=DRD%201%2E4% 2C%20Orbiter%20Products&Tag=0

Describes and controls the configuration of an orbiter's sensors, signal conditioners and data acquisition equipment. Its function is to provide orbiter information and direction to design, wiring, installation, test and operational groups.

# **MDM/DSC** Failure Impacts

This book in the MPSR has a complete listing of discipline failure impacts for OI MDM and DSCs.

# **Workstation Displays in MCC**

#### OIMON2

Provides data on all OI MDMs, DSCs and the PDI. Gives the channelization through the OI MDMs and DSCs. Provides the PCM counts for all OI data

#### JMEWS/ODRC

Allows the user to pull OI, PDI, MADS, or just about any telemetry that is downlinked; INCO cue card on the S drive under CUECARDS tells how to get started in JMEWS

#### MIS QUERY

Allows the user to view the channelization of parameters, telemetry format differences, sorts data by DSC or MSID. INCO SB 49 tells how to get started in MIS Query.

#### Telemetry Services DRLT-Shuttle Downlink Realtime

Allow the user to view raw or processed data being downlinked realtime and do calibration changes to parameters. INCO CHB SCP 5.10 tells how to get started in this application.

#### **RAW DATA**

Provides certain parameters from all OI DSCs and gives one the data for that certain parameter, used as a quick look to see that the OI DSCs are not down

# Flight Load CDs

These CDs are kept in the flight INST book, in the branch office and at the DPS Support console and contains information about GPC processes, such as FDA, SM bypass, and parameter processing.

#### **Payload Management Flight Software Requirements**

JSC-19478-xxx (xxx = flight number) - look up in SELS

Available online on SFOC Electronic Library System (SELS), this document contains the TFL/DFL and PSP configurations for each flight, as well as information on payload parameter processing in the SM and BFS.

# Payload Interface Control Documents (ICD)

Web Page: <a href="http://sspweb.jsc.nasa.gov/pils/nsts.cfm">http://sspweb.jsc.nasa.gov/pils/nsts.cfm</a>

Available from Payload Integration Library System (PILS), these documents describe requirements relative to payloads.

#### Flight Requirements Documents (FRD)

NSTS 17462- xxx (xxx = flight number) – look up in SELS

Web Page: <a href="http://sspweb.jsc.nasa.gov/efrd/index.cfm">http://sspweb.jsc.nasa.gov/efrd/index.cfm</a>

These documents contain flight operations and equipment requirements.

# Orbiter Command and Data (C and D) Annex 4

Available on PILS, this document contains detailed payload data requirements.

#### **TITLE**

**COMMAND** 

#### **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed pre-mission without review and approval at the FOIG.

#### **PURPOSE**

To define a standard set of procedures to be used by the Instrumentation and Communications Officer (INCO), RF Communications (COMM), and Instrumentation (INST) personnel when command activity is required to reconfigure/control the communications equipment or as requested by other flight controllers.

These procedures detail the transmission of real-time commands, command loads, and equivalent Integrated Display Processor (IDP) formally know as Display Electronic Unit (DEU) commands to the Data Processing System (DPS). References are made to enclosed diagrams, tables, Generic Command Server (GCS) workstation displays and Flight Controller Operations Handbook (FCOH) procedures.

#### **GENERAL**

The INCO/COMM/INST positions are responsible for uplinking all commands to the orbiter, with the exception of payload and abort commands. Table Maintenance Block Uplink (TMBU), IDP equivalent loads, delta NAV, state vector, landing site updates, quaternion reference, etc., are uplinked by INCO/COMM/INST, as requested by other positions and approved by the Flight Director (FD).

It is the responsibility of the command requester to ensure that his/her command loads are correct. The command requester shall provide INCO, COMM SUPPORT, or INST the following information before the command can be uplinked: Major Function (MF), Digital Select Matrix (DSM) number, IDP number (if required), and verification of FD approval for uplink.

In general, two-stage uplink loads that are used primarily for maintenance and general operations do not require crew coordination. Two-stage loads that require specific conditioning for vehicle control or systems monitoring applications software are coordinated with the crew. There may be some specific exceptions for loads in this category because of their repetitive nature

#### **CAUTION**

Do NOT command during OPS transitions. Commanding during onboard software Operational Sequence (OPS) transitions can cause the GPCs to fail to sync. Take care to monitor the voice loops for OPS transition calls. Verify completion of all OPS transitions with the DPS officer before resumption of commanding.

#### **PROCEDURE**

The following steps demonstrate how to transmit a general command load. The steps assume that the Space Shuttle Program GCS has been initialized and that the command loads have been generated and loaded into GCS in accordance with applicable procedures found in each console operators Console Handbook.

The command load originator coordinates with the INCO on the INCO loop and provides the DSM number, the required uplink time, the MF, and any other pertinent data; i.e., IDP, DPS configuration. In addition, the requesting position should verify, via the Load Inventory display, that all desired loads are stored and unsafed.

Note: The originator of the load is the final authority on the correct DSM sequence to be uplinked.

Each originator notifies the FD of his uplink requirements on the FD loop. The FD assigns priorities and approves the command loads.

Normally, proper execution of an uplink command is verified by observing the Command Tracking display (Figure 3.1-1) or the Command Config/Uplink Display (CCUD). If the uplink is a critical command or there is a problem with the uplink, the Uplink Verify display should be monitored (Figure 3.1-2).



Figure 3.1-1. Command Tracking display

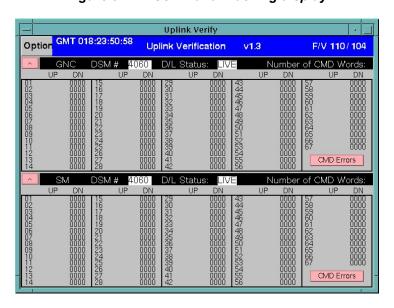


Figure 3.1-2. Uplink Verify display

INCO/COMM/INST determines the current software and hardware configuration of the orbiter, and, if required, may consult with DPS on the MOCR DPS/CDMS loop.

The INCO/COMM/INST verifies that they are configured as follows:

A. Verify that no command number (DSM) and title are displayed on the CCUD (Figure 3.1-3) or that no command number is displayed on the DSM function of the hardware command panel. If there is a DSM number displayed, press the DSM CLEAR button on the panel. Both the hardware panel and the CCUD will clear.

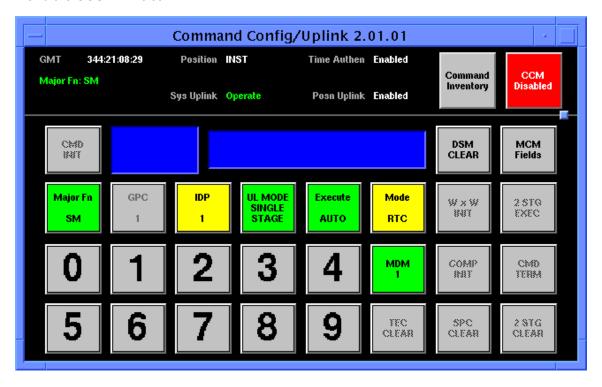


Figure 3.1-3. Command Config/Uplink display (CCUD)

- B. Select the LOAD or RTC (Real-Time Command) mode of command by depressing LOAD MODE/RTC MODE button. This button toggles between the two states.
- C. For RTCs, select the two-stage or single-stage execution of command by depressing the TWO-STAGE/SINGLE-STAGE button. Loads are always automatically uplinked as two-stage commands.
- D. Select the auto execution mode of two-stage processing by depressing the AUTO EXECUTE/MANUAL EXECUTE button. (This button has no effect on single-stage RTCs.)
- E. Select the destination of a command load by using the Major Function (MF) or General Purpose Computer (GPC) ID buttons. The MF button toggles through SM, PL, GNC, and BFS. The GPC ID buttons toggle through GPC1, GPC2, GPC3, GPC4, GPC5, and GPC ALL. If the command to uplink is an RTC, the destination Multiplexer/Demultiplexer (MDM) must be selected with the MDM 1/2 button.
- F. Only one MF or GPC ID selection is possible for a given load, and only MDM 1 or 2 can be selected.
- G. If IDP equivalents are to be transmitted, DPS must tell INCO which IDP is being emulated. INCO selects the IDP by depressing the IDP ID button. It toggles through the four valid IDP numbers.

H. Enable the panel by depressing the ENABLE/DISABLE button. The Configuration Control Module (CCM) Enable button changes from red to green.

The CAPCOM Console must inform the crew about any GNC, IDP equivalent, or TMBU loads. For IDP loads when the crew is awake, the crew informs the Mission Control Center (MCC) which IDP is being configured for the uplink.

Select the command load number (5 digits) or RTC number (4 digits) by using the digit buttons on the panel. The DSM number will be displayed along with the command title (CCUD only) when a valid DSM number is entered.

Note: If the DSM "dialed in" is safed, the DSM number and title are displayed in red characters on the CCUD. On the hardware panel, the DSM CLEAR button blinks. If the DSM dialed in does not exist in the command server, the DSM number is displayed with red characters, and no title is displayed. On the hardware panel, the DSM CLEAR button blinks.

Variance from this configuration indicates a problem that should be resolved with COMMAND on the COMMAND loop.

The INCO/COMM/INST can now send the command load or RTC by depressing the CMD INIT button. This action causes the GCS to perform validity and configuration checks. The command is transmitted from GCS to the uplink Front End Processor (FEP) for shipment to the orbiter if the configuration checks are passed. The uplink verification display is monitored to verify a good two-stage comparison on the uplinked command. The DN column is filled via downlist data from the orbiter. When the data in the DN column are complete, a comparison is made of the DN/UP columns. When the Up and Down columns command data words agree, the TWO STAGE EXEC button is highlighted on the CCUD (miscompares are discussed later in this procedure). The TWO-STAGE BUFFER EXECUTE (DSM 4060) is sent automatically if AUTO EXECUTE was selected.

If more commands must be uplinked, depress the DSM CLEAR button to clear the DSM number and title on the CCUD and repeat the above procedure. If there is a miscompare, it is probably caused by data dropout in the uplink or downlink. If time permits, depress the COMPARE INITIATE button. If the miscompare is sustained, depress the TWO-STAGE BUFFER CLEAR button and observe the data in the DN column of the uplink verification display. Reinitiate the sequence by transmitting the load or two-stage RTC.

An alternate method is to depress the WxW INITIATE button on the CCUD (the GCS automatically does a bit-by-bit comparison of the command load and downlist data). The Word-by-Word (WxW) compare begins with the first bit miscompare. If the first miscompare is early in a long command bit sequence, the WxW routine could be relatively long. The WxW INITIATE capability does not exist for the BFS MF. An attempt to execute a WxW compare while the BFS is selected causes an error message on the CCUD.

If two or more command loads are chained and auto execution is selected, the GCS automatically compares and TWO-STAGE BUFFER executes each sequential load. If there is a non-compare, the GCS automatically stops the transmission. In this case, the INCO/COMM/INST should execute a two-stage buffer clear and check with the requesting Flight Controller for further action (i.e. reuplink the entire sequence).

The INCO/COMM/INST should disable his/her interface to GCS by depressing the CCM ENABLE/DISABLE button when uplink of commands is not required for a few minutes or when leaving the console. During ascent phase, the MPSR command panels should remain disabled until post-MECO, unless explicitly requested to perform commanding by the INCO.

The following are some specific command uplink requirements.

A. Delta NAV state vectors may be uplinked to the GNC MF. Care must be taken not to uplink delta NAV state loads near or during an OPS transition. Details necessary for delta NAV state generation are provided in the GPO (pronounced Gee Po or Guidance) Console Handbook

#### **CAUTION**

Never send the same delta NAV state twice because the delta will be added to the state vector each time it is sent.

- B. Launch targets may be uplinked to the GNC or BFS MFs. Targets are not transmitted until the crew has acknowledged receipt of the Preliminary Advisory Data (PAD). Details necessary for launch target generation are provided in the Flight Dynamics Officer (FDO) Console Handbook.
- C. TMBU may be uplinked to the SM or BFS MFs. Ensure that SM SPEC 60 is not active because it will inhibit the load from executing. Further details regarding transmission of TMBUs can be found in the appropriate section of the INCO/COMM Console Handbook.
- D. Telemetry Format Load (TFL) and DECOM Format Load (DFL) may be uplinked to the SM MF or while the GNC MF is in OPS 9. Details necessary for TFL/DFL load generation are provided in SCP 3.9 (COMMAND SYSTEM: TFL/DFL OP CODE UPLINK COMMAND PROCESSING) in the INCO/COMM Console Handbook. This applies to building SM TFL loads; there are no plans or procedure for building G9 TFL loads.

WARNING - Ensure that SM SPEC 62 display is not active onboard because it will inhibit the load from executing.

E. IDP equivalent loads may be uplinked to the GNC or SM MFs. DPS coordinates with the crew to ensure which IDP is to be used for IDP uplink and to ensure that the IDP MF switch matches the MF selected by INCO. If the sequence is to tie up the specified IDP for a "significant" period of time, uplink UPLINK ACTIVITY ON, DSM 4064. When the IDP equivalent commanding is complete, uplink UPLINK ACTIVITY OFF, DSM 4065. This precaution will put a flashing "UL" on each display monitor that is configured to the same MF as the intended IDP equivalent uplink.

#### **Guidelines and Constraints:**

- 1. Although it is possible to uplink to a CRT that is powered off, DPS prefers to uplink IDP equivalents to a CRT that is powered on.
- 2. IDP equivalent uplinks that require calling a specific SPEC are coordinated with the crew because onboard SM SPEC call capability is affected.
- 3. All IDPs sent while the crew is awake should be coordinated with the crew.
- 4. The ground is prohibited from uplinking IDP equivalents that would cause OPS/major mode changes.
- 5. IDP equivalents are not available in the BFS.
- F. Stored Program Commands (SPCs) may be uplinked to the SM or BFS MFs.

SPCs are generated by the INCO/COMM/INST and are used to control and configure comm system equipment onboard the orbiter. See SCP 3.15, Stored Program Command (SPC): Build and Transmission Procedures in the INCO Console Handbook for details.

Load Safing (ref: FCOH/SOP 3.1.4)

#### A. Individual Safing

Pre-mission, certain commands are identified as individually safed commands; i.e., inhibited from being uplinked. Such commands are initialized in the "safed" state at GCS initialization. Commands that are not safed are considered enabled for uplink.

#### Procedure

If a safed command is required to be uplinked, the appropriate flight controller requests that COMMAND unsafe the command for uplink by providing the DSM number. When uplink is completed, the flight controller requests that COMMAND resafe the DSM number. If a command (RTC, SPC, or load) that was not identified as an individual safed command is to be safed, the flight controller provides COMMAND with the DSM number of the command to be safed. The Command Inventory display (Figure 3.1-4) is used to verify that a command is safed or unsafed.



Figure 3.1-4. Command Inventory display

#### B. Group Safing

Pre-mission, some commands are assigned to safed groups, referred to by their group identification number (1-29 for RTCs). There is a maximum of 10 commands per group. Such command groups are initialized in the safed state at GCS initialization. When these command groups are not safed, they are said to be enabled for uplink.

#### Procedure

Safed command groups are disabled/enabled by the COMMAND Controller from the safed groups display (Figure 3.1-5). If a member of a safed command group is required to be uplinked, the appropriate flight controller contacts Command to have the safed command group enabled. If an individual command within a safed command group is safed individually in addition to being group safed, these commands must also be singularly unsafed.

The command group(s) are re-safed (disabled) once there is no longer a need to uplink the commands. The flight controller requests COMMAND to disable the command group by providing the group number.

If an RTC that has not been previously identified as a safed command is to be added to a safed command group, the flight control position responsible provides COMMAND with the DSM number to be safed and the safed group number.

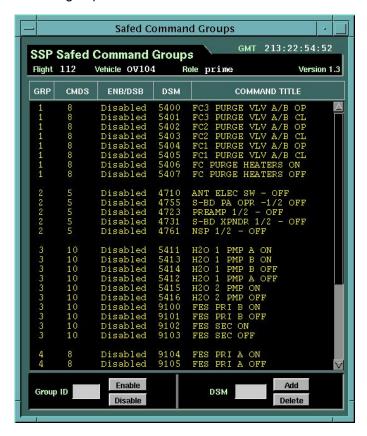


Figure 3.1-5. Orbiter Safed CMD Groups display

#### **Command Counter**

The command word counter was added to the MCC command system for comparison with the onboard command word counter. If these counters are diverging from each other, some facility, other than the MCC, is attempting to command to the orbiter. In this case, the crew should take the panel C3 Uplink switch to GPC BLOCK to prevent the unauthorized commands from being processed. Once the problem has been resolved, the crew should move the panel C3 Uplink switch back to ENABLE.

#### ----

#### **TITLE**

INCO OMI/PRELAUNCH PROCEDURES

#### **CAUTION**

3/31/2006: REV G, PCN 3

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

#### **COMMAND RESTRICTIONS/CONSTRAINTS**

This command procedure is valid in Ops 1 for the GNC and the BFS and Ops 9. Some commands must be sent quickly to avoid excessive loss of telemetry. Crew coordination is required for NSP switches since these will cause fault messages.

#### **PROCEDURE**

This procedure will review the general activities the INCO and COMM/INST MPSR must accomplish in the prelaunch or post scrub timeframe. Nominal as well as off nominal activities will be outlined. It should be remembered that this procedure *summarizes* the KSC operation and maintenance instructions (OMI's) and Launch Commit Criteria (LCC) documents. These are the controlling documents and as such should be carefully reviewed by the team during sims and prelaunch. Marking and tabbing the OMI's and LCC are especially helpful.

Note: The prelaunch OMI procedures are guided by the NASA Test Director (NTD) at KSC. All LCC violations and OMI deviations are reported to NTD. MCC-H-generated OMI deviations and detected LCC violations are reported to the NTD by the Flight Director (FD). The KSC Comm counterparts are referred to as CCSE, and the INST counterparts are referred to as CISL. There are also two KSC engineering team lead counterparts referred to as ETLs. All comm with the Astronaut Support Personnel (ASP) in the cabin will be conducted on ICOM A. The following voice loops should be monitored for all prelaunch operations through liftoff: OIS 232 - NTD, OIS 155 - ORB COMM (CCSE), OIS 145 - ORB INST (CISL), OIS 252 (NAV AIDS), OIS 173 (INST SYS B/U), OIS 214 - ICOM A.

Also, all prelaunch commands are normally sent by the INCO.

# A. OMI SOOO7 - SHUTTLE LAUNCH COUNTDOWN

All prelaunch and launch scrub operations are called out in OMI's, which are managed by KSC.

Figure 3.2-2 shows the launch countdown flow through SOOO7 and is included as a reference only. This figure is included in the front of SOOO7VL2.

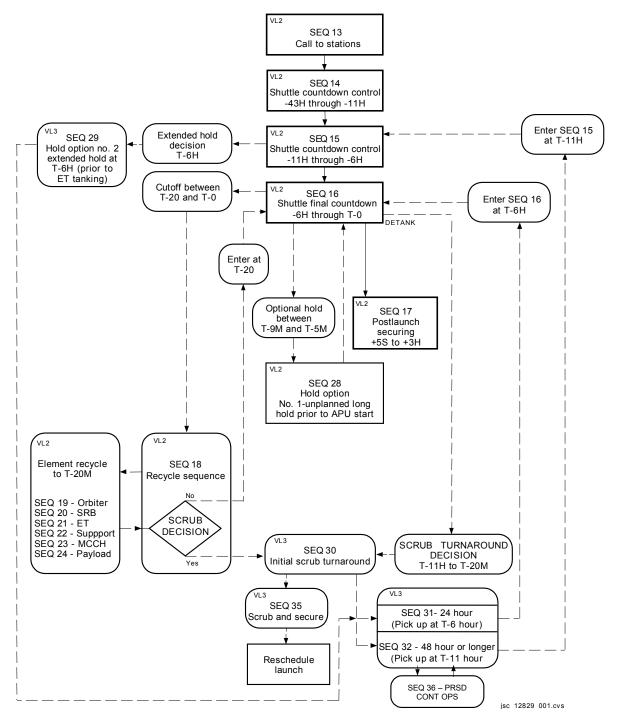


Figure 3.2-2. Launch Countdown Flow

# Volume 1

This volume is used by KSC only.

# Volume 2

This is the PRIME control document for countdown. It references specific procedures in other volumes and other documents such as the V1117. MCC typically begins support during sequence 14 at T - 11 H and holding. This volume also includes the initial steps for scrubs/recycles back to T - 20 M and for optional holds after T - 9 M.

#### Volume 3

This volume contains the scrub procedures.

#### Volume 4

This volume contains specific systems procedures. The following sequences are of interest to INCO:

**SEQ 38 - INSTRUMENTATION** 

All recorder (MADS/ SSR) configuration and activation procedures and the PCM to GSE Control procedure.

SEQ 49 - DPS SYSTEMS

TFL/DFL Load procedures.

SEQ 76 - SHUTTLE ASCENT SWITCHLIST

Ascent switchlist procedure.

#### Volume 5

This volume contains all the preplanned contingency procedures that are often referenced in the LCC. It also contains the emergency vehicle safing procedures in the *yellow* pages. The following sequences are of interest to INCO:

SEQ 112 - COMM AND TRACK

SEQ 113 - INST LCC WORKAROUNDS

SEQ 117 - G9/G1 LAUNCH POLYNOMIAL UPDATE [Ref FCOH (CPH) 3.2.6]

SEQ 132 - EMERGENCY INSTRUCTIONS - LOSS OF FIRING ROOM CONTROL/VISIBILITY, OPTION C - T - 31 SECONDS THRU SSME START

#### B. SHUTTLE COUNTDOWN TIMELINE

The following is a timeline of INCO related activities during the prelaunch countdown. The activities that require INCO participation are in **boldface**.

Enter SOOO7 VL2 SEQ 13 at T - 43H00M and holding.

T - 43H00M KSC call to stations.

Enter SOOO7 VL2 SEQ 14 at T - 43H00M and holding.

T - 40H35M DFL load for flight (VL4 SEQ 49).

OMRS S00FAO.301-IR

T - 40H25M TFL load for flight (VL4 SEQ 49).

OMRS S00FAO.301-IR

T - 39H55M Downlink format change (if launching in soft TFL).

T - 33H30m MADS FDM/PCM test (VL4 SEQ 38).

T - 32H30M MADS PCM/RCDR sample test (VL4 SEQ 38).

T - 40H00M Transport COMSEC unit to orbiter.

T - 39H00M COMSEC 1 and 2 key loading (OMI S9001 VL2).

T - 29H00M OI PCM to GSE control (VL4 SEQ 38).

T - 17H30M MADS RCDR configure for LCD (VL4 SEQ 38).

manual cals and PNL C3/A6L switch configurations.

OI RCDR configure for LCD.

erases and positions SSR's

T - 11H00M L - 1 day briefing.

Downlink format change (if soft TFL required for launch and not already

active)

Ascent switchlist (VL4 SEQ 76).

T - 11H00M COMM Activation MCCH (V1117 Task 8). (See section D of this SCP.)

Enter SOOO7 VL2 SEQ 15 during T - 11H00M hold.

T - 09H00M COMM CMD to Launch MCCH (V1117 Task 8). (See section D of this

SCP.)

T - 07H00M CCSE verifies S-band config.

MCCH Abort Advisory checks (FD/FDO).

Enter SOOO7 VL2 SEQ 16 during T - 06H00M hold.

T - 06H00M Go for ET tanking.

T - 04H30M MILA Antenna align.

command freq HI (LO).

freq LO must be UNSAFED!

Uplink PASS preflight RCQ QTY correction (RCS PVT init).

T - 04H00M MILA switch to secondary antenna.

T - 03H30M XPNDR switch to launch freq command freq LO (HI).

freq LO must be UNSAFED!

T - 03H00M (hold) Flightcrew Wakeup.

MCC Comm check with ASP (SIMO A/G A/A Delay Adjustment).

Flightcrew weather briefing.

Pre-Ingress switch reconfig (OI PCMMU PWR - 1).

Uplink ascent variable parameters if required.

T - 03H00M (hold) Remove GSE control from PCM.

T - 02H45M LCC status report.

T - 02H25M Flightcrew ingress.

Comm check with MCC.

T - 01H35M A/G Voice checks (CDR and PLT - A/G 1, A/G 2, A/A, SIMO.remainder of

crew - SIMO ONLY).

T - 01H25M ASP leaves crew module (PS ATU).

T - 01H20M Uplink Launch Polynomials/Targets, if required. [FCOH 3.2.4.1 (CPH)]

GPC D/L dump.

T - 00H55M S-band System to HI PWR/FM Activation.

Command PWR AMP STBY 2 – ON. Command PWR AMP STBY 1 – ON.

command PREAMP 2 - ON. command PWR AMP 2 - ON.

command FM System 1 -ON (√SSME input).

command S-band Mode - STDN HI.

MILA to JSC data checks.

T - 00H25M SIMO A/G voice checks.

T - 0H20M (hold) Uplink remaining ascent variable parameters (if required).

If P/L comm system ON, command to OFF (must be performed in G9).

T - 0H20M PASS OPS 1 transition. T - 00H18M30S BFS OPS 1 transition.

T-20M GPC dump (approx. 10 minutes to complete).

BFS WILL TAKE CONTROL OF THE PL BUSES - CMD VIA THE BFS MF!

T - 00H16M Uplink BFS loads (as required).

TMBU's/TDRS state vectors/Launch target loads.

T - 00H09M (hold) Uplink IMU Misalignment Correction (if required).

Uplink PASS target load (if required).

Uplink G1 Launch Polynomial (if required) (VL5 Seq 117). Uplink BFS G1 Launch Targets (if required for RNDZ).

Activate Recorders (SSR's, MADS) (VL4 Seq 38 L-0H15M00S).

T - 00H08M Uplink Ascent SPC (DSM 12101).

T - 00H05M

The GLS continuously monitors SSR 1 & 2 Critical BITEs and will hold if both show failed down to T-5M. If only one SSR fails, then no SSR reconfiguration is required since both record OI simultaneously.

T - 00H00M31S GLS GO for Auto Seq Start.

T - 00H00M10S GLS GO for SSME Start.

T - 00H00M06S SSME Start.

T - 00H00M00S SRB Ignition

MILA deselect KSC uplink on A/G 1/2 and A/A.

#### C. LAUNCH COUNTDOWN CONTINGENCY PROCEDURES

#### SOOO7 VL2 Seq 18 - Recycle Sequence

In the event of a launch scrub or recycle inside T - 20, this sequence in volume 2 will be run.

# ASAP after entering this sequence:

INCO - Clear SPC in BFS. INCO/COMM - Verify BFS buffer count to zero.

During this sequence, KSC will take the PCMMU to remote, and the OPS 1 to OPS 9 transition will take place. The GNC will obtain control of the PL Buses, and subsequent commanding will be via the *GNC MF*.

If this sequence is entered inside T - 9 (recorders already activated), then you will be directed to sequence 23 (see below), the MCCH recycle. Upon completion of your steps in seq 23, you will return to sequence 18 and either proceed from T - 20 for another launch attempt (in seq 16) or go to sequence 30 for scrub turnaround.

# SOOO7 VL2 Seq 23 - MCCH Recycle

INCO steps here are stopping the SSR's and powering off MADS. SSR 1 will be played back here if a scrub has been declared.

There are *optional* steps to erase SSR's. Perform these steps ONLY if absolutely necessary (see note below). Consult CISL of your decision. Also, if a scrub is declared, MCC will perform a playback of an SSR via command to recover the ICOM loops (KSC does not record these loops). This will occur *after* the last crewman has egressed the vehicle.

After completing this sequence, you will return to sequence 18.

Note: Space shuttle main engine (SSME) data requires 8 minutes prelaunch plus 18 minutes post-launch plus any possible holds. Allow 30 minutes of record time to be

safe (64 minutes available). (SSR 2 does not provide status on memory used by SSME data). ET/SRB data is required to be recorded on Seq 1 only of the MADS recorder. Allow 30 minutes of record time to be safe (120 minutes available). Thus, if MADS % tape > 75 then reconfiguration will be required.

# SOOO7 VL3 Seq 30 - Scrub Turnaround

This sequence does initial scrub/turnaround work. There are NO INCO actions. CCSE at KSC will command the orbiter to STDN LO and turn the FM OFF. Shortly thereafter, JSC is released from support.

From sequence 30, the recycle will proceed to sequence 31 for a 24-hour turnaround, sequence 32 for a 48-hour or longer turnaround, or to sequence 35 to secure and reschedule a new launch date.

# SOOO7 VL3 Seg 31 - 24-Hour Turnaround

There are NO INCO actions. Note that the comm systems remain powered.

This sequence will return to sequence 16 at T - 6 H.

# SOOO7 VL3 Seq 32 - 48-Hour or Longer Turnaround

There are NO INCO actions. Note that CCSE will command the entire comm system OFF. INCO will command the comm system back on at T - 16 H (V1117 Task 11 - Comm System Configure to T-11H, "short Comm Act").

This sequence will return to sequence 15 at T - 11 H.

#### D. V1117 - COMM ACTIVATION/COMMAND TO LAUNCH CONFIG

This book provides procedures for Communications checkout on the PAD in support of orbiter integrated testing. The two tasks of interest to INCO are Task 8 - Comm Activation/Command to Launch MCCH Option, and Task 11 - Comm System Configure to T - 11 Hours.

Task 8 - Comm Activation (T - 11H, L - 23H)

The purpose of this procedure is to configure and checkout the Comm system at the PAD, using MCCH for launch. The following systems are checked in this procedure:

Audio System GCIL DCDR's STDN HI - HDR/sys 1 STDN LO - HDR/sys 1 FM 1/2 (SSME Mode)

All checks are done in launch freq.

This procedure requires INCO, GC, and FD support from the MCC. The following is a detailed timeline of events during Comm Activation. The GNC has control of the PL Buses so all commanding will be done via the **GNC MF**.

KSC activates S-band PM system 1/FM system 1/UHF.

Verify initial configuration S-band PM System 1 STDN HI

FREQ = Launch freq HDR UP/DN Coding ON UP/OFF DN Encryption RCV FM 1 ON (SSME Mode)

MCC verifies acceptable D/L data from MILA.

MILA acquires the orbiter.

MCC verifies acceptable D/L data from MILA.

MCC (Comm Tech) performs extensive audio checks.

Command the GCIL DCDR's ON (DSM 4370, 4372).

Command REVERT to PANEL RESET (DSM 4376) via DCDR A.

Command STDN LO MODE (DSM 4735).

MCC verifies acceptable D/L data from MILA.

Command PWR AMP OPR 1/2 OFF (DSM 4755). **Safe Group 2 must be enabled!** 

Command PA STBY OFF (DSM 4751) via DCDR B.

Command FM SYSTEM 2 ON (DSM 4782).

Command FM SYSTEM 1/2 OFF (DSM 4781).

Command XPNDR RCV ONLY (DSM 4743), if required.

Comm Activation is complete! Verify final config

S-band PM System 1 STDN LO FREQ = Launch freq HDR UP/DN Coding ON UP/OFF DN Encryption RCV FM OFF

Remember to resafe any commands that were unsafed during this procedure and disable safe group 2.

Task 8 - Comm Command to Launch Config - MCCH Option (T - 9H, L - 13H)

This procedure is a continuation of the Comm activation procedure. The following systems are checked in this procedure:

STDN LO - HDR/sys 1 STDN HI - HDR/sys 1 TDRS - HDR/Coding ON/sys 1 and 2 STDN HI - HDR/Coding OFF/sys 2 STDN HI - HDR/Coding ON UP-OFF DN/sys 2 XPNDR 1/2 Threshold checks STDN LO - HDR/Coding ON UP-OFF DN/sys 2

All checks are done in launch freq

The following is a detailed timeline of events during Comm Command to Launch. The GNC has control of the PL Busses so all commanding will be done via the *GNC MF*. Initial configuration is same as final config of Comm Activation above.

#### Start the command sequence via DCDR A.

Command PA 1 ON (DSM 4754).

Command PA 2 STBY ON (DSM 4752).

Command XPNDR T/R (DSM 4742), if required.

Command PI SWEEP WIDE (DSM 4821).

Command STDN HI MODE (DSM 4734).

MCC verifies processing 192 kbs data plus voice.

# Command TDRS MRTC (DSM 4640) via TWO-STAGE MANUAL EXECUTE MODE!

This MRTC is stored in the server and contains the following commands:

DSM 4733 XPNDR - TDRS Mode.

DSM 4738 SPRD ON.

DSM 4759 NSP UPLINK HDR.

DSM 4764 DNLINK - HDR.

DSM 4766 XPNDR U/L FLTR WIDE.

DSM 4772 D/L Coding ON. DSM 4770 U/L Coding ON.

Command TWO-STAGE BUFFER EXECUTE (DSM 4060).

# The remaining commands will be via DCDR 2.

Command PWR AMP 2 ON (DSM 4756).

Command PRE AMP 2 ON (DSM 4724).

Command ELEC 2 (DSM 4711).

Command NSP 2 ON (DSM 4762).

Command XPNDR 2 (DSM 4732).

MCC verifies processing 192 kbs data plus voice.

Command STDN HI SALVO (DSM 4472).

NOTE: Uplink coding goes OFF!

MCC verifies lock on D/L data.

Command U/L CODING ON (DSM 4770).

Command XPNDR 1 ON (DSM 4730) for Threshold check.

Command XPNDR 2 ON (DSM 4732) for Threshold check.

Command XPNDR STDN LO MODE (DSM 4735).

Command PA 1/2 OPR OFF (DSM 4755). Safe Group 2 must be enabled!

Command PA STBY OFF (DSM 4751).

Command PRE AMP 1/2 OFF (DSM 4723). Safe Group 2 must be enabled!

Comm Command to Launch is complete! Verify final config

S-band PM System 2 STDN LO

FREQ = Launch Freq

HDR UP/DN

Coding ON UP/OFF DN

**Encryption RCV** 

**FM OFF** 

Remember to resafe any commands that were unsafed during this procedure and disable safe group 2.

Task 11 - Comm System Configure to T - 11 Hours

This procedure is to be used for a Comm Activation and Configure to T - 11H from a scrub/recycle (48 or 72 hours).

The following is a detailed timeline of events during Comm System Configure to T - 11H. The GNC has control of the PL Buses so all commanding will be done via the **GNC MF.** Note that the Comm system was powered down in command mode during scrub/recycle. The GCIL is still powered ON and in CMD mode.

KSC activates S-band PM System 1/FM System 1/UHF.

Verify initial config

S-band PM System 1

STDN HI

FREQ HI

HDR UP/DN

Coding OFF UP/DN

**Encryption RCV** 

FM System 1 ON (SSME Mode)

MCC verify acceptable D/L data (hardline) from MILA.

MILA acquire orbiter.

MCC verify acceptable D/L data (RF) from MILA.

Command PREAMP 2 ON (DSM 4724).

Command PWRAMP 2 ON (DSM 4756).

Command ELEC 2 ON (DSM 4711).

Command XPNDR 2 ON (DSM 4732).

Command NSP 2 ON (DSM 4762).

MCC verify acceptable D/L data (RF) from MILA.

Command XPNDR - STDN LO MODE (DSM 4735).

MCC (Comm Tech) performs audio checks.

Command ELEC 1 ON (DSM 4709).

Command XPNDR 1 ON (DSM 4730).

Command NSP 1 ON (DSM 4760).

Command PWRAMP 1/2 OPR OFF (DSM 4755).

Safe Group 2 must be enabled!

Command PREAMP 1/2 OFF (DSM 4723).

Safe Group 2 must be enabled!

Command PWRAMP STBY OFF (DSM 4751).

Command FREQ LO (DSM 4740) if required for launch.

freq LO must be UNSAFED!

Command FM System 1/2 OFF (DSM 4781).

Comm system configuration to T - 11H is complete! Verify final config

S-band PM System 1.

STDN LO.

FREQ = Launch freq

HDR UP/DN.

Coding OFF UP/DN.

Encryption RCV.

FM OFF.

Remember to resafe any commands that were unsafed during this procedure and disable safe group 2.

#### E. NETWORK/MCC PRELAUNCH EVENT TIMELINE

The Launch Count is the document that contains the countdown preparations for the MCC, NASCOM, GSTDN, and TDRS networks. It is issued as a DCN to the NOSP for each mission and is distributed to the INCO and INST consoles several days prior to launch. The following is a timeline of events of particular interest to INCO and is for *REFERENCE ONLY*.

L - 33H00M JSC/GSFC/NGT/MSFC/CSTC IP Network Validation Test.

L - 31H45M JSC/MILA/JDI Data flow test.

L - 30H00M Configure all voice loops to KSC.

JSC FEPS allocated and GCS checked out.

L - 26H00M MILA/JSC Interface validations.

MILA flow hardline telemetry to MCC.

Activate B30 access control.

L - 24H00M L - 1 day briefing.

FDF Transmit Launch and contingency support vectors to WSGT -

AOA,RTLS,TAL,BAL,ECAL,Launch.

FDF Transmits TDRS State Vectors to JSC.

	CAS data enabled to GSFC and WSC. Remote POCC command/telemetry interface checks performed.
L - 23H00M	Comm Activation Support.
L - 20H00M	SSME and SSR data flow test.
L - 14H00M	JSC/WSC OCA loopback test.
L - 12H20M	Command to Launch Config support.
L - 10H35M	Abort Advisory checks support.
L - 10H00M	WSC to JSC IONET interface check using WSC data generator.
L - 08H00M	Command server selectovers performed.
L - 06H50M	MILA Antenna align.
L - 04H30M	CMD safe alternate frequency command.
L - 04H20M	A/G voice checks and echo adjustments.
L - 03H00M	Receive updated TDRS state vectors if required.
L - 02H15M	Transmit Nominal Post-MECO and OMS2 vectors to GSFC.
L - 01H45M	GC Performs prelaunch briefing to GSFC and ground stations. S-band to high power/FM activation support.
L - 01H30M	Verify MILA best source select circuitry (MILA prime, MILA backup, PDL, JDI, and SLSS).
L - 00H45M	SIMO voice check support (ECHO adjustment, if required). Disable MER/SCA display request capability and verify that all MED's not required are logged off.
L - 00H30M	TDRS support begins - CMD verifies GCMR/valid ODM's.
L - 00H22M	All ground stations GO/NO GO for launch.
L - 00H05M	Verify all unnecessary command consoles are DISABLED.

#### F. LCC MONITORING AND VIOLATION REPORTING

LCC monitoring for the prelaunch phase occurs from T - XX hours until T - 31 seconds. LCC monitoring will also occur for MCC-H supported tests. This normally is in support of Terminal Countdown Demonstration Tests. The INCO and COMM/INST MPSR will participate in two types of LCC monitoring and reporting. The first type is that which INCO is directly responsible for monitoring, reporting, and possible action. The second is that which requires INCO support for other disciplines that may require actions, interpretations of data, or supply data for analysis.

#### INCO LCC ITEMS

SSID CT-02 S-band PM TRANSPONDER AGC Signal Strength TIME PERIOD EFFECTIVITY: PA HI PWR (T - 45 min) until GLS start (T - 9 min). INDICATIONS: Uplink signal strength lower than expected for uplink transmitter power out.

3/31/2006: REV G, PCN 3

ACTIONS: Monitor uplink signal strength on active transponder. Transponder receiver uplink signal strength versus uplink transmitted power is available from previous testing. Use calibration book to determine PCM counts or call up downlink real time display to obtain PCM counts.

SSID CT-03 GCIL Active (JSC nomenclature CMD)

TIME PERIOD EFFECTIVITY: PA HI PWR (T - 45 min) until T - 31 sec (RSLS start). INDICATIONS: GCIL state is PNL vice CMD.

ACTIONS: If the GCIL DID NOT revert to panel, (still on system 2 not system 1), then the vehicle will remain in the frequency selected (either HIGH or LO FREQ). A Revert To Panel Reset (KSC nomenclature is GCIL ACTIVE) command can be transmitted, and if the display indicates CMD, press for launch. If the Revert To Panel Reset (KSC nomenclature is GCIL ACTIVE) did not indicate CMD, eliminate the possibility of a telemetry failure by using the checkout commands. If the vehicle was configured for LO FREQ and the GCIL DID revert to panel, (on system 1 vice system 2), then the vehicle will be in HIGH FREQ and downlink data will drop out. Have MILA reconfigure for HIGH FREQ operations to establish telemetry and command capability. After MILA establishes two-way lock, follow the same procedures as outlined previously.

SSID CT-04 Network Signal Processor Frame Sync Lock TIME PERIOD EFFECTIVITY: PA HI PWR (T - 45 min) until T - 31 sec (RSLS start). INDICATIONS: Loss of NSP frame sync lock. (Either momentary or sustained). ACTIONS: Momentary frame sync losses may be caused by several items. Fault isolation extends from MCC-H to the vehicle. In MCC-H, can be caused by U/L FEP or timing subsystem problem or reset. Communications link (MDM's) problems can induce glitches. MILA equipment, including local configuration, can also induce glitches. Multipathing from the MILA antenna to the vehicle is a known problem. Specific action is to usually continue to monitor uplink frame sync and find the specific cause of the frame sync loss. Sustained loss of frame sync can be caused by any of the above items for momentary frame sync loss; however, multipathing will not normally cause a sustained loss. In addition, failures in the NSP/COMSEC equipment must be considered. If the NSP frame sync locks up when Encryption is bypassed, launch in the clear mode is acceptable if the GPC BLOCK SWITCH is used during non-commanding periods. Remember to advise the crew on use of the switch. Both NSP's must be functional for a launch but COMSEC capability is NOT required.

SSID CT-05 Voice Communications (S-BD A/G1 A/G2, UHF A/A, UHF A/G2) TIME PERIOD EFFECTIVITY: Comm activation until T - 5 min INDICATIONS: Loss of either uplink or downlink capability. ACTIONS: Isolate to vehicle or ground problem. Total comm loss is indicative of an ACCU problem. If comm is restored by switching to ACCU, hold. UHF must also be available onboard for ascent and TAL's. For NSP MUX failures (either uplink or downlink), and if it only includes one path (A/G1 or A/G2), press for launch.

SSID CT-09 S-band Phase Modulated Power Amplifier Anomaly. TIME PERIOD EFFECTIVITY: From PA to Hi power until T - 9 min INDICATIONS: Loss of or degraded PA output power or elevated levels of power output.

ACTIONS: For downlink loss, go to hard-line data and determine if the PA has failed or if the transponder has failed. Either case requires a hold. For degraded

performance, determine if this is a sensor failure (MILA read out of carrier downlink AGC) or actual degraded output. For sensor failure, press for launch and monitor PA temp. Degraded performance can affect TDRS acquisition if low enough (have held lock down to 60-W output). MILA can look at the spectrum and determine if the carrier has spurs. Sours that are within 12 dBM of main carrier will cause the ground.

3/31/2006: REV G, PCN 3

carrier has spurs. Spurs that are within 12 dBM of main carrier will cause the ground receivers to not lock. TDRS is more sensitive (spread spectrum) to spurs and is operating near threshold. This failure can be detected by MILA spectrum analyzer readout. Real elevated power output is indicative that the PA will fail in a relatively short period of time. Recommend a hold for evaluation.

SSID INS-01 Operational Instrumentation - PCM Good, TLM Down Link and Parity and Counter Good, OI and Toggle Buffer and Parity Good.

TIME PERIOD EFFECTIVITY: ET Cryo tanking (T - 6 hours) until T - 31 sec. INDICATIONS: Improper Bite Status Register Indications or unexpected change in state of the BSR.

ACTIONS: Determine if the problem is an instrumentation failure (function is working) or a real problem (function not working). Most confirmed instrumentation failures will be a GO for Launch. A NO GO for Launch will be called for failures in the transaction portion of the PCMMU because two of two is required. Switching PCMMU's, even if functions are restored on the alternate PCMMU, will not be a GO for Launch.

# SSID INS-02a SSR Anomaly.

TIME PERIOD EFFECTIVITY: ET Cryo tanking (T-6 hours) until T - 5 min (APU start). Only one recorder required for launch and only required to record Operational Instrumentation data and NOT Main Engine Data.

INDICATIONS: Recorder Critical BITE.

ACTIONS: For any problem with any SSR, it is not necessary to reconfigure the other SSR. May be required to command a comprehensive self-test to isolate the problem. SSR BITE may require a dump, if possible, to ascertain if a real problem or instrumentation problem. Dump would be through the FM system (reconfigured for MMU 1 or 2 mode).

SSID INS-04 Operational Instrumentation (DSC)

TIME PERIOD EFFECTIVITY: T - 6 hours until T - 5 min (APU start).

INDICATIONS: DSC BITE or parameter(s) out of limits.

ACTIONS: Determine if is a real problem (redundant power or card) or instrumentation problem. For redundant power loss, continue launch. For complete loss, hold.

Card failures require analysis of parameters lost. See LCC SSID INS-04 for required parameters.

SSID INS-05 Operational Instrumentation (MDM).

TIME PERIOD EFFECTIVITY: T - 6 hours until T - 31 sec (RSLS start).

INDICATIONS: Wrap failure on OI MDMs.

ACTIONS: Determine if a MDM is down (no transactions). If down, request a PCMMU switch; if recovered, GO for launch. If wrap remains FAIL, power cycle the affected MDM. Remember that MDM's are grouped for power. If not recovered, hold.

#### LCC ITEMS THAT MAY REQUIRE INCO SUPPORT.

SSID INS-03 MTU SIGNAL Distribution.

TIME PERIOD EFFECTIVITY: T - 6 hours until T - 31 sec (RSLS start).

INDICATIONS: DPS report of a failure either in frequency divider chain (1 or 2) or any IRIG-B channel.

ACTIONS: The loss of 1024 kHz clock means the loss of PSP commanding (PSP 1

wired to freq divider 1 and PSP 2 to freq divider 2). The divider fail indication DOES NOT mean that the 1024 kHz is bad but that one of the divider registers is bad. The BITE is driven by sensing the last register (the 1-Hz register). The frequency divider requirement is mission dependent upon requirement to command through the PSP, 1 of 2 PSP's required, 2 of 2 required, availability of IFM to rewire PSP outputs and time criticality of command capability. The only proof is to go to G9, power up the PSP(s), and send a verifiable NO-OP command to the payload. Remember that the PSP configuration message does not require the clock, only the command output register requires the clock. If the clock is not present, the PSP will display a command reject.

For an IRIG-B failure, the command uplink MUST be tested because the clock may supply time to the COMSEC unit. Any command will fail time authentication if IRIG-B time has failed to COMSEC If the command fails, reconfigure the vehicle and ground for Encryption Bypass and test the command uplink. If command capability is regained, GO for launch (remember advise the crew on GPC BLOCK switch).

#### SSID DPS-03 MDM BCE BYPASS

TIME PERIOD EFFECTIVITY: T - 6 hours until T - 31 sec (RSLS start).

INDICATIONS: Report from DPS that MDM XXX has sustained a return word BYPASS.

A BYPASS on MDM PL1 or PL2 is of special importance to INCO. Also reference SSID's DPS-19/20 and BFS-09.

ACTIONS: For any return word BYPASS, the possibility exists to take the BFS to OPS 000.

If INCO has uplinked the ascent SPC load (T - 9 min), the load will be lost and must be uplinked again.

The loss of either PL1 or PL2 has many ramifications for INCO. The loss of PL1 loses redundancy for S-band PM and FM systems, loss of control over SSR 1, and Ku-band system. PL2 will lose control (including antennas and mode control) on S-band PM and FM systems and SSR 2. Remember to look at other LCC's for violations if PL1 or PL2 is lost, for instance payload system requirements.

# SSID DPS-14 NETWORK SIGNAL PROCESSOR BUS CONTROL ELEMENT BYPASS

TIME PERIOD EFFECTIVITY: T - 6 hours until T - 31 sec (RSLS start).

INDICATIONS: NSP power discretes will not generate a message and must be observed. INCO is prime for observing NSP status.

If the NSP data path is BYPASSED, a Fault Summary Message will be generated. ACTIONS: 2 of 2 operational NSP's (voice and command) required for launch. See SSID CT-05 for A/G 1 and A/G 2 requirements.

If the power discrete for NSP 2 fails OFF but is not accompanied by a BCE message for NSP 2, NSP 2 is considered operational. Continue count.

If a BCE message is annunciated for NSP 2, NSP 2 is considered failed. A hold is required.

If the power discrete for NSP 1 fails OFF, NSP 1 is considered failed because the GPC will not upmode to establish communications with NSP 1 without the power discrete power bit set to on. A hold is required.

# SSID DPS-18 ENGINE INTERFACE UNIT MID FREQUENCY EXECUTIVE BCE BYPASS

TIME PERIOD EFFECTIVITY: T - 6 hours until T - 20 min (transition to OPS 1). INDICATIONS: DPS announcement that EIU-X has been BYPASSED.

ACTIONS: INCO verify through the attempted recovery procedure the status of MILA DECOMM lock on all three main engine data streams and report to FD/Booster/DPS. Loss of main engine data on FM or SSR 2 is NOT a hold for launch.

SSID DPS-19 MDM BSR ANOMALY

TIME PERIOD EFFECTIVITY: One time snapshot at T - 45 min

3/31/2006: REV G, PCN 3

INDICATIONS: DPS announcement of MDM XXX has a failed port. Also reference SSID's DPS-03/20 and BFS-09.

ACTIONS: The loss of either PL1 or PL2 primary ports has many ramifications for INCO. The loss of PL1 loses redundancy for S-band PM and FM systems, loss of control over SSR 1, and Ku-band system. PL2 will lose control (including antennas and mode control) on S-band PM and FM systems. Remember to look at other LCC's for violations if PL1 or PL2 is lost, for instance payload system requirements. The loss of FF1 will result in the loss of command capability through NSP 1 if activated.

The loss of FF3 will result in the loss of command capability though NSP 2. Remember both NSP's are required for launch. This includes command capability.

#### SSID DPS-20 MDM BSR ANOMALY

TIME PERIOD EFFECTIVITY: T - 6 hours until T - 10 sec (SSME start).

INDICATIONS: DPS announcement of MDM XXX has an indicated I/O failure. Also reference SSID's DPS-03/19 and BFS-09.

ACTIONS: NONE, requires the problem be fixed prior to launch. Remember that these messages are GPC mode sensitive. Flight-critical MDM's will not annunciate in G9, and the PL MDM's will not annunciate in OP1.

#### SSID BFS-09 BFS PAYLOAD MDM BYPASS INDICATION.

TIME PERIOD EFFECTIVITY: T - 18 min (transition to OPS 1) until T - 31 sec (RSLS start).

INDICATIONS: FSM I/O Error PL1/2. Also reference SSID's DPS-03/19/20 above. ACTIONS: The loss of either PL1 or PL2 primary ports has many ramifications for INCO. The loss of PL1 loses redundancy for S-band PM and FM systems, loss of control over SSR 1, and Ku-band system. PL2 will lose control (including antennas and mode control) on S-band PM and FM systems and SSR 2. Remember to look at other LCC's for violations if PL1 or PL2 is lost, for instance payload system requirements. The loss of one port (either primary or secondary) is acceptable for launch.

A complete loss of a PL MDM requires a hold.

#### SSID BFS-15 BFS I/O ERROR ANOMALY

TIME PERIOD EFFECTIVITY: T - 6 hour until T - 5 min (APU start).

INDICATIONS: FSM I/O ERROR PCM. Also reference SSID INS-01.

ACTIONS: 2 of 2 PCMMU's required for launch. May require PCMMU switch and, if a soft TFL required for launch, a TFL reload in G9.

#### SSID MILA-01 FORWARD LINK ANOMALY

TIME PERIOD EFFECTIVITY: T - hour 20 min until T - 31 sec (RSLS start)

INDICATIONS: Loss of forward link capability at MILA or PDL ground sites. (loss must be a ground problem not a vehicle problem).

ACTIONS: MILA mandatory for launch (system 1 or system 2).

PDL must provide either a forward link or UHF capability for launches greater than  $28.5^{\circ}$  inclination.

PDL is not required for launches at  $28.5^{\circ}$  or less inclination if MILA UHF is available. Also covered in FLIGHT RULES section 3.

# SSID MILA-02 S-BAND RETURN LINK SYSTEM ANOMALY

TIME PERIOD EFFECTIVITY: T - 5 hours 30 min until T - 31 sec (RSLS start).

INDICATIONS: Loss of MILA return link (telemetry and/or voice).

ACTIONS: MILA mandatory for launch (system 1 or system 2).

Either PDL or JDI required for launch. Also covered in FLIGHT RULES section 3.

SSID MILA-03 MILA UHF VOICE.

has been brought up to RUN.

TIME PERIOD EFFECTIVITY: T - 1 Hour 20 min until T - 31 sec (RSLS start). INDICATIONS: Loss of UHF voice capability. (Loss must be a ground problem not a vehicle problem.) Vehicle UHF capability required for launch (either 259.7 or 296.8 kHz and 240.0 kHz [quard frequency].

ACTIONS: MILA UHF required for launch. MILA and Losses other than MILA covered in FLIGHT RULES section 3.

SSID SH-04 SPACEHAB DMU INTERFACE (PDI)/POWER FAILURE TIME PERIOD EFFECTIVITY: T - 6 until T - 31 sec (RSLS start).

3/31/2006: REV G, PCN 3

INDICATIONS: Loss of Master Frame Lock on PDI DECOM 1 (prime DECOMM) and/or DECOM 3. (backup DECOM).

ACTIONS: If both DECOM's lose lock and do not recover, considered as a total PDI loss. Consult flight-specific Annex Flight Rule.

If the GPC's are in G9, DECOM 4 has a sustained Master Frame Lock loss, and DECOM 2 remains in Master Frame Lock, load backup TFL for down-listing DECOM 2. If the transition to OPS 101 has occurred, continue count. Payloads will monitor secondary parameters.

SSID SH-08 SPACEHAB CABIN (ARS) HX FLOW RATE (LOW) ANOMALY> TIME PERIOD EFFECTIVITY: T - 6 hour until T - 5 min (APU start). INDICATIONS: Payloads Officer reports indicated loss of Spacehab H2O heat

exchanger flow.

ACTIONS: Only INCO action may be to command a switch to water pump 2 and/or switch Spacehab cooling fans via uplink. This option will be exercised after the BFS

SSID SH-11 SPACEHAB WATER PUMP OUTLET PRESSURE (HIGH/LOW) ANOMALY>

TIME PERIOD EFFECTIVITY: T - 6 hour until T - 5 min (APU start).

INDICATIONS: Payloads Officer reports indicated Spacehab high or low H2O water pump pressure.

ACTIONS: Only INCO action may be to switch to water pump 2 via uplink. This option will be exercised after the BFS has been brought up to RUN.

# G. Helpful Web Pages

The following are a few web pages that can help with understanding these procedures:

LCC - http://kscgrndtsk1.ksc.nasa.gov/LaunchCommitCriteria/LccDocument.htm

OMI - http://usago1.ksc.nasa.gov/usago/orgs/omd/11133-omd/index.htm

# **TITLE**

# GENERAL INCO ASCENT/ENTRY PROCEDURES

### **CAUTION**

**REV G, PCN 6** 

8/3/2007:

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

### **PURPOSE**

This procedure will review the general activities the INCO and COMM/INST MPSR must accomplish during the ascent and entry timeframes. Only *noninclination-dependent* procedures will be included here.

### COMMAND RESTRICTIONS/CONSTRAINTS

These commands are valid in Ops 1, 3 and 6 in both the GNC and BFS major functions. Some commands must be sent quickly to avoid excessive loss of telemetry. Crew coordination is required before switching NSPs due to the fault message that will be generated.

# **PROCEDURE**

# A. VOICE LOOP MONITORING DURING ASCENT/ENTRY

The ascent and entry phases of flight are considered critical phases due to the dynamic nature of the environment. These phases do not allow the luxury of time to react to situations. For this reason, it is extremely important to minimize voice traffic on the loops and to be completely focused on the INCO systems. The INCO MPSR (as well as INCO) should carefully monitor all calls to the FD and the crew to be alerted of other systems impacts on INCO systems and to maintain a "big picture" view of where the mission is heading.

During the ascent and entry phases of flight, the onboard audio system is configured to transmit on all three of the voice loops simo (A/G 1, A/G 2, and UHF). The RF COMM, DATA COMM, and INST should independently monitor these loops to detect a failure. If a failure is suspected, it should be confirmed with COMM TECH ASAP, who is also monitoring these loops. The following configuration is recommended:

RF COMM Monitor A/G 1 only
DATA COMM Monitor UHF only
INST Monitor A/G 2 only

The DATA COMM and INST will verify to the RF COMM that they are hearing the crew downlink on their appropriate voice loop. The RF COMM will verify this with his loop and report to INCO. Generally, this report will be coupled with the following antenna selection verification call:

INCO COMM, three good voice and antenna selects

For the expected antenna selects during ascent, see section B.

During ascent, the following routine voice calls from the crew should be compared:

Roll program 7 sec

2. Go at throttle up 1 min

3. Negative return 4 min

4. Press to MECO 6 min

The calls made by the crew during entry are not as definite. The same loop monitoring configuration should be used, and a comparison should be made at the following approximate times:

**REV G. PCN 6** 

1. Immediately after handover from TDRS to GSTDN

8/3/2007:

- 2. Landing -4 min
- 3. Entering the HAC

# B. ASCENT PHASE OPS

Nominal MECO will usually occur between 8M and 9M MET. Each time an engine shuts down prematurely, the MECO will be extended. Launch Digitals, which is always displayed on the left screen in the FCR (also under Master DNAV), shows the predicted MECO time, ET sep status, roll attitude, and inertial velocity (Vi ft/s). The orbiter performs a roll program immediately off the launch pad, which places it into a "heads down" configuration (180°). The orbiter may roll to a "heads up" (RTHU) configuration part way through powered flight, based on the performance/abort scenario (see sections C 2 and 3 for abort descriptions). This RTHU is triggered by I-load velocities in the onboard guidance software. The following table summarizes the V-REL (VE) that triggers this RTHU.

Inclination	NOM, ATO, late TAL	Early TAL
	(includes TAL selected onboard after	(TAL selected onboard prior to V-
	V-REL in this column)	REL in previous column)
ALL	V-REL = 12.2k	V-REL = 14.0k

For all cases described above, the roll will occur at 5° per second and, thus, be complete in 36 seconds. The V-REL for both PASS and BFS are on the INCO Management display for this reason.

For RTLS aborts, the vehicle will remain heads down until powered pitch around, which occurs just prior to MECO. For all contingency aborts, the vehicle will roll heads up at variable times, depending on the scenario. For an ECAL, the vehicle will roll between about 6k and 12k (depends upon the I-load). At about 3M MET, 6k is reached, and 12k is reached no later than 8M MET.

All this information is required to determine when TDRS comm will be available because the ET interferes with TDRS comm when the line of site is within  $\pm$  20° of ET centerline on lower antennas.

More information is available in ASC G&C 2102 training manual, which is available in the training library and is recommended reading.

# C. ASCENTS

### 1. Nominal

All launches will be conducted from KSC (PAD A or B).

COMM/INST configuration at *lift-off* will be as follows:

S-band PM system 2 STDN HI mode HDR UP+DN Coding UP ON/DN OFF FREQ LO (unless flight-specific plan requires HI) **Encryption RCV** NSP voice RCD ON FM system 1 ON (SSME mode) SSR 2 RCDP (3 SSME EIU's plus OD 192K) SSR 1 RCDP (1 MADS PCM plus OD 192K) MADS recording continuous (SRB data assigned to SEQ 1 only) PCMMU 1 TFL 129 (unless EDO or flight-specific payload requires 166) PDI DFL's (flight specific) **PSP OFF** PI OFF ACCU 1 ATU config -AG 1, AG 2, A/A T/R for all crewmembers UHF SPLX 259.7 MHz

The S-band PNL A1 will be configured as follows:

S-band PM system 1 STDN HI HDR UP+DN Coding UP ON Coding DN OFF

During pre-launch operations, the ULA antenna will be selected. When the BFS is taken to run, it takes control of the payload buses, and completes the Ops 1 transition, while the antenna management program (AM) will be up and running. For Ol-30, the default configuration for the BFS AM site inhibits has PDL enabled and MILA inhibited for plume avoidance as described later. PDL is not in view in AM until liftoff + 7 seconds. Thus, nominal antenna selects for early first stage are as follows:

T + 0 (lift-off)	ULA	
T + 07 seconds	LLA	PDL becomes in view in AM
T + 14 seconds	LRA	During roll program
T + 21 seconds	URA	After completion of roll program

Note that even though the antennas are being selected to optimize PDL pointing, the forward link is being supported through MILA. However, early in the ascent phase, S-band to MILA experiences a period of severe plume attenuation of approximately 45 to 60 seconds. Thus, the forward link is handed over from MILA to PDL between T + 01M and T + 01M20S (inclination dependent). The forward link will be handed back to MILA at T + 02M30S. About 13 seconds before the MILA carrier up time (T + 02M17S), the INCO will send the BFS AM TMBU (DSM 12401) to inhibit PDL and enable MILA, which will result in a ULA antenna selection. This selection will optimize BFS antenna pointing to MILA. The downlink FEP has four sets of frame synchs set up up to process the MILA best source select telemetry (any one of MILA, JDI, or PDL telemetry sources), PDL line telemetry (still goes thru MILA), Wallops telemetry, and TDRS telemetry for the ascent phase. The final milestone for nominal ascent AM occurs just prior to MILA LOS. The nominal ascent MSPC (DSM 12101) will reconfigure the orbiter for TDRS mode at T + 07M30S. At this time, the network will hand over both links from MILA to an eastern TDRS (generally TDRS Spare at 47°). Note that MILA is still AOS for

up to 30 more seconds, and UHF voice should be used during the handover period. Between WLP AOS and MILA LOS, UHF will be handed over to WLP for support until WLP LOS (inclination dependent). Also, note that WLP can route TDRS mode telemetry until LOS, if required.

Communications will be maintained during the first ZOE to support the OMS 2 burn activity. The orbiter comm links will be handed over to TDRS Z..

All TDRS S-band acquisitions are performed with uplink modulation ON. In the past, these acquisitions were performed with uplink modulation OFF because of concerns that modulation sidebands could cause a false lock condition. On-orbit testing during STS-71 determined that the probability of false locks was extremely low and forward link acquisitions were greatly improved, thus, the procedure was changed to modulation ON acquisitions.

During ascent, to minimize the time required to acquire/reacquire the orbiter following site handovers and unexpected dropouts, a configuration was developed to allow acquisitions/reacquisitions with uplink modulation ON. This requires the modulation sidebands to be moved away from the acquisition bandwidth of the orbiter receiver. The following configuration accomplishes this:

- Uplink HDR
- Uplink coding ON
- Uplink encryption ON
- An uplink doppler bias applied at the ground stations

Should any of these conditions not be satisfied, modulation OFF acquisitions/reacquisitions must be performed. During a nominal ascent, a fixed doppler bias is applied (as documented in the NOSP 501-601 for each orbiter transponder) and is not varied. This bias allows the modulation ON acquisitions with the following exceptions:

- Following point of closest approach at WLP (negative doppler)
- During a RTLS
- At NHS

Modulation OFF acquisitions/reacquisitions must be performed in these cases.

# 2. Intact Aborts

Intact aborts are designed to provide a safe return of the orbiter to a planned landing site.

The following types of intact aborts may be called during ascent:

ATO - Abort to Orbit AOA - Abort Once Around

TAL - Transoceanic Abort Landing RTLS - Return to Launch Site

The type of failure and the time of the failure determine which type of abort is selected. During powered flight, the abort priorities for loss of performance are ATO, TAL, RTLS, TAL to an Augmented Contingency Landing Site (ACLS), and AOA shallow. These priorities were established to provide the highest probability of safe return of the orbiter and crew. For

specific systems failures, such as a cabin leak or loss of vehicle cooling capability, the abort priorities are RTLS, TAL, and AOA. These priorities were established to provide the earliest available landing time or to avoid continuing to orbit with a loss of capability. Note that for an AOA, the abort selected onboard will be ATO. Four TAL sites are available along the west coast of Europe and Africa (Banjul, Istres, Zaragosa, and Moron) and are inclination dependent.

More information is available in ATO/AOA/TAL 2102 and RTLS Abort 2102 training manuals that are available in the training library and are highly recommended.

Analysis of the results of DTO 700-13 (STS-81 and STS-86) has determined that a viable S-band link to MILA is available during an RTLS abort scenario and a handover to TDRS is not required. Due to antenna vibrations caused by saturation effects, MILA has requested that the orbiter be taken to STDN LO for RTLS just as for entry. The SPC will reconfigure the orbiter to STDN LO at 14m. Reasonable attempts should be made to get to STDN LO for failure scenarios. If this cannot be accomplished, a courtesy call should be made to the site. If the vibrations get too severe, MILA may have to take manual control of the antenna.

# 3. Contingency Aborts

Contingency aborts are designed to provide for crew survival and probably will result in loss of the vehicle.

The following types of contingency aborts may take place during ascent:

BAL - Bermuda abort landing

ECAL - East coast abort landing (high inclination only)

Ditch - Mode 8 egress (bailout)

ELS - Emergency landing site (due to a TAL problem)

All cases will require a handover to TDRS prior to GSTDN LOS.

More information is available in CONT ABT 2102 training manual that is available in the training library and is recommended reading.

# D. INCO ACTIONS DURING ASCENT PHASE

The following are INCO/COMM/INST actions during ascent phase with no comm failures. For the cases of two fuel cells and two Freon loops, you should check that the Systems AOA is still in sync with these suggested actions. The FDF is the controlling source. The AESP is effective from lift-off to ET-sep, and the APCL is used from ET-sep to OMS 2. Also, for any contingency procedures that take Master MADS OFF, the INST should verify the switch throw on C3, coordinate with DATA COMM to stop recording MADS PCM data on SSR 1, and then command MADS RCDR PWR OFF (DSM 4619).

Nominal ascent/ATO

INCO Command BFS AM site inhibits, as required for handovers.

COMM Verify WAMS up to date (including MOC COMP).

Monitor network status.

Check BFS TDRS SHO vs ACQMON thru first ZOE

INST At MECO + 06M:

MADS RCDR PWR ON (DSM 4618).
MADS CAL ON (DSM 4607) (wait 10 sec).

MADS CAL OFF (DSM 4608). MADS WB OFF (DSM 4602). MADS PCM OFF (DSM 4604).

Verify no tape motion.

MADS RCDR REW BOT (DSM 4605).

Wait until RCDR rewinds to original starting %

tape + 1 or 2%.

MADS OFF/STBY (DSM 4600).

Verify no tape motion.
MADS SEQ 3 (DSM 4609).

MADS RCDR PWR OFF (DSM 4619).

DataComm After WLPS LOS, reconfigure the FM system:

FM Mode MMU 1(2) (DSM 4728(4727)).

Prior to INST turning MADS PCM OFF (approximately MECO +

06M) reconfigure SSR1 to stop parallel recording: SSR1 STOP PAR RCD (DSM 9236).

Verify SSR 1 mode = RCDA.

At MET 25 min, coordinate with Booster/Main Engine to

 $reconfigure \ SSR \ 2 \ to \ stop \ Main \ Engine \ recording:$ 

SSR2 STOP PAR RCD (DSM 9336).

Verify SSR 2 mode = RCDA.

At dump site (inclination dependent) PB ascent data:

Remember to manage the hemi antennas; the BFS AM will not select hemi antennas when in TDRS MODE!

FM HEMI SEL UP/LO (if required).

Build queue and dump ascent data per SCP 3.22.

Prior to OMS 2 or LOS (whichever comes first):

verify both recorders recording D + V.

2. AOA

INCO Command BFS AM site inhibits, as required for handovers.

COMM Verify WAMS up to date (including MOC COMP).

Monitor network status.

Check TDRS SHO vs ACQMON thru landing

Build DGS SPC when PSAT available (if applicable). Build AOA SPC when entry ephemeris is available.

Verify BFS AM site inhibits for AOA site.

INST At MECO + 10M:

MADS CAL ON (DSM 4607) (wait 10 sec).

**REV G, PCN 6** 

MADS CAL OFF (DSM 4608).

Let MADS run continuously through landing.

After WLDS LOS reconfigure the EM system:

DataComm After WLPS LOS, reconfigure the FM system:

FM Mode MMU 1(2) (DSM 4728(4727)).

(No action required for the SSRs; they revert to RCDA mode

when SSME and MADS PCM data area is full.) At dump site (inclination dependent) PB ascent data:

Remember to manage the hemi antennas; the BFS AM will not select hemi antennas when in TDRS MODE!

FM HEMI SEL UP/LO (if required).

Build queue and dump ascent data per SCP 3.22. Uplink AUTO STOPs to both recorders at position 810.

Let both recorders run through landing.

TAL

INCO Command BFS AM site inhibits, as required for handovers.

Entry, landing, and postlanding will be performed on TDRS. Note

SCP 5.16 for final antenna selection if required.

COMM Verify WAMS up to date (including MOC COMP).

Monitor network status.

Verify INMARSAT support for UHF with COMMTECH.

INST At MECO + 10M:

MADS CAL ON (DSM 4607) (wait 10 sec).

MADS CAL OFF (DSM 4608).

Let MADS run continuously through landing.

DataComm Uplink AUTO STOPs to both recorders at position 810.

(Both SSRs revert to RCDA mode when SSME and MADS PCM

data area is full.)

Let both recorders run through landing.

RTLS (all except two fuel cells lost)

INCO ASAP clear SPC buffer:

SPC BUFFER CLEAR (BFS MF)(DSM 4063).

Uplink RTLS SPC (DSM 12104).

Verify BFS AM site inhibit:

if required, command PDL/MIL H/O (DSM 12401).

COMM ASAP verify SPC buffer clear and RTLS SPC onboard.

Notify COMMAND of the RTLS condition and that the SPC buffer

has been updated (STDN LO mode @ 14 minutes).

Note that the uplink coding stays ON.

INST No action.

DataComm Uplink AUTO STOPs to both recorders at position 810.

/JSC-12829 8/3/2007: REV G, PCN 6

5. RTLS (two fuel cells lost)

INCO ASAP clear BFS SPC Buffer:

SPC BUFFER CLEAR (BFS MF)(DSM 4063).

Command STDN LO MODE:

STDN LO MODE (DSM 4735)

Note that the uplink coding stays ON.

COMM ASAP verify SPC buffer clear.

Notify COMMAND of the RTLS condition, that the SPC buffer has been cleared, and that the Orbiter is configured for STDN LO

mode due to onboard problems.

INST No action.

DataComm Uplink AUTO STOPs to both recorders at position 810.

6. AOA (two freon loops lost)

INCO ASAP inform FD of limited TDRS Comm.

Command BFS AM site inhibits, as required for handovers.

If on STDN command STDN LO:

STDN LO MODE (DSM 4735).

Note that the uplink coding stays ON.

Command fuel cell purge on EGIL's call (unsafe group 1). Expect the comm systems to be powered down after MILA/WLP

LOS.

Expect no comm until UHF only at landing site AOS.

Note, if S-band comm required, expect encryption bypass, HIGH FREQ (have network reconfigure), and manual antennas.

COMM Verify WAMS up to date (including MOC COMP).

Monitor network status and keep them informed of onboard comm

config.

Note that the BFS will be powered OFF.

INST Follow the crew procedures and inform team of upcoming events.

Expect MASTER MADS PWR to OFF.

Follow-up: MADS RCDR PWR OFF (DSM 4619).

DataComm Uplink AUTO STOPs to both recorders at position 810.

Prior to MASTER MADS PWR to OFF reconfigure SSR1 to stop

parallel recording:

SSR1 STOP PAR RCD (DSM 9236).

Verify SSR 1 mode = RCDA.

Command the FM system OFF:

FM PWR OFF (DSM 4781).

AOA (two water loops lost).

INCO ASAP inform flight of limited TDRS comm.

Command BFS AM site inhibits, as required for handovers.

If on STDN command STDN LO MODE:

STDN LO MODE (DSM 4735).

Note that the uplink coding stays ON.

Command the FM system OFF:

FM PWR OFF (DSM 4781).

	Expect the comm systems to be powered down after MIL/WLP LOS.
	Expect no comm until V=12k (encryption bypass, HIGH FREQ (have network reconfigure), and manual antennas!).
COMM	Verify WAMS up to date (including MOC COMP).
	Monitor network status and keep them informed of onboard comm config.
	Note that the BFS will be powered OFF.
INST	Follow the crew procedures and inform team of upcoming events.
	Expect MASTER MADS PWR to OFF.
	MADS RCDR PWR OFF (DSM 4619).
DataComm	Uplink AUTO STOPs to both recorders at position 810.
	Prior to MASTER MADS PWR to OFF reconfigure SSR1 to stop parallel recording:
	SSR1 STOP PAR RCD (DSM 9236).
	Verify SSR 1 mode = RCDA.
	Command the FM system OFF:
	FM PWR OFF (DSM 4781).

### E. ENTRY PHASE OPS

Entry phase begins at deorbit burn and continues through landing. Atmospheric effects are defined to start from entry interface (EI), which occurs at an altitude of 400k ft and a range from the landing site of 4300 n. mi. The generic entry profile from EI through landing is the same for all missions (not altitude dependent). The orbiter attitude at EI is purely a 40° pitch with respect to the velocity vector, not the orbiter body axis (to protect for unacceptable aerothermodynamic heating on the upper surface and wing leading edge). The 40° angle of attack is maintained down to approximately Mach 12.5. The orbiter dissipates energy via atmospheric drag and manages the energy (lift/drag) by performing a series of roll maneuvers. These maneuvers are also with respect to the velocity vector, not the orbiter body axis. Thus, these maneuvers result in a combination of roll and yaw rates about the orbiter body axis (which affect antenna pointing). Also, these roll commands are performed by the onboard entry guidance system.

**REV G. PCN 6** 

8/3/2007:

All the inputs on the Deorbit/Entry Landing Data sheet supplied by the FDO's are predicted values determined by their ground entry processor (called the EPS) using atmospheric models. The first roll command occurs at approximately EI + 5 minutes and generally has a magnitude of between 60° and 85°. The direction of the first roll will always be toward the landing site with respect to the orbital ground track (i.e., if the orbital ground track passes to the west of the landing site for a descending entry, then the first roll will be to the left). The first roll makes up for almost all of the cross range. The maximum cross range is a mission-dependent value and is documented in the flight rule annex for each landing opportunity (it is generally between 700 and 900 n. mi.). The onboard guidance will command the next roll (first roll reversal) when the delta AZ (the heading error defined as the angle between the velocity vector and the runway) reaches its predefined boundary (I-load values known as reversal dead bands). Subsequent roll reversals work the same way. For comm purposes, the first roll and first roll reversal are the only two events to be concerned about as they impact antenna pointing to TDRS. The problem is to avoid a lower antenna selection while in the S-band blackout region (EI - 5 min to EI + 20 min). This region is caused by the plasma generated by the orbiter while passing through the upper atmosphere. This plasma mainly affects the lower quads only, but a wraparound effect may cause intermittent dropouts on the upper quads if the TDRS look angle is within an estimated 30° off the nose/tail. The subsequent roll reversals typically occur after exit of S-band blackout.

More detailed information on entry guidance may be found in the ENT GUID 2102 training manual that is available in the training library and is highly recommended.

Management of comm on TDRS for all entries into Edwards Air Force Base (EDW) and low inclination (28°) entries into Kennedy Space Center (KSC) are trivial (a loss of comm may not be avoided). This is due to the coverage of TDRS W (EDW) or the relative geometries involved (KSC - 28°). Higher inclination (≥39°) entries into KSC may require special comm management on TDRS, which is discussed in more detail in SCP 3.5.

# F. ENTRY/LANDING

### 1. General

The following things need to be considered to optimize comm coverage throughout entry and landing:

- a. Entry trajectory (direction, roll maneuvers, S-band blackout period, etc.)
- b. Inclination (TDRS handover required, TDRS to GSTDN handover time)
- c. BFS antenna management site inhibits (optimal antenna pointing)

# d. Landing site and runway (postlanding antenna selection)

8/3/2007:

The FDO constructs a deorbit landing data sheet for each entry opportunity and supplies a copy to each FCR operator on the day prior to landing. At this time, the Entry FDO nominally starts supporting for entry. Figure 3.3-1 shows an example of this data sheet. POINTING will get a copy from the FAO and work with the FDO to obtain orbiter state vector snapshots at the first roll command and the first roll reversal. Pointing will then run their processor and generate the AZ and EL for both TDRS (if in view) at each of these times. This information will be forwarded to the INCO in the form of a flight note for use in entry comm management/prediction (see SCP 3.5). Figure 3.3-2 shows an example of this flight note. INCO will subsequently generate a flight note flight note to the flight director detailing entry comm constraints; an example of this flight note is provided in Figure 3.3-3.

**REV G, PCN 6** 

It is very important to understand that the final pointing angles supplied to INCO are based on atmospheric models, and the orbiter may behave slightly differently due to the actual atmospheric conditions during entry. Thus, if the pointing angles are within about 10° of a lower antenna, it is possible that a loss of comm may occur because of a larger maneuver by onboard nav. This possibility should be identified and passed on to the FD and the crew in the flight note.

Post wheel-stop, the INCO will inhibit BFS antenna pointing (DSM 12440) and select the appropriate S-band PM/FM upper antennas via command for postlanding operations, if required. If command is not available, the INCO will request the crew to select the appropriate PM antenna manually via the switch on C3 (this overrides the BFS AM pointing). If the S-band FM lower hemi antenna is selected and command is not available, then the INCO will request the crew select the upper hemi manually via the switch on A1L (XMIT UP/RCV LO). The upper antennas are required per the flight rule. Nominal postlanding antenna selections to the ground station as a function of runway for KSC/MIL and EDW/DFRC are summarized as follows:

KSC 15	Concrete	URF
KSC 33	Concrete	ULA
EDW 04	Concrete	ULA
EDW 22	Concrete	URA
EDW 15	Lakebed	URA
EDW 33	Lakebed	ULF
EDW 05R	Lakebed	ULA
EDW 23L	Lakebed	URF
EDW 18L	Lakebed	URF
EDW 36R	Lakebed	ULA
EDW 17L	Lakebed	URA
EDW 35R	Lakebed	ULF

**POST-LANDING ANTENNA** 

Proper antennas for TDRS landings can be found in SCP 5.16. SCP 5.16 should be used for TAL's also.

# DEORBIT TO KSC33 ON ORBIT 223

# GENERATED MET 12/22:30

EVENT	TIME	LAT	LONG	Н	VEL	COMMENTS
	MET/CENTRAL	(D:M)	(D:M)		(KFPS)	
DEORBIT	13/22:23:40	21:06	127:57	133	25.4	ΔV= 213FPS
TIG	77/06:16:40	S	Е	NM	VI	ΔT= 2M:06S
						XRNG=+117NM
						INPLANE
TDRS-W	13/22:13:41	37:34	88:02	141	25.4	EI MINUS
AOS	77/06:06:41	S	E	NM	VI	31 MIN
EI	13/22:44:38	29:09	166:00	399.6	24.5	RANGE
	77/06:37:38	N	W	KFT	VREL	4405 NM
MACH 5	13/23:07:44	29:42	82:36	115.7	5.1	
	77/07:00:44	N	W	KFT	VREL	
MACH 4	13/23:08:39	29:13	82:02	102.0	4.0	
	77/07:01:39	N	W	KFT	VREL	
MACH 3	13/23:09:41	28:53	81:30	87.0	2.9	
	77/07:02:41	N	W	KFT	VREL	
MACH 2	13/23:10:42	28:47	81:04	73.4	1.9	
	77/07:03:42	N	W	KFT	VREL	
MACH 1	13/23:12:14	28:38	80:42	47.3	0.9	
	77/07:05:14	N	W	KFT	VREL	
HAC I/C	13/23:13:17	28:34	80:34	32.8	8.0	TURN ANGLE
	77/07:06:17	N	W	KFT	VREL	212 DEG
LANDING	13/23:16:29					RUNWAY
	77/07:09:29				KSC33	
ROLL SCHEDULE			R	OLL (DEG)	VREL	GMT
1ST RO	LL COMMAND (TO	THE RIGHT	·)	+83	24.5	12:43:13
1ST	1ST ROLL REVERSAL (R TO L)			53 to -53	19.8	12:51:15
2NE	ROLL REVERSAL	(L TO R)			10.1	
3RD	ROLL REVERSAL	(R TO L)			4.5	

WEATHER:

CLOUDS 25 SCT 250 SCT

VIS 7 ALT 30.03 WINDS 2105P10 TEMP 60°F

COMMENTS AFT 14Z WND 2110P15

FDO:E. González

Figure 3.3-1. Sample Deorbit/Landing Data sheet

TO: INCO FROM: PTG, FAO

RE: ROLL REVERSAL ANTENNA SELECTION

The following TDRS look angle data is based on state vector and attitude information provided by FDO for KSC 223:

			TD	RW	TD	RE
	GMT	ROLL	AZ	EL	AZ	EL
1st Roll Command	077:12:43:1 3	+ 80	30	- 13	(LOS)	(LOS)
1st Roll Reversal	077:12:51:1 5	+ 53	- 13	- 17	158	52
	3	- 53	- 59	- 59	- 165	61

Figure 3.3-2. Sample pointing flight note

TO: FD, CAPCOM, GC

FROM: INCO

RE: ENTRY COMM SUMMARY KSC REV xxx

TDRS East and TDRS Z prior to the D/O burn are good for comm.

TIG is 1.5 minutes after the handover to TDRS West. Expect good comm for TIG as well.

INCO will command a handover of TDRS satellites to avoid lower antenna selection during blackout prior to hand down to MILA.

EVENT	MET	GMT
TDRS E to Z	011/18:15: <sup>47</sup>	351/16:35: <sup>15</sup>
TDRS Z to W	011/18:27: <sup>05</sup>	351/16:46: <sup>33</sup>
TIG	011/18:28: <sup>45</sup>	351/16:48: <sup>13</sup>
TDRS W to E (1 <sup>st</sup> roll cmd)	011/19:08	351/17:28
TDRS E to W (1 <sup>st</sup> roll rev)	011/19:15	351/17:35
MILA UHF	011/19:23: <sup>33</sup>	351/17:43: <sup>01</sup>
TDRS E to MILA	011/19:24: <sup>32</sup>	351/17:44: <sup>00</sup>
HUD Video	011/19:31: <sup>32</sup>	351/17:53: <sup>00</sup>

Figure 3.3-3. Sample entry COMM coverage flight note

# 2. Kennedy Space Center

KSC will be the prime landing facility for all shuttle landings with few exceptions. The location of KSC/MILA with respect to TDRS W and S generates some opportunity for improved comm on higher inclination entries into KSC. These actions are discussed in SCP 3.5. KSC has one set of concrete runways (15/33).

**REV G, PCN 6** 

8/3/2007:

The nominal SPC will hand down from TDRS to MILA at MILA AOS rounded to the next whole minute. The rationale for this is that it is applicable for all inclinations, all entry profiles, consistent for both runways, maximizes comm, and simplifies command procedures. Also, past performance of MILA at AOS is excellent (9-m antenna). The SPC contains two STDN LO SALVO commands (DSM 4471) sent to both PF MDM's for redundancy. STDN LO is used because of saturation of the antenna control equipment in STDN HI. This saturation causes the antenna to vibrate. If vibration gets too severe, MILA may have to take manual control of the antenna, which is highly undesirable. When the entry ephemeris is available, the SPC should be built with the first command timetag equal to MILA AOS (rounded) and the second command timetag 1 second later to ensure proper onboard execution. Also, the BFS AM site inhibit table should be configured for landing (DSM 12420). TDRS will be used as the prime comm link through landing if MILA is unavailable.

MILA has two 9-meter antenna systems. MILA system no. 1 (MIL) has a north/south keyhole, which prevents it from being able to point at the Shuttle Landing Facility (SLF). Hence, MILA system no. 2 (MLX - east/west keyhole) is required for touchdown. For most entries, the handdown from TDRS will be to MILA system no. 1 and a handover to MILA system no. 2 will be performed as soon as reasonable after it acquires the vehicle. Some cases allow the initial handdown to be directly to MILA system no. 2, however, this is the exception, not the norm. If MILA system no. 2 is failed, landing can be performed on system no. 1. However, it may be required to have MILA increase their forward power to maintain the S-band forward link for this case. If unsuccessful with an increase in forward power, another option is to acquire the return with the User antenna, located on the 140ft tower and use UHF as the forward link. The User antenna must be pointed manually and could delay return link acquisition. Once return is acquired, MILA action is required to source the data to MCC. Last, but not least, the TDRS SHO will continue to be available for an hour after touchdown so it could be used by going back to TDRS mode on the orbiter.

# 3. Edwards Air Force Base

EDW nominally will be the backup landing facility for all shuttle landings with few exceptions. EDW has one set of concrete runways (04/22) and many sets of lakebed runways, as shown previously.

The nominal SPC will hand down from TDRS W to Dryden Flight Research Center (DFRC) at DFRS AOS + 2 minutes rounded off to the nearest whole minute. This is based on past performance of DFRC at AOS with the old 4.3m antennas. These antennas have since been upgraded to 7.3m but the handover time has not been re-addressed. The SPC contains two STDN HI SALVO commands (DSM 4472) sent to both PF MDM's for redundancy. When the entry ephemeris is available, the SPC should be built with the first command timetag equal to DFRC AOS rounded appropriately and the rest spaced 1 second later, respectively, to ensure proper onboard execution. Also, the BFS AM site inhibit table should be configured for landing (DSM 12420). If DFRC fails, the orbiter will need to be on TDRS prior to touchdown.

# 4. Northrup

Northrup, also known as White Sands Space Harbor (WSSH), is considered a backup landing facility only. It has two sets of lakebed runways only.

Landings here will be performed on TDRS W to the ground and UHF support via the new WSSH UHF system.

# G. INCO ACTIONS DURING ENTRY PHASE

The following are INCO/COMM/INST actions during entry phase with no comm failures. For any comm gear that is in an off-nominal config at convoy handover (postlanding), notify KSC (CCSE or CISL as appropriate) of the config and the rationale for it. Also, for any contingency procedures that take Master MADS OFF, the INST should verify the switch throw on C3, coordinate with DATA COMM to stop recording MADS PCM data on SSR1, and then command MADS RCDR PWR OFF (DSM 4619).

1. Nominal entry/postlanding

DataComm

INCO Brief FD on the entry comm flight note.

Command BFS AM site inhibits, as required for handovers. At wheel stop, inhibit BFS antenna pointing (DSM 12440). Command the appropriate upper S-band (PM and FM) antennas.

if required.

COMM Verify WAMS up to date (including MOC COMP).

Build entry SPC to hand down to landing site (MILA/DFRC).

Monitor network status.

At wheel stop, verify upper S-band (PM and FM) antennas

selected.

INST At TIG-1 hour, perform D/O MADS recorder checkout

(SCP 3.21).

At TIG-7 minutes:

MADS RCDR PWR ON (DSM 4618).

MADS WB ON (DSM 4601). MADS PCM ON (DSM 4603).

MADS CAL ON (DSM 4607) (wait 10 sec).

MADS CAL OFF (DSM 4608).

At wheel stop + 2 minutes:

MADS CAL ON (DSM 4607) (wait 10 sec).

MADS CAL OFF (DSM 4608).

At EI + 2500 seconds (~ TD + 11 minutes):

MADS RCDR PWR ON (DSM 4618).

MADS CAL ON (DSM 4607) (wait 10 sec).

MADS CAL OFF (DSM 4608). MADS WB OFF (DSM 4602).

MADS PCM OFF (DSM 4604).

verify no tape motion.
MADS OFF/STBY (DSM 4600).

MADS RCDR PWR OFF (DSM 4619).

MADS RCDR PWR OFF (DSM 4619).

At least 16 hours before entry TIG, finalize a plan to protect positions 0-161 on SSR1 for recording MADS PCM later.

At TIG-1H (seat ingress) configure for data+voice recording (notify crew):

Command RCDR VOICE ON (DSM 4774). Uplink Auto Stops to both SSRs at the position where voice recording was started (per SCP 3.22).

At EI - 10M configure SSR 1 to record MADS PCM data (make

3.3-15

sure there is no data that has not been dumped and verified in positions 0 to 53. Also verifiy that MADS PCM is ON):

SSR 1 HALT (DSM 9252) SSR 1 RCDP (DSM 9202)

Verify SSR 1 mode = RCDP

Postlanding configure FM for post landing recorder playback: FM – MMU 1(2) (DSM 4728(4727)

Verify RF power out and proper FM MODE.

At wheel stop + 2 minutes, uplink SSR1 STOP SER RCD (DSM 9235) and dump one SSR (all entry data with voice). Do not "HALT" all recording if still in parallel mode, because any NSP data left in the "E1" area will appear anomalous in the Dump FEP.

Notify INCO of approximate time to complete dump. Any "old" LOS data should also be dumped.

At wheel stop + 15M, dump MADS PCM data from SSR1.

Some wheel stop locations may not support acceptable dump quality such as KSC 33 or structural interference at EDW. For these cases, the dumps should still be attempted.

After dumps are complete configure recorders for handover to the convoy. Turn FM OFF (DSM 4781) and turn NSP RCD Voice OFF (DSM 4775).

Notify INCO commanding is complete. Log the number of commands sent to the vehicle.

Once NSP RCD Voice OFF command has been verified, notify KSC CCSE on OIS 155 with the time the NSP RCD Voice OFF command was sent. If CCSE can not be reached on their loop, use the ground line for Firing Room #4 (321-861-9860/9866).

For SSR2, continue recording but verify an AUTO STOP pointer has been placed to protect entry data.

Complete postflight recorder report per SCP 5.5.

2. Contingency entry landing site other than KSC/EDW.

INCO Same procedure as nominal plus the following:

Entry, landing, and postlanding will be performed on TDRS. Note SCP 5.16 for final antenna selection, if required.

Brief the FD of the comm plan.

COMM Same procedure as nominal except no landing site SPC will be

required.

INST Same procedure as nominal.

DataComm Perform nominal procedure.

No postlanding dump will occur, so the FM can remain

OFF.

Also, with no convoy support the vehicle will be safed and powered down rapidly (no cooling), but verify the autostop in case it's needed to avoid overwriting entry data.

# H. GUIDANCE LOADS DURING A/E HIGH SPEED OPS

The following guidance loads may be requested to be sent during "high-speed" ops (lift-off to MECO and EI-5 to TD). Note that the destination for all these loads is the *GNC MF*.

<u>DSM</u>	LOAD TYPE
40401	Delta Nav State

This load performs an "additive" function to the current onboard orbiter state vector and should be sent only ONCE! It is possible that another Delta Nav State may be required to be uplinked subsequently. In this case, the GPO will delete the current 40401 and rebuild a new Delta Nav State and assign it to 40401 once again. Also note that a Delta Nav State goes "stale" very

rapidly and must be uplinked ASAP after GPO requests it.

412xx Deorbit landing site 413xx Deorbit TACAN site

Note that an orbiter state vector is always assigned to DSM 40101 (very similar to the Delta Nav State) and should NEVER be uplinked during "high-speed" ops. The FDO's have been asked to delete 40101 during these phases to prevent this error from occurring.

#### **TITLE**

### ASCENT/ENTRY COMM MALFUNCTION ACTIONS

# **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

# **PURPOSE**

This procedure provides a set of INCO responses to comm system failures that occur during ascent and entry. Multiple failures in related systems (EPS, DPS, etc.) are generally not covered. Only *non-inclination-dependent* actions will be included here.

# COMMAND RESTRICTIONS/CONSTRAINTS

These commands are valid in OPS 1, 3, and 6 in both the GNC and BFS major functions. Some commands must be sent quickly to avoid excessive loss of telemetry. Crew coordination is required before switching NSP's due to the fault message that will be generated.

# **PROCEDURE**

# A. ASCENT COMM MALFUNCTION ACTIONS

The following assumptions are made:

- Comm and DPS systems in lift-off config (system 2 selected, etc.)
- No other comm system failures
- 1. LOSS OF D/L CARRIER (Call from the network is "Sharp cutoff")

Command PA1 ON (DSM 4754).

If no joy, command XPNDR1 ON (DSM 4730) (reacg required if on ground site).

If no joy, request PNL/CMD in the blind.

If TDRS, crew will need to execute a PNL/CMD, then item 46 on BFS SPEC 51, or reconfigure PNL A1L for TDRS per ACPL, p. 2-2, then PNL CMD.

If no joy, request crew select best antenna in the blind.

2. STATIC FRAME (sync, no val)

If no command available on string 1, reverse steps... Command NSP1 ON (DSM 4760) (notify crew to ignore fault message). If no joy, request crew select alternate PCMMU (TFL 129, fixed format).

3. LOSS OF D/L MOD (Call from the network is "Carrier no mod")

If no command available on string 1, reverse steps...

Command NSP1 ON (DSM 4760) (notify crew to ignore fault message).

If no joy, command XPNDR1 ON (DSM 4730) (reacg required if on ground site).

If no joy, request PNL/CMD in the blind.

If TDRS, crew will need to execute a PNL/CMD, then item 46 on BFS SPEC 51, or reconfigure PNL A1L for TDRS per ACPL, p. 2-2, then PNL CMD.

4. LOSS OF NSP BIT/FRM (NO CMD or S-band voice)

If STDN, request PNL/CMD prior to TDRS H/O.

If TDRS, request PNL/CMD via UHF at next available site.

Note that the crew may PNL/CMD then execute an ITEM 46 on BFS SPEC 51 or reconfigure PNL A1L for TDRS then perform a PNL/CMD prior to the next available site.

5. LOSS OF FF3 (NO command on NSP 2)

If command required, request PNL/CMD.

If TDRS, crew will need to execute a PNL/CMD, then item 46 on BFS SPEC 51, or reconfigure PNL A1L for TDRS per ACPL, p. 2-2, then PNL CMD.

6. LOSS OF GPC 3 (NO command on NSP 2)

If command required, request PNL/CMD.

If TDRS, crew will need to execute a PNL/CMD, then item 46 on BFS SPEC 51, or reconfigure PNL A1L for TDRS per ACPL, p. 2-2, then PNL CMD. Else, wait for restring post MECO.

7. LOSS OF BFS TRACK ON STRING 3 (NO BFS command)

Advise sites of non-optimum antenna selection.

If BFS command required, request PNL/CMD.

If TDRS, crew will need to PNL/CMD then execute an ITEM 46 on BFS SPEC 51 or reconfigure PNL A1L for TDRS per APCL, p. 2-2, then PNL/CMD.

8. LOSS OF BFS TRACK ON ALL STRINGS (BFS standalone) (NO BFS command)

Monitor antenna selects and uplink signal strength - crew may need to select antennas manually (BFS nav state goes bad).

SPC's OK.

9. BFS FAILED (fail/fail to halt) (NO BFS CMD) (NO SPC's) (GNC has PL buses)

All except RTLS, command to TDRS real time via *two-stage* MRTC to the GNC MF (Assumes H/O between 10m and 11m; i.e., after RTHU)

If nominal ascent, ATO, AOA, command MRTC DSM 4644/4645 (inclination dependent) to GNC MF.

(TDRS salvo, HDR UP+DN, FLTR WD, URF/URA)

If TAL, command MRTC 4644 to GNC MF.

(TDRS salvo, HDR UP+DN, FLTR WD, URF)

RTLS, command the appropriate forward antenna then to STDN LO mode (DSM 4735) GNC MF @ 14m or after ET sep. *Note that uplink coding stays ON.* 

# 10. BFS TRANSIENT HALT (NO SPC's)

Note that the BFS will come back up in OPS 0, and crew will try to recover. SPC gone, reuplink SPC. See BFS in OPS 0 action (step 11).

# 11. BFS IN OPS 0 (NO AM)

Monitor antenna selects and uplink signal strength - command as required (BFS MF).

Note: nominal TDRS E antenna = URF/URA (inclination dependent).

TAL TDRS E antenna = URF.

RTLS MILA antenna = URF/ULF (inclination dependent).

SPC OK

# 12. LOSS OF GNC DOWNLIST

Have DPS change downlisters (via crew item entry). If no joy, request crew select alternate PCMMU (TFL 129, fixed format).

### LOSS OF BFS DOWNLIST

If FD wants BFS downlist, request crew select alternate PCMMU (TFL 129, fixed format).

# 14. LOSS OF PF1 (no SSR 1 cmd, no MADS cmd)

Select MDM 2 on command panel.

The crew will have to manage the MADS recorder via the A6L switches (post-MECO/OMS burns)

### 15. LOSS OF PF2 (no SSR 2 cmd)

Command ANT ELEC 1 ON (DSM 4709).

# 16. LOSS OF A/G 1 D/L

Verify no A/G 1 D/L from multiple crewmembers.

If STDN, use A/G 2 and UHF (inform COMM TECH).

If TDRS and NSP bite, command NSP 1 ON (DSM 4760) (inform crew of fault msg)

If TDRS and no NSP bite, request crew select alternate ACCU.

If no joy, command NSP 1 ON (DSM 4760) (inform crew of fault msg).

### 17. LOSS OF UHF D/L CARRIER (Call from the site is "No carrier on UHF")

Verify no carrier from multiple crewmembers.

If no joy, request crew select alternate UHF frequency on PNL O6 (296.8 MHz). Notify COMMTECH to reconfigure sites.

If no joy, request crew take UHF PA OFF (may need squelch off at site).

If no joy, request crew select GUARD frequency (243.0 MHz). Notify COMMTECH to reconfigure sites.

# 18. LOSS OF UHF D/L MOD (Call from the site is "No downlink on UHF")

Verify no mod from multiple crewmembers.

Request crew select alternate ACCU.

If no joy, request crew select alternate UHF frequency on PNL O6 (296.8 MHz). Notify COMMTECH to reconfigure sites.

### 19. LOSS OF UHF U/L SIGNAL STRENGTH

Request a UHF only call

If no joy, request crew select alternate UHF frequency on PNL O6 (296.8 MHz).

Notify COMM TECH to reconfigure sites.

If no joy, request crew select GUARD frequency (243.0 MHz).

Notify COMM TECH to reconfigure sites.

# 20. LOSS OF UHF U/L (good signal strength)

Request crew select alternate ACCU.

If no joy, request crew select alternate UHF frequency on PNL O6 (296.8 MHz). Notify COMMTECH to reconfigure sites.

### 21. STUCK MIKE

Request crewmember with stuck mike cycle PTT several times.

If no joy, request crewmember select backup position on ATU.

CDR ATU to "RIGHT"

PLT ATU to "LEFT"

MS ATU to "PS"

If no joy, (stuck button) request crewmember go back to NORM and RCV on UHF (A/A) and other loops, if required, or have CCU power turned off.

If joy, but UHF carrier only still on (stuck ATU) request crewmember select RCV on A/A on original ATU.

# 22. LOSS OF MDM OF3

Notify crew that manual antenna select will be required for TDRS.

Note: Nominal TDRS E antenna = URF/URA (inclination dependent) TAL TDRS E antenna = URF.

# 23. LOSS OF SSR 2

(No action for loss of SSR.)

# 24. LOSS OF FM D/L (Call from the site is "Carrier no MOD" or "No carrier")

Command FM XMTR 2 ON (DSM 4782).

If no iov, monitor hemi selection (verify proper site selection).

# 25. PTT LOST (both RHC and HIU)

Request crewmember select backup position on ATU.

CDR ATU to "RIGHT"

PLT ATU to "LEFT"

MS ATU to "PS"

If no joy, request crewmember go back to NORM and select VOX/VOX.

# 26. COMSEC 2 RCV FAIL

If string 1 command not available, request crew select ENCR BYP on PNL A1L (notify COMMAND to reconfigure to clear on the forward link).

If STDN, request PNL/CMD prior to TDRS H/O via UHF.

If TDRS, request PNL/CMD via UHF at next available site.

Note that the crew may execute a PNL/CMD, then item 46 on BFS SPEC 51, or reconfigure PNL A1L for TDRS per ACPL, p. 2-2, then PNL CMD prior to the next available site.

# 27. LOSS OF MTU IRIG B (lose time authentication in COMSEC)

If command required, request crew select ENCR BYP on PNL A1L (notify COMMAND to reconfigure to clear on the forward link).

### B. ENTRY COMM MALFUNCTION ACTIONS

The following assumptions are made:

- Comm and DPS systems in entry config (system 2 selected, etc.)
- No other comm system failures unless specified
- 1. LOSS OF D/L CARRIER (Call from the network is "Sharp cut-off")

# If TDRS

Command PA 1 ON (DSM 4754).

If no joy, command XPNDR 1 ON (DSM 4730) (reacg required).

If no joy, request a PNL/CMD in the blind.

If comm required prior to STDN AOS the crew will need to execute a PNL/CMD, then item 46 on BFS SPEC 51, or reconfigure PNL A1L for TDRS per ECPL, p. 2-2, then PNL CMD.

### If STDN

Command STDN LO (DSM 4471).

If no joy, command XPNDR 1 ON (DSM 4730) (reacq required).

If no joy, request request a PNL/CMD in the blind on A/G and UHF.

If no joy, request crew select best antenna in the blind.

2. STATIC FRAME (sync, no val)

If no command available on string 1, reverse steps...

Command NSP 1 ON (DSM 4760) (notify crew to ignore fault message).

If no joy, request crew select alternate PCMMU (TFL 129, fixed format).

3. LOSS OF D/L MOD (Call from the network is "Carrier no mod")

If no command available on string 1, reverse steps...

Command NSP 1 ON (DSM 4760) (notify crew to ignore fault message).

If no joy, command XPNDR 1 ON (DSM 4730) (reacg required).

If no joy, request a PNL/CMD in the blind.

If comm required prior to STDN AOS the crew will need to execute a PNL/CMD, then item 46 on BFS SPEC 51, or reconfigure PNL A1L for TDRS per ECPL, p. 2-2, then PNL CMD.

4. LOSS OF NSP BIT/FRM (No CM or S-Band voice uplink)

When STDN AOS, inform crew of UHF only on the U/L.

If command or S-Band voice required, request a PNL/CMD.

Note that the crew may execute a PNL/CMD, then item 46 on BFS SPEC 51, or reconfigure PNL A1L for TDRS per ECPL, p. 2-2, then PNL CMD prior to STDN AOS.

5. LOSS OF FF3 (NO command on NSP 2)

If command required, request PNL/CMD.

If TDRS, crew will need to execute a PNL/CMD, then item 46 on BFS SPEC 51, or reconfigure PNL A1L for TDRS per ECPL, p. 2-2, then PNL CMD.

# 6. LOSS OF GPC 3 (No command on NSP 2)

If command required, request PNL/CMD.

If TDRS, crew will need to execute a PNL/CMD, then item 46 on BFS SPEC 51, or reconfigure PNL A1L for TDRS per ECPL, p. 2-2, then PNL CMD.

Else, wait for G9 transition postlanding.

# 7. LOSS OF BFS TRACK ON STRING 3 (NO BFS uplink CMD)

If BFS command required, request PNL/CMD.

If TDRS, crew will need to execute a PNL/CMD, then item 46 on BFS SPEC 51, or reconfigure PNL A1L for TDRS per ECPL, p. 2-2, then PNL CMD.

# 8. LOSS OF BFS TRACK ON ALL PASS STRINGS (BFS standalone) (NO BFS command)

Monitor antenna selects and uplink signal strength - crew may need to select antennas manually (BFS nav state goes bad).

SPC's OK

# 9. BFS FAILED (fail/fail to halt) (NO BFS CMD) (NO SPCs) (GNC has P/L buses)

Command STDN mode via salvo command to the GNC MF.

If KSC, then STDN LO (DSM 4471).

If EDW, then STDN HI (DSM 4472).

Command antennas via GNC MF.

### 10. BFS TRANSIENT HALT (NO SPC's)

Note that the BFS will come back up in OPS 0 and crew will try to recover.

SPC gone, reuplink SPC.

See BFS in OPS 0 actions (step 11).

# 11. BFS IN OPS 0 (NO AM)

Monitor antenna selects and uplink signal strength - command as required (BFS MF). SPC OK.

# 12. LOSS OF GNC DOWNLIST

Have DPS switch downlisters (via crew item entry). If no joy, request crew select alternate PCMMU (TFL 129, fixed format).

# 13. LOSS OF BFS DOWNLIST

If FD wants BFS downlist, request crew select alternate PCMMU (TFL 129, fixed format).

# 14. LOSS OF PF1 (no SSR 1 cmd, no MADS cmd)

Select MDM 2 on command panel.

Have crew perform postlanding MADS CAL, if required.

# 15. LOSS OF PF2 (no SSR 2)

Command ANT ELEC 1 (DSM 4709)

#### 16. LOSS OF A/G 1 D/L

Verify no A/G 1 D/L from multiple crewmembers.

If TDRS and NSP bite, command NSP 1 ON (DSM 4760) (inform crew of fault msg).

If TDRS and no NSP bite, request crew select alternate ACCU.

If no joy, command NSP 1 ON (DSM 4760) (inform crew of fault msg).

If STDN use A/G 2 and UHF (inform COMMTECH).

# 17. LOSS OF UHF D/L CARRIER (Call from site is "No carrier on UHF")

Verify no carrier from multiple crewmembers.

If no joy, request crew select alternate UHF frequency on PNL O6 (296.8 MHz).

Notify COMM TECH to reconfigure sites.

If no joy, request crew take UHF PA OFF (may need squelch off at site).

If no joy, have crew select GUARD frequency (243.0 MHz).

Notify COMMTECH to reconfigure sites.

# 18. LOSS OF UHF D/L MOD (Call from site is "No downlink on UHF")

Verify no mod from multiple crewmembers.

If no joy, request crew select alternate ACCU.

If no joy, request crew select alternate UHF frequency on PNL O6 (296.8 Mhz).

Notify COMM TECH to reconfigure sites.

# 19. LOSS OF UHF U/L S/S

Request a UHF only call.

If no joy, request crew select alternate UHF frequency on PNL O6 (296.8 MHz).

Notify COMM TECH to reconfigure sites.

If no joy, request crew select GUARD frequency (243.0 MHz).

Notify COMM TECH to reconfigure sites.

# 20. LOSS OF UHF U/L (good signal strength)

Request crew select alternate ACCU.

If no joy, request crew select alternate UHF frequency on PNL O6 (296.8 MHz). Notify COMMTECH to reconfigure sites.

# 21. STUCK MIKE

Request crewmember with stuck mike cycle PTT several times.

If no joy, request crewmember select backup position on ATU.

CDR ATU to "RIGHT"

PLT ATU to "LEFT"

MS ATU to "PS"

If no joy (stuck button), request crewmember go back to NORM and RCV on UHF (A/A) and other loops if required, or have CCU power turned off.

If joy, but UHF carrier only still on (stuck ATU), request crewmember select RCV on A/A on original ATU.

### 22. LOSS OF MDM OF3

If TDRS mode, then have crew select best antenna after STDN handover or uplink the BFS antenna pointing inhibit command (DSM 12434) and command antennas manually.

23. LOSS OF FM D/L (Call from the site is "No carrier" or "Carrier no MOD")

Command FM XMTR 2 ON (DSM 4782). If no joy, monitor hemi selection (verify proper site selection).

24. PTT LOST (both RHC and HIU)

Request crewmember select backup position on ATU CDR ATU to "RIGHT" PLT ATU to "LEFT" MS ATU to "PS"

If no joy, request crewmember go back to NORM and select VOX/VOX.

# 25. COMSEC 2 RCV FAIL

If string 1 command not available, request crew select ENCR BYP on PNL A1L (notify COMMAND to reconfigure to clear on the forward link).

If TDRS, request PNL/CMD via UHF at next available site.

Note that the crew may execute a PNL/CMD, then item 46 on BFS SPEC 51, or reconfigure PNL A1L for TDRS per ACPL, p. 2-2, then PNL/CMD prior to the next available site.

If STDN and command required, request crew perform PNL/CMD via UHF.

# 26. LOSS OF MTU IRIG B (loss of T/A in COMSEC)

If command required, request crew select ENCR BYP on PNL A1L (notify COMMAND to reconfigure to clear on the forward link).

# **TITLE**

# INCO A/E INCLINATION-SPECIFIC PROCEDURES

# **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed pre-mission without review and approval at the FOIG.

# **PURPOSE**

To describe 28° and 51° inclination ascent and entry procedures required for comm operations.

# **COMMAND RESTRICTIONS/CONSTRAINTS**

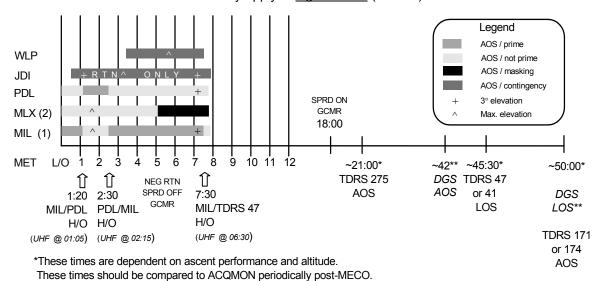
These commands are valid in OPS 1, 3, and 6. Some commands must be sent quickly to avoid excessive loss of telemetry. Crew coordination is required for NSP switches (Fault MSG to crew).

### **PROCEDURES**

# A. 28° INCLINATION ASCENT PROCEDURES

1. Comm coverage up through the first ZOE will be as follows:

Note: These data are based on the STS-109 ascent profile (308 n. mi. altitude). The times/elevations only apply to <u>high altitude</u> (Hubble) missions.



<sup>\*\*</sup>DGS will be available only for high altitude missions at this inclination.

Table 3.5-1 contains the 28° detailed site data.

Table 3.5-1. 28° detailed site data

Site	MIN EL/CLR	ASC 3°	MAX EL	Enter	CLR	DEC 3°	LOS/ENTR
	MSK	EL		MSK	MSK	EL	MSK
MIL (sys 1)	00:00/00:12	~00:15	01:37 / 40.1°			07:00	08:00
MLX (sys 2)	00:00/00:12	~00:15	01:37 / 40.1°	05:16*	*	N/A*	05:16*
PDL	~00:07	~00:15	~01:37 / 40°			~07:00	~07:48
JDI	00:30/00:36	01:01	03:15 / 20.6°			07:06	07:54
WLP	03:39		05:34 / 1.3°				07:30
TDRS 275 (Z)	21:05						01:17:17
TDRS 47	00:00						TBD
TDRS 41	00:00						45:26
DGSS	41:25/41:58	42:42	46:05 / 7.6°			49:29	50:21/50:48
TDRS 174	49:28						01:43:22
TDRS 171	TBD						TBD

<sup>\*</sup>Antenna keyhole - antenna stowed shortly thereafter.

2. The prime sites, handover times, and BFS Antenna Management (AM) config are as follows:

Timeframe	Event	Prime site	BFS AM config
1:20	Handover	MIL to PDL	PDL
2:17	Uplink DSM 12401		
2:30	Handover	PDL to MIL	MIL
7:30	Handover	MIL to TDRS 41/47	TDRS

# 3. Standard SPCs

12101	12101 - TDRS at 7:30M SPC						
MDM	DSM	TITLE	TIMEWORD				
1	4470	TDRS SBD SALVO	000:00:07:30				
2	4470	TDRS SBD SALVO	000:00:07:30				
1	4759	NSP UL HDR	000:00:07:31				
2	4759	NSP UL HDR	000:00:07:31				
1	4764	NSP DL HDR	000:00:07:31				
2	4764	NSP DL HDR	000:00:07:31				
1	4766	XPNDR UL FLTR WD	000:00:07:31				
2	4766	XPNDR UL FLTR WD	000:00:07:31				
1	4739	SPD SPM OFF	000:00:07:31				
2	4739	SPD SPM OFF	000:00:07:31				

12103 - SPREADING SPC						
MDM	DSM	TITLE	TIMEWORD			
1	4738	SPD SPM ON	000:00:18:00			
2	4738	SPD SPM ON	000:00:18:00			
-	-	-	-			

12102	12102 - RANGING SPC					
MDM	DSM	TITLE	TIMEWORD			
1	4745	RANGING OFF	000:00:01:20			
2	4745	RANGING OFF	000:00:01:20			
1	4746	RANGING ON	000:00:02:30			
2	4746	RANGING ON	000:00:02:30			
-	-	-	-			
-	-	-	-			
-	-	-	-			
-	-	-	-			
-	-	-	-			
-	-	-	-			

12104 - RTLS SPC					
MDM	DSM	TITLE	TIMEWORD		
1	4735	STDN LO MODE	000:00:14:00		
2	4735	STDN LO MODE	000:00:14:00		
_	_	-	-		

2

12105 - TDRS at 8M SPC					
DSM	TITLE	TIMEWORD			
4470	TDRS SBD SALVO	000:00:08:00			
4470	TDRS SBD SALVO	000:00:08:00			
4759	NSP UL HDR	000:00:08:01			
4759	NSP UL HDR	000:00:08:01			
4764	NSP DL HDR	000:00:08:01			
4764	NSP DL HDR	000:00:08:01			
4766	XPNDR UL FLTR WD	000:00:08:01			
	DSM 4470 4470 4759 4759 4764 4764	DSM TITLE  4470 TDRS SBD SALVO  4470 TDRS SBD SALVO  4759 NSP UL HDR  4759 NSP UL HDR  4764 NSP DL HDR  4764 NSP DL HDR			

4766 XPNDR UL FLTR WD

5/23/2005:

000:00:08:01

These SPCs are prestored in the standard rfae\_28 directory and are built with reference to PET 1. PET 1 in the CMD server should be set to the expected lift-off time. Then these SPCs should be submitted to the CMD server. If the launch slips by more than a few seconds, the PET 1 in the CMD server should be updated and all the SPCs should be resubmitted/overwritten to adjust for the new liftoff time. Always verify the time-word associated with any SPC prior to uplinking it to the vehicle. They are sent to both P/L MDMs for redundancy. The nominal SPCs (12101, 12102, and 12103) are uplinked at about T - 8M, unless there is an expected hold at T - 5M. 12101 provides TDRS handover at 7:30, 12102 disables ranging on PDL, and 12103 enables spread spectrum.

**REV G, PCN-1** 

12104 and 12105 are contingency SPCs. 12104 is a contingency SPC that is used for an RTLS case (note that uplink coding will stay ON). 12105 is a contingency SPC that is used for a TDRS down case.

28° contingency SPC procedures are as follows:

#### PTI 9

CLEAR nominal SPCs (12101/2/3) and uplink 12104.

# TDRS down

CLEAR nominal SPCs (12101/2/3) and uplink 12105.

If post SRB sep, verify RANGING config and cmd OFF if required.

# Performance problem/ditch case

Monitor GSTDN antenna elevation and, if it drops to  $5^\circ$  prior to 7M, consider commanding to TDRS early via MRTC.

# 4. 28° Standard MRTCs

These commands are used if it is required to command to TDRS real time (BFS or SPC problem). All MRTCs should be sent via **two-stage execute**. The SS ON commands are available if required (TDRS failure, GCMR failure, RTLS+MILA failure, RTLS turns into ditch, etc.).

### 4641 - TDRS SS OFF

(SALVO + UL HDR + DL HDR + UL FLTR WD + SS OFF)

This is used to command to TDRS with spread spectrum OFF when antenna selection is not required (i.e., BFS AM is selecting correctly).

# 4643 - TDRS URF SS OFF

(SALVO + UL HDR + DL HDR + UL FLTR WD + SS OFF + URF)

This is used to command to TDRS with spread spectrum OFF and select the appropriate post-Roll-To-Heads-Up (RTHU) antenna (URF) for the nominal, ATO, and TAL ascent cases (BFS problem).

# 4640 - TDRS SS ON

(SALVO + UL HDR + DL HDR + UL FLTR WD)

This is used to command to TDRS with spread spectrum ON (TDRS fail case, etc.) when antenna selection is not required (i.e., BFS AM is selecting correctly).

# 4645 - TDRS URF SS ON

(SALVO + UL HDR + DL HDR + UL FLTR WD + URF)

5/23/2005: REV G, PCN-1

This is used to command to TDRS with spread spectrum ON (network GCMR failed) and select the appropriate post-RTHU antenna (URF) for the nominal, ATO, and TAL ascent cases (BFS problem).

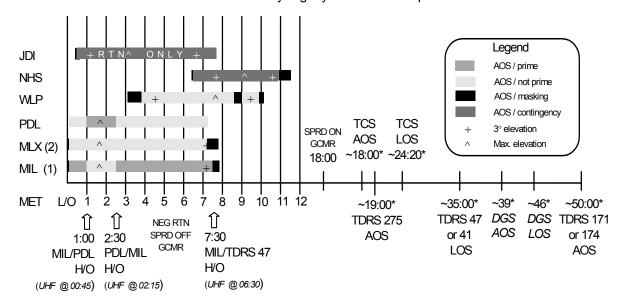
# B. 28° INCLINATION ENTRY PROCEDURES

The INCO should evaluate the predicted TDRS AZ and EL angles received from POINTING to determine if a lower antenna will be selected during the S-band blackout period. If this situation is predicted, the expected loss of comm times should be passed on to the Flight Director and the rest of the controllers (and possibly the crew).

### C. 51° INCLINATION ASCENT PROCEDURES

1. Comm coverage up through the first ZOE is as follows:

Note: These data are based on the STS-108 ascent profile (122 n. mi. insertion altitude). The times/elevation vary slightly on a mission-specific basis.



 $<sup>{}^{*}\</sup>text{These}$  times are dependent on ascent performance and altitude.

These times should be compared to ACQMON periodically post-MECO.

Table 3.5-2 contains the 51° nominal detailed site data.

Site MIN EL/ **MAX EL** DEC 3° ASC 3° Enter CLR **CLR MSK** EL **Enter MSK/** EL **MSK MSK** MIN EL MILS (sys 1) 00:00/00:12 ~00:18 01:37 / 37° 06:53 07:30/07:48 - - -MLXS (sys 2) 00:00/00:12 ~00:18 06:53 07:18/07:48 01:37 / 37° - - -- - -**PDLS** ~00:07 ~00:12 ~01:43/37° ~07:12 ~07:12 - - -- - -**JDIS** 00:30/00:36 01:07 03:08 / 14° 06:41 07:36 07:36 / 11° **WLPS** 03:08/03:51 04:34 09:22 09:57/10:10 08:37\* 09:00\* 09:09 / 7° NHSS 06:29/06:35 07:42 10:35 10:52/11:29 **TCSS** 17:35/18:14 18:14 20:49 / 65° 23:42 24:19/24:26 - - -- - -TDRS 275 (Z) 19:01 01:07:39 - - -- - -**TDRS 47** 00:00 **TBD** - - -- - -**TDRS 41** 00:00 35:38 - - -46:21/46:39 **DGSS** 38:52/39:00 39:33 42:45 / 69° 45:55 **TDRS 174** 49:28 01:39:54 - - -- - -- - -- - -- - -**TDRS 171 TBD TBD** 

Table 3.5-2. 51° nominal detailed site data

\*WLPS midpass masking (antenna keyholes) has been verified as capable of providing excellent return link (STS-74), and it is expected to support acceptable forward link also. The ascent comm plan no longer avoids this keyhole. WLPS has a new 11m antenna system with no keyhole concerns, however, Shuttle support has not yet been transitioned from the 9m to the 11m. Shuttle transition is currently under "study".

2. The prime sites, handover times, and BFS AM config are as follows:

Timeframe	Event	Prime site	BFS AM config
1:00	Handover	MIL to PDL	PDL
2:17	Uplink DSM 12401		
2:30	Handover	PDL to MIL	MIL
7:30	Handover	MIL to TDRS 41/47	TDRS

# 3. 51° Standard SPCs

12101	12101 - TDRS at 7:30M SPC					
MDM	DSM	TITLE	TIMEWORD			
1	4470	TDRS SBD SALVO	000:00:07:30			
2	4470	TDRS SBD SALVO	000:00:07:30			
1	4759	NSP UL HDR	000:00:07:31			
2	4759	NSP UL HDR	000:00:07:31			
1	4764	NSP DL HDR	000:00:07:31			
2	4764	NSP DL HDR	000:00:07:31			
1	4766	XPNDR UL FLTR WD	000:00:07:31			
2	4766	XPNDR UL FLTR WD	000:00:07:31			
1	4739	SPD SPM OFF	000:00:07:31			
2	4739	SPD SPM OFF	000:00:07:31			

12102 - RANGING SPC					
MDM	DSM	TITLE	TIMEWORD		
1	4745	RANGING OFF	000:00:01:00		
2	4745	RANGING OFF	000:00:01:00		
1	4746	RANGING ON	000:00:02:30		
2	4746	RANGING ON	000:00:02:30		
-	-	-	-		
-	-	-	-		
-	-	-	-		
-	-	-	-		
-	-	-	-		
-	-	-	-		

12103			
MDM	DSM	TITLE	TIMEWORD
1	4738	SPD SPM ON	000:00:18:00
2	4738	SPD SPM ON	000:00:18:00

12104 - RTLS					
MDM	DSM	TITLE	TIMEWORD		
1	4735	STDN LO MODE	000:00:14:00		
2	4735	STDN LO MODE	000:00:14:00		

12105	12105 - NHS SPC					
MDM	DSM	TITLE	TIMEWORD			
1	4473	SGLS SALVO	000:00:10:00			
2	4473	SGLS SALVO	000:00:10:00			
1	4745	RANGING OFF	000:00:10:01			
2	4745	RANGING OFF	000:00:10:01			
-	-	-	-			
-	-	-	-			
-	-	-	-			
-	-	-	-			
-	-	-	-			
-	-	-	-			

12106 - TDRS @ NHS LOS SPC					
MDM	DSM	TITLE	TIMEWORD		
1	4470	TDRS SBD SALVO	000:00:11:25		
2	4470	TDRS SBD SALVO	000:00:11:25		
1	4759	NSP UL HDR	000:00:11:26		
2	4759	NSP UL HDR	000:00:11:26		
1	4764	NSP DL HDR	000:00:11:26		
2	4764	NSP DL HDR	000:00:11:26		
1	4766	XPNDR UL FLTR WD	000:00:11:26		
2	4766	XPNDR UL FLTR WD	000:00:11:26		
-	-	-	-		
-	-	-	-		

12107 TCS SPC					
MDM	DSM	TITLE	TIMEWORD		
1	4473	SGLS SALVO)	000:00:18:00		
2	4473	SGLS SALVO)	000:00:18:00		
1	4745	RANGING OFF	000:00:18:01		
2	4745	RANGING OFF	000:00:18:01		
-	-	-	-		
-	-	-	-		
-	-	-	-		
-	-	-	-		
-	-	-	-		
-	-	-	-		

12108 - TDRS @ TCS LOS SPC					
MDM	DSM	TITLE	TIMEWORD		
1	4470	TDRS SBD SALVO	000:00:25:00		
2	4470	TDRS SBD SALVO	000:00:25:00		
1	4759	NSP UL HDR	000:00:25:01		
2	4759	NSP UL HDR	000:00:25:01		
1	4764	NSP DL HDR	000:00:25:01		
2	4764	NSP DL HDR	000:00:25:01		
1	4766	XPNDR UL FLTR WD	000:00:25:01		
2	4766	XPNDR UL FLTR WD	000:00:25:01		
-	-	-	-		
-	-	-	-		

12109 DGS SPC					
MDM	DSM	TITLE	TIMEWORD		
1	4473	SGLS SALVO	000:00:38:30		
2	4473	SGLS SALVO	000:00:38:30		
1	4745	RANGING OFF	000:00:38:31		
2	4745	RANGING OFF	000:00:38:31		
-	-	-	-		
-	-	-	-		
-	-	-	-		
-	-	-	-		
_	_	_			

12110 - TDRS @ DGS LOS SPC					
MDM	DSM	TITLE	TIMEWORD		
1	4470	TDRS SBD SALVO	000:00:48:00		
2	4470	TDRS SBD SALVO	000:00:48:00		
1	4759	NSP UL HDR	000:00:48:01		
2	4759	NSP UL HDR	000:00:48:01		
1	4764	NSP DL HDR	000:00:48:01		
2	4764	NSP DL HDR	000:00:48:01		
1	4766	XPNDR UL FLTR WD	000:00:48:01		
2	4766	XPNDR UL FLTR WD	000:00:48:01		
-	-	-	-		

These SPCs are prestored in the standard rfae\_51 directory and are built with reference to PET 1. PET 1 in the CMD server should be set to the expected lift-off time. Then, these SPCs should be submitted to the CMD server. If the launch slips by more than a few seconds, the PET 1 in the CMD server should be updated and all the SPCs should be resubmitted/overwritten to adjust for the new liftoff time. Always verify the time-word associated with any SPC prior to uplinking it to the vehicle. The SPCs are sent to both P/L MDMs for redundancy., The nominal SPCs (12101, 12102, and 12103) are uplinked at about T - 8M, unless there is an expected hold at T - 5M. 12102 is the SPC to deactivate ranging tones when using PDL and 12103 is to turn on spread spectrum coding for TDRS mode at MET 18:00.

12104 through 12110 are contingency SPCs. 12104 is for an RTLS case (note that uplink coding stays ON. 12105 and 12106 are to handover to NHS (BOSS) and back up to TDRS. 12107 and 12108 are to handover to TCS (LION) and back up to TDRS. 12109 and 12110 are to handover to DGS (REEF) and back to TDRS,

51° contingency SPC procedures are as follows:

#### RTLS

CLEAR nominal (12101/2/3) SPCs and uplink 12104.

5/23/2005:

# TDRS Spare/East down

CLEAR nominal SPC's (12101/2/3) post SRB sep, uplink 12105, 12106, 12107 and 12108. Have COMMAND manage forward link, as required (WLPS, NHS, TCS).

**REV G, PCN-1** 

REMEMBER TO GCMR NETWORK FOR SS OFF ONLY IF CREW USES BFS ITEM ENTRIES FOR TDRS MODE.

# **East Coast Abort Landing (ECAL)**

Monitor GSTDN antenna elevation and if it drops to 5° prior to 7M, consider commanding to TDRS early via MRTC.

# **Spread Spectrum SPC Cleared**

After clearing SPC 12103, build a new SPC based on 12103 template to execute at TDRS-Spare or TDRS-East LOS. This will enable spread-spectrum at a TDRS handover which should minimize loss of S-Band forward link.

#### **TDRS-Z Down**

Uplink 12109 and 12110 prior to TDRS Spare or East LOS.

# 4. 51° standard MRTCs

These commands are used if it is required to command to TDRS real time (BFS or SPC problem). All MRTCs should be sent via **two-stage execute**. The SS ON commands are available if required (GCMR failure, RTLS+MILA failure, RTLS turns into ditch, etc.).

### 4641 - TDRS SS OFF

(SALVO + UL HDR + DL HDR + UL FLTR WD + SS OFF)

Used to command to TDRS with spread spectrum OFF when antenna selection is not required (i.e., BFS AM is selecting correctly).

### 4642 - TDRS URA SS OFF

(SALVO + UL HDR + DL HDR + UL FLTR WD + SS OFF + URA)

Used to command to TDRS with spread spectrum OFF and to select the appropriate post-RTHU antenna (URA) for the nominal and ATO ascent cases (BFS problem).

# 4643 - TDRS URF SS OFF

(SALVO + UL HDR + DL HDR + UL FLTR WD + SS OFF + URF)

Used to command to TDRS with spread spectrum OFF and to select the appropriate post-RTHU antenna (URF) for the TAL ascent case (BFS problem).

### 4640 - TDRS SS ON

(SALVO + UL HDR + DL HDR + UL FLTR WD)

Used to command to TDRS with spread spectrum ON (network GCMR failed) when antenna selection is not required (i.e., BFS AM is selecting correctly).

4644 - TDRS URA SS ON

(SALVO + UL HDR + DL HDR + UL FLTR WD + URA)

5/23/2005:

Used to command to TDRS with spread spectrum ON (network GCMR failed) and to select the appropriate post-RTHU antenna (URA) for the nominal and ATO ascent cases (BFS problem).

**REV G, PCN-1** 

4645 - TDRS URF SS ON

(SALVO + UL HDR + DL HDR + UL FLTR WD + URF)
Used to command to TDRS with spread spectrum ON (network GCMR failed) and to select the appropriate post-RTHU antenna (URF) for the TAL ascent case (BFS problem).

### 51° East Coast Abort Landing

The following abort sites have been identified (ref ASC C/L for flight-specific sites):

- a. Wilmington, North Carolina (ILM)
- b. Cherry Point, North Carolina (NKT)
- c. Oceana, Virginia (NTU)
- d. Wallops, Virginia (WAL)
- e. Atlantic City, New Jersey (ACY)
- f. Gabreski, Long Island New York (FOK)
- g. Otis, Massachusetts (FMH)
- h. Pease, New Hampshire (PSM)
- i. Halifax, Nova Scotia/Canada (YHZ)
- j. Stephenville, Newfoundland/Canada (YJT)
- k. St John's, Newfoundland/Canada (YYT)
- I. Gander, Newfoundland/Canada (YQX)

To maximize communications for these abort landings, TDRS 41 or 47 must eventually be used. Ground station coverage will be reduced since the vehicle will be much lower in altitude. The goal is to select TDRS 41 or 47 as soon as possible once the vehicle is "heads up" but before ground station coverage ends. Based on simulations and knowledge of expected roll profiles for ECAL scenarios, a handover from GSTDN to TDRS of 7:30 MET will work in most cases. This time should be before MILA or Wallops LOS but after roll to "heads up." Therefore, the following procedure should be followed:

- a. Monitor the FD loop for FDO's call, "2 out second stage." This call implies that an ECAL is likely to be attempted. It should be followed with the target site.
- b. Verify that the TDRS Spread Spectrum OFF GCMR has been sent.
- c. Uplink a 41 or 47 TDRS state vector to slot 1. This protects antenna pointing if 171 or 174 unexpectedly comes into view (inaccurate BFS nav).

d. Notify DFE to have MILA report elevation angle above horizon in 1° steps, beginning when the vehicle is 10° high.

**REV G, PCN-1** 

5/23/2005:

- e. If the vehicle is expected to go below the horizon prior to 7:30 MET and Wallops has acquired, handover to Wallops. If Wallops has not acquired, command to TDRS in real time via MRTC.
- f. Monitor Launch Digitals for roll angle and Antenna Management for TDRS look angles and notify FD if TDRS acquisition is uncertain (because of still being "heads down").
- g. FDO is responsible for notifying GSFC FDF of the probable landing site. GSFC will attempt to send an Earth-fixed vector to WSGT to point the TDRS at the landing site.

## D. 51° INCLINATION ENTRY PROCEDURES

The INCO should evaluate the predicted TDRS AZ and EL angles received from POINTING to determine if a lower antenna will be selected during the S-band blackout period.

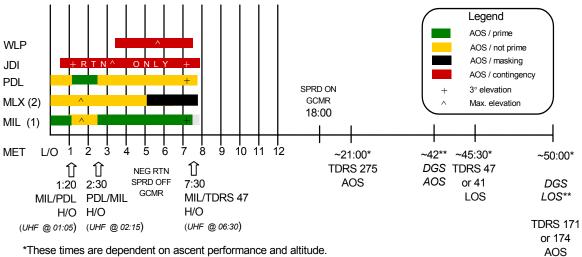
It has been determined that for certain 51° inclination entries into KSC, communications with the orbiter can be significantly increased by handing over from the Western TDRS (171° or 174°)to an Eastern TDRS (41° or 47°) before MIL AOS. Orbiter roll maneuvers that occur during the period normally associated with S-band blackout may allow an increased AOS period if antenna pointing can be maintained through an upper quad.

If it is determined that a handover to TDRS 47° or 41° is beneficial.

- 1. INCO determines the time at which the handover will occur. Generally, this is about 30 seconds prior to the expected time of the appropriate roll cmd.
- 2. INCO notifies the Flight Director and the rest of the controllers (and possibly the crew) of the expected loss of comm times and that a handover from the Western TDRS to the Eastern TDRS will be attempted to increase the comm coverage. The time of the expected handover is also be passed on to the flight control team (and possibly the crew).
- 3. INCO/COMM builds a TDRS 47° or 41° vector for slot 1.
- 4. INCO/COMM Supt notifies COMMAND of the expected handover time.
- 5. INCO uplinks the new TDRS vector to the BFS TWO-STAGE BUFFER via the **manual execute** option several minutes prior to the expected handover time.
- 6. At the planned handover time, the INCO sends the TWO-STAGE BUFFER EXECUTE to force the BFS to select the antenna for the Eastern TDRS. Comm should be restored as soon as the orbiter roll places the Eastern TDRS on an upper antenna.
- 7. The nominal SPC will hand down to the ground site at the appropriate time (site dependent).

## 28° INCLINATION ASCENTS

\* \* \* This timetable applies only to high altitude missions (Hubble/300nm) \* \* \*



<sup>\*</sup>These times are dependent on ascent performance and altitude.

<sup>\*\*</sup>DGS will be available only for high altitude missions at this inclination.

TMBUs			
2:17	12401 – MIL (nominal)		
	12404 – PDL		
	12405 – JDI		

SPCs				
12101	TDRS @ 7:30m			
12102	RANGING			
12103	SPREADING @ 18:00			
12104	RTLS - 14m (up coding ON)			
12105	TDRS at 8m			

		MRTCs
4641	TDRS S	SS OFF
4643	TDRS	URF SS OFF
4640	TDRS S	SS ON
4645	TDRS	URF SS ON

ANTS TO GROUND STATION		
KSC15	URF	
KSC33	ULA	
EDW04	ULA	
EDW22	URA	

Roll to	Nominal, ATO, Late TAL	Early TAL
Heads Up	V-REL = 12.2k	V-REL = 14.0k

Aborts *		OPS 1	OPS 6	
3 eng out	TAL else	- TAL - ditch	All	- ditch
2 eng out	1st stg 2nd stg droop	- ditch - BDA / ditch - TAL / ELS / ditch	Red / RTLS else	- RTLS - ditch
Stuck (1 eng out + 1 eng stuck min)	1st stg RTLS droop TAL	- ditch - RTLS - TAL / ELS / ditch - TAL		

\*From STS-109 ASC C/L.

BFS SPEC 51 OVERRIDE				
ITEM 46 TDRS (OPS 1/6 SS OFF)				
ITEM 47	STDN HI (OPS 1/6 UL coding ON)			
ITEM 48	STDN LO (OPS 1/6 UL coding ON)			
ITEM 49	SGLS			

	LCC				
CT-02	XPNDR AGC	T-9	2 of 2 rqd (NSP FRM & voice test)		
CT-03	GCIL ACTIVE	T-31	1 of 2 pwr/decoders rqd (cmd test)		
CT-04	NSP FRM SYNC	T-31	2 of 2 rqd (if COMSEC, byp & blk)		
CT-05	VOICE	T-5	1 of 2 A/G + UHF rqd (voice test)		
CT-09	PA RF OUT	T-9	2 of 2 rqd (use ground station)		
INS-01	OI PCMMU	T-31	2 of 2 rqd (BSR evaluation)		
INS-02a	SSR ANOMALY	T-5	1 of 2 rqd (critical BITE)		
INS-04	OI DSC BITE	T-9	data rqd (parameter evals)		
INS-05	OLMDM WRAP	T-31	data rod (PCM swap, pwr.cvcle)		

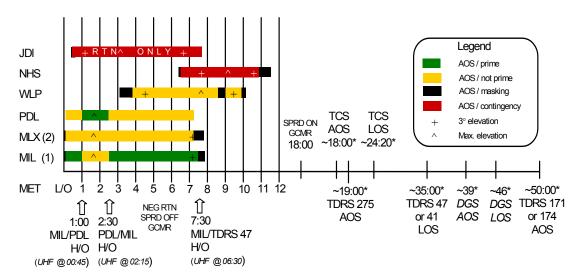
These times should be compared to ACQMON periodically post-MECO.

## 28° INCLINATION ASCENTS

Site	Rwy	TDRS W 171/174 (F-7) antenna	TDRS E 47/41 (F-4) antenna
Amilcar, Cabral	2	No view	URA
	20	No view	URF
Banjul, Gambia	14	No view	URA
	32	No view	ULF
Ben Guerir, Morocco	18	No view	URF
	36	No view	ULA
Bermuda	12	No view	ULF
	30	No view	ULA
Edwards, Cailifornia	4	URA	URF
	22	URF	ULA
	17	URA	ULF
	35	ULF	ULA
_	5	URA	URF
	23	URF	ULA
	15	URA	ULF
	33	ULF	ULA
	18	URF	ULF
	36	ULA	ULA
KSC, Florida	15	No view	ULF
	33	No view	ULA
Las Palmas, Spain	3	No view	URA
	21	No view	URF
Le Tube (Istres), France	15	No view	URF
	33	No view	ULA
Moron, Spain	2	No view	URA
	20	No view	URF
Northrup, New Mexico	5	URA	URF
	23	URF	ULA
	17	URA	ULF
	35	ULF	ULA
Rota, Spain	28	No view	ULF
	10	No view	URA
Zaragosa, Spain	12	No view	URA
	30	No view	ULF

## 51° INCLINATION ASCENTS

5/23/2005: REV G, PCN-1



 $^{\star}$ These times are dependent on ascent performance and altitude.

These times should be compared to ACQMON periodically post-MECO.

Ì	TMBUs		
	2:17	12401 – MIL (nominal)	
		12402 - WLP	
		12403 - NHS	
		12404 - PDL	
		12405 - JDI	

	SPCs
12101	TDRS @ 7:30m
12102 F	RANGING SPC
12103	SPREADING SPC
12104 F	RTLS - 14m (up coding ON)
12105 N	NHS SPC
12106	TDRS • NHS LOS
12107	TCS SPC
12108	TDRS @ TCS LOS
12109	OGS SPC
12110 7	TDRS @ DGS LOS
	DIG @ DG0 200
12110	15 NO @ 500 200
12110	MRTCs
4641 TD	MRTCs
4641 TD 4642 TD	MRTCs DRS ss off
4641 TE 4642 TE 4643 TE	MRTCs DRS ss off DRS URA ss off (not TAL)
4641 TC 4642 TC 4643 TC 4640 TC 4644 TC	MRTCs  ORS ss off ORS URA ss off (not TAL) ORS URF ss off (TAL) ORS ss on ORS URA ss on (not TAL)
4641 TC 4642 TC 4643 TC 4640 TC 4644 TC	MRTCs  ORS ss off  ORS URA ss off (not TAL)  ORS URF ss off (TAL)  ORS ss on
4641 TC 4642 TC 4643 TC 4640 TC 4644 TC 4645 TC	MRTCs  ORS ss off ORS URA ss off (not TAL) ORS URF ss off (TAL) ORS ss on ORS URA ss on (not TAL)

ULA

ULA URA

KSC 33

EDW 04

**EDW 22** 

Roll to	Nominal, ATO, Late TAL	Early TAL
Heads Up	V-REL = 12.2k	V-REL = 14.0k

Aborts*	OPS 1		OP:	S 6
3 eng out	TAL	- TAL	All	- ditch
	else	- ECAL / ditch		
2 eng out	1st stg	- ditch	Red / RTLS	- RTLS
	2nd stg	- ECAL / ditch	else	- ditch
	droop	- TAL / ELS / ditch		
Stuck	1st stg	- ditch		
(1 eng out +	RTLS	- RTLS		
1 eng stuck	droop	- TAL / ELS / ditch		
min)	TAL	- TAL		

\*From STS-108 ASC C/L.

BFS SPEC 51 OVERRIDE		
ITEM 46	TDRS (OPS 1/6 SS OFF)	
ITEM 47	STDN HI (OPS 1/6 UL coding ON)	
ITEM 48	STDN LO (OPS 1/6 UL coding ON)	
ITEM 49	SGLS	

	LCC				
CT-02	XPNDR AGC	T-9	2 of 2 rqd (NSP FRM & voice test)		
CT-03	GCIL ACTIVE	T-31	1 of 2 pwr/decoders rqd (cmd test)		
CT-04	NSP FRM SYNC	T-31	2 of 2 rqd (if COMSEC, byp & blk)		
CT-05	VOICE	T-5	1 of 2 A/G + UHF rqd (voice test)		
CT-09	PA RF OUT	T-9	2 of 2 rqd (use ground station)		
INS-01	OI PCMMU	T-31	2 of 2 rqd (BSR evaluation)		
INS-02a	SSR ANOMALY	T-5	1 of 2 rqd (critical BITE)		
INS-04	OI DSC BITE	T-9	data rqd (parameter evals)		
INS-05	OI MDM WRAP	T-31	data rgd (PCM swap, pwr cycle)		

5/23/2005: REV G, PCN-1

51° INCLINATION ASCENTS
-------------------------

		TDRS W	TDRS E
Site	Rwy	W171/174	W47/41
Onto	IXWy	antenna	antenna
Amilcar, Cabral	2	No view	URA
	20	No view	URF
Ben Guerir, Morocco	18	No view	URF
	36	No view	ULA
Cherry Point, North	32	No view	ULA
Carolina	23	No view	ULA
Edwards, Cailifornia	4	URA	URF
	22	URF	ULA
	17	URA	ULF
	35	ULF	ULA
	5	URA	URF
	23	URF	ULA
	15	URA	ULF
	33	ULF	ULA
	18	URF	ULF
	36	ULA	ULA
KSC, Florida	15	No view	ULF
	33	No view	ULA
Las Palmas, Spain	3	No view	URA
	21	No view	URF
Le Tube (Istres), France	15	No view	URF
	33	No view	ULA
Moron, Spain	2	No view	URA
	20	No view	URF
Northrup, New Mexico	5	URA	URF
	23	URF	ULA
	17	URA	ULF
	35	ULF	ULA
Oceana, Virginia	5	No view	URF
	23	No view	ULA
Otis, Massachusetts	14	No view	ULF
	32	No view	ULA
Pease, New Hampshire	16	No view	ULF
	34	No view	ULA
Rota, Spain	28	No view	ULF
	10	No view	URA
Zaragosa, Spain	12	No view	URA
	30	No view	ULF

# ASCENT MALFUNCTION PROCEDURES (before TDRS handover, unless specified)

5/23/2005: REV G, PCN-1

RED = INCO systems notes GREEN = uplink actions BLUE = crew actions

		BLUE = crew actions
s	SHARP CUTOFF	PA   XPNDR(acq)   PNL,CMD   Best Ant
	STATIC FRAME	if no CMD STR 1 ⇒ PCMMU   NSP else ⇒ NSP   PCMMU
B A	CARRIER NO MOD	if no CMD STR 1 ⇒ XPNDR   NSP   PNL,CMD else ⇒ NSP   XPNDR(acg)   PNL,CMD
N	NO NSP BIT/FRAME (No CMD or S-voice)	PNL,CMD before SPC timeout (UHF only) else ⇔ crew PNL,CMD: BFS SPEC 51, ITEM 46
D	COMSEC 2 RCV FAIL (No CMD or S-voice)	if no CMD STR 1 ⇒ try Encryption Select - Bypass (PNL A1L) else ⇒ PNL,CMD before SPC timeout (UHF only) else ⇒ crew PNL,CMD: BFS SPEC 51, ITEM 46
	FF1 DOWN (No CMD on NSP 1)	No action (remember no CMD if PNL,CMD)
	FF3 DOWN (No CMD on NSP 2)	if CMD Required ⇔ PNL,CMD
	GPC 3 DOWN (No CMD on NSP 2)	if CMD Required   PNL,CMD else   wait for restring post MECO
D	BFS DROPS TRK ON STRING 3 (SPC OK, No BFS CMD)	if BFS CMD Required ⇒ PNL,CMD Sites to expect nonoptimal antennas (cannot send AM loads)
	BFS STANDALONE (trk no strings) (SPC OK, No BFS CMD)	Monitor ant selects & S/S Crew sel best ant (BFS NAV bad / SPC OK)
Р	BFS DOWN (fail/fail to halt) (No SPC, No BFS CMD)	CMD antennas via GNC CMD TDRS+ANT via MRTC if rqd, Crew select best antenna on TDRS
	BFS TRANSIENT HALT (SPC LOST)	TDRE NOM=URF/URA   TAL=URF Reuplink SPC or command manually (note BFS IN OPS 0 steps)
s	BFS IN OPS 0 (SPC OK, No AM)	Command antennas via BFS TDRE NOM=URF/URA   TAL=URF
	NO GNC DOWNLIST	DPS Change downlisters   Alt PCMMU (fxd fmt)
	NO BFS DOWNLIST	If FLT wants it ⇒ Alt PCMMU (fxd fmt)
	PF1 DOWN (ANT 1, SSR1)	Sel MDM 2 on CMD Panel if MADS tape critical ⇒ MSTR MADS - OFF (PNL C3)
	PF2 DOWN (ANT 2, SSR 2)	✓ MDM 1 on CMD Panel Sel ANT ELEC #1
	NO A/G 1 D/L (mult crew)	if STDN, no action
Α		if TDRS and NSP BITE ⇒ Alt NSP if TDRS and no NSP BITE ⇒ Alt ACCU   Alt NSP
U	NO UHF D/L CARRIER (mult crew)	Alt Freq (✓site)   PA Off (✓ squelch off @ site)   Guard (✓ site)
	NO UHF D/L MOD (carrier no mod) (mult crew)	Alt ACCU   Alt Freq (✓site)
D	NO UHF U/L S/S	UHF only call
1	NO UHF U/L (good S/S)	Alt ACCU   Alt Freq ( / site)
o	STUCK MIKE  PTT LOST (RHC and HIU)	Crewman cycle PTT several times ATU BU   if nojoy (stuck button)  ⇒ ATU Norm + RCV ONLY or MIC Off if BU OK & UHF carrier still ON (stuck ATU)  ⇒ RCV on A/A BU on ATU   NORM on ATU + VOX/VOX
N N	MDM OF3 DOWN	Crew select antennas manually for TDRS TDRE NOM=URF/URA   TAL=URF
s	NO FM D/L (carrier no mod or sharp cutoff)	Alt FM System   ✓Hemi sel
т	NO MTU IRIG B (No COMSEC T/A)	if CMD rqd ⇒ Encryption Select - Bypass (PNL A1L)

# **ENTRY MALFUNCTION PROCEDURES** (after STDN handover, unless specified)

5/23/2005: REV G, PCN-1

RED = INCO systems notes GREEN = uplink actions BLUE = crew actions

		BLUE = crew actions
s	SHARP CUTOFF	if TDRS ⇒ PA   XPNDR(acq)   PNL,CMD if STDN ⇒ STDN LO   XPNDR(acq)   PNL,CMD   Best Ant
	STATIC FRAME	if no CMD STR 1 ⇔ PCMMU   NSP else ⇔ NSP   PCMMU
B A	CARRIER NO MOD	if no CMD STR 1 ⇒ XPNDR   NSP   PNL,CMD else ⇒ NSP   XPNDR(acq)   PNL,CMD
N	NO NSP BIT/FRAME	if TDRS ⇔ crew may PNL,CMD: BFS SPEC 51, ITEM 46
D	(No CMD or S-voice)	if STDN   PNL,CMD if CMD or S-voice rqd (UHF only)
	COMSEC 2 RCV FAIL (No CMD or S-voice)	if no CMD STR 1 ⇒ try Encryption Select - Bypass (PNL A1L) else if TDRS ⇔ crew may PNL,CMD: BFS SPEC 51, ITEM 46 else if STDN ⇒ PNL,CMD if CMD rqd (UHF only)
	FF1 DOWN (No CMD on NSP 1)	No action (remember no CMD if PNL,CMD)
	FF3 DOWN (No CMD on NSP 2)	if CMD Required ⇔ PNL,CMD
	GPC 3 DOWN (No CMD on NSP 2)	if CMD Required ⇔ PNL,CMD
	BFS DROPS TRK ON STRING 3 (SPC OK, No BFS CMD)	if BFS CMD Required ⇒ PNL,CMD
D	BFS STANDALONE (trk no strings) (SPC OK, No BFS CMD)	Monitor ant selects & S/S Crew sel best ant if rqd (BFS NAV bad / SPC OK)
Р	BFS DOWN (fail/fail to halt) (No SPC, No BFS CMD)	CMD antennas via GNC CMD to STDN via SALVO
	BFS TRANSIENT HALT (SPC LOST)	if TDRS ⇒ Reuplink SPC or command manually (note BFS IN OPS 0 steps)
s	BFS IN OPS 0 (SPC OK, No AM)	Command antennas via BFS
	NO GNC DOWNLIST	DPS Change downlisters   Alt PCMMU (fxd fmt)
	NO BFS DOWNLIST	If FLT wants it ⇒ Alt PCMMU (fxd fmt)
	PF1 DOWN (ANT 1, SSR1)	Sel MDM 2 on CMD Panel if rqd ⇔ crew perform postlanding MADS CAL
	PF2 DOWN (ANT 2, SSR2)	✓ MDM 1 on CMD Panel Sel ANT ELEC #1
А	NO A/G 1 D/L (mult crew)	if TDRS and NSP BITE ⇔ Alt NSP if TDRS and no NSP BITE ⇔ Alt ACCU   Alt NSP if STDN, no action
U	NO UHF D/L CARRIER (mult crew)	Alt Freq (✓ site)   PA Off (✓ squelch off @ site)   Guard (✓ site)
ľ	NO UHF D/L MOD (carrier no mod) (mult crew)	Alt ACCU   Alt Freq (✓site)
D	NO UHF U/L S/S	UHF only call
1	NO UHF U/L (good S/S)	Alt ACCU   Alt Freq ( site)
o	STUCK MIKE	Crewman cycle PTT several times ATU BU   if nojoy (stuck button) ⇒ ATU Norm + RCV ONLY or MIC Off if BU OK & UHF carrier still ON (stuck ATU) ⇒ RCV on A/A
	PTT LOST (RHC and HIU)	BU on ATU   NORM on ATU + VOX/VOX
I N	MDM OF3 DOWN	if TDRS    Crew select antennas manually for STDN or BFS ANT PTG INH
		and CMD antennas via BFS
s	NO FM D/L (no carrier/sharp cutoff)	Alt FM System   ✓Hemi sel
Т	NO MTU IRIG B (No COMSEC T/A)	if CMD rqd   Encryption Select - Bypass (PNL A1L)

#### **TITLE**

ON-ORBIT TDRSS/GROUND OPERATION PROCEDURES

## **CAUTION**

9/1/2004: REV G

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

#### **PURPOSE**

To describe the general procedures necessary for controlling TDRS operations.

## COMMAND RESTRICTIONS/CONSTRAINTS

These commands are valid in BFS Ops 1, 3 and 6 as well as SM Ops 2 and 4. There are no time constraints or crew coordination requirements.

#### **GENERAL**

The Tracking and Data Relay Satellite (TDRS) Space Network (SN) is controlled out of the White Sands Complext (WSC) at two primary terminals. The first terminal is called White Sands Ground Terminal (WSGT) and the second one is called Second TDRS Ground Terminal (STGT). Between these two locations all 6 TDRS are managed. WSGT controls the TDRS Z satellite through lines out to a remote terminal on the island of Guam called Guam Remote Terminal (GRTS). There are several interfaces that must be established to be able to use the TDRS SN. COMMAND personnel, in the operations support team (OST) Ground Operations Support Room (GOSR), are the single point of contact for these interfaces. They establish the schedule of operations (SHO) times for each TDRS support needed for a flight. They make real-time change requests to the TDRS and the ground equipment at the 3 satellite terminals. The following paragraphs generally discuss each of these interfaces. More detailed descriptions are available in the INCO Systems Breif (JSC–18611) sections for Ground Command System Description (SB 2) andTracking and Data Relay Satellite System (SB 48).

Scheduling TDRS resources is supported through the Network Control Center (NCC) at the WSC. COMMAND will submit a pre-mission SHO request for the whole flight two weeks before the expected launch day. NCC will process the request then return to COMMAND any rejected events. COMMAND and NCC negotiate the conflicts, and a final SHO is developed for the flight. Once the mission is started, COMMAND will "tweak" the SHO events so that the handover times are more accurate.

There are three types of handovers between the TDRS. An early handover is considered to be at the time the orbiter first comes into view of an eastern TDRS (41 or 47). A normal handover is considered to be at the time the orbiter passes the point it is in view of the current western TDRS (171 or 174). A mid pass handover is considered to be at some time when two TDRS are in view of the orbiter at the same time. Handovers between two TDRS can be as quick as 16 seconds but for simplicity COMMAND schedules a 20 second handover. This means that for 30 to 45 seconds the MCC will not be processing any data from the orbiter during the handovers.

Generally both the S-band and Ku-band services are scheduled to start and stop at the same time. These services include the forward and return links through a single access (SA) antenna on the TDRS. Both S-band and Ku-band can share an SA on a TDRS. The orbiter will acquire the TDRS forward links (both S-band and Ku-band) with modulation on, if the forward link is scheduled to be high data rate (normal configuration). If the orbiter is configured for low data rate on the forward link, the TDRS event will be scheduled with modulation off to allow for a better forward link acquisition. TDRS will acquire the S-band and Ku-band from the orbiter quicker than the orbiter will acquire the forward link from TDRS. The ground and TDRS equipment are reconfigured with Ground Control Message Requests (GCMR),

9/1/2004: REV G

which are shipped from the COMMAND console thru Goddard Space Flight Centers (GSCF), Network Control Center (NCC). At GSFC the GCMR is converted to a GCM which is sent to the terminal for the TDRS that requires the change at either WSGT or STGT.

## **SCHEDULING PROCEDURES**

#### **PRELAUNCH**

At approximately L - 21 days, COMMAND prepares the SHO's for the upcoming flight on the user planning system (UPS) terminal using the latest predicted mission AOS/LOS times. These AOS/LOS times are provided by the satellite acquisition (SATACQ) data generated by the TRACK console personnel. Predefined S-band forward (SFWD), S-band return (SRTN), Ku-band forward KFWD, Ku-band return (KRTN), and S-band track configuration codes are included with these SATACQ times. The individual SHO's, from prelaunch through mission elapsed time (MET) of 4 days, are transmitted to the NCC SN scheduling department. These schedules/configurations are considered approved (after resolving conflicts if necessary) and merged into the NCC database with other SN users. Configuration codes define the expected initial configuration for that link, and standard defaults (for KRTN 1.024 MBPS and TV is typical) are usually used. Necessary changes are made in real time via GCMR once a scheduled event has started.

The NCC develops a TDRS network (TN) schedule from all user requests and transmits a forecast mission schedule back to MCC (supposedly conflict free) at launch minus 7 days. COMMAND and NCC scheduling, with the help of the Flight Activities Officer (FAO) and GC, resolve any conflicts.

At approximately 1 to 2 days before flight, NCC transmits SHO's containing all fixed and reconfigurable parameters for each pass (SHO event) to the appropriate terminal (WSGT, STGT or GRTS), where they are stored in the automatic data processing equipment (ADPE), once again assuming no conflicts.

### **DURING THE MISSION**

During real-time console operations, INCO, FAO and COMMAND coordinate any schedule changes (e.g., normal to early handovers) for upcoming acquisitions. When input to the Universal Planning System (UPS), these changes are passed to NCC and then to the appropriate WSC terminal. This process continues until AOS minus 45 minutes. After this time and until the Western TDRS AOS minus 20 minutes, INCO must request that a priority request flag be set in the UPS, which results in a priority SHO being transmitted to the appropriate terminal. S-band and Ku-band SHO's can still be staggered if necessary, although this is undesirable from an NCC scheduling standpoint. Configuration changes are handled by GCMR after SHO start. A late change to handover times can cause a loss of the SHO because the old SHO must be deleted and a new one inserted. Another user could request the time on the TDRS while this process is taking place.

## **ACQUISITION PROCEDURES**

- COMMAND will ensure that S-band and Ku-band modulation is on and that S-band and Ku-band Doppler compensation is enabled at AOS (or handover time) and that the FEP output bit rate is correct.
- If a false lock is suspected, request COMMAND to cycle modulation off/on or to send a reacquisition GCMR for the affected link (e.g., SSA FWD).
- If S-band Doppler tracking has been scheduled (almost always the case), there is no longer any need to remove S-band Doppler compensation; Doppler can be enabled continuously. If the Kuband is being used for downlink telemetry, there is no longer a need to GCMR for S-band return link mode 3 (carrier only). S-band return link modulation can always remain. Ku-Band channel 1 normally processes data with convolutional coding enabled. In the event of a coding failure,

however, the capability remains to process telemetry with coding off as well. This would be done by verbal request to WSC who will manually configure the TDRS ground equipment to coding off.

- In the event of a dropout, the return link should automatically reacquire. If it does not, request that a return link reacquisition GCMR be sent.
- S-band frequency changes done by GCMR (versus SHO) require a return link reacquisition GCMR.

9/1/2004: REV G

## OTHER GCMR ACTIVITY ASSOCIATED WITH ACQUISITION/REACQUISITION

#### A. DOPPLER COMPENSATION

Carrier Doppler compensation will nominally be scheduled continuously for Ku-band and S-band. S-band spread spectrum Doppler compensation is also always scheduled.

International radiation limitation agreements require the normal use of spread spectrum for both S-band and Ku-band. A waiver must be requested from the Consultative Committee for International Radio (CCIR) to radiate with spread spectrum off. This waiver has been granted to allow quicker S-band forward link acquisitions during powered flight.

#### B. OTHER GCMR's

Other GCMR's that exist but which are rarely, if ever, used are the Forward Link Sweep Request, Expanded Frequency Uncertainty Request (for a noncoherent return link) and Forward Link EIRP Reconfiguration. These allow changes to the SHO frequencies in the event of unexpected shifts or change in the forward link power levels between normal and high. Shuttle S-band support is always high power and Ku-band is always normal power.

## **RECONFIGURATION PROCEDURES**

## A. GENERAL

The following is a list of ground control interface logic (GCIL) commands and multiple real-time commands (MRTC's) commonly used for orbiter S-band and Ku-band system configuration control.

Note: Refer to section 11 of the INCO System Briefs for additional GCIL command data.

1. DSM 4470 TDRS MODE (SALVO) – Commonly used to hand back to TDRS after using a ground site as prime

XPNDR mode - TDRS

U/L - LDR 

D/L - LDR 

U/L coding - ON

D/L coding - ON

Data source - S-band

Ranging - DISABLE

Spread spectrum - ON

XPNDR - T/R

Return link data - ENABLE

XPNDR direct - OFF

XPNDR filter - NARROW 

\*\*\*

 9/1/2004: REV G

DNLNK HDR, and DSM 4766 XNDR U/L FLTR - WIDE. For realtime commanding, this has been simplified with the use of DSM 4640 as explained below.

a. DSM 4640 TDRS SBD HDR MRTC supplies the TDRS mode salvo (4470) followed by the three required DSMs to correctly configure to HDR and filter wide.

TDRS SBD HDR MRTC (DSM 4640)

TDRS mode - (SALVO) (DSM 4470) NSP UPLINK - HDR (DSM 4759) DNLINK - HDR (DSM 4764) XPNDR U/L FLTR - WIDE (DSM 4766)

MRTCs should be sent two-stage to ensure all contained commands get onboard.

b. DSM 4641 TDRS SS OFF MRTC also supplies the TDRS mode salvo (4470) and the three required commands to configure HDR and filter wide, but also contains the Spread Spectrum OFF command (DSM 4739). This MRTC can be essential for a realtime handup to TDRS prior to the ascent Spreading ON MSPC at MET 18:00.

TDRS SS OFF MRTC (DSM 4641)

TDRS mode - (SALVO) (DSM 4470) NSP UPLINK HDR (DSM 4759) DNLINK - HDR (DSM 4764) XPNDR U/L FLTR - WIDE (DSM 4766) SPD SPM - OFF (DSM 4739)

MRTCs should be sent two-stage to ensure all contained commands get onboard.

c. DSM 4642 TDRS URA SS OFF MRTC performs the same command as DSM 4641 above, but in addition to TDRS mode salvo, HDR, filter wide, and spreading off, it supplies the antenna selection to Upper Right Aft. This is commanded to both Antenna Electronics 1 and Antenna Electronics 2. This MRTC can be used to hand up realtime to TDRS with spreading off when Antenna Management is not selecting antennas (BFS failure, GNC has the payloads). TDRS 47 will usually be the target to the URA antennas on TAL Abort.

TDRS URA SS OFF MRTC (4642)

TDRS mode - (SALVO) (DSM 4470) NSP UPLINK HDR (DSM 4759) DNKINL - HDR (DSM 4764) XPNDR U/L FLTR - WIDE (DSM 4766) SPD SPM - OFF (DSM 4739) SBD QUAD SEL 1 - UR/AFT (DSM 4679) SDB QUAD SEL 2 - UR/AFT (DSM 4695)

MRTCs should be sent two-stage to ensure all contained commands get onboard.

d. DSM 4643 TDRS URF SS OFF MRTC performs the same commands as DSM 4641 above, but in addition to TDRS mode salvo, HDR, filter wide, and spreading off, it supplies the antenna selection to Upper Right Forward. This is commanded to both Antenna Electronics 1 and Antenna Electronics 2. This MRTC can be used to hand up realtime to TDRS with spreading off when antenna management is not selecting antennas (BFS failure, GNC has the payloads). TDRS 47 will usually be the target for the URF antenna on nominal ascents as well as East Coast Aborts.

TDRS URF SS OFF MRTC (DSM 4643)

TDRS mode - (SALVO) (DSM 4470)
NSP UPLINK HDR (DSM 4759)
DNLINK - HDR (DSM 4764)
XPNDR U/L FLTR - WIDE (DSM 4766)
SPD SPM - OFF (DSM 4739)
SBD QUAD SEL 1 - UR/FWD (DSM 4678)
SDB QUAD SEL 2 - UR/FWD (DSM 4694)

9/1/2004: REV G

MRTCs should be sent two-stage to ensure all contained commands get onboard.

e. DSM 4644 TDRS URA SS ON MRTC is similar to DSM 4642 except that it contains no command to turn off Spread Spectrum. This MRTC can be used to hand up to TDRS realtime after the ascent MSPC has spreading enabled (MET 18:00) and antenna management is not selecting antennas. The TDRS target would most likely be in the URA quadrant during a TAL Abort.

TDRS URA SS ON MRTC (DSM 4644)

TDRS mode - (SALVO) (DSM 4470) NSP UPLINK HDR (DSM 4759) DNLINK - HDR (DSM 4764) XPNDR U/L FLTR - WIDE (DSM 4766) SDB QUAD SEL 1 - UR/AFT (DSM 4679) SDB QUAD SEL 2 - UR/AFT (DSM 4695)

MRTCs should be sent two-stage to ensure all contained commands get onboard.

f. DSM 4645 TDRS URF SS ON MRTC is similar to DSM 4643, except that it contains no commands to turn off Spread Spectrum. This MRTC can be used to hand up to TDRS realtime after the ascent MSPC has spreading enabled (MET 18:00) and antenna management is not selecting antennas. The TDRS target would most likely be in the URF quadrant during a nominal ascent or East Coast Abort.

TDRS URF SS ON MRTC (DSM 4645)

TDRS mode - (SALVO) (DSM 4470) NSP UPLINK HDR (DSM 4759) DNLINK - HDR (DSM 4764) XPNDR U/L FLTR - WIDE (DSM 4766) SDB QUAD SEL 1 - UR/FWD (DSM 4678) SDB QUAD SEL 2 - UR/FWD (DSM 4694)

MRTCs should be sent two-stage to ensure all contained commands get onboard.

2. DSM 4472 STDN HI MODE (SALVO) – Commonly used to hand the forward and return links from TDRS to a NASA ground site

XPNDR mode - STDN HI U/L - HDR D/L - HDR U/L coding - OFF D/L coding - OFF Data source - S-band Ranging - ENABLE XPNDR - T/R 9/1/2004: REV G

Return link data - ENABLE XPNDR direct - OFF XPNDR filter - WIDE

3. DSM 4471 STDN LOW MODE (SALVO) – Commonly used during entry to hand from TDRS to the landing site (MILA or DFRS)

XPNDR mode - STDN LOW

U/L - HDR

D/L - HDR

U/L coding - OFF

D/L coding - OFF

Data source - S-band

Ranging - ENABLE

XPNDR - T/R

Return link data - ENABLE

XPNDR direct - ON

XPNDR filter - WIDE

4. DSM 4473 SGLS MODE (SALVO) – Commonly used to hand the forward and return links from TDRS to an Air Force remote tracking station (RTS) ground site.

XPNDR mode - SGLS

U/L - HDR

D/L - HDR

U/L coding - OFF

D/L coding - OFF

Data source - S-band

Ranging - ENABLE

XPNDR - T/R

Return link data - ENABLE

XPNDR direct - ON

XPNDR filter - WIDE

5. Ku failover to S-band

Note: The following "fail-safe" function is not used since the automatic Ku handover capability started in OI-27 but is still available in the GCIL. This information will serve as reference in the event antenna management software is unavailable.

a. The following conditions must be met to "ARM" the failover function:

## **CAUTION**

The Ku/S failover function will offer no protection unless the conditions listed below are satisfied.

- □ S-band PM mode control (pnl C3) CMD
- ☐ Ku Signal Processor must be powered (COMM PWR ON)
- ☐ Ku fail-safe ENABLE with DSM 4140 (GCIL default is to disable)
- NSP data source Ku
- b. Once "ARMED," the failover will occur if/when the Ku-band data good bit = failed (V74X2613J = 0, "DATA GD" on the COMM MANAGEMENT display = blank). The following configuration will result.

## SHUTTLE OPS INCO/COMM/JSC-12829

U/L - LDR U/L coding - ON Data source - S-Band XPNDR mode - TDRS XPNDR filter - NARROW

Note: A/G2 will not be available until the NSP reconfigured to HDR U/L and D/L.

- c. Ku data good bit will equal zero approximately 13 seconds after the Ku data present bit drops to zero. The Ku data present bit is driven by the logic shown in "d" below. The 13-second delay is a function of the Ku system, not the GCIL. Note that if the Ku data good bit is low when all the conditions in "a" above are met, the failover will occur IMMEDIATELY.
- d. The Ku-band data present bit equals TRUE (1) when all of the following are satisfied .

IF Ku system is in the comm mode,

9/1/2004: REV G

and FWD link modulation = 1 (data DETECTED on carrier),

and FWD link carrier = 1 (LOCK, costas lock), and (if spread spectrum ON) PN = 1 (LOCK)

THEN data present = 1 ELSE data present = 0

## B. PROCEDURES

1.

То со	nfigure from TDRS S-band to STDN S-band or SGLS S-band to TDRS S-band
	INCO/COMM SUPPORT advises COMMAND at the earliest practical time of intent to hand down. Verify site and times.
	COMMAND performs command echo interface checks.
	COMM SUPPORT verifies correct SM site INH/ENBL status on INCO Management display or equivalent.
	INST advises DFE at least 1 minute in advance to allow time for reconfiguration of the FEP. Early notification will speed the routing of site data.
	INCO/COMM SUPPORT selects the technique of configuration change, MRTC or MSPC. The MRTC should be used only if time does not allow the preparation of an MSPC.
	COMM SUPPORT prepares an MSPC to configure at site AOS time utilizing DSM 4472 (for STDN HI), 4473 (for SGLS) or 4471 (for STDN LO) and return to TDRS at site LOS with DSM 4470 TDRS S-BAND MODE SALVO, <i>followed by</i> DSM's 4759 NSP UPLINK HDR, 4764 DNLINK - HDR, and 4766 XPNDR FLTR - WIDE. The MSPC should be built with at least 1 second separating each command. Pre-built MSPC templates exists in RF CMD BUILD application in the BUILD_LOADS/MSPC file which furnishes the required DSMs in order. They are titled "STDN HI/TDRS MSPC", "SGLS/TDRS MSPC", etc.
	- OR -
	INCO/COMM SUPPORT issues RTC DSM 4472, 4473 or 4471 at site AOS and MRTC DSM 4640 "TDRS SBD HDR MRTC" before site LOS. Two-stage auto

execution of the MRTC is required.

TDRS SBD HDR MRTC (DSM 4640)

TDRS mode - (SALVO) (DSM 4470) NSP UPKINK HDR (DSM 4759) DNLINK - HDR (DSM 4764) XPNDR U/L FLRT - WIDE (DSM 4766)

9/1/2004: REV G

- COMMAND and DFE configure as requested by COMM SUPPORT and INST.
- 2. To configure to alternate S-band XPNDR frequency
  - □ COMM SUPPORT should build a stored program command (SPC) to reconfigure the transponder to high (low) frequency. The best time for execution is during a zone of exclusion (ZOE). See SCP 3.15 MSPC/MRTC Build procedure for information on how to build the SPC.
  - Inform COMMAND that an SPC to command to high (low) frequency has been uplinked.

## **CAUTION**

COMMAND will build a GCMR (see SCP 3.1) to reconfigure the TDRS network to high (low) frequency. INCO should wait until COMMAND confirms that the GCMR is built and ready to be shipped out before continuing. The orbiter must be commanded to high (low) frequency before the GCMR is shipped or the forward link will be lost.

□ Verify that DSM 4741 High Freq (4740 Low Freq) is not safed and have COMMAND safe DSM 4740 Low Freq (4741 High Freq).

## **CAUTION**

The PI transmitter may interfere with the orbiter S-band PM transponder (XPNDR) receiver when the following channels/ frequency settings are selected. Interference can be severe enough to capture the XPNDR receiver lock.

<u>IF PI CHANNELS</u>
000-420, 900-909
421-882, 910-919
AVOID XPNDR PM FREQ
LOW
HIGH

- ☐ INCO/COMM SUPPORT uplinks the SPC to reconfigure to high (low) frequency
- Inform COMMAND to send the GCMR and drop the forward link modulation coincident with the SPC time-out.
- □ COMMAND announces when the GCMR has been shipped and accepted.
- □ COMMAND reapplies forward link modulation when the transponder is locked.
- ☐ Inform COMMAND to send the GCMR to reacquire the return link, if required.
- 3. To configure from S-band to Ku-band (forward and return links)

Note: The following procedure is not normally used with the automatic Ku handover feature.

4.

5.

6.

Notify COMMAND and DFE of time of configuration change. Verify that DSM 4767 DATA SOURCE - KU is unsafed. Ensure that Ku FAIL/SAFE has been enabled. If not, send DSM 4140 KU/S FAIL SAFE - ENA. Verify Ku-band DATA GD = GOOD (MSK 921) and Ku in GPC mode. Uplink an MSPC (containing DSM's 4767 DATA SOURCE Ku, and 4771 U/L CODING OFF). - OR -Build and send MRTC DSM 1500 MRTC K-band forward (DSM 4767 DATA SOURCE - KU and 4771 U/L CODING OFF), two-stage, auto execute. To configure from TDRS Ku-band to S-band (forward and return links ) Note: The following procedure is not normally used with the automatic Ku handover feature Notify COMMAND and DFE of time of intended configuration change. Uplink an MSPC (containing DSM 4470 TDRS S-BAND MODE SALVO, followed by DSM's 4759 U/L HDR, 4764 D/L HDR, and 4766 U/L FILTER WIDE). This MSPC will cause a short interruption in the return link as the S-band system reacquires. - OR -INCO/COMM SUPPORT issues MRTC 4640 TDRS SBD HDR MRTC. Two-stage auto execution is required. Following a failover to S-band (GCIL Failsafe Enable): Note: The following procedure is not used with the automatic Ku handover feature. INCO/COMM SUPPORT will direct COMMAND to select U/L LDR in the MCC and GCMR the network to S-band U/L LDR. Uplink modulation should be cycled OFF as the S-band transponder reacquires. Monitor for S-band forward link reacquisition. ☐ When the S-band forward link has reacquired, uplink RTC DSM 4759 U/L HDR to restore full S-band HDR capability. COMMAND must GCMR to U/L HDR to match orbiter configuration and reselect U/L HDR in the MCC. Ku-band mode changes during SHO time (Mode changes before SHO times are voice coordinated with COMMAND) a. PM/FM mode changes Give COMMAND notice of your intentions to switch between modes. If TV (FM mode) is desired on channel 3, coordinate with Houston TV with 5 to 10 minutes notice in advance to ensure that the TV longlines are ready and that

9/1/2004:

**REV G** 

the WSC TV recorders are set up.

b.

9/1/2004: REV G

	If FM analog or FM digital is desired on channel 3, inform COMMAND with advance notice so that WSC knows a configuration change is coming up. The Ku-band return link FM mode changes (PL ANLG, PL DIGITAL, or TV) can be done by GCMR when the SHO is active.			The
	Configuring for FM bent pipe (PL INTRG) require and perhaps 10 minutes advance notice for sett syncs. Also the video/digital switch at WSC requires some advance notice.	ing up PSI	K demods and	tid b
	If PM mode is desired (PL MAX), inform COMM that WSC prepared to record utilizing their High Dathat the Ku channel 1 data will be interrupted during	ata Rate re	corder. Take r	
	Send DSM 4122 (PM) or DSM's 4123 through 412	6 (FM) as c	desired.	
	Ask COMMAND to send the GCMR immediately after end item response confirmation.			nse
	Monitor the INCO Management display for proper return link reacquisition.			
Chan	nels 2 and 3 bit rate changes			
	Give COMMAND 3 minutes notice of intent reconfigured independently of the other two ch Management (TRM) is unavailable, request a ver on the other 2 channels.	annels. If	annel 2 can TDRS Resou to avoid dropo	urce
	For SSR dumps, channel 2 should be configured for the actual bit rate; i.e., 960 kbps or 1024 kbps (default is 1024 kbps). The channel 2 Data Quality Monitor (DQM) will always be set up to be accurate for both bit rates.			
	It is also important to remember that data code must be configured properly for channels 2 and 3 as follows (jitter settings are required as well):			
		Jitter, %	Code	
	Channel 2 dumps (SSR)	2	Biphase-L	
	Channel 2 digital data	0.1	NRZ-L	
	Channel 3 digital data	0.1	NRZ-L	
_	Inform COMMAND of the appropriate code when	request the	GCMR.	
	COMMAND will send the appropriate GCMR for channel 2 or 3.			
	and the second of the second o			

- Start the dump or notify the customer when COMMAND and DFE confirm proper configuration.
- Verify the data on channel 2 or 3 is available.

#### C. OTHER CONSIDERATIONS

- The WSC MRD Ku-band subcarrier lock status indication updates only every 15 seconds because of the ADPE polling frequency. Therefore, use bit sync status in the ODM's as your prime indication of return link modulation status when in the FM mode. Carrier lock is unavailable in the FM mode, only in PM. Subcarrier signal strength is unreliable and should not be used.
- TDRS handovers will be scheduled to occur at a specific time for S-band and for Ku-band. S-band handover can precede, equal, or follow Ku-band handover, but both times must be specifically scheduled. Onboard antenna management for both S-band and Ku-band must

be configured properly to stay in sync with TDRS scheduling. Simultaneous (overlapping) SHO's for Ku-band are difficult to schedule and should not, as a rule, be requested. Simultaneous SHO's for S-band can be scheduled, but this is only planned during the ascent and entry timeframe because of typical conflicts for usage in the TDRSS system.

 Experience has shown that more reliable TDRSS Ku-band pointing is obtained when autotrack is disabled. Autotrack enable/disable is reconfigurable via GCMR originating only in the NCC (voice call from MCC COMMAND to NCC). The default mode is autotrack disable. INCO does not nominally have to request this GCMR.

9/1/2004: REV G

- TDRS normally can support digital data up to 10 Mbps on Ku-band channel 3 in the FM mode. To accommodate users of the orbiter "bent pipe" mode, PSK demods and bit syncs have been installed (1024 kbps max.), which will allow channel 3 digital data to be processed and to be put on an MDM channel similar to channel 2. These must be manually configured.
- TDRS Z (ZOE) uses is a TDRS satellite located at 85° East (or 275° West) which provides communications support through the Zone of Exclusion (ZOE). The satellite control and telemetry routing is performed at a ground station located at Guam, and data is processed remotely from the Guam Remote Ground Terminal (GRGT) to WSC. The ground site has been upgraded with excess WSC equipment to support a space shuttle S-band and Kuband forward and return links. Ku-band return link is limited to 1024 Kbps of channel 2 data, due to a bandwidth limitation between Guam and WSC.

Both the SM and BFS software have been updated to easily utilize the -275 vector for pointing to the satellite.

## **TITLE**

ANTENNA MANAGEMENT: COMM LINK HANDOVER COMMAND PROCEDURES

## **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

## **PURPOSE**

To define a standard set of procedures for performing radio frequency (RF) link handovers using uplink commands to change the TDRS or ground site selection criteria in SM and/or BFS antenna management software.

#### **RESTRICTIONS & CONSTRAINTS**

These procedures are only valid in all ops modes of the SM and the BFS major functions. Some of these procedures require that the crew not have SPEC 60 active. The panel C3 Sband PM Antenna switch must be in GPC for these procedures to be effective.

#### **GENERAL**

The crew does not have the time to manage the TDRS or Ground site communications link handovers. The ground has the capability to relieve the crew of any actions related to comm link handovers and is considered by the crew and other flight controllers to be responsible for any and all comm link handovers. The following procedures are used to execute handovers for TDRS and ground sites for both the SM and BFS major functions

## **PROCEDURE**

The following procedures are divided into two sections. One section will discuss TDRS handovers for both SM and BFS while the other section will discuss ground site handovers for both SM and BFS.

## A. TDRS Handovers

The following paragraphs contain brief discussions about how the antenna management software works in the SM and BFS as well as procedures for executing the 3 different types of TDRS communications link handovers.

## 1. TDRS Antenna Management Software

Antenna Management (AM) is handled differently in the two major functions. The following are brief discussions on the different ways each AM cycle works.

## a. SM Major Function

The SM AM software has 6 TDRS state vector slots. Each slot requires a command to change its values. Each slot can be enabled for use or inhibited from use by ground command only. A priority technique is available in the SM to allow for early handovers. Default configuration has slot 1 as target A and slot 2 as target B. Any slot can be assigned as A or B via crew item entry or ground command. If AM is configured to A pri by the crew or ground command, and if the associated slot is in view it will be selected until it is no longer in view, then target B will be selected (if in view). If AM is configured to B pri by the crew or ground command, and if the associated slot is in view it will be

9/1/2004: REV G

selected until it is no longer in view, then target A will be selected (if in view). If neither target A or B is in view then the lowest numbered slot that is enabled and in view will be selected. The following commands are used to manage the SM antenna management software. They can be uplinked real-time or stored as TECs:

DSM	Title
14001	SM S-BD ANT PTG INH
14003	KU-BD TDRS TGT-A PRI
14004	KU-BD TDRS TGT-B PRI
14009	S-BD TDRS TGT-A PRI
14010	S-BD TDRS TGT-B PRI
14033	SM S-BD ANT PTG ENBL
14049	A-TGT TO TDRS VECTR 1
14050	A-TGT TO TDRS VECTR 2
14051	A-TGT TO TDRS VECTR 3
14052	A-TGT TO TDRS VECTR 4
14053	A-TGT TO TDRS VECTR 5
14054	A-TGT TO TDRS VECTR 6
14055	B-TGT TO TDRS VECTR 1
14056	B-TGT TO TDRS VECTR 2
14057	B-TGT TO TDRS VECTR 3
14058	B-TGT TO TDRS VECTR 4
14059	B-TGT TO TDRS VECTR 5
14060	B-TGT TO TDRS VECTR 6
14061	ENA TDRS VECTOR 1
14062	ENA TDRS VECTOR 2
14063	ENA TDRS VECTOR 3
14064	ENA TDRS VECTOR 4
14065	ENA TDRS VECTOR 5
14066	ENA TDRS VECTOR 6
14067	INH TDRS VECTOR 1
14068	INH TDRS VECTOR 2
14069	INH TDRS VECTOR 3
14070	INH TDRS VECTOR 4
14071	INH TDRS VECTOR 5
14072	INH TDRS VECTOR 6

## b. BFS Major Function

The BFS AM process is very simple. The lowest numbered TDRS state vector slot that is in view will be selected each AM cycle.

## 2. Normal Handovers

An example of a "Normal" handover would be at LOS of the current state vector slot, another slot that is in view would be selected. No action is necessary to execute a normal handover unless "Early" or "Mid-pass" handovers were previously executed.

## a. SM

Step	Action	Response
1	Verify the TDRS support plan via	
	the Schedule of Handover	
	Operations (SHO)	
2	Verify that targets A and B are assigned to the correct TDRS slots. If they are not build a TEC to move the A target to the correct slot at the start of the correct slots SHO time (cmd buffers display)	The command buffers display will show a TEC that will time out at the expected SHO start time.

9/1/2004: REV G

#### b. BFS

Step	Action	Response
1	Verify the TDRS support plan via	
	the Schedule of Handover	
	Operations (SHO)	
2	If an "Early" handover was	
	executed during the previous	
	TDRS pass, uplink <b>403xx</b> to put	
	TDRS 171° or 174° into slot 1	
	after LOS of TDRS 171°.	

## 3. Early Handovers

An example of an "Early" handover would be while selecting the current state vector slot, another slot comes into view. Once that other slot is in view, it is selected. No action is required to perform an early handover if the previous orbit was an early handover using the same satellites.

## a. SM

Step	Action	Response
1	Verify the TDRS support plan via the Schedule of Handover	
	Operations (SHO)	
2	Verify targets A and B are	Workstation Antenna
	assigned to the appropriate	Management System (WAMS)
	TDRS state vector slots.	display shows target A and B in
		the appropriate TDRS slots
3	Use RF CMD BUILD application	RF CMD BUILD shows the TECs
	to build TEC <b>134xx</b> target A to	built at the appropriate times
	vector slot X (1 – 6) to execute at	
	the time of the handover	
4	Have INCO verify the TECs	INCO verifies the TECs
5	Uplink TECs	TEC buffer count increments by
		Cmd buffers display shows
		the extra TECs onboard.

## b. BFS

The TEC buffer is not available in the BFS major function, therefore care must be taken with this procedure since commands must be executed real-time.

9/1/2004: REV G

Step	Action	Response
1	Verify the TDRS support plan via the Schedule of Handover Operations (SHO)	
2	Use the RF CMD BUILD application to build <b>403xx</b> to put TDRS 41° or 47° into TDRS <b>slot 1</b> and TDRS 171° or 174° into TDRS <b>slot 2</b>	RF CMD BUILD display shows TDRS 41° or 47° in slot 1.
3	Have INCO verify the TDRS state vector commands	
4	INCO uplinks 403xx (Western TDRS in slot 2) then 403xx (Eastern TDRS in slot 1) well before AOS of the Eastern TDRS.	Possible short telemetry drop while BFS selects slot 2 for AM. At the Eastern TDRS AOS, slot 1 will be selected.
5	After handover back to the Western TDRS after the early handover. Clean up the TDRS slots by uplinking the Western TDRS in slot 1 and Eastern TDRS in slot 2.	Nominal TDRS config displayed on WAMS

## 4. Mid-pass Handovers

A "Mid-pass" handover will occur when 2 or more state vector slots are in view and the second slot must be selected after it is AOS but before the first slot is LOS.

## a. SM

Step	Action	Response
1	Verify the handover plan with COMMAND	COMMAND checks the TDRS schedule of handover operations (SHO)
2	Use RF CMD BUILD display to build TEC <b>134xx</b> target A to vector slot X (1 – 6) to execute at handover time.	RF CMD BUILD shows the TECs built at the appropriate times
3	Have INCO verify the times with the Satellite Acq Time display	INCO verifies the times
4	Uplink TECs	TEC buffer count increments by 1. Cmd buffers display shows the extra TECs onboard.

## b. BFS

Step	Action	Response
1	Verify the TDRS support plan via	
	the Schedule of Handover	
	Operations (SHO)	
2	Use the RF CMD BUILD	RF CMD BUILD display shows
	application to build 403xx to put	TDRS 41° or 47° in slot 1.
	TDRS 41° or 47° into TDRS slot	
	1	

Step	Action	Response
3	Have INCO verify the TDRS	
	state vector command	
4	INCO will configure for	Uplink buffers display shows the
	"MANUAL EXEC" and BFS	command data words in the
	major function, then uplink 403xx	uplink and downlink columns
	(Eastern TDRS in slot 1)	
5	Just before the handover time,	Telemetry will drop out until the
	INCO presses the "2 STG EXEC"	eastern TDRS even starts.
	button.	WAMS will show slot 1 selected.
6	After LOS of the Western TDRS	Nominal TDRS config displayed
	clean up the TDRS slots by	on WAMS.
	uplinking the Western TDRS in	
	slot 1.	

## B. Ground Site Handovers

## 1. Ground Site Antenna Management

Ground site management is generally used to support recorder dumps while on orbit or operational data during ascent/entry times. The BFS and the SM handle ground sites differently. The following paragraphs document the standard procedures for ground site management.

## a. SM Major Function

The SM major function has two methods for ground site handovers. One method uses a command that may be stored in the TEC buffer or uplinked real-time. The primary method used is real-time uplink. The following is the standard procedure for enabling and inhibiting sites as well as site-to-site handovers.

Step	Action	Response
1	Request permission from INCO	INCO concurs
	to inhibit ground sites	
2	Verify SPEC 60 is not active on	
	the workstation display INCO	
	Management	
3	Uplink Inhibit commands for any	Comm_mgmt and inco_mgmt will
	ground sites that will not be used	show the enabled ground sites.
	to support shuttle activities. (see	
	table 3.7-1 for commands)	
4	At site handover time, uplink	WAMS (real-time), comm_mgmt
	<b>14012</b> to the SM major function	and inco_mgmt will show the
	to select the next ground site (if	currently selected ground site
	required)	change to the next available site.

DSM	Title	DSM	Title
12201	MIL INH	12217	MIL ENA
12202	NHS INH	12218	NHS ENA
12203	OTS INH	12219	OTS ENA
12204	DGS INH	12220	DGS ENA
12205	GTS INH	12221	GTS ENA
12206	HTS INH	12222	HTS ENA
12207	VTS INH	12223	VTS ENA
12208	DFR INH	12224	DFR ENA

1/2004:	REV (
---------	-------

12209	CTS INH	12225	CTS ENA
12210	JSC INH	12226	JSC ENA
12211	MAD INH	12227	MAD ENA
12212	GDX INH	12228	GDX ENA
12213	CAN INH	12229	CAN ENA
12214	WLP INH	12230	WLP ENA
12215	SITE 15 INH	12231	SITE 15 ENA
12216	SITE 16 INH	12232	SITE 16 ENA

Table 3.7-1 SM Site Enable/Inhibit commands

## b. BFS Major Function

The BFS requires the S-Band transponder to be in either STDN or SGLS mode before it will select ground sites for antenna pointing. The BFS only uses TMBUs for inhibiting sites. The process of enabling a site is to uplink a TMBU that does not include the site as inhibited.

Step	Action	Response	
1	Request from INCO permission	INCO concurs	
	to inhibit ground sites		
2	Uplink Inhibit TMBU that contains	asc_ent_comm_mgmt and	
	the sites to be inhibited. (see	asc_ent_inco_mgmt displays will	
	table 3.7-2 for commands)	show the enabled ground sites.	

DSM	Title
12401	BFS AM ASCENT NOMINAL
12402	BFS AM ASCENT WLPS
12403	BFS AM ASCENT NHS
12404	BFS AM ASCENT PDL
12405	BFS AM ASCENT JDI
12410	BFS AM ORBIT ALL RTS
12411	BFS AM ORBIT STDN/RTS
12420	BFS AM ENTRY NOMINAL
12421	BFS AM ENTRY MIL CONT
12434	BFS AM ALL SITES ENA
12435	BFS AM MIL ONLY ENA
12436	BFS AM PDL ONLY ENA
12437	BFS AM DFR ONLY ENA
12438	BFS AM WLP ONLY ENA
12439	BFS AM JDI ONLY ENA
12440	BFS AM CTS ONLY ENA
12441	BFS AM GTS ONLY ENA
12442	BFS AM HTS ONLY ENA
12443	BFS AM VTS ONLY ENA
12444	BFS AM OTS ONLY ENA
12445	BFS AM DGS ONLY ENA
12446	BFS AM NHS ONLY ENA
12447	BFS AM MAD ONLY ENA
12448	BFS AM GDX ONLY ENA
12449	BFS AM CAN ONLY ENA
12450	BFS AM JSC ONLY ENA

Table 3.7-2 BFS Ground Site Inhibit TMBU Commands

9/1/2004: REV G

## C. Crew Capabilities

The crew has some limited capabilities to manipulate the AM sequence via SPEC 201 Antenna in the SM major function and SPEC 51 Override in the BFS major function. The following paragraphs describe these capabilities.

## 1. SM SPEC 201 Antenna

The following is a listing of the item entries the crew can use to affect changes in AM.

ITEMS 1 through 6 TDRS TGT SELECT A or B – used to assign any of the 6 TDRS state vectors, to targets A or B. An '\*' is displayed in the 'A' column adjacent to the TDRS state vector slot number (1 – 6), if that TDRS state vector slot is selected as the 'A' target. An '\*' is displayed is displayed in the 'B' column adjacent to the TDRS state vector slot number (1 – 6), if that TDRS state vector slot is selected as the 'B'

target. Only one TDRS state vector slot can be assigned to target 'A' or 'B' at a time. The same TDRS state vector slot can be

assigned to both 'A' and 'B'.

ITEM 7 SELF- TEST – used to select or terminate the radar self-test

function. An '\*' appears next to item 7 when the self-test is selected. After the 3-minute test is completed, item 7 must be re-executed to deselect the self-test function and blank the test results (displayed

on the Range meter on panel A2).

ITEM 8 I/O RESET KU – used to initiate communications between the SM

GPC and the Ku-band system. An '\*' is displayed next to the item whenever the interface is enabled otherwise an 'M' is displayed.

When the SM is initialized the interface is enabled.

ITEM 9 and 10 TDRS KU PRI A/B – Item 9 allows the SM Antenna Management

(AM) software to select TDRS target 'A' for primary pointing of the Ku-band Comm antenna, if it is in view. If target 'A' is not in view but target 'B' is in view, the target 'B' TDRS satellite will be utilized for pointing. If neither target 'A' nor 'B' is in view, the lowest numbered TDRS state vector slot in view and enabled will be utilized for pointing (as denoted by the '\*' located in the 'IN VIEW' column of the TDRS STATE VECTORS table). Item 10 allows AM to select TDRS target 'B' for primary pointing if it is in view. If target 'B' is not in view but target 'A' is in view, the target 'A' TDRS satellite will be utilized for pointing. If neither is in view the lowest numbered slot in view and enabled will be used for pointing. An '\*' is displayed next to the

selected item entry. Initialization is in TDRS Ku A PRI.

ITEM 11 and 12 GPC ANT CMD ENA/INH – used to enable or inhibit AM selection of

S-band antennas. An '\*' is displayed next to the selected function.

ENA is selected at SM initialization.

ITEM 13 OVRD – used to force AM to TDRS mode and remain there. This

will allow AM to select the best S-Band antenna to TDRS even if there is a status problem preventing AM from knowing what is the correct mode. An '\*' is displayed next to the item when it is enabled.

The display is initialized with item 13 inhibited.

ITEM 14 and 15 TDRS S-Band PRI A/B - works the same as the Ku-band PRI A/B

function but for the S-Band antennas.

SHUTTLE OPS INCO/COMM/JSC-12829

9/1/2004: REV G

ITEMS 16 and 17 RDR RNG – used to control the range estimate output (AUTO or MIN) to the Ku-band Rendezvous Radar/COMM A system. An '\*' is displayed next to the selected item. Initialization is in AUTO.

## 2. BFS SPEC 51 Override

The following is a listing of the item entries the crew can use to affect changes in AM.

TDRS – used to configure the comm systems to communicate with TDRS. In Ops 1 and 6 S band spreading will be commanded off. In Ops 3 S band spreading will be commanded on.
 STDN-HI – used to configure the comm systems to communicate, in high power mode, with STDN ground sites. In Ops 1 and 6 Uplink coding will be commanded ON. In Ops 3 uplink coding will be commanded OFF.
 STDN-LO – used to configure the comm systems to communicate, in low power mode, with STDN ground sites. In Ops 1 and 6 Uplink

low power mode, with STDN ground sites. In Ops 1 and 6 Uplink coding will be commanded ON. In Ops 3 uplink coding will be commanded OFF.

SGLS – used to configure the comm systems to communicate with RTS (U.S. Air Force) ground sites.

**NOTE**: If the flight critical MDM used for commanding (FF1 with NSP1 and FF3 with NSP 2) is bypassed by the BFS the item entries listed above will not take affect until the bypass is cleared.

## D. AM Pointing Enable/Inhibit

ITEM 49

Both the SM and BFS can be forced to inhibit auto antenna selects so that the ground can take manual (command) control of the S-Band quad and hemi antennas. The following paragraphs explain this capability for both major functions.

## 1. SM

Uplink DSM 14033 to enable SM automatic antenna selection Uplink DSM 14001 to inhibit SM automatic antenna selection

## 2. BFS

Uplink DSM 12432 to enable BFS automatic antenna selection Uplink DSM 12433 to inhibit BFS automatic antenna selection

#### **TITLE**

LOSS OF S-BD U/L DUE TO TDRS CARRIER ONLY DOPPLER TRACKING

## **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

## **PURPOSE**

This procedure documents the plan for recovering from the loss of uplink due to the S-band transponder being configured for TDRS carrier only Doppler tracking.

#### COMMAND RESTRICTIONS/CONSTRAINTS

This command procedure is valid in all major modes for the GNC, SM and BFS major functions. Caution must be taken to follow this procedure in the correct order or loss of all upklink (command and voice) may occur. There are no time constraints in this procedure. Coordination with the crew is required for NSP swaps due to the fault message that will be generated.

## **GENERAL**

The S-band transponder design has a GCIL/PNL control function to disable downlink (D/L) data. Since the transponder uplink (U/L) and D/L control systems use the same circuits, the loss of U/L can occur whenever NSP's are switched while D/L data is disabled. This is usually done for the purpose of providing TDRS carrier only Doppler tracking, which is not used operationally anymore but is a capability that still is possible with the current system.

If command DSM 4737 (S-BD MODE - TDRS TRK) has been sent to support Doppler Tracking and NSP's are subsequently switched, the transponders will be configured to route U/L data to the unselected NSP, and a loss of S-band U/L will occur. This can be prevented by initially enabling S-band R/L data prior to switching NSP's.

#### **PROCEDURE**

#### A. Ground Procedure

Send DSM 4744 - S-band R/L DATA - ENA

Send DSM 4760 (4761), NSP 1 (2) ON to switch NSP's

If TDRS carrier only, Doppler tracking is still required, Send DSM 4737 - S-BD MODE - TDRS TRACK

Note: The TDRS Salvo command (DSM 4470) used in the STANDARD SPC's will also recover the U/L.

### B. Crew Procedure

U/L will be recovered when an S-band PNL/CMD is performed.

#### **TITLE**

TFL/DFL OP CODE UPLINK PROCESSING (INST CMD BUILD)

## **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

#### **PURPOSE**

To define a standard set of procedures for sending Telemetry Format Loads (TFLs) to the PCMMU and Data Format Loads (DFLs) to the PDI, using ground-initiated OP code uplink.

#### COMMAND RESTRICTIONS/CONSTRAINTS

This procedure is valid in SM ops 2 and 4. The crew must not have SM SPEC 62 active when uplinking TFL/DFL Op codes. Verify that status of SPEC 62 by using the INCO\_MANAGEMENT display to determine if SM VP slot 5 shows active (displays "SPEC 62"). SM common buffer must not be busy when commencing uplinks of TFL/DFL Op codes.

#### **GENERAL**

TFLs are used to program two of the three formatters in the Pulse Code Modulation Master Unit (PCMMU). These formats are used to select and sort the data, which will be downlinked from the shuttle to the ground. The DFLs are used to decommutate the data from a payload in the Payload Data Interleaver (PDI). The FPMs are used to integrate the decommutated payload data into a stream that the PCMMU can incorporate in the overall telemetry stream that it is downlinking. The following procedures explain how to build the commands, which load the TFLs in the PCMMU and the DFLs and FPMs into the PDI.

## PROCEDURE

A. To build TFL command loads using INST CMD BUILD Display

SEQ	Initiator	Action	Comments
1	INST	Call up the INST CMD BUILD display from the INCO GCS DNAV menu and select the TFL/DFL option from the Command Types menu	
2	INST	Enter a valid DSM number (12501 - 12599), along with a title (such as "TFL 184" or "TFL 184/103" etc.). The title can be any character string up to 21 characters long	
3	INST	If the DSM selected is an existing command load in the server, the DELETE LAST button must be used to clear the contents of the command before continuing	
4	INST	For a High Data Rate (HDR) TFL, select the format from the HDR list of valid formats. The range is 128-254	The right side of the display will show the onboard item entries required to load the TFL in the PCMMU.
5	INST	For a Low Data Rate (LDR) TFL, select the format from the LDR list of valid formats. The valid LDRs are 102 and 103	The right side will show the LDR format. Both the HDR and LDR can be built in the same command.
6	INST	From the Operations menu on the TFL/DFL build display, select the "Submit" option	Messages will appear at the bottom of the display to tell the user that the command server has accepted the command. The green "Edited" light will disappear.
7	INST	If there was a command already built with the DSM selected, a box will pop up asking the user to overwrite the existing command load. Press "Yes" to replace the command in the server	

B. To build DFL command Loads using INST CMD BUILD display

SEQ	Initiator	Action	Comments
1	INST	Call up the INST CMD BUILD display from the INCO GCS DNAV menu and select the TFL/DFL option from the Command Types menu	
2	INST	Enter a valid DSM number (12501 - 12599), along with a title (such as "DCM 1 FMT 6 SRC 3"). The title can be any character string up to 21 characters long	
3	INST	If the DSM selected is an existing command load in the server, the DELETE LAST button must be used to clear the contents of the command before continuing	
4	INST	Select the Decom from the list of valid decom numbers. The range is 1-4	The right side of the display will show the selected decom in the PDI
5	INST	Select the format from the list of valid DFL format. The range is 1-31	The right side will show the format ID
6	INST	Select the input source of the payload data from the list of valid SRCs. The range is 0-6	The right side will show the source ID
7	INST	From the Operations menu on the TFL/DFL build display, select the "Submit" option	Messages will appear at the bottom of the display to tell the user that the command server has accepted the command. The green "Edited" light will disappear
8	INST	If there was a command already built with the DSM selected, a box will pop up asking the user to overwrite the existing command load. Press "Yes" to replace the command in the server	

3/31/2006: REV G, PCN 3

Note: Not all the steps listed above must be executed. The minimum required steps to change a format in a decommutator are 1-5 and 7. To simply change a source in the decommutator, the minimum steps are 1-4, 6 and 7. Before uplinking a new FMT or SRC, be sure the decom the FMT or SRC will be placed into is FDA disabled or a message will be generated onboard.

## C. To build FPM command loads using INST CMD BUILD display

SEQ	Initiator	Action	Comments
1	INST	Call up the INST CMD BUILD display from the INCO GCS DNAV menu and select the TFL/DFL option from the Command Types menu	
2	INST	Enter a valid DSM number (12501- 12599), along with a title (such as "FPM 501"). The title can be any character string up to 21 characters long	
3	INST	If the DSM selected is an existing command load in the server, the DELETE LAST button must be used to clear the contents of the command before continuing	
4	INST	Select FPM from the list of valid decom numbers	The right side of the display will show a "5" for the selected decom in the PDI
5	INST	Select the format from the list of valid DFL format. The range is 501-525	The right side will show the format ID
6	INST	From the Operations menu on the TFL/DFL build display, select the "Submit" option	Messages will appear at the bottom of the display to tell the user that the command server has accepted the command. The green "Edited" light will disappear
7	INST	If there was a command already built with the DSM selected, a box will pop up asking the user to overwrite the existing command load. Press "Yes" to replace the command in the server	

## D. Function ID Definitions

Whenever a command load is built with the TFL/DFL build tool, the right side of the display will show the function codes used to make the requested change happen onboard. The following list shows the function codes and what they are used for.

Function ID no.	Description of function
01	Selects the fixed HDR downlink formatter (TFL = 129)
02	Selects the programmable HDR downlink formatter. (A TFL must have been loaded into the programmable (soft) formatter before this option should be used)
03	Selects a TFL to be loaded into the LDR or HDR formatter. Valid LDR formats are 102 and 103 (limited by the display). Valid HDR formats are 128 - 254
04	Actually loads the selected TFL into the formatter
05	PCMMU I/O reset, resets the bypassed TIO/SVC read tables in the SM GPC
06, 07	PSP 1(2) I/O reset, resets the interface between the SM GPC and the PSP. The PSP must be turned on before this can be done.
08	PDI I/O reset resets the bypass indicator for the SM PDI switch matrix read
09	Selects the desired PDI decom to be loaded (format, source, or both). This function will have a decom number displayed. 1-4 for decoms and 5 for FPM
10	Selects the format to be loaded into the selected decom. Valid DFLs are 00-31. Valid FPMs are 501 - 525 (limited by the display)
11	Actually loads the previously selected DFL/FPM
12	Selects the input source for the previously selected decom. Valid range is 0 to 6. Note that a source of 0 will effectively disable the decom
13	Actually loads the previously selected input source into the previously selected decom
14, 15, 16, 17	Toggles the FDA enable/disable bin for PDI decoms 1, 2, 3, and 4, respectively

## E. Predefined 125 load class commands

DSM no.	Function no.	Description	Device
12538	2	Selects the programmable HDR formatter	PCMMU
12539	1	Selects the fixed HDR formatter (TFL 129)	PCMMU
12540		Load TFLs 161 and 103	PCMMU
12541	14	Toggle Enable/Disable FDA on decom 1	PDI
12542	15	Toggle Enable/Disable FDA on decom 2	PDI
12543	16	Toggle Enable/Disable FDA on decom 3	PDI
12544	17	Toggle Enable/Disable FDA on decom 4	PDI
12545		Loads TFL 163 PL9, M/M Dump	PCMMU
12546		Loads TFL 164 and 102	PCMMU
12547	6	PSP 1 I/O reset	PSP 1
12548	7	PSP 2 I/O reset	PSP 2
12549	8	Reset switch element bypass indicator (I/O reset)	PDI
12550	5	Reset element bypass indicators (I/O reset)	PCMMU

## F. To uplink a TFL/DFL command

SEQ	Initiator	Action	Comments
1	INST	Call up the INST CMD BUILD display from the INCO GCS DNAV menu and select the TFL/DFL option from the Command Types menu	
2	INST	Verify that the DSM number and contents of the command are correct and request INCO's concurrence	
3	INST	Select SM Major function and Load mode on the DSM panel of the hardware or software command panels	
4	INST	Verify that the two stage buffer is not being used, SPEC 62 is not active, and the SM common buffer is not busy	
5	INST	Dial in the load number 125xx (where xx is from 01 to 99) on the DSM panel of the hardware or software command panels	
6	INST	Press the command init button on the DSM panel. Monitor the two-stage process for errors	
7	INST	Monitor pertinent downlink telemetry for each function of uplinked load  √ TFL STAT = 01, then 02  √ On Orbit Fault Message display for no "I/O ERROR MMU" message	If an MMU message appears, contact DPS and advise them of the problem. If a TFL load fails, reintiate load. If TFL LOAD REJECT indicator is illuminated, recheck load contents, correct the load, and retransmit the load. A TFL Load Reject will occur if SPEC 62 is up
8	INST	If necessary, press the Compare Initiate button to complete the buffer execute command	A TMRJ may occur on the buffer execute command because the SM downlist will be interrupted while the TFL is being loaded

### **CAVEATS AND NOTES**

Any and all references to any specific DSM numbers referenced herein are correct at the origination date. Users are cautioned to check the functions versus DSM numbers prior to use because the loads can change DSM numbers, be deleted, etc.

If multiple functions are uplinked in a single load, the SM GPC will work them off one at a time until all have been done. For further information on the exact format of the uplink load, see Systems Brief on COMMAND (INCO/COMM Systems Brief).

Following are the restrictions on use of PDI/PCMMU OP code load uplinks. Do not attempt a PCMMU/PDI load uplink while SM SPEC 62 is called up or overlayed on any DEU aboard the orbiter. If such an uplink is attempted while the SPEC is up, the entire load will be rejected. If the load contains an

illegal number of data sets (data sets >10), the load will be rejected. Any data set in the load containing an illegal function ID or format ID will be rejected, along with any subsequent data sets.

## **CAUTION**

Do not uplink TFL/DFL loads while in TFL 129 (Fixed HDR Format). This would require manually executing the two-stage buffer in the absence of an SM downlist, which requires explicit Flight Director approval, per Flight Rule A11-22.

The following conditions cause failure of TFL/DFL loads; listed indications are noted.

Condition	Indication	Results
Undefined TFL ID	TFL FAIL	PCMMU retains previous TFL value
Undefined DFL ID	None	PDI retains previous DFL value
Invalid TFL ID	TFL FAIL	Processing of the load ceases - no change to PCMMU
Invalid DFL ID	None	Processing of the load ceases - no change to PDI
SM common buffer busy	TFL - TFL FAIL DFL - None	Processing of the load ceases - no change to PDI/PCMMU
OPS transition during load attempt	TFL - TFL FAIL DFL - None	No change to PDI/PCMMU
I/O ERROR on PCMMU/PDI/MMU during load attempt	TFL - TFL FAIL DFL - Applicable decom format ID changed to zero	Zeroes out applicable PDI decom FMI ID for DFL load attempt
SPEC 62 terminated during load attempt	TFL - None DFL - None	TFL load attempt - successful completion. DFL load attempt - new DFL not loaded, no change to decom
Attempt to load PDI decom with no format ID entered, invalid format ID, invalid decom number, or invalid switch matrix input	None	Load attempt aborted. No change to PDI

When any transaction involving the SM common buffer is being processed (such as an SM GPC checkpoint or TFLs and DFLs), another parameter is set. This parameter is called SM COMM BUFF BUSY. Do not initiate any TFL or DFL OP code uplinks while this parameter indicates that the SM common buffer is busy. Any attempt at uplinking a TFL or DFL while the SM common buffer is busy will be rejected.

Note that if the SM machine is re-IPL'd after loading a PDI DFL, the PDI decom formats on SM SPEC 62 will be blank. The SM downlist will show all zeros, even though valid formats are currently loaded in the PDI.

If an OPS transition is initiated while a TFL load is in progress, the load will fail. If it fails, reload the TFL following termination of the OPS transition.

TFLs and DFLs loaded prelaunch via a GNC OPS G9 GPC will not show on SM SPEC 62 when the SM GPCs are brought up, even though the TFLs and DFLs have been loaded.

When PCMMU or PDI is power-cycled, the soft formats are erased in the devices, but SM SPEC 62 still shows the last loaded values.

An example of a TFL/DFL display is shown in Figure 3.9-1.

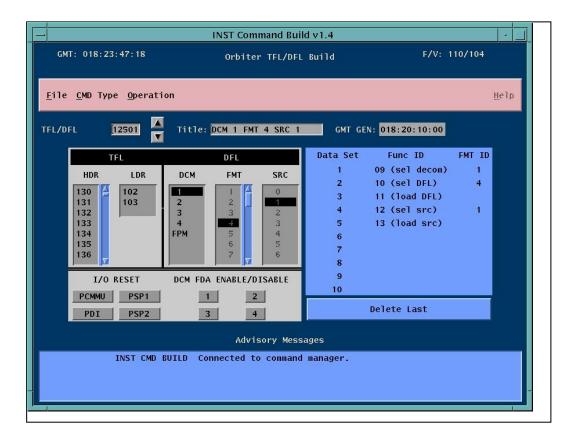


Figure 3.9-1. Example of TFL/DFL display

METERED RTC UPLINK USER'S GUIDE

#### **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed permission without review and approval at the FOIG.

### **GENERAL OVERVIEW**

The Metered real-time command (RTC) Uplink application was developed by the INCO group to satisfy the requirement to send numerous, redundant RTCs single stage to the Station-Shuttle Power Transfer System (SSPTS). SSPTS allows the Shuttle to partially utilize ISS Solar array generated energy, thus saving Fuel Cell power and allowing a longer duration mission. Once docked, the ISS can supply the SSPTS with 120 Vdc. This starts with the closure of 2 of 4 possible ISS remote power controllers (RPCs), allowing power flow from ISS, through the Androgynous Peripheral Attachment System (APAS) to the Power Transfer Units (PTUs).

The SSPTS has two PTUs, each of which has redundant converters. Crew action is required in order to initialize both PTUs as well as power the converters. This is accomplished by moving switches on panel (PNL) A15. The default output of the PTU is approximately 31.12 Vdc. The voltage output must then be adjusted to approximately 31.80 Vdc (final adjustment call is EGIL responsibility). This is accomplished by either the Shuttle crew voltage adjust switch or by INCO with use of the appropriate RTC. Each use of the onboard switch or the ground RTC will increase/decrease the output voltage by only 0.04 Vdc; therefore, numerous instances of the command are needed to establish the desired voltage output.

SSPTS processing is constrained by the 100 msec required to read command bit changes, which makes the use of the INCO MRTC (Multiple RTC) application ineffective due to NSP buffering. The command path is to the GN GPC then the FF MDMs; therefore, with no stored program command (SPC) buffer available, the use of SPCs is prevented. The Metered RTC Application enables quick and easy use of redundant RTCs at a pre-determined "metered rate" to the Generic Command Server (GCS). This allows the SSPTS LRUs to receive each instance of the command at a controlled spacing greater than 100 msec with adequate time to react to each instance.

#### COMMAND RESTRICTIONS/CONSTRAINTS

Metered RTC is a critical application. It interfaces directly to the GCS and should be treated with same constraints and practices as the Hardware Command Panel and the Command Configuration Uplink Display (CCUD) Software Command Panel (S/W Cmd Pnl). There are several features in this application that contribute to the desired level of safety. The application must be "Armed" prior to the "Send" actions. In addition, the CCUD S/W Cmd Panel must have the proper GPC Major Function (MF) selected to match the destination of the intended RTC. Only the SM and GN are permitted GPC MF destinations for the Metered RTC Application. This application cannot be used for commanding to the BFS. This application was designed to efficiently command the SSPTS but can be used prudently to command the other orbiter system during the Orbit phase, if redundant RTCs are necessary.

## A. MAIN DISPLAY

The Metered RTC Uplink display can found on the INCO DNAV under COMMAND. Once selected, the application will take a minute to establish an initially unarmed interface with the GCS and retrieve the RTC inventory. The display will appear as presented below:

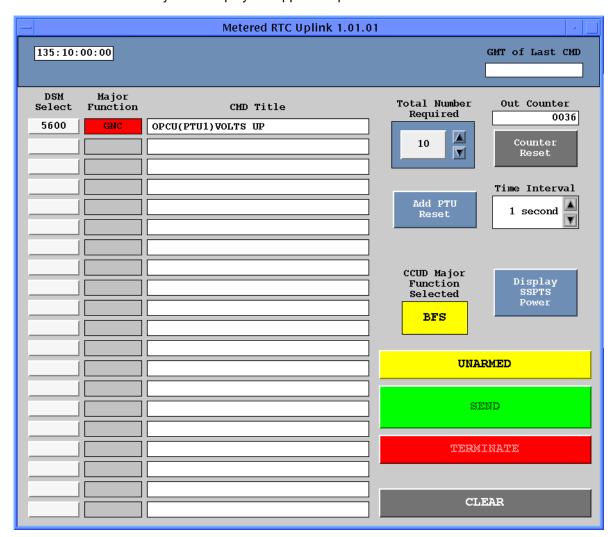


Figure 3.10-1. Metered RTC Uplink Display

The clock field dynamically displays the GMT kept by the GCS. It requires an interface with the GCS for updates.

The remaining fields will be explained in context with commanding procedures.

## **B.** Commanding Procedures

#### 1. Overview

The SSPTS commands are listed in Command Inventory. There are 6 RTCs available for selection. They are to be used in GNC OPS 2 configuration and are allowed to be uplinked only to the GNC MF. Typical usage timeline will be shortly after Docking and post-EVA. These commands are safed in the GCS until unsafed by the following procedure. Note that they are RTCs and are intended be sent as single stage only. The matrix below references the DSM, title, MSID, and Reset and Set data of the six commands.

	DSM			RESET	SET	
#	TITLE	MSID	Address	HEX	Address	HEX
5600	OPCU (PTU1) Volts UP	V76K2432U	FA1 CD12 CH2	C1050C00	FA1 CD12 CH2	C9050800
5601	OPCU (PTU1) Volts DN	V76K2433U	FA1 CD12 CH2	C1050C00	FA1 CD12 CH2	C9050400
5604	OPCU (PTU1) RESET	V76K2439U	FA1 CD12 CH2	C1050C00	FA1 CD12 CH2	C9050000
5602	OPCU (PTU2) Volts UP	V76K2532U	FA2 CD12 CH2	C1060C00	FA2 CD12 CH2	C9060800
5603	OPCU (PTU2) Volts DN	V76K2533U	FA2 CD12 CH2	C1060C00	FA2 CD12 CH2	C9060400
5605	OPCU (PTU2) RESET	V76K2539U	FA2 CD12 CH2	C1060C00	FA2 CD12 CH2	C9060000

#### 2. Protocol

EGIL/EPS will call INCO on DVIS <u>INCO</u> loop. The following information will be provided to INCO:

PTU to be adjusted.

DSM and name of RTC to be utilized.

Number of immediate instances of RTC to be sent.

Verbal OK to have the DSM unsafed.

- 3. On INCO go, operator will right mouse click in the <u>DSM Select</u> field and select the required DSM. (Example: 5600). The box in this field allows selection of DSMs from the Command Inventory. Once selected, the DSM number will remain visible. Any command can be selected from inventory; however, only GN and SM GPC processed commands can be armed with this application. The selector will default initially to SSPTS DSMs which are 5600-5605. The inventory can be browsed for selection of other system commands if needed.
- 4. Operator will then review the <u>CMD Title</u> field to verify intent. (Example: OPCU (PTU1) Volts UP). This field needs no action by the operator. As the desired DSM is selected, the Command Inventory nomenclature for the specified RTC will remain visible in this window.
- 5. Operator will note the <u>Major Function</u> field next to DSN number. To arm the command server interface, this designation must agree with current MF selection on the CCUD. This field is generated from internal logic and is not valid for BFS RTCs. Some RTCs are valid to either the SM or GN MF and will indicate a mixed field valid for both SM and GN. The operator will be responsible for knowledge of which MF these type commands must go to for certain circumstances. Note that the intended SSPTS RTCs will only display and accept the GN designation.

- 6. Operator will verify the <u>CCUD Major Function Selected</u> field is displaying the proper MF. (Example: GN for PTU voltage adjustment). The Metered RTC Uplink display reads the MF currently selected on the CCUD and displays it for benefit of the operator. This field is intended to remind the operator that the CCUD MF must match the DSM selection logic before the Metered RTC Uplink application can be armed. MF is selectable only on the CCUD S/W Cmd Pnl. For example, in Figure 3.10-1 above, the application cannot be "armed" to the GCS until the operator has changed the MF to "GN" via the CCUD.
- 7. Operator will select total number of RTC instances required and observe the number of redundant RTCs in the <u>Total Number Required</u> field. This feature allows the operator to select the total number of RTC instances that will be sent to the GCS. It reads the initial selected RTC and duplicates it for a total number. For example if 5600 OPCU (PTU 1) Volts Up is DSM selected and displayed in the top slot, the operator can use the scroll arrows provided to find "6" and click on the number. Five more instances of this RTC will appear for a total of six. The total number required is selectable from 2 through 19. There are 20 DSM fields, but one slot is held available for a required MDM Reset RTC. When the number in this field is changed, the number of RTCs in the command list at the left of the display is updated to match.
- 8. Operator will add the OPCU PTU RESET command via the <u>ADD PTU Reset</u> button. This button is only visible if the operator has selected an SSPTS RTC in the DSM Select field (5600-5605). Clicking on this button will add either 5604 (PTU 1 Voltage Reset) or 5605 (PTU 2 Voltage Reset) to the DSM Selection space immediately to the first empty DSM field. In the earlier example, it would be a separate 7th (and final) command instance. It is a smart button that can determine which PTU is being commanded in order to add the correct Voltage Reset. This button is only pertinent to SSPTS and will not be visible, nor needed for any other orbiter system DSMs. Since this command only resets the MDM output bits and does nothing to the PTU itself, it is only intended to reset the MDM output to a preferred configuration.
- 9. Operator will consider the "metered time" required, and adjust as needed using the <u>Time Interval</u> field. This is an interactive field that allows the operator to select the amount of time between RTC instances sent to the GCS. Without operator interaction, the default metered time is set to 1 second. For example, if 6 Voltage adjustment RTCs were uplinked, the application will send the first one to the GCS, wait a full second in time, then send the second instance and so on. This metering is required for the onboard SSPTS to process all commands. The metered setting can be adjusted by the operator by clicking the arrow on the right of the field and selecting the desired metering time. All times included are feasible for commanding the SSPTS, as is the default setting of 1 second. The selection is there simply for future needs.
- 10. Operator will note the <u>Out Counter</u> field and log the value with the current GMT. This field keeps track of the number of command instances sent by this application to the GCS. It has the capability to count up to 9999. It can be used to roughly estimate the voltage adjustment required or can be used along with Command Track History to verify onboard acceptance. Note that it also counts the MDM Reset commands sent.
- 11. The Out Counter can be optionally reset to 0 by clicking on the Counter Reset button.
- 12. Operator will note the <u>GMT of Last CMD</u> field and log the value. This field is a dynamic box that records the GMT of the last RTC sent from the display. It can be used to determine the last SSPTS commanding activity or to compare telemetry voltage increments with commanding efforts.
- 13. Operator will "Arm" the application using the <u>ARM/UNARMED</u> button. This is an interactive button for commanding use. "Arming" this button establishes a direct commanding interface to the GCS. This application can only be armed if the user position is "Enabled" both in the GCS by the OST Commander and enabled on the CCUD S/W Cmd Pnl. In addition, the MF selection on the CCUD must match the DSM MF determined by the Metered RTC application.

- 14. Operator will "Send" the loaded RTCs using the <u>SEND</u> button. Selecting this button sends the series of pre-arranged RTCs to the GCS. At this point, the operator is commanding the vehicle. The application will send the first RTC to the GCS, pause for the selected time interval, send the second RTC to the GCS, and so on, until the total number of listed RTCs is sent. The operator can observe each RTC leaving to the GCS as it disappears off the display. When the series of RTCs has been sent, the application will "Un-arm" itself automatically.
- 15. Operator will observe the Out Counter and Command History (or Command Summary) for successful initiation of application commands. Operator may observe end item response on the SSPTSPwr MSK display described below.
- 16. INCO will collaborate with EGIL on the results and await further direction.
- 17. At completion of Voltage adjust operations, operator will:

Safe the CCUD S/W Cmd Pnl

Have the SSPTS RTCs "safed" via the Commander

Log the total number of Voltage adjustment commands sent and the voltage adjustment observed.

18. <u>TERMINATE</u> Button - This button can be used at any point during the commanding process to halt commanding. Selecting this button will halt all communications between the Metered RTC Application and the GCS, which terminates display updates from the GCS and RTC transits to the GCS. The remaining RTCs will be shown in the list. Time of last command will be shown in the "GMT of Last CMD" field.

### C. SSPTSPwr Display

Selected via <u>Display SSPTS Power</u> button on the Metered RTC Uplink application - Similar to "Add PTU reset," this button will only appear if an SSPTS RTC is selected in the "DSM Select" field. Clicking on the Display SSPTS Power field will launch the SSPTSPwr mskview display. The MSIDs driving this display are owned by EGIL, and INCO use of this display is primarily in support of SSPTS commanding. The following is a brief explanation of the provided telemetry:

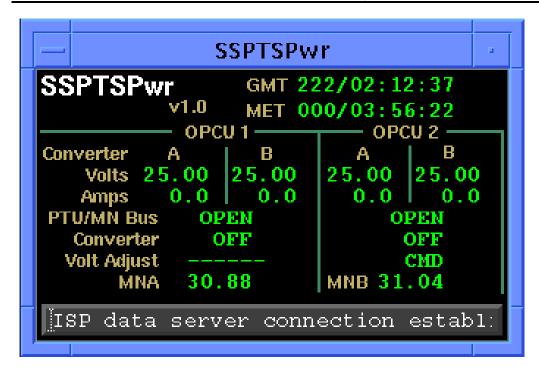


Figure 3.10-2. SSPTSPwr Mskview Display

### 1. GMT (M50Q0027HP)

This GMT, provided by the ISP server, is from the FEP. GMT nominally originates from the Master Timing Unit (MTU) on-board the vehicle but also represents "substitution" time if the original data is missing.

# 2. MET (M50Q00230HP)

This MET, provided by the ISP server, is from the FEP. MET nominally originates from the Master Timing Unit (MTU) on-board the vehicle but also represents "substitution" time if the original data is missing.

# 3. Volts (V76V2407A, V76V2408A, V76V2707A, V76V2708A)

This indicates the output power of the PTU. The power-on default value will be approximately 31.12 Vdc. This is the parameter INCO will change with PTU Voltage adjust commanding. The Power Converters for each OPCU may used singularly or in pairs. In addition, nominal usage is for both OPCU1 and OPCU 2 to be powered and used together; thus, INCO would normally see 2 to 4 sets of active voltages. Note that if the associated ISS RPCs are not closed, these telemetry parameters will default low to 25 VDC. It is normal to see the 25 Vdc until the PTU initialization steps are complete.

## 4. Amps (V76C2405A, V76C2406A, V76C2505A, V76C2506A)

This indicates the converter output amperage. This telemetry will be low (approximately zero) unless the ISS RPCs are closed and the PNL A15 Converter switches are ON.

### 5. PTU/MN Bus (V76X2400E, V76X2500E)

This telemetry indicates the status of the power feed connection of the PTU to Main Bus.

## 6. Converter (V76S2524E, V76S2525E)

This telemetry indicates the switch position on PNL A15. If the on-board switch for OPCU 1 converter is "ON," both converters A and B are powered. The same applies for OPCU 2.

## 7. Volt Adjust (V7652426E, V7652427E)

This telemetry reflects the position of the PTU V-ADJ switches on PNL A15. Each of the 2 switches (PTU 1 V-ADJ, PTU 2 V-ADJ) has 3 positions: CMD, OFF and PNL. The display reads low (blank) unless the CMD or PNL bit is set high. The crew can adjust the PTU voltage manually with this switch in "PNL" position, but INCO will need this switch in "CMD" position to send the voltage adjust commands via the MCC.

# 8. MNA / MNB (V76V0100A, V76V0200A)

This telemetry indicates the voltage on the Main buses. This will be active regardless of PTU status and is not dependent on PTU input. Nominally, the Main Bus output will be maintained by the Fuel Cell and/or the PTUs to a range of 27 - 32Vdc.

**CREW ALERT** 

## **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

### **PURPOSE**

To summarize how the crew alert commands work in relation to other class 3 alerts and to document the procedures for their use.

### **RESTRICTIONS & CONSTRAINTS**

This procedure is only valid in all ops modes of the SM major function. If a crew alert ON command is activated and the crew uses a master alarm reset PBI to turn off the tone, the next software driven alert will drive only a CRT message (no tone and the light stays on) and could easily be missed. Therefore, to guard against this possibility, always include the crew alert OFF command(s) in the multiple stored program command (MSPC) load. Because the tone remains on until reset (i.e., timer is not activated), 90 seconds between the ON and OFF commands is sufficient

#### **GENERAL**

When the crew alerts A and B ON commands are sent, two discretes are set high in both MDM's PF1 (for crew alert A) and PF2 (for crew alert B). One discrete activates the SM alert tone and the other activates the alert light on panel F7. There are several ways to turn off the light and tone.

- A. Crew depresses the ACKNOWLEDGE key on a keyboard. This key is usually used to stop a flashing message line from flashing. However, there is no associated message for crew alert.
- B. Crew depresses the MESSAGE RESET key on a keyboard. This key is usually used to clear a message line.
- C. MCC commands crew alert A (for PF1) and B (for PF2) OFF.

Each of these methods resets both bits in both MDM's.

A fourth option is to reset only the <u>tone</u> by using any of the four master alarm reset PBI's. However, because this reset is a hardware reset to the tone generator circuitry, the two MDM bits are <u>not</u> reset and the SM alert light remains on. Because the bits remain latched, the next (software-driven) SM alert will not result in an aural or visual indication to the crew and could easily be missed; however, they will still get a message. Software-driven SM alerts also activate a timer associated with the tone. When the timer times-out (set by the crew to a maximum of 99 seconds), the MDM tone bits (not the light bits) are reset, and all future tones should work as expected. Crew Alert commands may be sent to any major function that has control of the payload buses. These CMD's should be managed carefully to avoid unnecessarily disturbing crew sleep.

Flight Rule A11-14 provides rationale for the use of the crew alert SPC's. The Pre-Sleep Audio config in the ORB OPS C/L contains a note to the crew for actions to take if a crew alert alarm has timed out.

## **PROCEDURE**

- A. Before crew sleep, select a time approximately halfway through the crew sleep period. The time chosen should allow for an opportunity to clear the MSPC on both the western and eastern Tracking and Data Relay Satellites (TDRS).
- B. Build and uplink the MSPC to time out per step A. The MSPC will contain the following commands.

DSM 4984 CREW ALERT A ON DSM 4986 CREW ALERT B ON (90 seconds later)

DSM 4985 CREW ALERT A OFF DSM 4987 CREW ALERT B OFF

- C. Apprize the Flight Director of the MSPC timeout time in MET.
- D. Clear the MSPC prior to its time out and inform the Flight Director once it is cleared.
- E. After the MSPC has been cleared, DO NOT uplink another. ONLY ONE CREW ALERT PER SLEEP SHIFT IS REQUIRED.
- F. If the SPC buffer must be cleared early, REUPLINK THE SAME CREW ALERT MSPC. The crew alert MSPC should not be built into an MSPC with any other commands so that it can be easily reuplinked.

GENERIC COMMAND SYSTEM: TIME EXECUTE COMMAND: BUILD PROCEDURE

### **CAUTION**

These procedures are governed by FCOH procedure 3.1 and are not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

#### **PURPOSE**

To define a standard set of procedures for building time execute commands (TECs), and maintaining the contents of the onboard TEC storage area (TEC buffer).

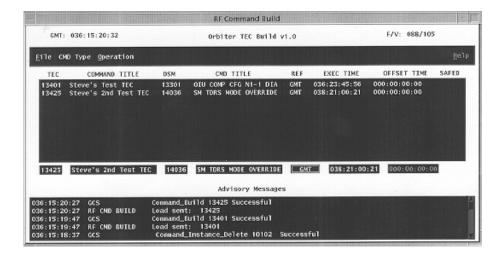
### **RESTRICTIONS & CONSTRAINTS**

These procedures are only valid in ops modes 2 and 4 of the SM major function. There are no special restrictions on execution of these procedures.

#### **GENERAL**

The RF CMD BUILD display is used to create, modify, and delete TECs in the generic command server (GCS). TECs are used to configure the antenna management software in the SM GPC and transfer command data from the SM GPC (using a serial input/output (SIO) MDM channel) either to a PSP or to a payload connected directly to the SIO port when the command's accompanying time of execution expires.

The TEC function is resident only in SM OPS 2 or 4, never in the GNC major function. A TEC can contain command data or antenna management configuration changes for only one function at a time. Several TECs can be chained together to send a set of command data or antenna management configuration changes more simply.



Example of the TEC build display

# **PROCEDURE**

A. To build TEC command loads using RF CMD BUILD Display

SEQ	Initiator	Action	Comments
1	COMM SPT	Call up the RF CMD BUILD display from the INCO GCS DNAV menu and select the TEC option from the Command Types menu	
2	COMM SPT	Enter a valid DSM number (13401 - 13450), along with a title (such as "S-band East Prime - TEC" etc.) The title can be any character string up to 21 characters long	
3	COMM SPT	If the DSM selected is an existing command load in the server, then data will have to be replaced by typing over the existing information	
4	COMM SPT	Enter the command DSM no. to be contained in the TEC. Select the time execution type (GMT/PET1/PET2), then enter an execution time or offset time	The data will be entered in the type in boxes at the bottom of the display
5	COMM SPT	From the Operations menu at the top of the display select the "Submit" option	The TEC will appear in the upper section of the display with any other TECs that have been saved to the GCS
6	COMM SPT	If there was a command already built with the DSM selected, then a box will pop up asking the user to overwrite the existing command load. Press Yes to replace the command in the server	
7	INCO	Verify the command was built correctly by checking the DSM of the command contained in the TEC and the execution time of the TEC	

B. For TEC transmission, use the procedure in SCP 3.1 for two-stage loads. After uplink, verify the correct number of TECs are in the buffer (INCO MANAGEMENT or COMM MGMT display). The onboard command buffers display should show the uplinked TECs and their execution times.

# C. To Save TEC command loads to the workstation

SEQ	Initiator	Action	Comments
1	COMM SPT	Call up the RF CMD BUILD display from the INCO GCS DNAV menu and select the TEC option from the Command Types menu	
2	COMM SPT	Select the TEC to be saved by "double- clicking" on the DSM no. in the middle of the display or enter the data for the TEC in the type in boxes at the bottom of the display	
3	COMM SPT	Select the "Save" option from the File menu	
4	COMM SPT	Select the directory to save the TEC into from the file selection display or use the default directory displayed	
5	COMM SPT	Type in the filename for the TEC and press the OK button to save the TEC to a file on the workstation	

CONTINGENCY RTC'S FOR EECOM/THERMAL

## **CAUTION**

9/1/2004: REV G

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

#### **PURPOSE**

In the event of a switch failure and the SM or BFS fails, EECOM may request the uplink of certain RTC's through the payload buses. These RTC's control  $H_2O$  loop pumps, freon loop pumps, ammonia boiler, and the flash evaporator system (FES).

### **RESTRICTIONS & CONSTRAINTS**

These procedures are only valid in all ops modes of the GNC, SM and the BFS major functions. Coordination with EECOM is required. The crew must have panel switches in the GPC position.

#### **GENERAL**

The list of the RTC's that are loaded and **safed** in the Command Server are as follows:

Safe group number	Title	DSM
3	H2O 1 PMP A ON	5411
	H2O 1 PMP A OFF	5412
	H2O 1 PMP B ON	5413
	H2O 1 PMP B OFF	5414
	H2O 2 PMP ON	5415
	H2O 2 PMP OFF	5416
3	FES PRI B ON	9100
	FES PRI B OFF	9101
	FES SEC ON	9102
	FES SEC OFF	9103
4	FES PRI A ON	9104
	FES PRI A OFF	9105
	NH3 PRI A/B ON GPC A	9106
	NH3 PRI A/B OFF GPC A	9107
	NH3 PRI A/B ON GPC B	9108
	NH3 PRI A/B OFF GPC B	9109
	NH3 PRI A/B ON GPC C	9110
	NH3 PRI A/B OFF GPC C	9111
*	FCL 1 PMP B ON	9112
	FCL 1 PMP B OFF	9113
	FCL 2 PMP B ON	9114
	FCL 2 PMP B OFF	9115

<sup>\*</sup> These commands are safed individually, not in a group.

Figure 3.13-1. EECOM RTC 's

# 9/1/2004: REV G

### **PROCEDURE**

- A. EECOM contacts INCO on the INCO loop with the request for a command uplink. EECOM will provide the following information:
  - 1. DSM number
  - 2. Major Mode (most likely GNC)
  - 3. Verification of Flight Director permission to uplink
- B. INCO informs COMMAND, on the COMMAND loop, to enable the group and/or unsafe the individual RTC per step A and the RTC chart in figure 3.13-1.
- C. INCO transmits the RTC's to the requested major mode.
- D. INCO confirms with EECOM that the command(s) have been transmitted successfully.
- E. INCO resafes/disables the command/group, once EECOM has verified that the commands were executed to their satisfaction.

GENERIC COMMAND SYSTEM: SPARE RTC BUILD

### **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

### **PURPOSE**

The following outline describes the use of the RF CMD BUILD display to build spare (real-time buildable) RTCs.

### **RESTRICTIONS & CONSTRAINTS**

These procedures are valid in all ops modes of the GNC, SM and BFS major functions. There are no special restrictions on execution of these procedures.

### **GENERAL**

The RF CMD BUILD display is used to create, modify and delete spare RTCs in the Generic Command Server (GCS). Spare RTCs are used when a real-time command to some orbiter or payload system has not been built previously for the flight. This option is very seldom used (other than for SSR) and must be used with great care because any RTC can be built with this tool. Use SCP 3.22 to build positional RTC's for SSR.

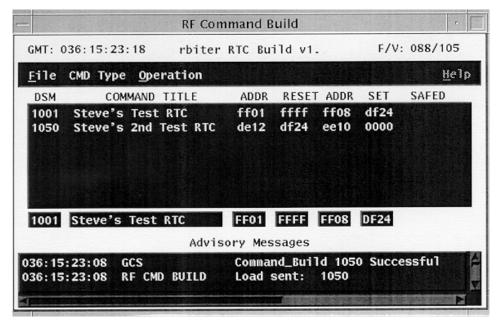


Figure 3.14-1. Example of RTC Build display

# **PROCEDURE**

A. To build a spare RTC using the RF CMD BUILD display (see Figure 3.14-1)

SEQ	Initiator	Action	Comments
1	COMM SPT	Call up the RF CMD BUILD display from the INCO GCS DNAV menu and select the RTC option from the Command Types menu	See SCP 7.43 for details on the description of the RF CMD BUILD display
2	COMM SPT	Enter a valid DSM number (1000-1099), along with a title (such as "Spare RTC for Payloads," etc.). The title can be any character string up to 21 characters long	
3	COMM SPT	If the DSM selected is an existing command load in the server, data will have to be replaced by typing over the existing information	
4	COMM SPT	Enter the MDM address, the reset bit mask, the MDM address, and the set bit mask in HEX characters	The display is smart enough to prevent a bad MDM address from being entered but any reset and set bit masks are excepted
5	COMM SPT	From the Operations menu at the top of the display, select the "Submit" option	The RTC will appear in the upper section of the display with any other RTCs that have been saved to the GCS
6	COMM SPT	If there was a command already built with the DSM selected, a box will pop up asking the user to overwrite the existing command load. Press Yes to replace the command in the server	
7	INCO	Verify the command was built correctly by checking the command data words of the RTC	

Note: ONLY approved Mission Action Request (MARS) or MAST II verified data may be entered for the reset and set bit mask HEX characters.

GENERIC COMMAND SYSTEM: MSPC/SPC/MRTC BUILD

## **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed pre-mission without review and approval at the FOIG.

### **PURPOSE**

The following outline describes the use of the RF CMD BUILD display to build, modify, and delete MRTCs, SPCs, and MSPCs in the command server. It also illustrates the use of the display to input PET 1 and 2 reference times.

## COMMAND RESTRICTIONS/CONSTRAINTS

MSPCs and SPCs are used to store RTCs onboard in the SM or BFS major functions for execution at some later time, valid in OPS 1, 2, 3, and 6. MRTCs are used to contain several RTCs that will be executed onboard as a group, instead of individually uplinking the RTCs, valid in any major mode.

### **PROCEDURE**

A. To set the Phased Elapsed Time (PET) 1 and 2 with the RF CMD BUILD display (see Figure 3-15-1)

SEQ	Initiator	Action	Comments
1	COMM SPT	Call up the RF CMD BUILD display from the INCO GCS DNAV menu and select the PET SET option from the Operations menu	See SCP 7.43 for details on the description of the RF CMD BUILD display
2	COMM SPT	Enter a valid time reference for PET 1, PET 2, or both in GMT. The format should be DDD:HH:MM:SS	Generally, INCO only uses PET 1 and that is set to the expected lift-off time
3	COMM SPT	Press the "Submit" button on the display	Messages will be displayed in the bottom section of the main display, but there is no indica- tion on the PET SET display that the times have been accepted

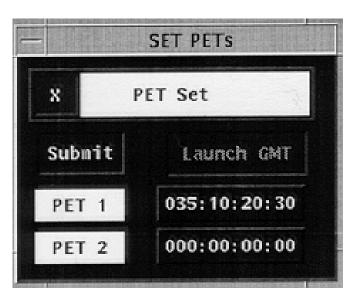
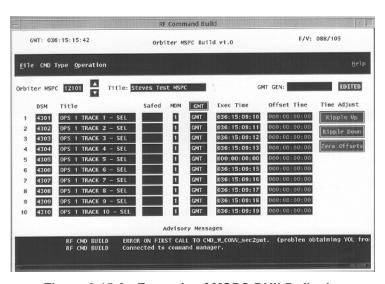


Figure 3.15-1. Example of the SET PETs display

# B. To build MSPC command loads using RF CMD BUILD Display (see Figure 3.15-2)

SEQ	Initiator	Action	Comments
1	COMM SPT	Call up the RF CMD BUILD display from the INCO GCS DNAV menu and select the MSPC option from the Command Types menu	
2	COMM SPT	Enter a valid DSM number (12101-12150), along with a title (such as Ku Forward or H/O to DGS Rev 24). The title can be any character string up to 21 characters long	The Edited light will turn on with a green background
3	COMM SPT	If the DSM selected is an existing command load in the server, the Clear option from the File menu must be used to clear the contents of the command before continuing. Repeat step 2	
4	COMM SPT	Enter the RTC DSM numbers of the commands to be contained in the MSPC	The titles of the RTCs will appear in the title box next to the DSM numbers
5	COMM SPT	Enter the MDM number for each RTC. Default is 1	
6	COMM SPT	Select the time reference to enter GMT, PET1, or PET2 by pressing the button at the top of the time reference column	All RTCs in the MSPC will use the same time reference. If PET1 or PET2 is used, the Offset time column will be active for entering the times, but if GMT is used, the Execution column will be active
7	COMM SPT	Once the contents of the MSPC are completed, press the Submit button from the Operations menu	Messages appear at the bottom of the display to tell the user the command server has accepted the command. The green Edited light will disappear
8	COMM SPT	If there was a MSPC already built with the DSM selected, a box will pop up asking the user to overwrite the existing command load. Press Yes to replace the command in the server	
9	INCO	Call up the MSPC part of the RF CMD BUILD display to verify that the MSPC was built by COMM SPT	



**SCP 3.15** 

Figure 3.15-2. Example of MSPC BUILD display

To build an SPC from the RF CMD BUILD display (see Figure 3.15-3) C.

SEQ	Initiator	Action	Comments
1	COMM SPT	Call up the RF CMD BUILD display from the INCO GCS DNAV menu and select the SPC option from the Command Types menu	
2	COMM SPT	Enter a valid DSM number (10101-12050), and a title (such as FM 1 ON -SPC). The title can be any character string up to 21 characters long	
3	COMM SPT	If the DSM selected is an existing command load in the server, data will have to be replaced by typing over the existing information	
4	COMM SPT	Enter the command to be contained in the SPC. Select the time reference type (GMT/PET1/PET2), enter an execution time or offset time	The data will be entered in the type in boxes at the bottom of the display
5	COMM SPT	From the Operations menu at the top of the display, select the Submit option	The SPC will appear in the upper section of the display with any other SPCs that have been saved to the GCS
6	COMM SPT	If there was a command already built with the DSM selected, a box will pop up asking the user to overwrite the existing command load. Press Yes to replace the command in the server	

SEQ	Initiator	Action	Comments
7	INCO	Verify that the command was built correctly by checking the DSM of the command contained in the SPC and the execution time of the SPC	

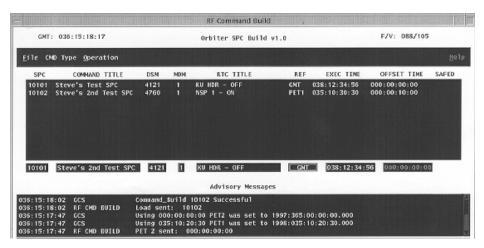


Figure 3.15-3. Example of the SPC BUILD display

D. To build an MRTC from the RF CMD BUILD display (see Figure 3. 15-4)

SEQ	Initiator	Action	Comments
1	COMM SPT	Call up the RF CMD BUILD display from the INCO GCS DNAV menu and select the MRTC option from the Command Types menu	
2	COMM SPT	Enter a valid DSM number (1500 - 1550), along with a title (such as Ku Forward or H/O to DGS Rev 24). The title can be any character string up to 21 characters long	
3	COMM SPT	If the DSM selected is an existing command load in the server, the Clear option from the File menu must be used to clear the contents of the command before continuing. Repeat step 2	The Edited light will turn on with a green background
4	COMM SPT	Enter the RTC DSM numbers of the commands to be contained in the MRTC	The titles of the RTCs will appear in the title box next to the DSM numbers

SEQ	Initiator	Action	Comments
5	COMM SPT	Once the contents of the MRTC are completed, press the Submit button from the Operations menu	Messages will appear at the bottom of the display to tell the user that the command server has accepted the command. The green Edited light will disappear
6	COMM SPT	If there was an MRTC already built with the DSM selected, a box will pop up asking the user to overwrite the existing command load. Press Yes to replace the command in the server	
7	INCO	Call up the MRTC part of the RF CMD BUILD display to verify that the MRTC was built by COMM SPT	

**GEN CMD SYS: MSPC/MRTC** 

**SCP 3.15** 

Note: MRTCs can be built that contain safed RTCs. If this is done, both the RTC and the MRTC will have to be unsafed before the MRTC can be uplinked.



Figure 3.15-4. Example of the MRTC BUILD display

# E. To modify an MPS/SPC/MRTC in the command server

SEQ	Initiator	Action	Comments
1	COMM SPT	Call up the RF CMD BUILD display from the INCO GCS DNAV menu and select the command type of the command to be modified from the Command Types menu	
2	COMM SPT	Enter the DSM number	The command will appear on the display
3	COMM SPT	Edit the command data as necessary: RTC DSMs, MDM selections, or times	
4	COMM SPT	Press the Submit button from the Operations menu, then press the Yes button when the message box asks if you want to overwrite the command that is already in the server	The green Edited light will disappear
5	INCO	INCO should verify all changes to MSPCs, SPCs, and MRTCs by viewing the commands on the RF CMD BUILD display	

Note: If an RTC DSM number is changed in an MSPC, be careful to enter a new offset or execution time because the previous time will be "zeroed out" when a new RTC is selected for that row.

# F. To delete an MSPC/SPC/MRTC from the command server

SEQ	Initiator	Action	Comments
1	COMM SPT	Call up the RF CMD BUILD display from the INCO GCS DNAV menu and select the command type of the command to be modified from the Command Types menu	
2	COMM SPT	Enter the DSM number	The command will appear on the display
3	COMM SPT	Press the Delete button from the Operations menu	The Operations menu can be "torn off" and put to the side, allowing the operator to delete multiple commands by pressing the Delete button as the commands appear on the display

# G. To save commands to a workstation file

SEQ	Initiator	Action	Comments
1	COMM SPT	Call up the RF CMD BUILD display from the INCO GCS DNAV menu and select the command type of the command to be modified from the Command Types menu	
2	COMM SPT	Enter all the command data to be saved to a file or enter the DSM of a command that already is in the command server	
3	COMM SPT	From the Files menu select the Save option	Another display will pop up with a list of currently saved files of that command type
4	COMM SPT	Enter a filename for the new workstation file. The filename should not contain any blank characters. The structure of the filename should be as follows:  CMD TITLE - CMD TYPE  Example: Ku_FWDMSPC.	The file will be saved to the workstation for use next time

# H. To recall command files from the workstation

SEQ	Initiator	Action	Comments
1	COMM SPT	Call up the RF CMD BUILD display from the INCO GCS DNAV menu and select the command type of the command to be modified from the Command Types menu	
2	COMM SPT	From the Files menu, select the Recall option	Another display will pop up with a list of currently saved files of that command type
3	COMM SPT	Select the filename to be loaded into the display	If the file contains data that will not work on the command type displayed, a message will be displayed at the bottom of the screen
4	COMM SPT	Follow the procedure for modifying the command data	

TABLE MAINTENANCE BLOCK UPLINK (TMBU) PROCEDURE

#### CAUTION

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

### **PURPOSE**

To define a standard set of procedures for performing updates/changes to the Backup Flight System (BFS) and primary Systems Management (SM) Fault Detection and Annunciation (FDA) limits and constants and special processing constants utilizing the Table Maintenance Block Uplink (TMBU) application in the Generic Command System (GCS).

#### COMMAND RESTRICTIONS/CONSTRAINTS

These procedures are only valid in ops modes 1, 2, 3, and 6 of the SM and the BFS major functions. Do not attempt to uplink a TMBU load while crew has SPEC 60 called up or else the TMBU will be rejected and the TMBU Reject error will be flagged onboard.

#### **GENERAL**

Updates or changes to the SM FDA limits, constants, and special processing constants are generally accomplished by ground command. It is the responsibility of individual flight controllers to build their own TMBUs, load them into the server, obtain approval from the Flight Director to uplink them, and then coordinate the uplink with Instrumentation on the INST COORD loop. INCO/COMM SUPPORT is responsible for building and initiating changes that affect communication system parameters or communication software programs/sequences. TMBU loads are supported in both the BFS and primary SM software. A workstation program titled TMBU is provided by DPS to help build and load TMBUs. For building TMBUs during a flight, refer to FCOH (prebuilt TMBUs do not apply). The following procedure covers the general actions that are involved in building a TMBU and loading it into the command server using the TMBU workstation program.

## **PROCEDURE**

A. Table maintenance block uplink - BUILD from TMBU program (SM or BFS)

The following types of information are needed when using the TMBU program:

- 1. The Measurement Stimulation Identification Number (MSID) associated with the value/limit to change.
  - 2. The new value for the MSID: The new value input is a decimal number in Engineering Units (EUs) that defines the value of the updated parameter. The initial value for parameters is found in the Reference Data book and in Table 3.16-1.

SCP 3.16

SEQ	Initiator	Action	Comments
1	COMM SPT or INST	Call up the TMBU display from MASTER DNAV, GLOBAL APPS/COMMAND SERVER/TMBU	
2	COMM SPT or INST	Enter a valid DSM number (12346-12360) with a title (such as NODE Protect Box). The title can be any character string up to 21 characters long	INCO has agreed to only use DSMs 12346 through 12360. The agreement is documented in the FCOH
3	COMM SPT or INST	Type the MSID into the MSID type-in box in the middle of the display, then press the return key	Another display will appear on the screen. MSID is used instead of parameter ID for this display
4	COMM SPT or INST	The popup display may have several options. See the next several substeps for each possible option. Some of the options may be input at the same time so that the TMBU will contain several different changes to the same MSID	
5		Enable/Inhibit Fault Messages - Select the ENA or INH button located in the lower right-hand side of the popup display, then repress the OK button. Example: Antenna Message inhibit	
6		Lower/Upper limit changes - Type in the new upper or lower limit for the set to be changed, then press the OK button. Both the upper and lower limits can be set in the same command load. Example: PA 1 temp change	
7		Constant change - Type in the new constant value for the MSID, then press the OK button. Example: Ku-band beta angle change	
8	COMM SPT or INST	From the Command menu, select the Send option. If the command DSM number is already in the command server, a display asking if the current command should be overwritten by the new command pops up	
9	COMM SPT or INST	From the Command menu at the top of the display, select the Verify option	
10	COMM SPT or INST	To view the command in the server, use the up or down arrows next to the DSM number box at the middle of the display	

Monitor the SM VPs on the inst management or inco\_management display to determine whether SPEC 60 is active on a CRT or is underneath another display or SPEC on a CRT. Slot 4 of the SM VPs contains the parameter that indicates whether SPEC 60 is active or not. If the value of that first parameter is 2XXX, 3XXX, AXXX, or BXXX, where X is any hex value, then SPEC 60 is active or buried on some CRT. If there is any question about the VP, contact DPS SUPT on the SSR1 loop.

# B. Saving the command to a file on the workstation

While the command is visible in the upper "build" part of the display, select the file Save option from the File menu. The file will be created with a name that includes the DSM number. If there is already a file with the DSM number, the display asks if the filename should be the DSM number with an extension.

Example: 12345.01

# C. TMBU - Special process for SM antenna management

The primary SM software provides a special TMBU update capability to the Antenna Management (AM) software. In addition to update capability of the X, Y, and Z position data for each of the 16 sites in the STDN SITE table, the STDN SITE ID may be changed. This change is accomplished by treating each site ID as a constant/character string and is updated as follows in Figure 3.16-1:

Change format for - STDN SITE "N" ID

Bit no.	1 2 3 4 5	6 7 8 9 10	11 12 13 14 15
Value	Char. 1 code	Char. 2 code	Char. 3 code

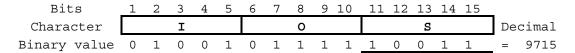
### Character code is defined as follows:

<u>Character</u>	Code	<u>Character</u>	<u>Code</u>	<u>Character</u>	<u>Code</u>
Α	00001	J	01010	S	10011
В	00010	K	01011	Т	10100
С	00011	L	01100	U	10101
D	00100	M	01101	V	10110
E	00101	N	01110	W	10111
F	00110	0	01111	X	11000
G	00111	Р	10000	Υ	11001
Н	01000	Q	10001	Z	11010
I	01001	R	10010		

Note: Codes 00000 and 11011-11111 are defined as blank.

Note:

The 16-bit word above is converted to decimal for input.



Example: MSID V98H5000C - STDN SITE 1 ADS ID (IOS)

Figure 3.16-1. Change format for STDN SITE "N" ID

Table 3.16-1 lists the PASS parameter names, MSIDs, and I-loaded values.

Site configuration values are given Table 3.16-2.

Table 3.16-1. PASS parameter name, MSID, and I-loaded values reference table

Parameter name	MSID	Case	UDS	Constant	Lower limit	Upper limit	Noise filter	Msg status
Ku-BD RF Protection Zone 1 Roll 1	V92H0169C			145°				
Ku-BD RF Protection Zone 1 Roll 2	V92H0170C			150°				
Ku-BD RF Protection Zone 1 Pitch 1	V92H0171C			-60°				
Ku-BD RF Protection Zone 1 Pitch 2	V92H0172C			-55°				
Ku-BD RF Protection Zone 2 Roll 1	V92H0887C			150°				
Ku-BD RF Protection Zone 2 Roll 2	V92H0888C			155°				
Ku-BD RF Protection Zone 2 Pitch 1	V92H0889C			-60°				
Ku-BD RF Protection Zone 2 Pitch 2	V92H0890C			-55°				
Ku-BD RF Protection Zone 3 Roll 1	V92H0891C			145°				
Ku-BD RF Protection Zone 3 Roll 2	V92H0892C			150°				
Ku-BD RF Protection Zone 3 Pitch 1	V92H0893C			-65°				
Ku-BD RF Protection Zone 3 Pitch 2	V92H0894C			-60°				
Ku-BD RF Protection Zone 4 Roll 1	V92H0895C			150°				
Ku-BD RF Protection Zone 4 Roll 2	V92H0896C			155°				
Ku-BD RF Protection Zone 4 Pitch 1	V92H0897C			-65°				
Ku-BD RF Protection Zone 4 Pitch 2	V92H0898C			-60°				
S-Band Quad Fwd Beam Select Limit	V92U0960C			0.12187				
S-Band Quad Aft Beam Select Limit	V92U0961C			0.052336				
Ku GPC Acquire Delay Time	V92W1010C			20.0 sec				
Attitude Compensation Delay Time	V92W1013C			0.2 sec				
TDRS Minimum Elevation	V92W1016C			0.0 °				
Site Minimum Elevation	V92W1005C			0.0 °				
Auto Ku To S H/O Minimum AGC	V93V1017C			1.04 VDC				
Auto S-Band to Ku-Band H/O Time	V93W1018C			15 sec				
Auto Ku-Band to S-Band H/O Time	V93W1019C			5 sec				
Ku Beta Angle	V98H5064C			21°				
Ku-Band XMTR Temp	V74T2497A	1			OSL	OSH	15	Enabled
Ku-Band A-Gimbal Temp	V74T2965A	1			OSL OSL	171° OSH	15	Enabled
Ku-Band A-Gimbai Temp	V7412905A	2			OSL	150	15	Enabled
Ku-Band Gyro Temp	V74T2967A	1			OSL	OSH	15	Enabled
- 1 2	1111200771	2			OSL	155°		
Ku-Band B-Gimbal Temp	V74T2969A	1			OSL	OSH	15	Enabled
		2			OSL	166°	-	
PA 1 Output Low	V74E4512A				60 w	OSH	15	Enabled
PA 2 Output Low	V74E4513A				60 w	OSH	15	Enabled
PWR AMP 1 TEMP	V74T4514A				OSL OSL	230 230	15	Enabled
PWR AMP 2 TEMP GCIL ACTIVE	V74T4515A V74X5052E		0		USL	230	15 15	Enabled Enabled

Parameter name	MSID	Case	UDS	Constant	Lower limit	Upper limit	Noise filter	Msg status
QUAD ANT VERIF	V92X1049X		1				8	Enabled
OIU Temp limit (PF1 MDM)	P50T4000V				OSL	212°	10	Enabled
OIU Temp Limit (PF 2 MDM)	P50T4001V				OSL	212°	10	Enabled
OIU CONV ERR	P50X4288E						10	Enabled
OIU AD 1 NO LK	P50X4440E	1	2				10	Enabled
		2	1					
OIU AD 2 NO LK	P50X4450E	1	2				10	Enabled
		2	1					
OIU AD 3 NO LK	P50X4460E	1	2				10	Enabled
		2	1					
OIU AD 4 NO LK	P50X4470E	1	2				10	Enabled
		2	1					

Case - Some parameters have more than one possible level of failure detection. These are noted by more than one case.

Table 3.16-2. Site configuration values

Parameter name		SM		BFS			
	Туре	MSID	Initial value	Type	MSID	Initial value	
STDN Site 1 ID	17	V98H5000C	13612 (MIL)	253	N/A	(MIL)	
STDN Site 1 X LOC	17	V98H5001C	2976090 ft	253	2	2976090	
STDN Site 1 Y LOC	17	V98H5002C	-18160085 ft	253	4	-18160085	
STDN Site 1 Z LOC	17	V98H5003C	9928196 ft	253	6	9928196	
STDN Site 2 ID	17	V98H5004C	14611 (NHS)	253	N/A	(PDL)	
STDN Site 2 X LOC.	17	V98H5005C	4834982 ft ´	253	8	2890910	
STDN Site 2 Y LOC.	17	V98H5006C	-14560344 ft	253	10	-18074807	
STDN Site 2 Z LOC.	17	V98H5007C	14183518 ft	253	12	10106183	
STDN Site 3 ID	17	V98H5008C	16019 (OTS)	253	N/A	(DFR)	
STDN Site 3 X LOC.	17	V98H5009C	13161595 ft	253	14	-8032187	
STDN Site 3 Y LOC.	17	V98H5010C	-205622 ft	253	16	-15178240	
STDN Site 3 Z LOC.	17	V98H5011C	16212284 ft	253	18	11921592	
STDN Site 4 ID	17	V98H5012C	4339 (DGS)	253	N/A	(WLP)	
STDN Site 4 X LOC.	17	V98H5013C	6287048 ft	253	20	4144984	
STDN Site 4 Y LOC.	17	V98H5014C	19783338 ft	253	22	-15998608	
STDN Site 4 Z LOC	17	V98H5015C	-2630439 ft	253	24	12792264	
STDN Site 5 ID	17	V98H5016C	7827 <b>(GTS)</b>	253	N/A	(JDI)	
STDN Site 5 X LOC.	17	V98H5017C	-16633654 ft	253	26	325621	
STDN Site 5 Y LOC.	17	V98H5018C	11709733 ft	253	28	-18383145	
STDN Site 5 Z LOC.	17	V98H5019C	4894214 ft	253	30	9437432	
STDN Site 6 ID	17	V98H5020C	8851 (HTS)	253	N/A	(CTS)	
STDN Site 6 X LOC.	17	V98H5021C	-18085622 ft	253	32	-4097347	
STDN Site 6 Y LOC.	17	V98H5022C	-7210938 ft	253	34	-15810853	
STDN Site 6 Z LOC.	17	V98H5023C	7645063 ft	253	36	13047085	
STDN Site 7 ID	17	V98H5024C	23187 <b>(VTS)</b>	253	N/A	(GTS)	
STDN Site 7 X LOC.	17	V98H5025C	-8729631 ft	253	38	-16633654	
STDN Site 7 Y LOC.	17	V98H5026C	-14816835 ft	253	40	11709733	
STDN Site 7 Z LOC.	17	V98H5027C	11883737 ft	253	42	4894214	
STDN Site 8 ID	17	V98H5028C	4306 ( <b>DFR</b> )	253	N/A	(HTS)	
STDN Site 8 X LOC	17	V98H5029C	-8032187 ft	253	44	-18085622	
STDN Site 8 Y LOC.	17	V98H5030C	-15178240 ft	253	46	-7210938	
STDN Site 8 Z LOC.	17	V98H5031C	11921592 ft	253	48	7645063	
STDN Site 9 ID	17	V98H5032C	3731 <b>(CTS)</b>	253	N/A	(VTS)	
STDN Site 9 X LOC.	17	V98H5033C	-4097347 ft	253	50	-8729631	
STDN Site 9 Y LOC.	17	V98H5034C	-15810853 ft	253	52	-14816835	
STDN Site 9 Z LOC.	17	V98H5035C	13047085 ft	253	54	11883737	
STDN Site 10 ID	17	V98H5036C	10851 <b>(JSC)</b>	253	N/A	(OTS)	
STDN Site 10 ID	17	V98H5037C	1608712 ft	253	56	13161595	
STDN Site 10 X LOC.	17	V98H5038C	-18144482 ft	253	58	-205622	
STDN Site 10 T LOC.	17	V98H5039C	10264751ft	253	60	16212284	
STDN Site 10 2 LOC.	17	V98H5040C	13348 <b>(MAD)</b>	253	N/A	(DGS)	
STDN Site 11 ID	17	V98H5041C	15909274 ft	253	62	6287048	
STDN Site 11 X LOC.	17	V98H5042C	-1182650 ft	253	64	19783338	
STDN Site 11 7 LOC.	17	V98H5043C	13500655 ft	253	66	-2630439	
STDN Site 11 Z LOC.	17			253 253	N/A		
STDN Site 12 ID STDN Site 12 X LOC.	17	V98H5044C V98H5045C	7320 <b>(GDX)</b> -7725536 ft	253 253	1N/A 68	(NHS) 4834982	

UDS - Undesirable state. OSL - Offscale low.

OSH - Offscale high.

Parameter name		SM			BFS	
	Type	MSID	Initial value	Type	MSID	Initial value
STDN Site 12 Y LOC.	17	V98H5046C	-15245317 ft	253	70	-14560344
STDN Site 12 Z LOC.	17	V98H5047C	12038785 ft	253	72	14183518
STDN Site 13 ID	17	V98H5048C	3118 (CAN)	253	N/A	(MAD)
STDN Site 13 X LOC.	17	V98H5049C	-14635284 ft	253	74	15909274
STDN Site 13 Y LOC.	17	V98H5050C	8799650 ft	253	76	-1182650
STDN Site 13 Z LOC.	17	V98H5051C	-12057073 ft	253	78	13500655
STDN Site 14 ID	17	V98H5052C	23952 (WLP)	253	N/A	(GDX)
STDN Site 14 X LOC	17	V98H5053C	4144984 ft	253	80	-7725536
STDN Site 14 Y LOC	17	V98H5054C	-15998608 ft	253	82	-15245317
STDN Site 14 Z LOC	17	V98H5055C	12792264 ft	253	84	12038785
STDN Site 15 ID	17	V98H5056C	0 (blank)	253		(CAN)
STDN Site 15 X LOC	17	V98H5057C	2976090 ft	253	86	-14635284
STDN Site 15 Y LOC	17	V98H5058C	-18160085 ft	253	88	8799650
STDN Site 15 Z LOC	17	V98H5059C	9928196 ft	253	90	-12057073
STDN Site 16 ID	17	V98H5060C	0 <b>(blank)</b>	253		(JSC)
STDN Site 16 X LOC	17	V98H5061C	2976090 ft	253	92	1608712
STDN Site 16 Y LOC	17	V98H5062C	-18160085 ft	253	94	-18144482
STDN Site 16 Z LOC	17	V98H5063C	9928196 ft	253	96	10264751
STDN_INHIBIT (OI 29)			_	253	V96U7799C	0110 0000 00
<u> </u>						0000
STDN_INHIBIT (OI 30)				253	V96U7799C	1000 1111 100
						1111

## TMBU VERIFICATION

The TMBU load is a two-stage command load which uplinks a maximum of 10 table maintenance data set changes. Each data set is composed of a type, a parameter ID, and the desired new value. Figure 3.16-2 shows the GCS TMBU application window. The data that are actually uplinked are in the verification window in the lower box of the TMBU form. The data set type is an 8-bit integer field, the parameter ID is a 24-bit integer field, and the new value is a 64-bit double-precision floating-point field. Each data set, therefore, is six 16-bit words.

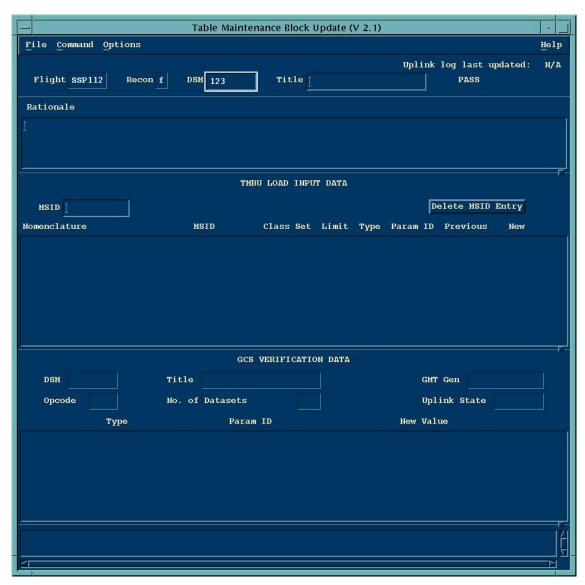


Figure 3.16-2. Table Maintenance Block Update application

A TMBU load can be sent to the PASS or BFS, but the software designs are different and, consequently, the loads are different.

## PASS TMBU VERIFICATION

# A. Data set type

The data set type is a two-digit decimal number that defines the update as a constant, an enable/inhibit, a noise filter, or one of eight FDA limit changes (Table 3.16-3).

Table 3.16-3. PASS data set types

Parameter	Class	Limit	Type code
Alert limit set 1	3*	Low High	02 03
Alert limit set 2	3*	Low High	04 05
Alert limit set 3	3*	Low High	06 07
Alert noise filter	3*		08
Alert enable	3*		09
Alert inhibit	3*		10
Backup C&W limit	2	Low High	11 12
BU C&W noise filter	2		13
BU C&W enable	2		14
BU C&W inhibit	2		15
Constant	N/A	Constant	17

<sup>\*</sup>Can also have class 0 or 4 parameters.

## B. Parameter ID

In SM OPS 2, the parameter ID is formed from the MSID (MML number) by converting the first alphabetic field to a one-digit decimal number (see Table 3.16-4) and dropping subsequent alphabetic fields.

Example: V45C0100A = 0450100.

Table 3.16-4. PASS parameter ID conversion

V	0	Orbiter vehicle
Α	1	Ground test article
В	2	SRB
E	3	SSME
F	4	FSE
G	5	GSE
Р	6	Payload
Т	7	ET
U	8	SSUS (IUS)
L	9	Spacelab

### C. New value

The new value is the new desired value of the limit or constant specified. This value must not exceed the software range of that parameter as specified by the calculated off-scale high and low values. PASS parameters with first order (linear) positively sloped cal curves are uplinked in EUs and stored in PCM counts. Nonlinear or negatively sloped cal curve parameters and constants are uplinked and stored in EUs.

Enable/inhibits require a value of 1.0 be entered for the new value. All other dataset types use the desired value specified on the TMBU form.

The calibration curve for each transducer reflects the relationship between the physical measurement (temp, pressure) and the voltage provided to the MDM by the signal conditioner. The MDM generates an integer called PCM count that corresponds to an analog measurement. The conversion of PCM to EU is given by the following equation, where  $A_0$ ,  $A_1$ ,  $A_2$ , and  $A_3$  are the coefficients of the cal curve. Usually, this equation is no more than third order.

$$EU = A_0 + A_1 (PCM) + A_2 (PCM)^2 + A_3 (PCM)^3$$

The cal curve for each transducer and the associated parameters is located in the SM/PM Database Information Listing (DBIL).

### BFS TMBU

### A. Dataset type

The dataset type indicates in which of seven tables the value of interest is located (see Table 3.16-5).

Data set type	BFS table		
255	FDA high limits		
254	FDA low limits		
253	SM and special processes constants		
252	Sequencing constants		
251	Payload FDA high-limit set		
250	Payload FDA low-limit set		
249	Payload constant values		
248	Invalid		

Table 3.16-5. BFS data set types

# B. Parameter ID

The parameter ID for a BFS parameter is a decimal number that represents the offset (index) into the appropriate table (array) of limit, constant, or discrete values. The parameter type (integer, scalar, etc.) determines the format of its ID, based upon how many half-words are required to store its limit value in the array. See Table 3.16-6 for these definitions. Specifically, a parameter that occupies one 16-bit half-word has an ID created by decimally adding the array offset to 1114112 (1114112 decimal is equivalent to 110000 hex). The parameter type is apparent from the 11 in the left two places (11XXXX), where XXXX is the array offset. Parameters that occupy a full word (32-bit floating point) are represented by an ID that is the direct array offset (since the offset is implicitly added to 0000000, which can be thought of as the decimal equivalent to 00XXXX hex).

Table 3.16-6. BFS parameter ID

Parameter type	No. half-words for array data	ID hex format	ID decimal format
Single-precision integers	1	110000	1114112 + offset
Double-precision integers	2	000000	Offset
Single-precision scalars	2	000000	Offset
Double-precision scalars	4	000000	Offset
Bit string variables	1 or 2	110000 or 000000	(Either method)
Boolean (1 bit)	1	110000	1114112 + offset

### C. New value

- 1. Discretes (1 or 0) are stored as 16-bit integer 1 or 0 value and may be entered into the uplink system as 1 or 0.
- 2. Analog FDA limits (non-payload) are stored in PCM \* 64 format. The GPC left-justifies the 10-bit parameter (9 bits plus sign) in a 16-bit word. This shift-left is accomplished by multiplying the PCM value by 64. Since BFS FDA processing of integers directly converts the uplink double-precision floating-point value to the integer format, the uplinked value must be multiplied by 64 before uplink.

FDA parameters are received from an MDM as 10-bit binary numbers that are left-justified within a 16-bit word. In order to save GPC processing, the values are not right-justified; i.e., divided by 64. Therefore, ground-initiated changes have to be uplinked as PCM x 64.

The following formula, derived from the cal curve equation, is used for linear analog parameters to convert the desired EU value to PCM counts:

$$PCM = (Desired value - A_0)$$

$$A_1 \times 64$$

The  $A_1$  coefficient must also be multiplied by 64. The value of  $A_1$  (which is the value that is listed on the fiche) is predivided by 64. When BFS displays a parameter on a CRT, the PCM counts must be converted to EU. Since PCM is stored as PCM x 64, predivision of the  $A_1$  coefficients has the effect of dividing PCM by 64. Therefore, the PCM count is adjusted to the correct value without an additional division operation.

This PCM value must be rounded to a whole PCM count before multiplying by 64. This ensures that the remaining 6 bits (least significant) are all zero. The rule for rounding is for an upper limit, round down to the next integer; for a lower limit, round up to the next integer.

Linear analog parameters are set Off-Scale High (OSH) by using OSH = +32,704 PCM counts or Off-Scale Low (OSL) by using OSL = -32,768 PCM counts (see Table 3.16-7).

SHUTTLE OPS CMD SYS: TMBU INCO/COMM/JSC-12829 3/31/2006: REV G, PCN 3 SCP 3.16

Sign bit OSH = +32.704(Stored PCM \*64) Analog **FDA** X = 0 = POSSHL 6 bits (Linear and Sign bit constants) OSL = -32,768(Stored PCM \* 64) X = 1 = NEGSHL 6 bits Sign bit OSH = +511(Stored PCM)  $0 \ 0 \ 0 \ 0 \ 0 \ X$ PYLD -APP-FUNC \* X = 0 = POStype 251, 250 Sign bit OSL = -512(Stored PCM) 0 0 0 0 0 0 X 0 0 0 0 0 0 0 0

Table 3.16-7. BFS off-scale values

j\_18819\_205.cvs

3. Analog nonlinear parameters are handled the same way as linear parameters, except that the increased complexity of trying to solve a cubic equation for PCM has been done already and the PCM versus EU values are given in tabular form in the back of the DBIL. For a lower limit, select the PCM count value that corresponds to the EU value just above the desired EU value. For an upper limit, select the PCM count value that corresponds to the EU value just below the desired EU value.

X = 1 = NEG

4. Analog constants are most often stored as single-precision floating-point values and are entered into the uplink system in EUs; some are stored as integers.

## D. Payload parameters

BFS software release 09.21 (STS-9) introduced a new module, PYLD\_APP\_FUNC, which performs downlist processing, FDA, and scaling for display for up to 50 payload-dependent parameters. The parameters are restricted to two types, discretes and linear analogs, the limit values of which are contained in either the upper limit table (data type 251) or low limit table (data type 250).

Since only 25 half-words of the BFS downlist are allocated to payloads, this dictates the possible combination of analog and discrete parameters. An analog equals 1 half-word, and 16 discretes

<sup>\*</sup> Payload analog parameters are 10-bit signed 2's complement, 8-bit signed 2's complement, or 8-bit unsigned.

equal 1 half-word. Therefore, maximum content could be 50 discretes (although 400 discretes could be packed into 25 H/Ws) or 25 analogs, or some combination thereof that does not exceed 50 parameters (TMBU storage locations) or 25 half-words.

This module differs from other BFS FDA processing. The analog limits are stored in PCM counts (not PCM \* 64) since the 10-bit parameter has already been shifted right 6 bits. The off-scale range, however, is still -512/+511 PCM counts.

1. Payload parameters that are processed by PYLD\_APP\_FUNC are already shifted right and are stored in PCM counts (not PCM \*64). Therefore, it is not necessary to multiply the rounded PCM value by 64 before uplink. The new value for uplink is calculated using the following equation.

$$\frac{\text{PCM} = (\text{Desired value - A0})}{\text{A1}}$$

- 2. The  $A_1$  coefficient is not predivided by 64; therefore, multiplication by 64 is not required. The same rounding technique (used for non-payload parameters) is used, and the whole PCM value is then uplinked.
- 3. The cal curve for each transducer and the associated parameters is located in the BFS Database Listing. In most cases, these cal curves are identical to the identical parameter in PASS.

## TITLE

USE OF THE GENERIC COMMAND BUILD TOOL

## **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed pre-mission without review and approval at the FOIG.

## **PURPOSE**

This procedure defines the process for building or modifying a generic command load.

## **GENERAL**

Generic command loads are used to change values for systems that do not have a predefined command op code or command build tool in the Mission Control Center. The primary users of the generic command capability are PDRS and DPS. PDRS uses generic command for their payload identifier changes while DPS uses this capability for some prelaunch command loads..

#### COMMAND RESTRICTIONS/CONSTRAINTS

This procedure is valid in all major modes except Ops 0 and PL. Each command built with the generic command build tool will be safed by default. The user must get permission from the Flight Directors before the command is unsafed and uplinked. There are no crew coordination requirements for this type of command.

#### **PROCEDURE**

SEQ	Initiator	Action	Comments
1	INCO	Request approval from the Flight Director to build a generic command load	
2	COMM SPT or INST	Request that Command enable generic command for the workstation and op code needed. Example: "Command, enable white-mpsr10 for generic command with Op Code OA"	Command will need to type in the complete workstation name to enable access to build generic commands
3	COMM SPT or INST	Build the command by selecting the DSM number, title, and command data words	The command will be stored in the server as Safed
4	INCO	Request a GO from the Flight Director for uplinking the command	
5	COMM SPT or INST	Request Command to unsafe the DSM number for the command	The command will show up as unsafed on the command inventory display

SEQ	Initiator	Action	Comments
6	INCO	Uplink the command per FCOH SOPs 3.1 and 3.2.3	
7	COMM SPT or INST	Request that Command disable generic commanding for the workstation used to build the load and safe the DSM number of the command load	

## **BASIC DISPLAY DISCRIPTION**

A. DSM number – Load class is 199. Load sequence is a decimal integer between 01-50. The allocation of generic command DSM numbers is as follows:

19901 – 19915 DPS 19916 – 19920 Spare 19921 – 19925 GNC 19926 – 19940 RMS 19941 – 19950 Spare

- B. TITLE 21-character maximum. Default title is Generic Command Load.
- C. OPTION Default to manual generation. Only the title and uplink data words may be changed with the modify option.
- D. OP CODE The minimum/maximum range is 01-7E hexadecimal. The OP code must be validated against the valid two-stage OP codes in the OP Code Control Status Table display and the Downlist/Uplink CPDS or the BFS PRD

Web Page: <a href="http://opic.cal.boeing.com/data-b6/fsw-team/software.htm">http://opic.cal.boeing.com/data-b6/fsw-team/software.htm</a>

- E. MF MF = 0 indicates that the major function will be determined by the console configuration at the time of uplink.
- F. UPWD HEX 02-67 Uplink data words 02 through 03 are the minimum required input data words. Each uplink data word provided shall be four hexadecimal characters. The total number of 48-bit words in a generic command load cannot be increased or reduced by the modify option.

#### **TITLE**

#### COMMAND SAFING PROCEDURES

## **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to change in real time without review and approval of the Flight Director or be changed premission without review and approval at the FOIG.

#### **PURPOSE**

To document command safing procedures including rationale.

## **GENERAL**

Following the unintentional uplink of ops recorder commands on STS-69, the MOD Safety Board recommended setting up a process to determine if commands should be protected from unintentional uplink by safing them in the command server. The criteria that are used to assess whether commands should be safed are as follows: Commands that pose a safety risk to the orbiter, its payloads, or its crew if unintentionally uplinked should require unsafing to accomplish uplink during the susceptibility window.

## **PROCEDURE**

- A. The following commands should be verified safed in the command server during prelaunch.
  - 1. Ku-band beta angle commands
    - a. DSM 12233 KU BAND BETA -15 DEG
    - b. DSM 12234 KU BAND BETA -10 DEG
    - c. DSM 12235 KU BAND BETA -5 DEG
    - d. DSM 12236 KU BAND BETA 0 DEG
    - e. DSM 12237 KU BAND BETA 5 DEG
    - f. DSM 12238 KU BAND BETA 10 DEG
    - g. DSM 12239 KU BAND BETA 15 DEG
    - h. DSM 12240 KU BAND BETA 21 DEG

Note: Any Ku-band TMBUs built in real time will require safing after build.

- 2. Ku-band beta plus mask command
  - a. DSM 14035 KU OBSC SEL BETA/MASK
- 3. Ku-band obscuration override command
  - a. DSM 14030 KU OBSC OVRD ON

- 4. Ku-band RF Protect zone disable commands
  - a. DSM 14038 KU -BD RF ZONE 1 INH
  - b. DSM 14044 KU-BD RF ZONE 2 INH
  - c. DSM 14046 KU-BD RF ZONE 3 INH
  - d. DSM 14048 KU-BD RF ZONE 4 INH
- B. The commands will be unsafed for real-time usage and resafed after uplink.
- C. If it is not possible to unsafe and safe these commands without operational impact, the INCO must ask the Flight Director for real-time concurrence to leave the commands unsafed. The commands will be resafed at the next operationally feasible time.

## **RATIONALE**

The rationale for command safing follows:

- 1. Ku-band beta angle commands
- 2. Ku-band RF protect box commands
- 3. Ku-band beta plus mask command
- 4. Ku-band obscuration override command
- 5. Ku-band RF protect inhibit command

If these commands are unintentionally sent they may cause the Ku-band antenna to irradiate the crew cabin, an EVA crewmember, a payload, or the ISS. If that happens, it may cause damage to personnel or to critical equipment.

## **TITLE**

## MADS ACTIVATION/DEACTIVATION AND OPERATION

## **CAUTION**

9/1/2004: REV G

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

## **PURPOSE**

Define procedures used for Modular Auxiliary Data System (MADS) system activation, deactivation, and normal operations.

#### **RESTRICTIONS & CONSTRAINTS**

These procedures are only valid in all ops modes of the GNC, SM and the BFS major functions. The crew has sole control over MADS PCM record mode (sample or continuous). The commands listed in this SCP are all RTCs. There are no constraints relating to flight, vehicle, OI load, major function, OPS mode, time, or crew/MCC coordination.

## **GENERAL**

The RTCs in this procedure have been verified and prestored in the server, and only the MADS RCDR PWR OFF command requires safing. The MADS RCDR PWR OFF command should not be sent until tape motion has stopped. The MADS WB ON and MADS PCM ON commands should not be sent until the RCDR PWR ON command has been sent. Verification that the MADS RCDR PWR ON command has been sent can be confirmed by the recorder BITE good indication. This command is sent first to avoid unnecessary interruptions in recorder power when sending MADS PCM OFF and MADS WB OFF. Sending these commands while the recorder power switch is in PCM/WB ENABLE and the MADS RCDR PWR ON command has not been sent removes power from the recorder before tape motion is stopped, which can damage the tape and/or cause the tape to fall out of the tape path. The commands can be considered routine and continuous, which requires only initial flight director approval for uplink.

## **CAUTION**

Uplink of DSM 4619 MADS RCDR PWR OFF while the recorder tape is in motion may cause loss of the MADS recorder. STS-53 post-flight investigation revealed that an inadvertent MADS OFF/STBY command, which removed power to the recorder while the tape was in motion, contributed to the unrecoverable loss of tape tension. DSM 4619 should be unsafed only when intended for use.

## **PROCEDURES**

## A. COMMAND CONCERNS

All of these commands will be built into the command server and uplinked via the command panel. Commands normally will be sent by the INST, except for prelaunch. It is the INST's call as to when he/she informs the INCO of any commands sent.

## B. ACTIVATION

Switch configuration for control by the MCC

PNL A6L cb MADS PWR MNB - CL
PNL C3 MSTR MADS PWR - ON
PNL A6L MADS RCDR PWR-PCM/WB ENA
PB FWD - CMD
STRAIN GAUGE - PCM ENA
WB/ACIP PCM - CMD
PCM - CMD
RCD MODE - SAMPLE
FDM CNTL - DATA
MAN CALBR - N/A

## Uplink commandDSM

MADS RCDR PWR ON4618
Confirm RCDR BITE = GOOD
MADS WB/ACIP - ON4601
Confirm that recorder is in RCD, motion indicates RUN, and recorder is pulling tape
MADS PCM - ON4603
MADS CAL - ON4607
Wait 10 seconds
MADS CAL - OFF4608

#### C. DEACTIVATION

The MADS system is to be deactivated whenever recording is complete.

a. Immediate or emergency power down (crew action only)

PNL C3 MASTER MADS POWER - OFF or PNL A6L cb MADS PWR - OPEN

Note: MCC must uplink DSM 4619, MADS RCDR PWR OFF to remove power from the recorder.

b. Nominal power down and post-landing procedure

Uplink command

MADS RCDR PWR ON

(This is a precautionary measure to apply power via PF1)

MADS CAL - ON

Wait 10 seconds

MADS CAL - OFF	4608
MADS WB/ACIP OFF	4602
MADS PCM - OFF	4604
Verify no tape motion.	
MADS OFF/STBY	4600
MADS RCDR PWR OFF	4619

## D. REPOSITIONING THE RECORDER, TRACK SEQUENCE SELECTION

To reposition the MADS tape to BOT or EOT, the MADS RCDR REWIND BOT and MADS RCDR REWIND EOT commands, DSM 4605 and 4606, respectively, are used. The rewind EOT (or BOT) commands do not control power to the recorder. To rewind or fast forward the recorder, power must be supplied via panel A6L RCDR Power ON or by using the MADS RCDR PWR ON command, DSM 4618. Before reaching EOT or BOT, it is important to let the recorder cool a few minutes as a precautionary measure by stopping the recorder before reaching BOT/EOT and then resuming the reconfiguration after a short pause. This can be done by sending MADS STDBY/OFF, DSM 4600, before reaching BOT or EOT. This procedure should be used to avoid creating a sticky tape problem where the heat generated near the tape melts part of the substance and causes the tape to adhere to the electronics, hence the "sticky tape." MADS STDBY OFF, DSM 4600, MUST always be sent after using the MADS RCDR REWIND BOT/EOT commands and the repositioning is complete in order to reset any relays or command bits set by the MADS RCDR REWIND BOT/EOT commands.

Uplink command

MADS RCDR PWR ON

(This is a precautionary measure to apply power via PF1
)

MADS RCDR REWIND BOT (EOT)

Once BOT( EOT) is reached:

MADS STDBY/OFF

4600

#### **NOTES**

- a. Because of the time required to shuffle tape, caution must be exercised when using either rewind command.
- b. The PB FWD command resets relay K7, which controls tape direction. Use of this command, RWD EOT, will reset track sequence 2 if this mode was active. To reestablish sequence 2, the RCDR must reach EOT and then be rewound to the percent tape required.
- c. The recorder does not have an erase-before-write capability. If the rewind BOT is used and you record over data, the old data is virtually erased, and the new data will be noisy.
- d. Activating Sequence 3

The MADS recorder automatically selects track sequence 2 once it reaches EOT. However, once the MADS recorder reaches BOT on track sequence 2, the recorder goes to a standby mode until track sequence 3 is initiated from the ground. MADS TRACK SEQ 3 ON, DSM 4609 must be sent in order to record on track sequence 3. MADS TRACK SEQ 3 OFF, DSM 4610 is not normally used. It could be used, however, if for some reason one needed to continue recording on track sequence 1 or 2 again. If this command must be used, pay careful attention to notes b and c.

<u>Uplink command</u> <u>DSM</u> MADS TRACK SEQ 3 ON 4609

#### E. NOMINAL OPERATIONS

Flight-specific requirements mandate different operational plans for the MADS. Most flights require only ascent and entry data, in which case the MADS activation is performed for ascent and entry only. On-orbit data requirements are identified in the Flight Requirements Document or flight specific chits or INST memo. MADS command plans for a specific flight are developed by the lead INST and are located on console during the flight.

- 1. Unique requirements/exceptions are:
  - a. If on-orbit recording is not required, track sequence 2 is avoided because limitations in the post-mission processing system at KSC. Therefore, the recorder is repositioned to BOT+7% and then track sequence 3 is activated for the entry data take (at NO LATER THAN TIG 7 minutes).
  - b. If on-orbit recording is required, track sequence 1 will consist of ascent recording and onorbit recording, track sequence 2 will consist of on-orbit recording only, and track sequence 3 will have 0 to 30 minutes of on-orbit recording followed by entry recording.

## 2. Prelaunch:

T - 33h30m	MADS FDM/PCM test (VL4 SEQ 38)
T - 32h30m	MADS PCM/RCDR sample test (VL4 SEQ 38)
T - 17h30m	MADS RCDR configure for LCD (VL4 SEQ 38)
	Manual cals and PNL C3/A6L switch configurations
T - 00h09m	Activate MADS recorder (VL4 SEQ 38)

#### 3. Ascent

The MADS system is activated during the T - 9 hold and nominally remains active until MECO + 06 m. In a launch hold/scrub case, allow 30 minutes of record time in order to be safe. Recall that there are 120 minutes available on each track sequence of the MADS recorder. Keep in mind that EOT may actually be reached (and most often is) before the percent tape counter indicates 100 percent. Also, flight-specific on-orbit data takes may require that the reconfiguration be performed prior to 25 percent tape used in order to conserve tape. This type of coordination information should be determined by the lead INST prior to the flight. Note that the MCC-H recycle steps for MADS are located in S0007, Volume 2, sequence 23.

#### (a) Nominal ascent/ATO

AT MECO + 6 m, perform MADS deactivation per SCP 3.3 (includes rewinding and selecting SEQ 3 if on-orbit recording is not required)

#### (b) TAL

Nominal postlanding deactivation at wheel stop + 2 m

(c) RTLS

Nominal postlanding deactivation at wheel stop + 2 m

(d) AOA (two Freon loops or two H2O loops) - Expect Master MADS OFFMADS RCDR PWR OFF (DSM 4619) after tape motion is stopped

9/1/2004: REV G

## 4. On-Orbit

For On-Orbit operations, refer to the flight Requirements Document along with the INST memo.

5. D/O MADS Recorder Checkout - One hour before the deorbit burn, a checkout of the MADS recorder should be performed to allow time for troubleshooting if needed. If WB Shelf temp is over 20° F at checkout time, it should be warm enough (30° F) for proper operation by EI. Otherwise, you may need to get the crew to switch panel A6L STRAIN GAUGE – ON.

Perform MADS activation. Verify Sequence 3 is ON. If proper tape motion is observed, deactivate the MADS until the entry data take or else perform SCP 4.14.

## 6. Entry

MADS systems are to be activated at TIG - 7 minutes. Recording is to continue until EI + 2500 seconds, when the MADS deactivation procedure should be performed. At wheel stop plus 2 minutes, a calibration should be performed to ensure a calibration is performed prior to EOT being reached.

To perform a calibration:

MADS CAL ON (DSM 4607) wait 10 seconds MADS CAL OFF (DSM 4608)

## 7. Postlanding

MADS system deactivation is performed at EI + 2500 seconds.

## F. FDF LOCATIONS

Several switch lists confirm MADS switches are in the correct position. Various powerdown procedures also call out MASTER MADS OFF.

## MADS OPS NOTES

- 1. The MADS control module timer (for PCM sample mode) is not reinitialized by mode changes. The timer will cycle whenever the MCM is powered.
- 2. At Pulse-Code Modulation Unit (PCMU) powerup, the PCMU bite will toggle while the bite circuit is initialized.
- 3. At RCDR powerup, RCDR may indicate tape motion until motion circuit is fully powered.
- 4. The AUTO CAL command must remain high for 2 seconds to be active.

9/1/2004: REV G

- 5. The FDM will indicate DATA for data mode if the FDM is on and not being calibrated. If it is off or being calibrated, data mode will show CAL.
- 6. Sending TRACK SEQ 3 OFF while in TRACK SEQ 3 will automatically switch recorder back to TRACK SEQ 1 at the same percent tape and moving in the same direction.

Table 3.28-1. MADS equipment temperature management

Site/	System	Temperature	Operating	Cooldov	vn
mission phase	equipment operating	at initial activation, °F	thermal rate increase time, min/∆°F	Method	Thermal rate decrease time, min/∆1°F
Launch (no hold)	Full system (17 min operation)	85	↑ 2.4	N/A	N/A
On orbit*	t* PCM - snapshot (with/without SGSC)  No system thermal constraint for operation in the snapshot mode within the operating temperature from 30° to 140° F  System cooldown proposed achieved in either snapshot achieved in either snapshot temperature of ≤100 initiation. The difference temperature rate because of the extremal constraint achieved in either snapshot a		System cooldown prior to achieved in either snaps powerdown mode to ensitemperature of ≤100° prinitiation. The difference temperature rate between and powerdown modes because of the extremel duty cycle, with all other	pshot or ensure a shelf prior to entry ice in the shelf een the snapshot is is insignificant nely low snapshot	
Full system - 100 continuous		↑ 1.5	In the ZLV attitude with the shelf temperature at 104° F, it will require 15 hours to reach 100° F with the MADS		
	PCM only - continuous	100	↑9.5	system powered off. In the Sun attitude for the same conditions, 38 hours is required to reach 100° F	
Entry/ landing	Full system	<100	↑ 2.3	MADS configured as rec	quired by mission

<sup>\*</sup>MADS continuous component operation on orbit is not recommended (except just prior to entry) because of the rapid temperature rise rate associated with this condition.

## **TITLE**

RECORDER SYSTEMS: SSR 1(2) COMMAND CONTROL PROCEDURES

5/31/2007:

## **CAUTION**

**REV G, PCN-5** 

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

## **PURPOSE**

To define a standard set of command procedures for performing routine Solid State Recorder (SSR) operations.

## **GENERAL**

All commands listed in this SCP are RTCs. Most RTCs in this procedure are verified and prestored in the GCS, and most do not require safing. The positional RTC's that are built during the mission are covered in this SCP. RTC's that are safed are listed in INCO Systems Brief Section 40.

#### **RESTRICTIONS & CONSTRAINTS**

These procedures are valid in all ops modes of the GNC, SM and BFS major functions. There are no special restrictions on execution of these procedures. The only restriction on uplink is that the commands shall not be uplinked during OPS transitions. There are no constraints relating to flight, vehicle, OI load, major functions, OPS mode, time, or crew/MCC coordination.

- A. The SSR will reject commands that are invalid for a particular mode or command sequence. Valid mode transitions, as well as the list of pre-built commands, are described in Systems Brief 40.
  - 1. The following commands are *invalid* in any mode *except* STANDBY:
    - a. Maintenance commands: RESET, SELF TEST, ERASE, REMAP
    - b. Non-queued playback (PB) or Space Shuttle Main Engine (SSME) PB
    - c. Store or recall a position
  - 2. The following command sequences must be completed to avoid a rejection of a subsequent command:
    - a. Maintenance command ENABLE followed by related EXECUTE command
    - b. Define PB queue START followed by queue END command
  - 3. Refer to SB 40, Table 40-14, for a complete list of commands allowed per mode.
- B. Commands that could cause a significant loss of recorded data are *not* expected to be used regularly and are nominally safed:
  - 1. Clear all PB queue slots
  - 2. Unprotect parallel data
  - 3. Maintenance commands

- 5/31/2007: REV G, PCN-5
- C. Positional commands must be built real-time per section H of this SCP, because the position is embedded in the command:
  - 1. Record or PB at a position
  - 2. Auto-stop at a position
  - 3. Define a PB queue

#### **PROCEDURE**

- A. General SSR operations
  - 1. To stop an operation:
    - a. DSM 9252 (9352) SSR 1(2) HALT (stops all operations)
    - b. DSM 9235 (9335) SSR 1(2) STOP SER RCD
    - c. DSM 9236 (9336) SSR 1(2) STOP PAR RCD
    - d. DSM 9238 (9338) SSR 1(2) STOP PB
    - e. OR build and uplink a command per section H for serial record auto-stop at a position
    - f. After using the auto-stop, uplink a clear auto-stop RTC or SPC as needed to ensure the auto-stop does not execute unexpectedly the next time around

DSM 9237 (9337) - SSR 1(2) CLR AUTO STOP

- 2. There is a feature to suspend recording at the current position, and the position can be stored in a register to return to recording later. To store a current position (while in STANDBY mode) for future operation and subsequently return to that position (while in STANDBY mode):
  - a. DSM 9239 (9339) SSR 1(2) STORE POS1
  - b. DSM 9240 (9340) SSR 1(2) STORE POS2
  - c. DSM 9241 (9341) SSR 1(2) RECALL POS1
  - d. DSM 9242 (9342) SSR 1(2) RECALL POS2
- 3. To record OI data at input A:

DSM 9200 (9300) - SSR 1(2) RCDA (starting at the current indicated position)

OR build and uplink a command to RCDA starting at a desired position per section H.

## **NOTE**

If required, NSP RECORD VOICE 1/2 can be turned ON (OFF) by transmitting DSM 4774 (4775).

4. To record payload data at input B:

DSM 9201 (9301) - SSR 1(2) RCDB (starting at the current indicated position)

*OR* build and uplink a command to RCDB starting at a desired position per section H.

5. Data can be played back at various rates, but the preferred rate for OD (NSP) data is 1024 Kbps with or without voice. We also need to consider other ground user requirements when playing back data. For example, when dumping Data + Voice via Ku Band, notify COMMAND that voice is present so that the appropriate GCMR will be used. To select a PB rate as a multiple of the recorded rate:

Kb/sec RCD	<u>Multiple</u>	Kb/sec PB	Nominal use
60	16	960	None*
64	16	1024	MADS data

\*SSME EIU main engine controller data at 60 kb/sec each E input; E1 = center engine, E2 = left engine, E3 = right engine.

6. For a non-queued PB (commanded while in STANDBY mode):

DSM 9203-9209 (9303-9309) - SSR 1(2) PB (select PB rates from 2048 to 32, PB starts at the current indicated position)

*OR* build and uplink a command to PB at the desired rate starting at a desired position per section H.

### NOTE

Review MOH, Vol III, Sections 6 (COMMAND) and 7 (DFE/NIP SUP), which highlight their standard operating procedures before, during, and after SSR playback operations.

- 7. To define a PB queue, build and uplink the sequential commands to define the start and end of the PB queue per section H.
- 8. To clear a PB queue slot:

DSM 9220-9234 (9320-9334) - SSR 1(2) CLR PBQ (select queue 1-F)

9. To PB all queued data for a certain rate:

DSM 9214-9218 (9314-9318) - SSR 1(2) PB QUE (select rate 2048-128)

B. Modular Auxiliary Data System (MADS) PCM record and playback operations

Recording of MADS PCM data through SSR1 E1 input will begin just prior to exiting the T - 9 min hold and after the MADS recorder is properly configured by the S0007 OMI. Termination of MADS PCM data recording on SSR1 will occur just prior to turning MADS PCM off, when the E1 data area is full or by the various ascent-abort scenarios that can be encountered during powered flight regime. MADS PCM data will also be recorded upon entry beginning at EI - 10M. Therefore the E1 data region (position 0 - 53) should be protected approximately 24 hours before entry by building a queue of an unused rate. It is important that MADS PCM be ON before the SSR begins recording MADS data, otherwise an unwanted signal (noise) will be sent to the SSR which will fill the E1 data region with unreadable data. It is also important to make sure that the SSR is not in RCDP when the MADS recorder is in RCD mode and MADS PCM is powered off, otherwise unreadable data will also be sent to the SSR. These requirements are outlined as follows:

SHUTTLE OPS INCO/COMM/JSC-12829

5/31/2007: REV G, PCN-5

<u>Cases</u> <u>Actions</u>

Nominal/ATO Record MADS PCM data until just prior to INST

turning MADS PCM off (about MECO + 06M)

Performance/Systems Aborts (AOA, RTLS, TAL)

Record MADS data until SSR reconfigures itself to serial A mode for Ol/voice on TAL, until just prior to the crew taking MASTER MADS PWR to OFF on AOA, or

until ready for post-landing dump on RTLS.

## NOTE

The following command is called out in OMI S0007. INCO will transmit this command per the OMI.

- 1. To initiate recording of MADS PCM and OI data (presumes SSR 1 is clean)
  - Transmit DSM 9202 SSR 1 RCDP
  - b. Verify that SSR 1 management display indicates

Mode: RCDP

Position: 162 (OI serial A position when first started)

BITE: GOOD

E data source code and P data status code for positions 0-161

2. OI data will also be recorded on SSR 2.

If an SSR 1 malfunction occurs during pre-launch countdown time period, make sure that OI data is being recorded on SSR 2. SSME data will be recorded in the E1, E2, and E3 inputs simultaneously with OI data on SSR 2 by using the parallel recording mode (procedure C below).

The Ground Launch Sequencer (GLS) monitors the BITE status of both recorders and will cause a launch hold if both recorders are outputting zero for critical BITE failure (CBF) status. The LCC requires one recorder for launch. The GLS monitors this status from T-6 hours to T-5 minutes.

- 3. To terminate MADS PCM recording, perform the following steps:
  - a. Transmit DSM 9236 SSR 1 STOP PAR RCD
  - b. Verify that SSR 1 management display indicates

Mode: RCDA

E data source code and P data status code for positions 0-161

4. MADS PCM data playback operations

MADS PCM data will be played back after Main Engine and Ascent/Entry data. Build a queue for MADS PCM data, in the E1 region, at a selected PB rate (nominally 1024-kb/sec). Calculate the number of segments to dump, because the SSR Management display thinks it is receiving 60kbps of data and increments every 70sec, when in reality the SSR is receiving 64kbps of MADS PCM data and the recorder is filling up a segment every 66 seconds. In order to figure out how many segments to dump, just divide the total number of seconds recorded by 66 and subtract 1 (due to the 0 segment) to get the number of segments to dump (rounded up to the next segment).

SHUTTLE OPS INCO/COMM/JSC-12829

5/31/2007: REV G, PCN-5

Before initiating the MADS PCM playback, coordinate with and inform DFE that this is a MADS PCM data playback. When DFE is ready, dump the MADS PCM queue (simultaneously recording). This data should be protected until INCO receives a CHIT from the MER to release the MADS data stored on the SSR.

C. Space Shuttle Main Engine (SSME) record and playback data operations

Recording of SSME data will begin just prior to exiting the T - 9 min hold as instructed by the S0007 OMI. Termination of SSME data recording is determined by when the SSME Main Engine Controllers (MECs) are powered off by the crew per the Ascent Pocket C/L and also by the various ascent-abort scenarios that can be encountered during powered flight regime. These requirements are outlined as follows:

<u>Cases</u> <u>Actions</u>

Nominal/ATO Record SSME data until MET of 25 minutes, but call

Main Engine Data on SSR1 loop to confirm before

stopping recording of SSME.

Performance/Systems Aborts

(AOA, RTLS, TAL)

Record SSME data until SSR reconfigures itself to serial A mode for Ol/voice on TAL, or until ready for

post-landing dump on RTLS.

## **NOTE**

The following command is called out in OMI S0007. INCO will transmit this command per the OMI.

- 1. To initiate recording of SSME and OI data (presumes SSR 2 is clean)
  - a. Transmit DSM 9302 SSR 2 RCDP
  - b. Verify that SSR 2 management display indicates

Mode: RCDP

Position: 162 (OI serial A position when first started)

BITE: GOOD

E data source code and P data status code for positions 0-161

2. OI data will also be recorded on SSR 1, unless a payload is using input B during launch phase (unlikely).

If an SSR 2 malfunction occurs during pre-launch countdown time period, make sure that OI data is being recorded on SSR 1. MADS PCM data will be recorded in the E1 input simultaneously with OI data on SSR 1 by using the parallel recording mode (procedure B above).

- 3. To terminate SSME recording, perform the following steps:
  - a. Transmit DSM 9336 SSR 2 STOP PAR RCD
  - b. Verify that SSR 2 management display indicates

Mode: RCDA

E data source code and P data status code for positions 0-161

#### **CAUTION**

5/31/2007: REV G, PCN-5

Protect (do not overwrite) SSME data until it has been played back and is released by a fax originating from MSFC within a couple of hours of SSME playback completion. This fax is forwarded to the GC, who in turn provides a copy to the INCO team for SSME data release confirmation and logging purposes.

## 4. SSME data playback operations

SSME data will be played back during the first available Ku-band playback opportunity. It is desirable and much easier to play back all SSME data at one time instead of playing back bits and pieces of data. This means that the playback must be planned for uninterrupted Ku coverage. In addition, flight-specific requirements could force SSME playback opportunities to occur later on in the mission if the playback is delayed for any reason.

Before an SSME playback is to occur, elements from the Space Network (SN), MILA, and Marshall Space Flight Center (MSFC) must be configured correctly to receive the SSME playback data in real time. It is *not* necessary for MILA or MSFC to receive these data in real time, only *desirable*. WSC records the SSME playback in real time and transmits the playback to a requester as required.

Before initiating the SSME playback, coordinate with and inform DFE and COMMAND that this is an SSME data playback on Ku-band channel 2, which requires a specific Ground Control Message Request (GCMR) be transmitted by COMMAND to the TDRS network (1024 or 960-kb/sec, Bi-Ø-L, data stream ID [DSID] 116). DFE will coordinate with the SN, MSFC, and MILA prior to the playback. It is best to give notice to the DFE at least 45 minutes before initiation of the SSME playback to allow all participants ample time to prepare to receive the SSME playback.

5. Performing an SSME data playback.

The SSR can sequentially PB data recorded for three SSMEs using the PBME 960 command, but to satisfy a requirement from KSC ground processing, queues will be built and dumped as follows:

a. Calculate SSME (EIU) number of positions (Np) recorded in parallel mode, where Np = {number of seconds recording in parallel  $\div$  70 sec/position}

Note: The SSR display calculates and marks the three EIU recording positions.

- b. Positions containing EIU1 data = POS 0 through POS Np
- c. Positions containing EIU2 data = POS 54 through POS 54 + Np"
- d. Positions containing EIU3 data = POS 108 through POS 108 + Np
- e. Build separate queues for EIU 1, 2, 3 data, + 6 extra segments at the end of the first two queues to provide 26 second gaps (containing all "ones")

Note: The PB rate can be selected.

f. When DFE is ready, dump all three SSME queues (simultaneously recording). When you get to the end of recorded data, you will see an NCBF only while dumping all ones.

D. EVA recorder management

During the EVA periods only PCMMU data is recorded.

E. Recorder operations for GPC dump support (coordinate everything closely with INCO)

5/31/2007:

Before and after the dump is captured, protect the data until it is released by DPS. Play back GPC dump data recorded on SSR per SCP 3.34.

**REV G, PCN-5** 

- F. If cryo savings goals for a mission require powering off MMU2, delay powering MMU2 off until after the SSME data is released by MSFC, and keep both MMUs powered up after Ku stow. Depending on the mission, modifications to the Group B Power Up/Down callouts in the flight plan may be required.
- G. Recorder operations for entry/post landing

## **NOTE**

When performing FM recorder dumps using BFS antenna management in the TDRS mode, the UPPER or LOWER HEMI must be selected manually, using the WAMS site COMP to determine the appropriate antenna

- 1. The SSRs will record PCMMU OI and voice, with the NSP configured with VOICE ON (DSM 4774), from CDR/PLT seat ingress (see Deorbit Prep C/L deorbit TIG 1 hour ) through wheel stop. Manage the SSRs as you would during normal orbit. Insert an auto-stop (per section H) on both SSRs at the position where voice was turned on.
- SSR1 will record MADS PCM data beginning at EI-10M. Before initiating the recording of MADS PCM data check with INST to verify that MADS is operating nominally and PCM is on. SSR1 will be commanded to HALT (DSM 9252) then to RCDP (DSM 9202), and will record thru wheel stop + 15 minutes.

## **NOTE**

After the G9 transition, all SSR command sequences need to be preceded by taking the BFS mode switch to STBY. This action assigns the PL buses to the GNC GPC (GNC must be selected on CCM panel). Once the command sequence is complete, the BFS should be configured back to RUN until the next command sequence. Leaving the BFS in RUN, except when command uplink operations are required, allows FDA processing to occur in the BFS, which is used to obtain EECOM parameters via the PL buses.

3. Shortly after wheel stop, coordinate with DFE to play back data at KSC/EDW landing sites. At wheel stop +2 minutes, uplink SSR1 STOP SER RCD (DSM 9235). Coordinate with INST to stop recording MADS PCM before the PCM Unit is turned off. When site is configured and ready to receive data, begin playback of data. Dump all OI data with voice from one or both SSRs as required to get all the voice dumped. Once complete with the OI/voice playback, dump MADS PCM data from the E1 input data range.

# NOTE

**REV G, PCN-5** 

5/31/2007:

Complete the flight recorder status sheet per the INCO/COMM Console Handbook SCP 5.5, KSC/MCC Flight Recorder Status Reporting, whether the playbacks are completed or not completed successfully.

- 4. When SSR playback is terminated, make sure SSR2 is still recording with the auto-stop enabled to prevent overwriting entry data. For SSR1, leave the parallel data protection enabled, and verify SSR1 in STBY. At this time turn FM system OFF (DSM 4781) and turn NSP RCD Voice OFF (DSM 4775).
- H. Positional commands are built using the SSR management application. The Flight Controller should delete any built command after it is no longer needed.
  - 1. The following table lists the command DSM and value limits for SSR 1(2), for reference only:

#### SSR buildable command table

The first 32 bits define the reset command and the next 32 bits define the set command. The 10 least significant bits (LSB) define the position, from 0 to 810 (32A<sub>H</sub>). The SSR management application uses certain command titles (if uplinked exactly as indicated below) to set status indicators on the display.

nnn = decimal equivalent of position placed into command title NNN = last 12 bits of command, including 10 position bits MIN(MAX) = minimum(maximum) hexadecimal value of NNN

COMMAND TITLE	HEX COMMAND DATA	MIN	MAX
BUILDABLE RTCs 1000-1049			
SSR1 RCDA @nnn	0009 FFFF 0809 0NNN	400	72A
SSR1 RCDB @nnn	0009 FFFF 0809 0NNN	800	B2A
SSR1 RCDP @nnn	0009 FFFF 0809 0NNN	C00	F2A
SSR1 PB2048 @nnn	0009 FFFF 0809 1NNN	000	32A
SSR1 PB1024 @nnn	0009 FFFF 0809 1NNN	400	72A
SSR1 PB960 @nnn	0009 FFFF 0809 1NNN	800	B2A
SSR1 PB192 @nnn	0009 FFFF 0809 1NNN	C00	F2A
SSR1 PB128 @nnn	0009 FFFF 0809 2NNN	000	32A
SSR1 PB64 @nnn	0009 FFFF 0809 2NNN	400	72A
SSR1 PB32 @nnn	0009 FFFF 0809 2NNN	800	B2A
SSR1 Q START @nnn	0009 FFFF 0809 3NNN	000	32A
SSR1 Q END 2048 @nnn	0009 FFFF 0809 ENNN	000	32A
SSR1 Q END 1024 @nnn	0009 FFFF 0809 ENNN	400	72A
SSR1 Q END 960 @nnn	0009 FFFF 0809 ENNN	800	B2A
SSR1 Q END 192 @nnn	0009 FFFF 0809 ENNN	C00	F2A
SSR1 Q END 128 @nnn	0009 FFFF 0809 FNNN	000	32A
SSR1 AUTO-STOP @nnn	0009 FFFF 0809 4NNN	400	72A

BUILDABLE RTCs 1050-1099			
SSR2 RCDA @nnn	A08A FFFF A88A 0NNN	400	72A
SSR2 RCDB @nnn	A08A FFFF A88A 0NNN	800	B2A
SSR2 RCDP @nnn	A08A FFFF A88A 0NNN	C00	F2A
SSR2 PB2048 @nnn	A08A FFFF A88A 1NNN	000	32A
SSR2 PB1024 @nnn	A08A FFFF A88A 1NNN	400	72A
SSR2 PB960 @nnn	A08A FFFF A88A 1NNN	800	B2A
SSR2 PB192 @nnn	A08A FFFF A88A 2NNN	C00	F2A
SSR2 PB128 @nnn	A08A FFFF A88A 2NNN	000	32A
SSR2 PB64 @nnn	A08A FFFF A88A 2NNN	400	72A
SSR2 PB32 @nnn	A08A FFFF A88A 2NNN	800	B2A
SSR2 Q START @nnn	A08A FFFF A88A 3NNN	000	32A
SSR2 Q END 2048 @nnn	A08A FFFF A88A ENNN	000	32A
SSR2 Q END 1024 @nnn	A08A FFFF A88A ENNN	400	72A
SSR2 Q END 960 @nnn	A08A FFFF A88A ENNN	800	B2A
SSR2 Q END 192 @nnn	A08A FFFF A88A ENNN	C00	F2A
SSR2 Q END 128 @nnn	A08A FFFF A88A FNNN	000	32A
SSR2 AUTO-STOP @nnn	A08A FFFF A88A 4NNN	400	72A

2. The application will build the command title and data per the table above. The display will also fill in a default DSM number, i.e., the lowest number not already in the server; if no 1000(1050) series RTCs are in the server, the number used will be 1000(1050).

To open the SSR management command build menu: either click the CMD button, select the command type, and fill in the position number as required; or right mouse click or swipe on the data code (D, V, B, or E) and select the **command build** option. A swipe is used to define the start and end of a PB queue, and a click is used to define the position for the other commands.

SEQ	Action	Comments
1	Select command type (RCDA, RCDB, RCDP, PB, DEFQ, ASTOP [auto stop])	Display will fill in DSM, title, and position at this time. If building PB or DEFQ CMD, PB rate is blank.
2	If PB or DEFQ command, select rate	Display will fill in PB rate in title
3	Click on FILL	Display will fill in command data
4	Select the Submit RTC option	

The buildable RTCs existing in the server for the appropriate SSR will be displayed in the command window. RTCs defining a PB queue should be left in the server until the dumped data is verified.

Figure 3.22-1 is an example of the SSR positional RTC build window of the display.

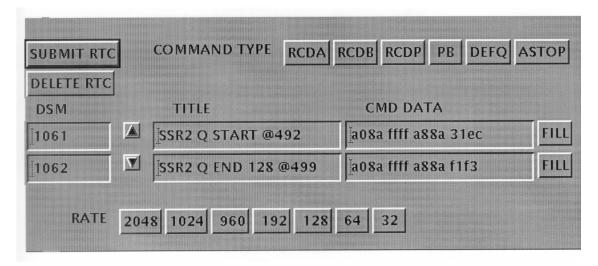


Figure 3.22-1. Example of SSR2 positional command build display

If required, any position number previously fed into the application can be edited; if this editing is done before "FILL" is selected, the proper data for the edited position will be filled into the command.

- 3. Positional commands can also be built without the help of this application, using the following technique:
  - a. Find the command in the SSR Buildable Command Table; e.g.,

SSR2 Q START @nnn A08A FFFF A8

A08A FFFF A88A 3NNN 000 32A (MIN)

b. Build the new command per the following sequence:

## **CAUTION**

Since commands affecting any system can be built using this method, always verify that you are using the correct command data when building these commands.

SEQ	Action	Comments
1	Convert the decimal position number to hexadecimal	e.g., convert 555 to 22B
2	Add the hexadecimal value to the (MIN) value in the table	e.g., 000 + 22B = 22B
3	Build command using RF CMD Build, making title consistent with syntax in command table	e.g., SSR2 Q START @555
4	For command data, replace NNN with value calculated in step 2	e.g., A08A FFFF A88A 322B
5	Submit the RTC	

- I. Miscellaneous procedures
  - 1. The following crew procedures are not used and are provided here for reference only:
    - a. RCD DATA ONLY
      - C3 ✓S-BD PM CNTL CMD

## SM 1 DPS UTILITY

CRT RTC (RCDR VOICE 1 / 2 - OFF via GCIL A(B))
ITEM13 + 7 1 0 9 0 1 F F EXEC
(710A 01FF)
CMD - ITEM 14 EXEC
ITEM13 + 7 9 0 9 0 0 5 D EXEC
(790A 005D)
CMD - ITEM 14 EXEC

b. RCD DATA AND VOICE

A1R ✓AUD CTR VOICE RCD SEL CH 1 - ICOM A

✓CH 2 - ICOM B

C3 ✓S-BD PM CNTL - CMD

## SM 1 DPS UTILITY

CRT RTC (RCDR VOICE 1 / 2 - ON via GCIL A(B))
ITEM13 + 7 1 0 9 0 1 F F EXEC
(710A 01FF)
CMD - ITEM 14 EXEC
ITEM13 + 7 9 0 9 0 0 5 E EXEC
(790A 005E)
CMD - ITEM 14 EXEC

## 2. Recovery procedures

a. If an uncommanded POST event occurs during a mission:

5/31/2007:

- (1) Log the position of latest recorded data
- (2) Hard copy the display
- (3) Clear all queues from the display
- (4) Start recording at the position of latest recorded data
  - (a) Build and uplink the positional RCDA command

**REV G, PCN-5** 

- (b) This will preserve the latest AOS data
- (5) Uplink queue definitions for data not yet dumped
- b. For an unexplained NCBF
  - (1) Perform a self-test (unsafe the commands)
    - (a) DSM 9250(9350) SSR 1(2) SLF TST ENA
    - (b) DSM 9251(9351) SSR 1(2) SLF TST EXEC
  - (2) If NCBF remains, power cycle the MMU (coordinate with EGIL and DPS).
  - (3) If NCBF remains, perform test recording and dumping to determine the record capability of the SSR.
- c. For a CBF, perform self-test and power cycle as required.

## **SSR Information**

MEASUREMENTS	SSR 1	SSR 2	PRESET CONDITION
Power On (CNTL Bus)	V72S7185E	V72S7186E (AB2)	
Mode MSB 6	V75X2966E	V75X2866E	0
Mode Bit 5	V75X2965E	V75X2865E	0
Mode Bit 4	V75X2957E	V75X2857E	0
Mode Bit 3	V75X2956E	V75X2856E	0
Mode Bit 2	V75X2955E	V75X2855E	0
Mode LSB 1	V75X2944E	V75X2844E	0
Critical Bite Failure	V75X2943E	V75X2843E	Good (1)
Non-Critical Bite Failure	V75X2942E	V75X2842E	Good (1)
Queue Count MSB 4	V75X2941E	V75X2841E	0
Queue Count Bit 3	V75X2940E	V75X2840E	0
Queue Count Bit 2	V75X2931E	V75X2831E	0
Queue Count LSB 1	V75X2929E	V75X2829E	0
Command Reject	V75X2960E	V75X2860E	1
Auto Stop Enable	V75X2959E	V75X2859E	False (0)
Parallel Protect	V75X2950E	V75X2850E	False (0)
Position MSB 10	V75X2949E	V75X2849E	0
Position Bit 9	V75X2948E	V75X2848E	0
Position Bit 8	V75X2947E	V75X2847E	0
Position Bit 7	V75X2934E	V75X2834E	0
Position Bit 6	V75X2933E	V75X2833E	0
Position Bit 5	V75X2921E	V75X2821E	0
Position Bit 4	V75X2913E	V75X2813E	0
Position Bit 3	V75X2911E	V75X2811E	0
Position Bit 2	V75X2909E	V75X2809E	0
Position LSB 1	V75X2905E	V75X2805E	0

RCD/PB Rate (Kbps)	Time Per Segment (sec)
32	131.1
60	69.9
64	65.5
128	32.8
192	21.8
960	4.4
1024	4.1
2048	2

RECORD	PLAYBACK	MULTIPLE
192	960	5
128	1024	8
60	960	16
64	1024	16
32	1024	32

	FM SP	FM XMTR	FM SW
Location:	AV Bay 3A	AV Bay 3A	AV Bay 3A
	Tray/Shelf 1	Tray/Shelf 2	Tray/Shelf 2
		MA16F	MA16F
Cooling:	Air	Water loops	Air
	FM 1	FM 2	
Power CNTL	CNTL BC1	CNTL BC2	
Source:	MNB FLC 2	MNC FLC 3	

LCC - INS-02a Verify SSRs not failed prior to T- 5
Failed: BITE CBF

FR - A11-71 ASC: SSR2 RCD PAR(nominally)
ORB: SSR fail no impact to mission duration
A11-9 RECORDER USAGE

**SB** - SSR: 40; FM: 8 **SSSH** - SSR: 16.21; FM: 16.8

MDM OF1 MDM OF4 MDM OF3 MDM OF2 FM SYS 1 ON (V74X6120E) FM SSR2 (V74X4800E) All SSR 1 Telemetry All SSR 2 Telemetry FM Main Engine (V74X4801E) FM SYS 2 ON (V74X6121E) FM RF OUTPUT 1 (V74E6650A) FM SSR1 (V74X4802E) FM RF OUTPUT 2 (V74E6651A) FM PL DIGI (V74X4803E) FM ANT SEL L (V74S6506E) FM PL ANLG (V74X4804E) FM ANT SEL U (V74S6505E) FM DOD (V74X4805E) ANT POS S5B (V74X6676E) FM TV (V74X4806E) ANT POS S5A (V74X6675E) FM CONTROL, GCIL (V74S6550E)

PBQ RAT	E R/	ATE CODE	BACKGROUND
			COLOR
960		0	Light blue
128		1	Pink
192		2	Yellow-green
1024		4	Light green
2048		8	Light blue-green

# SSR Information (concluded)

BIN	DEC	MODE	DESCRIPTION
000000	0	NONE	MMU power down or loss of mode telemetry
000001	1	STBY	Standby, no record or playback or maintenance operation in process
000001	2	RCDA	Recording Serial A, NSP1(NSP2) data or data and voice
000010	3	RCDB	Recording Serial B, payload input
000111	4	RCDE	Recording main engine or payload data at the EIU1(2, 3) inputs
000100	5	RCDP	Recording three EIU inputs and Serial A input
000101	6	PB2048	Dumping at 2048 Kbps
000110	7	PB1024	Dumping at 1024 Kbps
001000	8	PB960	Dumping at 1924 Rops  Dumping at 960 Kbps
001000	9	PB192	Dumping at 192 Kbps
001001	10	PB128	Dumping at 128 Kbps
001010	11	PB64	Dumping at 125 Kbps  Dumping at 64 Kbps
001011	12	PB04 PB32	. •
			Dumping at 32 Kbps
001101	13	PBME	Dumping all EIU data in 1,2,3 order at 960 Kbps
001110	14	PB E1	Dumping EIU1 data at 60 Kbps
001111	15	PB E2	Dumping EIU2 data at 60 Kbps
010000	16	PB E3	Dumping EIU3 data at 60 Kbps
010001	17	PBQ2048	Dumping all data slots queued at 2048 Kbps
010010	18	PBQ1024	Dumping all data slots queued at 1024 Kbps
010011	19	PBQ960	Dumping all data slots queued at 960 Kbps
010100	20	PBQ192	Dumping all data slots queued at 192 Kbps
010101	21	PBQ128	Dumping all data slots queued at 128 Kbps
010110	22	A/PB2048	Simultaneously recording Serial A data and dumping per mode 17
010111	23	A/PB1024	Simultaneously recording Serial A data and dumping per mode 18
011000	24	A/PB960	Simultaneously recording Serial A data and dumping per mode 19
011001	25	A/PB192	Simultaneously recording Serial A data and dumping per mode 20
011010	26	A/PB128	Simultaneously recording Serial A data and dumping per mode 21
011011	27	B/PB2048	Simultaneously recording Serial B data and dumping per mode 17
011100	28	B/PB1024	Simultaneously recording Serial B data and dumping per mode 18
011101	29	B/PB960	Simultaneously recording Serial B data and dumping per mode 19
011110	30	B/PB192	Simultaneously recording Serial B data and dumping per mode 20
011111	31	B/PB128	Simultaneously recording Serial B data and dumping per mode 21
100000	32	P/PB2048	Simultaneously recording per mode 5 and dumping per mode 17
100001	33	P/PB1024	Simultaneously recording per mode 5 and dumping per mode 18
100010	34	P/PB960	Simultaneously recording per mode 5 and dumping per mode 19
100011	35	P/PB192	Simultaneously recording per mode 5 and dumping per mode 20
100100	36	P/PB128	Simultaneously recording per mode 5 and dumping per mode 21
100101	37	E/PB2048	Simultaneously recording per mode 4 and dumping per mode 17
100110	38	E/PB1024	Simultaneously recording per mode 4 and dumping per mode 18
100111	39	E/PB960	Simultaneously recording per mode 4 and dumping per mode 19
101000	40	E/PB192	Simultaneously recording per mode 4 and dumping per mode 20
101001	41	E/PB128	Simultaneously recording per mode 4 and dumping per mode 21
101010	42	ERASE	Erasing all non-volatile memory (NVM) (maintenance function)
101011	43	REMAP	Destructive remapping of NVM to exclude bad segments (maintenance
	-		function)
101100	44	TEST	Non-destructive in-depth self-testing (maintenance function)
101101	45	POST	Power-on self-test mode
1	>45	INVAL	Values of 46 through 63 are invalid

5/31/2007: REV G, PCN-5

	SSR 1	SSR 2
Location	Av Bay 1	Av Bay 2
	Shelf 2	Shelf 2
	MF43G	MF57G
Cooling	Water Loops	Water Loops
Power	CNTL AB1	CNTL AB2
	MNA FPC1	MNB FPC2
	O14:F MMU1	O15:F MMU2
	ON/OFF	ON/OFF

#### TITLE

ORBITER INTERFACE UNIT (OIU) ACTIVATION/ DEACTIVATION

## **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

## **PURPOSE**

This procedure will provide the standard steps required for OIU activation and deactivation.

#### **RESTRICTIONS & CONSTRAINTS**

These procedures are valid in all ops modes of the GNC, SM and the BFS major functions. Crew coordination is required for OIU power control.

## **PROCEDURE**

- A. OIU Activation
  - 1. Load PCMMU and PDI for the planned user configuration.

Note: If configuration downlinks two different OIU DFLs, DFE will need to select the 1<sup>st</sup> or 2<sup>nd</sup> occurrence appropriately.

SKIP NEXT STEP IF THE CORRECT PSP IS ALREADY POWERED (PSP 1 required for OIU 1, PSP 2 required for OIU 2).

2. Power on PSP 1 (2):

PL PSP - SEL (DSM 4803)

PL SYSTEM 1 (2) - ON (DSM 4800 [4802])

Perform a PSP 1 (2) I/O Reset (DSM 12547[12548]).

3. Load PSP configuration for OIU commanding:

DSM 133XX PSP Dummy for OIU

4. Request crew to power on OIU 1 (2).

SSP 1 OIU - OIU 1 (2) ON tb UP (DN)

5. Command OIU to update time with the current year

DSM 133XX OIU UPDATE YEAR xxxx

- 6. Evaluate OIU telemetry.
  - a. Notice if PTB read was successful by evaluating OIU time and OIU PTB H&S errors. If read was unsuccessful, OIU time will be set to its default value of 01/00/00/00 and not the current orbiter GMT. The PTB NOT AVAILABLE error (P50X4308E) will also be set if read was unsuccessful.

- b. Evaluate PSP-OIU interface by verifying that an idle pattern is being received by the OIU. If PSP configured correctly, the PSP SIGNAL(P50X4283E) flag should not be set. In addition, verify that the command counter incremented to a value of 1 and that the command to update the year was successful.
- c. Verify format ID is valid for the current configuration, and temperature for the active OIU is less than 150° F.

The following checkout steps can be performed in the event of an anomaly.

7. Command OIU to ERROR LOG DUMP format (FMT 254).

DSM 133XX OIU FMT 254

8. Load PCMMU and PDI for OIU ERROR LOG DUMP configuration.

Note: If configuration downlinks two different OIU DFLs, DFE will need to select the 1<sup>st</sup> or 2<sup>nd</sup> occurrence appropriately.

- 9. Evaluate OIU telemetry and ERROR LOG dump.
  - a. The MER is responsible for evaluating the ERROR LOG dump. The error log, which is repeatedly dumped in format 255, consists of 1612 bytes and takes approximately 2 seconds to dump.
  - b. Evaluate OIU telemetry by verifying that OIU format ID is 254 and command counter is incremented to a value of 2.

Repeat steps 1-9 for other OIU if required.

B. OIU deactivation

Note: Verify that ISS operations are complete.

Possible "S62 PDI DECOM FAIL" message if the FDA is ENA

1. Have crew power off the OIU.

SSP 1 OIU - center position, tb - BP

2. Load PCMMU and PDI as required.

#### **TITLE**

ORBITER INTERFACE UNIT (OIU) CONFIGURATION CONTROL

#### CAUTION

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed pre-mission without review and approval at the FOIG.

## **PURPOSE**

This procedure provides the standard steps required for all aspects of OIU configuration control.

## **RESTRICTIONS & CONSTRAINTS**

These procedures are only valid in all ops modes of the SM major function. Some steps may be time critical to minimize the loss of ISS telemetry. Crew action is required only for powering on/off or swapping between OIUs.

#### **GENERAL**

OIU configuration commands are used for time updates, bus configurations, command rerouting, and changes to physical device data and to load the OIU format.

All OIU configuration commands are Payload Data Loads (PDLs). Each command can be built using the General Payload Load Build menu on the Generic Command Server (GCS) Inst Command Build application. SCP 3.28 define the standard procedure to build a PDL for the GCS. The contents (HEX data words) for each configuration command, except composite commands, are defined in the Command and Data (C&D) Annex. The structure of the configuration commands is defined in the OIU System Brief.

## **PROCEDURE**

## A. OIU Format Load

The OIU format simply determines what and how Space Station Element telemetry is processed. The formats are Flight Re-configurable (RECON) products and, therefore, are mission dependent. Each format defines which logical devices are active and defines the structure of the telemetry stream. All formats include OIU Health and Status (H&S) information.

Figure 3.24-1 gives an example of the HEX data words defined in the C&D Annex for an OIU format load and defines the structure of the command

Nomenclature

0008 1401 1901 1901 00E2

OIU FMT 1

Preamble	Byte Count	CMD Type	No. of Subtypes to Follow
0000 0000	0000 1000	0001 0100	0000 0001
00h	08h	14h	01h

Subtype	OIU FMT No.	Unused*	Unused*
0001 1001	0000 0001	0001 1001	0000 0001
19h	01h	19h	01h

Routing Code	Parity Byte
0000 0000	1110 0010
00h	E2h

<sup>\*</sup>Unused bits are "don't cares" and can be set to any value; however, changing them requires a new parity byte calculation.

## Figure 3.24-1. OIU format configuration command structure

## B. Assigning a Physical Device (PD) to a Logical Device (LD)

A logical device is a type of MS1553B On-Orbit Replaceable Unit (ORU) that communicates with the OIU. The Alpha Magnetic Spectrometer (AMS) computer; Mini Pressurized Logistics Module (MPLM) MDM; Russian Functional Cargo Block (FGB); Node MDM; and Guidance, Navigation, and Control (GNC) MDM are all examples of logical devices.

Logical device data tell the OIU how to communicate with a particular type of MS1553B ORU. However, the OIU must know which physical device is mapped to the logical device in order to collect telemetry and route commands to the device. For example, assume the FGB is an active device in the current OIU format. There are two FGB MDMs, a prime and a backup. Each MDM is physically located on an MS1553B bus at different RT addresses. While these two devices look the same to the OIU (both are represented by the same logical device), only one at a time is active and talking to the OIU.

When more than one physical device is represented by a single logical device, as in the example of the two FGB MDMs, only one physical device is mapped to a logical device at any given time. The OIU communicates with that physical device to process its telemetry and to route its commands. If the OIU is required to communicate with both the prime and backup devices simultaneously, two logical devices, one for each physical device, must be defined.

Figure 3.24-2 gives an example of the HEX data words defined in the C&D Annex for a PD to LD mapping load and defines the structure of the command.

Nomenclature

0008 1401 1705 0A0A 00F0

OIU LD FGB ⇒ PD FGB2

Preamble	Byte Count	CMD Type	No. of Subtypes to
0000 0000	0000 1000	0001 0100	0000 0001
00h	08h	14h	01h

Subtype	LD ID No.	PD ID No.	Unused*
0001 0111	0000 0101	0000 1010	0000 1010
17h	05h	0Ah	0Ah

Routing Code	Parity Byte
0000 0000	1111 0000
00h	F0h

LD ID No.: PD ID No.: 1-35 1-50

Figure 3.24-2. OIU PD to LD mapping configuration command structure

## C. BC/Remote Terminal (RT) and Channel A/B Configuration

The OIU supports four MS1553B hardline buses. The OIU can be configured so that it operates either as a BC or as a RT on that bus. However, only one bus can be configured as RT at a time because of limitations in the ability of the OIU to sync to more than one BC.

When configured as a BC, the OIU schedules bus traffic and actively requests data from the device, and when configured as an RT, the OIU waits for another device on the MS1553B bus to supply the data. In addition, if the OIU is a BC on the bus, the bus configuration data inform the OIU which channel (A/B) to use as the primary channel for communicating with physical devices on that bus.

Figure 3.24-3 gives an example of the HEX data words defined in the C&D Annex for a channel change load and defines the structure of the command.

<u>← Command Words 1-64 → Nomenclature</u>

0008 1401 1510 FEAD 00B4 OIU Channel A Bus 1

<sup>\*</sup>Unused bits are "don't cares" and can be set to any value; however, changing them requires a new parity byte calculation.

9/1/2004: REV 0	9/1	/200	4:	REV	G
-----------------	-----	------	----	-----	---

Preamble	Byte Count	CMD Type	No. of Subtypes To Follow
0000 0000	0000 1000	0001 0100	0000 0001
00h	08h	14h	01h

Subtype	Bus No.	CH	BC/RT Flag	Unused*
0001 0101	0001	0000	1111	1110 1010 1101
15h	1h	0h	Fh	EADh

Routing Code	Parity Byte
0000 0000	1011 0100
00h	B4h

Bus No.: Channel: BC/RT Flag:

1-4 0 = A 0 = OIU is RT

1 = B 1 = OIU is BC

'1111'B = No change '1111'B = No change

Figure 3.24-3. OIU channel or BC/RT configuration command structure

## D. PD Bus or RT Address Change

This type of command is used to map a PD to a new bus or new RT address that is different from the mapping specified in the reconfiguration table. These changes remain in effect until the OIU is power cycled or commanded to return to original mapping. This type of command is useful for checkout or troubleshooting purposes if a physical device interfaces with the OIU on more than one bus.

Figure 3.24-4 gives an example of the HEX data words defined in the C&D Annex for a PD bus change load and defines the structure of the command.

<sup>\*</sup>Unused bits are "don't cares" and can be set to any value; however, changing them requires a new parity byte calculation.

9/1	/2004:	REV C
-----	--------	-------

Preamble	Byte Count	CMD Type	No. of Subtypes to Follow
0000 0000	0000 1000	0001 0100	0000 0001
00h	08h	14h	01h

Subtype	PD ID No.	Unused*	Bus No.	RT Address
0001 0110	0000 1010	1111	0100	1111 1111
16h	0Ah	Fh	4h	FFh

Routing Code	Parity Byte
0000 0000	1111 0101
00h	F5h

PD ID No.: Bus No.: RT Address: 0-50 1-4 or 0-30 or '1111'B = No change '1111'B = No change

\*Unused bits are "don't cares" and can be set to any value; however, changing them requires a new parity byte calculation.

Figure 3.24-4. OIU PD bus or RT address configuration command structure

## E. Reroute Commands

This command type can be used to route commands with a given destination to a destination specified by another routing code. For example, this command can cause the OIU to route commands with a routing code of FGB MDM to the N1 MDM. There are no plans to use this type of configuration command, and, therefore, none have been pre-built.

## F. Composite Commands

Composite commands contain multiple configuration commands and eliminate any awkward or nonessential configuration. The commands discussed in steps A-E above are the only subtype commands that can be combined to form a composite command. Composite commands are processed in series and all commands are implemented before the OIU returns to normal command processing.

Data words for a composite command are not included in the C&D Annex. To build a composite command, the subtype data words defined in the C&D Annex will be combined in the following manner:

To build a composite command to configure: Bus no. 3 to BC mode

Bus no. 4 to RT mode Map PD N1-2 to LD N1 Load OIU FMT 2

1. First define the data words located in the C&D Annex for the subtype commands.

	Nomenclature Nomenclature
0008 1401 153F 1919 00C8	OIU BC on bus 3
0008 1401 154F 0F0F 00B8	OIU RT on bus 4
0008 1401 1704 0825 00DC	OIU LD N1 = N1-2
0008 1401 1902 1902 00E2	OIU FMT 2

2. Determine number of subtypes to follow:

Number of subtypes to follow = Number of subtype commands to combine = 4

3. Calculate byte count:

4. Truncate the preamble, byte count, CMD type, number of subtypes to follow, routing code, and parity byte from each of the subtype data words defined in the C&D Annex.

<u>Nomenclature</u>	$\Leftarrow$ Command Words 1-64 $\Rightarrow$	Truncated to
OIU BC on bus 3	0008 1401 <u>153F 1919</u> 00C8	153F 1919
OIU RT on bus 4	0008 1401 <u>154F 0F0F</u> 00B8	154F 0F0F
OIU LD N1 = N1-2	0008 1401 <u>1704 0825</u> 00DC	1704 0825
OIU FMT 2	0008 1401 1902 1902 00E2	1902 1902

5. Combine the above results using the following format:

00 xx 14 yy aaaaaaaa bbbbbbbb ccccccc dddddddd 00pp

where xx = byte count

yy = no. of subtypes to follow

aaaaaaaa = truncated subtype 1 data words

bbbbbbbb = truncated subtype 2 data words

cccccccc = truncated subtype 3 data words

dddddddd = truncated subtype 4 data words

pp = parity byte

Composite command = 0014 1404 153F 1919 154F 0F0F 1704 0825 1902 1902 00pp

6. To calculate parity byte, Exclusive Or (⊕) all bytes, except routing code together with FFh:

 $00h \oplus 14h \oplus 14h \oplus 04h \oplus 15h \oplus 3Fh \oplus 19h \oplus 19h \oplus 15h \oplus 4Fh \oplus 0Fh \oplus 0Fh \oplus 17h \oplus 04h \oplus 08h \oplus 25h \oplus 19h \oplus 02h \oplus 19h \oplus 02h \oplus FFh = B5h$ 

After parity byte is calculated, HEX data words for the composite command are complete: 0014 1404 153F 1919 154F 0F0F 1704 0825 1902 1902 00B5

Figure 3.24-5 illustrates the completed HEX data words for a composite command and defines the structure of the command.

Preamble	Byte Count	CMD Type	No. of Subtypes to Follow
0000 0000	0001 0100	0001 0100	0000 0004
00h	14h(20 Bytes)	14h	04h

Subtype	Bus No.	CH	BC/RT	Unused*
0001 0101	0011	1111	0001	1001 0001 1001
15h	3h	Fh	1h	919h

Subtype	Bus No.	CH	BC/RT	Unused*
0001 0101	0100	1111	0000	1111 0000 1111
15h	4h	Fh	0h	F0Fh

Subtype	LD ID No.	PD ID No.	Unused*
0001 0111	0000 0100	0000 1000	0010 0101
17h	04h	08h	25h

Subtype	OIU Format No.	Unused*	
0001 1001	No.	0001 1001 0000 0010	
19h	02h	1902h	

Routing Code	Parity Byte	
0000 0000	1011 0101	
00h	B5h	

<sup>\*</sup>Unused bits are "don't cares" and can be set to any value; however, changing them requires a new parity byte calculation.

Figure 3.24-5. OIU N1-2 PRI composite configuration command structure

## G. Payload Timing Buffer (PTB) Updates

As part of the application initialization, the OIU allows 2.5 seconds to read the PTB time. If the PTB read is successful, the internal time will be set to the PTB time. If PTB time cannot be acquired within 2.5 seconds, there are two possible actions:

- 1. If the OIU is processing a power on application initialization, OIU internal time is set to a default value 1/0/0/0/0 (dd/hh/mm/ss/ $\mu\mu$ ).
- 2. If application initialization is occurring for some reason other than a power on (e.g., configuration commands or a sync loss), internal time retains its current value.

## H. Node MDM Diagnostic Dump Procedures

OIU Format 250 and 251 are used to support diagnostic dumps of the Node MDMs. Format 250 supports a dump of the MDM memory map, while Format 251 supports a dump of the MDM BIT

Summary Tables. After the OIU is configured by INST, ODIN performs the appropriate load and/or dump, coordinating with ISS GC/DFE/COMMAND to capture a delog of the dump.

- ODIN ensures that the MDM command load is properly built; ODIN contacts COMMAND to configure the ISS command server to send a load to a diagnostic MDM.
- 2. ODIN contacts INCO on INCO loop to request configuring the OIU for format 250 or 251 with the relevant Node MDM.
- 3. INST uplinks the prebuilt composite command for the appropriate MDM and appropriate format.
- 4. INST configures the PCMMU and PDI appropriately for diagnostic data.
- 5. NCO contacts ODIN on the ODIN loop when the configuration is complete.
- 6. ODIN coordinates with ISS GC/DFE/COMMAND to prepare for the dump.
- 7. ODIN then uplinks the appropriate initiating command, with FD GO.
- 8. ODIN determines when a dump is complete and contacts ISS GC/DFE to terminate the dump configuration.
- 9. ODIN reports the results of the dump to ISS FD.
- 10. ODIN contacts COMMAND and INCO, when appropriate, to restore the nominal commanding and telemetry configurations

IM/JSC-12829 5/31/2007: REV G, PCN-5

#### TITLE

ORBITER INTERFACE UNIT (OIU) TO SPACE TO SPACE ORBITER RADIO (SSOR) ENCRYPTION KEY SELECTION COMMANDS

## **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed pre-mission without review and approval at the FOIG.

## **PURPOSE**

This procedure provides the standard steps required for building the commands needed to select specific encryption keys for the SSOR.

## **RESTRICTIONS & CONSTRAINTS**

These procedures are only valid in all ops modes of the SM major function. Some steps may be time critical to minimize the loss of ISS telemetry. Crew action is required only for powering on/off or swapping between OIUs.

Time constraints, crew coordination requirements: Some steps may be time critical to minimize the loss of ISS telemetry. Crew action is required only for powering on/off or swapping between OIUs.

## **GENERAL**

These OIU commands are used to configure the SSOR to support a specific encryption key. The SSOR has 4096 different encryption keys preloaded. CATO and INCO have decided to assign the first 100 encryption keys to be used for SSOR/Space to Space Station Radio (SSSR) communications. Encryption keys #0 and #11 are test keys. Encryption key #11 is the default key when the SSOR encryption switch is taken to ON by the crew (O6 UHF ENCRYPT – ON).

For each mission, INCO and CATO will determine how many encryption keys may be required to support the mission and will agree which keys to use. The number of keys will be the minimum required + 2 contingencies. CATO will maintain a log of all SSCS encryption keys available for use and that have already been used. Each key can only be used once.

A new SSOR key command must be uplinked each time the SSOR is powered up with encryption on to communicate with the SSSR. Most of the time SSSR keys will be sent to the SSSR via the ISS S-Band link. If that link is not available, the SSSR key commands can be sent via the OIU and SSOR, but the SSSR key command must be changed before the SSOR key command in order to avoid a key mismatch.

All OIU to SSOR commands are Payload Data Loads (PDLs). Each command can be built using the General Payload Load Build menu on the Generic Command Server (GCS) Inst Command Build application. SCP 3.28 defines the standard procedure to build a PDL for the GCS. The structure of the OIU commands is defined in the OIU System Brief.

#### **PROCEDURE**

The SSOR key commands tell the SSOR which encryption key to use. This key must match the key that is selected in the SSSR. The routing code for OIU to SSOR commands is 03hex(h). The SSOR can receive a command with up to 64 commands words, but since words 2-64 are not used (fill data), only command word 1 is required in the OIU SSOR key command. Figure 3.25-1 and Figure 3.25-1 give examples of the HEX data words needed for two SSOR key commands and define the structure of each command. Note that bit 0 is the LSB and bit 15 is the MSB.

Command Words Nomenclature 0004 000B 03F3 SSOR KEY 11

To calculate parity byte (Key 11), Exclusive Or  $(\oplus)$  all bytes with FFh:  $00h \oplus 04h \oplus 00h \oplus 08h \oplus 03h \oplus FFh = F3h$ 

Preamble	Byte Count	SSOR key#	Routing Code	Parity Byte
0000 0000	0000 0100	0000 0000 0000 1011	0000 0011	1111 0011
00h	04h	000Bh	03h	F3h

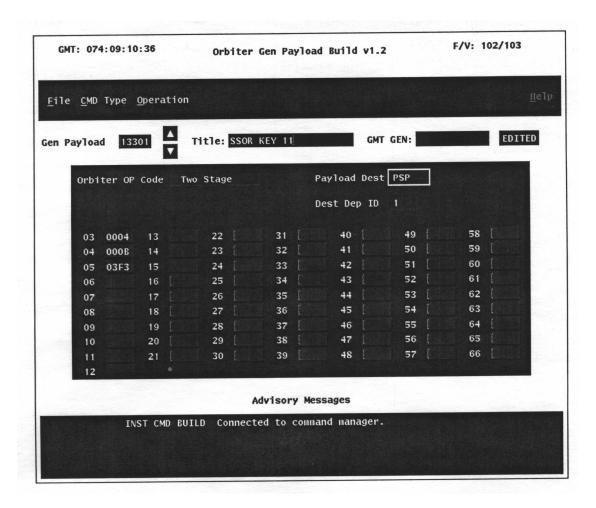


Figure 3.25-1. Example 1: SSOR key command structure for SSOR KEY 11

Command Words Nomenclature
0004 0FFF 0308 SSOR KEY 4095

To calculate parity byte (Key 4095), Exclusive Or  $(\oplus)$  all bytes with FFh:  $00h \oplus 04h \oplus 0Fh \oplus FFh \oplus 03h \oplus FFh = 08h$ 

Preamble	Byte Count	SSOR key#	Routing Code	Parity Byte
0000 0000	0000 0100	0000 1111 1111 1111	0000 0011	0000 1000
00h	04h	0FFFh	03h	08h

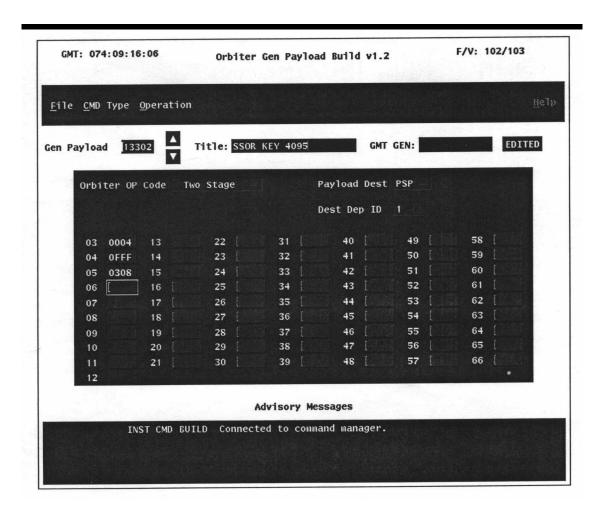


Figure 3.25-2. Example 2: SSOR key command structure for SSOR KEY 4095

The following table contains the HEX command words needed for the first 300 SSOR key commands.

Table 3.25-1. SSOR key command words

Key Number	HEX	Command V	Vords
0 (test)	0004	0000	03F8
1	0004	0001	03F9
2	0004	0002	03FA
3	0004	0003	03FB
4	0004	0004	03FC
5	0004	0005	03FD
6	0004	0006	03FE
7	0004	0007	03FF
8	0004	8000	03F0
9	0004	0009	03F1
10	0004	000A	03F2
11 (test/default)	0004	000B	03F3
12	0004	000C	03F4
13	0004	000D	03F5
14	0004	000E	03F6
15	0004	000E	03F7
16	0004	0010	03E8
17	0004	0011	03E9
18	0004	0012	03EA
19	0004	0013	03EB
20	0004	0014	03EC
21	0004	0015	03ED
22	0004	0016	03EE
23	0004	0017	03EF
24	0004	0018	03E0
25	0004	0019	03E1
26	0004	001A	03E2
27	0004	001B	03E3
28	0004	001C	03E4
29	0004	001D	03E5
30	0004	001E	03E6
31	0004	001E	03E7
32	0004	0020	03D8
33	0004	0021	03D9
34	0004	0021	03DA
35	0004	0023	03DB
36	0004	0024	03DC
37	0004	0025	03DD
38	0004	0026	03DE
39	0004	0027	03DF
40	0004	0028	03D0
41	0004	0029	03D1
42	0004	002A	03D2
43	0004	002A	03D3
44	0004	002C	03D4
45	0004	002D	03D5
46	0004	002E	03D6
47	0004	002E	03D0 03D7
48	0004	0030	03D7
49	0004	0030	03C8
45	0004	0031	0308

Key Number	HEX	Command V	Vords
50	0004	0032	03CA
51	0004	0033	03CB
52	0004	0034	03CC
53	0004	0035	03CD
54	0004	0036	03CE
55	0004	0037	03CF
56	0004	0038	03C0
57	0004	0039	03C1
58	0004	003A	03C2
59	0004	003B	03C3
60	0004	003C	03C4
61	0004	003D	03C5
62	0004	003E	03C6
63	0004	003F	03C7
64	0004	0040	03B8
65	0004	0041	03B9
66	0004	0042	03BA
67	0004	0043	03BB
68	0004	0044	03BC
69	0004	0045	03BD
70	0004	0046	03BE
71	0004	0047	03BF
72	0004	0048	03B0
73	0004	0049	03B1
74	0004	004A	03B2
75	0004	004B	03B3
76	0004	004C	03B4
77	0004	004D	03B5
78	0004	004E	03B6
79	0004	004F	03B7
80	0004	0050	03A8
81	0004	0051	03A9
82	0004	0052	03AA
83	0004	0053	03AB
84	0004	0054	03AC
85	0004	0055	03AD
86	0004	0056	03AE
87	0004	0057	03AF
88	0004	0058	03A0
89	0004	0059	03A1
90	0004	005A	03A2
91	0004	005B	03A3
92	0004	005C	03A4
93	0004	005D	03A5
94	0004	005E	03A6
95	0004	005F	03A7
96	0004	0060	0398
97	0004	0061	0399
98	0004	0062	039A
99	0004	0063	039B

Key Number	HEX	Command V	Vords
100	0004	0064	039C
101	0004	0065	039D
102	0004	0066	039E
103	0004	0067	039F
104	0004	0068	0390
105	0004	0069	0391
106	0004	006A	0392
107	0004	006B	0393
108	0004	006C	0394
109	0004	006D	0395
110	0004	006E	0396
111	0004	006F	0397
112	0004	0070	0388
113	0004	0071	0389
114	0004	0072	038A
115	0004	0073	038B
116	0004	0074	038C
117	0004	0075	038D
118	0004	0076	038E
119	0004	0077	038F
120	0004	0078	0380
121	0004	0079	0381
122	0004	007A	0382
123	0004	007B	0383
124	0004	007C	0384
125	0004	007D	0385
126	0004	007E	0386
127	0004	007F	0387
128	0004	0080	0378
129	0004	0081	0379
130	0004	0082	037A
131	0004	0083	037B
132	0004	0084	037C
133	0004	0085	037D
134	0004	0086	037E
135	0004	0087	037F
136	0004	8800	0370
137	0004	0089	0371
138	0004	A800	0372
139	0004	008B	0373
140	0004	008C	0374
141	0004	008D	0375
142	0004	008E	0376
143	0004	008F	0377
144	0004	0090	0368
145	0004	0091	0369
146	0004	0092	036A
147	0004	0093	036B
148	0004	0094	036C
149	0004	0095	036D

Key Number	HEX	Command V	Vords
150	0004	0096	036E
151	0004	0097	036F
152	0004	0098	0360
153	0004	0099	0361
154	0004	009A	0362
155	0004	009B	0363
156	0004	009C	0364
157	0004	009D	0365
158	0004	009E	0366
159	0004	009F	0367
160	0004	00A0	0358
161	0004	00A1	0359
162	0004	00A2	035A
163	0004	00A3	035B
164	0004	00A4	035C
165	0004	00A5	035D
166	0004	00A6	035E
167	0004	00A0 00A7	035F
168	0004	00A7	0350
169	0004	00A9	0351
170	0004	00A3	0352
171	0004	00AB	0353
172	0004	00AD	0354
173	0004	00AC	0355
174	0004	00AE	0356
175	0004	00AE	0357
176	0004	00B0	0348
177	0004	00B0 00B1	0349
178	0004	00B1	0349 034A
179	0004	00B2	034B
180	0004	00B3	034C
181	0004	00B5	034D
182	0004	00B6	034E
183	0004	00B0 00B7	034E
184	0004	00B8	0340
185	0004	00B9	0341
186	0004	00B3	0342
187	0004	00BA	0342
188	0004	00BC	0344
189	0004	00BC	0345
190	0004	00BE	0346
191	0004	00BE	0347
192	0004	00C0	0338
193	0004	00C0 00C1	0339
194	0004	00C1	033A
195	0004	00C2	033A
196	0004	00C4	033C
197	0004	00C4 00C5	033D
198	0004	00C5 00C6	033E
199	0004	00C7	033F
100	7	0001	0001

Key Number	HEX	Command V	Vords
200	0004	00C8	0330
201	0004	00C9	0331
202	0004	00CA	0332
203	0004	00CB	0333
204	0004	00CC	0334
205	0004	00CD	0335
206	0004	00CE	0336
207	0004	00CF	0337
208	0004	00D0	0328
209	0004	00D1	0329
210	0004	00D2	032A
211	0004	00D3	032B
212	0004	00D4	032C
213	0004	00D5	032D
214	0004	00D6	032E
215	0004	00D7	032F
216	0004	00D7	0320
217	0004	00D0	0321
218	0004	00D3	0322
219	0004	00DR	0323
220	0004	00DC	0324
221	0004	00DD	0325
222	0004	00DE	0326
223	0004	00DE 00DF	0327
224	0004	00E0	0318
225	0004	00E0	0310
226	0004	00E2	031A
227	0004	00E3	031A 031B
228	0004	00E3	031C
229	0004	00E5	031D
230	0004	00E6	031E
231	0004	00E7	031F
232	0004	00E8	0310
233	0004	00E9	0311
234	0004	00EA	0312
235	0004	00EB	0312
236	0004	00EC	0314
237	0004	00ED	0314
238	0004	00EE	0316
239	0004	00EF	0317
240	0004	00F0	0308
241	0004	00F1	0309
242	0004	00F2	030A
243	0004	00F3	030B
244	0004	00F4	030C
245	0004	00F5	030D
246	0004	00F6	030E
247	0004	00F7	030E
248	0004	00F8	0300
249	0004	00F9	0301
270	UUU <del>T</del>	001 3	0001

Key Number	HEX	Command V	Vords
250	0004	00FA	0302
251	0004	00FB	0303
252	0004	00FC	0304
253	0004	00FD	0305
254	0004	00FE	0306
255	0004	00FF	0307
256	0004	0100	03F9
257	0004	0101	03F8
258	0004	0102	03FB
259	0004	0103	03FA
260	0004	0104	03FD
261	0004	0105	03FC
262	0004	0106	03FF
263	0004	0107	03FE
264	0004	0108	03F1
265	0004	0109	03F0
266	0004	010A	03F3
267	0004	010B	03F2
268	0004	010C	03F5
269	0004	010D	03F4
270	0004	010E	03F7
271	0004	010F	03F6
272	0004	0110	03E9
273	0004	0111	03E8
274	0004	0112	03EB
275	0004	0113	03EA
276	0004	0114	03ED
277	0004	0115	03EC
278	0004	0116	03EF
279	0004	0117	03EE
280	0004	0118	03E1
281	0004	0119	03E0
282	0004	011A	03E3
283	0004	011B	03E2
284	0004	011C	03E5
285	0004	011D	03E4
286	0004	011E	03E7
287	0004	011F	03E6
288	0004	0120	03D9
289	0004	0121	03D8
290	0004	0122	03DB
291	0004	0123	03DA
292	0004	0124	03DD
293	0004	0125	03DC
294	0004	0126	03DF
295	0004	0127	03DE
296	0004	0128	03D1
297	0004	0129	03D0
298	0004	012A	03D3
299	0004	012B	03D2
200	0004	0120	0002

PAYLOAD SIGNAL PROCESSOR CONFIGURATION MESSAGE UPDATE TO THE SM GPC

9/1/2004: REV G

#### CAUTION

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

#### **PURPOSE**

To define a standard set of procedures for using and building Payload Signal Processor (PSP) configuration message updates and for transmitting the contents to the SM GPC.

## **RESTRICTIONS & CONSTRAINTS**

These procedures are only valid in all ops modes of the SM major function.

## **GENERAL**

The PSP is configured and controlled by ten 16-bit word configuration messages, which are stored only in the SM applications software. Each of these messages relates to specific payload requirements and provides all the information necessary to configure the PSP to support that payload for command through the hardline or the Payload Interrogator (PI) interface and the telemetry data transfer from the PI to the Payload Data Interleaver (PDI).

On missions that do not use the PSP or when all ten PSP configuration messages IDs are not required, ten messages are still allocated in SM memory.

The SM software will be updated with the flight-specific PSP configuration messages before each flight. These prestored SM PSP configuration messages can be found in the Payload Management Level C Requirements, JSC-19478, Table 7.17.1. This table should be compared against the Integrated Mission Orbiter Command and Data Annex (Annex 4), JSC-22636-XX, Table 19, which also displays PSP configuration messages. See these documents at the following web pages

For JSC-19478: go to <a href="http://usa10.unitedspacealliance.com/tx/sels/">http://usa10.unitedspacealliance.com/tx/sels/</a> and type in 19478 in the document number type in box. After the list of documents is displayed, select the applicable STS flight id number document from the list.

For JSC-22636: go to <a href="http://usa10.unitedspacealliance.com/tx/sels/">http://usa10.unitedspacealliance.com/tx/sels/</a> and type in 22636 in the document number type in box. After the list of documents is displayed, select the applicable STS flight id number document from the list.

Note: Changes to the prestored SM PSP configuration messages may or may not be required. For whatever reason, if an update is required, this SCP describes how to build and uplink the load to the SM GPC.

Note: To actually load the PSP with the desired configuration message, simply initiating a command destined for the PSP will configure the PSP. The SM GPC always precedes each PSP-destined command with a configuration message.

Note: Prior to the payload customer initiating required mission commands, the INST will verify that the first used SM prestored configuration message is accurate by uplinking a PL throughput command destined for the PSP. Using SCP 3.28, INST builds the command with the data

portion of the command, which consists of one 16-bit word of all zeros (i.e., this corresponds to uplink word 3 being 0000 in hex). This is called the PSP DUMMY command. INST CMD BUILD display has templates of this command already available to modify for use.

## **PROCEDURE**

# A. PSP configuration message build

The PSP configuration message uses INST CMD BUILD and will be built by Instrumentation or Comm Support. The INST CMD BUILD display should have some PSP configuration message load files built that can be used as a template for the new load you are building. See Figure 3.26-1.

SEQ	Initiator	Action	Comments
1	INST	Call up the INST CMD BUILD display from the INCO GCS DNAV menu and select the PSP CONFIG option from the Operations menu	See SCP 7.42 for details on the description of the INST CMD BUILD display
2	INST	Enter a valid DSM number (13201-13250) with a title (such as PSP CONFIG FOR SPAS). The title can be any character string up to 21 characters long	
3	INST	If the DSM selected is an existing command load in the server, select the Clear option from the File menu	
4	INST	Select or enter the data required to build the PSP configuration message	The numbers inclosed in the "( )" are the values used in the PM Level C, Annex 4
5	INST	Select the Submit option from the Operations menu	The green Edited light will disappear
6	INCO	Verify the command by looking at it from the INST CMD BUILD display on the PSP Config subdisplay	

# B. PSP configuration message uplink to SM GPC

SEQ	Initiator	Action	Comment
1	INST	Select SM MF, AUTO EXECUTE, and LOAD mode	This U/L is a two-stage OP code
2	INST	On DSM, enter load number	
3	INST	Depress CMD INIT button	This load is being sent only to the SM computer, not the PSP!

# C. Discriptions of the PSP configuration messages

The following tables discribe the components of a PSP configuration message as they are documented in the CPDS and the FSR documents.

Table 3.26-1. P/L command rate

Hexadecimal	Binary bit pattern	Command rate
0	0000	Not used
1	0001	Not used
2	0010	Not used
3	0011	Not used
4	0100	125/16 BPS (7.81)
5	0101	125/8 BPS (15.62)
6	0110	125/4 BPS (21.25)
7	0111	125/2 bps (62.5)
8	1000	125 BPS
9	1001	250 BPS
Α	1010	500 BPS
В	1011	1000 BPS
С	1100	2000 BPS
D	1101	Not used
E	1110	Not used
F	1111	Not used

Table 3.26-2. P/L command data type (PCM format)

Hexadecimal	Binary bit pattern	CMD format
0	00	Not used
1	01	NRZ-L
2	10	NRZ-M
3	11	NRZ-S

Table 3.26-3. P/L umbilical

Hexadecimal	Binary bit pattern	Umbilical Selection
0	000	Not used
1	001	1
2	010	2
3	011	3
4	100	4
5	101	5
6	110	6
7	111	Not used

Table 3.26-4. Command subcarrier (idle pattern)

Hexadecimal	Binary bit pattern	ldle pattern
0	00	OFF
1	01	ON

Table 3.26-5. Telemetry data rate

Hexadecimal	Binary Bit pattern	Telemetry rate	
0	000	Not used	
1	001	1 KBPS	
2	010	2 KBPS	
3	011	4 KBPS	
4	100	8 KBPS	
5	101	16 KBPS	
6	110	Not used	
7	111	Not used	

Table 3.26-6. Telemetry data type (PCM format)

Hexadecimal	Binary bit pattern	PCM format
0	000	Not used
1	001	Bi φ-L
2	010	Bi φ-L
3	011	Bi φ-L
4	100	NRZ-L
5	101	NRZ-M
6	110	NRZ-S
7	111	Not used

Table 3.26-7. Telemetry frame length

Hexadecimal	Binary bit pattern	Frame length*
0	0000 0000 0000	Not used
1	000 0000 0001	1
2	000 0000 0010	2
•	•	•
•	•	•
3FF	011 1111 1111	1023
400	100 0000 0000	1024
401	100 0000 0001	Not used
•	•	•
•	•	•
7FF	111 1111 1111	Not used

<sup>\*</sup>Frame lengths specified are the number of 8-bit words (not including frame sync bits).

Table 3.26-8. PSP port mode

Hexadecimal	Binary bit pattern	Port
0	00	Umbilical
1	01	Pl

Table 3.26-9. Frame sync word length

Hexadecimal	Bit pattern	Word length (bits)
0	000	Not used
1	001	8
2	010	16
3	011	24
4	100	32
5	101	Not used
6	110	Not used
7	111	Not used

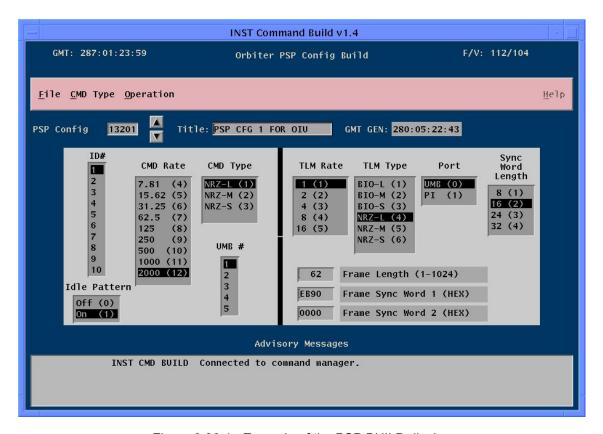


Figure 3.26-1. Example of the PSP BUILD display

PAYLOAD SYSTEM COMMANDS VIA GCIL

## **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

#### **PURPOSE**

This procedure documents the process for commanding the change of the payload communications systems (PSP and PI) in support of malfunction resolution or payload requirements.

## **COMMAND RESTRICTIONS/CONSTRAINTS**

These procedures are valid in all major modes. There are no time constraints on the execution of these procedures but the crew must be informed of any action being taken since there is the potential for fault messages being generated during the procedures.

## **GENERAL**

The Payload Interrogator (PI) and the Payload Signal Processor (PSP) interlock signals were not tied together to provide PI/PSP/ BOTH GCIL configuration redundancy between Payload Systems 1 and 2. When the S-bd PL Control switch is moved from the PNL to CMD position, the PI/PSP/BOTH GCIL configuration in the active (powered) system will be set to ON, while the PI/PSP/BOTH GCIL configuration in the inactive (unpowered) system will be set to OFF. Therefore, the inactive string is no longer configured like the active string. **This PL COMM System characteristic affects only switching strings**.

Operationally, this means the following:

If the S-bd PL CONTROL switch has been in the PNL, then CMD position, when swapping PL COMM systems via command, both a configuration command (PI/PSP/BOTH) and a system command (PL SYS 1/2 ON) must be sent. The order of the command does not matter, but both must be sent to power up the other PL COMM string LRUs. A configuration command is typically sent first. Once both have been sent, further switching between PI/PSP/BOTH on the same string requires only the configuration command, and switching between strings 1 and 2 requires only a system command. This cycle repeats for each PNL then CMD action on the A1L panel. (Therefore, the commands in *italics* in the following procedures may not be necessary.)

When the PI is powered OFF by the crew, the power for the channel select thumbwheels goes low. So, when the S-bd PL CONTROL switch is moved from PNL to CMD, the channel switches are read as 000. When the ground commands the PI ON, the PI will come up in channel 000. For the ground to avoid bringing up the PI in channel 000, first send a PI channel selection two-stage MRTC, then turn the PI on (PL INTGR - SEL 4804) or both the PSP/PIs on (PL PSP/INTGR - SEL 4805).

## **PROCEDURES**

There are nine unique PL System commanding scenarios: PSP ON, PSP OFF, PI ON, PI OFF, PSP/PI ON, PSP/PI OFF, PI Channel Selection, Swapping Systems, and PL System Configuration for ERPCL.

For all cases, coordinate activities with PL DATA, ACO DATA, PAYLOADS, or ACO on INST COORD, inform INCO before any commanding, ensure that the PL Mode switch is in CMD, and verify end item response and configuration.

Any command in italics may not be required as discussed in the first paragraph of this SCP.

For all cases, coordinate activities with PL DATA or PAYLOADS on INST COORD, inform INCO before any commanding, ensure that the PL Mode switch is in CMD, and verify end item response and configuration.

## A. PSP ON

1. If PI not required:

PL PSP - SEL 4803 PL SYSTEM 1 (2) - ON 4800 (4802)

If PI required:

PL PSP/INTGR - SEL 4805 PL SYSTEM 1 (2) - ON 4800 (4802)

- 2. INST uplinks PSP 1 (2) I/O reset 12547 (12548) to establish I/O with the SM GPC.
- 3. INST uplinks a PSP dummy command with the desired PSP configuration message ID to verify that the SM configuration message is accurate and the PSP does indeed get configured properly.

## B. PSP OFF

#### WARNING

Removing power from a PSP that has I/O established with the SM GPC will cause an S62 BCE BYP PSP 1(2) message.

1. If PI not required:

PL SYSTEM - OFF 4801

If PI required (PSP Bypass operations or Bent Pipe):

PL INTGR - SEL 4804

## C. PI ON

- 1. To avoid bringing up the PI in channel 000, a PI channel selection two-stage MRTC may be required. (See the PI CHANNEL SELECTIONS caution note.)
- 2. If PSP not required (PSP Bypass operations or Bent Pipe):

PL INTGR - SEL 4804 PL SYSTEM 1 (2) - ON 4800 (4802)

If PSP required:

PL PSP/INTGR - SEL 4805 PL SYSTEM 1 (2) - ON 4800 (4802)

- a. INST uplinks PSP 1 (2) I/O reset 12547 (12548) to establish I/O with the SM GPC.
- b. INST uplinks a PSP dummy command with the desired PSP configuration message in order to verify that the SM configuration message is accurate and the PSP does indeed get configured properly.
- 3. The PI may require more configuration commanding for transmitter power levels, antenna polarization, modulation on/off, transmitter frequency sweep, or frequency sweep wide/narrow.

## D. PI OFF

## **WARNING**

Removing a payload RF link may cause an S62 PDI DECOM FAIL message. Removing power from a PSP that has I/O established with the SM GPC will cause an S62 BCE BYP PSP 1 (2) message.

1. If PSP not required:

PL SYSTEM - OFF 4801

If PSP required:

PL PSP - SEL 4803

## E. PSP/PI ON

- 1. To avoid bringing up the PI in channel 000, a PI channel selection two-stage MRTC may be required. (See the PI CHANNEL SELECTIONS caution note.)
- 2. PL PSP/INTGR SEL 4805.
- 3. PL SYSTEM 1 (2) ON 4800 (4802).
- 4. INST uplinks PSP 1 (2) I/O reset 12547 (12548) to establish I/O with the SM GPC.
- INST uplinks a PSP dummy command with the desired PSP configuration message to verify that the SM configuration message is accurate and the PSP does indeed get configured properly.
- The PI may require more configuration commanding for transmitter power levels, antenna polarization, modulation on/off, transmitter frequency sweep, or frequency sweep wide/narrow.

## F. PSP/PI OFF

## **WARNING**

Removing power from the PSP that has I/O established with the SM GPC will cause an S62 BCE BYP PSP 1(2) message; removing a payload rf telemetry link (PI or PSP off) may cause an S62 PDI DECOM FAIL message.

PL SYSTEM – OFF 4801

SHUTTLE OPS P/L SYS CMD INCO/COMM/JSC-12829 9/1/2004: REV G SCP 3.27

## G. PI CHANNEL SELECTION

## CAUTION

The PI transmitter may interfere with the orbiter S-band PM Transponder (XPNDR) receiver when the following channels/frequency settings are selected. Interference can be severe enough to capture the XPNDR receiver lock.

 IF PI CHANNELS
 AVOID XPNDR PM FREQ

 000-420, 900-909
 LOW

 421-882, 910-919
 HIGH

1. All PI channel selection commands must be sent as two-stage MRTCs.

- 2. The first command in the MRTC MUST be PL FREQ SEL RESET 4834. If this command is not issued first, erroneous PI channel selection will occur.
- 3. The subsequent MRTC PI channel selection commands should be in the sequence of 100's, TENs, then UNITs.

Example: To select PI channel 241:

An MRTC would be built as follows:

PL FREQ SEL - RESET 4834 PL FREQ 100 SEL - 2 4831 PL FREQ TENS SEL - 4 4828 PL FREQ UNIT SEL - 1 4822

## H. SWAPPING SYSTEMS

- 1. Use two-stage MRTC for PI channel selection.
- 2. Select one of the following channels, depending on desired PSP/PI usage:

PI INTGR - SEL 4804 PL PSP - SEL 4803

PL PSP/INTGR - SEL 4805

3. Then send one of the following commands:

PL SYSTEM 1 - ON 4800 PL SYSTEM 2 - ON 4802

- 4. INST uplinks PSP 1 (2) I/O reset 12547 (12548) to establish I/O with the SM GPC.
- 5. If required, INST uplinks a PSP dummy command with the desired PSP configuration message in order to verify that the SM configuration message is accurate and the PSP does indeed get configured properly.
- 6. The PI may require more configuration commanding for transmitter power levels, antenna polarization, modulation on/off, transmitter frequency sweep, or frequency sweep wide/narrow.

## I. PL SYSTEM CONFIGURATION FOR ERPCL

To select between the PI and ERPCL for command and/or telemetry, uplink the proper PSP CONFIG MSG and/or confirm that it is resident in SM, using the appropriate PSP Dummy. Do not attempt to route commands to the PI or ERPCL using the GCIL commands PL PSP CMD OUT - INT(UMB), because those commands will be overridden by the PSP CONFIG MSG that is sent with the next command.

## **ADDITIONAL OPERATIONAL NOTES**

- 1. Based on STS-57 (EURECA) and STS-51 (ORFEUS-SPAS) mission experiences and subsequent Electronic Systems Test Laboratory (ESTL) testing, 2250-MHz orbiter downlink FM transmission interfering with the payload return link is probable. Test results show that ALL PI received channels are susceptible to interference from the orbiter FM transmission (either TV or recorder source) when the upper hemi antenna is used. The lower hemi has a negligible effect on the operation of the payload return link. See SCP 3.35 for more details on PI frequency constraints. (This information came from an EV4/Systems Analysis and Test Branch memo, EV4-11/94-026 dated November 14, 1994.)
- 2. The potential exists to lose power to either the PI or PSP when the S-bd PL CONTROL switch is in the PNL position and the Power Select switch is moved. For example, if in PNL and both the PI and PSP are powered, taking the Select switch from BOTH to PSP can cause the PSP to lose power while the switch contact is moving from BOTH to PSP (break before make). Crew procedures should be written so that switch changes are performed, while in CMD, then the crew performs a switch to PNL, then back to CMD.
- 3. STS 103, the latest Hubble repair mission, was the most recent use of the PI "Bent Pipe" mode. This mode requires the use of the DOD mode of operation so that the PI data can be passed directly to the Ku band channel 2 (PL Digital mode). A laptop computer was also used to process the data from the PI before it was routed to the PDI for incorporation into the downlink.

# PAYLOAD DATA LOAD AND PAYLOAD THROUGHPUT LOAD GENERATION

9/1/2004: REV G

## **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed pre-mission without review and approval at the FOIG.

## **PURPOSE**

TITLE

This procedure defines a standard set of processes for usage and generation of the Payload Data Load (PDL) and Payload Throughput Load (PTL).

#### **GENERAL**

The PDL and PTL types are of the same basic format; however, the OP code and onboard processing are slightly different. The basic format provides for destination selection, destination-dependent ID selection, and the number of valid words uplinked. These data are used by the SM application uplink software to determine which set of interface software should process the uplink load. The valid destinations follow:

- Payload Signal Processor (PSP)
- Standard Serial Interface (SSI)

The following destination-dependent IDs are:

- For PSP 0 to 10
- For SSI 1 to 8

All others, except the ones identified previously, are invalid. In addition, the number of valid uplink 16-bit data words is different for each destination, and they are identified as follows.

- PSP 0 to 64 words
- SSI 1 to 32 words

As noted previously, PDL and the PTL are processed differently by the onboard uplink software. The PDL is a two-stage load and therefore requires a downlink of the Two-Stage Buffer (TSB) for verification and review prior to uplink of a two-stage buffer execute command. The PTL is loaded into the payload throughput buffer instead of the two-stage buffer, and, therefore, does not require a buffer execute command. The PTL command is transferred to its destination once the last command word has been received and no errors were detected.

# **PROCEDURE**

PDL and PTL command loads are built from the INST CMD BUILD display.

SEQ	Initiator	Action	Comments
1	INST	Call up the INST CMD BUILD display from the INCO GCS DNAV menu and select the Gen Payload option from the Command Types menu	See SCP 7.42 for more information on the INST CMD BUILD display
2	INST	Enter a valid DSM number (13301 to 13350 or 71201 to 71250; 712xx is used by the Payloads position only) with a title (such as PSP Dummy - 1). The title can be any character string up to 21 characters long	
3	INST	Select the options for  Oribter Op code: Two stage Single stage  Payload Dest: PSP SSI  Dest Dep ID: PSP = 1 - 10 SSI = 1 - 8	PDLs will use the two-stage buffer while PTLs are single stage and use the payload throughput buffer
4	INST	Fill in the hex character command words in the middle section of the display	If PSP is selected in step 3, command data words 3-66 are available, but if SSI is selected, only words 3-34 are available
5	INST	From the Operations menu, select the Submit option	The green Edited light will disappear as the command is sent to the command server

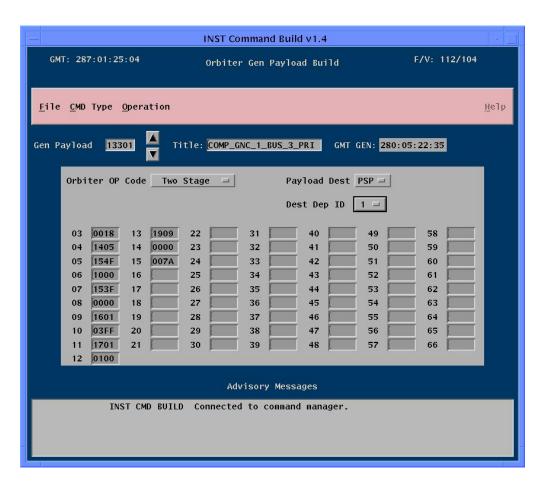


Figure 3.28-1. Example of General Payload Load Build display

## CCTV CAMERA POWER STATUS WITHOUT TV DOWNLINK

## **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

## **PURPOSE**

This procedure allows INCO to determine which cameras are powered without TV downlink.

9/1/2004: REV G

## **COMMAND RESTRICTIONS AND CONSTRAINTS**

Ground CMD of CCTV cameras requires crew coordination. These commands are legal in all OPS modes of the GNC, SM and BFS major functions.

## **PROCEDURE**

D.

U/L DSM 4249

Be sure CCTV is in "Sync" mode. Sync mode may not be compatible with crew activities. Note that the VCU defaults to sync mode at power up.

A.	U/L DSM 4251	TEST PATTERN SEL
B.	U/L DSM 4249	DOWNLINK
	✓	ALC - "blank"
C.	U/L DSM 42XX	CAMERA SELECT

**DOWNLINK** If ALC not = "blank" then camera is ON.

If ALC = "blank" then camera is OFF or malfunctioned.

REPEAT steps A through D for all cameras.

## **CCTV CAMERA POSITIONING**

## **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

## **PURPOSE**

This procedure allows the INCO to position the payload bay (PLB) cameras without TV downlink This procedure should be used to preposition the cameras for an INCO-commanded PLB camera sequence. If the crew is using the TV, this procedure should not be used.

Note: Flight-specific rules should be checked for restrictions on PLB cameras before using this procedure.

## **COMMAND RESTRICTIONS AND CONSTRAINTS**

Ground CMD of CCTV cameras requires crew coordination. These commands are valid in all OPS modes of the GNC, SM and BFS major functions.

## **PROCEDURE**

A.	U/L DSM	4200	VCU MAIN A
B.	U/L DSM	42XX	CAMERA SELECT
C.	U/L DSM	4254	ZOOM OUT
D.	U/L DSM	4271	TILT DOWN
E.	U/L DSM	4273	PAN LEFT (A or C) (FWD or AFT)
		or 4274	or PAN RIGHT (B or D) (KEEL or SRMS)
F.	U/L DSM	4265	ZOOM STOP
			WAIT 30 SEC
G.	U/L DSM	4272	TILT STOP
H.	U/L DSM	4275	PAN STOP
I.	U/L DSM	4270	TILT UP
			WAIT 6 SEC
J.	U/L DSM	4272	TILT STOP

SHUTTLE OPS INCO/COMM/JSC-12829			9/1/2004: REV G	CCTV CAMR POSIT SCP 3.30
K.	U/L DSM	4274 or 4276	PAN RIGHT (A or C) (FWD or AFT) or PAN LEFT (B or D) (KEEL or SRMS)	
			WAIT 14 SEC	
L.	U/L DSM	4275	PAN STOP	
M.	U/L DSM	4273	PAN/TILT RESET	
			CONTINUE WITH NEXT CAMERA	

LOSS-OF-VOICE PROCEDURE

## **CAUTION**

9/1/2004: REV G

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or be changed premission without review and approval at the FOIG.

## **PURPOSE**

To define procedures to be used in the event of loss of two-way voice communications with the ground.

## COMMAND RESTRICTIONS/CONSTRAINTS

This procedure is valid in all ops modes of the GNC, SM and BFS major functions.

## **GENERAL**

According to the flight rules, loss of voice during the ascent phase requires the crew to perform next day primary landing site (PLS) deorbit if command is still available. If both voice and command are lost during ascent, the rules require an orbit 2 PLS deorbit. Once the "go for orbit" call has been given, loss of voice necessitates a next PLS entry if command is available. If unavailable an ELS landing may be required, depending upon state vector stability. Therefore, it is important to keep the crew informed of the uplink command status. Refer to Flight Rules A11-1 and A11-2, the COMM LOST procedure in the Ascent Pocket Checklist, and SSR 1 in the communications section of the Crew Malfunction Procedures.

#### **PROCEDURE**

See the Flight Data File Ascent Pocket Checklist and MALF COMM SSR-1.

Without voice, several commands can be used to inform the crew that uplink command is still available. The uplink activity indicator may be commanded on and off cyclically via GNC and/or SM (not BFS) to cause a flashing "UL" indication on the associated crew displays. Additionally, any time a load is retained in the GNC, SM, or BFS two-stage buffers, the flashing "UL" will appear on the appropriate displays driven by that GPC major function. It is also possible to get the crew's attention by deliberately causing an alarm via either an NSP switch, a crew alert command that causes a class 3 alert (but no message), or the abort light. To minimize any uncertainty, it is a good idea to precoordinate with the crew the method to be used.

Once in orbit, the audio central control unit (ACCU) bypass connectors may be installed via IFM in an attempt to restore S-band or Ku-band (but not UHF) voice in the event of a dual ACCU failure. Should this attempt be unsuccessful, the steps defined in COMM SSR-1 of the Malfunction Procedures book may be consulted. These steps include: OCA telecon if available will restore 2 way voice comm, while Ku band is deployed. All these methods (including SAREX if flown) bypass the orbiter audio system. The following are the appropriate DSM numbers:

UL activity on DSM 4064 (not BFS) UL activity off DSM 4065 (not BFS)

For providing a flashing "UL" on a BFS display, select "MANUAL EXEC" on the command panel and uplink, but do not execute, a BFS two-stage load.

S-BAND AND KU-BAND RADIATION MANAGEMENT DURING PAYLOAD AND EVA OPERATIONS

9/1/2004: REV G

## **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

#### **PURPOSE**

This procedure defines steps taken by the lead INCO for a flight to develop a mission-specific communications plan that will avoid S-band or Ku-band radiation of either a payload or an EVA crewmember.

#### **PROCEDURES**

A. Ku-band β mask DETERMINATION and radiation management planning

Several of the steps used for determining acceptable Ku-band system management planning are identical for both EVA crewmembers and payloads. Differences will be noted where required.

Radiation limits for payloads are defined on a mission-dependent basis. Radiation limits for EVA crewmembers are based on the specified limits of the EMU or 20 volts/meter (V/m). This represents the limit of testing on the EMU's. The human exposure limit is 137 V/m for a period not to exceed 6 minutes per ANSI C95.1-1982. This requires that for all EMU operations there be no allowed radiation of the EVA crewmember by the Ku-band main beam.

- 1. The following steps are provided as a general outline for determining the Ku-band system management.
  - a. EVA work area determination Meet with EVA personnel and get from them the defined work areas for all mission-specific EVA's. Include in this a determination of the route that will be taken from airlock to worksite, worksite to worksite, and worksite to airlock. Also determine the work "volumes" that will be used by the crewmember once he is at the worksite.

These volumes should only include nominal activities planed for the EVA timeline. Incidents such as the loss of grip by the crewmember and subsequent retention by a tether, that occur external to a defined worksite volume cannot be predicted and do not need to be considered.

- b. Payload location determination Depending upon the payload, meet with either Payloads or RMS to determine the location and orientation of the payload during all flight phases. Often this step will not be required since the Pointers will already have certified models for use in the next step.
- 2. Contact the lead Pointer for this particular flight and request that plots showing the locations previously defined be created with several  $\beta$  masks superimposed upon them. Pointing has certified tools to provide this information.
- 3. Determine the necessary  $\beta$  values for protection of the EVA crewmember/payload and develop a management plan that includes this data. The  $\beta$  mask determination may require

evaluation of payload constraints that require additional protection beyond the minimum  $\beta$  angle that prevents main beam impingement. An example of this would be the STS-48 UARS payload requirement for an additional 5° safety zone beyond this minimum  $\beta$ . Consider that the use of a  $\beta$  mask is not the only accepted means of protection as long as the radiation limits are not exceeded. For EVA, it is allowable to use non- $\beta$  means per Flight Rules. See SCP 3.33 for building RF protect boxes.

4. Document this plan through the use of mission-specific flight rules and the communications planning memo.

9/1/2004: REV G

B. S-band Radiation Management Planning

S-band radiation from any of the three sources (PM, FM, or PI) has never been identified as a significant cause of concern for payloads. A concern relating to EVA operations has been identified because the specified EMU S-band radiation limit is 20 V/m. Just as with Ku-band, this value exists it is the upper limit of testing on the EMU's. Also, as with Ku-band, the radiation limit for S-band exposure in humans is 137 V/m for a period not to exceed 6 minutes per ANSI C95.1-1982.

1. S-band PM - The S-band PM antennae beams, since they provide the prime orbiter operational link, provide the most challenge for management. EMU avoidance of the PM antenna beams is the preferred method of management. The avoidance area is defined as that area within 1 meter of any S-Band antenna, per the EVA flight rules.

#### Other considerations

- a. Orbiter attitude control to force the selection of only those antennae  $\approx$  180 $^{\circ}$  away from the EVA worksite
- b. Inhibition of S-band pointing with commanding of antenna selections via RTC or, based on the ATL, via SPC
- c. Crew control via the C3 switch is possible, but radiation of the crewmember is possible as the switch is cycled through different positions to the desired location.
- d. Coordination with FAO/POINTING is required since other constraints must be considered, such as thermal and lighting concerns.
- 2. S-band FM The S-band FM antennas do not pose as significant a threat as the PM antennas pose. If avoidance of the PM antennas is the chosen option, then no evaluation of the FM system is required because its avoidance area is contained in the PM avoidance area. The FM avoidance area is a cylinder with a radius of 2 feet centered on  $X_0$  = 510,  $Y_0$  = 0,  $Z_0$  = 500, and extending 3 feet above the orbiter skin. A similar area would exist for the lower FM antenna; however since no EVA's are planned to this region at this time, it is not included in these considerations or Flight Rules. The EVA flight rule specifies a 1 meter keep-out zone for all S-Band antennas.

#### Other considerations

- a. The FM system can be turned off during the EVA.
- b. The lower hemi can be "forced" via crew control, or if SM antenna pointing is inhibited, can be controlled via ground command.
- c. EVA crewmember avoidance of the area may be taught as a part of training.

3. S-band payload interrogator (PI) - The PI, as with the FM, can be operated without restriction if a decision is made to avoid the PM antennas. The PI avoidance area is the cylindrical volume 2 feet in radius centered on  $X_0 = 558$ ,  $Y_0 = 0$ ,  $Z_0 = 500$ , and extending 3 feet above the orbiter skin, not including the area within the payload bay. The EVA flight rule specifies a 1 meter keep-out zone for all S-Band antennas.

9/1/2004: REV G

## Other considerations

- a. The PI can be turned off during the EVA.
- b. The PI transmitter power can be placed in low power. There are no restrictions for EVA/PI operations if this is done.
- c. EVA crewmember avoidance of the area may be taught as a part of training.

**KU-BAND PROTECTION BOX** 

## **CAUTION**

9/1/2004: REV G

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

## **PURPOSE**

This procedure provides the steps needed to build, modify, delete and manage the Ku-band protection box process in the Systems Management (SM) major function on the shuttle.

## COMMAND RESTRICTIONS/CONSTRAINTS

These commands are valid in SM OPS 2 and 4.

Time constraints, crew coordination requirements: The protection boxes must be enabled before the crew exits the airlock during an EVA. The boxes must be enabled before the Ku-band system can be used in cases where the Ku-band could radiate hardware that should not be radiated.

#### **GENERAL**

The SM Antenna Management (AM) software includes the capability for inhibiting output from the Kuband Traveling Wave Tube (TWT) when the antenna is pointing into any of four designated roll (azimuth)/pitch (elevation) boxes. The SM monitors the actual roll and pitch angles of the Ku-band system. Once the angles are within the designated box, the SM inhibits the Ku-band TWT. After the angles are no longer inside the box, the SM enables the TWT. There is a command to enable or inhibit each of the four RF Protection Boxes. This capability allows for more Ku-band downlink during EVA activities and when there is hardware in or around the orbiter that should not be radiated.

#### **PROCEDURES**

A RF protection box is made up of two roll/pitch pairs that represent a box in which the TWT will be inhibited. There are two different types of RF Protection boxes. The users must be careful to put the roll angles in the proper order or they may have a box that does not represent the designated area. This procedure is dependent on the INCO/COMM Console Handbook procedure for building TMBUs (SCP 3.16). The following procedure details the steps needed to build, edit, or delete the Table Maintenance Block Update (TMBU) commands used to define each box in the SM.

## A. Build, edit EVA protection box TMBUs

SEQ	Initiator	Action	Comments
1	COMM SPT or INST	Verify that the roll/pitch pairs that define the boxes are valid. $ +90^{\circ} \geq \text{Pitch2} \ (\text{V92H0172C}) > \text{Pitch1} \ (\text{V92H0171C}) \geq -90^{\circ} \\  \  \  \  \  \  \  \  \  \  \  \  \  $	There are up to four boxes available
2	COMM SPT or INST	Use the TMBU program to enter the MSIDs and their associated values. For the box to protect the under side ("belly box") of the orbiter, make Roll1 > Roll2. For a box to protect above or to the sides of the orbiter, make Roll2 > Roll1. See the example of the antenna display with the two types of boxes displayed (Figure 3.33-1)	INCO has agreed to use only DSMs 12346 through 12360. The agreement is documented in the FCOH

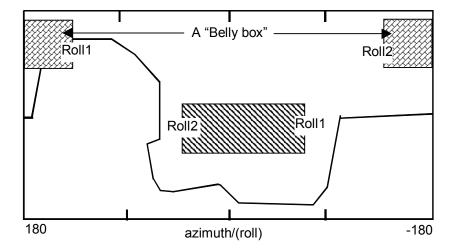


Figure 3.33-1. Example of the two types of protection boxes

- B. Delete RF Protection box TMBUs.
  - Use the TMBU SCP to delete the RF Protection box commands.
- C. Build, edit, and delete time executable commands to enable/inhibit the RF Protection boxes

  These commands can be built to execute in the future. Use the INCO SCP for building TECs.

## D. RF Protection Box Features

- 1. RADAR Mode RF Protect Boxes will not inhibit the TWT when the Ku Band is in RADAR mode. Once GNC SPEC 33 ITEM 2 is executed the RF Protect Boxes are no longer used by SM AM. A second SPEC 33 ITEM 2 must be executed to start use of the RF Protect Box inhibits.
- 2. "Acq in the Box" If handover to a new TDRS satellite occurs inside one of the RF Protection boxes but out side the BETA limit there is the possibility that the Ku band will see the TDRS forward link before the RF Protection Box can inhibit the TWT. This is a race condition between the Ku band processor and the SM flight software. The following procedures will be used to prevent inadvertent RF radiation into enabled RF protection boxes.
  - A. Build and uplink a TEC (14032 Ku TWTA OFF) or send it in real-time to inhibit the TWT before handover to the TDRS that will "Acg in the Box".
  - B. Build and uplink a TEC (14031 Ku TWTA ON) to enable the TWT about 3 minutes after handover to the new TDRS. This will allow for enough time for the Ku Band antenna to get to the proper location, which will allow the RF Protect boxes to do their job. The 3 minutes also allows for a search operation to complete.

The TWT could be enabled via real-time command once the Ku band has started tracking TDRS.

GPC DUMPS (REAL TIME OR PLAYBACK)/TFL COMPATIBILITY

## **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG

#### **PURPOSE**

To define a standard set of procedures to be used by INCO/DATACOMM personnel when retrieving general purpose computer (GPC) memory dumps via real-time downlink or Solid-State recorder playback. INCO/INST personnel will also use this section in order to ensure that a particular TFL is compatible with a given GPC Memory Dump.

#### **GENERAL**

During a mission, the crew may be required to dump the memory of a particular GPC or set of GPC's to the MCC and/or a Solid-State recorder. The following paragraphs contain the procedures to be used for real-time and recorder playbacks of GPC dumps.

## **GPC HARDWARE DUMP CONSTRAINTS**

A GPC hardware dump must be preceded by an active valid downlist format. If the dump is not preceded by a valid format, the FEP's will not be able to process the dump because the GPC dump takes on the format characteristics of the previous format. GPC hardware dumps are normally not a problem because a new computer is assigned to the major function (SM) or as the prime downlister (GNC redundant set) prior to dumping a failed GPC. However, in the case of a BFS failure during ascent, when time does not allow the selection of a new BFS GPC, a dump should not be attempted.

## **REAL-TIME GPC DUMPS**

Nominally, the crew will dump the GPC memory during TDRS AOS and the memory dump will be received real time. If, however, the real-time dump was corrupted by data hits, the INCO may be requested to playback the recorded data.

The following procedures must be executed to ensure a good playback of the GPC memory data.

- 1. Check to see that the active TFL has the bandwidth to support the type of dump to be performed. Refer to table 3.34-1 or the Payload Management Flight Software Requirements (FSR) to find a list of GPC dump types and the standard formats that will support them. If a nonstandard format is being used, compare the available bandwidth (downlist data rate) for the appropriate major function with the required bandwidth listed in table 3.34-1. If the active TFL cannot support the dump, another will have to be loaded.
- 2. The goal is to provide a good, solid downlink with no dropouts. To ensure that no dropouts occur, Ku blockage (or antenna switches, in the absence of Ku-band) should be avoided by using antenna predictions. The actual dump may take from approximately 1.5 to 18.2 minutes, depending on the type of dump, major function, and rate, so you need to know the length of the dump. DPS will be able to supply this information to INCO. See table 3.34-1 for times.
- 3. Have a Solid-State recorder running to back up the real-time downlink. Note the Solid State recorder, position, and GMT of when the dump was started and completed. Protect the dump on the recorder until confirmation of the receipt of a good dump on the ground is received. To protect

this data on a Solid State Recorder, assign a queue that encompasses the entire GPC dump with an off-nominal dump rate.

## RECORDER PLAYBACKS OF GPC DUMPS

The real-time dump procedures in the previous section must have been followed to ensure a successful recorder playback of the GPC dump.

- A. The data processing system (DPS) officer or DPS support will contact INCO or DATACOMM to request a playback of the recorder with the GPC dump data.
- B. Nominally the GPC dump(s) will be played back through Ku-band to avoid FM antenna switches. If FM is to be used, select a probable playback site and run an antenna plot to determine the extent of FM antenna switches during the pass. There must be a period of at least 1.5 minutes playback time with no switches during the actual GPC dump. If multiple dumps are on a recorder, these times apply to each dump.
- C. DATACOMM should notify the Data Flow Engineer (DFE) prior to the recorder playback that a GPC dump is contained in the recorder playback.
- D. When the recorder playback is started, confirm (by checking the snapshot GMT in the dump FEP) that a GPC dump will be covered. (The GMT should cover from before the start of the dump until after the end of the dump.)
- E. Monitor the data dropouts using the valid frames per second and percent total frames parameters. If numerous dropouts are encountered, the playback should be repeated. The main goal is to play back the data with <u>no dropouts</u>. A dump FEP report is also available to verify the quality of the dump.
- F. DATACOMM will coordinate the playback of the GPC dump from the dump FEP, via the playback FEP, to the DPS application. DATACOMM will notify DPS support of the number of times the recorder was played back, the quality, etc. DPS will decide which recorder playback(s) to process if more than one exists.
- G. DFE will communicate with DATACOMM and DPS support on INST COORD to coordinate the start of playback. DATACOMM will monitor the playback on the dump FEP display.

## HOW THE GPC MEMORY DUMP TIMES WERE CALCULATED

Consider a DPS request to do a complete software dump of the SM 2 GPC main memory data because SM 2 failed on orbit. The current TFL is 161, which has a downlist data rate that will support the SM 2 GPC dump. In nearly all cases, the entire contents of the GPC are dumped by specifying a starting address of "0" and dumping all 262,144 half words; however, any partial addresses within the GPC downlist may be dumped. Therefore, a complete GPC main memory consists of 262,144 16-bit words and is brought down at a rate of 25 frames per OI major frame per second. A GPC dump frame is captured every four OI minor frames. Therefore, 50 GPC dump frames are captured every 2 OI major frames occurring every 2 seconds.

To determine the frame length (the number of 16-bit words per frame) in each dump frame, first divide the bandwidth (downlist data rate) by 25 frames per second. The result will represent bits per frame. Divide this value by 16 bits per word to end up with words per frame. Continuing with the above example, the bandwidth is 19.2 kbps, and when divided by 25 frames per second and then by 16 bits per word, the result is 48 words per frame. The frame lengths have all been predetermined and placed in table 3.34-1.

Next, consider the overhead in each frame. Overhead includes the GPC data cycle header, frame header, checksum word, and the additional words added to the header to identify the dump as main memory or mass memory. The GPC data cycle header consists of six 16-bit words. These words are

located in words 1 through 6 of frames 0 and 25 and contain the sync word, frame counter, format ID, vehicle ID, GPC ID, mission ID, and GMT (12 words per 50-frame cycle). The frame header consists of two 16-bit words located in words 1 and 2 of frames 1 to 24 and 26 to 49 (96 words per cycle). Since the frame header is a subset of the data cycle header, words 1 and 2 are the same in all frames. To identify the main memory data, six additional 16-bit words are added to the headers in each frame. These words are located in words 7 through 12 of the data cycle header and in words 3 through 8 of the frame header (300 words per cycle). One checksum word per frame equals 50 per cycle.

5/31/2007: REV G, PCN-5

$$50 + 300 + 96 + 12 = 458$$
 overhead words per cycle.

The next step is to subtract the number of overhead words per 50 GPC dump frames from the total number of words per 50 GPC dump frames to determine the number of words available for dump data per 50 GPC dump frames. Multiply 48 words per frame by 50 GPC dump frames. The result is 2400 words per 50 GPC dump frames. Subtract from this the overhead, 13 cycle header, main memory identifier, and checksum words from each frame 0 and 25, 9 frame header, main memory identifier, and checksum words from each frame 1 to 24 and 25 to 49, for a total of 458 overhead words. Subtracting 458 overhead words from 2400 total words results in 1942 total available words per every 50 GPC dump frames for dump data. To determine how many major frames will be brought down before all 262,144 GPC memory words are captured in the dump, divide 262,144 words by 1942 available dump words per every 50 GPC dump frames to derive 134.98661 frames. In actuality, one frame in this result represents two OI major frames, since it takes two OI major frames to capture 50 GPC dump frames.

The time can be calculated in two parts. Since it takes 2 seconds for two major frames to come down through the return link, multiply 134 (which is the number of frames from the value 134.98661 completely filled with dump data) by 2 seconds to derive 268 seconds. The fraction 0.98661 may be converted into the number of minor frames filled with dump data in the last two major OI frames filled with dump data. Multiply 1942 dump words by 0.98661. This result is equal to 1916 words filled with dump data in the last two major frames.

To determine the number of minor frames filled up by 1916 words, start with the following equation:

$$N = M(n - 9) + y(n - 13)$$

where N = the number of words filled with dump data in the last two OI major frames, M = the number of minor frames filled with dump data in the last two OI major frames, and n = the frame length. The expression (n - 9) represents the number of available words in the minor dump frames 1 to 24 and 26 to 49, and the expression (n - 13) represents the number of available words in the minor frame(s) 0 and/or 25. The variable y will be a 1 or a 2, depending on whether the 26th minor dump frame has been filled with dump data. In this case, since 0.98661 > 0.5, then at least the 26th minor dump frame, which is in the second OI major frame, has been filled with dump data. From here solve for the variable M

$$M = [(N - y(n - 13))/(n - 9)]$$

Using the numbers derived thus far from the example's calculations, solve for M

$$M = [(1916 - 2(48 - 13))/(48 - 9)]$$
  
 $M = 47.333$  minor frames

Approximately 48 minor dump frames are filled with dump data in the last two OI major frames, and frame 49 is filled with fill data. Data are selected to fill the unused data locations at the end of the dump to complete the current data cycle. Since 1 GPC minor dump frame occurs every 4 OI minor frames, and 25 GPC dump minor frames occur every OI major frame per second, then a GPC minor dump frame occurs every 40 milliseconds. Multiply 48 minor dump frames by 0.04 seconds to derive 1.89 seconds. This is the time it takes to dump the last 48 minor dump frames. Therefore, the total time it takes to dump the complete SM 2 GPC main memory equals 269.89 seconds (268 seconds plus 1.89 seconds) or 4 minutes 30 seconds. The dump times have all been predetermined and placed in Table 3.34-1.

## **REFERENCES**

Computer Program Development Specification (CPDS), volume 1, book 4, SS-P-0002-140.

Table 3.34-1. GPC memory dump times and formats

# **HIGH DATA RATE**

BFS HISAM

	Bandwidth (kb)	WDS/FRM	Time required min:sec	Toggle Buffer	Compatible Downlist Formats prior to dumping
OPS 0	12.8	32	7:39	4	All formats
GNC Ops 1 (Ascent)	51.2	128	1:29	1	21
GNC OPS 2 (Orbit)	44.8	112	1:42	1	22
GNC Ops 3 (Entry)	51.2	128	1:29	1	23
SM Ops 2 & 4 (Orbit)	19.2	48	4:30	2	24, 25, 26
BFS (Ascent/Entry)	12.8	32	7:39	5	12, 13
PASS HISAM	44.8	112	1:42	1	22
BFS HISAM	12.8	32	7:39	5	12, 13
LOW DATA RATE					
OPS 0	6.4	16	25:33	4	All formats
GNC Ops 1 (Ascent)	25.6	64	3:12	1	21
GNC Ops 2 (Orbit)	22.4	56	3:44	1	62, 72
GNC Ops 3 (Entry)	25.6	64	3:12	1	23
SM Ops 2 & 4 (Orbit)	9.6	24	11:47	2	64, 65
BFS (Ascent/Entry)	6.4	16	25:33	5	12, 13
PASS HISAM	I DD HIGVY	A dumne cann	ot he nerfor	med	
DEC LICANA	LDR HISAM dumps cannot be performed.				

Note: Low data rate software GPC dumps are feasible but would require additional crew steps to select word count prior to dumping.

LDR HISAM dumps cannot be performed.

## **TITLE**

#### PAYLOAD INTERROGATOR AND S-BAND PM/FM FREQUENCY CONSTRAINTS

#### **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

## **GENERAL**

The payload interrogator (PI) is functionally a ground station that can support a space/ground link system (SGLS), STDN, or deep space network (DSN) spacecraft. Because the orbiter is a spacecraft that can operate in either the STDN/TDRS or SGLS mode, the potential of interference between the orbiter and the PI is very real.

The following is a list of PI channels and corresponding S-band PM frequencies known to be compatible (Table 3.35-1 to Table 3.35-3). Figure 3.35-1 illustrates the frequency spectrum and shows the frequencies of the PI and S-band PM/FM systems.

The FM system transmits in the exact center of the band and can thus interfere with the PI reception on any PI channel. The interference will be much worse when the FM is on the upper hemi and may be negligible when the FM is on the lower hemi. TV modulation is worse than Solid State Recorder dumps.

## COMPATIBLE PI CHANNELS AND S-BAND FREQUENCIES

PI CHANNEL	S-BAND PM FREQUENCY
001-407	HIGH
408-433	DO NOT USE
434-882	LOW
900-909	HIGH
910-919	LOW

<sup>\*</sup> Channels 649, 650, 651, 652, and 653 are to be used in Low Power Transmit Mode only.

UNASSIGNED CHANNELS: 000, 802-849

Note: When one changes channels, if the PI is ON, it will sweep through the intervening channels as the thumbwheels are turned or as the commands are sent. If the commands are sent from the ground, it is recommended that a two-stage MRTC or SPC (with "times in the past" loaded) be used or that the PI be turned OFF before changing frequency.

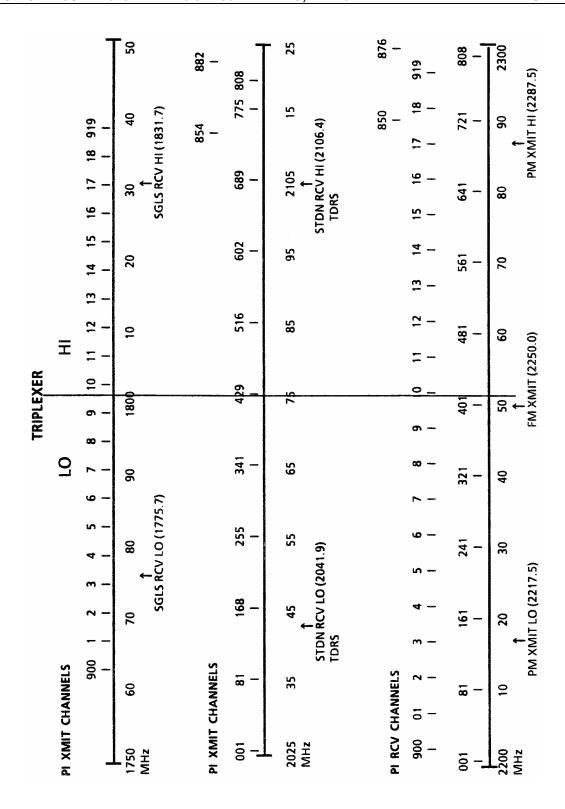


Figure 3.35-1. Space Shuttle S-band spectrum

Table 3.35-1. STDN channel and frequency assignment

CHANNEL	TRANSMIT	RECEIVE
	221/240	0.125 MHz (Intervals)
0	2025.718229	2199.875
1	2025.833400	2200.000
2	2025.948504	2200.125
3	2026.063608	2200.250
4	2026.178712	2200.375
5	2026.293816	2200.500
6	2026.408920	2200.625
7	2026.524024	2200.750
8	2026.639128	2200.875
9	2026.754232	2201.000
10	2026.869336	2201.125
11	2026.984440	2201.250
12	2027.099544	2201.375
13	2027.214648	2201.500
14	2027.329752	2201.625
15	2027.444856	2201.750
16	2027.559960	2201.875
17	2027.675064	2202.000
18	2027.790168	2202.125
19	2027.905272	2202.250
20	2028.020376	2202.375
21	2028.135480	2202.500
22	2028.250584	2202.625
23	2028.365688	2202.750
24	2028.480792	2202.875
25	2028.595896	2203.000
26	2028.711000	2203.125
27	2028.826104	2203.250
28	2028.941208	2203.375
29	2029.056312	2203.500
30	2029.171416	2203.625
31	2029.286520	2203.750
32	2029.401624	2203.875
33	2029.516728	2204.000
34	2029.631832	2204.125
35	2029.746936	2204.250
36	2029.862040	2204.375
37	2029.977144	2204.500
38	2030.092248	2204.625
39	2030.207352	2204.750
40	2030.322456	2204.875
41	2030.437560	2205.000
42	2030.552664	2205.125
43	2030.667768	2205.250
44	2030.782872	2205.375
45	2030.897976	2205.500
46	2031.013080	2205.625
47	2031.128184	2205.750
48	2031.243288	2205.875
70	2001.270200	2200.010

Table 3.35-1. STDN channel and frequency assignment (continued)

CHANNEL	TRANSMIT	RECEIVE
	221/240	0.125 MHz (Intervals)
49	2031.358392	2206.000
50	2031.473496	2206.125
51	2031.588600	2206.250
52	2031.703704	2206.375
53	2031.818808	2206.500
54	2031.933912	2206.625
55	2032.049016	2206.750
56	2032.164120	2206.875
57	2032.279224	2207.000
58	2032.394328	2207.125
59	2032.509432	2207.250
60	2032.624536	2207.375
61	2032.739640	2207.500
62	2032.854744	2207.625
63	2032.969848	2207.750
64	2033.084952	2207.875
65	2033.200056	2208.000
66	2033.315160	2208.125
67	2033.430264	2208.250
68	2033.545368	2208.375
69	2033.660472	2208.500
70	2033.775576	2208.625
71	2033.890680	2208.750
72	2034.005784	2208.875
73	2034.120888	2209.000
74	2034.235992	2209.125
<b>75</b>	2034.351096	2209.250
76	2034.466200	2209.375
77	2034.581304	2209.500
78	2034.696408	2209.625
79	2034.811512	2209.750
80	2034.926616	2209.875
81	2035.041720	2210.000
82	2035.156824	2210.125
83	2035.271928	2210.250
84	2035.387032	2210.375
85	2035.507632	2210.500
86	2035.617240	2210.625
87	2035.732344	2210.750
88	2035.847448	2210.875
89	2035.962552	2211.000
90	2036.077656	2211.125
91	2036.192760	2211.250
92	2036.307864	2211.375
93	2036.422968	2211.500
94	2036.538072	2211.625
95	2036.653176	2211.750
96	2036.768280	2211.875
97	2036.766266	2212.000
01	2000.000004	22 12.000

Table 3.35-1. STDN channel and frequency assignment (continued)

CHANNEL	TRANSMIT 221/240	RECEIVE
00		0.125 MHz (Intervals)
98	2036.998488	2212.125
99	2037.113592	2212.250
100	2037.228696	2212.375
101	2037.343800	2212.500
102	2037.458904	2212.625
103	2037.574008	2212.750
104	2037.689112	2212.875
105	2037.804216	2213.000
106	2037.919320	2213.125
107	2038.034424	2213.250
108	2038.149528	2213.375
109	2038.264632	2213.500
110	2038.379736	2213.625
111	2038.494840	2213.750
112	2038.609944	2213.875
113	2038.725048	2214.000
114	2038.840152	2214.125
115	2038.955256	2214.250
116	2039.070360	2214.375
117	2039.185464	2214.500
118	2039.300568	2214.625
119	2039.415672	2214.750
120	2039.530776	2214.875
121	2039.645880	2215.000
122	2039.760984	2215.125
123	2039.876088	2215.250
124	2039.991192	2215.375
125	2040.106296	2215.500
126	2040.221400	2215.625
127	2040.336504	2215.750
128	2040.451608	2215.875
129	2040.566712	2216.000
130	2040.681816	2216.125
131	2040.796920	2216.250
132	2040.912024	2216.375
133	2041.027128	2216.500
134	2041.142232	2216.625
135	2041.257336	2216.750
136	2041.372440	2216.875
137	2041.487544	2217.000
138	2041.602648	2217.125
139	2041.717752	2217.250
140	2041.832856	2217.375
*141	2041.947960	2217.500
142	2042.063064	2217.625
143	2042.178168	2217.750
144	2042.293272	2217.875

-

<sup>\*</sup>The orbiter S-PM uses these if frequencies in TDRS and STDN LOW FREQ mode.

Table 3.35-1. STDN channel and frequency assignment (continued)

CHANNEL	TRANSMIT	RECEIVE
OI II WALLE	221/240	0.125 MHz (Intervals)
145	2042.408376	2218.000
146	2042.523480	2218.125
147	2042.638584	2218.250
148	2042.753688	2218.375
149	2042.868792	2218.500
150	2042.983896	2218.625
151	2042.983696	2218.750
152	2043.099000	2218.875
		2219.000
153	2043.329208	
154	2043.444312	2210.125
155	2043.559416	2219.250
156	2043.674520	2219.375
157	2043.789624	2219.500
158	2043.904728	2219.625
159	2044.019832	2219.750
160	2044.134936	2219.875
161	2044.250040	2220.000
162	2044.365144	2220.125
163	2044.480248	2220.250
164	2044.595352	2220.375
165	2044.710456	2220.500
166	2044.825560	2220.625
167	2044.940664	2220.750
168	2045.055768	2220.875
169	2045.170872	2221.000
170	2045.285976	2221.125
171	2045.401080	2221.250
172	2045.516184	2221.375
173	2045.631288	2221.500
174	2045.746392	2221.625
175	2045.861496	2221.750
176	2045.976600	2221.875
177	2046.091704	2222.000
178	2046.206808	2222.125
179	2046.321912	2222.250
180	2046.437016	2222.375
181	2046.552120	2222.500
182	2046.667224	2222.625
183	2046.782328	2222.750
184	2046.897432	2222.875
185	2047.012536	2223.000
186	2047.127640	2223.125
187	2047.242744	2223.250
188	2047.357848	2223.375
189	2047.472952	2223.500
190	2047.588056	2223.625
191	2047.703160	2223.750
192	2047.703100	2223.875
193	2047.818204	2224.000
190	2077.333300	222 <del>1</del> .000

Table 3.35-1. STDN channel and frequency assignment (continued)

CHANNEL	TRANSMIT	RECEIVE
	221/240	0.125 MHz (Intervals)
194	2048.048472	2224.125
195	2048.163576	2224.250
196	2048.278680	2224.375
197	2048.393784	2224.500
198	2048.508888	2224.625
199	2048.623992	2224.750
200	2048.739096	2224.875
201	2048.854200	2225.000
202	2048.969304	2225.125
203	2049.084408	2225.250
204	2049.199512	2225.375
205	2049.314616	2225.500
206	2049.429720	2225.625
207	2049.544824	2225.750
208	2049.659928	2225.875
209	2049.775032	2226.000
210	2049.890136	2226.125
211	2050.005240	2226.250
212	2050.120344	2226.375
213	2050.235448	2226.500
214	2050.350552	2226.625
215	2050.465656	2226.750
216	2050.580760	2226.875
217	2050.695864	2227.000
218	2050.810968	2227.125
219	2050.926072	2227.250
220	2051.041176	2227.375
221	2051.156280	2227.500
222	2051.271384	2227.625
223	2051.386488	2227.750
224	2051.501592	2227.875
225	2051.616696	2228.000
226	2051.731800	2228.125
227	2051.846904	2228.250
228	2051.962008	2228.375
229	2052.077112	2228.500
230	2052.192216	2228.625
231	2052.307320	2228.750
232	2052.422424	2228.875
233	2052.537528	2229.000
234	2052.652632	2229.125
235	2052.767736	2229.250
236	2052.882840	2229.375
237	2052.997944	2229.500
238	2053.113048	2229.625
239	2053.228152	2229.750
240	2053.343256	2229.875
241	2053.458360	2230.000
242	2053.573464	2230.125

Table 3.35-1. STDN channel and frequency assignment (continued)

CHANNEL	TRANSMIT	RECEIVE
0.1.1.1.1.	221/240	0.125 MHz (Intervals)
243	2053.688568	2230.250
244	2053.803672	2230.375
245	2053.918776	2230.500
246	2054.033880	2230.625
247	2054.148984	2230.750
248	2054.264088	2230.875
249	2054.379192	2231.000
250	2054.494296	2231.125
251	2054.609400	2231.250
252	2054.724504	2231.375
253	2054.839608	2231.500
254	2054.954712	2231.625
255	2055.069816	2231.750
256	2055.184920	2231.875
257	2055.300024	2232.000
258	2055.415128	2232.125
259	2055.530232	2232.250
260	2055.645336	2232.375
261	2055.760440	2232.500
262	2055.875544	2232.625
263	2055.990648	2232.750
264	2056.105752	2232.875
265	2056.220856	2233.000
266	2056.335960	2233.125
267	2056.451064	2233.250
268	2056.566168	2233.375
269	2056.681272	2233.500
270	2056.796376	2233.625
271	2056.911480	2233.750
272	2057.026584	2233.875
273	2057.141688	2234.000
274	2057.256792	2234.125
275	2057.371896	2234.250
276	2057.487000	2234.375
277	2057.602104	2234.500
278	2057.717208	2234.625
279	2057.832312	2234.750
280	2057.947416	2234.875
281	2058.062520	2235.000
282	2058.177624	2235.125
283	2058.292728	2235.250
284	2058.407832	2235.375
285	2058.522936	2235.500
286	2058.638040	2235.625
287 288	2058.753144 2058.868248	2235.750 2235.875
289	2058.868246	2236.000
290	2056.965352	2236.125
290 291	2059.096456	2236.250
201	2009.210000	2200.200

Table 3.35-1. STDN channel and frequency assignment (continued)

OLIANINIEI	TDANOMIT	DEOEN/E
CHANNEL	TRANSMIT 221/240	RECEIVE 0.125 MHz (Intervals)
000		, ,
292	2059.328664	2236.375
293	2059.443768	2236.500
294	2059.558872	2236.625
295	2059.673976	2236.750
296	2059.789080	2236.875
297	2059.904184	2237.000
298	2060.019288	2237.125
299	2060.134392	2237.250
300	2060.249496	2237.375
301	2060.364600	2237.500
302	2060.479704	2237.625
303	2060.594808	2237.750
304	2060.709912	2237.875
305	2060.825016	2238.000
306	2060.940120	2238.125
307	2061.055224	2238.250
308	2061.170328	2238.375
309	2061.285432	2238.500
310	2061.400536	2238.625
311	2061.515640	2238.750
312	2061.630744	2238.875
313	2061.745848	2239.000
314	2061.860952	2239.125
315	2061.976056	2239.250
316	2062.091160	2239.375
317	2062.206264	2239.500
318	2062.321368	2239.625
319	2062.436472	2239.750
320	2062.551576	2239.875
321	2062.666680	2240.000
322	2062.781784	2240.125
323	2062.896888	2240.250
324	2063.011992	2240.375
325	2063.127096	2240.500
326	2063.242200	2240.625
327	2063.357304	2240.750
328	2063.472408	2240.875
329	2063.587512	2241.000
330	2063.702616	2241.125
331	2063.817720	2241.250
332	2063.932824	2241.375
333	2064.047928	2241.500
334	2064.163032	2241.625
335	2064.278136	2241.750
336	2064.393240	2241.875
337	2064.508344	2242.000
338	2064.623448	2242.125
339	2064.738552	2242.250
340	2064.853656	2242.375

Table 3.35-1. STDN channel and frequency assignment (continued)

CHANNEL	TRANSMIT	RECEIVE
OHAMINE	221/240	0.125 MHz (Intervals)
341	2064.968760	2242.500
342	2065.083864	2242.625
343	2065.198968	2242.750
344	2065.314072	2242.875
345	2065.429176	2243.000
346	2065.544280	2243.000
347	2065.659384	2243.250
347 348	2065.774488	2243.375
349		2243.500
	2065.889592	
350	2066.004696	2243.625
351	2066.119800	2243.750
352	2066.234904	2243.875
353	2066.350008	2244.000
354	2066.465112	2244.125
355	2066.580216	2244.250
356	2066.695320	2244.375
357	2066.810424	2244.500
358	2066.925528	2244.625
359	2067.040632	2244.750
360	2067.155736	2244.875
361	2067.270840	2245.000
362	2067.385944	2245.125
363	2067.501048	2245.250
364	2067.616152	2245.375
365	2067.731256	2245.500
366	2067.846360	2245.625
367	2067.961464	2245.750
368	2068.076568	2245.875
369	2068.191672	2246.000
370	2068.306776	2246.125
371	2068.421880	2246.250
372	2068.536984	2246.375
373	2068.652088	2246.500
374	2068.767192	2246.625
375	2068.882296	2246.750
376	2068.997400	2246.875
377	2069.112504	2247.000
378	2069.227608	2247.125
379	2069.342712	2247.250
380	2069.457816	2247.375
381	2069.572920	2247.500
382	2069.688024	2247.625
383	2069.803128	2247.750
384	2069.918232	2247.875
385	2070.033336	2248.000
386	2070.148440	2248.125
387	2070.263544	2248.250
388	2070.378648	2248.375
389	2070.493752	2248.500

Table 3.35-1. STDN channel and frequency assignment (continued)

		, ,
CHANNEL	TRANSMIT	RECEIVE
	221/240	0.125 MHz (Intervals)
390	2070.608856	2248.625
391	2070.723960	2248.750
392	2070.839064	2248.875
393	2070.954168	2249.000
394	2071.069272	2249.125
395	2071.184376	2249.250
396	2071.299480	2249.375
397	2071.414584	2249.500
398	2071.529688	2249.625
399	2071.644792	2249.750
400	2071.759896	2249.875
*401	2071.875000	2250.000
402	2071.990104	2250.125
403	2072.105208	2250.250
404	2072.220312	2250.375
405	2072.335416	2250.500
406	2072.450520	2250.625
407	2072.565624	2250.750
408	2072.680728	2250.875
409	2072.795832	2251.000
410	2072.910936	2251.125
411	2073.026040	2251.250
412	2073.141144	2251.375
413	2073.256248	2251.500
414	2073.371352	2251.625
415	2073.486456	2251.750
416	2073.601560	2251.875
417	2073.716664	2252.000
418	2073.831768	2252.125
419	2073.946872	2252.250
420	2074.061976	2252.375
421	2074.177080	2252.500
422	2074.292184	2252.625
423	2074.407288	2252.750
424	2074.522392	2252.875
425	2074.637496	2253.000
426	2074.752600	2253.125
427	2074.752000	2253.250
428	2074.982808	2253.250
429	2075.097912	2253.500
430	2075.213016	2253.625
431	2075.328120	2253.750
431	2075.326120	2253.750 2253.875
432	2075.558328	
	2075.673432	2254.000
434		2254.125
435	2075.788536	2254.250
436	2075.903640	2254.375

<sup>\*</sup>The orbiter S-FM transmits on this PI receive frequency.

Table 3.35-1. STDN channel and frequency assignment (continued)

CHANNEL	TDANICMIT	DECENT
CHANNEL	TRANSMIT 221/240	RECEIVE 0.125 MHz (Intervals)
427	2076.018744	
437 438	2076.133848	2254.500 2254.625
439		
439 440	2076.248952	2254.750
440 441	2076.364056	2254.875
	2076.479160	2255.000
442	2076.594264	2255.125
443	2076.709368	2255.250
444	2076.824472	2255.375
445	2076.939576	2255.500
446	2077.054680	2255.625
447	2077.169784	2255.750
448	2077.284888	2255.875
449	2077.399992	2256.000
450	2077.515096	2256.125
451	2077.630200	2256.250
452	2077.745304	2256.375
453	2077.860408	2256.500
454	2077.975512	2256.625
455	2078.090616	2256.750
456	2078.205720	2256.875
457	2078.320824	2257.000
458	2078.435928	2257.125
459	2078.551032	2257.250
460	2078.666136	2257.375
461	2078.781240	2257.500
462	2078.896344	2257.625
463	2079.011448	2257.750
464	2079.126552	2257.875
465	2079.241656	2258.000
466	2079.356760	2258.125
467	2079.471864	2258.250
468	2079.586968	2258.375
469	2079.702072	2258.500
470	2079.817176	2258.625
471	2079.932280	2258.750
472	2080.047384	2258.875
473	2080.162488	2259.000
474	2080.277592	2259.125
475	2080.392696	2259.250
476	2080.507800	2259.375
477	2080.622904	2259.500
478	2080.738008	2259.625
479	2080.853112	2259.750
480	2080.968216	2259.875
481	2081.083320	2260.000
482	2081.198424	2260.125
483	2081.313528	2260.250
484	2081.428632	2260.375
485	2081.543736	2260.500

Table 3.35-1. STDN channel and frequency assignment (continued)

CHANNEL	TRANSMIT	RECEIVE
	221/240	0.125 MHz (Intervals)
486	2081.658840	2260.625
487	2081.773944	2260.750
488	2081.889048	2260.875
489	2082.004152	2261.000
490	2082.119256	2261.125
491	2082.234360	2261.250
492	2082.349464	2261.375
493	2082.464568	2261.500
494	2082.579672	2261.625
495	2082.694776	2261.750
496	2082.809880	2261.875
497	2082.924984	2262.000
498	2083.040088	2262.125
499	2083.155192	2262.250
500	2083.270296	2262.375
501	2083.385400	2262.500
502	2083.500504	2262.625
503	2083.615608	2262.750
504	2083.730712	2262.875
505	2083.845816	2263.000
506	2083.960920	2263.125
507	2084.076024	2263.250
508	2084.191128	2263.375
509	2084.306232	2263.500
510	2084.421336	2263.625
511	2084.536440	2263.750
512	2084.651544	2263.875
513	2084.766648	2264.000
514	2084.881752	2264.125
515	2084.996856	2264.250
516	2085.111960	2264.375
517	2085.227064	2264.500
518	2085.342168	2264.625
519	2085.457272	2264.750
520	2085.572376	2264.875
521	2085.687480	2265.000
522	2085.802584	2265.125
523	2085.917688	2265.250
524	2086.032792	2265.375
525	2086.147896	2265.500
526	2086.263000	2265.625
527	2086.378104	2265.750
528	2086.493208	2265.875
529	2086.608312	2266.000
530	2086.723416	2266.125
531	2086.838520	2266.250
532	2086.953624	2266.375
533	2087.068728	2266.500
534	2087.183832	2266.625

Table 3.35-1. STDN channel and frequency assignment (continued)

		,
CHANNEL	TRANSMIT	RECEIVE
	221/240	0.125 MHz (Intervals)
535	2087.298936	2266.750
536	2087.414040	2266.875
537	2087.529144	2267.000
538	2087.644248	2267.125
539	2087.759352	2267.250
540	2087.874456	2267.375
541	2087.989560	2267.500
542	2088.104664	2267.625
543	2088.219768	2267.750
544	2088.334872	2267.875
545	2088.449976	2268.000
546	2088.565080	2268.125
547	2088.680184	2268.250
548	2088.795288	2268.375
549	2088.910392	2268.500
550	2089.025496	2268.625
551	2089.140600	2268.750
552	2089.255704	2268.875
553	2089.370808	2269.000
554	2089.485912	2269.125
555	2089.601016	2269.250
556	2089.716120	2269.375
557	2089.831224	2269.500
558	2089.946328	2269.625
559	2090.061432	2269.750
560	2090.176536	2269.875
561	2090.291640	2270.000
562	2090.406774	2270.125
563	2090.521848	2270.250
564	2090.636952	2270.375
565	2090.752056	2270.500
566	2090.867160	2270.625
567	2090.982264	2270.750
568	2091.097368	2270.875
569	2091.212472	2271.000
570	2091.327576	2271.125
571	2091.442680	2271.250
572	2091.557784	2271.375
573	2091.672888	2271.573
574	2091.787992	2271.625
574 575	2091.767992	2271.025
576	2092.018200	2271.750
576 577	2092.018200	2271.875
		2272.000 2272.125
578 570	2092.248408	_
579 580	2092.363512	2272.250
580 581	2092.478616	2272.375
581	2092.593720	2272.500
582	2092.708824	2272.625
583	2092.823928	2272.750

Table 3.35-1. STDN channel and frequency assignment (continued)

		,
CHANNEL	TRANSMIT	RECEIVE
	221/240	0.125 MHz (Intervals)
584	2092.939032	2272.875
585	2093.054136	2273.000
586	2093.169240	2273.125
587	2093.284344	2273.250
588	2093.399448	2273.375
589	5093.514552	2273.500
590	2093.629656	2273.625
591	2093.744760	2273.750
592	2093.859864	2273.875
593	2093.974968	2274.000
594	2094.090072	2274.125
595	2094.205176	2274.250
596	2094.320280	2274.375
597	2094.435384	2274.500
598	2094.550488	2274.625
599	2094.665592	2274.750
600	2094.780696	2274.875
601	2094.895800	2275.000
602	2095.010904	2275.125
603	2095.126008	2275.250
604	2095.241112	2275.375
605	2095.356216	2275.500
606	2095.471320	2275.625
607	2095.586424	2275.750
608	2095.701528	2275.875
609	2095.816632	2276.000
610	2095.931736	2276.125
611	2096.046840	2276.123
612	2096.161944	2276.375
613	2096.277048	2276.575
614	2096.392152	2276.625
615		
	2096.507256	2276.750
616	2096.622360	2276.875
617	2096.737464	2277.000
618	2096.852568	2277.125
619	2096.967672	2277.250
620	2097.082776	2277.375
621	2097.197880	2277.500
622	2097.312984	2277.625
623	2097.428088	2477.750
624	2097.543192	2277.875
625	2097.658296	2278.000
626	2097.773400	2278.125
627	2097.888504	2278.250
628	2098.003608	2278.375
629	2098.118712	2278.500
630	2098.233816	2278.625
631	2098.348920	2278.750
632	2098.464024	2278.875

Table 3.35-1. STDN channel and frequency assignment (continued)

CHANNEL	TRANSMIT	RECEIVE
	221/240	0.125 MHz (Intervals)
633	2098.579128	2279.000
634	2098.694232	2279.125
635	2098.809336	2279.250
636	2098.924440	2279.375
637	2099.039544	2279.500
638	2099.154648	2279.625
639	2099.269752	2279.750
640	2099.384856	2279.875
641	2099.499960	2280.000
642	2099.615064	2280.125
643	2099.730168	2280.250
644	2099.845272	2280.375
645	2099.960376	2280.500
646	2100.075480	2280.625
647	2100.070400	2280.750
648	2100.305688	2280.875
*649	2100.303080	2281.000
*650	2100.535896	2281.125
*651	2100.553090	2281.250
*652	2100.031000	2281.375
*653	2100.760104	2281.500
654	2100.861206	
		2281.625
655	2101.111416	2281.750
656	2101.226520	2281.875
657	2101.341624	2282.000
658	2101.456728	2282.125
659	2101.571832	2282.250
660	2101.686936	2282.375
661	2101.802040	2282.500
662	2101.917144	2282.625
663	2102.032248	2282.750
664	2102.147352	2282.875
665	2102.262456	2283.000
666	2102.377560	2283.125
667	2102.492664	2283.250
668	2102.607768	2283.375
669	2102.722872	2283.500
670	2102.837976	2283.625
671	2102.953080	2283.750
672	2103.068184	2283.875
673	2103.183288	2284.000
674	2103.298392	2284.125
675	2103.413496	2284.250
676	2103.528600	2284.375
677	2103.643704	2284.500
678	2103.758808	2284.625

-

<sup>\*</sup>Channels 649, 650, 651, 652, and 653 are to be used in the Low-Power Transmit Mode only. Use of these channels in High-Power Transmit Mode will cause the PI to lock on itself.

Table 3.35-1. STDN channel and frequency assignment (continued)

		<b>3</b>
CHANNEL	TRANSMIT 221/240	RECEIVE 0.125 MHz (Intervals)
679	2103.873912	2284.750
680	2103.989016	2284.875
681	2104.104120	2285.000
682	2104.104120	2285.125
683	2104.334328	2285.250
684	2104.449432	2285.375
685	2104.564536	2285.500
686	2104.679640	2285.625
687	2104.794744	2285.750
688	2104.909848	2285.875
689	2105.024952	2286.000
690	2105.140056	2286.125
691	2105.255160	2286.250
692	2105.370264	2286.375
693	2105.485368	2286.500
694	2105.600472	2286.625
695	2105.715576	2286.750
696	2105.830680	2286.875
697	2105.945784	2287.000
698	2106.060888	2287.125
699	2106.175992	2287.250
700	2106.291096	2287.375
*701	2106.406200	2287.500
702	2106.521304	2287.625
703	2106.636408	2287.750
704	2106.751512	2287.875
705	2106.866616	2288.000
706	2106.981720	2288.125
707	2107.096824	2288.250
708	2107.211928	2288.375
709	2107.327032	2288.500
710	2107.442136	2288.625
711	2107.557240	2288.750
712	2107.672344	2288.875
713	2107.787448	2289.000
714	2107.902552	2289.125
715	2108.017656	2289.250
716	2108.132760	2289.375
717	2108.247864	2289.500
718	2108.362968	2289.625
719	2108.478072	2289.750
720	2108.593176	2289.875
721	2108.708280	2290.000
722	2108.823384	2290.125
723	2108.938488	2290.250
724	2109.053592	2290.375
725	2109.168696	2290.500

-

<sup>\*</sup>The orbiter S-PM uses these frequencies in TDRS and STDN HIGH FREQ mode.

Table 3.35-1. STDN channel and frequency assignment (continued)

		()
CHANNEL	TRANSMIT	RECEIVE
	221/240	0.125 MHz (Intervals)
726	2109.283800	2290.625
727	2109.398904	2290.750
728	2109.514008	2290.875
729	2109.629112	2291.000
730	2109.744216	2291.125
731	2109.859320	2291.250
732	2109.974424	2291.375
733	2110.089528	2291.500
734	2110.204632	2291.625
735	2110.319736	2291.750
736	2110.434840	2291.875
737	2110.549944	2292.000
738	2110.665048	2292.125
739	2110.780152	2292.250
740	2110.895256	2292.375
741	2111.010360	2292.500
742	2111.125464	2292.625
743	2111.240568	2292.750
744	2111.355672	2292.875
745	2111.470776	2293.000
746	2111.585880	2293.125
747	2111.700984	2293.250
748	2111.816088	2293.375
749	2111.931192	2293.500
750	2112.046296	2293.625
751	2112.161400	2293.750
752	2112.276504	2293.875
753	2112.391608	2294.000
754	2112.506712	2294.125
755	2112.621816	2294.250
756	2112.736920	2294.375
757	2112.852024	2294.500
758	2112.967128	2294.625
759	2113.082232	2294.750
760	2113.197336	2294.875
761	2113.312440	2295.000
762	2113.427544	2295.125
763	2113.542648	2295.250
764	2113.657752	2295.375
765	2113.772856	2295.500
766	2113.887960	2295.625
767	2114.003064	2295.750
768	2114.118168	2295.875
769	2114.233272	2296.000
770	2114.348376	2296.125
771	2114.463480	2296.250
772	2114.578584	2296.375
773	2114.693688	2296.500
774	2114.808792	2296.625

Table 3.35-1. STDN channel and frequency assignment (continued)

CHANNEL	TRANSMIT 221/240	RECEIVE 0.125 MHz (Intervals)
775	2114.923896	
775 776	2114.923696	2296.750 2296.875
776 777		
	2115.154104	2297.000
778 770	2115.269208	2297.125
779 700	2115.384312	2297.250
780 704	2115.499416	2297.375
781	2115.614520	2297.500
782	2115.729624	2297.625
783 704	2115.844728	2297.750
784 705	2115.959832	2297.875
785	2116.074936	2298.000
786	2116.190040	2298.125
787	2116.305144	2298.250
788	2116.420248	2298.375
789	2116.535352	2298.500
790	2116.650456	2298.625
791	2116.765560	2298.750
792	2116.880664	2298.875
793	2116.995768	2299.000
794	2117.110872	2299.125
795	2117.225976	2299.250
796	2117.341080	2299.375
797	2117.456184	2299.500
798	2117.571288	2299.625
799	2117.686392	2299.750
800	2117.801496	2299.875
801	2117.916600	2300.000
802	2118.031771	2300.125
803	2118.146875	2300.250
804	2118.261979	2300.375
805	2118.377083	2300.500
806	2118.492188	2300.625
807	2118.607291	2300.750
808	2118.722396	2300.875
809	2118.837500	2301.000
810	2118.952604	2301.125

Transmit/Receive frequencies for channels 811-848 are random and therefore should not be used.

Table 3.35-2. NASA/DSN channel and frequency assignments

Channel	Transmit, MHz	Receive, MHz
849	2108.537808	2289.814814
*850		2290.185185
*851		2290.555556
*852		2290.925926
*853		2291.296296
854	2110.243056	2291.666667
855	2110.584105	2292.037037
856	2110.925154	2292.407407
857	2111.266204	2292.777778
858	2111.607253	2293.148148
859	2111.948303	2293.518519
860	2112.289352	2293.888889
861	2112.630401	2294.259259
862	2112.971451	2294.629630
863	2113.312500	2295.000000
864	2113.653549	2295.370370
865	2113.994599	2295.740741
866	2114.335648	2296.111111
867	2114.676697	2296.481481
868	2115.017747	2296.851852
869	2115.358796	2297.222222
870	2115.699846	2297.592593
871	2116.040895	2297.962963
872	2116.381944	2298.333333
873	2116.722994	2298.703704
874	2117.064043	2299.074074
875	2117.405092	2299.444444
876	2117.746142	2299.814815
877	2118.087191	2300.186018
878	2118.428241	2300.556389
879	2118.769290	2300.926759
880	2119.110339	2301.297129
881	2119.451389	2301.667500
882	2119.792438	2302.037871
883	2120.133487	2302.408241

Transmit/receive ratio: 205/256

\*Channels 850, 851, 852, and 853 are TX "Inhibit" channels, and produce 3.2 mW transmit power maximum, "0 output" minimum.

Transmit/receive frequencies for channels 884-898 are random and therefore should not be used.

Table 3.35-3. DOD/SGLS channel and frequency assignments

Channel	Transmit	Receive DOD Payloads To Orbiter, MHz
	Orbiter to DOD Payloads, MHz	(5 MHz Intervals)
	(4.004 MHz Intervals)	
899	1759.717	1197.500
900	1763.721	2202.500
901	1767.725	2207.500
902	1771.729	2212.500
*903	1775.733	2217.500
904	1779.736	2222.500
905	1783.740	2227.500
906	1787.744	2232.500
907	1791.748	2237.500
908	1795.752	2242.500
909	1799.756	2247.500
910	1803.760	2252.500
911	1807.764	2257.500
912	1811.768	2262.500
913	1815.772	2267.500
914	1819.775	2272.500
915	1823.779	2277.500
916	1827.783	2282.500
**917	1831.787	2287.500
918	1835.791	2292.500
919	1839.795	2297.500
920	1843.799	2302.500

Transmit/receive ratio: 205/256

Transmit/receive frequencies for channels 921-999 are random and therefore should not be used.

<sup>\*</sup>The orbiter S-PM uses these frequencies in SGLS LOW FREQ mode.

<sup>\*\*</sup>The orbiter S-FM uses these frequencies in SGLS HIGH FREQ mode.

# **TITLE**

# S-BAND REAL-TIME DOWNLINK DATA RECOVERY USING FM SYSTEM

# **CAUTION**

9/1/2004: REV G

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

# **GENERAL**

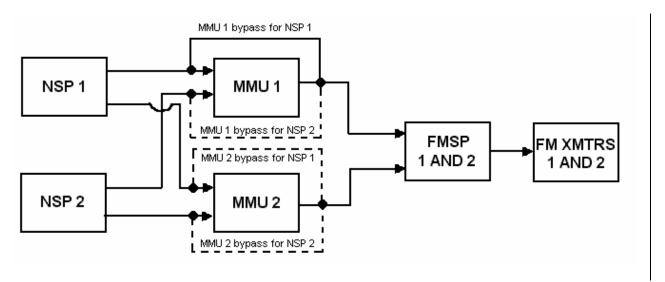
An in-flight maintenance (IFM) procedure exists to recover the S-band downlink for the STDN using the FM signal processor and FM transmitter. Use of this procedure would be considered if transponder downlink capability has failed. It results in the loss of one SSR (either one can be bypassed) and only requires that FM modes be changed to switch between real-time data and recorder dumps. NSP real-time data will not be downlinked while a recorder dump is taking place.

#### COMMAND RESTRICTIONS/CONSTRAINTS

- 1. These commands are valid in all major modes and all OPS modes.
- 2. Time constraints, crew coordination requirements: After the IFM is completed, commands must be executed exactly as outlined in this SCP.

### **PROCEDURE**

- A. INCO should confirm (via other procedures) that one or both transponders have lost downlink capability, and that the IFM procedure should be performed.
- B. Request that the crew implement the IFM (2 hours estimated), and specify which NSP to select and which MMU(SSR) to bypass.
- C. The IFM procedure has the crew install a jumper from the input connector of either SSR to the output connector of the SSR. This jumper connects the selected NSP's recorder output (now used for real-time data) to the selected SSR's FM dump data output. Select the FM source for the bypassed SSR, and realtime telemetry will be downlinked at AOS



D. In order to dump the SSR that is not bypassed, select the FM source for that SSR and begin the dump. Real-time data will be lost when the FM source is changed to the other SSR. Assuming that NSP 1 is selected to downlink real-time data by bypassing MMU1 (as shown above with a solid line for the bypass jumper), the following procedure can be used:

9/1/2004: REV G

- 1. At AOS verify: NSP 1 ON FM DATA MODE SSR 1
- 2. Verify good real-time data via FM (assumes one or both transponder downlinks have been lost).
- 3. To begin the dump:

CMD FM MMU 2 (lose real-time data) (4727) CMD SSR 2 PBQ 1024 (assumes all ques are defined at 1024 kbps) (9315)

- 4. Verify good dump data.
- 5. When dump complete:

CMD FM MMU 1 (regain real-time data) (4728)

INCO/COMM/JSC-12829 7/1/2005: REV G, PCN 2 **SCP 3.37** 

#### TITLE

COMMAND PLAN FOR CONTINGENCY SHUTTLE CREW SUPPORT (CSCS)

#### CAUTION

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

#### **GENERAL**

CSCS will be invoked if there is some problem with the Orbiter such that extra time docked to the International Space Station (ISS) is required to execute a repair to the Orbiter before a safe landing can occur or if the Orbiter can not be made safe to land with a crew onboard, which requires the crew to remain on ISS until a rescue mission can be launched. CSCS will power down the orbiter to the lowest level possible so that the cryogenics can be conserved to allow for a longer than normal stay attached to the Space Station. The orbiter communications equipment will be re-powered once a day so that a status of the systems on board can be reviewed by Mission Control. Once this analysis is complete the crew will power down the communications equipment again. This procedure documents the power down and power up procedures as well as the command plan associated with them.

# COMMAND RESTRICTIONS/CONSTRAINTS

- 1. These commands are valid in OPS 201 only.
- 2. Time constraints, crew coordination requirements: Crew coordination is required to prevent becoming out of sync while uplinking commands. There are no time constraints.

#### **PROCEDURE**

There are several procedures involved with CSCS power configurations. The first procedure that will be invoked is the "CSCS Group C+ PWRDWN" procedure. This procedure will take the Orbiter to a minimal power level which maintains enough heater and systems control to allow for a safe reactivation of the Orbiter systems in preparation for a deorbit and landing. The second procedure is co-located with the CSCS Group C+ Power Down procedure. It is simply titled "COMM PWRUP". This procedure is used to turn on the necessary communications equipment to get a daily check of the health and status of the Orbiter and its active systems. The third procedure is the "CSCS Group C+ PWRUP" power up procedure. This one will reactivate the systems needed to undock and deorbit the Orbiter. The following sections discuss each of these procedures as they relate to the Orbiter Instrumentation and Communications systems and the ground commands that are required to support them.

- CSCS Group C+ PWRDWN Α.
  - Impacts: The following are the Communications and Instrumentation Systems which are powered down in this procedure.
    - Sequential Still Video (SSV) a.
    - **CDR ATU** b.
    - PL 2 MDM (manual Antennas) C.
    - Ku Band off, pins locked but still antenna deployed
    - Redundant Power off for all DSCs and MDMs
    - DSC OM3 off f.
    - S Band PM off, back panel configured for string 2 g.
    - h. COMSECs off (Encryption Select to BYPASS)
    - S Band FM off
    - j. CCTV system off (monitors, cameras and RCU/VSU)
    - WVS off

7/1/2005: REV G, PCN 2 **SCP 3.37** 

- DTV off I.
- m. VPU off
- PS ATU off
- Cbs for UHF, Ku Elec, Ku Sig Proc, all PLB cameras and VPU open
- 2. **INCO Command Actions:**

When the crew takes Encryption Select - BYPASS have the MCC configure to a CLEAR Uplink (TA Disable)

- B. COMM PWRUP (When required for MCC data snapshots) + INCO Command Actions
  - Impacts: Crew will
    - Turn on S Band PM system 2 with a PNL/CMD
    - DSC OM3 cb closed on panel O16 row B
    - Select Best Antenna on panel C3. C.

NOTE: There will be a 140 second wait before processing the downlink, while the S Band Power Amplifier warms up.

- d. Once MCC has all the data required, the crew will open the cb for DSC OM3 again and INCO will command the S Band PM system off.
- 2. **INCO Command Actions:** 
  - Recommend best antenna to the crew over S/G1.
  - After MCC data snapshot is complete Command the S Band system back off with an MRTC (two stage auto execute)

**REMINDER**: Safed Group 2 must be ENABLED to uplink of this MRTC

MRTC t	itle: S BAND PWR DOWN MRTC
RTCs	Titles
4761	NSP 1/2 - OFF
4755	S-BD PA OPR - 1/2 OFF
4751	S-BD PA STBY - OFF
4731	S-BD XPNDR 1/2 - OFF
4723	PREAMP 1/2 - OFF
4710	ANT ELEC SW - OFF

#### C. CSCS GROUP C+ PWRUP

NOTE: Manual antennas are required until after IMU alignment is completed. (Crew must select best antenna on C3)

- 1. Impacts:
  - Crew executes COMM PWRUP steps from the CSCS GROUP C+ PWRDWN procedure
  - b. Ku band is activated in low power RADAR mode
  - SSV ON in outrate 3
  - Payload Bay camera cbs are closed
  - After IMU align complete S BD PM Ant sel GPC
- 2. INCO Actions:
  - Recommend best antenna to the crew over S/G1 (Use predicted antenna as best guess)
  - b. Uplink new Orbiter and Target State vectors as required.
  - Uplink new TDRS State vectors before the crew selects GPC for the antennas
  - d. Power up PDI then load PCMMU and PDI with config to support SSV downlink.
  - Power up CCTV system and select a camera for SSV downlink.
  - Inform crew of CCTV, PDI and S Band configurations once completed. f.

#### TITLE

#### COMMAND PLAN FOR UNMANNED UNDOCKING OF THE ORBITER FROM ISS

#### CAUTION

7/1/2005: REV G, PCN 2

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

#### **GENERAL**

In the event that the Orbiter is not able to support a crew for entry, the Orbiter must be undocked from the International Space Station (ISS) before the rescue Orbiter can dock to pick up the crew. The general flow of the unmanned undocking operation starts with a determination that this process must be initiated. The crew will perform an In-flight Maintenance (IFM) procedure to connect some launch bus power feeds so that INCO can command the Orbiter's Androgynous Peripheral Docking System (APDS) hooks to drive open allowing the Orbiter to drift away from ISS (i.e. undock). At a predefined range from ISS, INCO will command the RCS engines to fire for a separation burn. INCO will later command the Orbiter to maneuver to a deorbit/disposal burn attitude and once again fire the OMS engines to execute a controlled re-entry in which the Orbiter will break up in the upper atmosphere over the Pacific Ocean. This procedure contains the steps and the sequence of commands that INCO must execute to support this critical operation.

# COMMAND RESTRICTIONS/CONSTRAINTS

- 1. These commands are valid in OPS 201 only.
- Time constraints, crew coordination requirements: Crew coordination is required to prevent a
  premature undocking from ISS. All commands must be executed on time for a successful
  and safe re-entry.

# **PROCEDURE**

The following procedures must be performed so that a successful undock and deorbit burn can occur. The CSCS UNDOCK/SEPARATION TIMELINE contains the complete timeline for this process.

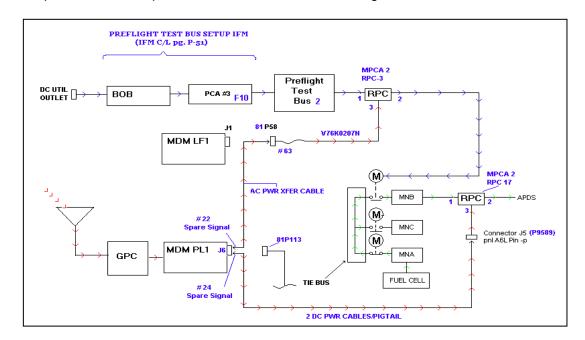
- 1. The following INCO team members are recommended to support this activity.
  - a. FCR INCO- perform commanding and realtime operations.
  - b. FCR Logtaker- This person will be responsible for keeping the log at the INCO console. This person is required due to the large volume of commands that are required to be sent by INCO, with a significant number being time critical commands.
  - c. RF COMM (preferrably a certified INCO)
  - d. INST.
- Crew performs "APDS REMOTE COMMAND" IFM through step 22, the day before the expected undock.
- 3. INCO sends commands, to the SM Major Function and PL 1 MDM, to test that the IFM was correctly done.

7/1/2005: REV G, PCN 2

NOTE: For STS 114 and 121 these commands do not exist in the Command server. INCO will need to build them with the rf\_cmd\_build display on the RTC build menu. Once they are built, MMACS will review them and give their approval. The Flight Director will also approve these commands. It is recommended that these commands be built and safed during prelaunch operations. For 115 and subs, the commands have DSM numbers 5302 and 5303. The following are the data for these two commands:

DSM	Title	MSID	<b>Command Data Words</b>
1098	CSCS UNDOCK CMD ON	V53K2001U	7109 0000 7909 5000
1099	CSCS UNDOCK CMD OFF	V53K2002U	7109 5000 7909 0000

4. Crew completes the first part of the IFM by executing steps 24 through 26. The following figure, copied from the IFM procedure itself, shows the final configuration of the IFM.



- 5. Prior to GROUP C+ PWRUP, coordinate with GC to schedule satellite handovers. The recommended optimal configuration is to schedule TRDS-275 from is AOS to LOS with "normal" handovers between TDRS-171( or TDRS-174) and TDRS-47(or TDRS-41). If possible, schedule overlapping events between TDRS-275 and TDRS-171/174 handovers. (Most of the commands that have to be uplinked happen during TDRS-275 and during the handover between TDRS 275 and TDRS-171/174).
- At approximately 4 hours before undock, the crew executes CSCS Group C+ PWRUP (see INCO SCP 3.37), which includes activation of S Band string 2, the Ku band in low power RADAR and parts of the CCTV system.
- 7 About 1:30 before the planned undock, two crewmen complete the last few steps of the IFM then egress the Orbiter closing all the hatches behind them.

# **WARNING**

If the CSCS UNDOCK CMD ON command is sent after the IFM is completed, the Orbiter will start driving the APDS hooks open. If the crew is still in the Orbiter and/or the hatches are still open at this time it will cause loss of both crew, ISS and Orbiter.

7/1/2005: REV G, PCN 2

- 8 15 minutes before undock, INCO will uplink some IDP equivalents to configure IDPs to support the undocking operations.
- 9. At 4:40 minutes before undock,

**NOTE**: The commands in sub-steps 'a' and 'b' are time critical.

- a. INCO sends "CSCS UNDOCK CMD ON" to the SM Major Function in Two Stage Auto Execute. This will start to supply power to the Main B power, bus which will start driving the APDS Hooks open. It will also supply power to the Ku band system, which will start its TWT warm up sequence.
- b. At approximately 20 seconds before undock, INCO will send the command to configure the orbiter to inertial hold attitude. This is to be done on MMACS call of "APDS hooks at 10%".
- c. INCO will enable I/O between the Ku band system and the SM and GNC major functions

Send DSM \_\_\_\_\_GNC I/O RESET (IDP Equivalent) to the GNC auto execute Send DSM 14007 Ku Band serial I/O Enable to the SM auto execute

- 10. At approximately 100 feet separation and when the Ku band RADAR has acquired ISS, INCO will allow the GNC to start using the RADAR data by uplink of more IDP Equivalent commands to the GNC.
- 11. When range is greater than 1000 feet (approximately undock + 35 minutes), INCO will uplink a set of IDP Equivalent commands to the GNC to perform the approximately 10 minute "+X Reboost burn" which will increase the separation rates between ISS and the Orbiter.
- 12. 20 minutes before the disposal burn (approximately undock + 1:00 hour), INCO will uplink a set of IDP Equivalent commands to the GNC to perform the maneuver to the disposal burn attitude.

NOTE: The command in step 11 is time critical

- 13. When range to ISS is greater than 6500 feet and more than 1 hour 20 minutes since undock and within 15 seconds of D/O Burn TIG, INCO will execute the D/O Burn IDP Equivalent command to the GNC.
- 14. If required, INCO will uplink a set of IDP Equivalent commands, to the GNC, to maneuver to a post burn attitude.

5/23/2005: REV G, PCN-1 SCP 3.39

#### TITLE

ENHANCED LAUNCH VEHICLE IMAGING SYSTEM (ELVIS) OPERATIONS

#### CAUTION

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

#### **GENERAL**

ELVIS consists of: three cameras located on each of two Solid Rocket Boosters, an RF downlinked camera on the External Tank, a digital still camera in the Orbiter's starboard umbilical well and a crew hand-held digital still camera. Each of these cameras has a special designator but the two that are of direct interest to INCO are the ET TPS camera (i.e. Digital Still camera in the umbilical well) and ET LO<sub>2</sub> Feedline camera (i.e. ET RF downlinked camera). ELVIS is designed to collect images of the underside of the Orbiter and the External Tank during ascent and shortly thereafter as a way to determine from where debris originated. INCO does not have any telemetry on this system but there are two commands that INCO must send so that the crew can collect the images from the digital still camera in the umbilical well. These images are downlinked via Orbiter Communications Adapter (OCA) along with the images collected from the crew hand-held digital still camera.

# **COMMAND RESTRICTIONS/CONSTRAINTS**

- 1. These commands are valid in GNC OPS 201 only.
- 2. Time constraints, crew coordination requirements: The Camera/heater ON command described below must be sent before the crew can collect images from the ET TPS camera. Because the camera requires up to two hours to warm up before the crew can collect images, it should be turned on as soon as GNC OPS 201 is established.

# **PROCEDURE**

During ascent the INCO team on console should note, in their flight logs, whether or not the crew was given a GO for the "+X maneuver" and the "ET Photo Maneuver". If the crew was told not to execute the +X maneuver, the images collected by the ET TPS camera will not include views of much of the ET. This is because the ET will simply fall way from the orbiter without the orbiter maneuvering over it. If the crew was told not to execute the ET Photo maneuver, they will not be able to collect any images of the ET at all.

As soon as the crew has completed the Ops transition to OPS 201 for the GNC GPC, INCO will send the following command to the GNC major function (MDM FA1), to turn the ET TPS camera and heaters back on.

DSM Title		MSID	Command Words
5300	UMB WELL STILL CMR ON	V56K0010U	F085 0000 F885 0100

Note: The camera and heaters were turned off by the GNC during the MPS dump procedure at about 2 minutes after ET separation.

Once the crew has completed collecting images from the camera, INCO turns the camera back off for the duration of the mission with the following command.

DSM	Title	MSID	Command Words
5301	UMB WELL STIL CMR OFF	V56K0011U	F085 0100 F885 0000

5/23/2005: REV G, PCN -1 SCP 3.40

#### TITLE

ORBITER BOOM SENSOR SYSTEM (OBSS) OPERATIONS

### **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed premission without review and approval at the FOIG.

#### **GENERAL**

OBSS is a 50 foot long boom which carries two sensor packages used to survey the thermal protection system (TPS) for damage. Associated with the OBSS is a small camera mounted on the end effector (EE) of the Remote Manipulator System (RMS). The RMS Side-view Camera (RSC) is a situational awareness device for the crew used to confirm the location of the OBSS as they are scanning the TPS for damage. Sensor package 1 (SP 1) includes a standard Orbiter Pan/Tilt Unit holding an Intensified Television Camera (ITVC) along with the LASER Dynamic Range Imager (LDRI). Sensor package 2 (SP 2) includes the LASER Camera System (LCS) with expansion capabilities for a digital still camera. SP 1 data is collected on the Digital Television System's Video Tape Recorder while SP 2 data is stored on a new laptop computer designated as A31P. Data from SP 1 is downlinked via DTV to the Ku band system as video. Data from SP 2 is downlinked via the Orbiter Communications Adapter (OCA) to the Ku band system. INCO has no control or telemetry on SP 2 other than indications that power is supplied to the system. INCO does have some control and telemetry for SP 1 since it functions very much like a payload bay camera.

# **COMMAND RESTRICTIONS/CONSTRAINTS**

- 1. These commands are valid in SM OPS 201 only.
- 2. Time constraints, crew coordination requirements: Operation of any part of the CCTV system requires coordination with the crew. There are no time constraints on these operations.

# **PROCEDURE**

- A. Sensor Package 1 (SP 1) Control and Telemetry
  - 1. OBSS Stowed in starboard MPMs

INCO can observe the temperature for the LDRI, ITVC, PTU, and avionics box 1 on the ISIS display from the INCO Displays DNAV menu.

- 2. OBSS deployed (i.e. attached to SRMS)
  - a. LDRI has six modes of operation. For the MCC to tell which mode is selected on LDRI, the Mid-deck camera source must be selected (V74X0798E = 1) for Downlink while PL 2 is selected DTV. This allows MCC to view the images being downlinked. The table below shows what each mode does and how the MCC can tell which one is active.

LDRI Mode	Description	Telemetry
1 - Standby	ITVC video on PL2, LDRI in standby	No output from LDRI so no telemetry indication

SCP 3.40

5/23/2005: REV G, PCN -1

LDRI Mode	Description	Telemetry
2 - Illuminator	ITVC video w/LDRI as the illuminator on PL2, LDRI LASER active but camera inactive	No output from LDRI so no telemetry indication. ITVC should have a brighter image during eclipse passes
3 - 2D	Two dimensional data (image) on PL2 similar to ITVC video but with rounded corners on the image	ALC Avg (V74X0845E = 1)
4 - 2D Gamma	Same as mode 3 but with gamma black stretch on	Gamma White (V74X0846E = 1)
5 - 3D	Three dimensional data (flickering image) on PL2 with rounded corners on the image	Gamma Norm (V74X0847E = 1)
6 - 3D Gamma	Same as mode 5 but with gamma black stretch on	Gamma Black (V74X0848E = 1)

b. A specialized command field on the hardware and software command panels was created to allow MCC to command the different modes. The labels on the buttons were modified from the titles for the commands to make MCC operation of LDRI much easier. The following table can be used to convert the DSM number and title to the labels on the command buttons.

DSM	Command Server Title (what is on command track display)	Command Panel Label
4231	TV MID DECK CAM -SEL	LDRI Control
4243	TV P/L 2 - SEL	Select PL2
4249	TV DOWNLINK	Downlink
4250	TV PAYLOAD	DTV
4280	TV ALC - PEAK	Mode 1
4281	TV ALC - NORM	Mode 2
4282	TV ALC - AVG	Mode 3
4283	TV GAM - WHITE STRCH	Mode 4
4284	TV GAM - NORM	Mode 5
4285	TV GAM - BLACK STRCH	Mode 6
4266	TV IRIS - OPEN	Increase Gain
4268	TV IRIS - STOP	Stop Gain
4267	TV IRIS - CLOSE	Decrease Gain

5/23/2005: REV G, PCN -1

**SCP 3.40** 

c. To Pan/Tilt LDRI, PL 2 must be selected. This will allow commands to the PTU, which is controlled by the ITVC at the PL 2 camera address. There is no need to return to mode 1 or 2 on the LDRI to be able to move the PTU since modes 3 and up give the ground and the crew images of where the camera is pointing and PTU angles are available to the crew and the ground in the LDRI VID.

# WARNING - DO NOT command the PTU during the Wing Leading Edge surveys. If the PTU is moved during survey operations, the crew will have to stop the survey and reset the PTU to the proper angles. DO NOT send the PTU Reset command. This will confuse the crew during survey since they expect to see predefined angles and must move the PTU to new angles during the survey. If the angle value is reset, the crew will have to execute a procedure to "Re-Zero Out" the PTU angles and return to the expected angles before continuing the survey.

- d. ITVC operations from the ground or the crew are fairly simple.
   Select MID-DECK as the source and change LDRI mode to 1 or
   2. This will allow ITVC images to be downlinked. Select PL 2 again and operate the ITVC normally.
- B. Sensor Package 2 (SP 2) Indications
  - OBSS Stowed in starboard MPMs

INCO can observe the temperature for LCS and avionics box 2 on the ISIS Display from the INCO Displays DNAV menu

2. OBSS deployed, (i.e. attached to the SRMS)

INCO can observe that APCU 2 is powered up (P50V9007V > 100v) and that converter A (P50C9009V > 10a) and B (P50C9011V > 10a) show current flow. This information is also on the ISIS display. LCS gets 124 Vdc from APCU 2 only. APCU 2 gets power from PL PRI but control to close the relay to get power to LCS comes from the AUX PL B bus.

C. RMS Side-view Camera (RSC) Control and Telemetry

The RSC is on VSU port PL 3 after the crew connects the output from the camera on panel R12 OPP to the PL 3 connector on the VPU. The camera is left on for the duration of the mission after its activation, because the heater power for the camera is the same as the operational power for it. It will not be available for downlink during EVAs because the WVS will use PL 3 as it downlink path.

**NOTE**: Cycling panel R12 OBSS SPEE PWR switch to switch illumination levels on the RSC illumination ring will reset the PTU angles for LDRI/ITVC and put LDRI in mode 1.

#### **TITLE**

#### STANDARD COMM MALFUNCTION RECONFIGURATION PROCEDURES

# **CAUTION**

This procedure is governed by FCOH procedure 3.1 and is not to be changed in real time without review and approval of the Flight Director or changed pre-mission without review and approval at the FOIG.

# **PURPOSE**

To provide a standard set of system configuration procedures to be used in response to comm system malfunctions.

### **GENERAL**

In the event of the malfunctions listed, comm system personnel will exercise the specific procedure to set up a comm system configuration that provides maximum redundancy and minimum impact to other operations/procedures.

#### ASSUMPTIONS/GUIDELINES

- On orbit, the crew is assumed to have the time for complex troubleshooting by trying different configurations on panel A1. During entry, it is assumed that panel A1 is unaccessible.
- During entry, UHF is assumed available as a source of voice. UHF is assumed to be unavailable
  on orbit.
- If a choice must be made, it is more important to recover S-band voice before telemetry when on orbit. During entry, since UHF is available, telemetry is more important.
- Only one failure is assumed, as noted in each paragraph. Configurations of panel A1 are intended to protect against the next worst failure.
- On orbit, continuous use of uplink or downlink low data rate is assumed to be unacceptable because some missions, such as Spacelab, need both A/G loops. Another consideration is that MCC monitoring assumes HDR. However, Flight Rules allow mission continuation if all HDR is failed.
- Cross-strapping should be avoided in the panel configuration for entry because any of four
  potential bus losses can cause an unrecoverable loss of S-band. However, on orbit, it should be
  permissible to cross-strap because the crew has time to troubleshoot and isolate the remaining Sband capabilities following failures of an S-band LRU and a bus.

#### **PROCEDURE**

# Malfunction

# Configuration procedure

- High-frequency capability lost in S-BD A. SYS 1 or 2
- Select low frequency for use on S-band SYS 1
- Notify GC of frequency change.
- Maintain standard orbit configuration (SYS 1 on PNL, cmd SYS 2).

B. S-BD SYS 2 LRU lost

- The configuration will vary as a function of the LRU which failed and the flight phase. See the following pages for specifics. Note: These changes may impact numerous
  - pocket C/L procedures.

C. FF3 lost

- Change orbit configuration to fly on SYS 1 with SYS 2 on PNL. Note: This impacts numerous pocket C/L procedures.
- D. Standard S-band PNL/CMD configurations for given LRU failures
  - XPNDR 2 UPLINK FAILURE

# **ORBIT**

	XPNDR	NSP	ANT	PREAMP	PA
CMD -	1	2	2	2	2
PNL -	1	1	1	1	1

<b>ENTRY</b>					
	XPNDR	NSP	ANT	PREAMP	PA
CMD -	1	1	1	1	1
PNL -	2	2	2	2	2

XPNDR 2 DOWNLINK FAILURE 1b.

#### ORBIT/ENTRY

	XPNDR	NSP	ANT	PREAMP	PA
CMD -	1	2	2	2	2
PNL -	1	1	1	1	1

NSP 2 UPLINK FAILURE - (VOICE AND/OR COMMAND; BOTH DATA RATES)

# ORBIT

OINDIT					
	XPNDR	NSP	ANT	PREAMP	PA
CMD -	2	1	2	2	2
PNL -	1	1	1	1	1

## **ENTRY**

_	XPNDR	NSP	ANT	PREAMP	PA
CMD -	1	1	1	1	1
PNL -	2	2	2	2	2

2b. NSP 2 UPLINK FAILURE - HIGH DATA RATE (LOW DATA RATE IS OK)

ORBIT

	XPNDR	NSP	ANT	PREAMP	PA
CMD -	2	1	2	2	2
PNL -	1	1	1	1	1

(Advise crew to select NSP 2 and uplink low data rate and repeat PNL/CMD if no comm)

**ENTRY** 

	XPNDR	NSP	ANT	PREAMP	PA
CMD -	1	1	1	1	1
PNL -	2	2	2	2	2
(Config I	PNL A1 for	low data	a rate up	olink)	

2c. NSP 2 DOWNLINK FAILURE - (VOICE AND TELEMETRY LOST)

ORBIT/ENTRY

	XPNDR	NSP	ANT	PREAMP	PA
CMD -	2	1	2	2	2
PNL -	1	1	1	1	1

2d. NSP 2 DOWNLINK FAILURE - HIGH DATA RATE (LOW DATA RATE IS OK)

**ORBIT** 

	XPNDR	NSP	ANT	PREAMP	PA
CMD -	2	1	2	2	2
PNL -	1	1	1	1	1

(Advise crew to select NSP 2 and downlink low data rate and repeat PNL/CMD if no comm)

**ENTRY** 

_	XPNDR	NSP	ANT	PREAMP	PA
CMD -	1	1	1	1	1
PNL -	2	2	2	2	2

(Config PNL A1 for low data rate downlink)

2e. NSP 2 DOWNLINK FAILURE - (VOICE LOST; TELEMETRY OK)

**ORBIT** 

	XPNDR	NSP	ANT	PREAMP	PA
CMD -	2	1	2	2	2
PNL -	1	1	1	1	1

**ENTRY** 

	XPNDR	NSP	ANT	PREAMP	PA
CMD -	1	1	1	1	1
PNL -	2	2	2	2	2

2f. NSP 2 DOWNLINK FAILURE - (TELEMETRY LOST; VOICE OK)

ORBIT/ENTRY

	XPNDR	NSP	ANT	PREAMP	PA
CMD -	2	1	2	2	2
PNL -	1	1	1	1	1

(Advise crew (on orbit) to select NSP 2 and repeat PNL/CMD if no comm)

3. ANT ELEC 2 FAILURE - ORBIT AND ENTRY

	XPNDR	NSP	ANT	PREAMP	PA
CMD -	2	2	1	2	2
PNL -	1	1	1	1	1

4a. PREAMP 2 FAILURE - ORBIT

	XPNDR	NSP	ANT	PREAMP	PA
CMD -	2	2	2	1	2
PNL -	1	1	1	1	1

4b. PREAMP 2 FAILURE - ENTRY

	XPNDR	NSP	ANT	PREAMP	PA
CMD -	2	2	2	1	2
PNL -	1	1	1	1	1

Note: Select LRU's as above, except position S-band PM mode select rotary to STDN LO.

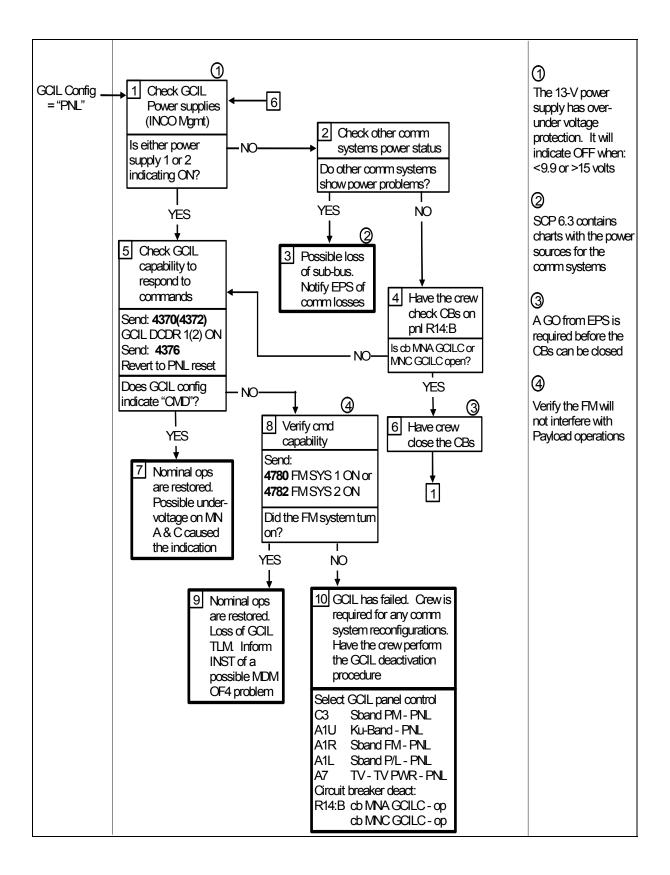
5a. POWER AMP 2 FAILURE - ORBIT

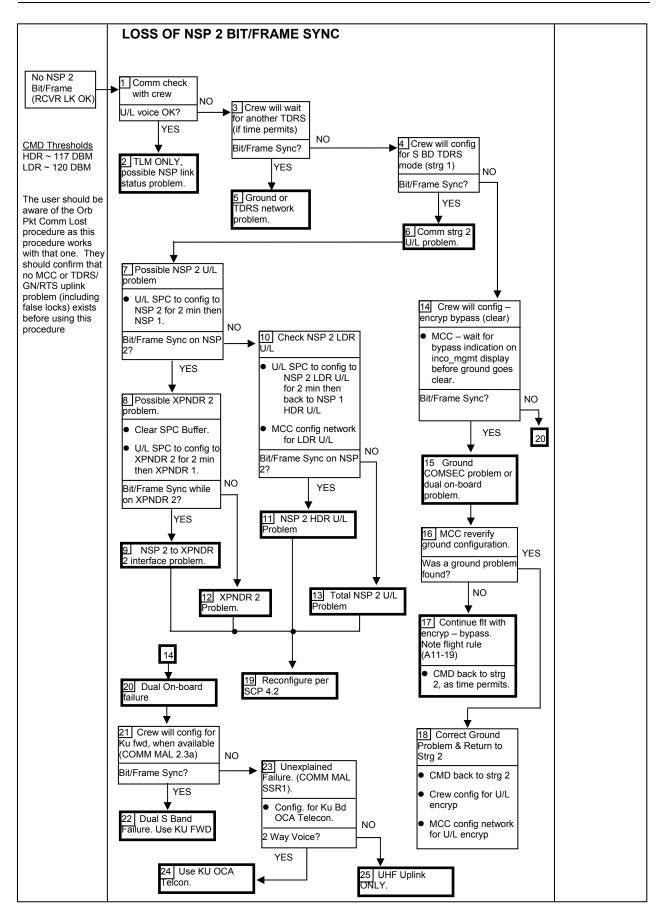
	XPNDR	NSP	ANT	PREAMP	PA	
CMD -	2	2	2	2	1	
PNL -	1	1	1	1	1	

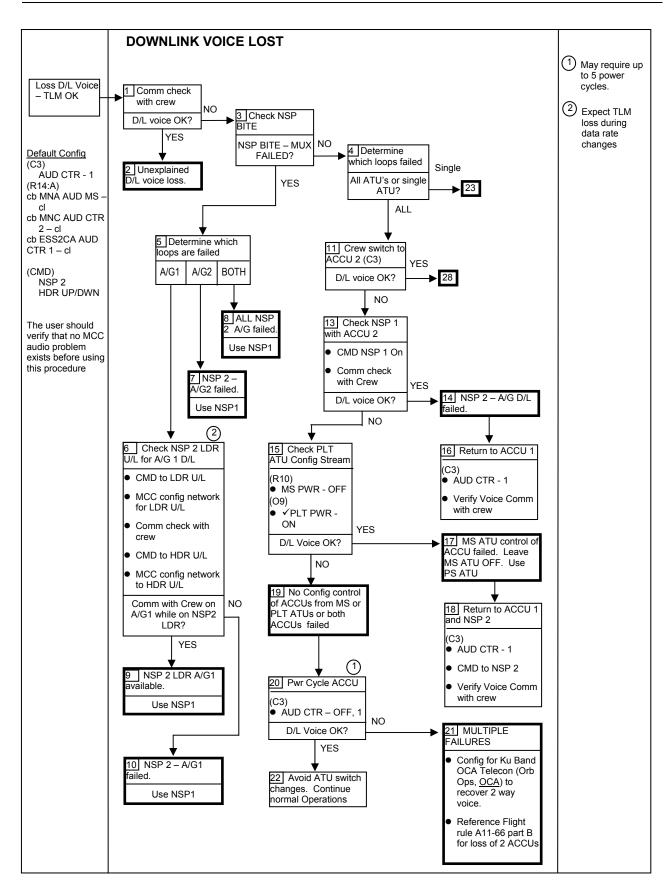
5b. POWER AMP 2 FAILURE - ENTRY

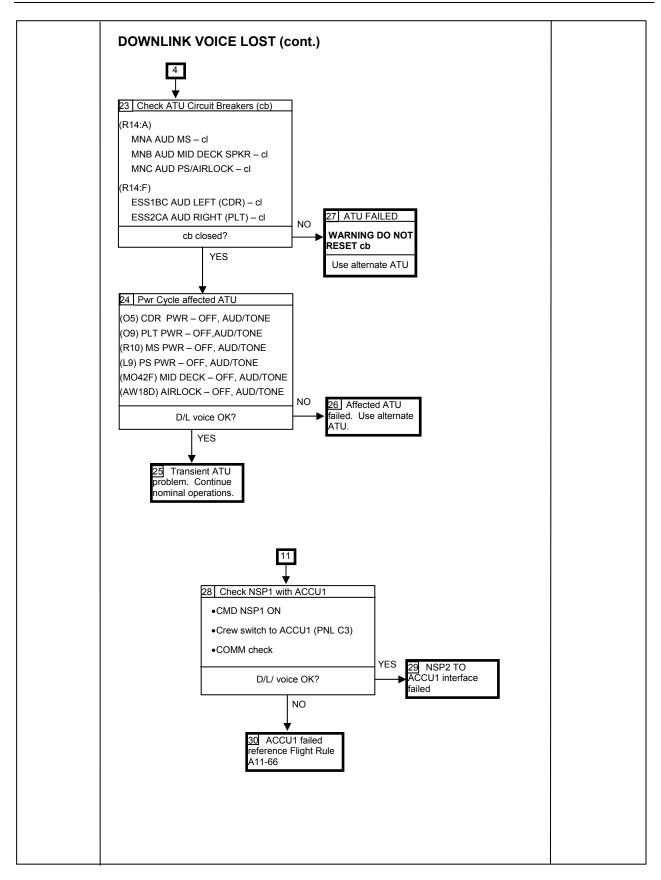
	XPNDR	NSP	ANT	PREAMP	PA
CMD -	2	2	2	2	1
PNL -	1	1	1	1	1

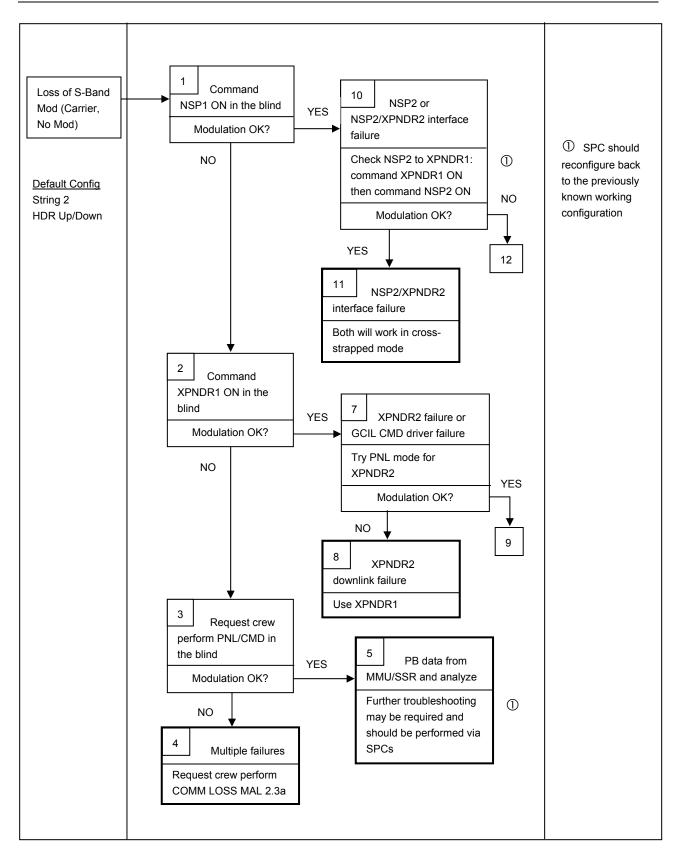
Note: Select LRU's as above, except position S-band PM mode select rotary to STDN LO on PNL A1.

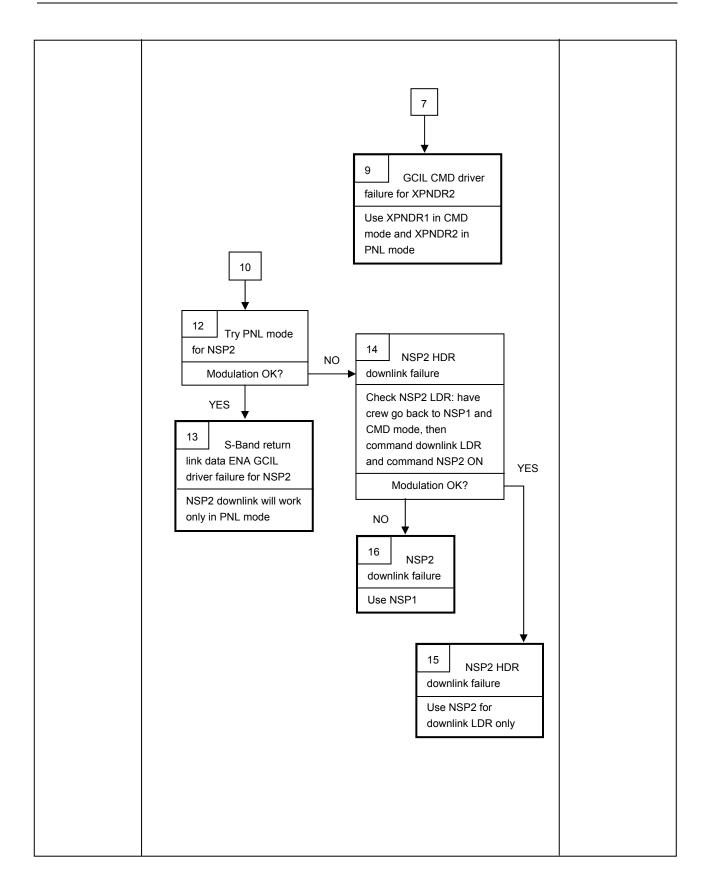


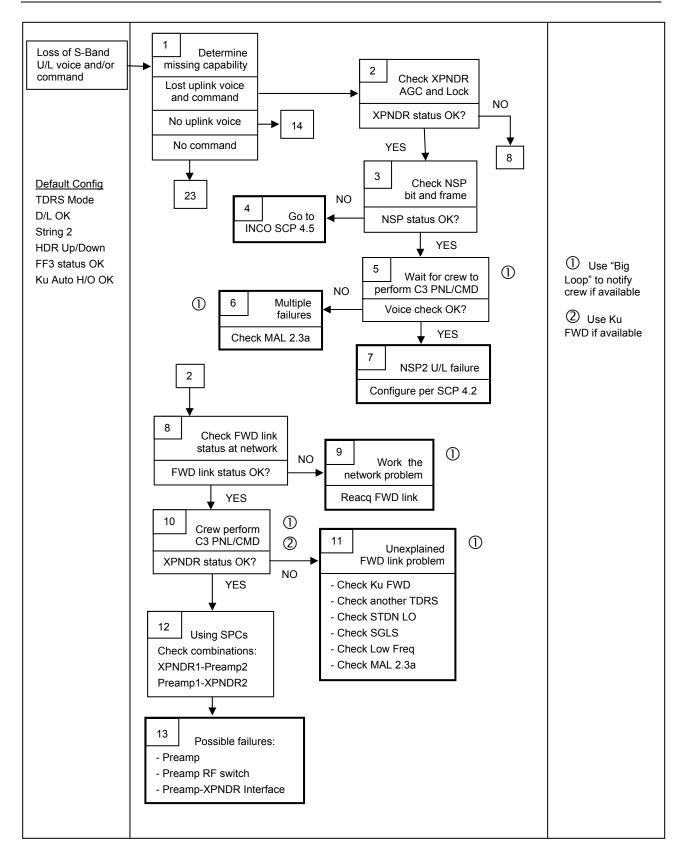


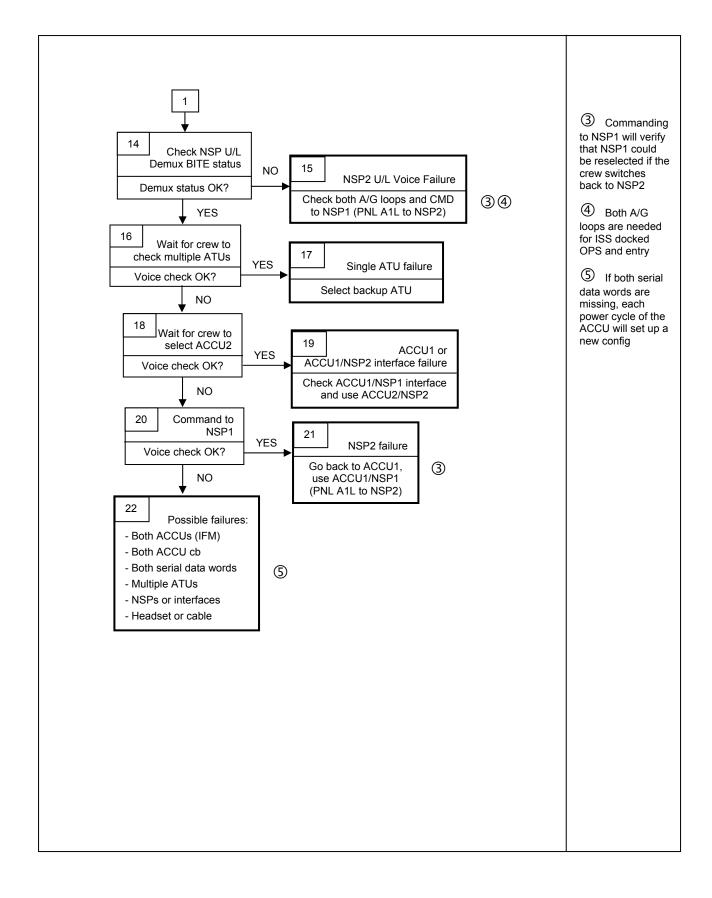


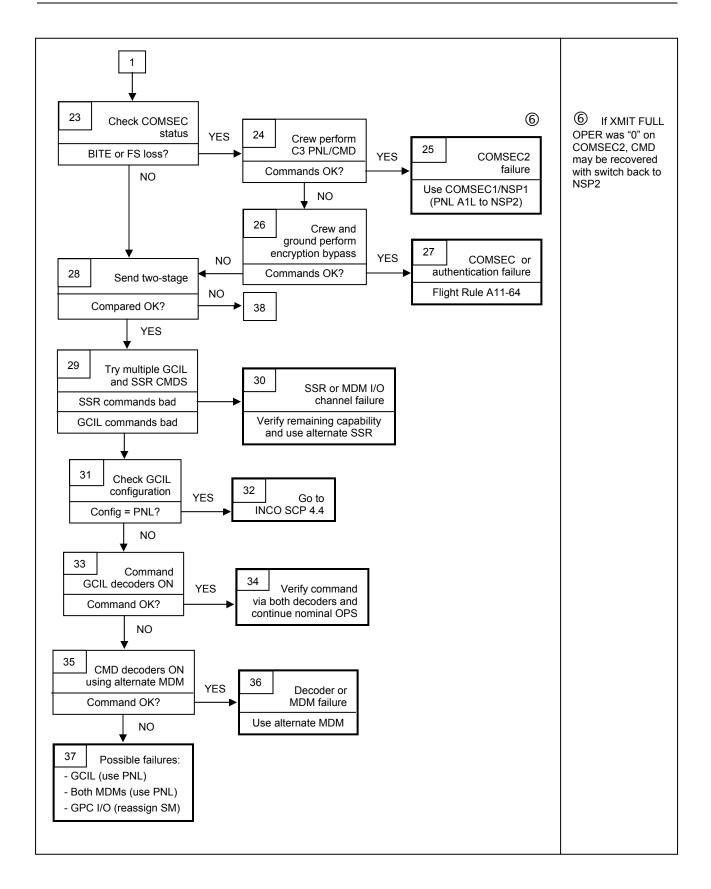


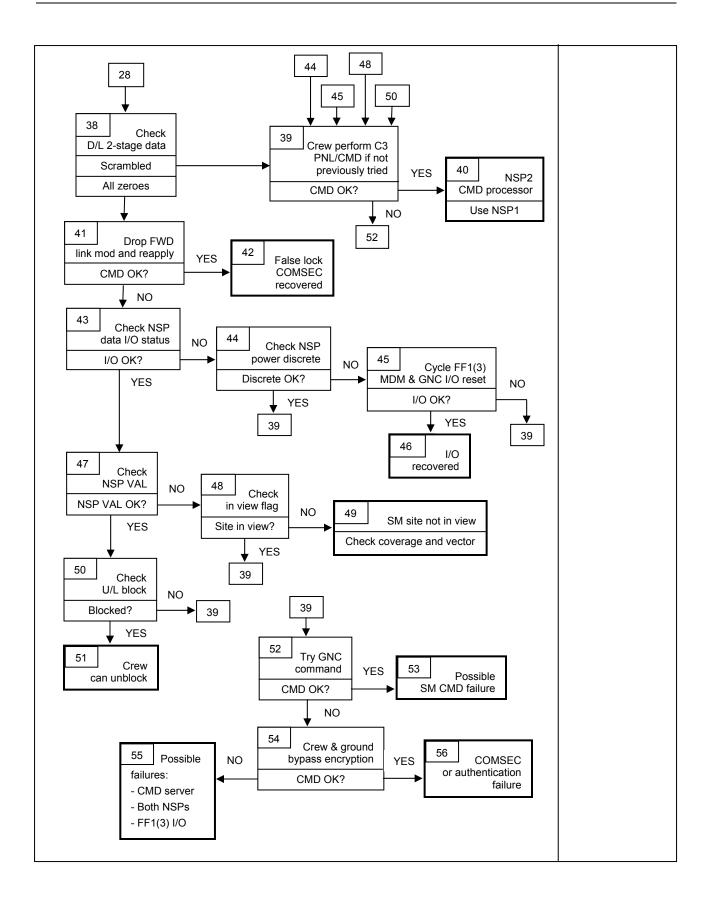


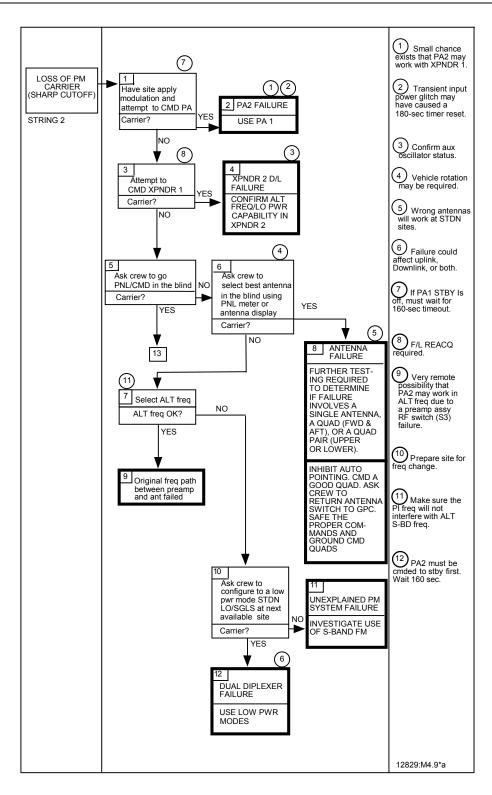


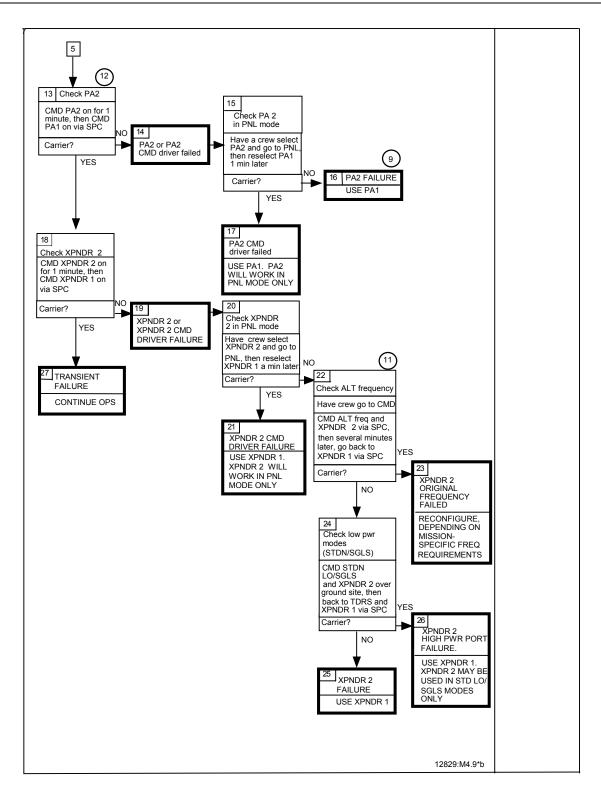


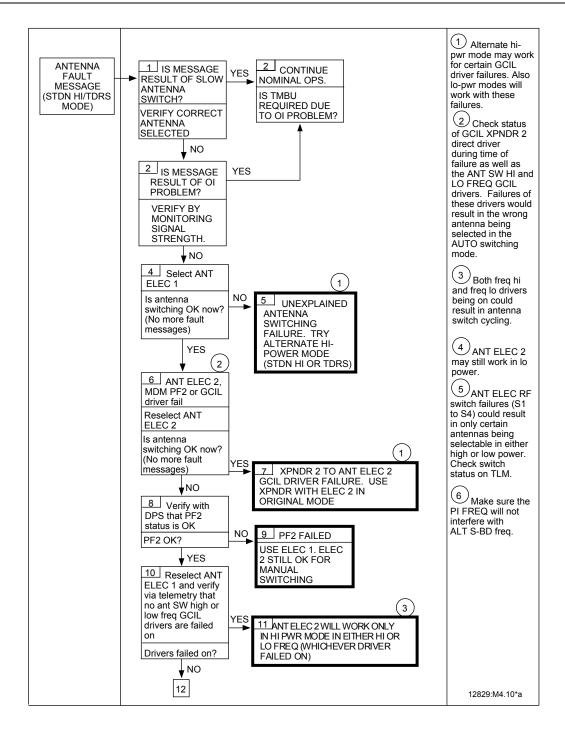


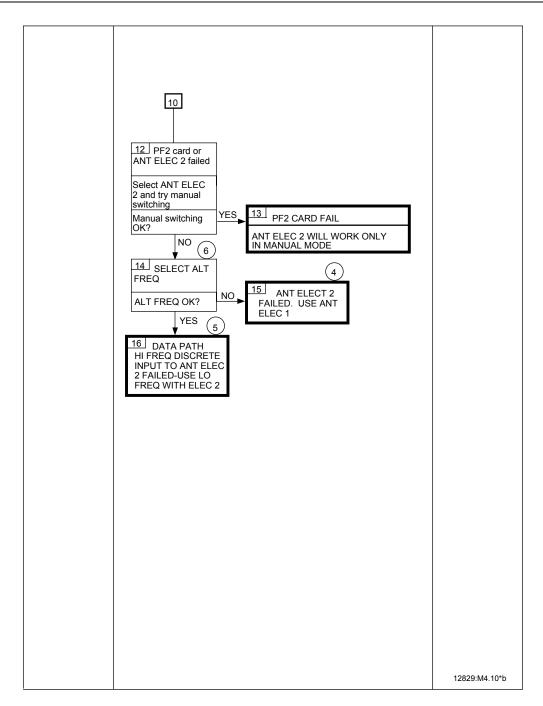


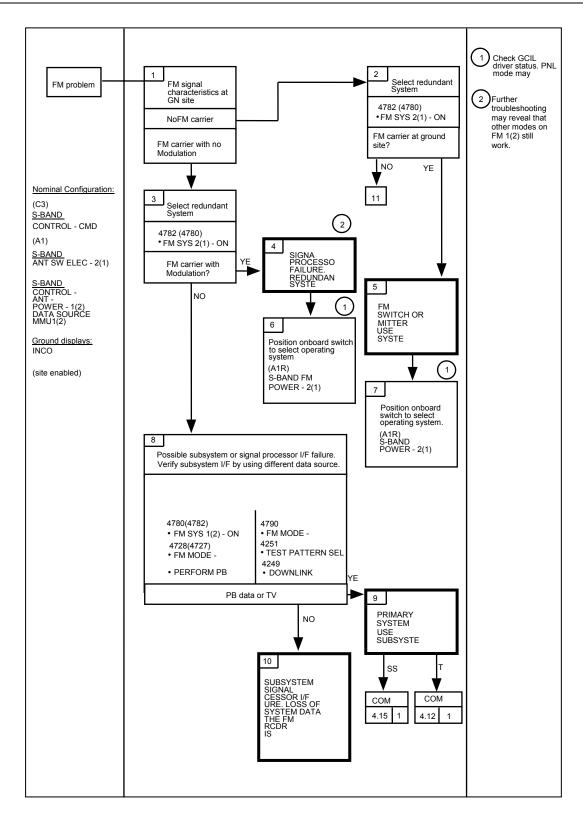


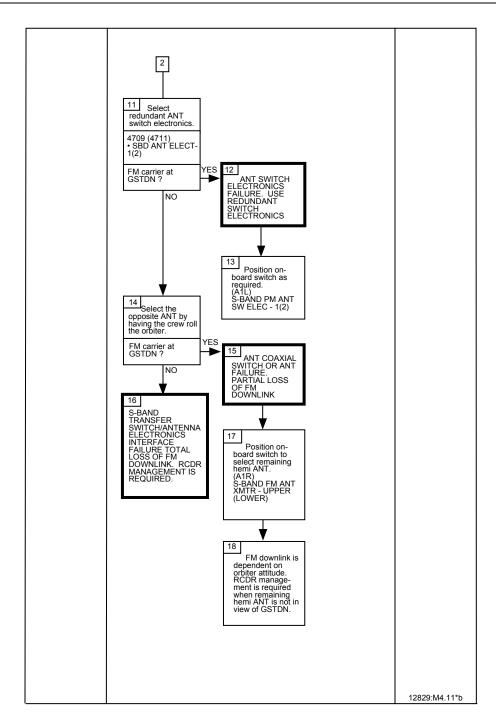


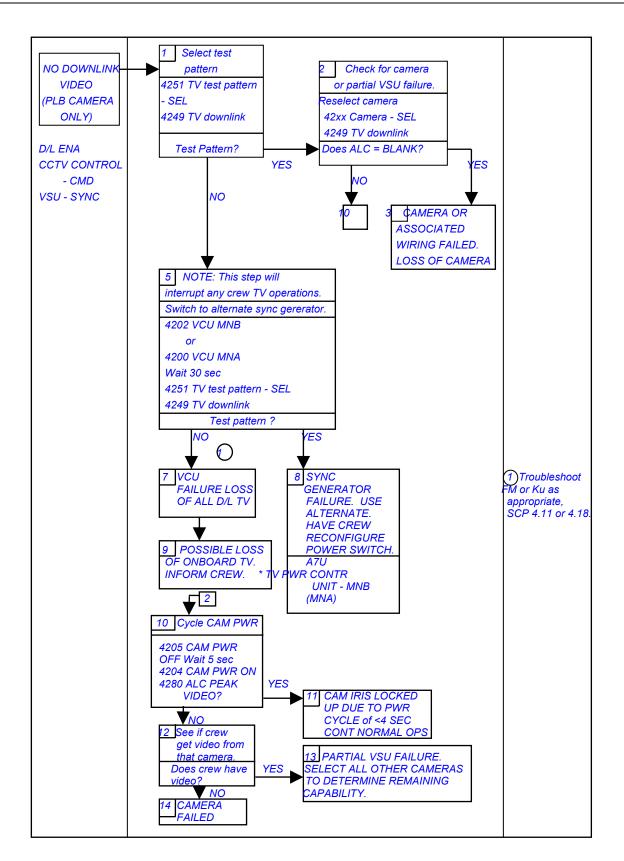


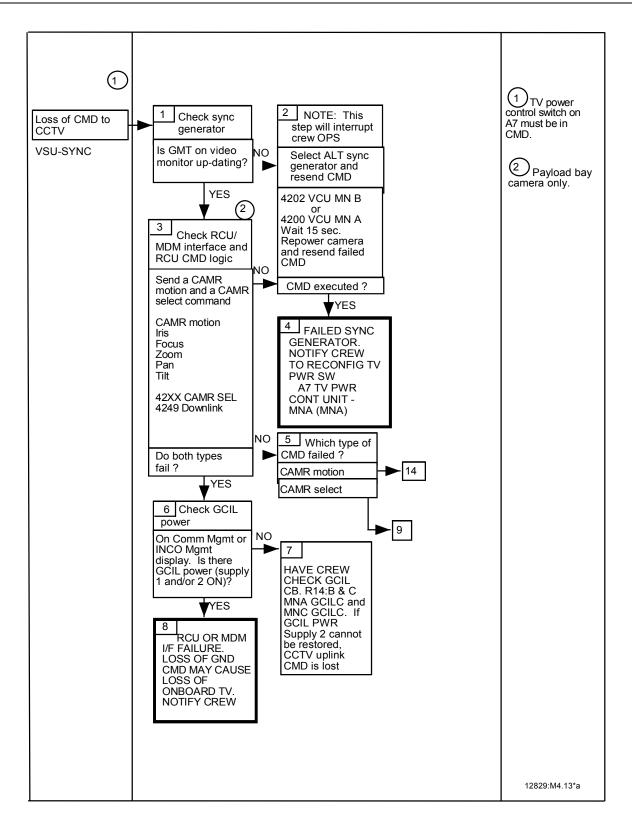


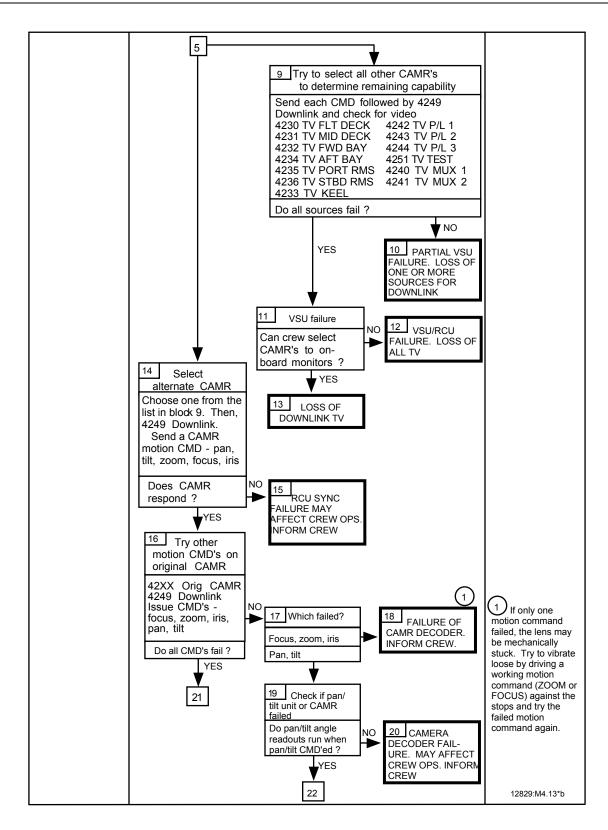


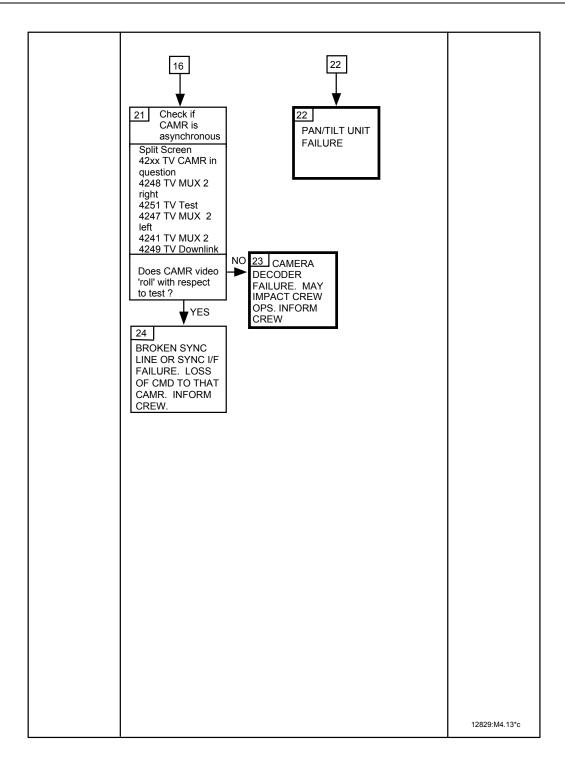


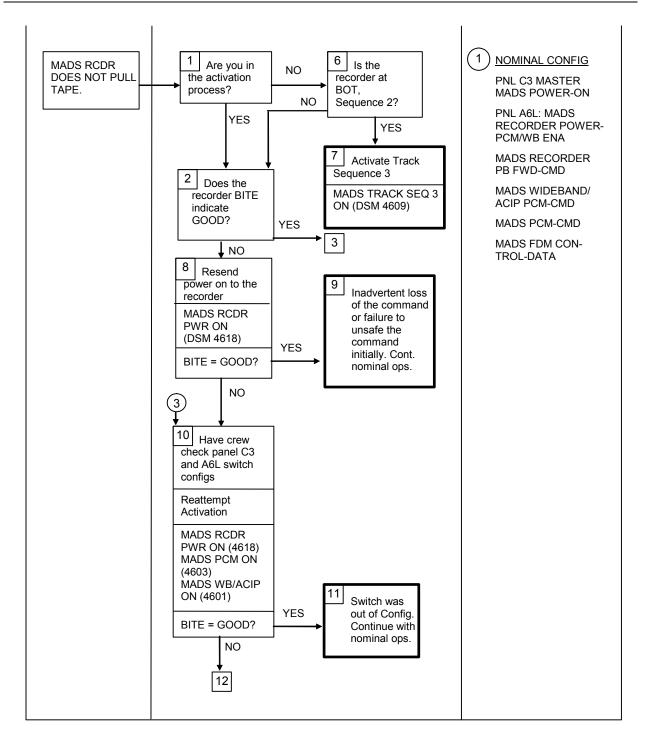


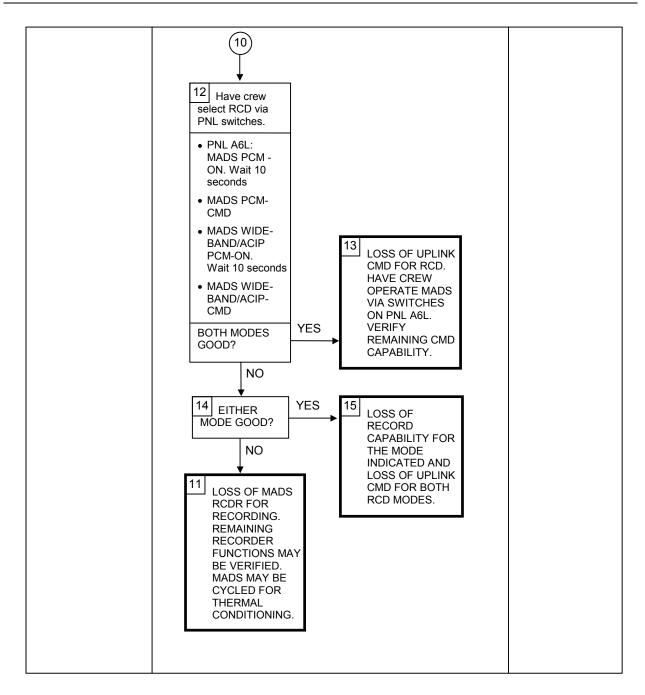


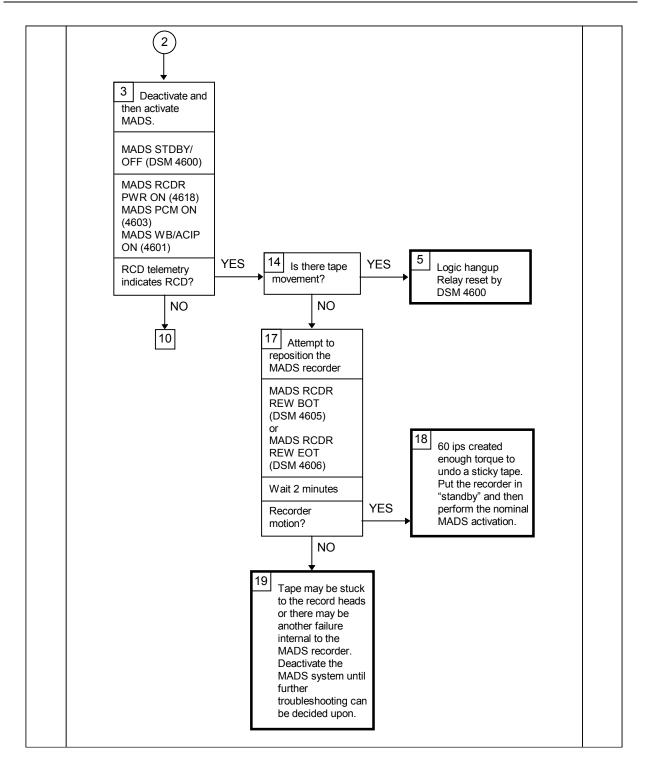




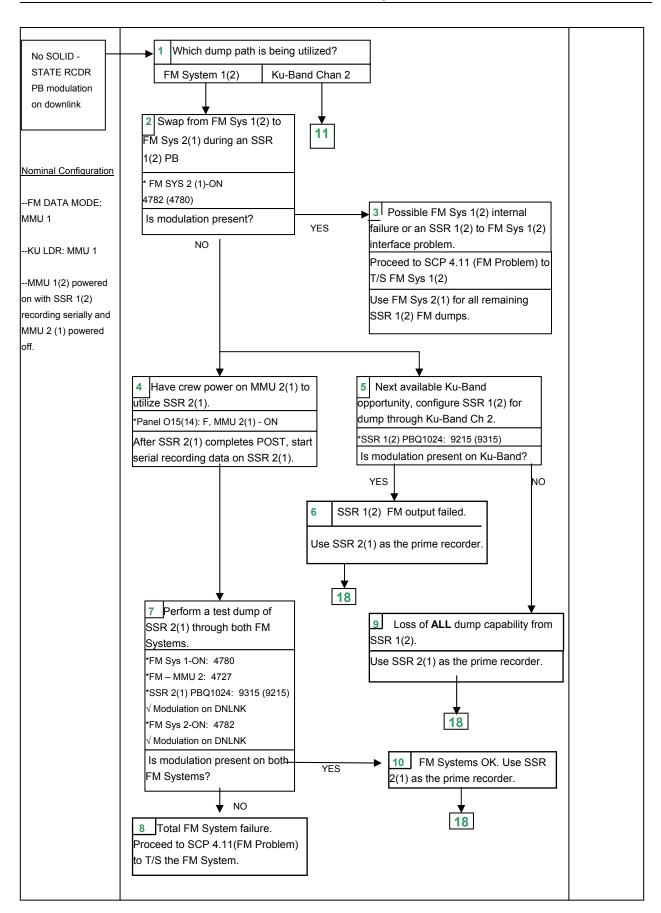




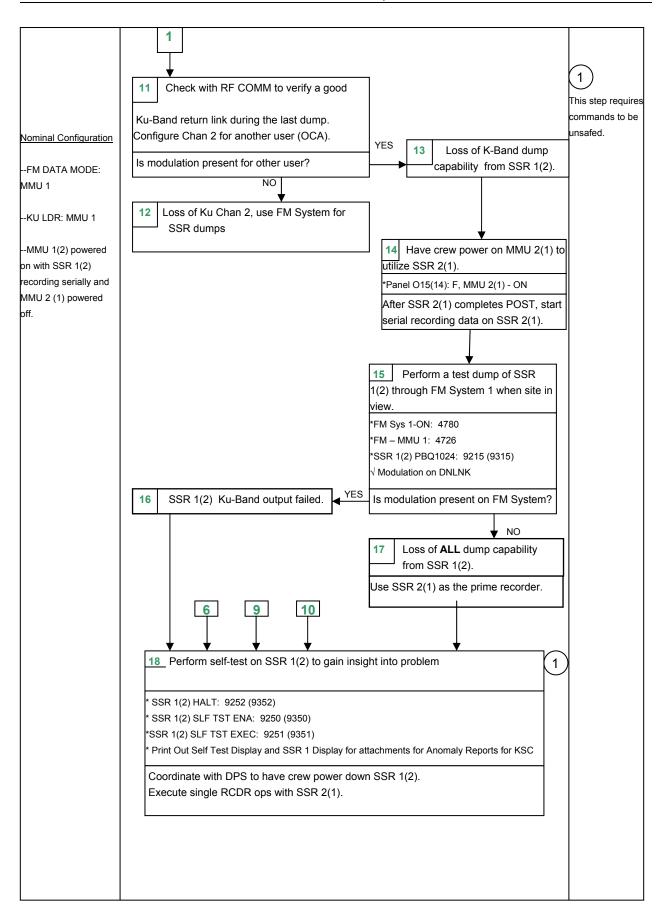


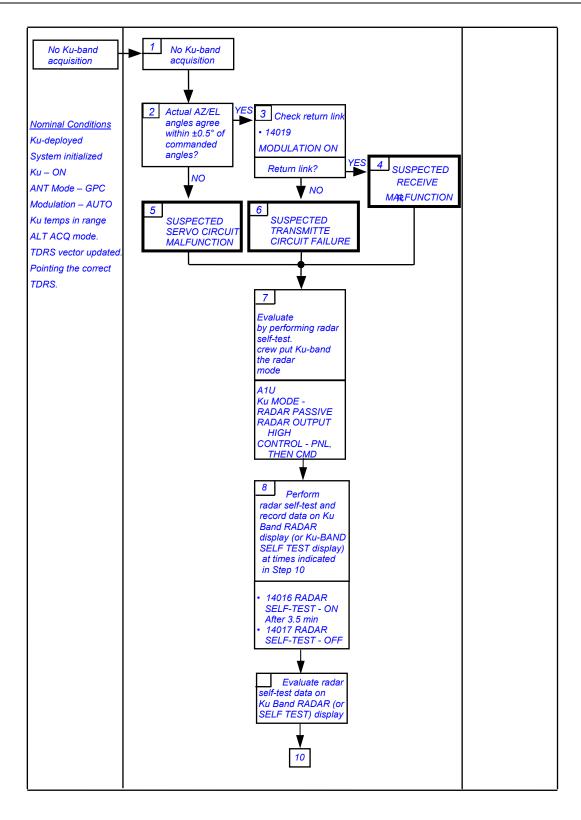


5/31/2007: REV G, PCN-5



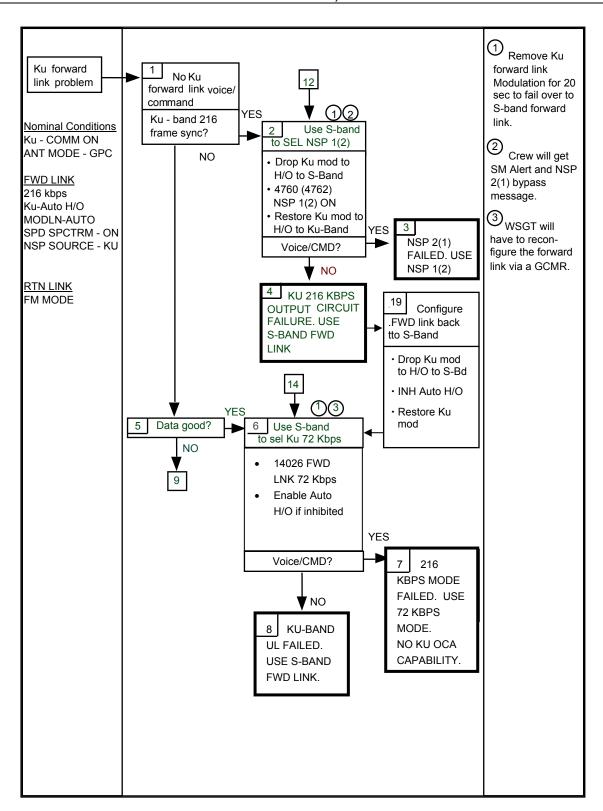
5/31/2007: REV G, PCN-5

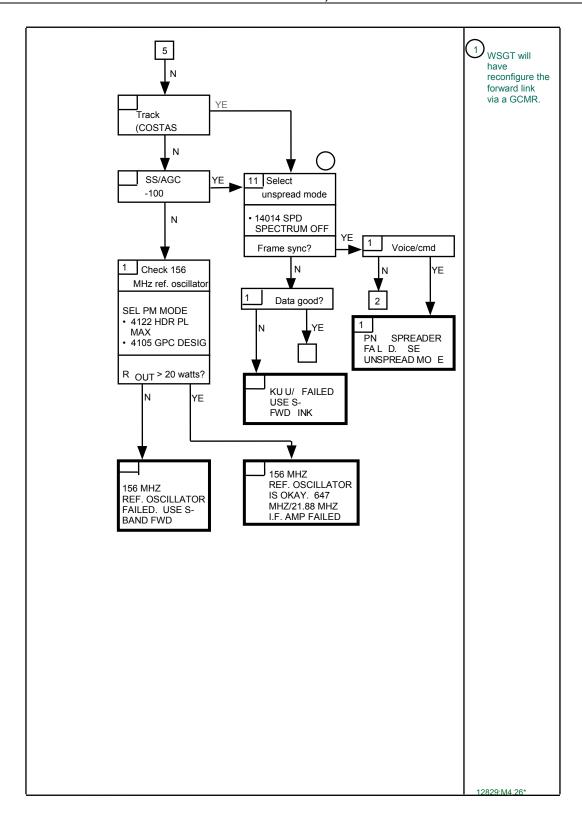


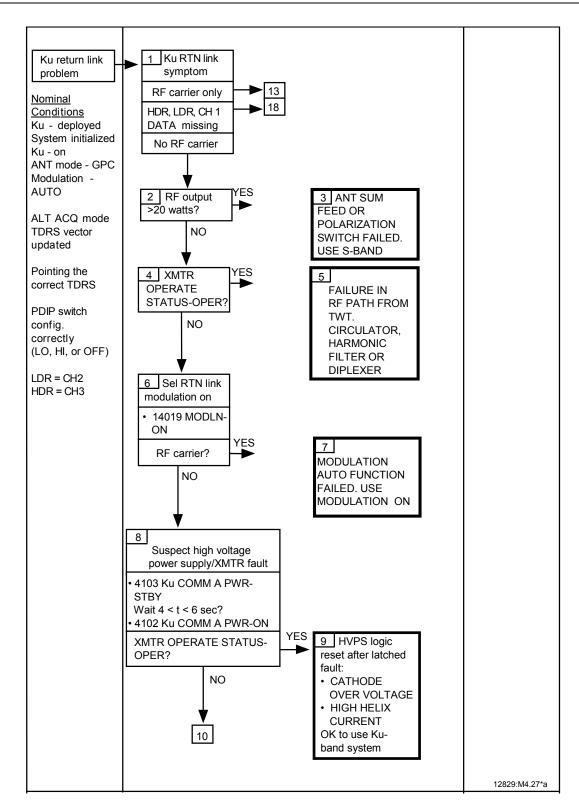


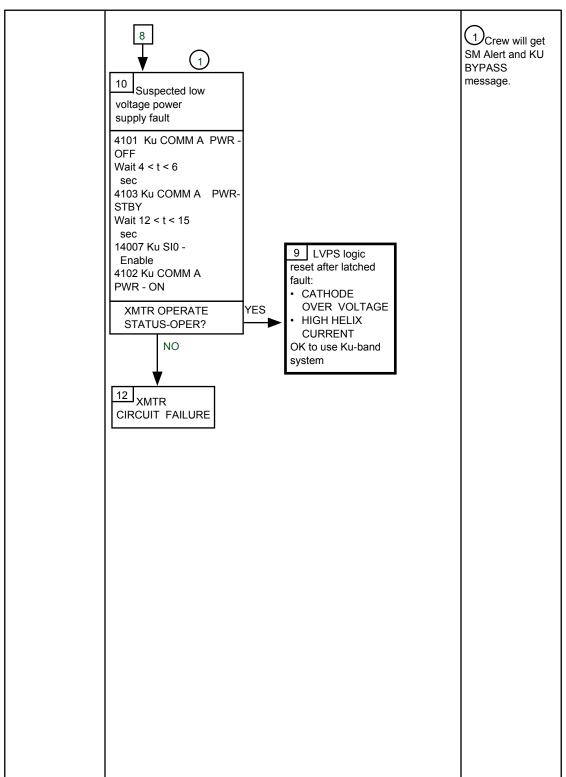


		<b>V</b>	
10		CONCLUSION	
TIME (SEC)	<u>PARAMETER</u>	VALUES AGREE	VALUES DO NOT AGREE
40	EL = 30°		
	AZ = 30°		
55	EL = 30°	α & β SERVO CIRCUITS ARE OK.	α & β OR BOTH GIMBAL SERVO CIRCUITS HAVE FAILED.
	AZ = -30°	OINCOTTO ARE ON.	OINCOTTO HAVE TAILED.
70	<i>EL</i> = 0°		
	AZ = 0°		
90	OPER STATUS = OPER	TRANSMITTER IS OK.	TRANSMITTER OR RECEIVER CIRCUIT FAILURE.
	AGC > 0 VOLTS	RECEIVER IS OK.	
100	RANGE = 5,300 ± 500 FT		
110	RANGE = 0 FT	SUM RECEIVE CHANNEL TO EA-2 PROCESSOR IS OK.	CHANNEL FROM ANTENNA TO
120	RANGE = 10,200 ± 500 FT		
150	AZ ANG RATE = -16.38/SEC	DEA & EA-2 LRUs ARE OK.	DEA OR EA-2 RECEIVE PATH FAILURE.
	EL ANG RATE = -16.38/SEC		
200	RANGE = 888,800 FT	SYSTEM IS OK	SYSTEM FAILURE AS DESCRIBED ABOVE.
	RANGE = 333,300 FT		

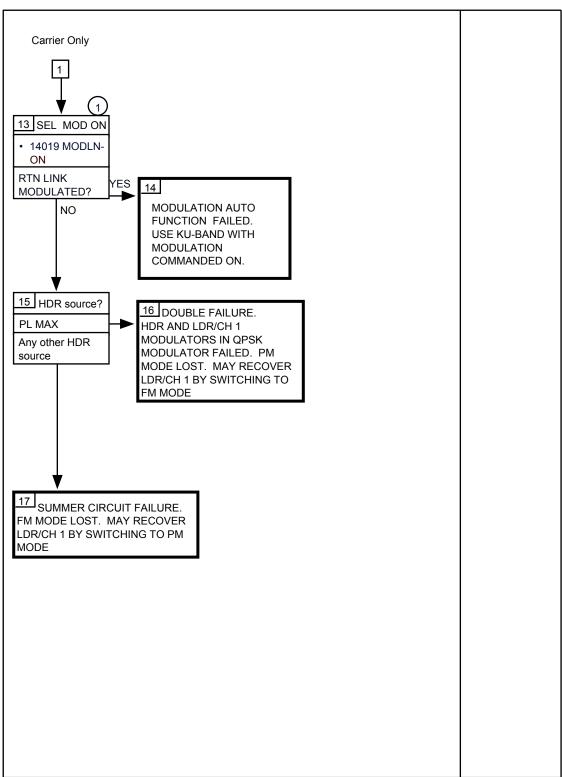




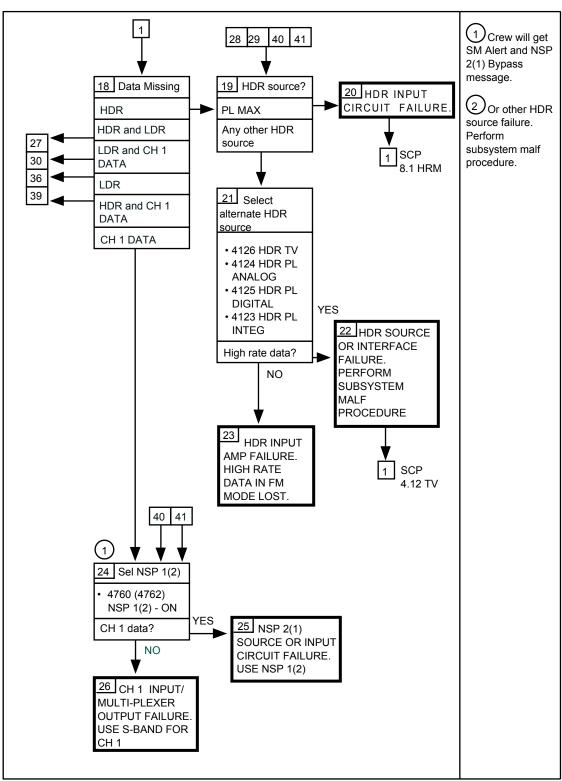




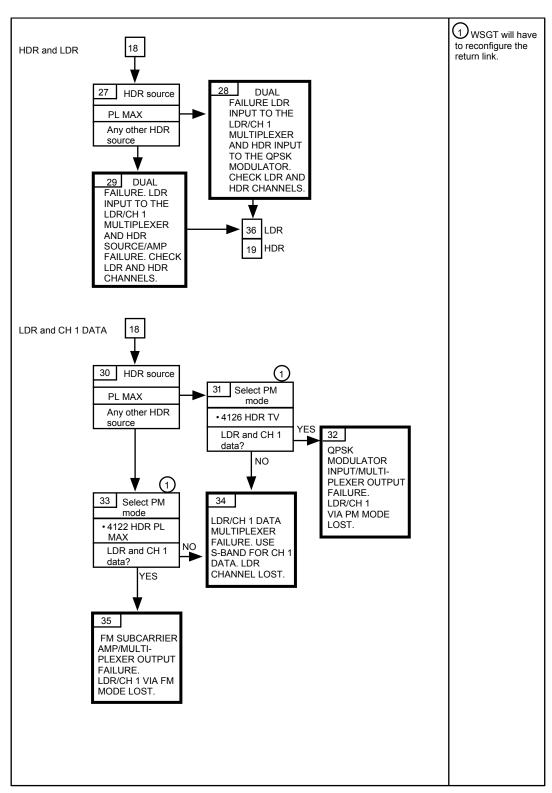
12829:M4.27\*b



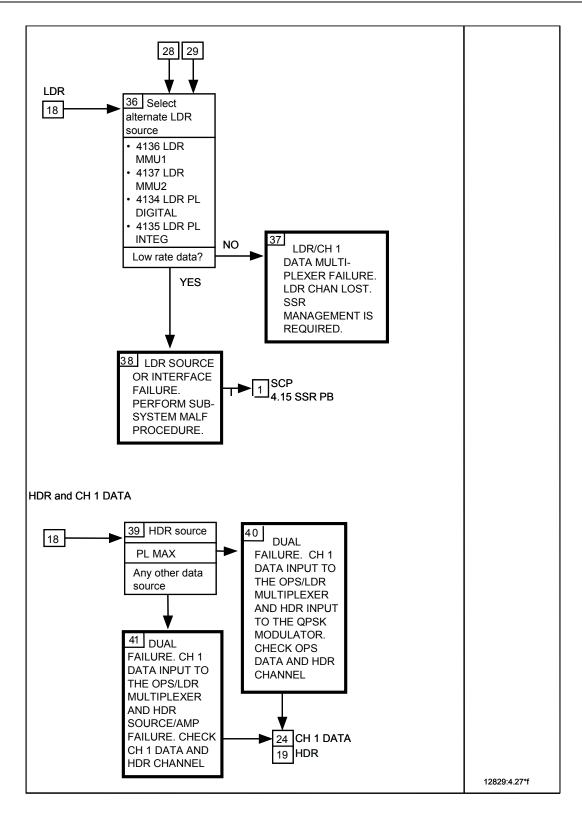
12829:M4.27\*c

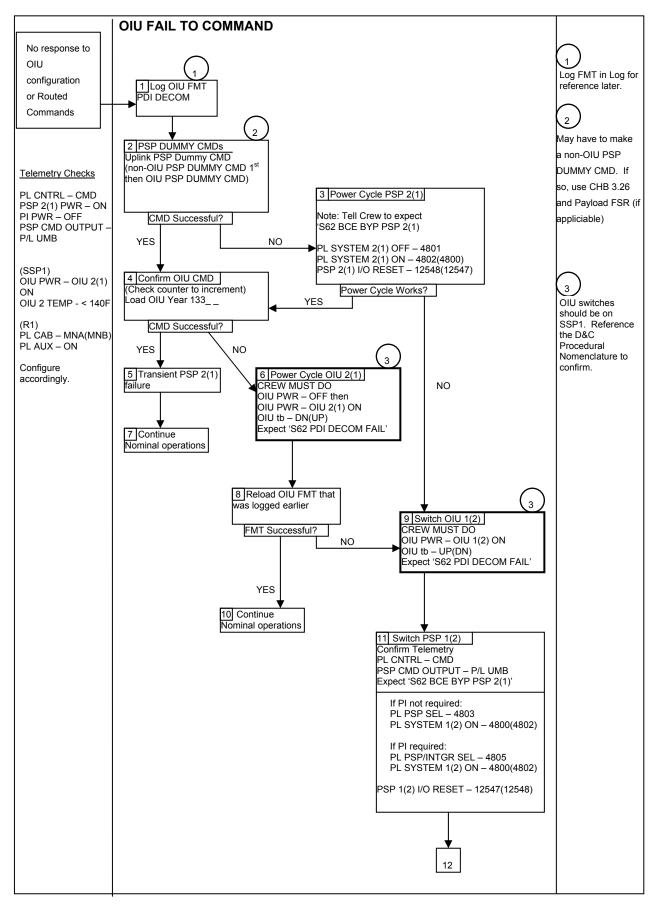


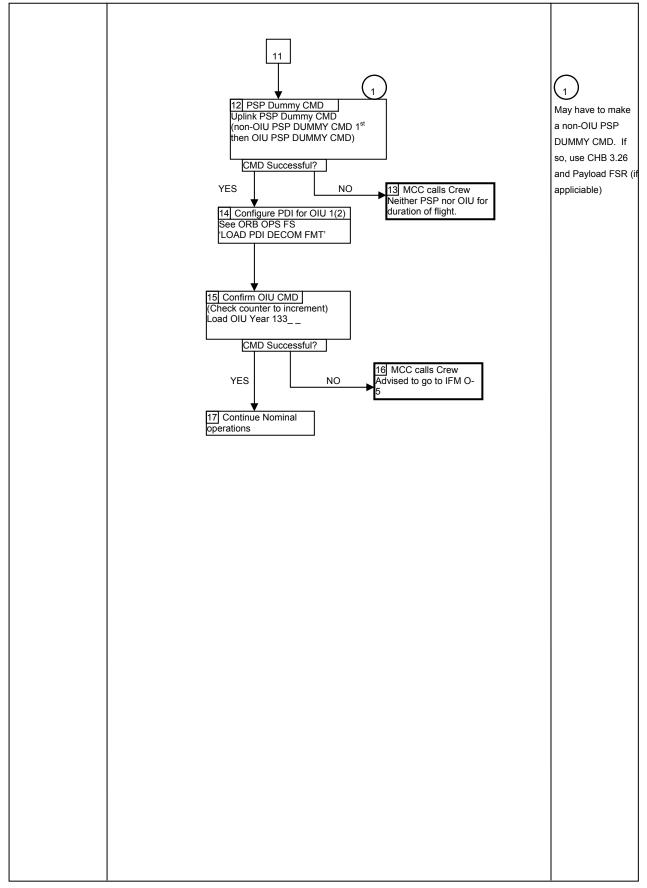
12829:M4.27\*d

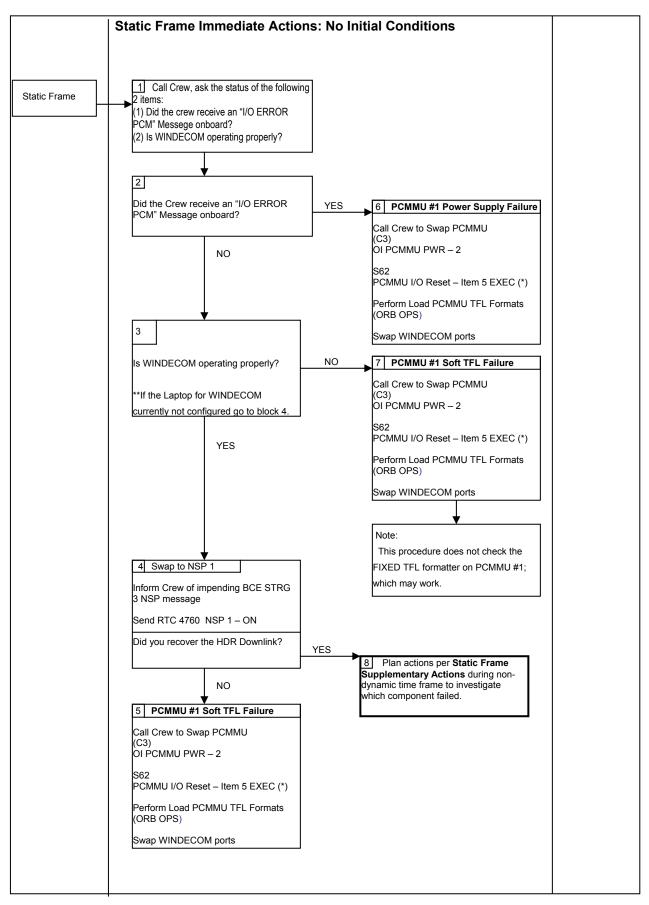


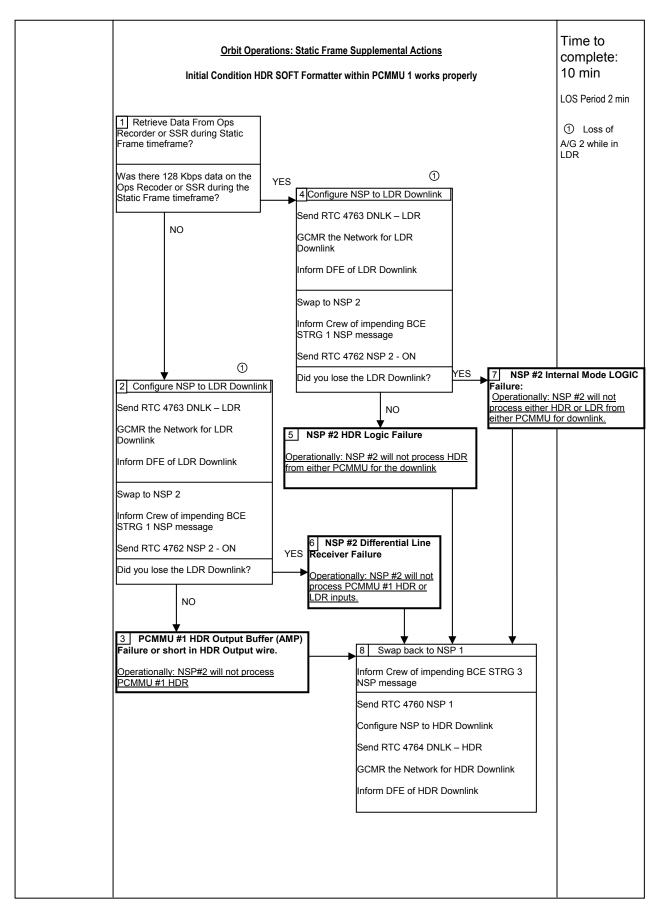
12829:M4.27\*e

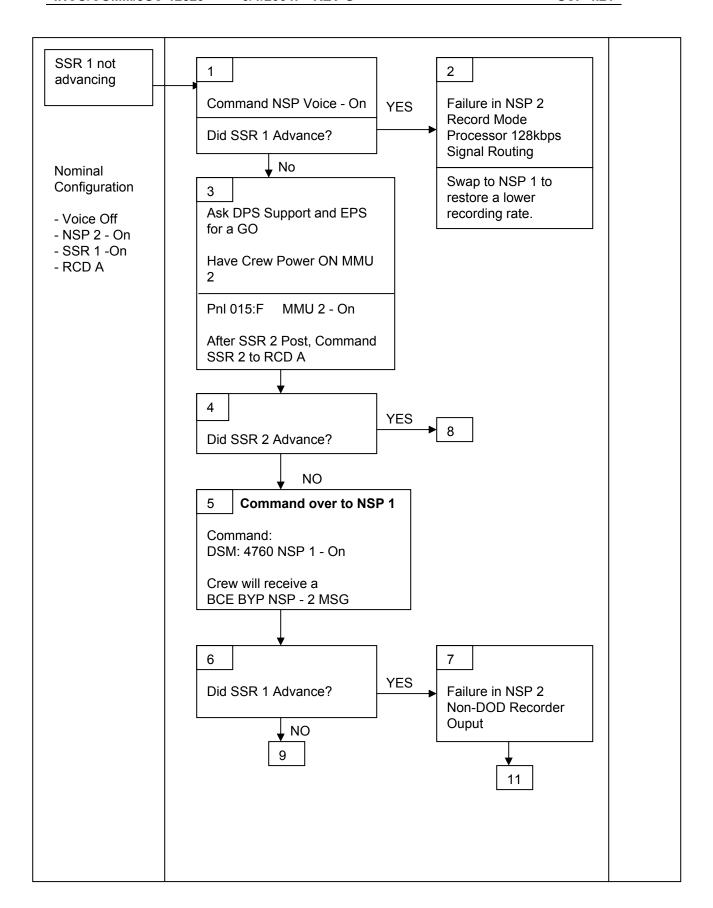


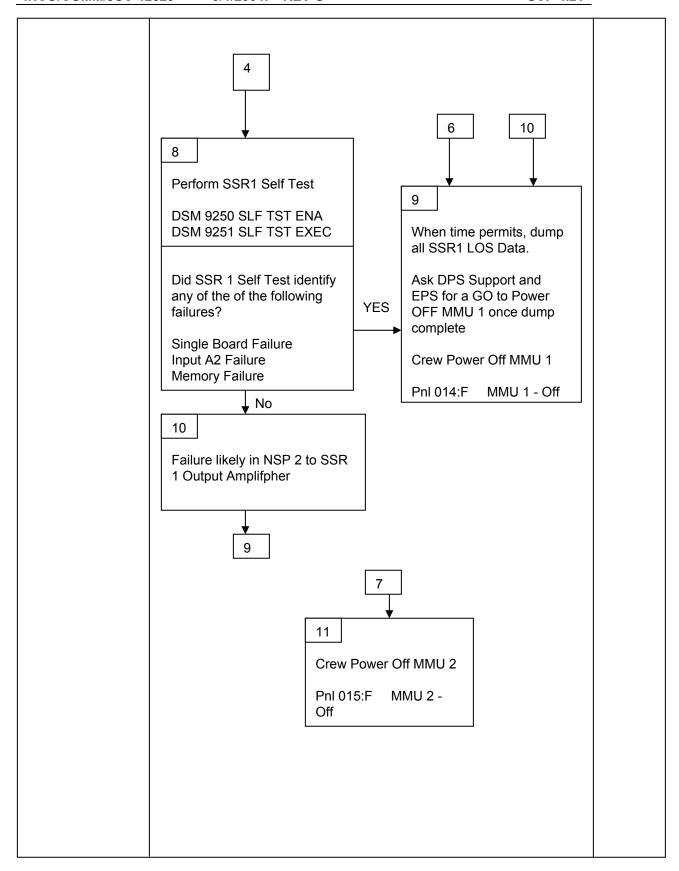


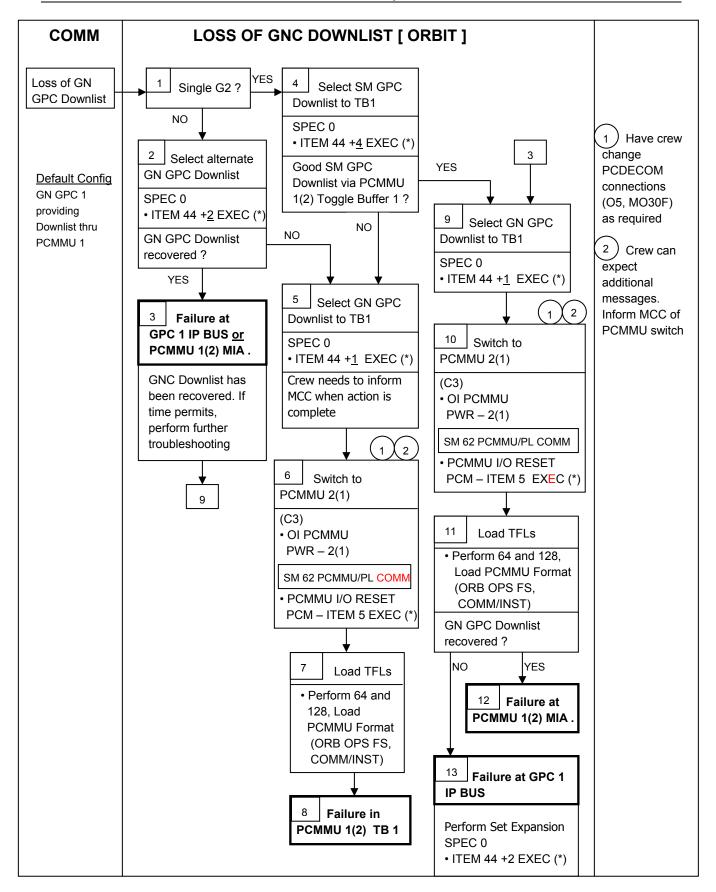


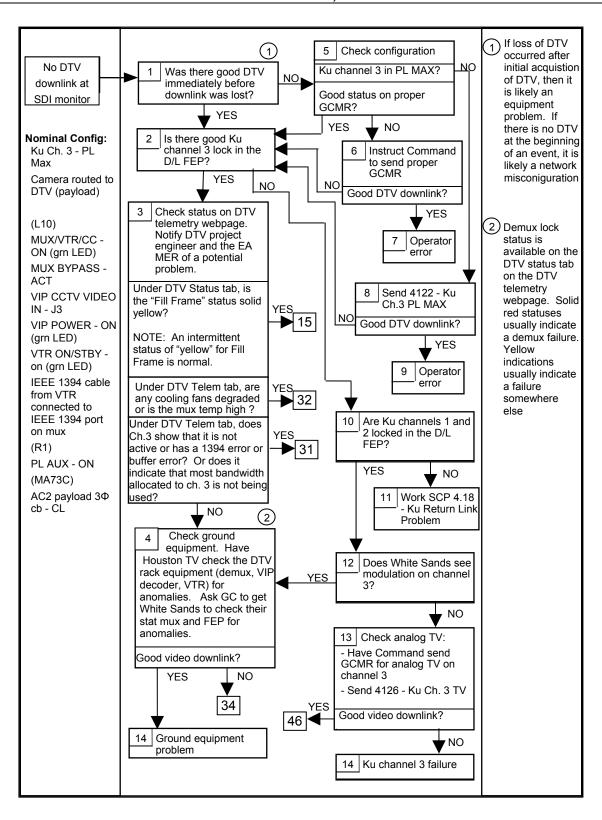


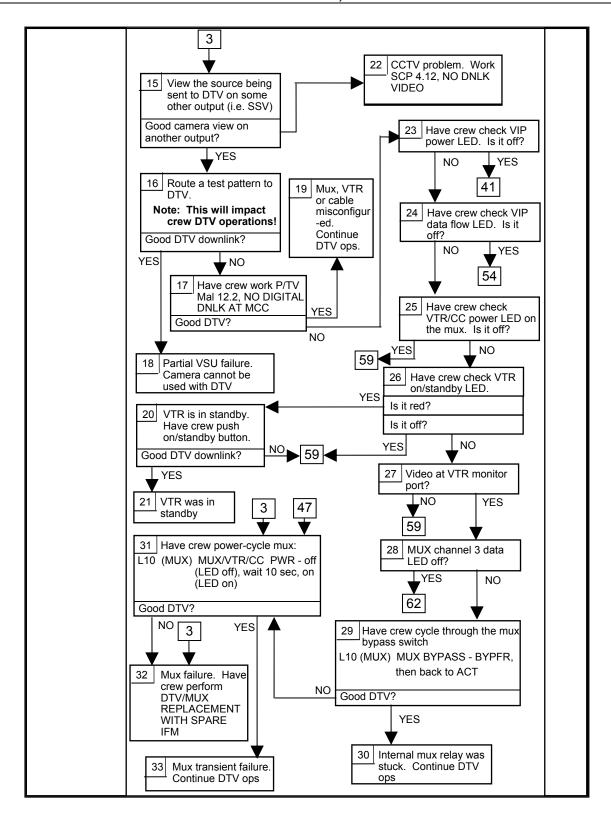


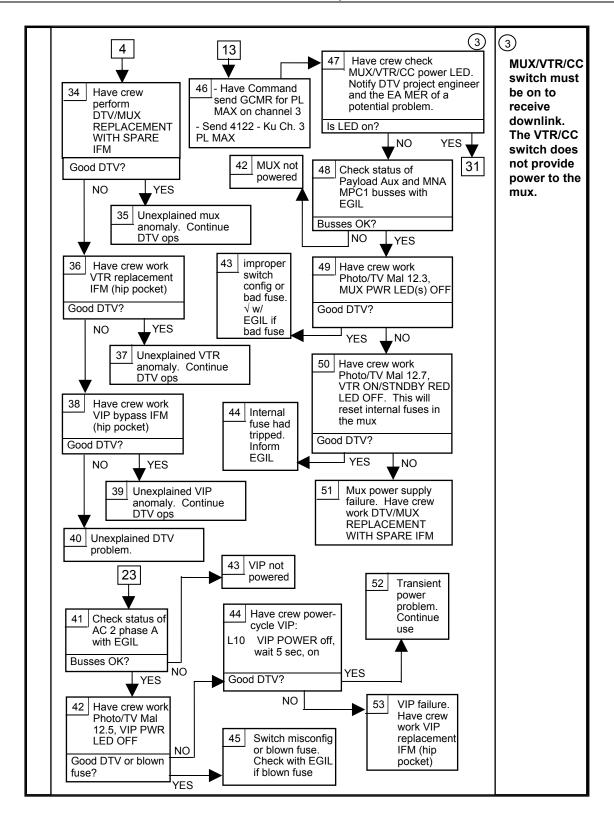


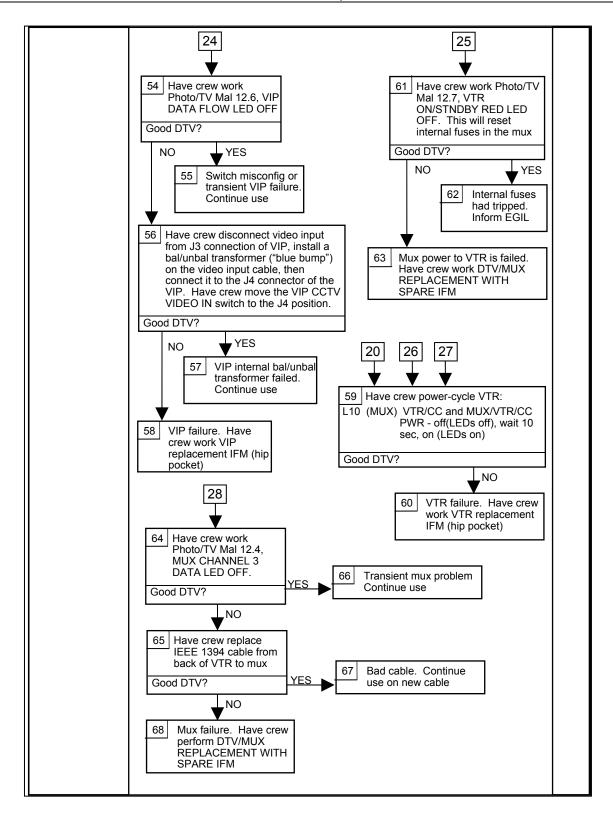












#### **TITLE**

## COMMAND APPLICATION INITIALIZATION

# **PURPOSE**

To define the procedures used to initialize the command applications and the interface to the space shuttle Generic Command System (GCS) from the MCC workstations.

# **GENERAL**

These procedures are used to initialize the interface to the GCS from the MCC workstations. There are four procedures included in this SCP. The first one is a step-by-step sequence to register a workstation as a command user with the GCS. The second sequence starts the hardware panel. The third starts the point-and-click command displays. The last sequence terminates the command interface to the GCS.

# **PROCEDURE**

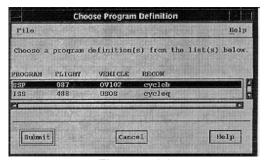
# A. To Register as a Command User

- 1. Select INCO display navigation menu.
- 2. Start Command/Start Command Manager First. A small display will pop up on the screen (figure 5.1-1) that indicates the status of the interface between the workstation and the command server.



**Figure 5.1-1** 

- 3. A display will pop up in the middle of the screen for requesting a link between the workstation and the shuttle (SSP) or station (ISS) command server (figure 5.1-2).
- Select the SSP command server by pressing the left mouse button while the mouse cursor is located over the SSP line in the display (figure 5.1-2). Press the Submit button to complete the selection.
- 5. Shortly after the command manager status display is started, another display will pop up on the screen. This is the Kerberos access display (figure 5.1-3). The access code must be typed into this display, then press the "Enter" key. If the correct access code is entered, the command manager display will change to green and indicate that the interface is active. The access codes can be



**Figure 5.1-2** 



**Figure 5.1-3** 

obtained from the INCO Group Lead. There will be access codes for each flight and for test/simulation mode activities. The Access and Control personnel generate new access codes about every 3 months.

If an invalid access code is entered, the Kerberos display will replace the "enter access code" message located just above the type-in box with an error message. To correct this error, type in the correct access code. There will be no indication that the correct access code was entered, except that the Kerberos display will disappear, and the command manager display will turn green.

6. Once the correct Kerberos access code is entered, a display will pop up that is used to select a position (figure 5.1-4). There are six possible positions for the INCO group. The standard Workstation/Positions are listed in the table below. Each position can be used on up to four workstations, but only one user ID can be attached to the position. This means that the person using the INCO workstations can select INCO as the position on both of them, as long as the same user ID was used to log on to both INCO workstations. There are two extra positions available for those users who need access to the displays, but are not the primary operators.

<b>Workstation</b>		<b>Position</b>
WF 5/24	<b>→</b>	INCO
WM 10	<b>→</b>	Datacomm
WM 5	<b>→</b>	RF Comm
WM 13	<b>→</b>	INST
extra	<b>→</b>	INCO01
extra	<b>→</b>	INCO02

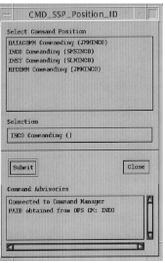


Figure 5.1-4

7. Contact the COMMAND flight control position on the COMMAND loop to have the Position selected enabled. Once COMMAND reports back that the position is enabled, this procedure is completed. The display to verify the enable disable status is located on the INCO DNAV Command/Other Command Displays/Position Status."

# B. To Start the Hardware Command Panel

1. From the INCO display navigation menu, select either the GCS/H/W CMD PANEL - Orbit or H/W CMD PANEL - Ascent option. The hardware panel user interface will start, and the NASA "meatball" will appear on the panel buttons.

# NOTE

The INCO console has two workstations on it. The hardware panel can be started only from the workstation named white-fcr 5. Attempting to start the hardware panel from white-fcr24 will not be successful.

- 2. After the NASA "meatball" appears, press any PBI on the panel to continue.
- 3. Press the enable button on the CMD\_W\_pbimgr window.
- 4. Continue with nominal operations.

# C. To Start the Software Command Panel (point and click)

- From the INCO display navigation menu, select either the Command/S/W CMD PANEL -Orbit or Command/S/W CMD PANEL - Ascent option.
- 2. The display will appear on the screen (figure 5.1 5). See SCP 7.40 for an explanation of the display.
- 3. Continue with nominal operations.



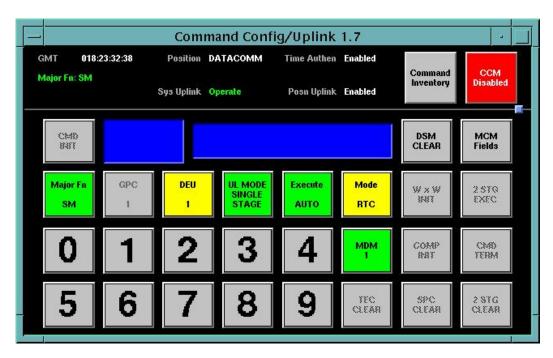


Figure 5.1-5 Command Config. Uplink Display

# D. To Shut Down the Command Manager

- 1. Close all command displays.
- 2. From the INCO DNAV, select Command/KILL COMMAND MANAGER DEAD. The command manager status display will change to red and indicate that the command manager interface to the command server is closing. Once the command manager display has disappeared from the screen, the interface to the command server is closed.

#### **TITLE**

PCMMU NOTES. PCMMU PGM MODE SELECTION AND AUTO LDR TFL LOAD

#### **GENERAL**

# A. PROGRAM MODE WITH NO HDR TFL LOADED

A problem exists with the PCMMU: If the program (PGM) mode of operation is selected by either Spec 62 or the onboard mode switch (S8, PNL C3), and the data random access memory (RAM) has not been loaded with a valid TFL format beforehand, the PCMMU will output a non-intelligent stream of data.

It was previously thought that if a non-intelligent stream of data occurred, the only action necessary was to select the FIXED mode by either the switch or Spec 62. Engineering and Development (E&D) has stated that on some occasions (specifically during STS-3 checkout), the PCMMU would not select the FIXED mode. E&D has further stated that this condition is due to the CMOS logic employed (the logic will not detect a mode change).

The solution to this condition is

- 1. Select the GPC mode (if in S2 or S9) or the FIXED mode on the mode switch.
- 2. Either switch PCMMU's or power the PCMMU OFF, then ON. This action will put the PCMMU into the FIXED mode.
- 3. Load the appropriate TFL (if in S2 or S9) via the cue card.

# B. BFS AUTO LDR TFL LOAD

The BFS GPC acquires the PCMMU 1&2 power switch discretes, V75S2107E and V75S2109E "PCM MASTER PWR ON," respectively, via MDM OF1. In the event that MDM OF1 shows failed (WRAP) and PCMMU's are switched to try to recover the MDM, there is a possibility that the BFS GPC will not proceed with the LDR TFL load.

The BFS GPC takes the PCMMU 1&2 power switch discretes, labels them PCMSWPST (PCMMU SWITCH PAST), and then stores them in RAM. On the next pass, the BFS takes the power switch discretes and labels them PCMSWCUR (PCMMU SWITCH CURRENT). The BFS then compares PCMSWCUR with PCMSWPST. If the two compare and BFS MEMORY display has ITEM 29 with an '\*' (meaning enabled), the BFS will continue to update PCMSWCUR every pass and compare it with PCMSWPST. In the event that PCMSWCUR and PCMSWPST do not compare, the BFS will test to see whether the PCMMU power switch is off (explained in more detail below). If the PCMMU power switch is off, the BFS continues with the compare routine; if the switch is on, the BFS performs the LDR TFL load.

As an example, if PCMMU 2 is on and 1 is off, a value of 0,1 will be stored as PCMSWPST. Before the next pass, PCMMU's are switched so that PCMSWCUR will be 1,0. When the BFS compares PCMSWCUR with PCMSWPST, it will see a miscompare and test to see whether PCMSWCUR is a 0,0 (switch off). Since PCMMU 1 is powered, PCMSWCUR does not equal 0,0, and the BFS will perform the TFL load.

If the situation involves a PCMMU switch while MDM OF1 is failed, the BFS will use the power up value in the active PCMMU's RAM as PCMSWCUR. There are two varieties of PCMMUS. One powers up with all values set low (i.e. 0) while the other type will power up with all values set high (i.e. 1). Using the above example again, if PCMMU 2 is on and 1 is off, PCMSWPST will be 0,1. In this case, MDM OF1 fails and PCMMU are switched to try to recover OF1. Since OF1 is failed, PCMMU 1 will not receive the PCMMU 1&2 power switch discretes, and the BFS GPC will use the

power up value in PCMMU 1 RAM. If PCMMU 1 RAM comes up with a value 0,0 (PCM off), the BFS will not perform the TFL load. If the RAM comes up with a value of 1,1 (a change and PCM on), the BFS will perform the TFL load. Note: PCMMU S/N 017 is the only one that powers up with all ones in RAM.

In the SMS when an MDM fails and PCMMU's are switched, the active PCMMU's RAM addresses for the failed MDM always come up with zeros. Therefore, in a sim, if MDM OF1 fails, there is no chance that the auto LDR TFL load will be performed.

# **TITLE**

INTERPRETING PCMMU ELEMENT BYPASS INDICATIONS

# **PURPOSE**

This procedure allows INST to analyze PCMMU element bypass indications to determine the affected OI MDM card/channel and MSID's.

## **GENERAL**

The comm\_bypass display located under the INCO DNAV will indicate different types of PCMMU element bypasses. Six of these element bypasses occur on timer-initiated transactions between the SM GPC and the PCMMU (PMU TIO BYPASS). The other six indications are for bypasses for supervisor-call-initiated transactions between the SM GPC and the PCMMU (PMU SVC BYPASS). These bypass indications can be used to determine MDM, card/channel, and MSID's affected.

Each of these bypass indications represents a single downlisted parameter. This downlisted indication is actually the result of OR-combining up to 48 separate bypass indications for individual read elements. These bypass bits for the individual read elements are not downlisted in order to save downlist bandwidth. They are maintained in SM GPC memory and can be retrieved by downlist dumping of memory locations. In order to determine which MDM and which MSID's have been affected by a PCMMU element bypass, the bypass indications must be analyzed by the following procedure.

# **PROCEDURE**

- A. Whenever a PMU bypass is on, it is first important to analyze the BITE words associated with the PCMMU and the OI MDM's. If an MDM or PCMMU BITE bit is on, this technique will allow fault identification to the lowest level in the MDM.
- B. If more than one bypass indication is on, it will be necessary to dump the GPC memory locations that contain the actual read element bypasses. This dump can be done by asking DPS to dump the following memory data:

<u>HAL name</u> <u>HAL module</u> <u>Size</u>

CSAS ERT DL APPL.SRC.CSAERT 36 halfwords

The memory location for CSAS\_ERT\_DL is found in the HALSTAT global symbol dictionary, then in the DASS SM2/SM4 listing by memory address location. The contents of each address bit can be found in the master source listing under the application software module. The application software is written in HAL code, hence the name HALSTAT for HAL statistics.

CSAS\_ERT\_DL is a two-dimensional array (12 entries of 48 bits each or 3 halfwords). The bypass definition for each bit in this array is contained in HAL module APPL.SRC.CSAERT. This module identifies bypass indications by a V95 MSID number. The 48 bits in each entry correspond one-to-one with the 48 MSID of the form V95XnnnnX, where nnnn is defined in figure 5.3-1. Each bit that is on represents an element that is bypassed. The bypassed element can be mapped to the associated PMU address and OI MDM using the bypass bit map in the PMU ELEMENT BYPASS READ table. See table 5.3-1 for example. This number can be used to identify PCMMU RAM addresses that were being accessed by the GPC at the time of the bypass. To do this, look up the V95 MSID in the PMU ELEMENT BYPASS list located in the flight-specific INST binder at the INST console. Having located the bypass in the list, proceed to step G of this procedure.

PMU TIMER READ BYPASS BITS

9/1/2004: REV G

BYPASS WD/CYCLE 1

SM2	DIIADO DI	15	DITAL	DD WD/CIC	
MSID	ELEM NO	ADDR	LEN	MDM	RATE
V95X1261X	1	2328	31	OA02	.5 Cycle 1
V95X1262X	2	542	6	OA01	.5
V95X1263X	3	180	6	OA02	.5
V95X1264X	4	1192	2	OF04	.5
V95X1265X	5	1162	2	OF04	.5
V95X1266X	6	2812	15	OF04	1 Cycle 7
V95X1267X	7	2548	10	OF01	1
V95X1268X	8	3467	9	SSC	1
V95X1269X	9	2224	6	SSC	1
V95X1270X	10	2605	6	OF01	1
V95X1271X	11	2476	4	OA01	1
V95X1272X	12	928	4	OF02	1
V95X1273X	13	1027	3	OF03	1
V95X1274X	14	3431	3	SSC	1
V95X1275X	15	826	2	OF02	1
V95X1276X	16	1174	2	OF04	1
V95X1277X	17	2427	2	OA03	1
V95X1278X	18	3855	2	EXC	1
V95X1279X	19	136	1	OA02	1
V95X1280X	20	3017	1	SSC	1
V95X1281X	21	2708	1	OF03	1
V95X1282X	22	1119	1	OF04	1
V95X1283X	23	3364	1	SSC	1
V95X1284X	24	1431	1	PDI	1 End of Cycle 1
V95X1285X	25	2554	28	OF01	.5
V95X1286X V95X1287X	26	2365	6 6	OA02	.5
	27	2652	2	OF02	.5 .5
V95X1288X V95X1289X	28 29	2362 1151	2	OA02 OF04	.5 End of Cycle 7
V95X1289X V95X1290X	30	1131	2	0104	.5 End of Cycle /
V95X1290X V95X1291X	31				
V95X1291X V95X1292X	32				
V95X1292X V95X1293X	33				
V95X1294X	34				
V95X1294X V95X1295X	35				
V93X1293X ↓	<b>↓</b>				
<b></b>	<b>U</b>				
$\downarrow$	$\downarrow$				
V95X1308X	48				

Figure 5.3-1. PCMMU timer read bypass table

- C. If only one bypass is on, consult the INCO Management display. Observe the error count ECNT (V92U0600C) in the SM GPC block. This is the number of PCMMU I/O errors observed by the GPC since the last PCMMU I/O error reset. If this number is more than two, then more than one PCMMU read element bypass has occured. If this is the case, dump the GPC locations per step B, and after locating the bypass bits in the list, proceed to step F of this procedure.
- D. If only one bypass is on (the error count is 2), then the number of the read element that was bypassed is available in telemetry. Consult the INCO Management display. Copy down the PCM ELEM NUM (V92U0599C). It can be found by clicking on the SM GPC block which displays expanded SM & PCM I/O information including the element bypass number.
- E. Go to the PMU ELEMENT BYPASS list located in the flight-specific INST binder at the INST console. Locate the page associated with the PMU element bypass light that was observed. For example, if the PMU TIO 1 BYPASS light was on, find the page labeled PMU TIMER READ

9/1/2004:

BYPASS BITS BYPASS WD/CYCLE 1. Using the PCM ELEM NUM from the INCO Management display, locate the line with the same number. For example, if the PCM ELEM NUM read 6, locate the line labeled ELEMENT NO. 6.

**REV G** 

F. If you want to see what the read cycle ID of the last SM error encountered from a transaction on the PCMMU data bus, check the PCM ID LAST ERR (V92U0597C). It can be found by clicking on the SM block in INCO Management. The PCM ID LAST ERR parameter is made up of bits 13-16 in the 1st SM PCMMU I/O Error Status word. The following table is contained in the SM CPDS which contains the binary representation of the PCM ID LAST ERR which indicates which TIO or SVC read cycle that last error occurred in. Then, using the INST binder, INST can determine which MDM (or PDI) is affected by that bypass.

Read cycle PMU read cycle 1 PMU read cycle 1 PMU read cycle 2 PMU read cycle 2 PMU read cycle 3 PMU read cycle 3	TIO SVC TIO SVC TIO SVC
Read cycle PMU read cycle 4 PMU read cycle 4 PMU read cycle 5 PMU read cycle 5 PMU read cycle 6 PMU read cycle 6	TIO SVC TIO SVC TIO SVC
	PMU read cycle 1 PMU read cycle 1 PMU read cycle 2 PMU read cycle 2 PMU read cycle 3 PMU read cycle 3 PMU read cycle 3  Read cycle PMU read cycle 4 PMU read cycle 4 PMU read cycle 5 PMU read cycle 5 PMU read cycle 5

All other values are illegal.

G. Write down the RAM address and the number of words for the bypass that has been identified. Note that on this same line it lists the MDM (or PDI) that has been affected by this bypass.

H. The mapping of PCMMU RAM address to MSID can be found in the mission specific flight software CD in the SMPM.dat file (directions on how to use it are in the Lead INST SCP), or by using the mission information system (MIS) query application. If using the CD, if the number of words indicated for the transaction is one, simply locate the RAM address in the SMPM.dat file. On the same page, the MSID associated with the RAM address will be identified. If the number of words in the transaction is greater than one, locate all RAM addresses between the starting address indicated in the PMU bypass list and the sum of the starting address and the number of words. Be aware that some of the RAM addresses point to parent words that may contain measurements

from many subsystems. Using MIS and the list of MSID affected by the bypass, INST can identify the cards and channels of the OI MDM's that have been bypassed. This capability enables INST

**REV G** 

9/1/2004:

to identify a single card or channel failure to the lowest possible level.

- I. A more straightforward alternative is to use MIS from the onset. The mapping is quite easy this way since once the program is provided with the address(s) to map, it provides not only the MSID but also the MDM, card, and channel, if correctly specified in the "Create Your Own Format" option for SCAP.
- J. Notify the appropriate subsystems that their parameters are no longer available to the SM GPC. This step may be of major importance because several critical functions (antenna management, payload bay door operations, etc.) use data acquired in this manner.

## NOTE

The identification of card or channel failure by this technique does not necessarily mean that the MDM has failed. The only definitive information gained in this technique is that the SM GPC can no longer acquire data gathered by the PCMMU from a certain card/channel in an OI MDM. The failure could be in the GPC or MDM.

**Entries Addresses**  $\Leftarrow$  48 bits long  $\Rightarrow$ Cycle 1/7 timer I/O (1261 - 1308)Cycle 1/7 SVC I/O (2501 - 2548)Cycle 2/8 timer I/O (1310 - 1357)Cycle 2/8 SVC I/O (2550 - 2597)Cycle 3/9 timer I/O (1361 - 1408)Cycle 3/9 SVC I/O (2601 - 2648)(1410 - 1457)Cycle 4/10 timer I/O Cycle 4/10 SVC I/O (2650 - 2697)Cycle 5/11 timer I/O (1461 - 1508)

(2701 - 2748)

(1510 - 1557)

(2750 - 2797)

Cycle 5/11 SVC I/O

Cycle 6/12 timer I/O

Cycle 6/12 timer I/O

Table 5.3-1. Layout of CSAS ERT DL

#### **TITLE**

#### RECORDER DATA PROTECTION

#### **PURPOSE**

Briefly explain the need for protecting data on the onboard recorders and procedures to

9/1/2004: REV G

- Perform nominal dumps.
- B. Verify good data was received by the MCC.
- C. Special procedures needed to recover onboard recorded voice data if needed.

## **GENERAL**

In order to ensure that all required recorder data dumps get to the MCC successfully, this data needs to be protected from overwriting on the onboard recorders, until it can be verified that the data was successfully received by the MCC. This protected data includes all ascent and entry data, as well as all data recorded during any significant loss of signal (LOS). The dump FEP report provides the information to verify that the data has been received with acceptable quality. After the acceptable receipt of data has been verified, the data may then be overwritten onboard.

In addition, ascent voice, as well as EVA LOS voice, is not required to be recovered unless a special request for specific time periods of recorded voice is made. The data will be dumped, but no special effort will be made to recover voice, under nominal circumstances. Once the recorded voice is overwritten, voice recovery by the operations support team (OST) is possible, although not time efficient.

# **NOMINAL DUMPS**

Data will nominally be dumped in the most efficient manner, which implies dumping at 1024 kbps for Solid State Recorder (SSR). Dumps with voice included will nominally be handled as a data-only dump, since the dump FEP will not process and playback voice. Specific command sequences for nominal dumping are covered in the SSR command SCP 3.22.

If data is dumped to a NASA ground site, it may be played back at 1:1 to the MCC, where it will be routed directly to the ODRC, without processing by the dump FEP. The NASA ground site recording equipment can only dump in the forward direction (same direction as received from the orbiter).

Data that is dumped via Ku-band or SGLS sites (USAF RTS) will be received at the MCC in real-time and rate reduced before playing back to the ODRC.

In the postlanding phase, the dump of entry voice and data will be performed as nominal, which implies at 1024 kbps for SSR. If voice is required, DFE will set up the front end to process voice as it is received from the dump site. This action can require a rate reduction of the dump before sending it to the MCC. Usually KSC can route the dump to MCC at 1024 as it is being dumped, depending on network capacity; in this case, it is processed by the dump FEP just like an on-orbit dump.

If dumped data is lost due to ground equipment malfunction or operator error after it is overwritten onboard, it can be played back to the dump FEP from the front end (Metrum) tapes for reprocessing. If the data is not found in the Metrum tapes for any reason, the data can usually be played back from the ground receipt site.

#### **VERIFYING GOOD DUMPS**

At the conclusion of a dump, the DFE will send a file of the dump FEP report to the proper INCO directory (/users/inco/rw common/dump). The INST will then call up the Dump Report application from SSR

Management Displays and make a determination, based on the dump FEP report, on whether or not the data can be overwritten onboard. DFE will name the file according to the dump site or satellite and orbit number; e.g., 120tw or 111TDE or 101gts (case sensitive). One hundred frames per second times with no dropouts will be merged by the application into time segments to be verified. Dropouts can be inferred by gaps between the listed 100 percent segments on the dump report.

The size of acceptable gaps can range from 4-30 seconds, depending on operator workload and criticality of the data (gaps of over 8 seconds are rarely accepted without attempts to recover).

#### RECOVERING ONBOARD RECORDED VOICE

If it is determined that voice data that is found only on the recorders (e.g., EVA LOS voice) needs to be recovered, the preferred method of dumping is via the S-band FM system to a NASA ground site at 1024 kbps for SSR. The site may be able to rate reduce the dump to 192 kbps when relaying it to the MCC. The MCC front end must be set up in that case to process voice as it is received from the site. In addition, two voice recorder channels must be preempted to capture the dumped voice since there are no spare voice recorder channels.

If no NASA sites with rate reduction capability are available, the data with voice can be dumped at 192 Kbps via Ku or FM to a USAF remote tracking site (RTS). The front end must be set up to process voice at the time of dump.

When a nominal dump of voice and data is made, only the data is processed; however, the dump voice data is also captured on the Metrum recorders and may be recoverable by the OST, using time-consuming manual procedures involving PDRE recorders that could be removed from the MCC at any time.

#### **SUMMARY**

Data recorded at 128 kbps needs to be protected only until it is dumped to the MCC and the dump FEP report shows that the dump quality was acceptable. If the data is lost due to a ground problem, the data can still be recovered.

Data and voice recorded at 192 kbps will be nominally dumped without regard to recovery of voice. If a mishap investigation requires recovery of onboard recorded voice, or even of voice overwritten onboard, the voice can usually be recovered.

#### **REFERENCES**

Flight Control Operations Handbook (FCOH), vol. I, Shuttle OPS, JSC-22438

Mission Control Center Operations Handbook (MOH), vol. II and III, RSOC 86-0055

#### **TITLE**

KSC/MCC FLIGHT RECORDER STATUS REPORTING

#### **PURPOSE**

To prepare KSC/MCC ground crews for post-mission recorder dumps and data analysis. This is for non-DOD flights only.

# **PROCEDURES**

- A. Lead INST should copy this procedure to the DF24\Fltinfo\Sts\_futr\Sts-XX directory for the appropriate flight, naming it something like XX report.doc (where XX represents the flight number) before launch.
- B. Solid State Recorders For each recorder, report the location and type of all existing data, whether dumped or yet to be dumped; fill in the tables using MS Word. Add relevant comments (such as weak FM signal for postlanding dump) to the tables.

Refer to Figure 5.5-1 for Solid State Recorders (2 pages)

C. MADS recorder - Report the location (pass sequence, percent tape), GMT (and/or MET), and type of data (cal, ascent, DTO XXX, deploy, etc.) recorded for the entire tape.

Refer to Figure 5.5-2 for MADS

D. E-mail a copy of the filled out tables to the following (you can copy and paste these addresses):

Peter.T.Johnson@nasa.gov; Patricia.R.Hart@usa-spaceops.com; Rick.E.Brown@usa-spaceops.com; Ralph.E.David@nasa.gov; richard.kraesig@lmco.com

Phone contact is no longer required now that we e-mail the report.

For any complications, contact the KSC INST personnel (Pete Johnson) at 9-1-321-861-3863.

STS- SSR 1 Flight Recorder Status – Contact Munish Patel @ (281)244-0083

FF	ROM		ТО		DATA INFO*		
POS	GMT	POS	GMT	Orbit or Entry	DATA RATE	dumped via SSR1?	dumped via SSR2?*
	The	e following s	lot definitions w	ere left on th	ne SSR by	INCO	
Auto-stop (	Auto-stop CLEAR? or ENABLED at POSITION						

<sup>\*</sup>Log all NSP and MADS data on the recorder as of end of post-landing dump. Make sure any data that KSC will see is logged, including on-orbit data.

Figure 5.5-1. Flight solid state recorder status sheet

STS- SSR 2 Flight Recorder Status – Contact Munish Patel @ (281)244-0083

FR	ROM		ТО		DATA INFO*		
POS	GMT	POS	GMT	Orbit or Entry	DATA RATE	dumped via SSR1?	dumped via SSR2?*
	The	e following sl	ot definitions w	ere left on th	ne SSR by	INCO	
Auto-stop CLEAR? or ENABLED at POSITION							

<sup>\*</sup> Log all NSP data on the recorder as of end of post-landing dump. Make sure any data that KSC will see is logged, including on-orbit data.

Figure 5.5-1. Flight solid state recorder status sheet (concluded)

# STS- MADS RECORDER ACTIVITY LOG - Contact Munish Patel @ (281)244-0083

	MA	MADS COMMANDS (X) - click on box								
GMT	PCM ON	PCM OFF	W/B ON	W/B OFF	CAL ON	CAL OFF	SEQ	%TP	TEMP	EVENT

Figure 5.5-2. MADS recorder status sheet

#### **TITLE**

# POSTFLIGHT RECORDS

# **PURPOSE**

The following guidelines are established to ensure that data accumulated during real-time flight operations is retained in a fashion that minimizes space requirements while ensuring that sufficient information is readily accessible to allow a particular flight to be researched if necessary.

**REV G, PCN-5** 

5/31/2007:

#### **GENERAL**

In general all data accumulated during a flight should be retained if it could conceivably be useful in recreating events. The data should be stored in their original form using office storage facilities until at which time the data is converted to some long term storage medium.

#### **PROCEDURE**

Retain the data for each flight in their original paper form using office storage areas.

After landing and when no longer needed for reference, the following data should be converted to a current medium for long term storage in the office (i.e. scanned to CD ROM or DVD). The originals will be sent on to the National Archives.

- A. The postflight report, to include flight overview data such as crewmember names, launch/landing dates and times, vehicle, altitude(s), inclination, landing site, and the prime manifest or mission objective(s). The report should include a summary of mission accomplishments, a summary of Comm/Inst systems performance, lessons learned, action items to work, recommendations for improvement, etc. Include a copy of the mission manning roster.
- B. The INCO premission planning Comm memo.
- C. The INCO, RF Comm and INST shift handover sheets.
- D. The final flight anomaly report.
- E. SPAN chits of interest.
- F. Execute packages, as marked up by the INCO team.
- G. Command Track history will not be printed out unless a section of command history is needed to complete postflight reports. Command Track history will be stored electronically.
- H. All console logs (INCO, RF COMM, and INST), to include hard copies of <u>useful</u> data normally retained in these logs.
- I. Anomaly log write-ups and associated data.
- J. MEWS/PIRT plots.

The individual systems experts within the section should maintain anomaly information on their systems, including any closeout information issued by the project postflight.

Flight Data File checklists unique to a previous flight can generally be discarded; however, checklists that may be useful references for similar upcoming flights (e.g., SpaceHab, HST) should be forwarded to the lead INCO for that flight.

# **TITLE**

# SM GPC REASSIGNMENT ACTIONS/CLEANUP

# **PURPOSE**

To describe INCO actions when the SM GPC is going to be reassigned. The SM GPC is critical for many INCO activities and when it is unavailable, INCO must be aware of the many actions that may be required to maintain communications with the orbiter. The actions and cleanup steps should be reviewed and completed ASAP after INCO is informed that the SM GPC will be reassigned or has failed.

The INCO team should verify each step as completed or not applicable.

# ACTIONS SUMMARIZED (PRIOR TO SM DOWN AND DURING NO SM OPS)

- A. Are there any Ku radiation constraints? If so, command Ku to STBY.
- B. Is the NSP configured for Ku fwd? If so a panel command may be required to regain comm.
- C. Verify SPC and TEC buffer contents and impacts if the stored commands are not executed.
- D. Verify if configured for EARLY/MIDPASS handover.
- E. Verify which antenna is required manually per upcoming maneuver, H/O or ZOE.
- F. Verify that the TDRS vector configuration will maintain comm.
- G. Disable Payload commanding.

## CLEANUP ACTIONS SUMMARIZED (NEW SM UP AND OPERATIONAL)

- A. Verify that GPC is selecting correct antenna for active event.
- B. Antenna selection back to GPC (as required).
- C. Uplink TDRS vectors (as required).
- D. GCIL decoders commanded ON.
- E. Reload PDI and Low data rate TFL (if crew did not).
- F. Configure Ku-band BETA and RF Protect Boxs per timeline requirements, then turn ON Ku-band system.
- G. PSP item 6 or 7 via crew or INCO uplink.
- H. Clean up the Onboard Command Buffers display as required.
- I. Re-enable Payload commanding.
- J. Check for any TMBU uplinked after the last SM checkpoint (may have to re-uplink).

SHUTTLE OPS ACCU BYPASD INCO/COMM/JSC-12829 9/1/2004: REV G SCP 5.8

#### **TITLE**

**ACCU BYPASS** 

# **PROCEDURE**

A. Loss of two ACCU's

Perform the full IFM "ACCU BYPASS CONNECTOR INSTALLATION" (p. A1). This procedure will put the PLT audio terminal unit (ATU) hot mike to AG 1 of NSP 2 and the CDR ATU hot mike to AG 1 of NSP 1. Crew will configure as follows:

For NSP 2;

05 LEFT AUDIO CONTROL - RIGHT 09 RIGHT AUDIO CONTROL - NORM

If NSP 1 is selected

05 LEFT AUDIO CONTROL - NORM 09 RIGHT AUDIO CONTROL - LEFT

- B. Loss of one ACCU [J4 ACCU BYPASS]
  - 1. Perform the IFM "ACCU BYPASS CONNECTOR INSTALLATION" (p. A1), but do only the J4 positions (i.e., do not disconnect cables from ACCU J3) and power the good ACCU back up when the procedure is finished.

Use AG 1 with NSP 1 (AG 2 is lost).

Use AG 2 with NSP 2 (AG 1 is hot to PLT ATU).

09 R AUD CNTL - LEFT 05 L AUD CNTL - NORM

A1 AUD CNTR VOICE RCD SEL CH 1 - ICOM A

CH 2 - ICOM A

The following functions have been lost:

PS ATU
OS ATU
AL ATU
NSP 1 AG 2
TACAN 3 TONES
NSP 1 RCD V2
NSP 2 RCD V 1
C&W (B) VIA ACCU, MD SMU IN ACCU/BYPASS IS OK
ICOM B - PLB (CCTV)
ICOM B - T-O UMB

Only ICOM A is being recorded by the OPS recorders (on channel 2 if using NSP 2 or channel 1 if using NSP 1).

- 2. For a subsequent failure, reconfigure as follows.
  - a. ACCU failure (the remaining one)

If on orbit, complete the ACCU BYPASS procedure.

If during entry, 09 R AUD CNTL - NORM 05 L AUD CNTL - RIGHT

This places both CDR and PLT hot mic to NSP 2 A/G 1. AG 2 on NSP 2 and both AG 1 and AG 2 on NSP 1 will be dead. No UHF as well.

# b. NSP failure

INCO switch NSP's (or crew do PNL/CMD) and use alternate A/G. (AG 1 on NSP 1 and AG 2 on NSP 2). No loss of voice capability.

# c. CDR ATU failure

If on orbit and time permits, remove J4 bypass. If during entry,

09 R AUD CNTL - NORM 05 L AUD CNTL - RIGHT

Same impact as (a).

ACCU FUNCTIONS FUNCTIONS REMAINING

AFTER BYPASS

J3 Full bypass (J3 and J4)

CDR ATU (STA 1) CDR ATU (STA 1) MS ATU (STA 3) PLT ATU (STA 2)

BYPASS MD SMU (STA 6) NSP1 AG1

MD CCU (STA 7) NSP2 AG1 NSP 2 AG 2

NSP 1 AG 1 UHF

TACAN 1 TONE

TACAN 2 TONES
NSP 1 RCD CH 1
NSP 2 RCD CH 2
C&W TONES - A

ICOM A - PLB (CCTV)
ICOM A - LAUNCH UMB

IR AM AUDIO (NOT USED)

J4 BYPASS

PLT ATU (STA 2)

PS ATU (STA 4) PLT ATU (STA2) OS ATU (STA 5) NSP2 AG1

AL ATU (STA 8) ALL J3 FUNCTIONS

NSP 1 AG 2 NSP 2 AG 1

TACAN 3 TONES NSP 1 RCD CH 2 NSP 2 RCH CH 1

**ACCU FUNCTIONS** 

FUNCTIONS REMAINING AFTER BYPASS

C&W TONES - B
ICOM B - PLB (CCTV)
ICOM - B LAUNCH UMB
IR FM AUDIO (NOT USED)
EXP RCDR AUDIO (NOT USED)
USED)

For full implementation of the IFM procedure, the CDR is hot mike to A/G 1 of NSP 1 in addition to the PLT's ATU being hot mike to A/G1 of NSP 2. All other functions are lost. If only the J4 ACCU bypass is performed, the PLT is hot mike to A/G 1 of NSP 2. All other J4 functions are lost.

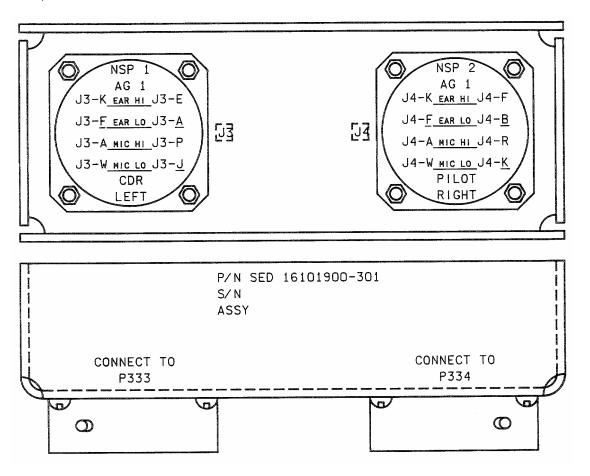


Figure 5.8-1. ACCU bypass connector module

INCO/COMM/JSC-12829 9/1/2004: REV G

#### **TITLE**

SEQUENTIAL STILL VIDEO (SSV) CONFIGURATION

### **PURPOSE**

This procedure outlines the steps to be performed by INST for the configuration of the SSV for downlink video.

# CREW CONFIGURATION (Performed per P/TV Gen., Section 12)

CCTV DNLK: IN SEL – NTSC (Nominal)

CC DNLK: IN SEL – Y/C

PICTURE QUALITY: MODE – 3 (Nominal)

OUTPUT FRAME RATE: OUT RATE – 1 though 8 (per Flight Plan)

POWER SELECTION: PWR - ON

#### INSTRUMENTION PROCEDURE

- 1. Verify correct Decommutator Format Load (DFL) to the Payload Data Interleaver (PDI). This allows data to flow from the SSV to the PDI Toggle Buffer.
- 2. Verify on INST MNGT display, the PDI DECOM LOCK has attained Bit, Word, Frame, and Accuracy (BWFA).
- 3. Verify correct Telemetry Format Load (TFL) and Fetch Point Memory (FPM) are loaded to conduct SSV operations.
- 4. Contact DFE informing him, "Downlinking SSV Data"
- 5. Verify on DOWNLINK FEP (FEP STATUS) display the following items:
  - (a) MAINFRAME OI has correct SYNC, VAL, and FMT
  - (b) WINDOWS does **not** have SYNC and VAL. SSV is PDI Type 4, block data, hence no FEP processing.
  - (c) WINDOWS has correct TYPE and FMT.
- 6. On the DOWNLINK FEP (FEP STATUS), depress PDIS. Verify SYNC and VAL are illuminated for the proper DFL. PDIS processes the PDI Type 4, block data.
- 7. Power ON the SSV Base Band (BB) Video Monitor
- 8. Switch the SSV "Blank/Active" toggle switch to the "Blank" position.
- 9. Power ON the SSV CPU and Monitor.
- 10. At prompt, type (not case sensitive):

С

RTN key

SBYT1

RTN key

RTN key

11. Verify that the CPU is receiving an SSV image by checking SSV Monitor to display:

```
*** De-framer Status ***
Reset done:
                     Received
Clock:
                     Clk/Data Locked
Frame:
                     Locked
Dfail:
                     Received
Start of frame: Received
Data polarity: Inverted
Fill Frame:
                     Not Receiving
*** De-framer telemetry ***
Status byte 1 = 10 Status byte 2 = ff8c
Status byte 3 = 0 Status byte 4 = 64
VCID = 38 Output Rate Select: 4
*** Video Digitizer and Encoder Telemetry ***
Video input:
               Composite
Compression Mode: 3 Q value: 50
Re-writing Q tables before each frame
Hit Enter to exit....
End of Bt858 / Display Init (brkinntl)
```

Figure 5.9-1. SSV Receiving Image

12. If SSV ground monitor is **not** receiving SSV image, it will display the following:

```
*** De-framer Status ***
Reset done: Received
Clock: No Clock Clock Search: Searching
```

Figure 5.9-2. SSV Not Receiving either Clock or Image

- 13. Coordinate with RF COMM or INCO for proper SSV input. Verify "Good" video on SSV BB Video Monitor.
- 14. Switch the SSV "Blank/Active" toggle switch to the "Active" position. The "Active" position forwards the video on to *Houston TV* for TV RF Channel Distribution.

# **POWER DOWN PROCEDURE**

- 1. Contact and inform DFE that "SSV Ops are complete".
- 2. Switch the SSV "Blank/Active" toggle switch to the "Blank" position.
- 3. Power OFF the SSV Base Band (BB) Monitor.
- 4. Power OFF the SSV CPU and Monitor.

## **BASIC TROUBLESHOOTING**

- 1. PDI DECOM does not indicate SSV status of "BWFA".
  - a. Verify TFL/DFL loads used onboard matches the "Output Rate Select" on the SSV console display.
  - b. Write a Flight Note requesting the crew to perform the following onboard SSV Items:

9/1/2004: REV G

- (1) Verify PDI Cable configuration per the "Photo TV" FDF Section 12 Diagrams.
- (2) Verify Unit is powered "On" by the unit "PWR" LED.
- (3) Check and correct the "Out Rate" switch for the proper setting, per the Flight Plan.
- 2. PDI DECOM indicates good SSV input signal (BWFA), but no ground SSV picture.
  - a. Have DFE verify processing of PDI SSV Type 4 Block Data.
  - b. Verify SSV Console display is showing good "Clock/Data Locked"
  - c. Verify VCID = 38.
  - d. Have INCO or RF COMM verify that the onboard video source configuration is good.
  - e. Have INCO or RF COMM source onboard SSV Unit to the orbiter CCTV Test Pattern, if possible to verify SSV Unit and interfaces are operational.
- 3. BB Monitor is showing good video, although *Houston TV* not receiving SSV:
  - a. Verify that the SSV "Blank/Active" toggle switch to the "Active" position.
- 4. SSV Video is consistently coming in ratty or off color:
  - a. Verify appropriate DECOM indicates "BWFA".
  - b. Verify downlink TLM is not taking "many" data dropouts.
    - (1) Check SSV Display for a good VCID = 38. If VCID =0, SSV ground equipment is not locked-up to the orbiter equipment.
    - (2) Downlink TLM verification can be accomplished by contacting "Comm Control" on the "OST-1" internal loop or by use of phone x34455.
  - c. Contact Lead Engineer as describe in Step "6".
- 5. SSV picture quality is poor:
  - a. Have RF COMM or INCO verify the onboard configuration is good with cameras used in proper lighting.
  - b. Verify downlink TLM is not taking many data dropouts.
  - c. Check SSV Console Display for a Compression Mode Selection of 3 and a "Q" value of 50 % or higher. If mode selection is of a lower number, inform Flight Director to ask crew to take SSV "Mode" to a number of 3 or greater. Crew should not select "Mode 6", or a TLM test pattern with no video output will result.
- 6. Contact Technical Expert for irresolvable SSV equipment problems.
  - a. During <u>non-critical SSV Ops</u>, do <u>not</u> power cycle SSV Equipment to attempt system recovery.
  - b. Contact the SSV Lead Engineer Doug Holland @ Pager # 281-434-5542, <u>anytime during flight</u> to resolve equipment anomalies.

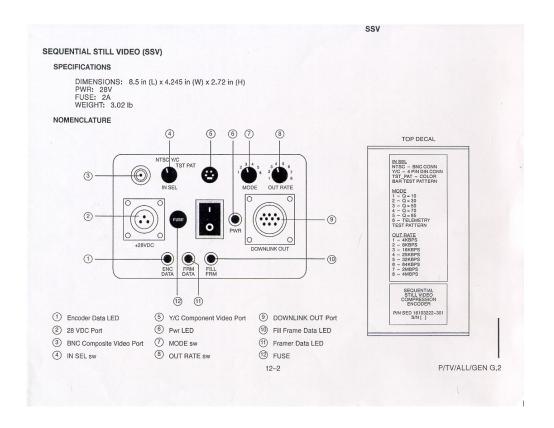


Figure 5.9-3. SSV Front Plate

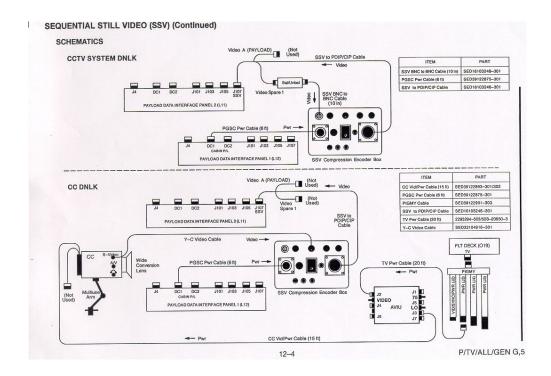


Figure 5.9-4. Example of SSV interfaces hookup from the Generic Photo TV FDF

#### TITLE

MULTICALS AND CALIBRATION DATA CHANGES IN THE MCC

# **PURPOSE**

Describe how to select a different series curve and how to verify which curve is selected in the Front End Processor (FEP) for measurements with multiple series actual Calibration (CAL) data (multicals). Explain how to view the CAL coefficients for each Measurement Stimulus Identification (MSID) and CAL series in the FEP, verify that the CAL data for each MSID and series is correct, change the CAL data in the FEP during real-time operations, note how CAL data is changed in the Operational Data Reduction Complex (ODRC) host, and enter special CAL coefficients in the FEP.

#### **GENERAL**

Refer to Systems Brief 49 for details on telemetry data processing.

The FEP is initialized by the MOD Reconfiguration (recon) group, with the proper CAL's installed for each flight. The INCO CAL lead receives an electronic document from the MOD recon group, containing the COMM CAL's in the CAL MOD data set for each flight. The lead RFCOMM for each flight should ensure that a copy of that document, as well as documentation on late CAL changes, is inserted into the console CAL notebook and that the CAL's installed in the FEP match the CAL's in the document.

#### VIEWING RAW DATA IN THE FEP

A snapshot value of a telemetry parameter in the FEP may be viewed in raw PCM counts via the telemetry services parameter report. The parameter may also be viewed dynamically (with real-time updates).

- A. Starting telemetry services
  - 1. Select **Master** Display Navigation (DNAV) Menu.
  - 2. Select Global Apps.
  - 3. Select Telemetry Services.
  - Select DLRT-Downlink Real Time.
  - 5. After a minute, the **Select Vehicle** window will appear.
  - 6. Select the first button (Orbiter with PLBD closed).
- B. Selecting a parameter to be viewed (snapshot)
  - 1. From telemetry services, select **Parameter Readout.**
  - Select Define Parameter Readout and fill in the blanks as follows:

Parameter <u>V75T2517A</u>	Data Type	Display Format
Sample Number <u>1</u>	♦Raw	♦HEX
	<b> ♦</b> Processed	<b>♦Predefined</b>

3. Select **OK**, and select **OK** on the worry box.

- C. Viewing the parameter report (Figure 5.10-1)
  - 1. From telemetry services, select **Parameter Readout.**
  - 2. Select View Parameter Readout Report.
  - 3. Select a single line from the list provided and view as follows:

# Parameter Report

#### Shuttle OI/GPC

SITE ID: MILA DISCIPLINE: inco ONBOARD TIME: 339:05:00:35.334

PARAMETER: V75T2517A SUBCOM: O

PARAMETER DESCRIPTION: RCDR OPS 1 HEAD TEMPERATURE

ATTRIBUTE: 2/D DATASET ID: 192

DATA TYPE: AMU
OVERRIDE VALUE: N/

CALIBRATION CHANGE: NO
OFFSCALE CHECKING: YES
OFFSCALE HIGH: 2.5000000E+02
OFFSCALE LOW: 0.0000000E+00

\_\_\_\_\_\_

SAM RAW VAL(hex) CONVERTED VAL(predef) PROCESSED VALUE(hex) PROCESSED VAL(predef)
1 B0 1.7600000E+02 40 58 4E D5 BF B1 8F B9 9.7231796E+01

# Figure 5.10-1. Parameter Report (abbreviated)

- D. Viewing a dynamic parameter readout:
  - 1. With a parameter already selected for viewing as in step B, from telemetry services, select **Enable Dynamic Parameters**, select the appropriate parameter, select **Enable**, and **OK**.
  - 2. From telemetry services, select **Dynamic Parameter Readout**. Parameter value will be either raw or processed, as selected in step B.

# **SELECTION OF CAL CURVES**

There are multiple actual CAL curves (multicals) in the FEP for S-band transponder 1(2) automatic gain control (AGC) uplink signal strength, S-band transponder 1(2) RF power output, S-band power amplifier 1(2) RF power output, and Ku-band radar/comm AGC uplink signal strength. Each orbiter LRU is assigned a serial number, and each sensor on these LRU's is calibrated separately in each operational mode. Each CAL curve for a multical MSID is assigned a series number in the CAL MOD data set. The series number is assigned by the SASCB according to the requiest of the Flight Control discipline that owns the MSID. This assigned series number and the requirements for console CAL selection must be coordinated so that the correct CAL curve will be loaded in the FEP for the selected mode. The FEP and ODRC provide auto-CAL selection, based on algorithms provided by INCO. Alternate CAL series may not be selected for an auto-selected CAL because it will automatically revert to the CAL specified in the algorithm. If there is a failure (including an invalid or unspecified combination of data) in telemetry driving the autocal, no CAL will be applied, which yields a raw (uncalibrated) data curve.

The CAL coefficients currently stored for a parameter in the FEP may be viewed via the telemetry services parameter calibration report. If desired, an alternative CAL series may be manually selected for a multical not included in an autocal series.

- A. Start telemetry services (list A under GENERAL section, page 5.10-1).
- B. Viewing a parameter calibration report (Figure 5.10-2)
  - 1. From telemetry services, select **Calibration Change**.
  - 2. Select Parameter Calibration Reports.
  - Select View Parameter CAL Report.
  - 4. Enter the MSID filter (e.g., V74E) and select Filter.
  - 5. Select a single MSID from the list provided and **OK**.
  - 6. Select curve number button.
  - 7. Select curve number or **ALL** and **OK**, and view as follows:

Parameter Calibration Report

Shuttle OI/GPC

GMT: 332:20:58:40.306

PARAMETER: V74E2508A DISCIPLINE: NONE

NUMBER OF CURVES: 2 CURRENT CURVE: 2

CURVE NUMBER: 2

**ORIGINAL PERMANENT TEMPORARY** Coeff 0 0.00000000000000E+00 Coeff 1 2.0000000000000E-02 Coeff 2 0.0000000000000E+00 0.00000000000000E+00 Coeff 3 Coeff 4 0.00000000000000E+00 0.00000000000000E+00 Coeff 5 Coeff 6 0.00000000000000E+00 Coeff 7 0.00000000000000E+00 Coeff 8 0.00000000000000E+00

Figure 5.10-2. Parameter Calibration Report

- C. Selecting a different group CAL series
  - 1. From telemetry services, select Calibration Change.
  - 2. Select Select Group CAL Curves.
  - 3. Select desired CAL group and curve number button.
  - 4. Select curve number and **OK** (and **OK** in the worry box).
  - 5. Verify the desired series CAL coefficients are selected in the FEP using the parameter calibration report. The coefficients in the FEP for each series can be verified against the SASCB-approved CAL by comparison with data in the MCC recon group's CAL document, which should be in the CAL book that is kept at the RF COMM console during a flight.

- 6. After the desired CAL curve series number is selected and verified, check end item response.
- D. Selecting a different CAL series for a single parameter:
  - 1. From telemetry services, select **Calibration Change**.
  - Select Select Parameter CAL Curve.
  - 3. Enter the MSID search filter (e.g., V74E) and select Filter.
  - 4. Select a single parameter and **OK**.
  - 5. Select curve number button.
  - 6. Select curve number and **OK** (and **OK** in the worry box).
  - 7. Verify the desired series CAL coefficients are selected in the FEP using the parameter calibration report. The coefficients in the FEP for each series can be verified against the SASCB-approved CAL by comparison with data in the MCC recon group's CAL document, which should be in the CAL book that is kept at the RF COMM console during a flight.
  - 8. After the desired CAL curve series number is selected and verified, check end item response.

# **AUTO-SELECTED CAL SERIES FOR COMM**

A cal computation display is provided with the INCO management display to show which cal curve is being selected by the FEP. A description of the cal comp is provided at the end of this section. The data for cal comp is supplied by the FEP via a Status Data Message (SDM).

A. S-BD XPNDR AGC 1/2 (V74E4080A/V74E4081A) multicals

There are five series of actual signal strength CAL data for each S-BD transponder (XPNDR) line replaceable unit (LRU). The calibrated XPNDR AGC data will be displayed on the S-BD XPNDR display, inco\_management and asc\_ent\_inco\_management displays in engineering units (dBm). Each actual CAL curve for a transponder mode is assigned a designated series number in the FEP as follows:

Series 1 = TDRS (high freg)

Series 2 = STDN LO

Series 3 = STDN HI

Series 4 = SGLS

Series 5 = TDRS (low freq)

The FEP defaults to series 1 (TDRS mode, high frequency) when it is initialized. The appropriate series CAL curve must be selected by the FEP to match the active mode of the S-BD XPNDR in order to get an accurate uplink signal strength reading.

On inco\_management, the AGC value should read between -100 and -122 dBm for TDRS mode and between -45 and -100 dBm for all other modes (STDN HI/LO and SGLS). The following table gives the auto CAL series selection criteria for V74E4080A/V74E4081A:

SERIES	V74X4786E	V74X4787E	V74X4788E	V74X4789E	V74X4793E	V74X4792E
1	1	0	0	0	1	0
2	0	1	0	0	X	X
3	0	0	1	0	Х	Х
4	0	0	0	1	Х	Х
5	1	0	0	0	0	1

# B. S-BD PM XPNDR 1/2 RF POWER (V74E4088A/V74E4089A) and S-BD PWR AMP 1/2 RF POWER (V74E4512A/V74E4513A) multicals

There are two series of actual CAL data for each of these four MSID's. Each MSID represents a measurement from a different LRU. Series 1 represents the high-frequency CAL data and series 2 represents the low-frequency CAL data for each LRU because both the XPNDR and PA must be configured to the same frequency. The FEP defaults to series 1 (high freq) when it is initialized. The appropriate series CAL curve must be selected by the FEP to match the frequency mode of the S-BD XPNDR to get an accurate power output reading.

The XPNDR RF power output can be monitored in engineering units (watts) on the S-BAND PM XPNDR display; XPNDR POWER OUT should read between 3 and 5 W.

The S-BD PM PWR AMP RF power output can be monitored in engineering units (watts) on the S-BAND ANTENNA display when the S-BD PM system is in a high power (STDN HIGH or TDRS) mode; PA POWER OUT should read between 100 and 160 W.

The following table gives the auto CAL series selection criteria for V74E4088A/V74E4089A and V74E4512A/V74E4513A:

SERIES	V74X4793E	V74X4792E
1	1	0
2	0	1

# C. KU-BD RADAR/COMM AGC (V74E2508A) multical selection

There are two series of actual CAL data for Ku-band uplink AGC. Series 1 is the CAL curve for the COMM mode, and series 2 is the CAL curve for the RADAR mode. The FEP defaults to series 1 (COMM mode) at initialization. The appropriate series CAL curve must be selected by the FEP to match the mode of the Ku-BD system in order to get an accurate uplink signal strength reading.

The Ku-BD can be configured to either one of two modes for RF power output, NARROW BEAM and WIDE BEAM. These two modes would require two CAL curves for MSID V74E2511A, KU-BD COMM & RADAR POWER. However, the WIDE BEAM mode will never be used operationally during a shuttle mission because of an incompatibility with TDRS. Therefore, only NARROW BEAM CAL data will be documented. There are no requirements for multical selection for this MSID.

On inco\_management, the Ku-BD AGC should read between -88 and -120 dBm in COMM mode and between 0 and 5 V in RADAR mode.

The following table gives the auto CAL series selection criteria for V74E2508A:

SERIES	V74X4818E	V74X4807E	V74S2420E	V74S2419E
1	Х	X	0	0
2	0	0	X	Х

# **CAL COMP FOR INCO MANAGEMENT DISPLAY**

All multical curve series numbers currently in use by the D/L FEP are contained within a multi-sample status data message (SDM) parameter: M21F1115F - Integer - 4 Bytes.

CAL COMP	paragraph
Ku RADAR/COMM AGC	<a.< td=""></a.<>
S-Band U/L AGC	<b.< td=""></b.<>
S-Band PWR	<c.< td=""></c.<>

MSID	Sample	Nomenclature
V74E2508A	18	Ku RADAR/COMM AGC
V74E4080A	19	S-Bd XPNDR U/L AGC 1
V74E4081A	20	S-Bd XPNDR U/L AGC 2
V74E4088A	21	S-Bd XPNDR RF PWR 1
V74E4089A	22	S-Bd XPNDR RF PWR 2
V74E4512A	23	S-Bd PA RF PWR 1
V74E4513A	24	S-Bd PA RF PWR 2

A. Ku RADAR/COMM AGC CAL series: output MSID = KU\_AGC

```
KU_AGC 4 char alpha (green)
Sample 18
1 COMM (green)
2 RADAR (green)
any other ERR (green)
```

B. S-Bd U/L AGC CAL series: output MSID = SB\_AGC

SB_AGC	4 char alpha (green)	
Sample 19	Sample 20	
1 and	1	TDRSS HI FREQ (green)
2 and	2	STDN LO (green)
3 and	3	STDN HI (green)
4 and	4	SGLS (green)
5 and	5	TDRSS LO FREQ (green)
any other		ERR (green)

C. S-Bd PWR CAL series: output MSID = SB\_PWR

SB_PWR	4 char alpha (green)			
Sample 21	Sample 22	Sample 23	Sample 24	
1 and	1 and	1 and	1	HI FREQ (green)
2 and	2 and	2 and	2	LO FREQ(green)
any other				ERR (green)

### CAL COEFFICIENT CHANGES IN THE MCC

### **NOTE**

CAL coefficients should be changed in this manner during a flight ONLY if the available coefficients are not accurate; i.e., if a discrepancy is found in the coefficient(s) and if an AR is being submitted on this anomalous condition (or if it is a know problem, with a CAL alteration used as the workaround).

Special S-BD PM XPNDR AGC CAL coefficients are used in the SMS for V74E4080A and V74E4081A. The signal strength measurements displayed in the MCC should be in the proper range but will not track the linearity of the data from the SMS, although the INCO group, along with the COMM training group, has elected not to update the CAL for simulations. The following procedure may be used to change the coefficients on any CAL. This procedure or generic equivalent can be found in the FCOH.

### **CAUTION**

If a CAL alteration is made permanent during a flight or SIM, it will remain in the altered state until altered again. Make sure all permanent CAL updates are correct, either via approved procedures or by letter or FAX from reconfiguration.

- A. Start telemetry services (list A under GENERAL section, page 5.10-1).
- B. Altering CAL coefficients
  - 1. From telemetry services, select **Calibration Change.**
  - 2. Select Alter Parameter CAL Coefficients.
  - 3. Select MSID desired for changing coefficient and **OK**.
  - 4. Select the desired CAL curve number and "temporary" or "permanent."
  - 5. Enter the new coefficient values.
  - 6. Select **OK** (and **OK** in the worry box).
  - 7. Verify the desired series CAL coefficients are selected in the FEP using the parameter calibration report.
  - 8. After the desired CAL coefficients are verified, check end item response.
  - 9. Notify WSS that a CAL was manually altered, identify the CAL, and ask them to update the database for all downlink FEP's per the CAL change.

### **SUMMARY**

Automatic CAL changes are performed by the FEP and by the ODRC. Flight Controllers can make multical selections via the FEP telemetry services calibration change display. Manual CAL coefficient changes premission should be temporary unless approved as permanent. Real-time changes during the mission should be PERMANENT. Send copies of the changes and the time of change to SPAN, MER, and Ground Controller (GC).

The Mission Operations Handbook (MOH) procedures for FEP telemetry services are as follows:

MOH, vol. 2, COP 18.16, Telemetry Calibration Changes in the FEP MOH, vol. 2, COP 18.23, Telemetry Parameter Readout From the FEP

MULTICAL SCP 5.10

Further information and details on how to make CAL data changes in the old MCC can also be found in the following MOH procedures:

MOH, vol. 2, COP 15.7, Stream Processing Table Changes

MOH, vol. 2, COP 16.7, Calibration

MOH, vol, 3, COP 12.7, Parameter Calibration Display

MOH, vol, 3, COP 12.8, Parameter Calibration Changes

MOH, vol, 3, COP 12.9, Telemetry Parameter Readouts From MOC

### **REFERENCES**

Flight Control Operations Handbook (FCOH), vol. I, Shuttle OPS, JSC-22438.

MCC Level B & C Requirements for Shuttle, vol. I, SDPC Software, JSC-11028.

MCC Level B & C Requirements for Shuttle, vol. XIV, RDCS, JSC-11028.

Mission Control Center Operations Handbook (MOH), vols. II and III, RSOC 86-0055.

Shuttle Calibration Data Book, vol. VIII, FOD Calibration Data, JSC-16486-xx.

Shuttle Data Integration Plan (DIP), vols. I, II, and III, JSC-18206.

STS Calibration Handling Handbook, JSC-22438.

JSC Correspondence, DF2-95-11, Autocal Selection

### **TITLE**

# THERMAL PARAMETERS

### **GENERAL**

The following is a summary of those temperature limits and operating limits relevant to INCO. LRU's that are not listed either have no known usage limit (assuming nominal cooling system operation) and/or are not instrumented with temperature sensors.

5/31/2007:

**REV G, PCN-5** 

Parameter	MSID	Minimum operating temp, °F	Maximum operating temp, °F
MMU 1 Temp a	Note 3	5	130 (Note 2)
MMU 2 Temp <sup>a</sup>	Note 3	5	130 (Note 2)

<sup>&</sup>lt;sup>a</sup> Modular Memory Unit (SSR + SSMM) temp specified at cold plate.

- 1. See REF DATA for various H2O LOOP messages (none for SSR).
- 2. 130° F if water is flowing in the cold plate, otherwise 120° F for up to 30 minutes.
- 3. Cold plate water temps are displayed on SSR Management; one loop is active at a time.
- 4. <u>ACTION</u>: Expect a major case power-down (including MMU) if cold plate reaches 120° F.

Parameter	MSID	Minimum operating temp, °C	Maximum operating temp, °C
TVC temp	V74X0847E	0	55 <sup>⁵</sup>

 $<sup>^{\</sup>rm b}$  Some hardware damage may occur at 60° C.

- Class 3 SM Alert "S76 COMM" message occurs for any television camera (TVC) sensed at 45° C by VSU (synchronous mode). Crew sees CAM OVERTEMP = YES on S76 COMM.
- 2. Ground will see temperature flash on monitor at 45° C.
- 3. ACTION: Power off camera at 45° C if possible, or monitor closely.
- 4. Camera heaters maintain a minimum temperature of 4° to 10° C, depending on type.

5/31/2007: REV G, PCN-5

Parameter	MSID	Minimum operating temp, °F	Maximum operating temp, °F	
MADS Shelf Temp (WB)	V78T9607A	30	140	

- 1. Strain gauge duty cycling can be used for temperature control.
- 2. Exceeding maximum temperature can result in component damage.
- 3. When testing MADS prior to entry, shelf temp should be between 20° and 100° F. When activated at TIG-15, temp will rise about 1° F per 2.3 minutes and should be over 30° F prior to Entry Interface.
- 4. <u>ACTION</u>: Turn off/on strain gauge signal conditioners (SGSC's) or WB/PCM as required to stay within limits.

Parameter	MSID	Minimum operating temp,°F	Maximum operating temp,°F	
S-Band Power Amp Collector 1 Collector 2	V74T4514A V74T4515A	35 35	230 230	

Class 3 SM alert "S76 PA 2(1) TEMP" message occurs for temperatures exceeding 230°.

System	MSID	Minimum operating temp, °F	Maximum operating temp, °F
UHF ATC XCEIVER	N/A	N/A	120

There is no limit on continuous transmitter (XMTR) use with proper cooling.

5/31/2007: REV G, PCN-5

Parameter	MSID	Minimum survival temp, °F	Minimum turn on temp, °F	Minimum operating temp, °F	Maximum operating temp, °F	Maximum survival temp, °F
DEA XMTR	V74T2497A	-60	5	5	171	195
DEA RCVR	V74T2961A	-60	5	5	156	195
A-AXIS GIMBAL	V74T2965A	-60	-60	5	150	180
B-AXIS GIMBAL	V74T2969A	-60	-60	5	166	180
ANTENNA FEED	V74T2963A	-60	-60	5	186	245
GYRO PACK	V74T2967A	-60	-30	5	155	180

- Class 3 SM Alert "S76 KU-xxxx TEMP" message occurs for either XMTR >171° F, GMBL A >150° F, GMBL B >166° F, or GYRO >155° F.
- 2. Power off the system (SM Alert) or go to STANDBY as appropriate to limit high temperatures. Antenna heater circuit breaker can be opened if required.
- 3. Measurement accuracy of 1.7 percent full scale (5° F) is factored into these numbers.

Parameter	MSID	Minimum operating temp,°F	Maximum operating temp,°F	
OIU 1 Temp	P50T4000V	- 5	150	
OIU 2 Temp	P50T4001V	- 5	150	

- 1. These MSIDs are sent to PF 1 / 2 MDM Respectively.
- 2. OIU Temp (degrees F) = V (32.029) + 140.60854
- 3. The OIU temperature is sensed in the System Maintenance (SM) General Purpose Computer (GPC) for Fault Detection and Annunciation (FDA) purposes.
- 4, The FDA limit is 212° F, and the message is S212 OIU TEMP HI.

Parameter	MSID	Minimum storage temp,°C	Maximum storage temp,°C
OBSS PTU OBSS ITVC	STBD_LED_EP_TEMP STBD_LED_SP_TEMP	- 10 - 10	N/A N/A
OBSS LDRI	STBD_LED_SV_TEMP	- 0	N/A
OBSS_LCS	STBD_LED_WP_TEMP	- 110	N/A

1. MSIDs are from a PDRS ground computation. The actual MSIDs are shared with the RMS.

### **TITLE**

## TO DETERMINE REDUNDANCY OF AUDIO CONFIGURATION CONTROL DATA

### **GENERAL**

The audio center panel has a control data interface to the audio center control unit (ACCU) through the pilot (PLT) and mission station (MS) audio terminal units (ATU). The serial data routed from each ATU is a 128-bit Manchester encoded word transmitted every 5.12 milliseconds. This data word includes both station control signals as well as system configuration control signals. The configuration signals are unique to the PLT and MS ATUs. They control switching and routing functions within the ACCU when interfacing with external systems, such as routing air-to-ground loops to the NSP that is currently active.

9/1/2004: REV G

The serial data word contains a status bit that is transmitted to the ACCU acknowledging which NSP is presently active. By switching NSP's and subsequently their active states, proper operation of audio configuration control data via the PLT and MS ATUscan be determined.

### **PROCEDURE**

To check for operation of the mission station configuration control data

PNL 09 (PLT ATU)

Right audio power SW - OFF

PNL R10 (MS ATU)

S6 MS audio power SW - AUD/TONE or AUD

For the next steps, select an audio station that is known to be operating properly other than 09 (PLT) or R10 (MS)

PNL X (05 CDR, L9 PS, or A13 OS)

- A/A SW OFF
- Verify that PNL is configured for normal operation and that A/G 1 SW (S2) is in T/R.
- Contact CAPCOM on A/G 1 and request that INCO switch to alternate NSP.
- Wait approximately 1 minute for CAPCOM to confirm NSP switch.
- After confirmation, conduct short voice check with CAPCOM on A/G 1.

If OK, then MS data word is OK. If CAPCOM does not reply, then configuration control data from MS ATU has probably failed.

PNL 09 (PLT ATU)

Right audio power SW - AUD/TONE or AUD.

To check for operation of the right (PLT ATU) audio station configuration control data:

PNL R10 (MS ATU)

MS audio, power SW - OFF.

PNL 05 (PLT ATU)

Right audio power SW - AUD/TONE or AUD

For the next steps, select an audio station that is known to be operating properly other than 09 (PLT) or R10 (MS).

PNL X (05 CDR, L9 PS, or A13 OS)

- A/A SW OFF
- Verify that PNL is configured for normal operation and that A/G 1 SW 1(S2) is in TR.
- Contact CAPCOM on A/G 1 and request that INCO switch to alternate NSP.
- Wait approximately 1 minute for CAPCOM to confirm NSP switch.
- After confirmation, conduct short voice check with CAPCOM on A/G 1.

If OK, then pilot data word is OK. If CAPCOM does not reply, then configuration control data from PLT ATU has probably failed.

PNL R10 (MS ATU)

MS audio, power SW - AUDIO/TONE or AUD.

### **TITLE**

INTEGRATED LOAD CHECKOUT (ILC) SUPPORT PROCEDURE AND SHUTTLE MISSION SIMULATOR (SMS) - MCC LOAD CHECKOUT

### **PURPOSE**

To define a standard set of procedures for performing the ILC and SMS-MCC load checkout.

### **GENERAL INFORMATION**

The ILC is used to check out new MOC, workstation and SMS loads. The purpose of the test is to verify that the data pack inputs, new parameters, telemetry format loads (TFLs), decom format loads (DFLs), commands, workstation tools, and onboard software have been incorporated correctly. There is a form at the end of this procedure that should be copied and filled out for each ILC performed.

### **PROCEDURE**

- A. Verify the telemetry displays and computations
  - 1. Call up each display from DNAV and verify that the correct data is shown.
  - 2. Write anomaly reports (ARs) for all problems found. Make copies of the ARs for the lead INCO and workstation group administrator (GA). Turn in the originals to the ground controller (GC) in the white FCR.

## B. Verify Command

- 1. Check both the hardware and software command panels for proper configuration for flight.
- 2. Verify the uplink by sending representative commands as time permits.
- 3. Verify that the two-stage uplink works properly by uplinking a load. Check the uplink verify displays.
- 4. Verify any new command types or op codes by uplinking those commands.
- 5. Write ARs as required. Make copies for the lead INCO and the GA.
- C. Verify TFL/DFL and PSP/PI configurations
  - 1. Build and uplink the TFLs for the flight. Verify the telemetry to show that the TFLs function correctly.
  - 2. Verify proper operations of the PSP and PI configurations.
  - 3. Build and uplink the DFLs for the flight. Verify with the customer that the DFLs are processing the data correctly.
  - 4. Verify proper rendezvous RADAR operations (if required for flight).
  - 5. Write ARs as required. Make copies for the lead INCO and the GA.
- D. Verify /checkout SMS/NSS updates as required by the training team.

**SHUTTLE OPS** INCO/COMM/JSC-12829

## How to use the checkout form

This form is to be used to help INCO and the backroom with an SMS-MCC load checkout. The major areas covered are:

- Console software configuration
- Orbiter (SMS and onboard software)
- Ground processing software
- Payload configuration

If any problems are observed, place a note with a number beside the appropriate line and write up a detailed description on another sheet of paper.

# SHUTTLE OPS INCO/COMM/JSC-12829

# 3/31/2006 REV G, PCN 3

FLIGHT #	Vehicle #	Load #	Runs ASC
Workstation #	_Date//		ORB
			ENT

# Orbiter displays

Name	✓	Name	✓	Name	✓	Name	✓
inco mgmt		comm bypass		command		oimon2_status	
A/E inco mgmt		bfs nsp		fm config		oimon2	
antman(WAMS)		ssr mgmt		ku comm		ptc	
sb antenna		gnc nsp		ku radar		dsc_lcc	
a/e event		nsp config		ku mech		oiu	
dsc status		comsec		radar comm		ssor	
mdm dsc		cctv		power amp		pirt	
pi		stdn antenna		transponder		elog	
pcmmu event		cmd error		bio med		rt plot	
gcil_bit		alpha beta		raw data		bfs_ant	
dump report		pdi		psp		world map	
comm event		ssr test		ku self test			

# Command Server displays

Name	✓	Name	✓
cmd trk history		uplink verify	
rf_cmd_build		inst_cmd_build	
cmd buffers		ccud	

# **Cmd Panel Configs**

Name	✓
Ascent/Entry	
Orbit	

Which command types were sent to the orbiter?

Command Type	✓	Command Type	✓
general payload		TFL	
RTCs		DFL	
MSPC		TMBU (BFS)	
SPC		TMBU (SM)	
TEC		TDRS State Vec.	
PSP config		Orb State Vector	

# Downlist Windows OK?

Down List windows	✓
OI	
BFS	
SM	
GNC	
PDI decom 1	
PDI decom 2	
PDI decom 3	
PDI decom 4	

What TFLs were checked?

What DFI	/FPMs were	checked?

TFL	✓	TFL	✓
129		161	
102		103	

DCM	FMT	SRC	✓	DCM	FMT	SRC	✓
1				1			
2				2			
3				3			
4				4			
FPM				FPM			

Which PI channels were tested?

PI 1		
PI 2		

Which PSP configurations were tested?

Config #			
Status Word			
1			
2			
3			
Frame sync 1			
2			

Which downlist formats were seen?

SM	✓	GNC	✓	BFS	✓
24		21		12	
25		22		13	
26		23			
64		32			
		62			

Ground site and TDRS interface checks

				TDRS			
	GSTDN	275	171	174	41	47	SGLS
Command							
Telemetry							
Recorder							
Dumps							

Attach copies of any ARs written and turn this checklist in to the lead INCO.

#### TITLE

GPC VARIABLES FOR USE IN INCO/COMM/INST TROUBLESHOOTING

### **PURPOSE**

To provide the High-Order Assembly Language (HAL) names of pertinent flight software variables to allow for real-time troubleshooting of flight software problems by memory dump.

#### **GENERAL**

INCO/COMM/INST personnel are responsible for many functions on the orbiter that have extensive flight software support, such as telemetry format load, command uplink, antenna management, and payload communications management. If a problem in one of these areas is traced to flight software, the following variables contain status information that can be used to troubleshoot problems. These data can be transmitted to the ground by using variable parameter downlist in the appropriate major function or by asking DPS to perform a GPC memory dump. In general, a GPC memory dump is used to recover data quickly on a single occurrence of an anomaly, and a variable parameter downlist is used to monitor a process over a period of time. The intent is to gather as much data in real time as possible to allow the software community to spot problem areas and recommend workarounds.

To perform a GPC memory dump, INCO/COMM/INST should request DPS to perform a real-time memory dump. When the dump is made, INCO should ask DPS to hard copy their memory dump display and generate an MER request with hard copy attached for United Space Alliance analysis.

If it is desired to monitor a parameter over a period of time, INCO/COMM/INST should request DPS to place the variables in the variable downlist of the appropriate major function. Variable downlist parameters are on the DPS overview display. DPS SUPPORT can assist you in looking up GPC memory addresses for these HAL names.

### UPLINK COMMAND TWO-STAGE PROCESS AND ERROR CHECKING

HAL NAME	NOTES	
CDUV_IND	SYS S/W	(Major function of GPC)
CDUV_GPC_ID	SYS S/W	(Individual GPC ID)
CDU2_STAGE_COUNTER	SYS S/W	(Number of words in buffer)
CDUV_TWO_STAGE_BUFF	SYS S/W	(The two-stage buffer)
CDUB_GPC_VAL_WORD	SYS S/W	(GPC validity word)
CDUV_CURRENT_NSP	SYS S/W	(Current selected NSP)
CDUV_BYPASS_INDEX	SYS S/W	(Bypass status)
CDUE_APPL_PROCEED	SYS S/W	(Indicates whether each major function GNC, SM, or PL is ready to process uplink)
CDUV_NSP_VEHICLE_ILOAD	SYS S/W	Vehicle ID
UPLINK COMMAND SM SPC BUFFER		
HAL NAME	NOTES	
CDCV_NBR_SPC	SYS S/W	(Use only from SM computer; indicates number of SPCs)
CDCV_SPC_BUFF	SYS S/W	(Use only from SM computer; is the SPC buffer)
CDCV_PTR	SYS S/W	(Use only from SM computer; shows ordering of execution of SPC buffer)

# 5/31/2007: REV G, PCN-5

# UPLINK COMMAND SM SPC BUFFER

HAL NAME	NOTES	
CDUV_GPC_VAL_DOWNLIST	SYS SW	(GPC validity word)
CDUV_NSP_STAT_DOWNLIST	SYS SW	(NSP status word)
CDUV_NSP_VAL_DOWNLIST	SYS SW	(NSP validity word)
CDUB_POWER_DISCRETE1_DOWNLIST	SYS SW	(NSP1 pwr on ind)
CDUB_POWER_DISCRETE2_DOWNLIST	SYS SW	(NSP2 pwr on ind)

# UPLINK COMMAND - PROCESS INPUTS

HAL NAME	NOTES	
CDUE_NSP_PROCESS	SYS S/W	(Status of process)
CDUV_NSP1_INPUT	SYS S/W	(NSP1 input to uplink s/w)
CDUV_NSP2_INPUT	SYS S/W	(NSP2 input to uplink s/w)
CDUB_DUP_POWER DISCRETE1	SYS S/W	(NSP1 pwr disc inputs)
CDUB_DUP_DISCRETE1	SYS S/W	(NSP1 pwr disc)
CDUB_DUP_POWER DISCRETE2	SYS S/W	(NSP2 pwr disc inputs)
CDUB_DUP_DISCRETE2	SYS S/W	(NSP2 pwr disc)
CDUB_NSP_STATUS	SYS S/W	(NSP status word input)
CDUB_NSP_VAL WORD	SYS S/W	(NSP validity word received from NSP)
CDUV_SKIP_FLAG	SYS S/W	(Indicates uplink process did not complete processing on last cycle)

## ANTENNA MANAGEMENT - S BAND

HAL NAME	NOTES	
CSMB_SITE_INH	SM2	(16 long vector contains site inhibit status for each site)
CSMB_SITE_POS	SM2	(16-element array. Each element is a three- element vector corresponding to the x, y, and z position of the site in feet. Position words are double precision)
CSMB_SITE_IN_VIEW	SM2	(Indicates that SM believes a site or TDRS is in view)
CSMV_SITE_VIS_ABOVE_HORIZON	SM2	(TM constant (can be updated by TMBU), which describes how many degrees a site must be above the horizon in order to be in view)
SSM_QUAD_SEL_BY_GPC	SM2	(Quad selected by GPC 1 = UR, 2 = LR, 3 = LL, 4 = UL)
CSSV_SPOB_D100201	SM2	(PF1 MDM output buffer for antenna electronics number 1)
CSSV_SPOB_D120201	SM2	(PF2 MDM output buffer for antenna electronics number 2)

SHUTTLE OPS INCO/COMM/JSC-12829	5/31/2007: REV	GPC VARIABLES G, PCN-5 SCP 5.14
CSMV_TDRS_VIS	SM2	(TM constant (can be updated by TMBU), which describes how many degrees above the horizon the TDRS must be to be in view)
ANTENNA CONTROL - KU BAND		
HAL NAME	NOTES	
CSMV_KUBAND_BIAS_MATRIX	SM2	(Ku-band antenna bias matrix. There are nine elements in the array; each is 32 bits (two words) long)
CSMV_KUBAND_UL_CMD_WRD	SM2	(First word of the SM GPC Ku signal processor serial I/O. It is altered by Ku antenna OP code loads to configure the Ku band)
UPLINK CONTROL		
HAL NAME	NOTES	
CZ1B_D_UL_CNTL	SYS S/W	(Set by SPEC 1 item entries X8000 = Inhibit X4000 = Enable X2000 = Auto)
CZ1B_D_UL_CNTL_SM	SYS S/W	(Is a combination of CZ1B_D_UL_CNTL as set by SPEC 1 and CSMB_SITE_IN_VIEW as set by antenna management. It is the same as CZ1B_D_UL_CNTL, except that bit 4 is on when a site is in view. Thus, if UL CONTROL is in auto and a site is in view, CZ1B_D_UL_CNTL_SM should equal X3000)
PCMMU BYPASS ELEMENTS		
HAL NAME	NOTES	
CSAS_ERT_DL	SM2	(Contains the full table used to drive the 12 PMU bypass discretes. Analyze this table when multiple ambiguous element bypass indications are on)
PAYLOAD SIGNAL PROCESSOR SUPP	ORT	
HAL NAME	NOTES	
CSPV_CON_CONFIG_MSG	SM2	(10 copies of the structure contain the 10 prestored PSP configuration messages)

# PCMMU/PDI (TFL/DFL LOAD) SUPPORT

HAL NAME	NOTES	
CSLV_PPCOMM_LOAD_REJ_IND	SM2	(If the SM uplink process rejects a load format or the TFL/DFL does not load properly, this flag is set to the item in the load that failed. If this is set to 11, it means that the entire load was rejected. When an element of a load is rejected, no further elements of the load are attempted)
CSLB_PPCOMM_UPLNK_ACT_FLG	SM2	(Indicates that an uplink TFL/DFL operation is being processed)
CSLB_PPCOMM_UPLNK_ERROR_FLG	SM2	(Indicates that an uplink TFL/DFL opcode operation failed)
CSLB_PPCOMM_SPEC_ACT_FLG	SM2	(Indicates that crew has requested a TFL/DFL operation)
CSLV_ITEM_NO	SM2	(The item number selected by TFL/DFL uplink opcode or by crew entry on SPEC 62. Examples are PDI decom select or PDI format select)
CSLV_ITEM_VAL	SM2	(The item value selected by uplink or crew; for example, formats 4 or 161)
CSLB PMU TFL IN PROG FLG	SM2	(Indicates TFL in progress)
CSLB_PDI_DFL_FPL_IN_PROG_FLG	SM2	(Indicates DFL or FPM load in progress)
CSLV_DFL_FPL_DIR_INDEX	SM2	(If a request DFL or FPM is in the directory, this should be the index for that format in the directory)
CSLV_TFL_DIR_INDEX	SM2	(Same as above except for TFLs)
CVAV_TDIR_MM_DIR	SM2	(I-loaded director of TFLs available on the MMU)
CVAV_DDIR_DIRECTOR	SM2	(I-loaded directory of DFLs available on the MMU)
CVAV_FDIR_DIRECTORY	SM2	(I-loaded directory of FPLs available on the MMU)
CVAV_TDIR_NUM_FMT	SM2	(Total number of TFLs available in directory)
SPC_ERROR_FLG	SM2	(Indicates that the TFL/DFL process (SPCPPCOMM) has found an error while attempting to perform a SPEC 62 or TFL/DFL uplink operation. Examples would be TFL/DFL/FPM not in directory, attempting to select a nonexistent decom or FPM, etc.)
SPC_ITEM_TYPE_TBL	SM2	(Table used for program routing internal to SPCPPCOMM - TFL/DFL processor)
CSLB_SEL_FMT_RAM_FLG	SM2	(Indicates SPCPPCOMM has determined that a request has been made to load the LDR RAM)

SHUTTLE OPS INCO/COMM/JSC-12829	5/31/2007:	REV G, PCN-5	GPC VARIABLES SCP 5.14
CSLB_INVAL_FLG	SM2	uplink or SPEC 62 re	M - Indicates that an equest has failed a rior to starting a TFL/DFL
			ectory; bit 2 = gal; bit 3 = DFL/FPM FMT t 4 = invalid input source)
CVDV_INPUT_SEL	SM2	` •	M - Indicates the switch ed for the next switch
CVDV_DECOM_SEL	SM2	2 (Set by SPCPPCOM selected for the next	M - Indicates the decom DFL)
CVDV_FORMAT_SEL	SM2	` •	M - Indicates the next o be loaded in the next
CVLV_LOADED_FRM_LGTH	SM2	rames for HDR teler	GPC can output LDR metry (to make bandwidth s); this indicator is on if g out LDR frames)

5/31/2007: REV G, PCN-5

\*

# \* FLIGHT SOFTWARE MODULES THAT AFFECT INCO/COMM/INST \*

## APPLICATION SOFTWARE

SSMANTMG - MAIN ANTENNA MANAGEMENT MODULE

SULUPLINK - SM UPLINK PROCESSOR

SAFACO - PCMMU DATA ACQUISITON BY SM

CSAERT - COMPOOL CONTAINING PCMMU I/O ELEMENT BYPASSES

SPSPSPCYCLIC - PSP PROCESSOR

SAM - ANTENNA DISPLAY KEYBOARD PROCESSOR

SLSSPEC - SPEC 62 PROCESSOR

SPCPPCOMM - PERFORMS PCMMU/PDI/PSP I/O REQUESTS FROM SPEC 62 OR UPLINK

CSLFORMAT - ACTUALLY READS MASS MEMORY AND WRITES ON PL1 OR IP BUS FOR PCMMU/PDI TFL/DFL BY REQUEST FROM SPCPPCOMM

PMQTECPOLL - PERFORMS TEC CYCLIC PROCESSING

### SYSTEM SOFTWARE

**DUPNSP - NSP UPLINK MESSAGE PROCESSOR** 

DUPSPC - STORED PROGRAM COMMAND CYCLIC PROCESSOR

AIESIP - SYSTEM INTERFACE PROCESSOR - MAIN DRIVER FOR OPERATING SYSTEM SCHEDULES NSP I/O

DUMULK - DUMMY PROCESS THAT RUNS UNTIL UPLINK COMMANDS ARE READY TO PROCESS

CDULNK - COMPOOL FOR UPLINK

DUP2STGEXEC - UPLINK TWO-STAGE LOAD PROCESSOR

DLALIGHT - MANAGES SM ALERT LIGHT/TONE

3/31/2006: REV G, PCN 3

# **TITLE**

PARAMETERS LISTED ACCORDING TO MDM AND DSC

# **GENERAL**

The following is intended to provide a summary listing of INCO parameters or commands as a function of multiplexer/demultiplexer (MDM) and dedicated signal conditioner (DSC). Specific parameters for a particular flight/vehicle can be found in the appropriate computer listings.

	MDM	DSC
OA1	DSC OA1, OM3 BITE DSC OA 1/2/3 power on	OA1 None
OA2	DSC OA2 BITE MADS shelf temp	OA2 None
OA3	DSC OA3 BITE MADS BITE's (5) MADS WB mode	OA3 None
OF1	DSC OF1 BITE SSR 1 (28), MMU1 power Ku-band temps (2) PCMMU 1 GPC, PGM, RPC-A PCMMU 2 RPC-A COMSEC power (2) PDI power (1) MADS recorder (6) MTU 1 (Inform DPS) PCMMU 1/2 select (BFS auto TFL uncertain)	OF1  Ku-band temps (2) PCMMU 1 FMT GPC, PGM  MADS percent tape MADS recorder tape MTN
OF2	DSC OF2 BITE SSR 2 (28), MMU2 power ECG (2) PI (42) PSP BIT/FRM (4) PCMMU 2 GPC, PGM, RPC-B COMSEC power (2)	OF2 PCMMU 2 FMT GPC, PGM

3/31/2006: REV G, PCN 3

MDM	DSC
DSC OF3 BITE Ku-band (14) Ku-band temp (4) S-band PM (87) S-band FM (6) UHF AGC (4) SSOR (5) COMSEC (14) PCMMU 1 RPC-C PDI power (1) GCIL active	OF3  Ku-band XMTR temp Ku-band RCVR temp Ku-band A gimbal temp Biomed CH 1 switch pos. (6) Biomed CH 2 switch pos. (6) F9 meter (buffer amp)
DSC OM1, OM2 BITE Biomed CH 1 switch pos. (6) Biomed CH 2 switch pos. (6) CCTV (25) UHF (7) SSOR (2) Ku-band (9) S-band PL (10) S-band PM (15) S-band FM (10) MDM OA 1/2/3 power on DSC OL/OR 1/2 power (2) GCIL power (2) COMSEC (3)	OF4 None
PF1  Ku-band control words S-band antenna selects PM/FM to antenna ELEC 1 GCIL DCDR A CMD's Ku-band status words MADS CMD's PSP 1 CMD's/CONFIGURATION OIU 1 temp SSR 1 CMD's	
PF2  CCTV CMD's except VCU power S-band antenna selects PM/FM to antenna ELEC 2  GCIL DCDR B CMD's PSP 2 CMD's/CONFIGURATION OIU 2 temp SSR 2 CMD's	

3/31/2006: REV G, PCN 3

MDM	DSC
	OL1, OL2
	None
	OM1
	None
	OM2
	MADS temp Ku-band gimbal temp
	OR1, OR2
	None

### **TITLE**

### POSTLANDING ANTENNA POINTING TO TDRS

## **PURPOSE**

To document the postlanding antenna selection from various landing sites and runways to TDRS. This data will be useful in antenna selection to TDRS while landing at any of these sites in the event of BFS navigation problems.

### **PROCEDURE**

Prior to landing, get the landing site and runway from the FDO. Look up the site and associated runway in table 5.16-1 to determine proper antenna for on final through postlanding.

Note: The data in table 5.16-1 were computed assuming a spherical Earth (no oblateness and no altitude variation). This assumption will cause errors less than 1°. The procedure, equations, and computations are described after the table.

Table 5.16-1. Postlanding TDRS antenna selections

			S-band antenna to select for:				
Site	Rwy	Des	TDRS 41	TDRS 47	TDRS 171	TDRS 174	TDRS 275
Al Baha, Saudi Arabia	7 25	EBA					URF ULA
Arlanda, Sweden	1 19	ARL	ULA URF	ULA URF			URA ULF
Amberly, Australia	15 33	AM			ULF URA	ULF URA	URA ULF
Amilcar, Cabral	2 20	AML	ULA URF	ULA URF			
Ascension IS, St Helena	14 32	HAW	URA ULF	URA ULF			
Aukland, New Zealand	5 23	ZAA			ULA URF	ULA URF	
Banjul, Gambia	14 32	BYD	URA ULF	URA ULF			
Ben Guerir, Morocco	18 36	BEN	URF ULA	URF ULA			
Bermuda	12 30	BDA	URF ULA	URF ULA			
Bombay, India	9 27	ABB					URF ULA
Calcutta, India	1 19	ECC					ULA URF
Cherry Point, NC	32 23	NKT	URA ULA	URA ULA			
Ching Chuan Kang, Taiwan	18 36	CMQ			ULF URA	ULF URA	URF ULA
Colombo, Sri Lanka	4 22	СВІ					URA ULF
Dakar, Senegal	18 36	YOF	URF ULA	URF ULA			

			S-band antenna to select for:				
Site	Rwy	Des	TDRS	TDRS	TDRS	TDRS	TDRS
	_		41	47	171	174	275
Darwin, Australia	11	DDN			ULF	ULF	URA
	29				URA	URA	ULF
Diego Garcia, UK	31 13	JDG					ULF URA
	19		ULF	ULF			
Dover, DE	32	DOV	URA	URA			
Dyess, TX	16	DYS	ULF	ULF	URA	URA	
- Dycoc, 17(	34	D10	URA	URA	ULF	ULF	
	4		URF	URF	ULA	ULA	
	22		ULA	ULA	URF	URF	
	17		ULF	ULF	URF	URF	
	35		URA	URA	ULA	ULA	
Edwards, CA	5	EDW	URF	URF	ULA	ULA	
Lawards, OA	23	LDVV	ULA	ULA	URF	URF	
	15		ULF	ULF	URA	URA	
	33		URA	URA	ULF	ULF	
	18		ULF	ULF	URF	URF	
	36		URA	URA	ULA	ULA	
E	5				ULA	ULA	
Elmendorf, AK	23	EDF			URF	URF	
	13		ULF	ULF	URA	URA	
Ellsworth, SD	31	RCA	URA	URA	ULF	ULF	
Esenboga, Turkey	3	ESN	ULA				URF
3 / 3	21		URF				ULA
Fairford, England	9	FFA	URA	URA			
r amora, England	27	, ,	ULF	ULF			
Gander, New Foundland	4	YQX	URF	URF			
Garider, New Foundiand	22	ΙQΛ	ULA	ULA			
Original IN	5	01.10	URF	URF			
Grissom, IN	23	GUS	ULA	ULA			
	14			ULF	URA	URA	
Grant County, WA	32	MWH		URA	ULF	ULF	
	6			0101	URF	URF	ULA
Guam	24	GUA			ULA	ULA	URF
				ULA			
Guarulhos, Brazil	9	BGR	ULF				
,	27		URA	URF			
Guararapes, Brazil	18	BRF	URA	URA			
Cadrarapoo, Brazii	36	Ditti	ULF	ULF			
Halifay Intl. Nova Soctio	6	VU7	URF	URF			
Halifax Intl, Nova Scotia	24	YHZ	ULA	ULA	-		
Hee Atel Franch Dates at	12	1140			ULA	ULA	
Hao Atol, French Polynesia	30	HAO			URF	URF	
	18		URA	URA			ULA
Hoedspruit, South Africa	36	HDS	ULF	ULF			URF
	8				URA	URA	
Honolulu, HA	26	HNL			ULF	ULF	<b></b>
						ULF	
Ivato, Madagascar	11	MMI					ULF
, 5	29						URA
Kennedy, FL	15	KSC	ULF	ULF			
<b>-,</b> - <b>-</b>	33		URA	URA			

			S-band antenna to select for:				
Site	Rwy	Des	TDRS	TDRS	TDRS	TDRS	TDRS
		<b>D</b> 03	41	47	171	174	275
King Khalid, Saudi Arabia	15 33	KKI					ULF URA
Kinshasa, Zaire	6 24	KIN	ULA URF	ULA URF			URF ULA
Koln Bonn, West Germany	14 32	KBO	URA ULF	URA ULF			
Lajes, Portugal	15 33	LAJ	URF ULA	URF ULA			
Las Palmas, Canary IS	3 21	GDV	ULA URF	ULA URF			
Lincoln, NB	17 35	LNK	ULF URA	ULF URA	URA ULF	URA ULF	
Maiscal Sucre, Ecuador	17 35	EQU	ULF URA	ULF URA			
Mataveria, Chile	10 28	CIP	ULF URA	ULF URA	ULA URF	ULA URF	
Moron, Spain	2 20	MRN	ULA URF	ULA URF			
Mountain Home, ID	12 30	MUO	ULF URA	ULF URA	URA ULF	URA ULF	
Myrtle Beach, SC	17 35	MYR	ULF URA	ULF URA			
Nassau, Bahamas	14 32	ZQA	ULF URA	ULF URA			
Northrup, NM	5 23 17 35	NOR	URF ULA ULF URA	URF ULA ULF URA	ULA URF URA ULF	ULA URF URA ULF	  
Oceana, VA	5 23	NTU	URF ULA	URF ULA	 		
Orlando, FL	18 36	ORL	ULF URA	ULF URA			
Otis, MA	14 32	FMH	ULF URA	ULF URA			
Pago Pago, Solomon IS	5 23	STU			ULF URA	ULF URA	
Pease, NH	16 34	PSM	ULF URA	ULF URA			
Perth, Australia	3 21	PPH			URF ULA	URF ULA	ULF URA
Plattsburg, NY	17 35	PBG	ULF URA	ULF URA			
Rio Gallegos, Argentina	7 25	AWG	ULF URA	ULF URA		 	
Roberts, Liberia	4 22	ROB	ULA URF	ULA URF			
Rochambeau, French Guiana	8 26	OCA	URF ULA	URF ULA			
Rota, Spain	10 28	AOG	URA ULF	URA ULF			

			S-band antenna to select for:				
Site	Dun	Des	TDRS	TDRS	TDRS	TDRS	TDRS
Site	Rwy	Des	41	47	171	174	275
Santiago, Spain	17	EST	URF	URF			
Santiago, Spain	35	LSI	ULA	ULA			
Shannon, Ireland	6	INN	URA	URA			
Chamber, ireland	24	11414	ULF	ULF			-
Simon Bolivar, Venezuala	9	VMI	URF	URF			
Cirrion Bolivar, Venezuala	27	VIVII	ULA	ULA			
Souda Bay, Crete	11	SUD	URA	URA			ULF
Journal Day, Crete	29	300	ULF	ULF			URA
St John's, New Foundland	11	YYT	ULF	ULF			
Ot boiling, ivew i ballalana	29		URA	URA	-		
Stephenville, New Foundland	10	YJT	URF	URF			
Stephenville, New Foundand	28	101	ULA	ULA			
Tamanrasset, Algeria	3	TMS	ULA	ULA			URF
Tamamasset, Algeria	21	11010	URF	URF			ULA
U-taphao, Thailand	18	TBU					URF
O-taphao, mailana	36	100					ULA
Wake IS, Wake IS	10	WAK			URF	URF	
Wake 10, Wake 10	28	V V / \( \( \)			ULA	ULA	
Westover, MA	5	CEF	URF	URF			
Westover, IVIA	23	OLI	ULA	ULA			
Wright-Patt, OH	5	FFO	URF	URF			
Winging att, Off	23	- 1 0	ULA	ULA			
Yokota, Japan	18	JTY			ULF	ULF	URF
Tokota, Japan	36				URA	URA	ULA
Zaragosa, Spain	12	ZZA	URA	URA			
Zaragooa, opani	30	<i></i> \	ULF	ULF			

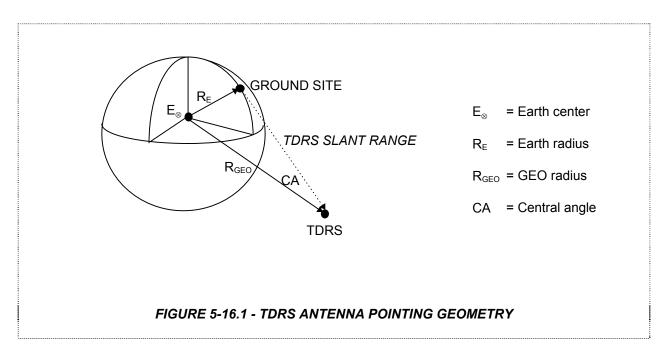
<sup>-- = &</sup>quot;No View", TDRS below horizon (cannot "see" runway).

## **PROCEDURE**

Periodically, new landing sites or TDRS satellites may be added requiring new antenna calculations to be performed. The following documents the procedure, equations, and calculations required to generate new values. These equations are captured in EXCEL files for easy use.

For our calculations, we will assume that the Earth is a sphere. Thus, spherical trigonometry is used to define the central angle (CA). The CA is computed using the right spherical triangle formula:

 $CA = arc \cos [\cos (a) \cdot \cos(b)]$ 



### VARIABLES USED:

$$k_1 = R_E = 3443.8 \text{ nmi}$$

$$k_2 = R_{GEO} = 22766.83 \text{ nmi}$$

$$k_3$$
 = conversion of degrees to radians =  $\frac{\pi}{180}$  = 0.017453293 rad/deg

$$k_4$$
 = conversion of radians to degrees =  $\frac{180}{\pi}$  = 57.29577951 deg/rad

1. Acquire the following landing site information from FDO or TRAJ: runway (RWY), runway latitude (site\_lat), runway longitude (site\_long), and magnetic variance\* (MAG VAR).

\*In navigation, magnetic variance can be defined as the horizontal angle between true north and magnetic north measured from E or W, according to whether magnetic north lies E or W of true north.

- 2. Compute the runway magnetic azimuth by adding a zero to the end of the runway number. This will be accurate to within  $\pm 5^{\circ}$ .
- 3. Compute the true runway azimuth (TRUE RWY AZ) by subtracting the amount of magnetic variance from the runway magnetic azimuth. West magnetic variance is negative and East magnetic variance is positive.

Note: For calculation purposes, the TRUE RWY AZ must be less than zero. If TRUE RWY AZ > 0, then subtract 360 until it is less than zero.

4. Compute the TDRS central angle (CA). See figure 5-16.1.

$$CA = arc \cos \langle [\cos(site\_lat \bullet k_3)] \bullet \{\cos[(site\_long - TDRS\_long) \bullet k_3] \rangle \rangle$$

5. Compute the slant range (SLANT\_RANGE) from the landing site to TDRS.

$$SLANT RANGE = \sqrt{k_1^2 + k_2^2 - 2 \cdot k_1 \cdot k_2 \cdot \cos(CA)}$$

6. Compute the TDRS elevation (TDRS EL) from the landing site.

$$TDRS\_EL = arc \cos \left( \frac{SLANT\_RANGE^2 + k_1^2 + k_2^2}{2 \bullet SLANT\_RANGE \bullet k_1} \right) \bullet k_4 - 90$$

7. Compute the TDRS azimuth (TDRS\_AZ) from the landing site.

If 
$$\sin[(site\_long - TDRS\_long) \bullet k_3] < 0$$

Then 
$$TDRS\_AZ = a \, rc \cos \left[ \frac{-\sin \left( site\_lat \bullet k_3 \right) \bullet \cos \left( CENT \angle \right)}{\sin \left( CENT \angle \right)} \right] \bullet k_4$$

Else 
$$TDRS\_AZ = 360 - \left\{ arc \cos \left[ \frac{-\sin(site\_lat \bullet k_3) \bullet \cos(CENT\angle)}{\sin(CENT\angle)} \right] \bullet k_4 \right\}$$

8. Compute the degrees to TDRS (DEG\_TO\_TDRS):

The result is the number of degrees from the nose of the vehicle (on the runway) to the TDRS line of site (LOS).

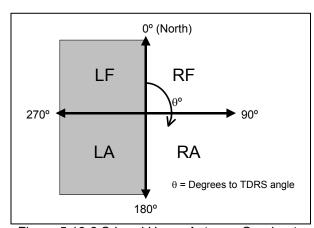


Figure 5.16-2 S-band Upper Antenna Quadrants

9. Compute whether an upper antenna will be selected or if the TDRS is not in view.

IF TDRS EL >0

THEN "UPPER"

ELSE "--"

10. If TDRS in view (result of 9 is "UPPER"), compute whether a right or left antenna will be selected.

IF 0<STD\_DEG\_TO\_TDRS<180

THEN "RIGHT"

ELSE "LEFT"

11. If TDRS in view (result of 9 is "UPPER"), compute whether a forward or an aft antenna will be selected.

IF 90<STD\_DEG\_TO\_TDRS<270

THEN "AFT"

ELSE "FWD"

- NOTE 1: To add a new site to the EXCEL files, insert new row(s), copy/paste existing row, and edit site information (first six columns). This will maintain the embedded equations.
- NOTE 2: For real time operations, if the BFS NAV STATE is good, then use the BFS antenna selection.
- NOTE 3: To verify antenna selections given by the EXCEL program, use the Attitude & Pointing LOS program (back room FOP program):

Directory: INCO

File: INCOG

TITLE

### MINIMUM-RANGE CALCULATIONS FOR RF-SENSITIVE PAYLOADS

### **PURPOSE**

To provide a method for calculating the "safe" range for payloads sensitive to RF emissions from the Kuband, S-band PM, and payload interrogator.

9/1/2004: REV G

### **PROCEDURES**

Table 5.17-1 provides the RF transmission frequencies for the S-band PM and payload interrogator, and the Ku-band antenna. This table can be used to determine the orbiter antennas with transmitting frequencies which may be hazardous to payload systems. The procedures provided in A, B, and C can then be used to determine the minimum "safe" range for a given RF sensitivity. For payloads within the payload bay envelope, figure 5.17-1 provides the field intensity as a function of position within the bay. The Ku-band antenna curve plotted in figure 5.17-1 is a composite curve showing "worst case" or maximum field intensity for a full range of Ku-band antenna attitudes and operation modes with masking enabled.

Table 5.17-1. RF transmission frequencies for the S-band and payload interrogator

Transmitter	Antenna (1)	Carrier Freq (fc)	Modulation
S-band PM (network transponder)	S-band quad	2217.5 OR 2287.5 MHz	PSK, PM
Payload Interrogator		0005 00044	
STDN (NASA) (2)	S-band payload	2025.8334 to 2117.9166 MHz	PM
DSN (NASA) (3)	S-band payload	2110.2431 to 2119.7924 MHz	РМ
SGLS (DOD) (4)	S-band payload	1763.721 to 1839.795 MHz	РМ
Ku-band	Ku-band		
	Return link	15.0034 GHz	QPSK, FM
	Radar ranging	13.883 GHz (5)	Pulsed carrier pulse rates:
			268,3000,
			7000 PPS
			Pulse width -
			66.4 µs
			max.
			122.0 hs
			min.

## Notes:

- (1) Cargo bay radiation levels defined in figure 5.17-1.
- (2) 801 selectable channels over indicated frequency range.
- (3) 29 selectable channels over indicated frequency range.
- (4) 20 selectable channels over indicated frequency range.
- (5) Passive tracking uses frequency diversity technique employing center frequencies of 13.779, 13.831, 13.935, and 13.987 GHz. Active tracking uses 13.883 GHz only.

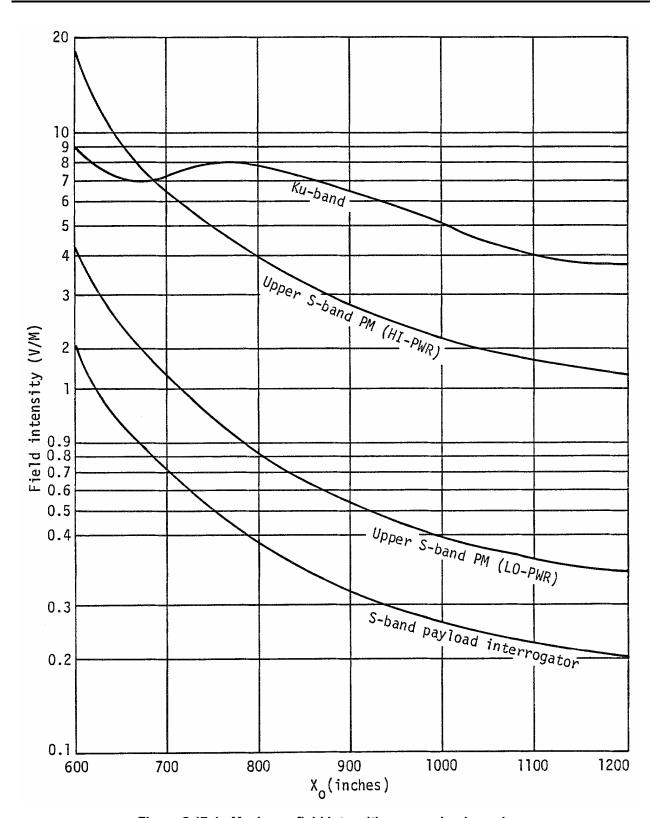


Figure 5.17-1. Maximum field intensities on payload envelope

#### A. S-band PM

1. From figure 5.17-2, determine the angular region of interest. (The portion of the curve located to the right of the point of inflection at q = 78° should be used for all payloads positioned aft of the antenna location at X0 = 551.15, and above the X, Y plane passing through Z0 = 472.50. For payloads located forward of the antenna and above the X, Y plane through Z0 = 472.50, the left portion of the curve should be used. In both cases, q is referenced to the X, Y plane forward of the antenna location).

9/1/2004: REV G

- Select the greatest field strength value (VOLTS/METER @ 1 METER) within the region of interest.
- 3. If the antenna is in the high power mode; step 4.

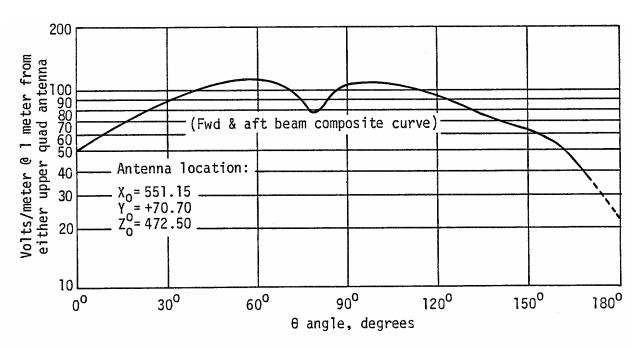
IF the antenna is in the low power mode, multiply this value by 0.158 (-16 dB); step 4.

4. For a given payload sensitivity, substitute this value in equation 1 to obtain the minimum "safe" range.

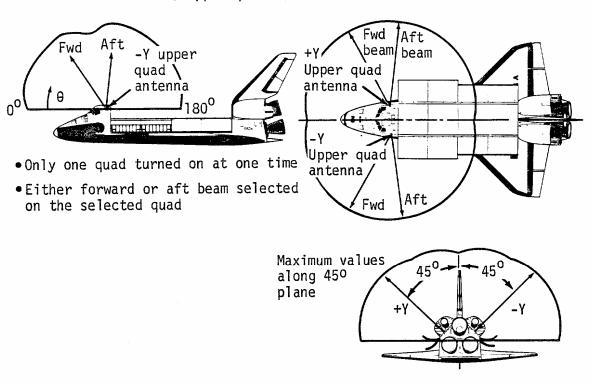
RANGE (METERS) = <u>VOLTS/METER</u> (EQUATION 1) SENSITIVITY (VOLTS/METER)

### B. S-band payload interrogator

- 1. From figure 5.17-3, determine the angular region of interest. (The plane of figure 5.17-3 should be rotated ±90° about the boresight to select the region of interest for payloads not located along the vehicle centerline.)
- Select the greatest field strength value (VOLTS/METER <u>@ 1 METER</u>) within the region of interest.
- 3. IF the antenna is in the high power mode; step 4.
  - IF the antenna is in the medium power mode, multiply this value by 0.316 (-10 dB); step 4.
  - IF the antenna is in the low power mode, multiply this value by 0.071 (-23 dB); step 4.
- 4. For a given payload sensitivity, substitute this value in equation 1 to obtain the minimum "safe" range.



a. S-band PM, upper quad antennas, maximum field intensities



b. S-band network transponder, upper quad antennas, beam configuration

Figure 5.17-2. S-band PM

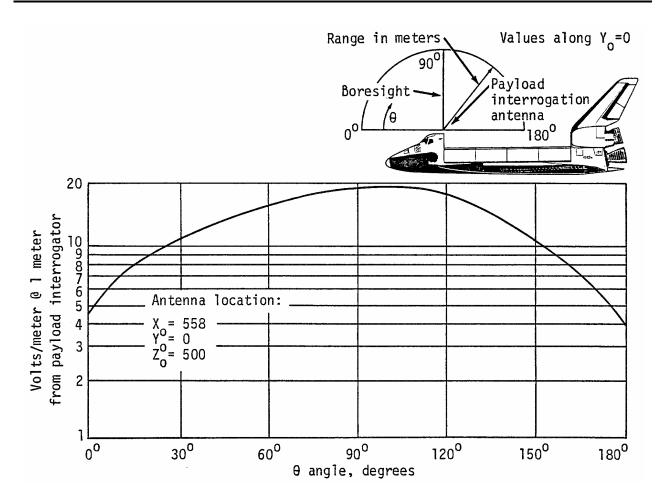


Figure 5.17-3. S-band payload interrogator, maximum field intensities

### C. Ku-band

1. <u>Communication Mode</u> - Using figure 5.17-4, locate the payload sensitivity along the vertical axis. Move this point horizontally until intersecting the curve. The horizontal coordinate of this point corresponds to the minimum "safe" range (in METERS) for a payload positioned directly within the Ku-band beam.

9/1/2004: REV G

Radar Mode - Using figure 5.17-5, locate the payload sensitivity along the vertical axis. Move this point horizontally until intersecting the appropriate power level curve. The horizontal coordinate of this point corresponds to the minimum "safe" range (in METERS) for a payload positioned directly within the Ku-band beam.

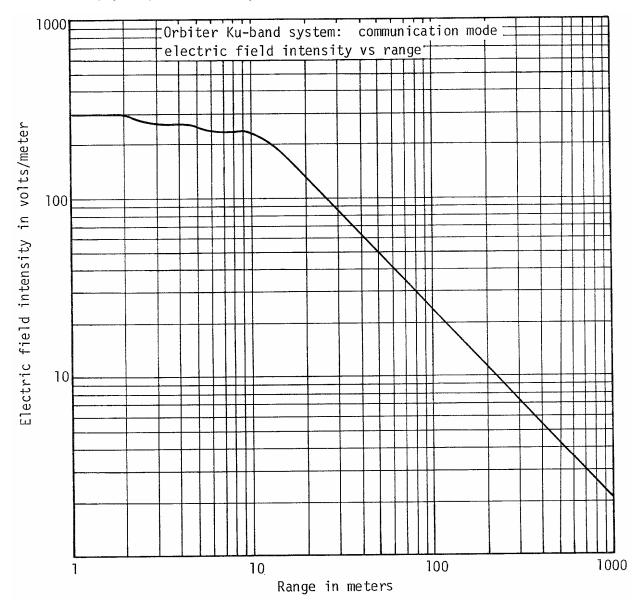


Figure 5.17-4. Communication mode electric field intensity vs. range

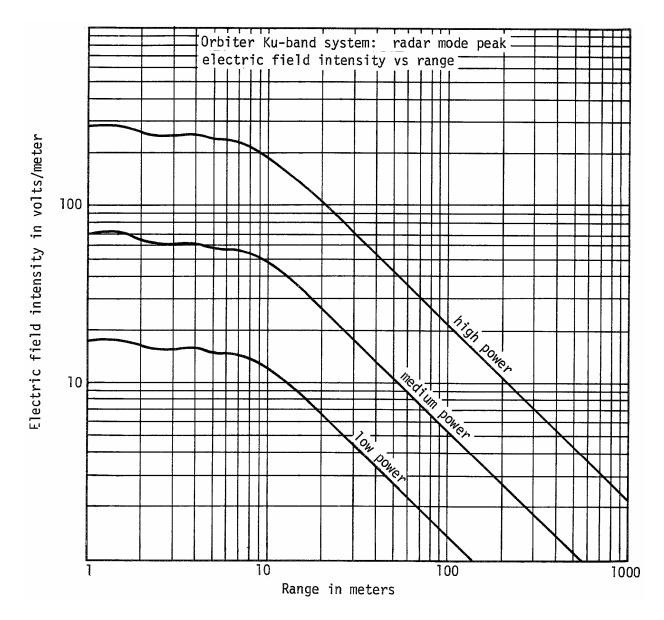


Figure 5.17-5. Radar mode peak electric field intensity vs. range

#### **TITLE**

EMCC DOCUMENTATION ENGINEER (EDE) DUTIES AND RESPONSIBILITIES

### **PURPOSE**

To define a standard set of procedures to be used by the EMCC Documentation Engineer (EDE) when preparing the EMCC documentation for mission support.

### **GENERAL**

Before each mission, the EDE is required to ensure that the EMCC documentation is up to date and ready for EMCC activation. The documentation for EMCC is an important supplement to the EMCC. The documents provide essential recorded knowledge to the EMCC INCO and other flight controllers. The flight control team uses this information to control and monitor orbiter systems to ensure the safe return of the crew and vehicle.

### **EMCC DOCUMENTS LOCATION**

Bldg **4N** Room **1010** Near the door in the INCO library

### **EMCC DOCUMENTATION**

At 3 weeks prior to each flight, the EDE should start preparing the documentation for EMCC support. This should allow enough time for the EDE to gather documents and work any unforeseen problems in retrieving the data for the documents. Once all the documents have been retrieved, the EDE should confirm EMCC documentation readiness with the lead INCO for the flight.

The EMCC Preparation Checklist (Figure 5.18-1) is a checklist of all documentation required for EMCC support. The EDE is responsible for verifying that material listed in the documentation portion of the checklist is flight ready. Flight ready, in this case, means the documentation is correct, complete, up to date, and in the designated location. The following is a brief synopsis on each document listed.

- (1) RTC listing hard copy Hard copies made on console of all prebuilt RTCs to be used during the specific flight. Typically obtained several weeks prior to launch during a mission-specific simulation.
- (2) Loads listing hard copy Hard copies made on console of all prebuilt loads to be used during the specific flight. Typically obtained several weeks prior to launch during a mission-specific simulation.
- (3) Orbiter Instrumentation Program and Components List (IPCL) (STS89-0887, vols. I, II, and III) Obtain a copy from the DF technical librarian. The IPCL provides Shuttle Program information and direction to design, wiring, installation, test, and operational groups.
- (4) Space Shuttle Systems Handbook (JSC-11174, Secs. 16 and 17) Schematic drawings of the orbiter communication and instrumentation systems.
- (5) INCO/COMM Systems Brief (JSC-18611) Provides a detailed description of the orbiter communication and instrumentation equipment.
- (6) INCO/COMM Console Handbook (JSC-12829) A set of display briefs and procedures on the use and applications of numerous INCO displays, working tools and INCO malfunction procedures.
- (7) SSP EMCC Activation and Operations Procedures (450-CAP-EMCC) A set of procedures for activating EMCC from startup to breakdown of the software and hardware components.
- (8) List of all applicable Web Based Documentation Addresses listed in Table 5.18 1.

# WEB BASED DOCUMENTATION ADDRESSES TABLE 5.18-1

NASA Homepage	http://www4.jsc.nasa.gov/
DF MASTER	http://stic.jsc.nasa.gov/dbase/iso9000/docs/DF/master.htm
Interface Controls Document (ICD)	http://www.unitedspacealliance.com/ICD/index.htm
Payload Integration Library System (PILS)	http://sspweb.jsc.nasa.gov/pils/payload.cfm?mask=A
Panel Imagery	http://vittimagery.jsc.nasa.gov/
Shuttle Operational  Data Book	https://ssveo.jsc.nasa.gov/sodw/
USA Homepage	http://www.usa1.unitedspacealliance.com/
Flight Software	http://opic.cal.boeing.com/data_b6/fsw_team/software.htm

STS	DF24 EMCC PREPARATION CHECKLIST
Documentation	
Documentation	
	RTC listing hard copy
	Loads listing hard copy
	Orbiter IPCL (STS89-0887, vols. I, II, and III)
	Space Shuttle Systems Handbook (JSC-11174, secs. 16 and 17)
	INCO/COMM Systems Brief (JSC-18611)
	INCO/COMM Console Handbook (JSC-12829)
	EMCC Activation and Operations Procedures (450-CAP-EMCC)
	Web Based Documentation Addresses Table 5.18-1
	Flight Specific Payload Flight Software Review (JSC-19478)
	Other - Flight specific
EDE:	Date:

Figure 5.18-1 EMCC Preparation Checklist

#### TITLE

EMERGENCY MISSION CONTROL CENTER (EMCC) PREPARATION, ACTIVATION, AND OPERATION

## **PURPOSE**

The EMCC is located at the NASA Launch Control Complex (LCC) at Kennedy Space Center. It is intended to serve as the backup facility for the MCC for any contingency which severely reduces or completely prohibits operational activities during a Space Shuttle flight. When activated, the EMCC provides essential operational capabilities that will allow relocated flight controllers to communicate with Space Shuttle crew, monitor flight activities and interface directly with network elements. If possible, mission objectives will be completed until safe re-entry and landing of the Space Shuttle Orbiter.

This SCP consists of several procedures to be used by the INCO team to execute the following EMCC tasks.

- Pre-Mission Preparation Ensure DF24 pre-mission preparedness
- EMCC Activation Participate in the activation of EMCC
- EMCC Operation Function as an INCO in the EMCC

## **PRE-MISSION PREPARATION**

There are several parts to Pre-Mission preparation which are required to make for a successful deployment of the EMCC to KSC. The following list of requirements should be reviewed by anyone that has the potential to be deployed as the INCO representative in the EMCC.

## **Training**

Before anyone is deployed to KSC for EMCC operations they should be familiar with the procedures which will be used in the event of a deployment. They should be familiar with but not expert at the use of the consoles in the LCC, what displays are available, what the command capability is in the LCC and how data, voice and command flow through the LCC to and from the orbiter.

NOTE: EMCC is not intended nor does it have the capabilities to support ascent or sophisticated payload operations.

## **General Overview**

KSC and GSFC will be informed of EMCC activation as soon as practical by the Mission Operations Directorate Representative for the mission or the on console Flight Director. Once they have declared that EMCC must be deployed, KSC will start working their procedures to activate the EMCC in the LCC, JSC logistics and air operations will implement their EMCC plans, and the assigned flight controllers will report to Ellington to ride a NASA plane to KSC. This should happen within the first two hours after EMCC is declared.

If the MCC is not able to support flight operations until EMCC is up and running, the GSFC Network Director (ND) will assume responsibility for the mission and activate communications with the crew until the EMCC is activated. If the MCC is able to support until EMCC is activated, then a clean handover of operations will take place between the MCC and the EMCC at the LCC as soon as the EMCC flight control team is supporting from the LCC. Figure 5.19-1 is the location of the LCC at KSC.

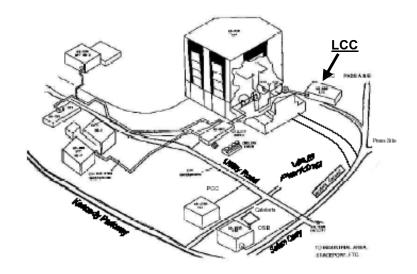


Figure 5.19-1 Location of LCC at KSC

## **KSC Support**

As soon as KSC has been informed of EMCC activation they will start working through their preplanned Operation and Maintenance Instruction (OMI). OMI S1032 instructs the KSC team in the LCC to configure their communications systems at KSC and at MILA to support the arrival of the flight control team. They will configure the consoles per their instructions in the OMI and be ready with head sets for the flight control team when they arrive in the LCC. Their will be a team of KSC air operations personnel at the Shuttle Landing Facility (SLF) to escort the flight control team into the LCC.

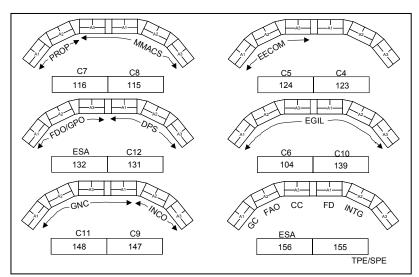


Figure 5.19-2 LCC Console Configuration

## **Console Configuration**

Each flight controller is assigned a console or set of Checkout, Control and Monitor Subsystem (CCMS) consoles in the LCC. More than likely, firing room 1 or 3 will be used but firing room 2 is a possibility. Firing rooms 1 and 3 are very similar while firing room 2 is

a unique configuration. Figure 5.19-2 shows the seating locations for each flight controller in firing rooms 1 and 3.

The INCO console will be located in the back row of the firing room at console 147 (firing room (FR) 1) or 647 (FR 3). Each console has a unique software load. The INCO console will be loaded with the 'C9' load which includes the software for the Communications and Instrumentation displays. There is one monitor in each of the three sections to a console. Unfortunately, INCO is only allotted two sections of the console assigned since the third section will be used to support GNC's navigation displays which are also part of the 'C9' load. Figure 5.19-3 is a picture of the INCO console in firing room 1.



Figure 5.19-3 INCO Console in FR 1

INCO will use the LCC provided headsets connected to the communications units in the consoles. There are two versions of these panels. The primary one that INCO will use is an 8 channel panel located at the left end of the 'A2' section of the INCO console. Figure 5.19-4 is an example of the 8 channel panel. Figure 5.19-5 is an example of the 4 channel panel.

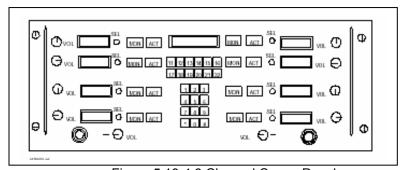


Figure 5.19-4 8 Channel Comm Panel

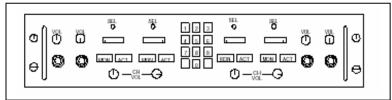


Figure 5.19-5 4 Channel Comm Panel

The communications loops, called Operation Intercommunications System - Digital (OIS-D) end instruments (EI) between the various consoles, sites and other control centers (including JSC) for EMCC are listed in table 5.19-1.

Voice Conference	KSC OIS Channels	Capability
A/G 1	6312 (CR1) or 6332 (CR3)	М
A/G 2	6313 (CR1) or 6333 (CR3)	M
UHF	6311 (CR1) or 6331 (CR3)	M
Prime Ops	6611	TM
Site/TN Coord/STS Sup	6900	TM
JSC Flight Director	6001	M
EMCC FD	6908	TM
EMCC FAO/PLO	6901	TM
EMCC GC	6902	TM
EMCC FDO/GPO	6903	TM
EMCC PROP/GNC	6904	TM
EMCC DPS/MMACS	6905	TM
EMCC EGIL/EECOM	6906	TM
EMCC INCO	6907	TM
CCSE	6155	TM
CISL	6145	TM
AFD	1161	TM

M - Monitor only, TM - Talk/Listen Monitor

Table 5.19-1 OIS loops

## Display Capabiltiy

As stated earlier there are a set of displays, called Ground Operations Aerospace Language (GOAL). available in the software loaded into the INCO console. These displays are grouped, 6 to a group, with up to 6 groups in a software load. The display groups are selected from the Programmable Function Panel (PFP) display (see figure 5.19-6) by pressing the push button next to the group of displays the user wants to view. Once the group of displays is selected the first one in the group will be displayed on the monitor. The displays with in that group can be selected from the keyboard built into the console. The "APP 1" through "APP 6" keys located in the set of keys just above the standard

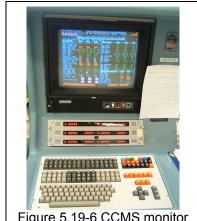


Figure 5.19-6 CCMS monitor

key set are used to select the various displays. See the EMCC, Miscellaneous Documents binder located with the other EMCC documentation for examples of the GOAL displays.

A second set of displays must be built at each console which wants to view them. There can be up to 3 Data Monitor (DMON) displays at each monitor. These DMON displays are simply MSIDs with titles and values displayed to the screen. This is the method for displaying the two stage buffers in the major functions. It is fairly easy to build these displays but they have a very limited capability. Figure 5.19-7 is an example of a DMON display to show the first 30 - 16 bit HEX words in the GNC two stage buffer.

```
234:1705/11 SB115A
                       5-20 CDT +00:0336/52
SM SA 0123 D123 E123 1AB 2AB 3AB 4AB 5AB 6AB SAB12
DMON V92U6169CX
TWO STAGE BUFFER #1
                      #0000
TWO STAGE BUFFER #2
                      #0000
TWO STAGE BUFFER #3
                      #0000
TWO STAGE BUFFER #4
                      #0000
TWO STAGE BUFFER #5
                      #0000
TWO STAGE BUFFER #6
                      #0000
TWO STAGE BUFFER #7
                      #0000
TWO STAGE BUFFER #8
                      #0000
TWO STAGE BUFFER #9
TWO STAGE BUFFER #10
                      #0000
TWO STAGE BUFFER #11
                      #0000
TWO STAGE BUFFER #12
                      #0000
TWO STAGE BUFFER #13
                      #0000
```

Figure 5.19-7 DMON Display

The last display tool available at the INCO's console in the LCC is a PC application called "PC GOAL". This tool has displays similar to the GOAL displays which are available on the monitors in the consoles. It is much more user friendly than the GOAL displays with an easy to use navigation tool on the left side of the PC monitor. Figure 5.19-8 is an example of a PC GOAL display.

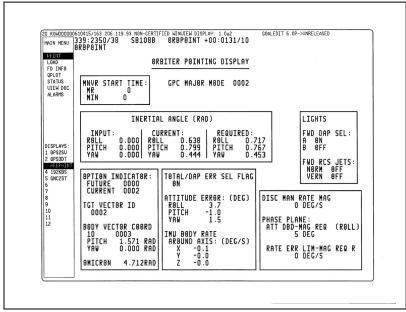


Figure 5.19-8 PC GOAL display

A version of PC GOAL is available in the MCC. This version is called "XGOAL" and is available by opening an XTERM and typein /g "/users/bseds/uncert apps/bin/run-xgoal".

## **Command Capability**

The CCMS displays for the communications and instrumentation systems were built to allow the console operator to command those systems. Each display with command capability has some form of a small box '□' shape next to the system to be commanded to. The user moves the screen cursor over the small box then presses the "1 XMIT CMD" key located in the upper left corner of the middle section of the console key board. The user needs to make sure that they have selected the correct major function and PL MDM for the commands to work. A KSC LCC representative will be located with the EMCC INCO so that they can assist with this command configuration and uplink operation.

## Voice, Telemetry and Command Flow

For EMCC deployment, voice, telemetry and command will not be routed through JSC after EMCC is activated. All the links, which will eventually reach the orbiter, will pass through the KSC support systems to Goddard Space Flight Center to the terminals (White Sands or Dryden) with the exception of MILA. Mila will support directly from KSC to the orbiter. See figure 5.19-9 for the comm configurations from the LCC to the orbiter.

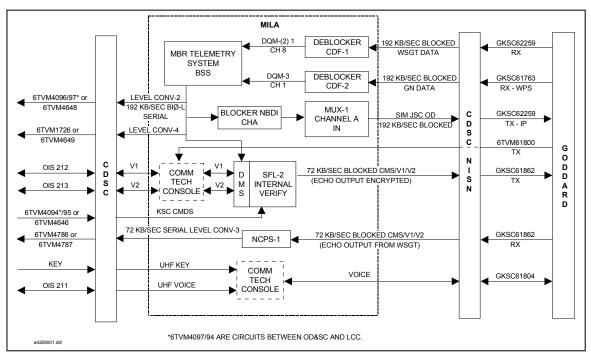


Figure 5.19-9 Communications Configuration

Uplink voice leaves the LCC firing rooms as three discrete channels (OIS 211 - UHF, OIS 212 - Air to Ground (A/G)1, OIS 213 - A/G2) to the Communications Distribution and Switching Center (CDSC), also called the "Pink Building", located near the KSC Headquarters building. From there the three voice links are sent to MILA. At MILA, the two A/G links are blocked with the command data and sent back to the CDSC from transmission to GSFC then to TDRS or other sites, unless MILA has a direct link with the orbiter. Downlink voice simply takes the reverse path through the facilities.

Commands leaving the firing rooms, goes through the CDSC to MILA where it is blocked with the A/Gs and then encrypted. The encrypted uplink is sent back to the CDSC for transmission to GSFC.

Telemetry from the orbiter is received by the ground site or TDRS, sent to GSFC which forwards it to the CDSC. The CDSC sends the telemetry and voice to MILA where the downlink is deblocked, splitting the telemetry and the two air-to-ground voice loops into individual channels. These are sent back to the CDSC for transmission to the firing rooms. The telemetry is displayed at the consoles while the voice goes to the comm panels.

#### **Document Maintenance**

Each console position is required to maintain a set of documentation that they may require during deployment to KSC. These documents are maintained by the INCO EMCC Document Engineer (EDE) per INCO Console Handbook Procedure SCP 5.18. It is the responsibility of the MPSR team to go to building 4 and collect the documents for pick up at the loading dock for building 4. The transportation personnel will not search the building for EMCC documentation.

## **Personal Gear**

The INCO that is assigned to be deployed with the EMCC is required to be prepared to report to Ellington Field at any time during the mission. They should have an overnight bag packed and ready to go. This bag may not weigh more than 12 pounds and must be a soft-sided cylindrical bag such as a gym bag or flight bag. This **bag must have a clear label** with owners name, company and contact information. It will be stored somewhere in the LCC and the security personnel require clear identification otherwise they will remove and destroy it. Ties are not required but a jacket may be needed on the airplane ride to and from KSC.

## **Pagers**

The INCO FCR operators will have been issued NASA flight pagers a few days before the mission. These pagers must be carried at all times when away from the MCC during a mission. The INCO assigned as the EMCC person, usually the ascent/entry INCO, will be notified via their assigned pager at the time EMCC is activated. Table 5.19-2 is a list of the NASA flight pagers that will be used during the mission. Any exceptions to this list are attached to the EMCC manning list which is provided to the Flight directors office before each mission.

User	Pager#
Orb 1 INCO	281-439-3096
Orb 2 INCO	281-439-3097
Orb 3 INCO	281-439-3098
Orb 4 INCO	281-439-3099

Table 5.19-2 EMCC Pager numbers

## **ACTIVATION**

### **Time Line**

The following is a listing of the flow for activating the EMCC. This is just an overview of what EMCC deployment might be; because of the dynamic nature of this activity, the flow could change in real-time depending on the circumstances.

- 1. MOD Director, FD or MMT declares an EMCC activation
- 2. FD or FCR operators contact assigned EMCC flight controller
- If not already done pre-mission, the EMCC INCO will provide to the on-console INCO
  their Social Security number as well as the correct spelling of their name to forward to the
  appropriate party (FD or GC) so that KSC security will be able to generate the
  appropriate access badges.
- 4. Crew is informed of activation
- 5. Network is informed of activation

- MSPR/FCR personnel collect the required console documentation that needs to go with the EMCC INCO.
  - a. Current SHO schedule
  - b. TDRS Satellite Acquision table
  - c. Ground site acquision table
  - d. Applicable flight notes
  - e. copy of INCO flight log
  - f. Include one of the MSPR egg timers with the documentation, since there are no good "wall clock" type displays in the LCC.
- 7. Assigned EMCC INCO proceeds ASAP, with personal gear, to Ellington Field's building 993 which is located just behind hanger 990, to board the NASA plane for the trip to KSC. See figure 5.19-10. Enter code "\*01" to get personnel in the RGO to unlock the gate during business hours. After hours, a guard will have to be called to open the gate.
- The on-console INCO should do the following if possible before EMCC assumes control from KSC
  - a. Schedule all TDRSS events as normal handovers
  - b. Schedule TDRS Z for all ZOEs to reduce recorder dump requirements
- Parking Hangar Bldg.

  Parking Parking

Locked pedestrian gate with keypad/intercom

- c. Update the on-board General Purpose Computer (GPC) TDRS state vectors
- Discuss with ACO/PLO and FD the possibility of going to TFL 161 for the duration of the activation period
- e. Determine if the ATL is updated for the EMCC activity and print out as many orbits of WAMS predictions as practical to FAX to KSC.
- f. Print out the SSR management display(s) and annotate the status of any data that needs to be dumped or protected, and FAX the copies to KSC.
- 9. An on-console MPSR flight controller, probably INST, will go to building 4 to collect the EMCC documentation in room 1010 on the right hand top self next to the door. This documentation is in white binders with red EMCC labels. They bring these books to the MCC and combine these books with the documentation gathered from the MCC. They give the documentation in its container (provided by transportation) to the transportation personnel who will take it to Ellington Field, hanger 990.
- KSC configure the LCC firing room for arrival of the EMCC flight control Team per OMI S-1032.
- 11. EMCC team flies to KSC (estimated flight time 1 hour 50 minutes). Be sure to wear ear protection (provided by the RGO) if riding on the KC 135. It is very noisy.
- 12. KSC provides transportation from the Shuttle Landing Facility (SLF) to the LCC
- 13. EMCC flight control team establishes voice communications with the crew and regains control over the mission.

#### **KSC Actions**

While the flight control team is collecting documentation and flying to KSC, the KSC team will be preparing the LCC for the team to arrive. The following is a high level review, excerpt from OMI S1032, of what they will be doing to make the firing room ready for flight controllers to use.

- 1. Firing room personnel are called to stations. They have two hours to show up in the LCC
- The LCC consoles are loaded with the appropriate software load to support the flight control team.
- SLF personnel prepare for arrival of the flight control team, with trucks for the carrying the documentation collected at the MCC and building 4. A bus or vans are dispatched to the SLF to carry the flight control team.
- 4. KSC security prepares the access badges for all members of the flight control team.
- 5. After the Firing room personnel are on station, voice, command and telemetry links are tested.
- After the Firing room is confirmed ready to support, NTD will assume responsibility of the shuttle and crew until the flight control team has entered the LCC and are ready to assume this duty.

## **OPERATION**

Once all personnel are on console, the flight control team along with the LCC staff will manage the shuttle systems and crew very similar to the way it would be done from the MCC. The flight control team will be out of their normal environment, so they will be very dependant on the LCC staff to help them with where to find information on the console's telemetry and command displays. The following explains what could be expected to be done in support of the current mission from the LCC from an INCO point of view.

## **KSC Support**

INCO will be supported by a NASA INST, USA INST, NASA Comm and a USA Comm. Use these personnel as if they were MPSR personnel but be sure to clarify any actions that are required because they do not always speak the same "lingo" that JSC flight controllers do. They are trained to operate the systems but their training emphasizes testing the systems not operating the systems.

## Voice

The OIS-D system is very limited. INCO will have an 8 channel comm panel available to use while the LCC staff with them will only have the 4 channel comm panels. INCO should attempt to limit the channels they monitor to:

A/G1 A/G2 Site/TN Coord EMCC FD EMCC INCO EMCC GC AFD (OIS 161) Possibly NTD or OTC

### **Displays**

The Comm and Inst displays available in the LCC are very different from the ones that are commonly used by the INCO team in the MCC. INCO will <u>NOT</u> have WAMS, world map, wall clocks, OIMON, inco management, SPECs, OFS or anything that will replicate these displays. INCO will have to use an egg timer at the console to keep track of AOS/LOS times for TDRS and ground site support. DPS will have to announce to the team any fault messages that get

generated since there is no display for that at the INCO console. INCO can use PC GOAL to view other systems displays if needed. The INCO that may be deployed should spend a little time using the X GOAL displays, which are available in the MCC, so that they know better what they are getting to use once they get to KSC.

## Command

INCO will be commanding the communications and instrumentation systems during EMCC operations. The KSC support personnel are very familiar with their command capability. INCO will not be able to command any loads or SPCs to the BFS. Each command load that must be uplinked is uplinked by doing a Word by Word correction of the two stage buffer in that major function. BFS does not have this capability any longer, therefore no loads can be sent to the BFS from KSC. Any RTCs other than comm or instrumentation RTCs will have to be sent by typing in the correct string of text. OMI S1032 has the skeleton for this process. Below is an example procedure for sending an RTC to command a fuel cell purge heater on. INCO should take advantage of the KSC team by letting them do most of the commanding since they are most familiar with the system. Should INCO need to command the following is an example of how that commanding will flow.

#### **EXAMPLE:**

- 1. Move cursor to the home position
- type the following:

ISSU,V45K0843U,E08A0000E88AC000,SM,

- Depress "XMIT CMD" function key
- 4. Depress "EXEC CMD" function key

INCO commands to the communications and instrumentation systems are done via the GOAL displays. It is a fairly simple process of moving the display cursor to the box next to the function to be commanded then press the "XMIT CMD".

There are several commands that have already be documented in the KSC OMI S1032 for use during EMCC. The following is a list of these commands.

Deorbit Guidance Peg 4 Load Deorbit Guidance Target Peg 7 Load Deorbit landing Site Parameters Load **Deorbit TACAN Parameters** Orbiter State Vector **IMU** Accelerometer Bias IMU Gyro Bias Load Ku/S Band Antenna Control MDM Bite Data Read On-orbit Guidance Targets Peg 7 Load PCMMU Telemetry and PDI Decom Format Load RCS Quantity Monitoring Load Table Maintenance Block Update - NOT BFS TDRS State Vector Load Variable D/L Select Vent/RCS Body Force Vector Load

To command one of these loads above the INCO will have to follow the procedures for each one in the OMI. Each of these procedures starts the same way. The INCO will command via typing in the following sequence:

ISSU V74K3000UU,, GN&C,,,MULTIPLE
 Depress the "XMIT CMD" key
 Depress the "EXEC CMD" key

- 4. WBWC,GN&C,0,8E46
- 5. Depress the "XMIT CMD" key
- 6. Depress the "EXEC CMD" key
- Repeat steps 4 through 6 until changing the command data word number just after the GN&C and the command data word.
- 8. INCO and the originator of the command, visually verify the contents of the two stage buffer by looking at the DMON display with the buffer appropriate MSIDs (FDs at KSC).
- 9. If the two stage buffer is verified
  - a. Type: TSBR EXECUTE GN&C
  - b. Depress the "XMIT CMD" key
  - c. Depress the "EXEC CMD" key
- 10. Verify the two stage buffer is empty.

To monitor the SPC and TEC buffer command count, a DMON will need to be built. The MSIDs are:

V92U6105C SM SPC Buffer
V92J1126C SM TEC Buffer
V98J4298C BFS SPC Buffer

NOTE: If executing an entry and landing from EMCC, the only way to inhibit pointing of

the S Band antennas post landing is to have the crew go to manual antennas on

panel C3 and A1.

NOTE: KSC can not assemble the 216 KBPS Ku band forward link. If Ku band forward

is required the Ku band system will have to be commanded to mode 2 forward.

## **DEACTIVATION**

Once EMCC support is no longer required, the flight control team will collect their paperwork, shut down any special equipment they brought from JSC and head to the SLF to be transported back to Ellington Field. If the reason EMCC is no longer required is because of a successful landing of the orbiter, the EMCC team will handover control of the orbiter after the crew has egressed the cabin as they would for a normal landing. The KSC personnel will assume responsibility and execute their OMIs for post-landing operations.

## REFERENCE DOCUMENTS

450-CAP-EMCC Human Spaceflight Program Emergency Mission Control Center Activation and

Operations Procedures (GSFC)

OMI S1032 EMCC Activation and Support (KSC)

# **TITLE**

# INCO SYSTEMS POWERDOWN OPTIONS

# **GENERAL**

This document lists the INCO systems that may be considered for powerdown during a power saving mode outside the realm of a Procedural Group Powerdown.

		·	
<u>LRU</u>	Power usage (W)	Consequences	Powerdown procedure
FM System  Modular  Memory	81.1	Typically powered down during a Group B Priority Powerdown. Used mostly in support of SSR dumps and for TV downlink Typically, one MMU is powered down after post-insertion and powered back up before	Group B (as reqd) Group C Group B (MMU 2)
Unit/Solid State Recorder		deorbit prep. Do not consider powering off both MMUs. If the other MMU is powered down, there will be no way to load software into a GPC or record OI data.	Group 1 (MMU 2) Group 7 (MMU 1, both powered off)
UHF XCVR	25 (RCV) 35 (KEY)	Do not consider powering off if another voice link is already lost. If powered off, then single fault tolerant on the voice loops. If no capability	
PA	160 (KEY)	exists on the ground to command the vehicle out of this situation, will have to depend on the crew to power UHF back on in this case	
SSOR	56 (high power) 30 (low power)	The SSOR is typically turned off except during EVAs and rendezvous/undock.	
MADS	5 (off) 59 (STBY and POWER ON)	Other than ascent and entry phases, the MADS recorder is typically powered down.	Group B Group C Group 2
OV-103 MCM only Total in		Occasionally, DTO's have requirements for MADS recorder - data collection, and whether these requirements are to be adhered to will need to be decided on a mission-by-mission	Gloup 2
Rcd Cont.	20.7	basis.	
OV-104 MCM only Total in Rcd	602		
Cont. OV-105	20.7		
MCM only Total in Rcd	349		
Cont.	20.7		
	500		
PDI	27	During missions in which there are no P/L data telemetry processing requirements through the PDI, it may be powered off. However, when the PDI is powered off, it will mask PCMMU element bypass checks on several SM GPC	Group C
PSP	32	tables because these tables will be bypassed Mission payload requirements will determine the need for allowing the PSP to be powered down. Potential loss of command and/or	Group C
PI	98	telemetry link to specific payloads See PSP references. Do not power down during phases of flight for which the PI is	Group C

<u>LRU</u>	Power usage (W)	Consequences	Powerdown procedure
		required to support RF payload operations	
PCMMU	68	Do not power off the operating PCMMU. Without an operating PCMMU, no telemetry will be received or be recoverable on the ground. Voice will still be available	
OI MDM	41-47	Do not power down any OI MDM's	
OI DSC Poweramp	9-32 11(STBY) 387(OPERATE)	Do not power down any OI DSC's Do not power off the operating PA. The other PA is placed in off except during high activity periods. The PA is used in TDRS and STDN HI modes for S-band return link amplification	
Transponder	59(Direct mode) 41(TDRS mode)	Do not power off the operating Transponder since it is the onboard transmitter and receiver for the forward and return link S-band signals	
Preamp	20	Do not power off the operating Preamp since it is needed for S-band forward link amplification in TDRS and STDN HI modes	
Antenna Switch Elec.	0.6	Do not power off the operating Antenna Electronics. It is needed for automatic antenna selection.	
NSP	29	Do not power off the operating NSP. If the NSP is powered off, the only available comm link will be voice through UHF. Data will not be recoverable	NSP 1 - Group 7: MDM FF1 - OFF
Comsec	2.5(STBY) 25(OPERATE)	The capability exists to fly in the clear (encryption bypass) on the uplink. The crew would be responsible for controlling the uplink block switch to comply with Flight Rule 11-3. It is recommended that the operating Comsec not be powered off except in the case of redundant Comsec failures	
GCIL	51	When the GCIL loses both power sources, all systems fail to panel mode	
Ku-Band Standby: Comm Mode w/o htrs w htrs	262 567	Do not power down the Ku-band. Power is needed to stow the antenna. Do not power off the heaters while Ku-Band is in standby or the gimbals may freeze. The heaters generally are not activated for very long after the initial warmup period with one exception, the transmitter heater.	Group B - as reqd Group C - 2 hrs/day max Group 5 - Stow and htr cbs open
Radar Mode w/o htrs w htrs On:	262 567	uansmiller nealer.	
Comm Mode w/o htrs w htrs Radar Mode	527 832		
w/o htrs	442		
w/ htrs ACCU	747 40	Do not power down the current operating ACCU since all voice loops would be lost	
ATU Transmit Receive	12 4	The power consumption on the ATU's is so minimal, 4 W, when no signal is present that powering off an ATU does not significantly contribute to any power savings	
CCTV VCU	46	Do not power off the VCU unless there are no requirements for camera/video operations. If	Group 6 (cameras)

<u>LRU</u>	Power usage (W)	Consequences	Powerdown procedure
CTVC heaters ITVC heaters	19 26 33 13 22	powered off, the VCU defaults to sync mode When not in use, keep cameras powered down. Powering off the heaters for an extended period of time may damage the cameras, so it would not be recommended	Group 6
DTV Mux VTR VIP	30 31 7	DTV is typically turned off when it is not being used.	
SSV	12	SSV is typically turned off when it is not being	
OIU	35	used. The OIU is used as an alternate ISS command and telemetry path when the shuttle is docked.	Group 3B (PL PWRDN)
VPU	2.7	It may be powered off if ISS does not need it. Power to the VPU is required for ISS video routing and sync/command for keel 1, pri and sec C/L, and mission cameras. Other VPU functions (including the WIB) do not need power. The VPU uses a very small amount of power, so very little would be gained	
CCTV monitors WVS	56(each)	Do not power off the monitors unless there are no requirements for camera/video operations The Wireless video transceivers are nominally	
transceivers	80 (40 each)	powered off when they are not in use (used for EVA). Powering off the heaters for an	
heaters and antenna electronics	335 (30 for each antenna heater, 5 for each antenna electronics, 45 for each transceiver heater)	extended period of time may damage the antennas and transceivers, so it would not be recommended	

#### **TITLE**

#### DIGITAL TELEVISION SYSTEM RESOURCES ON CONSOLE

#### **GENERAL**

This document outlines resources available for analyzing and troubleshooting the DTV system.

# **DTV** lead engineer

- Clint Baggerman

e-mail: clinton.d.baggerman@nasa.gov

office phone: x37491 cell phone: (832) 385-4212

## **DTV Telemetry Webpage**

http://ea.isc.nasa.gov/eawebfiles/EA-Projects/flightgfe/Dtv/Html/DTVControlConsumer.HTM

- This webpage is used for viewing real-time DTV telemetry from MCC's DTV downlink processing equipment. It contains MUX telemetry and CCTV telemetry from the VIP decoder.

# **DTV Project Homepage**

http://ea.jsc.nasa.gov/eawebfiles/EA-Projects/flightgfe/Dtv/Html/DTVControlConsumer.HTM

- A source for detailed technical documents on the DTV system as well as overviews

## **INCO** documents

- -SSSH 16.2 sheet 4
- -System Brief 76
- -SCP 4.23, No DTV Downlink

# Photo/TV Book, section 12

- DTV Setup A guide for the crew on how to set DTV up
- DTV Specifications Technical data on the DTV system
- DTV Nomenclature Outlines decals present on the DTV equipment
- DTV Functional Schematic Overview of DTV connectors and interfaces
- DTV VTR Clock Set
- DTV MAL procedures
  - No Video at VTR Monitor
  - No Digital Downlink Video at MCC
  - MUX Power LED's Off
  - MUX Channel 3 Data LED Off
  - VIP Power LED Off
  - VIP Data Flow LED Off
  - VTR On/Standby Red LED Off
  - VTR Starts Recording or Rewinds and Starts Playing After MUX Power Applied
  - VTR Tape Controls Not Functioning (VTR Displays Indicates "ERR")
  - VTR Displays Error Message 32
  - VTR Displays Error Message 21
  - VTR Automatically Powers Off
  - VTR Automatically Rewinds at End of Tape

### **IFM BOOK**

- -DTV/MUX REPLACEMENT WITH SPARE In the event of a mux failure, this will change it out with one stowed away in a mid-deck locker
- The VTR can also be changed out with a spare. This will require a hip pocket IFM
- In the event of a VIP failure, there is no spare. However, the VIP can be bypassed by disconnecting the J3 input and routing it to the VTR. This will require a hip pocket IFM. The DTV can still digitize video, but there will be no vertical interval data or audio with the digital video.

## **SDI Monitor**

- To view DTV downlink, press the "C/SDI" and "Line/RGB" buttons such that both are illuminated.
  - To view analog TV, press the "A/RGB" button such that it is illuminated and all the others are not.

# **Ground Processing Equipment**

- Stat Mux located at White Sands
- Stat Demux located at MCC Ground Control
- DTV rack (and spare) located at Houston TV in MCC. This rack contains a DTV demux, VTR, and VIP decoder.

**SCP 5.22** 

#### TITLE

FOCUSED INSPECTION PROCEDURES USING SENSOR PACKAGE 2

## **GENERAL**

Sensor package 1 (LASER Dynamic Range Imager (LDRI) & Intensified TeleVision Camera (ITVC)) is used to perform the inspections of the starboard forward RCC, nose cap, and port forward RCC. Ground imagery personnel, including the Thermal Protection System (TPS) Image Coordinator (TIC), are viewing/recording this video information and performing in-depth analysis to verify orbiter integrity. If the video data indicates the possible delamination, fracture, or holes that can potentially compromise the shuttle's thermal protection, the Flight Control Team or Mission Management Team may require a more detailed scan/3-dimensional profile in a relatively small area to determine extend of the damage.

It is the TIC's responsibility to provide the best sensor/software to obtain the most optimized detailed scan of the compromised area. TIC will review details of the area (location/color/shape), the flaw (delamination/puncture/erosion), and select the best sensor to analysis the area. It is INCO's responsible to merge the TIC's request into either a procedure or Flight Note to allow the crew to work with pre-existing procedures. This SCP documents the basic pros/cons of the individual sensors, how INCO interacts with both PDRS and TIC for sensor constraints and positions, and specific software the crew must run to activate Sensor Package 2.

#### COMMAND RESTRICTIONS/CONSTRAINTS

 Time constraints, crew coordination requirements: Crew coordination is required to prevent downlinking MIDDECK PAO camera during inappropriate times.

## **PRIORITIES**

1. In general, TIC has assigned the following sensors as Primary and Backup for focused inspections:

Primary 3D: Sensor Package 2 – Laser Camera System (LCS)

Primary 2D: Sensor Package 2 – ISIS Digital Camera (IDC)

Backup 3D: Sensor Package 1 – Laser Dynamic Range Imager (LDRI)

Backup 2D: Sensor Package 1 – Intensified Television Camera (ITVC)

TIC may request a backup sensor for specific reasons. Examples are: the primary sensor has either failed, cannot be positioned to image the target, or cannot obtain correct incidence angles.

In general, TIC will try to drive PDRS to a particular position to use either Sensor Package 1 or 2. In a lot of cases with the singularities exhibited on the shuttle ARM/OBSS, only Sensor Package 1 is available because of the versatility of the PAN/TILT LRU.

## DAMAGED AREA REQUIRED SCANS

In general, TIC uses specific guidelines in imaging a suspected damaged area as follows:

**Tile Cavities** require 3D Data with at least two incidence angles for deep (or unknown depth) cavities. One angle is normal to the tile surface, the other is looking into the cavity sidewall where any burrowing

may have occurred (generally placed forward looking aft at an angle approximately 30 deg from the normal to the tile).

**Reinforced Carbon (RCC)** requires 2D Data with two opposing incidence angles. The first angle will be +30 to +45 degrees from surface normal while the second angle should be -30 to -45 degrees from surface normal.

**Gap Fillers** can be accomplished with 3D or 2D data with an order of preference: LCS, IDC, ITVC, LDRI. Only one incidence angle - 30 to 60 degrees off normal to tile surface, imaging the long edge of the protruding gap filler is required.

**Thermal Barriers** requires both 2D and 3D data. Two incidence angles are required with the first normal to the tile surface and the second looking at a cavity sidewall (at an angle approx 30 deg from the normal to the tile) where any breach may have occurred

ET Door Closure requires 3D data with one incidence angle required (normal to tile surface).

#### FLIGHT CONTROL ROOM PROCEDURE FOR HANDLING TIC REQUESTS

- 1. TPS Inspection Coordinator (TIC) should submit a very detailed chit with lighting, dimensions, scan rates, etc. TIC will need to translate this data (using SENSORS aid) to direct INCO and PDRS to the best available sensor, any lighting requirements, whether the scan will be dynamic or static, and any software the crew must operate.
  - a. If sensor package 1 is used, PDRS will normally write the entire procedure including LDRI Activation using Mode 6 for a good 3D scan. INCO should verify this procedure and the LDRI activation.
  - b. If sensor package 2 is used, PDRS will normally only write the procedure to get the arm in position. It is INCO's responsibility (with TIC's aid) to provide a Flight Note (FN) to detail out which Pre-Loaded LCC Scan and IDC software sets the crew will perform.
- 2. If sensor package 2 is used, contact PDRS and determine:
  - a. If the inspection will be a "Static" Picture or the SRMS will be dynamic.
  - b. The distance between the sensors and the inspection point.
  - c. The basic points needed to be scanned. It might be practical to bring a basic shuttle model to highlight the focused inspection areas.
- 3. Inform TIC to logistically move the individual, who is manning the specific SENSORS position (LCS and/or IDC), to the FCR to help write the FN. This action aids the Flight Director/Crew in getting a quick response to any questions.
- 4. Verify pertinent Flight Rules for Window Hatch or RF protection needed during LASER scans.
- 5. Write a Flight Note directing the crew to the specific LCC/IDC scans that are going to be needed.
- 6. Do not perform LCC deactivation until OCA has verified all images are down on the ground and verified.

#### AN EXAMPLE OF A FLIGHT NOTE USING SENSOR PACKAGE 2

The following is an example of a Flight Note generated to perform inspections on a 1/8 inch hole which protruded through the Orbiter's hull port side of the cabin, forward of the Side Hatch. The LCS was used to physically map the hole and determine physical depth and shape. The IDC was used because it is the best sensor for small defects.

This procedure assumes the following Actions are already performed:

- LCH Activation (turns on the Heaters & Sensor Software)
- LCC Activation (turns on the PGSC & loads LCC application)
- LCC Deactivation (Turns off Sensors & PGSC, but maintains heaters)
- LDRI Activation Mode 1
- TIC has determined they want to use Sensor Package 2. LCS determines preloaded Area Scans 14 and 16 will obtain all necessary information about the damage in 3D. IDC wants a preloaded Scenario File called, "Black Tile Night" if this occurs during Night or "Black Tile Day" to examine the area for Fine Detail damage.
- 1. Once the OBSS is in position wait 90 seconds for vibrations to dampen out.
- 2. Verify Side Window Hatch and Port Crew Cabin Hatch are Installed.
- 3. Remove Middeck PAO Camera Sony PD100 from AVIU Port.
- 4. Configure CCTV MidDeck -- Spare (SSV)
- 5. LCS Inspection (~ 6 minutes)
  - a. LCC Activation (turns on the PGSC)
  - b. Sel Area Scan 14 (Area Scan 14 was determined by TIC)
  - c. Sel Area Scan 16 (Area Scan 16 was determined by TIC)
- 6. Configure LDRI Mode 2, Pan/Tilt to obtain lighting for the IDC.
- 7. IDC Inspection (~ 5 minutes)
  - a. Perform IDC Software Activation (IDC Cue Card, Photo/TV)
  - b. Perform IDC Operations Steps 1,2 & 3 for Night Conditions or Steps 2 & 3 for Daylight
  - c. Use File Scenario File "Black Tile Night" if this occurs during Night or "Black Tile Day" for Daylight Ops
- 8. MCC will contact the Crew once all the files are OCA'ed down and verified.
- 9. Perform LCC Deactivation (LCS Cue Card, Photo/TV)

TITLE

COMM-RELATED ONBOARD FAULT MESSAGES

# **PROCEDURE**

Note: The messages below are class 3 messages and will generate a C/W tone and light.

MF	Message	NF	Possible causes	Malf no.
SM	S76 GCIL FAIL	15	The ground control interface logic (GCIL) is configured to panel mode (V74X5052E = 0)	2.2a
SM	S76 COMM CAM TEMP	15	The video switch unit (VSU) detected a camera at >45° C (V74X0847E = 1), any async source being used while the VSU is in synchronous mode	N/A
SM	S76 KU-XMTR TEMP	15	Ku-band transmitter temp >171° F (V74T2497A)	2.2a
SM	S76 KU-GMBL A(B) TEMP	15	A Ku-band antenna gimbal is over its temperature limit. "A" limit (V74T2965A) is 150° F or "B" limit (V74T2969A) is 166° F	2.2a
SM	S76 KU-GYRO TEMP	15	Ku-band gyro temperature >155° F (V74T2967A)	2.2a
SM	S76 COMM PA2(1) TEMP	15	S-band power amplifier temperature >230° F (V74T4514A or V74T4515A)	N/A
SM	S76 PA2(1) OUTPUT LOW	15	S-band power amplifier power output <60 W (V74E4512A or V74E4513A)	N/A
SM	S76 NSP 2(1) BITE	15	A Network Signal Processor (NSP) Built-In Test Equipment (BITE) indicates a failure (V74X5184E or V74X5185E)	N/A
SM	S76 COMSEC 2(1) BITE	15	Network comsec 2 or 1 indicates a BITE failure (V74X5003E or V74X5004E) Precondition: NSP 2(1) is receive encrypted (V74X5590E or V74X5390E)	N/A
SM	ANTENNA	8	The commanded and reported S-band antennas do not agree, the panel C3 ant. switch is in GPC, and the SM antenna pointing is enabled. The antenna electronics or MDM OF3 is failed or command path (PL MDM)	2.3b
SM	S62 BCE BYP OF A	2 <sup>a</sup>	MDM OF1 or OF2 failure, card failure in OF1 or OF2, OF1/OF2 data path to the PCMMU failure	2.4a
SM	S62 BCE BYP OF B	2 <sup>a</sup>	MDM OF3 or OF4 failure, card failure in OF3 or OF4, OF3/OF4 data path to the PCMMU failure	2.4b
SM	S62 BCE BYP OA	2 <sup>a</sup>	MDM OA1, OA2, or OA3 failure; card failure in OA1, OA2, or OA3; OA1/OA2/OA3 data path to the PCMMU failure	2.4c

<sup>&</sup>lt;sup>a</sup>Noise filter NF is part of the system software and cannot be modified.

MF	Message	NF	Possible causes	Malf no.
SM	S62 BCE BYP PL	2 <sup>a</sup>	PDI port failure, PCMMU port failure, PDI to PCMMU data path failure	2.4d
SM	S62 BCE BYP PDI	2 <sup>a</sup>	PDI P/L bus port failure, GPC P/L port failure, PDI to GPC data path failure	2.4e
SM	S62 BCE BYP PSP 1(2)	2 <sup>a</sup>	PSP 1(2) to PF 1(2) MDM interface failure, PSP powered off, PSP power supply failure	2.4f
SM	S62 PDI DECOM FAIL	2 <sup>a</sup>	PDI DECOM 1(2,3,4) failure, P/L to PI RF link failure, P/L TLM output to PDI failure, PSP to PDI hard line failure, nonzero source with a PDI BSR word bypassed	2.4g
			Preconditions: If no frame sync, no word sync, or no bit sync, and FDA is enabled, then set the message	
			else, if PDI BSR is comm faulted and a source is greater than 0	
SM or BFS	I/O ERROR PCM	2 <sup>a</sup>	PCMMU failed to respond to the SM or BFS GPC	5.5a or 5.5b
SM or GNC	I/O ERROR D/L	2 <sup>a</sup>	SM or GNC downlister GPC detected a busy I/O PCMMU MIA when a downlist write was attempted	5.5c
GNC or BFS	BCE STRG 1(3) NSP	2 <sup>a</sup>	I/O error between NSP 1(2) and GNC or BFS GPC	5.3b
SM	BCE BYP KU	2 <sup>a</sup>	I/O error between PF1 MDM card 8 channel 2 interface to SM GPC	N/A
BFS	TFL FAIL	1	TFL checksum on LDR TFL readback miscompared with checksum of the loaded LDR TFL	N/A
SM	212 OIU TEMP	10 <sup>a</sup>	The active OIU (1or 2) has a power supply temperature greater than 212°	N/A
SM	212 OIU CONV ERR	10 <sup>a</sup>	The active OIU has an error converting floating point values from the bus controller unit	N/A
SM	212 AD1(2,3,4) NOLK	10 <sup>a</sup>	The active OIU (1 or 2) is no longer processing the data from an active device (1,2, 3 or 4)	N/A

<sup>&</sup>lt;sup>a</sup>Noise filter NF is part of the system software and cannot be modified.

MF	Message	NF	Possible causes	Malf no.
GNC	G33 RNDV RADAR	1	Ku-track (V74X2903B) = 0 and was 1 on the previous 1-second cycle	N/A
			Preconditions 1. No COMM faults 2. In radar mode (V74X2883B = 1) 3. In GPC ACQ (V74X2886B = 1) 4. No self-test in progress (V74X2892B = 0) 5. RNDZ NAV is active	
(Note:	The following message	s are	class 4 messages and will NOT generate a C/W tone or	a light.)
SM	ITEM RJCT PSP		A rejected or incomplete PSP CC SPEC (Cargo Control SPEC) item entry was made	N/A
SM	TLF LOAD FAIL		TFL checksum miscompared on readback after attempting to load an LDR or HDR TFL, or an OPS transition was in progress during a TFL load, or the SM common buffer or mass memory unit was busy before the attempt to load a TFL was made	N/A

(Note: See the SM FSSR for more information on how these messages are generated.)

# TITLE

SUGGESTED ACTIONS FOR OI MDM AND DSC CARD FAILURES AFFECTING INCO

# **GENERAL**

The following tables give suggested actions for card failures in the PL MDM, OI MDM and DSC's that contain INCO parameters.

MDM	Card	Lost	Action
		PCMMU 1 format select switch (GPC, program)	None
	2	MADS recorder motion	Verify motion by changes in % tape
		DSC OF1 BITE	Verify the data from the DSC via the raw_data display
		SSR 1 telemetry bits	Use SSR 2
	3	Ku-band antenna feed and gyro temperature	Stow Ku-band antenna for the loss of insight into the gyro temp (flight rule A11-57) unless otherwise noted in flight-specific rules
OF 1	4	MADS recorder BITE, mode and sequence 1 - 2	Verify proper operation via % tape change and direction expected
		PCMMU 1 RPC A	None
	6	MADS MCM sequence 3	None
	10	SSR 1 telemetry bits	Use SSR 2
	11	MADS recorder % tape	Verify nominal operations via mode and motion indications
		COMSEC 1 RPC A	None
	12	PCMMU 1 power switch	LDR TFL may not be loaded by the BFS during a PCMMU swap
		PDI RPC A	
		PCMMU 2 RPC A	None
		COMSEC 2 RPC A	None
	14	PCMMU 2 power switch	LDR TFL may not be loaded by the BFS during a PCMMU swap

MDM	Card	Lost	Action
		PSP 1 frame and bit sync lock	Use PSP 2, if required
	2	DSC OF 2 BITE	Verify data from the DSC via the raw_data
			display
		SSR 2 telemetry bits	Use SSR 1
		PI sweep narrow	None
	4	PI 1 input power, channel select 1	None
		PI 2 input power, channel select 2	None
		PCMMU 2 RPC B	None
		PI freq sweep on, sweep wide, RF	Verify payload receiver lock and AGC with
		low power switch, modulation on	the Payload Officer
	6	PI 1 phase lock, channel select 2,	Use PI 2
		10, 80	
OF 2		PI 2 channel select 4, 20, 100	None
	8	PI 1 and 2 AGC, RF out, loop stress	None
		TACAN 2 and 3 AGC	None
		PSP 2 bit and frame sync lock	Use PSP 1
		PCMMU 2 format select switch	None
	10	(GPC, program)	
		SSR 2 telemetry bits	Use SSR 1
		PI 1 channel select 4, 20, 100, 400	None
		PI 2 channel select 8, 40, 200, 400,	Use PI 1
	12	phase lock	
		COMSEC 1 RPC B	None
		PI 1 channel select 8, 40, 200, 800	None
	14	PI 2 channel select 1, 10, 80, 800	None
		PI RF power high and medium	Verify payload receiver AGC with the
		switch	Payload Officer
	15	BIOMED ECG channel 1 and 2	Report loss to the Surgeon and EVA officers

NSP 1 BITE, bit and frame sync lock, receive, transmit, and record encrypted   NSP 1 and 2 command validity   None	
lock, receive, transmit, and record encrypted  NSP 1 and 2 command validity  DSC OF 3 BITE  COMSEC 1 and 2 authenticate and frame sync  COMSEC 1 BITE, receive and transmit full-operate, alarm, zeroized  Ku-band alpha gimbal temperature  Ku-band alpha gimbal temperature  XPNDR 1 phase lock, power on Antenna elec. 1 power  Preamp 2 heater on  GCIL frequency low, STDN high power mode, NSP transmit HDR, receive coding on  Power amp 1 operate  Beam control 1 and 2 power on  Verify data from the DSC via the radisplay  Verify data from the DSC via the radisplay  Stow Ku-band antenna (light rule unless otherwise noted in flight-sprules  Use XPNDR 2  Use Antenna elec. 2  Verify state with ground sites	ecific
DSC OF 3 BITE  2 COMSEC 1 and 2 authenticate and frame sync COMSEC 1 BITE, receive and transmit full-operate, alarm, zeroized  Ku-band alpha gimbal temperature  3 XPNDR 1 phase lock, power on Antenna elec. 1 power Preamp 2 heater on GCIL frequency low, STDN high power mode, NSP transmit HDR, receive coding on Power amp 1 operate Beam control 1 and 2 power on  Verify data from the DSC via the redisplay Use GNC, SM, or BFS frame sync determine command link status Use NSP/COMSEC 2  Stow Ku-band antenna (flight rule unless otherwise noted in flight-spirules  Use XPNDR 2 Use XPNDR 2 Use antenna elec. 2 Use Preamp 1 Verify state with ground sites  Verify state with ground sites	
COMSEC 1 and 2 authenticate and frame sync determine command link status  COMSEC 1 BITE, receive and transmit full-operate, alarm, zeroized  Ku-band alpha gimbal temperature  XPNDR 1 phase lock, power on Antenna elec. 1 power Antenna elec. 1 power  GCIL frequency low, STDN high power mode, NSP transmit HDR, receive coding on  Power amp 1 operate Beam control 1 and 2 power on  Verify beam switching via telemetr	
frame sync  COMSEC 1 BITE, receive and transmit full-operate, alarm, zeroized  Ku-band alpha gimbal temperature  XPNDR 1 phase lock, power on  Antenna elec. 1 power  Preamp 2 heater on  GCIL frequency low, STDN high power mode, NSP transmit HDR, receive coding on  4 Power amp 1 operate  Beam control 1 and 2 power on  Use NSP/COMSEC 2	_
transmit full-operate, alarm, zeroized  Ku-band alpha gimbal temperature  Stow Ku-band antenna (flight rule unless otherwise noted in flight-sprules  XPNDR 1 phase lock, power on Antenna elec. 1 power Use XPNDR 2  Antenna elec. 1 power Use antenna elec. 2  Preamp 2 heater on Use Preamp 1  GCIL frequency low, STDN high power mode, NSP transmit HDR, receive coding on  Power amp 1 operate Beam control 1 and 2 power on Verify beam switching via telemetr	to
3 unless otherwise noted in flight-sprules  XPNDR 1 phase lock, power on Use XPNDR 2  Antenna elec. 1 power Use antenna elec. 2  Preamp 2 heater on Use Preamp 1  GCIL frequency low, STDN high power mode, NSP transmit HDR, receive coding on  4 Power amp 1 operate  Beam control 1 and 2 power on Verify beam switching via telemetr	
Antenna elec. 1 power  Preamp 2 heater on  GCIL frequency low, STDN high power mode, NSP transmit HDR, receive coding on  Power amp 1 operate  Beam control 1 and 2 power on  Use antenna elec. 2  Use Preamp 1  Verify state with ground sites  Verify state with ground sites	
Antenna elec. 1 power  Preamp 2 heater on  GCIL frequency low, STDN high power mode, NSP transmit HDR, receive coding on  Power amp 1 operate  Beam control 1 and 2 power on  Use antenna elec. 2  Use Preamp 1  Verify state with ground sites  Verify state with ground sites  Verify state with ground sites	
OF 3  GCIL frequency low, STDN high power mode, NSP transmit HDR, receive coding on  Power amp 1 operate Beam control 1 and 2 power on  Verify state with ground sites	
OF 3 power mode, NSP transmit HDR, receive coding on  4 Power amp 1 operate Beam control 1 and 2 power on  Verify beam switching via telemetr	
receive coding on  4 Power amp 1 operate  Beam control 1 and 2 power on  Verify beam switching via telemetr	
4 Power amp 1 operate None Beam control 1 and 2 power on Verify beam switching via telemetr	
Beam control 1 and 2 power on Verify beam switching via telemetr	
Antenna switch S2A and S3B on None	у
FM antenna switch S5A on None	
Power amp 2 standby power on Expect a possible 140-second time	out
delay before recovering data wher	
switching to PA 2  5 Ku radar transmitter temperature None	
Preamp 1 heater on Use preamp 2	
GCIL high frequency, SGLS mode, Verify state with ground sites	
transmit coding on, source Ku,	
active	
Power amp 2 operate None	
Ku-band GPC acquire, HDR - PL None analog, LDR - PL digital, standby on	
FM antenna switch S5B on None	
PM antenna switch S4A on None	
Power amp 1 standby power on Expect a possible 140-second time delay before recovering data where switching to PA 1	
Antenna elec. 2 on Verify antenna switching	
Antenna switch beam select ULF, ULA, URF, URA, LLF, LLA, LRF, LRA	

MDM	Card	Lost	Action					
	7	UHF 296.8 receiver AGC	None					
		SSOR RF PWR output	Notify crew of larger keep-out zone					
		XPNDR 1 and 2 AGC, phase error, RF out	None					
	8	Ku receiver AGC	None					
		PA 1 and 2 temperature and reflected power	None					
		FM 1 and 2 RF out	None					
		COMSEC 2 BITE, transmit and receive full-operate, alarm, zeroized	Use NSP/COMSEC 1					
	10	NSP 2 bit and frame sync lock, receive, transmit and record encrypted	Use NSP/COMSEC 1					
		SSOR PRI FS & SIG PROC, SEC FS & SIG PROC status	None					
	11	UHF 259.7 receiver AGC None						
		NSP receive HDR and LDR, record voice on	None					
OF 3	12	Ku-band pointing GPC designate, HDR - PL digital, LDR - MMU1	Have the crew configure the switches on panel A1 to the desired state					
		GCIL spread spectrum disable, transmit coding off, Ku power on, transponder transmit/receive mode, TDRS mode, XPNDR 1 direct	Have the crew configure the switches on panel A1 to the desired state					
		FM 1 power on	Verify via RF out and ground signal strength					
		XPNDR 2 lock, power on	Verify via NSP bit and frame lock					
		Preamp 1 and 2 power on	None					
		Antenna switch S1A and S4B on	None					
		PCMMU 1 RPC C	None					
	14	GCIL - XPNDR 2 direct, STDN low power, Ku auto track, LDR - MMU2, ranging off, Ku failsafe enable, HDR - TV, NSP rcv coding off, NSP xmit LDR, record voice on	Have the crew configure the switches on panel A1 to the desired state					
		FM 2 power on	Verify via RF out and ground signal strength					
		UHF 243.0 and 279.0 receiver AGC	None					
		Antenna switch S3A on	None					
		PDI RPC C	None					
	15	NSP 1 and 2 bit error rate	None					
		SSOR input current	Verify SSOR power is on					

MDM	Card	Lost	Action				
		BIOMED channel 1 select switch position	None				
	0	BIOMED channel 2 select switch position	None				
		DSC OM2 BITE	Verify data from the DSC via the raw_data display				
		CCTV sync normal, TV downlink inhibit	None				
		Ku radar output high	None				
	2	PNL C3 - Antenna switch position ULF, URF, LLF	None				
		Ku-band LDR - PI	None				
		UHF PA switch off	Verify that the UHF is in high power by doing a voice check				
		XPNDR low frequency	None				
	3	DSC OM1 BITE	Verify data from the DSC via the raw_data display				
OF 4		CCTV sync reverse, main A power source	None				
		S-band PM panel switch	None				
		FM data source - MMU1	None				
	4	UHF guard transmit/receive, and simplex	None				
		PSP 1 power on	None				
		PNL C3 - Antenna switch position LRF, ULA	None				
		FM data source - DOD, SSME	None				
		S-band return link enable	None				
		CCTV power source main B, panel command switch	None				
		PDI power on	Verify that the PDI is still powered by monitoring the PDI telemetry				
	5	UHF simplex + guard	None				
		FM antenna switch transmit upper/receive lower	None				
		GCIL power supply 1 on	None				
		PNL C3 - Antenna switch position URA	None				
		PSP 2 power on	None				
		DSC OL 1/2 power switch on or CNTL AB2	Verify data from the DSC via the raw_data display				

MDM	Card	Lost	Action
		FM data source - TV	None
		UHF frequency selected - 296.8	None
		GCIL - XPNDR in high frequency	None
	7	PSP command link umbilical	None
		PNL C3 - Antenna switch position GPC	None
		CCTV selected PL1 or FWD bay selected	None
		DSC OR 1/2 power switch on or CNTL AB3	Verify data from the DSC via the raw_data display
		Ku radar passive mode	None
		FM data source MMU2 or PL analog	None
	10	CCTV source select PL 2 or keel	None
		PL power switch - PI only	None
		Ku HDR - PL MAX	None
		Ku panel command switch position	None
	12	CCTV source select PL 3 or aft bay	None
		SSOR string select	None
		Ku LDR - PI	None
OF 4		CCTV sync A selected, source selected flight deck, middeck and starboard RMS, gamma white and black stretch, overtemp	Cycle though the camera to view their temperature at least once per rev
		Ku antenna manual slew	None
	13	PI frequency sweep off	None
	. •	COMSEC encryption power	None
		PL power switch - PSP only	None
		SSOR encryption on	None
		FM antenna switch transmit lower/receive upper	None
		COMSEC 1 zeroize switch	Use COMSEC 2
		CCTV source select cabin camera 3, port RMS	None
		UHF squelch switch	None
		FM panel command switch	None
	15	PI modulation on switch	None
		Ku radar output - medium	None
		NSP 1 PSS voice enable	None
		PNL C3 - Antenna switch position LLA	None
		PSP source interrogator	None
		MDM OA 1/2/3 power switch on	Verify that data from those MDM's are valid via the raw_data display

MDM	Card	Lost	Action
	3	DSC OP 1 BITE (EDO only)	Verify that data from this DSC is valid via the raw_data display
OA 1	12	DSC OA 1/2/3 power switch on or CNTL AB2	Verify that data from those DSC's are valid via the raw_data display
	14	DSC OA 1 and OM 3 BITE	Verify that data from those DSC's are valid via the raw_data display
OA 2	9	MADS wideband heat sink temperature	None
	14	DSC OA 2 BITE	Verify that data from those DSC's are valid via the raw_data display
	3	MADS wideband mode FDM 2 MUX1 and MUX2 and MUX3 and MUX4 and PCM2 and PCM3 BITE's	None
OA 3		DSC OP 2 BITE (EDO only)	Verify that data from this DSC is valid via the raw_data display
		DSC OA 3 BITE	Verify that data from this DSC is valid via the raw_data display
	14	MADS wideband mode FDM 1 MUX1 and MUX2 and MUX3 and MUX4 and PCM1 BITE's	None

MDM	Card	Lost	Action			
	0	SSR 1 commands	Use SSR 2			
	1	OIU 1 Temp (ISS flights only)	Use OIU 2			
		Antenna electronics 1 FM antenna selects	Use antenna electronics 2 or the crew will have to control the antenna selection from panel A1L			
	2	Antenna electronics 1 PM antenna selects	Use antenna electronics 2 or the crew will have to select PM antennas from the C3 switch			
		MADS calibrate, sequence 3, and SGSC commands	Crew will have to use the switches on panel A6L to calibrate MADS and turn on the strain gauge signal conditioner			
PF 1	7	GCIL decoder A command bits and select command	Use MDM 2 on the command panel			
		ALL Ku-band telemetry with exception of temperatures	Stow the Ku-band antenna for loss of insight into the antenna (flight rule A11-57)			
	8	ALL Ku-band configuration commands	Stow the Ku-band antenna for loss of control of the antenna (flight rule A11-57)			
		PSP 1 SIO commands & status	Use PSP 2			
		MADS wideband/ACIP PCM on,	Crew will have to control the operations of			
	14	PCM on, recorder playback reverse and playback forward commands	the MADS recorder from panel A6L			
	1	OIU 2 Temp (ISS flights only)	Use OIU 1			
	2	Antenna electronics 2 FM antenna selects	Use antenna electronics 1 or the crew will have to control the antenna selection from panel A1L			
PF 2		Antenna electronics 2 PM antenna selects	Use antenna electronics 1 or the crew will have to control the antenna selection from panel C3			
		CCTV configuration commands	Crew will have to control the CCTV system from panel A7U			
	7	GCIL decoder B command bits and select command	Use MDM 1 on the command panel			
	8	PSP 2 SIO commands & status	Use PSP 1			
	10	SSR 2 commands	Use SSR 1			

DSC	Card	Lost	Action
	7	PCMMU 1 format select switch position (GPC, program)	Use PCMMU 2
OF 1	16	MADS recorder motion MADS recorder % tape	Verify motion via % tape change Verify % tape change via the motion bit
	24	Ku-band antenna feed and gyro temperature	Stow Ku-band antenna for loss of insight into gyro temp (flight rule A11-57) unless otherwise noted in flight-specific rules
OF 2	7	PCMMU 2 format select switch position (GPC, program)	Use PCMMU 1
	17	V74E4082A buffer amp drive for F9 meter, uplink signal strength	Use meter on panel A1U
	18	Biomed Ch 1 switch	None
	19	Biomed Ch 2 switch	None
OF 3	20	Ku-band receiver temperature	None
		Ku radar transmitter temperature	None
		Ku-band alpha gimbal temperature	Stow Ku-band antenna for loss of insight into gimbal temp (flight rule A11-57) unless otherwise noted in flight-specific rules
OF 4	N/A		
OA 1	N/A		
OA 2	N/A		
OA 3	N/A		
OM 1	N/A		
OM 2	5	Ku-band beta gimbal temperature	Stow Ku-band antenna for the loss of insight into the gimbal temp (flight rule A11-57) unless otherwise noted in flight-specific rules
	25	MADS wideband heat sink temperature	None

## **TITLE**

## COMMUNICATION SYSTEMS POWER REQUIREMENTS AND THERMAL LIMITS

## **PURPOSE**

These data are for use in determining power requirements and bus allocations as well as listing thermal control and constraints.

## **PROCEDURE**

The data contained in Table 6.3-1 will allow an operator to determine what reconfiguration, if any, is required if an electrical, coolant, or line replaceable unit (LRU) problem occurs on the orbiter. It will also provide insight into any LRU management that might be required if thermal limits are approached or exceeded.

Table 6.3-2 presents LRU and power usage by electrical bus in matrix form. This table is intended to be used in tracking down bus failure impacts and visualizing redundancy.

Table 6.3-3 has been included to assist in isolating partial control bus failures.

Table 6.3-1. Communications equipment: power and coolant summary

LRU	Quan tity	Power consumption,	Power bus	Coolant source	LRU location	Circuit protection	Control signal	Mini- mum temp.	Maximum Long term	short Short term	Notes
Network signal processor	2	28.8	(1) MNB FLC2 (2) MNC FLC3	Water loop	Bay 3A	(1) LCA-2, F(3A) (2) LCA-3, F(3A)	(1) CNTL BC-1 (2) CNTL BC-2 CNTL AB2,(GPC BLOCK SW TLM)	Air tempera Minimun Maximur Baseplate Minimun Maximur	n: -20° l m: 120° l temperature n: 35° l	= e =	
S-BD transponder Mode - DIREC - TDRS - RCV C		58.5 41.0 30.0	(1) MNB FLC2 (2) MNC FLC3	Water loop	Bay 3A	(1) LCA-2, F(10A) (2) LCA-3, F(10A)	(1) CNTL BC-1 (2) CNTL BC-2		(a)		
S-BD power amp Mode - OPER - STBY	2 ATE	(1) 373.6 (1) 387.2 11.2	(1) MNB FPC2 (1) MNB FLC2 (2) MNC FPC3 (2) MNC FLC3	Water loop	Bay 3A	OPERATE: (1) LCA-2, F(3A) (2) LCA-3, F(3A) OPERATE/STBY: (1) PCA-2, RPC(20A) (2) PCA-3, RPC(20A)	(1) CNTL BC-1 (2) CNTL BC-2	35° F	212° F	225° F	The S-BD power amp has temperature telemetry (212 <sup>↑</sup> )
S-BD pre amp Mode - OPER	2 ATE	39.9	(1) MNB FLC2 (2) MNC FLC3	Water loop	Bay 3A	OPERATE/STBY (1) LCA-2, F(10A)	(1) CNTL BC-1 (2) CNTL BC-2			(a)	Start up (S/U) approx 10 min.
S/U - OPER, - STBY - STBY		38.7 29.6 14.8				(2) LCA-3, F(10A)					STBY equals 2 heaters on
S-BD FM XMTR	2	(1) 75.7 (2) 74.2	(1) MNB FLC2 (2) MNC FLC3	Water loop	Bay 3A	(1) LCA-2, F(3A) (2) LCA-3, F(3A) Fusable line	(1) CNTL BC-1 (2) CNTL BC-2			(a)	
S-BD FM signal processor	1	3.8	(1) MNB FLC2 (2) MNC FLC3	Air	Bay 3A	LCA-2, F(3A) LCA-3, F(3A)	(1) CNTL BC-1 (2) CNTL BC-2				The LRU is internally redundant
S-BD FM RF switch Mode - QUIES - SWITC	3	0 11.2*	MNB FLC2 MNC FLC3	Air	Bay 3A	LCA-2, F(3A) LCA-3, F(3A)	N/A				*Switching peak
S-BD ANT switch a Mode - QUIES - PM* - FM*		0.6 19.6* 10.0*	(1) MNB FLC2 (2) MNC FLC3	Air	Bay 3A	LCA-2, F(3A) LCA-3, F(3A)	(1) CNTL BC-1 (2) CNTL BC-2	-20° F	120° F	120° F	The LRU is internally redundant. *Switching peak
S-BD switch beam electronics	1	3.0	(1) MNB FLC2 (2) MNC FLC3	Air	Bay 3A	LCA-2, F(3A) LCA-3, F(3A)	(1) CNTL BC-1 (2) CNTL BC-2	-20° F	120° F	120° F	OV099
COMSEC unit Mode - OPER - STBY	2 ATE	25.0 2.5	(1,2) MNA FPC1 (1,2) MNB FPC2	Water loop	Bay 3A	PCA-1&2	(1,2) CNTL AB1 (1,2) CNTL AB3				
GCIL	1	50.9	MNA R14 MNC R14	Water loop	Bay 3A	CB-44, 3A CB-49, 3A	N/A	0° F	140° F	140° F	The GCIL is powered by Main A and/or Main C

<sup>(</sup>a) The baseplate temperature is assumed to be the same as the coldplate temperature. (The baseplate temperature limits take into account thermal rise caused by LRU heat dissipation.)

 Table 6.3-1. Communications equipment: power and coolant summary (Continued)

LRU	Quan-	Power	Power	Coolant	LRU	Circuit	Control	Mini-	Maximun	n temp.	Notes
	tity	consumption, W	bus	source	location	protection	signal	mum temp.	Long term	Short term	
ACCU	2	36.3	(1) ESS 2 CA (2) MNC R14	Water loop	Bay 1	(1) CB-1, 3A (2) CB-9, 3A	N/A	-20° F	100° F	120° F	The LRU is internally redundant
ATU  Mode - No sig - Signal  PILOT  CDR  MS  MIDDECK SPEAKER  MIDDECK CCU  PS  AL	8	4.3 11.8	ESS 2 CA ESS 1 BC MNA R14 MNB R14 MNB R14 MNC R14 MNC R14	Cabin air (convec- tion)	Cabin	CB-6, 3A CB-4, 3A CB-2, 3A CB-5, 3A CB-3, 3A CB-10, 3A	N/A	-20° F	100° F	120° F	
Speaker unit Mode - No sig - Signal OS Middeck	2	3.0 14.9	MNA R14 MNB R14	Cabin air (convec- tion)	Cabin	CB-2, 3A CB-5, 3A	N/A	-20° F	100° F	120° F	
HIU Mode - No sig - Signal	2	0.5 0.76			Cabin			-20° F	100° F	120° F	Powered via CCU PWR switch; same source, circuit protection as associated ATU
TV Monitor	2	36.4	(1) MNA R14 (2) MNB R14	Cabin air (forced)	Cabin	(1) CB-38, 3A (2) CB-43, 3A	N/A	TBS	88° C	88° C	Fault light comes on at 88° C (190° F)
TV remote control unit (RCU)/ video switching unit (VSU)	1	46.2	MNA R14 or MNB R14	Cabin air (forced)	Cabin	CB-37, 3A CB-42, 3A	CNTL AB-1 CNTL BC-1	TBS	140° F	TBS	The RCU and VSU have the same power supply. S17 PNL A7 selects MNA or MNB TV power. Loss of GCIL MNC R11 and R14 loses TV UL CMD
TV camera	9	19.0 CTVC 17.3 ITVC						32° F	131° F	140° F	PTU, not included
Flight deck Middeck		17.51170	MNC R15	Cabin air (convec- tion)	Cabin	CB-48, 5A	N/A	(0° C)	(55° C)	(60° C)	VFM power not Included
CAMR/PAN-TILT A CAMR/PAN-TILT C			MNB R14 MNA R14	Not actively	PLB	CB-39, 3A CB-34, 3A	N/A				Camera has temp telemetry. Camera
CAMR/PAN-TILT RMS ELB CAMR/PAN-TILT B CAMR/PAN-TILT D			MNB R14 MNC R14 MNA R14			CB-55, 3A CB-45, 3A CB-51, 3A					degradation may occur >60° C

Table 6.3-1. Communications equipment: power and coolant summary (Continued)

LRU	Quan-	Power	Power	Coolant	LRU	Circuit	Control	Mini-	Maximun	n temp.	Notes
	tity	consumption, W	bus	source	location	protection	signal	mum temp.	Long term	Short term	
TV camera (heaters)	5	24 CTVC 27.5 ITVC		Not	PLB		Thermostat	32° F	113° F	113° F	The heater turns
CAMR HTR A		27.51110	MNB R14	actively		CB-40, 3A					on at 33.8° F

# SHUTTLE OPS INCO/COMM/JSC-12829

CAMR HTR C CAMR HTR RMS WRS CAMR HTR RMS ELB CAMR HTR B CAMR HTR D			MNA R14 MNB R14 MNB R14 MNC R14 MNA R14	cooled		CB-35, 3A CB-56, 3A CB-56, 3A CB-46, 3A CB-52, 3A					and off at approx. 46° F
Pan tilt unit (PTU) Mode - STBY - 1 MOTOR - 2 MOTORS	4	0.2 2.7 5.2	See note	Not actively cooled	PLB	See note	N/A	TBS	TBS	TBS	PTU power bus, location, circuit protection same as associated PLB camera. (No PTU's in RMS wrist and keel locations)
Pan/tilt heaters PAN-TILT HTR A PAN-TILT HTR C PAN-TILT HTR RMS ELB PAN-TILT HTR B PAN-TILT HTR D	4	8.2	MNB R14 MNA R14 MNB R14 MNC R14 MNA R14	Not actively cooled	PLB	CB-41, 3A CB-36, 3A CB-57, 3A CB-47, 3A CB-53, 3A	Thermostat	TBS	TBS	TBS	The heater turns on at 25° F (-10° C) and off at approx. 38° F
Remote video switches (RVS)	1	0.01	MNB R14	Not actively cooled	PLB	CB-55, 3A	N/A	TBS	TBS	TBS	

Table 6.3-1. Communications equipment: power and coolant summary (Continued)

LRU	Quan-	Power	Power	Coolant	LRU	Circuit	Control	Mini-	Maximu	m temp.	Notes
	tity	consumption, W	bus	source	location	protection	signal	mum temp.	Long term	Short term	
ayload interrogator	2	97.9	(1) MNB FLC2 (2) MNC FLC3	Water loop	Bay 2	(1) LCA2 (2) LCA3	(1) CNTL BC1 (2) CNTL BC2	-20° F	120° F	120° F	
ayload interrogator RF switch	1	0	MNB FLC2 MNC FLC3	Water loop	Bay 2	Fuse, 10A LCA2 Fuse, 10A LCA3	CNTL BC1 (TLM only)				
ayload data interleaver	1	27	MNA FPC1 MNC FPC3	Water loop	Bay 1	RPC(5A) RPC(5A)	CNTL BC1 CNTL BC2	35° F	120° F	120° F	
ayload signal processor	2	32.0	(1) MNB FLC2 (2) MNC FLC3	Water loop	Bay 2	(1) Fuse, 3A LCA2 (2) Fuse, 3A LCA3	(1) CNTL BC1 (2) CNTL BC2	-20° F	120° F	120° F	
HF antenna	1							-65° F	180° F	500° F	Thermal limits for pattern degradation
HF EVA/ATC XCVR  Mode - Simplex (XMIT) (RCV) - EVA (XMIT) (RCV) - Simplex + GRD - Guard (XMIT) (RCV)	1	158.0 25.0 34.0 21.0 25.0 165.0 25.0	MNA R14 MNC R14	Water loop	Bay 3A	CB-13, 7.5A CB-18, 7.5A	CNTL CA1, CNTL CA2 (TLM only)	15° F	155° F	155° F	
ADS control module	1	20.7	MNB A14	Cabin air (forced)	Vol. D of crew comp. (under mid- deck floor)	CB-1, 5A	N/A	°F	125° F	125° F	Power depends on MADS RCDR direction
IADS strain gauges	85	112 (all)	MNA MPC1	Not actively cooled	PLB	RPC(15A)	MNB A14	+20° F	165° F	165° F	
IADS wideband system - FDM - Wideband equip: FASCO pressure sensors WBSC	1 2 10 12	56 115	MNA MPC1	Not actively cooled	PLB	RPC(15A)	MNB A14	-65° F +20° F	165° F 165° F	165° F 165° F	
MADS PCMU	1	60	MNB MPC2	Not actively cooled	PLB	RPC(15A)	MNB A14	-45° F	150° F	150° F	
MADS RCDR - STBY - RCD 3.75 IPS - RCD 15 IPS - PB 60 IPS	1	58 103 106 109	MNB FPC2	Cabin air (forced)	Vol. D of crew comp. (under mid- deck floor)	RPC(10A)	MNB A14	35° F	120° F	120° F	Temp on TLM

Table 6.3-1. Communications equipment: power and coolant summary (Continued)

LRU	Quan-	Power	Power	Coolant	LRU	Circuit	Control	Mini-	Maximum	temp.	Notes	
	tity	consumption,	bus	source	location	protection	signal	mum	Long	Short		
		W						temp.	term	term		
KU-BD signal processor	1	87	MNC R14	Water	Bay 3B	CB31, 5A	EA-1	0° F	140° F	140° F		

assembly				loop							
KU-BD electronics assembly 1	1	150	MNC FPCA3	Water loop	Bay 3A	RPC53, 10A	MNB R14	0° F	140° F	140° F	
KU-BD electronics assembly 2	1	48	MNB R14	Water loop	Bay 3A	CB23, 15A	EA-1	0° F	140° F	140° F	
KU-BD digital display and X-PNTR	1	15	MNB R14	Cabin air	Cabin	CB23, 15A Fuse, 3A					
KU-BD deployed electronics assembly Mode - COMM ON - COMM STBY - RADAR ON - RADAR STBY		290 112 244 112	MNB MPC2	Not actively cooled	PLB	Fuse, 20A	MNB R14	0° F	156° F	156° F	
KU-BD deployed me- chanical assembly (ANT GIMBAL MOTORS)	1	20 83W PEAK 4.5W AVG	MNC FPCA3	Not actively cooled	PLB	RPC53, 10A	MNB R14	0° F	180° F	180° F	Temp limits for lubricant
KU-BD deployed me- chanical assembly HEATER	1	115.5	MNB MPC2	Not actively cooled	PLB	Fuse, 20A	MNB R14				For gyro assembly gimbal motors A and B and antenna feed SPEC 76 COMM ALERT temp on TLM
KU-BD deployed elec- tronics assembly HEATER	2	134	(1) MNB MPC2 (2) MNB MPC2	Not actively cooled	PLB	(1) Fuse, 20A (2) Fuse, 20A	MNB R14				Temp on TLM
EBIA (Encrypton Bypass Isolation Assb.	1	5	MNCFPC3	11	Bay 3A	PCA-3 (10A)	CNTL CA1				

Table 6.3-1. Communications equipment: power and coolant summary (Continued)

LRU	Quan-	Power	Power	Coolant	LRU	Circuit	Control	Mini-	Maximun	n temp.	Notes
	tity	consumption, W	bus	source	location	protection	signal	mum temp.	Long term	Short term	
S-BD quad antenna	4							-160° F	180° F	500° F	Thermal limits for pattern degradation
S-BD quad switched beam antenna	4							-160° F	180° F	500° F	Thermal limits for pattern degradation
S-BD hemi antenna	2							-160° F	180° F	500° F	Thermal limits for pattern degradation
S-BD payload antenna	1							-160° F	180° F	500° F	Thermal limits for pattern degradation
(U-BD antenna	1										
Dedicated signal conditioner OI OA1	1	36.2	MNA APC4 MNB APC5	Cold- plate Freon	Aft bay 4	RPC 5A RPC 5A	CNTL AB2 CNTL BC2 017 S17	-65° F	160° F	160° F	Redundant power
Dedicated signal conditioner OI OA2	1	29.1	MNB APC5 MNC APC6	Cold- plate Freon	Aft bay 5	RPC 5A RPC 5A	CNTL BC2 CNTL CA1 017 S17	-65° F	160° F	160° F	Redundant power
Dedicated signal conditioner OI OA3	1	29.1	MNA APC4 MNC APC6	Cold- plate Freon	Aft bay 6	RPC 5A RPC 5A	CNTL AB2 CNTL CA1 017 S17	-65° F	160° F	160° F	Redundant power
Dedicated signal conditoner OI OF1	1	22.8	MNA 014 MNB 015	Cold- plate water	Middeck bay 1	014 CB2 015 CB2	None	-65° F	160° F	160° F	Redundant power
Dedicated signal conditioner OI OF2	1	32.6	MNB 015 MNC 016	Cold- plate water	Middeck bay 2	015 CB3 016 CB2	None	-65° F	160° F	160° F	Redundant power
Dedicated signal conditioner OI OF3	1	26.8	MNC 016 MNB 015	Cold- plate water	Avionics bay 3	016 CB2 015 CB3	None	-65° F	160° F	160° F	Redundant power
Dedicated signal conditioner OI OF4	1	26.9	MNB 015 MNA 014	Not actively cooled	FWD RCS Module	015 CB2 014 CB2	None	-65° F	160° F	160° F	Redundant power
Dedicated signal conditioner OI OL1	1	23.3	MNB APC2 MNA APC1	Not actively cooled	Left-hand OMS pod	RPC 5A RPC 5A	CNTL BC2 CNTL AB2 017 S13	-65° F	160° F	160° F	Redundant power
Dedicated signal conditioner OI OL2	1	21.4	MNA APC1 MNC APC3	Not actively cooled	Left-hand OMS pod	RPC 5A RPC 5A	CNTL AB2 CNTL CA2 017 S13	-65° F	160° F	160° F	Redundant power

Table 6.3-1. Communications equipment: power and coolant summary (Continued)

LRU	Quan-	Power	Power	Coolant	LRU	Circuit	Control	Mini-	Maximun	n temp.	Notes
	tity	consumption, W	bus	source	location	protection	signal	mum temp.	Long term	Short term	
Dedicated signal conditioner OI OM1	1	13.9	MNB 015 MNA 014	Not actively cooled	Mid- fuselage	015 CB4 014 CB3	None	-65° F	160° F	160° F	Redundant power
Dedicated signal conditioner OI OM2	1	22.1	MNB 015 MNA 014	Not actively cooled	Mid- fuselage	015 CB4 014 CB3	None	-65° F	160° F	160° F	Redundant power
Dedicated signal conditioner OI OM3	1	13.4	MNB 015 MNC 016	Not actively cooled	Mid- fuselage	015 CB37 016 CB31	None	-65° F	160° F	160° F	Reduntant power
Dedicated signal conditioner OI OR1	1	23.3	MNB APC2 MNA APC1	Not actively cooled	Right- hand OMS pod	RPC 5A RPC 5A	CNTL BC3 CNTL AB3 017 S14	-65° F	160° F	160° F	Redundant power
Dedicated signal conditioner OI OR2	1	21.4	MNB APC2 MNC APC3	Not actively cooled	Right- hand OMS pod	RPC 5A RPC 5A	CNTL BC3 CNTL CA3 017 S14	-65° F	160° F	160° F	Redundant power
Dedicated signal conditioner OI OP1	1	8.7	MNA R14 MNB R14	Not actively cooled	EDO pallete	R14 CB74 R14 CB75	None	-65° F	160° F	160° F	Redundant power
Dedicated signal conditioner OI OP2	1	8.7	MNA R14 MNC R14	Not actively cooled	EDO pallete	R14 CB74 R14 CB76	None	-65° F	160° F	160° F	Redundant power
Multiplexer demultiplexer OI OA1	1	41.3	MNB APC5 MNA APC4	Cold- plate Freon	Aft bay 4	RPC 5A RPC 5A	CNTL BC1 CNTL AB1 017 S19	-65° F	160° F	160° F	Redundant power
Multiplexer demultiplexer OI OA2	1	42.1	MNC APC6 MNB APC5	Cold- plate Freon	Aft bay 4	RPC 5A RPC 5A	CNTL CA2 CNTL BC1 017 S19	-65° F	160° F	160° F	Redundant power
Multiplexer demultiplexer OI OA3	1	42.7	MNC APC6 MNA APC4	Cold- plate Freon	Aft bay 6	RPC 5A RPC 5A	CNTL CA2 CNTL AB1 017 S19	-65° F	160° F	160° F	Redundant power
Multiplexer demultiplexer OI OF1	1	46.8	MNA 014 MNB 015	Cold- plate water	Bay 1	014 CB4 015 CB5	None	-65° F	160° F	160° F	Redundant power
Multiplexer demultiplexer OI OF2	1	46.8	MNA 014 MNB 015	Cold- plate water	Bay 2	014 CB4 015 CB5	None	-65° F	160° F	160° F	Redundant power

Table 6.3-1. Communications equipment: power and coolant summary (Concluded)

LRU	Quan-	Power	Power	Coolant	LRU	Circuit	Control	Mini-	Maximun	n temp.	Notes
	tity	consumption, W	bus	source	location	protection	signal	mum temp.	Long term	Short term	
Multiplexer demultiplexer OI OF3	1	47.4	MNA 014 MNC 016	Cold- plate water	Bay 3	014 CB5 016 CB3	None	-65° F	160° F	160° F	Redundant power
Multiplexer demultiplexer OI OF4	1	40.4	MNA 014 MNC 016	Cold- plate water	Flight deck	014 CB5 016 CB3	None	-65° F	160° F	160° F	Redundant power
PCMMU OI1	1	55	MNC FPC3 MNA FPC1	Cold- plate water	Bay 1	RPC 5A RPC 5A	CNTL CA1 CNTL AB1 C3 S7	35° F	120° F	120° F	
PCMMU OI2	1	55	MNA FPC1 MNB FPC2	Cold- plate water	Bay 2	RPC 5A RPC 5A	CNTL AB1 CNTL BC1 C3 S7	35° F	120° F	120° F	
Transducer power (SSSH 17.1-1) 54V75A64	1	0.2	MNA APC4	Not actively cooled	Aft bay 4	RPC 5A	CNTL AB2 017 S17	20° F	165° F	165° F	
Transducer power (SSSH 17.1-1) 54V75A65	1	0.2	MNA APC4	Not actively cooled	Aft bay 4	RPC 5A	CNTL AB2 017 S17	20° F	165° F	165° F	
Transducer power (SSSH 17.1-1) 54V75A67	1	0.2	MNA APC4	Not actively cooled	Aft bay 4	RPC 5A	CNTL AB2 017 S17	20° F	165° F	165° F	
Transducer power (SSSH 17.1-1) 54V75A68	1	0.2	MNA APC4	Not actively cooled	Aft bay 4	RPC 5A	CNTL AB2 017 S17	20° F	165° F	165° F	
Transducer power (SSSH 17.1-1) 55V75A70	1	0.2	MNB APC5	Not actively cooled	Aft bay 5	RPC 5A	CNTL BC2 017 S17	20° F	165° F	165° F	
Transducer power (SSSH 17.1-1) 55V75A71	1	0.2	MNB APC5	Not actively cooled	Aft bay 5	RPC 5A	CNTL BC2 017 S17	20° F	165° F	165° F	

Table 6.3-2. Communications equipment power matrix

	E	SS				CNTL								MAIN			
	1BC	2CA	AB1	AB2	AB3	BC1	BC2	CA1	CA2		A		В				С
	O13&R14	O13&R14									FPC 1		FF	PC 2		1	FPC 3
GPC BLK SW (ANDED)				Х			Х			R14		R14		FLC 2	R14		FLC 3
NETWK SIG PROC 1						Х								28.8			
TRANSPONDER 1						х								DIR 58.5 TDRS 41.0 RCV 31.3			
PWR AMPL 1 OPERATE						Х							387.3	1.7			
PWR AMPL 1 STANDBY						Х							11.2				
PREAMPL 1						Х								20.4			
ANTENNA SW ELEC 1						X ANT TM								0.6			
NETWK SIG PROC 2							Х										28.8
TRANSPONDER 2							х										DIR 58.5 TDRS 41.0 RCV 31.3
PWR AMPL 2 OPERATE							Х									387.3	1.7
PWR AMPL 2 STANDBY							Х									11.2	
PREAMPL 2							Х										20.4
ANTENNA SW ELEC 2							Х										0.6
GCIL R										50.9					50.9		
FM SYSTEM						1	2							81.1			81.1
COMSEC 1, 2,			UNITS 1 & 2		UNITS 1 & 2						1,2 OPR 25 STBY 2.5		1,2 OPR 25 STBY 2.5			3 OPR 25 STBY 2.5	
MMU 1			Х								64						
MMU 2				Х									64				
ACCU's		40													40		
ATU's	CDR XMT 11.8 RCV 4.3	PLT XMT 11.8 RCV 4.3								MS.MD 3.7		MD SMU 5.9			PS.AL3.7		
UHF (XCVR) R									TLM	RCV 25 KEY 35					RCV 25 KEY 35		
UHF (PA)								TLM		KEY 160							
SSOR									х	High 56 Low 56 OFF 5					High 56 Low 56 Off 5		
SSOR Encryption								Х									

One control bus and associated MAIN BUS required

R Redundantly powered

Table 6.3-2. Communications equipment power matrix (Continued)

	ES	SS		CN	ITL											MAIN		-					
	1BC	2CA	AB1	AB2	BC1	BC2		,	A							В					(	;	
							R14	MPC 1 PL AUX	PL CAB	PL CAB	PL CAB	R14	PL CAB	PL CAB	PL CAB	MPC 2		FPC 2	R14		FPC 3	MMCA2	MPC 3
								Α	1	2	3		1	2	3		FLC 2	AC2 FA			FLC 3		
/IDEO CNTL UNIT ®			Х		Х		46.2					46.2							GND CMD				
/IDEO PROC UNIT												2.7											
WVS System					Х																		XCVR 120 ANT 35***
WVS Heaters					Х																		350
DIGITAL TV VIP																		MA73C 6.8					
DIGITAL TV MUX / VTR	Х							STBY 45.4 ON 61															
MONITOR							35.0	ON 01				35.0											
/TR											43				43								
LT DECK																			20 MAX				
MID DECK						<u> </u>							ļ				1		20 MAX	<u> </u>		1	
FWD BAY CAM (A)												CAM 20 HTR 19											
FWD BAY P/T												P/T 8 HTR 8											
AFT BAY CAM (C)							CAM 20 HTR 19																
AFT BAY P/T							P/T 8 HTR 8																
STBD RMS CAM (D)							CAM 20 HTR 19																
STBD RMS P/T							P/T 8 HTR 8																
PORT RMS CAM												CAM 20 HTR 19											
PORT RMS P/T												P/T 8 HTR 8											
KEEL CAM (B)																			CAM 20 HTR 19				
KEEL P/T																			P/T 8 HTR 8				
KU-BAND ELEC												EA-2 48 DISP 15								EA-1 150			
KU SPA																			87.0				
KU DA HTR			TLM									*				383.5							
KU DA												*				COM 299 RDR 253 STBY 113						DEPLOYED TLM**	
PSP/PI 1					х											0101 113	PSP 32.0 PI 97.9						
PSP/PI 2						х											11 91.9				PSP 32.0 PI 97.9		
KU ANT JET A							ML86B X														11 91.9		
(U ANT JET B							^												ML86B X				

R - Redundantly powered
\* - 28-V dc discrete to MPCA 2 enables 28-V dc heater and LRU power to the DEA

<sup>-\*\* -</sup> Deployed telemetry is the transmit enable signal to the Ku-band. If lost, Ku-band goes into the idle mode (no xmit, no motion). A redundant signal is available from MMCA4. The crew must turn it on - panel MA73C.
-\*\*\* - WVS antennas use 5 Watts per antenna. Nominal configuration is 7 antennas.

Ontrol AB1 with MAIN A or control B1 with MAIN B required.

Table 6.3-2. Communications equipment power matrix (Concluded)

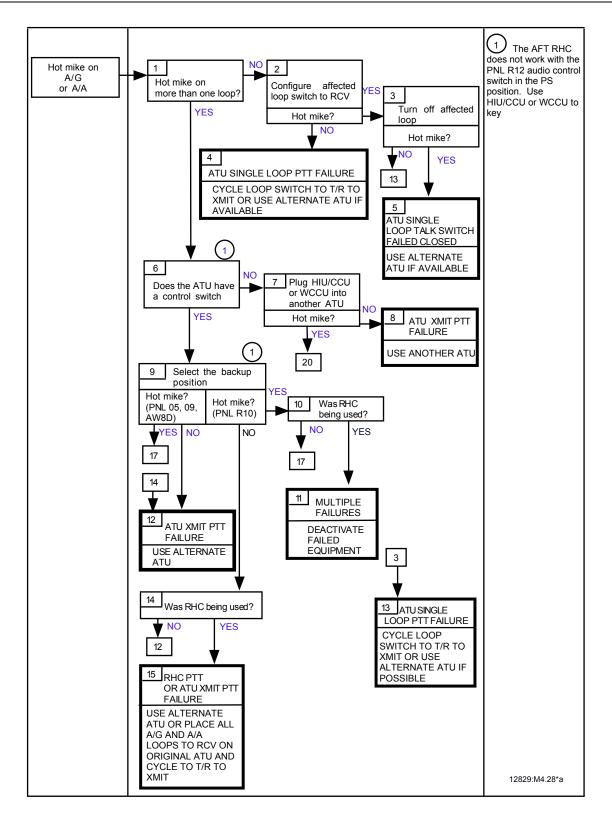
	1	ſ	ſ	ſ	ſ	ı			T	ſ		T
	MNA O14	MNA R14	MNB O15	CNTL AB1	CNTL AB2	CNTL AB3	CNTL BC1	CNTL BC2	CNTL BC3	CNTL CA1	CNTL CA2	CNTL CA3
APC1					DSC OL1 DSC OL2	DSC OR1						
				MDM OA1	DSC OL2							
MNA APC4				MDM OA1	DSC OA1							
				PCMMU 1			PDI					
MNA FPC1				PCMMU 2								
				MMU 1								
			DSC OF1									
			DSC OF4 DSC OM1									
MNA O14			DSC OM2									
			MDM OF1									
			MDM OF2									
APC2								DSC OL1	DSC OR1			
							MDM 044	200.044	DSC OR2			
MNB APC5							MDM OA1 MDM OA2	DSC OA1 DSC OA2				
FLC2							PL SYS1	DOG GAL				
1 202							FM SYS 1					
MNB FPC2					MMU 2		PCMMU 2					
MNB R14		DSC OP1										
APC3											DSC OL2	DSC OR2
MNC APC6										DSC OA2	MDM OA2	
										DSC OA3	MDM OA3	
FLC3								PL SYS2				
								FM SYS 2 PDI		PCMMU1		
MNC FPC3								PUI		PCIVIIVIOT		
	MDM OF3		DSC OF2									
MNC 016	MDM OF4		DSC OF3 DSC OM3									
MNC R14		DSC OP2	D3C OIVI3									
		SINGLE BI	IC									
						Ins	trumenta	tion Pow	er (Watts	s)		
MNA FLC1 (ESS1BC CNT	L)	MADS REVE	KSE RUD									
MNA MPC1			IG COND, FDN	I, STR GAUGE		PSF	PDI	OIU	PI			
MNB FPC2		MADS RCDF	RPWR					4.5				
MNB MPC2		MADS PCM				36.5	51 24.8	18	95.48			
MNB A14		MASTER MA	ADS									
MNA FLC1		Auto CAL co	ntrol									

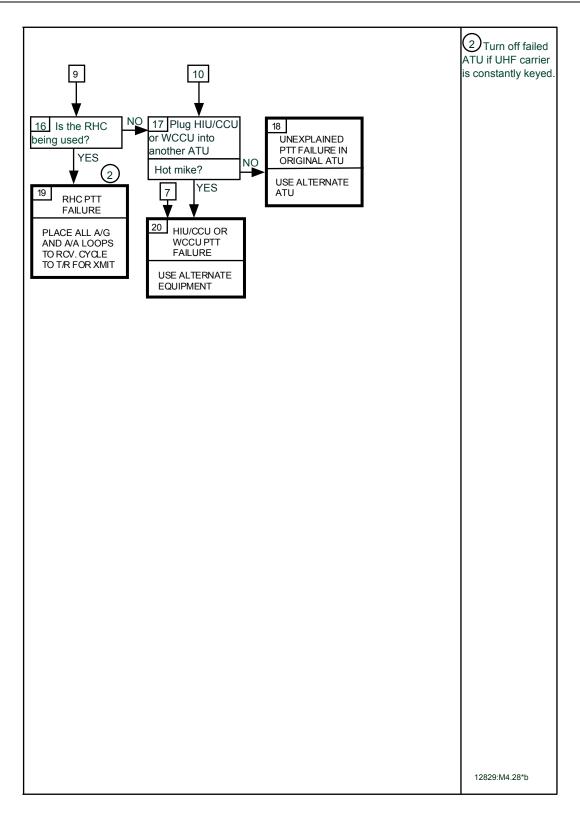
Table 6.3-3. Communications control bus/panel isolation matrix

LRU/FUNCTION				CONTR	ROL BUS PANEL	ROUTING			
	AB1	AB2	AB3	BC1	BC2	BC3	CA1	CA2	CA3
GPC BLK SW (ANDED)		C3A5S13			C3A5S13				
NSP 1				A1A2S23					
XPNDR 1				A1A2S16					
PA1 OPERATE				A1A2S12					
PA1 STANDBY				A1A2S11					
PREAMP 1				A1A2S10					
ANT SW ELECT 1				A1A2S5					
ANT SW (ROTARY TLM)				C3A7S10					
NSP 2					A1A2S23				
XPNDR 2					A1A2S16				
PA2 OPERATE					A1A2S12				
PA2 STANDBY					A1A2S11				
PREAMP 2					A1A2S10				
ANT SW ELECT 2					A1A2S5				
FM SYS 1				A1A3S3					
FM SYS 2					A1A3S3				
COMSEC 1	A1A2S24								
COMSEC 2			A1A2S24						
COMSEC 1 ZEROIZE (TLM)								R12A2S12	
UHF XCVR MODE (TLM)								06S6	
UHF PA (TLM)							06S10		
UHF TX FREQ (TLM)								06S7	
UHF SQUELCH (TLM)								06S9	
VIDEO CNTL UNIT R	A7A1S12			A7A1S12					
VCU-SYNC (TLM)	A7A1S18								
VCU-DOWNLINK (TLM)	A7A1S11								
KU DA HTR (TLM)	A14S19								

Table 6.3-3. Communications control bus/panel isolation matrix (Concluded)

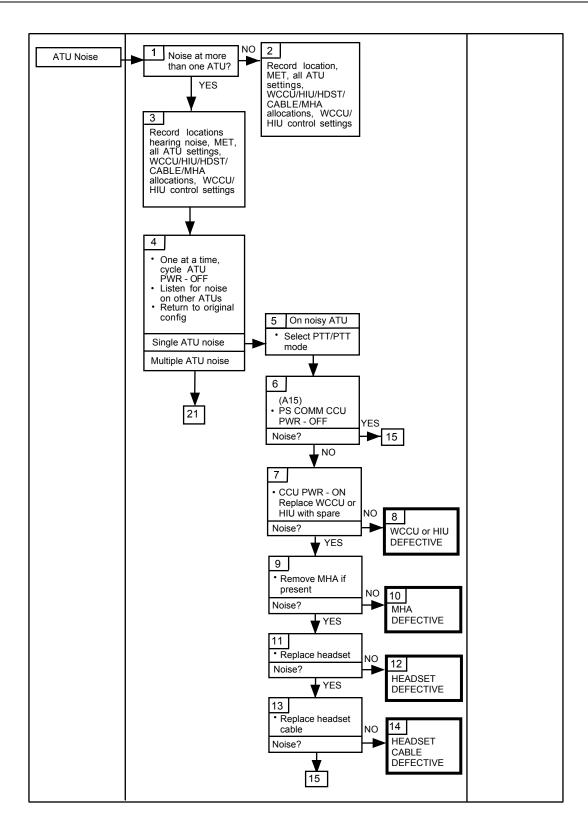
LRU/FUNCTION					CONTR	OL BUS PANEL	ROUTING			
		AB1	AB2	AB3	BC1	BC2	BC3	CA1	CA2	CA3
PDI					A1A2S17	A1A2S17				
PCM 1	C3	A7S7						C3A7S7		
PCM 2	C3	A7S7			C3A7S7					
MDM OA01	01	7: DS19			017:DS19					
MDM OA02					017:DS19				017: DS19	
MDM OA03	01	7: DS19							O17: DS19	
DSC OA1			017: DS17			017: DS17				
DSC OA2						017: DS17		017: DS17		
DSC OA3			017: DS17					017: DS17		
DSC OL1			017: CS13			017: CS13				
DSC 0L2			017: CS13						017: CS13	
DSC OR1				017: CS14			017: CS14			
DSC OR2							017: CS14			017: CS14
MADS CAL (OV 102)										A7A2S7
ANT STO/DPLY MTR 1								R13A2S8	R13A2S8	
ANT STO/DPLY MTR 2					R13A2S8	R13A2S8				
ANT DIRECT STOW (1)								R13A2S12	R13A2S12	
KU ANT DIRECT STOW (2)					R13A2S12	R13A2S12				
KU ANT BOOM STOW INITIATE	R				R13A2S8			R13A2S8		
KU ANT STO/DPLY MTR 1 LIMIT SW										MA73C: AS12
KU ANT STO/DPLY MTR 2 LIMIT SW							MA73C: BS9			
MDM PF1	R 06	S52		06S52						
MDM PF2	R				06S20		06S20			
MDM FF1	R		06S26	06S26						
MDM FF3	R								06S28	06S28
PSP/PI 1					A1A2S13					
PSP/PI 2						A1A2S13				
PSP/PI SW SEL (TLM)					A1A2S14					

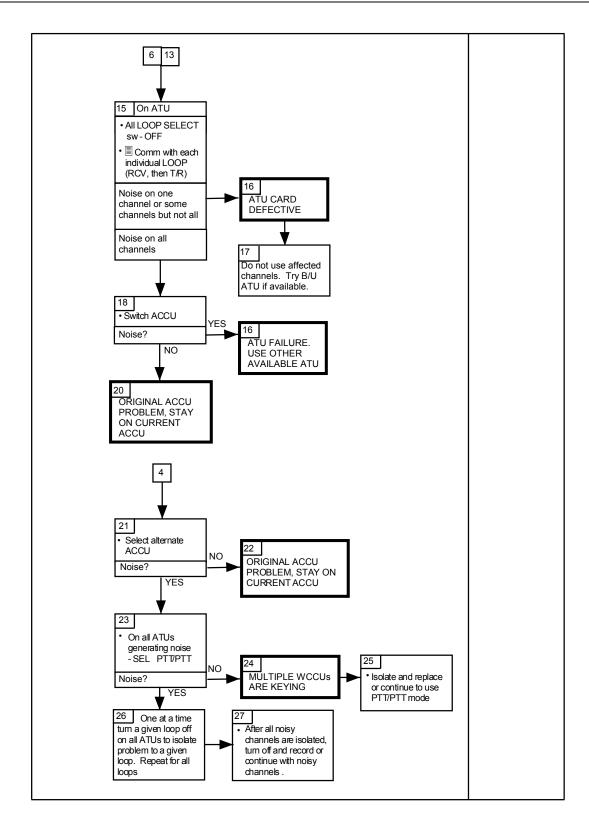




12829:M4.29\*

Prelaunch 1 Use of this procedure assumes Loss of CDR, Try the that the LCC requires PROCEED IF PI T following steps to restore comm 2-way comm from MS2 COMM NO LCC the affected VIOLATIONS crewmember for Nominal Config? AUD PWR SW launch. LCC REQUIRES: The helmet (with AUD dual mike/ CDR, PLT, MS, AUD CNTL - ALT earphones) YES PS, MIDDECK POS. interfaces with a ATÚ's ACCU - 2 Affected short pigtail. A/G1 OR A/G2 crewmember will The pigtail plugs AND UHF IN Comm returned? not have local into the HIU which **EACH ACCU** PTT capability. in turn plugs into NO the CCU. Spare helmet components are 2 kept in the white Return to original room. It is also configuration possible that MS3 or PS components (<sub>2</sub>) Note: may work. FAO volume 5 of the Crew Systems 4 MS1 and MS1 and affected crewmember S0007 OMI contains\ maintains size info. the latest proceaffected disconnect helmet from pigtail and plug into dure and should be crewmember turn each other's pigtail, HIU, CCU assembly CCU PWR - OFF committed. Both MS1 and affected crewmember turn CCU PWR - ON Comm returned to affected crewmember? NO YES (3) If time per-Helmet mits (i.e., if not yet into T - 9 min **FAILED** CONTRACT FAO OR hold), try to restore nominal LCC FOR POSSIBLE SWAP config to affected crewmember Both MS1 and affected crewmember turn CCU **PWR-OFF** Both MS1 and affected crewmember disconnect helmet from pigtail. MS1 return to original config. Affected crewmember swap original pigtail and HIU with spare in MS1 FDF bag and connect to original CCU Both crewmembers? CCU PWR - ON Comm returned to affected crewmember? YES NO PIGTAIL OR 10 CCU FAILURE HIU FAILURE LCC VIOLATION STOW IN MS 1 HOLD AND **BAG AND PRESS** EVALUATE.





9/1/2004: REV G

## **TITLE**

WIRELESS AUDIO PROBLEM

## **PURPOSE**

To provide the console operators with a quick reference of probable wireless comm system problems/failures and their causes.

## **GENERAL**

This procedure should be of help in analyzing the status of the WCCS should a wireless problem arise which the crew cannot isolate using the onboard malfunction procedure.

## **PROCEDURE**

Refer to the following tables of symptoms to determine which problem or failure is the probable cause.

Effect	Operational problem
Loss of RCV audio of all CRU channels	CRU volume control low
CRU with greatest signal at AIU will retain sidetone and XMIT to others	Two CRU's on same channel
Loss of RCV and/or XMIT	CRU selects unassigned channel
Loss of XMIT/RCV on AIU channel 1	AIU selecting mode 2*
Loss of XMIT/RCV on AIU channel 2	AIU selecting mode 1*
Loss of XMIT/RCV on AIU channel 1 and 2	AIU selecting mode HL*
Loss of XMIT/RCV on AIU channel 1 and 2 and green power light off	AIU mode OFF
Problem will match ATU configuration	ATU misconfigured

<sup>\*</sup>For XMIT/RCV on channels 1 and 2 AIU rotary must select "BOTH" position

Effect	Hardware function failure
Loss of RCV AUD on all CRU channels	VLHS earphone
Loss of sidetone on all CRU channels	VLHS microphone
Loss of XMIT to all other crewmembers	
Keying will XMIT/ICOM alternate AIU channel	
Loss of RCV AUD on all CRU channels	CRU battery
Loss of XMIT to other crewmembers	
No CRU turn-on tone	
Loss of RCV AUD on all CRU channels	CRU receiver
Loss of sidetone on all CRU channels	CRU transmitter
Loss of XMIT/ICOM PTT functions on all CRU channels	CRU PTT encoder
Loss of RCV AUD and AIU channel X at all CRU's	AIU transmitter channel X
Loss of sidetone on AIU channel X at all CRU's	AIU receiver channel X
Loss of XMIT/ICOM PTT function on AIU channel X at all CRU's	AIU PTT decoder channel X
Loss of all RCV AUD except AUD from CRU on alternate channel	AIU-ATU interface cable
Loss of XMIT/ICOM on both AIU channels	
Loss of power to AIU	

#### **TITLE**

## **ENTRY WEIGHT REDUCTION**

## **GENERAL**

For some entry cases in which the thermal protection system (TPS) is suspect and repair options are limited, the flight control team may be asked to suggest methods to reduce vehicle weight during reentry in order to minimize thermal environment around the vehicle. This procedure includes the major weight savings suggestions most readily available.

# **PROCEDURE**

# 1. External Hardware

### A. Ku-Band Antenna

Ku-Band Antenna jettison procedure is located in Section 2 of the Orbit Ops Checklist.

B. Orbiter Boom Sensor System (OBSS)

The OBSS jettison procedure is located in the PDRS Checklist.

## 2. Cabin Hardware

## A. Loose Equipment

All loose communications equipment not essentially for landing (camcorders, V-10 VCRs, video cables, battery power speaker mic unit (BPSMU), BPSMU cables, etc.) can be collected by the crew for EVA jettison.

# B. Installed Equipment

Closed Circuit Television (CCTV) monitors could be removed from their mounted position on panel A3 for EVA jettision. Consultation with IFM would be necessary to determine the procedure to remove the monitors from their brackets.

# **TITLE**

Workstation Antenna Management Software (WAMS) - version 3.3.2

# **CONTENTS**

A. BFS Realtime Display 3
1. File Menu 3

I	DISP	ΙΔΥ	DES	CRI	PTIC	М

0 01 411 5 11	4
3. Clear All Button	
4. TGRTS	
5. Plot Area	
6. Comp	
8. Shrink Button	
B. SM Realtime Display	8
1. File Menu	
2. Settings Menu	
3. Ku-Band Menu	
4. S-Band Menu	
5. Trends Menu	
7. COMP	
8. GMT/MET Button	
9. DAP	
10. Clear All Button	
11. Plot Area	13
12. Digital Data area	
13. Shrink Button	16
C. Predict Display	17
1. File Menu	
2. Settings Menu	
3. Ku-Band Menu	
4. S-Band Menu	
4. S-Band Menu5. Comm Coverage Menu	
5. Comm Coverage Menu	23 29
5. Comm Coverage Menu 6. GMT/MET	23 29 30
5. Comm Coverage Menu 6. GMT/MET 7. Digital Prediction Data 8. BETA Mask	23 30 30
5. Comm Coverage Menu 6. GMT/MET 7. Digital Prediction Data 8. BETA Mask 9. Points selection	23 30 30
5. Comm Coverage Menu 6. GMT/MET 7. Digital Prediction Data 8. BETA Mask 9. Points selection 10. Events Selection	23 30 30 30
5. Comm Coverage Menu 6. GMT/MET 7. Digital Prediction Data 8. BETA Mask 9. Points selection 10. Events Selection 11. Plot Area	23 30 30 30 30
5. Comm Coverage Menu 6. GMT/MET 7. Digital Prediction Data 8. BETA Mask 9. Points selection 10. Events Selection	23 30 30 30 30
5. Comm Coverage Menu 6. GMT/MET 7. Digital Prediction Data 8. BETA Mask 9. Points selection 10. Events Selection 11. Plot Area	23 30 30 30 30
5. Comm Coverage Menu 6. GMT/MET 7. Digital Prediction Data 8. BETA Mask 9. Points selection 10. Events Selection 11. Plot Area	23 30 30 30 30
5. Comm Coverage Menu 6. GMT/MET 7. Digital Prediction Data 8. BETA Mask 9. Points selection 10. Events Selection 11. Plot Area 12. Shrink Button	23 30 30 30 30
5. Comm Coverage Menu 6. GMT/MET 7. Digital Prediction Data 8. BETA Mask 9. Points selection 10. Events Selection 11. Plot Area 12. Shrink Button	23 30 30 30 30 31
5. Comm Coverage Menu 6. GMT/MET 7. Digital Prediction Data 8. BETA Mask 9. Points selection 10. Events Selection 11. Plot Area 12. Shrink Button  II. DISPLAY COMPS  A. WAMS_COMP	23 30 30 30 30 31
5. Comm Coverage Menu 6. GMT/MET 7. Digital Prediction Data 8. BETA Mask 9. Points selection 10. Events Selection 11. Plot Area 12. Shrink Button  II. DISPLAY COMPS  A. WAMS_COMP 1. MSIDs	23 29 30 30 30 31 31
5. Comm Coverage Menu 6. GMT/MET 7. Digital Prediction Data 8. BETA Mask 9. Points selection 10. Events Selection 11. Plot Area 12. Shrink Button  II. DISPLAY COMPS  A. WAMS_COMP	23 29 30 30 30 31 31

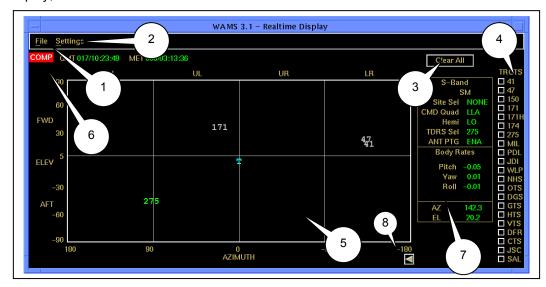
B. MOC COMP	32
1. MSIDs	
2. Symbols	
III. OPERATIONAL PROCEDURES	
A. Starting Display	
B. Stopping Displays	34
C. Utilizing Moc_Comp	34
D. Bringing up Predict display	
E. Utilizing Predicts	
1. Events Track	
2. Mouse Cursor	
3. Points	
4. Mutilple Events	
F. Building a Comm Coverage Note	
1. Automatic Coverage	
2. Additional Masking	
2. Coverage Window	
3. File Transfer Process (FTP)	
4. MCC PC V drive	
5. Comm Coverage Template	
6. Flight Note System	43

### I. DISPLAY DESCRIPTION

WAMS is a workstation application, which displays the status of the Systems Management (SM) and Backup Flight System (BFS) Antenna Management software (AM). The display is made up of three major parts, BFS Real-time Display, SM Real-time Display, and Predict Display. In addition, 2 computations are provided: the WAMS comp. and moc\_comp. Each of these parts of the application will be discussed in the following sections as well as how to operate the displays.

## A. BFS Real-time Display

The BFS real-time display processes the telemetry for the antenna management software running in the BFS general-purpose computer as well as the ground processed WAMS comp (see section II A p. 31). Each of the parameters used as well as the menus on this display, are discussed below.



### 1. File Menu

The file menu is used to select the different displays available in WAMS as well as to close the individual display or the entire application. The options are:

# a. Predict Display (ctrl+p)

This option will start the Predict display (see section C).

## b. SM Real-time Display (ctrl+b)

This option will close the BFS Real-time display and start the SM Real-time display (see section B).

## c. Close (ctrl+c)

This option will close the BFS Real-time display but allow any other WAMS displays to remain active.

## d. Exit (ctrl+x)

This option closes all WAMS displays and background processes with the exception of WAMS comp and MOC\_COMP.

Settings

Track Limits... Multi-Pathing

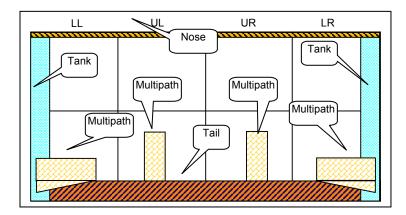
### 2. Settings Menu

This menu is primarily used to modify the look of the plot area (see this section part 5). The options are:

### a. Track Limits

Track Limits

Track Limits refers to the graphical trace of the most recent track for each enabled target. A default setting of 15 minutes is provided without any additional actions by the user. However, this default can be adjusted by selecting "track limits" and by entering the desired time and selecting O.K. Pressing the "Cancel" button retains the current displayed value.



## b. Multi-Pathing

When this option is selected the areas of expected S Band multipathing will be displayed as dark blue polygons in the plot area. If it is selected a second time the areas of multi-pathing will be removed from the plot area. Each of these masks is located in the masks directory under the wams directory on the workstation high availability server.

#### c. Nose/Tail

When this option is selected the areas in the S band antenna pattern that represent low gain are displayed as dark blue polygons in the plot area. These are generally called "Off the Nose" and "Off the Tail". The area for "Off the Nose" is elevation angles greater than +85°. The area for "Off the Tail" is elevation angles of less than -70°. If this option is selected a second time the areas for "Nose/Tail" are removed from the plot area.

# d. Tank

When this option is selected the area in the S Band antenna pattern, which is blocked by the External Tank, is displayed as dark blue polygons in the plot area. This area is defined as azimuth angles of greater than 160° and azimuth angles of less than -160°. If this option is selected a second time the area for "Tank" is removed from the plot area.

### 3. Clear All Button

The "Clear All" button will delete the historical path of the targets that are displayed in the plot area.

### 4. TRGTS

TRGTS is a menu for selecting and deselecting targets to display in the plot area of the BFS real-time display. An Azimuth/Elevation pair calculated in the moccomp application represents each target. (see section II B p. 32 for details on moc-comp). The targets available on the BFS real-time display are: TDRS 41, TDRS 47, TDRS 150, TDRS 171, TDRS 171H, TDRS 174, TDRS 275 and ground sites Merritt Island, Florida (MILA), Ponce Deleon Inlet, Florida (PDL), Jonathan Dickenson, Florida (JDI), Wallops Island, Virginia (WLP), New Boston, New Hampshire (NHS), Oakhanger AFB, England (OTS), Diego Garcia AFB, Diego Garcia Island (DGS), Guam, Island (GTS), Kaena Point, Hawaii (HTS), Vandenberg AFB, California (VTS), Dryden Flight Research Center, California (DFR), Colorado Springs, Colorado (CTS), Johnson Space Center, Texas (JSC), Salinas Peak, New Mexico (SAL). They are graphically displayed as burnt orange text that includes the letter 'G' at the end of the label.

### 5. Plot Area

The plot area is the primary part of the BFS real-time display which is used to depict where the targets are with-in the S Band antenna pattern. The BFS downlinks the orbiter line of sight position coordinates for only one target. All the other targets that can be displayed are calculated in the moc\_comp and made available to the display as Azimuth/Elevation angle data. The application was built so that when the S Band transponder is in TDRS mode the active TDRS state vector is displayed as the active downlink target and when the transponder is in some other mode than TDRS (STDN HI, STDN Lo or SGLS) the selected ground site is displayed as the active downlink target. The following are the computations done in the BFS real-time display to determine which label to put on the active downlink target.

V98 X07 01X	V98 X07 17X	V98 X07 18X	V98 X07 19X	W01 G32 11R	Label on the active Target
1	1	0	0	X	SV1
1	0	1	0	X	SV2
1	0	0	1	Х	SV3
0	Χ	Χ	Х	0	JSC
0	Χ	Х	Х	1	MIL
0	Χ	Χ	Χ	2	PDL
0	Χ	Χ	Χ	3	DFR
0	Χ	Χ	Χ	4	WLP
0	Χ	Χ	Χ	5	JDI
0	Χ	Χ	Χ	6	CTS
0	Χ	Χ	Χ	7	GTS
0	Χ	Χ	Χ	8	HTS
0	Χ	Χ	Χ	9	VTS
0	Χ	Χ	Χ	10	OTS
0	Χ	Χ	Χ	11	DGS
0	Χ	Χ	Χ	12	NHS
0	Χ	Χ	Χ	13	MAD
0	Х	Х	Х	14	GDX
0	Χ	Х	Χ	15	CAN
					Any other is "ERR"

The computation used to calculate azimuth/elevation angles for the active target is:

as documented in the WAMS Users Guide.

### 6. COMP

This is an indicator light which shows the status of an application named moc\_comp. This application calculates the azimuth/elevation angles for TDRS satellites as well as several ground stations.

COMP – **Green** indicates running with no errors

Red indicates the comp is not running or a failure to retrieve data from the trajectory server.

Section II A has a detailed discussion of the moc\_comp application.

# 7. Digital Data Area

The digital data area includes all the telemetry down linked from the BFS and the OI that is important to the on board antenna management systems. The following are the parameters displayed in this area.

### a. S-Band

 SM - SM format ID is indicated. Major Function is SM (V93Q0022CY = "status good") as defined in wams\_comp as the parameter AMC\_DATAMODE.



**BFS** - BFS format is indicated. Major Function is BFS (V98Q009C = "status good" as defined in wams\_comp as the parameter AMC\_DATAMODE.

- Site Sel AMC\_SITESEL Displays the selected ground site from the BFS or SM antenna management software. Default is JSC. If AMC\_DATAMODE = BFS then display the output of W01G3211R (from commsys\_comp) but if AMC\_DATAMODE = SM then display the output of W01G3210R (from commsys\_comp).
- CMD Quad AMC\_CMD\_QUAD -Displays which S-Band antenna is currently selected by whichever major function is down listing. If the major function is SM the display uses the output of the commsys\_comp; W03I0603R but if the major function is BFS, wams comp uses the following table

V98 X07 02X	V98 X07 10X	V98 X07 05X	V98 X07 06X	V98 X07 07X	V98 X07 08X	Antenna Commanded
1	Х	1	Х	Х	Х	ULF
1	Х	0	1	Х	Х	URF
1	Х	0	0	1	Х	LLF
1	Х	0	0	0	1	LRF
0	1	1	Х	Х	Х	ULA
0	1	0	1	Х	Х	URA
0	1	0	0	1	Х	LLA
0	1	0	0	0	1	LRA

4. Hemi – Displays the actual S-band FM hemi selected per the table below

SM	BFS	V98 X07 03X	V98 X07 04X	W03 I02 00R	Selected FM ant
1	Х	Χ	Χ	0	LO
1	Х	Х	Х	1	UP
Х	1	1	0	Χ	LO
Х	1	0	1	Х	UP

 TDRS Sel – This will display the longitude of the selected TDRS (comp W04G3210R in compsys\_comp) while using the SM major function but will only display SV1, SV2 or SV3 while the BFS major function is used. The following is the table for the BFS Major Function process.

V98 X07 01X	V98 X07 17X	V98 X07 18X	V98 X07 19X	BFS Selected TDRS
1	1	0	0	SV1
1	0	1	0	SV2
1	0	0	1	SV3

SM major Function uses the output of W04G3210R:

V93 X10 86X	V93 X10 87X	V93 X10 88X	V93 X10 89X	V93 X56 68X	V93 X56 69X	V92 X23 49X	value of
1	0	0	0	0	0	0	V92H2354C
0	1	0	0	0	0	0	V92H2357C
0	0	1	0	0	0	0	V92H2361C
0	0	0	1	0	0	1	V92H2354C
0	0	0	0	1	0	1	V92H2357C
0	0	0	0	0	1	1	V92H2361C
0	0	0	0	0	0	Х	none

6. **ANT PTG** – This indicates if the SM or BFS is enabled to command the S-Band antennas or not.

SM	BFS	V93 X56 25X	V93 X56 26X	V98 X07 13X	Antenna Pointing State
1	Χ	1	0	Χ	ENA (green)
1	Χ	0	1	Χ	INH (red)
1	Х	1	1	Х	ERR (gray)
1	Х	0	0	Х	ERR (gray)
0	1	Х	Х	1	ENA (green)
0	1	X	X	0	INH (red)

- b. **Body Rates** This area of the digital data section represents the rates of change in orbiter pitch, yaw and roll.
  - 1. Pitch V72R0917C
  - 2. Yaw V72R0916C
  - 3. Roll V72R0918C

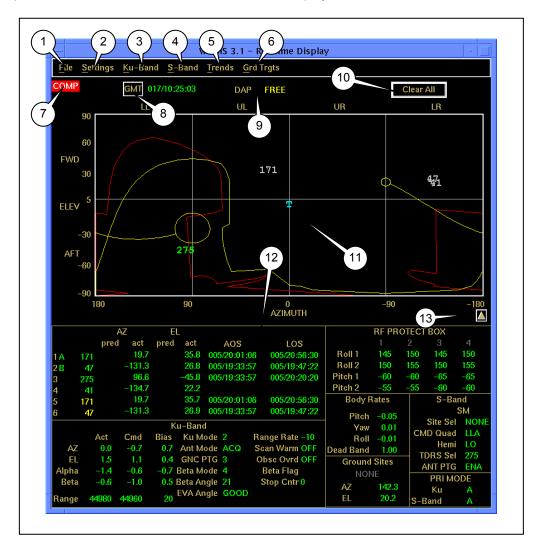
- c. **Active Target angles** This area of the digital data section represents the values for the active target in the BFS which must be converted from the orbiter position line of sight (LOS) in X, Y and Z. See section A. part 5 Plot Area for the computation for these parameters.
  - 1. AZ azimuth
  - 2. EL elevation

# 8. Shrinky-Dink

This is the small arrow button '◀' located just to the left of the Digital data area. It is used to shrink the display by removing the Digital Data area from view. If the display is reduced to just the plot area the '▶' can be pressed to restore the digital prediction data area at the top of the display.

# B. SM Real-time Display

The SM Real-time display is the first display to "pop up" after WAMS is selected from the DNAV. This display processes the System Management version of the on board antenna management software running in a General Purpose Computer (GPC), usually GPC 4 as well as the ground processed WAMS comp (see section II A p. 31). Each of the parameters used as well as the menus on the display are discussed below.



### 1. File Menu

The file menu is used to select the different displays available in WAMS as well as to close the individual display or the entire application. The options are:

# a. Predict Display (ctrl+p)

This option will start the Predict display (see section C).

# b. BFS Real-time Display (ctrl+s)

This option will close the SM Real-time display and start the BFS Real-time display (see section A).

## c. Close (ctrl+c)

This option will close the SM Real-time display but allow any other WAMS displays to remain active.

## d. Exit (ctrl+x)

This option closes all WAMS displays and background processes with the exception of WAMS comp.

# 2. Settings Menu

This menu is primarily used to modify the look of the plot area (see this section part 11). The options are:

## a. Track Limits

Track Limits will pop up a small display, which can be used to change the historical trend of each of the targets displayed in the plot area. Changing the default value of 15 minutes to some other value then selecting the "OK" button does this. Pressing the "Cancel" button retains the current settings.



## b. Show Predicts

When this option is selected, the currently active and visible TDRS targets in the plot area will have their predicted path through the antenna pattern displayed as a gray line preceding the target marker. Selecting this option a second time will turn off this function. As a TDRS comes into view of the orbiter, the prediction for that TDRS will be displayed. As a TDRS goes out of view of the orbiter, its prediction will be replaced by the next orbit's predictions for that TDRS.

# c. All Blockage Areas

This option is mutually exclusive with the "Ku-Band Only" and the "S-Band Only" options on the Settings menu. A marker is placed in front of the active selection between these three choices. If "All Blockage Areas" is selected (default) then both the S-band and Ku band blockages are shown in the plot area.

## d. Ku-Band Only

This option is mutually exclusive with the "All Blockage Areas" and the "S-Band Only" options on the Settings menu. A marker is placed in front of the active selection between these three choices It enables the Ku-Band masks and disables the S-Band masks. The Ku-Band masks displayed in the plot area are the orbiter obscuration mask (displayed as **red** lines), the Beta mask (displayed as a **yellow** curved line), the Beta stops (displayed as **yellow** circles at +85 and -75 Beta angles.), the Alpha stops (displayed as a **yellow** line connecting the two Beta stops), any RF protect boxes that are enabled (displayed as **red** hashed boxes) and any other Ku-Band user defined masks (displayed as **red** hashed areas).

### e. S-Band Only

This option is mutually exclusive with the "All Blockage Areas" and the "Ku-Band Only" options on the Settings menu. A marker is placed in front of the active selection between these three choices. If "S-Band Only" is selected the active options selected from the "S-Band" menu (see this section part 4) are displayed.

## 3. Ku-Band Menu

This menu is used to display various maskings for the Ku band system. Generally this menu is changed from flight to flight since the configuration of the objects that must be masked out by the Ku band system very from flight to flight.



There are 3 user-built masks for the Ku band menu. The figure to the right is an example of what the menu could look like. See section C for details on "Updating Masks".

#### 4. S-Band Menu

This menu is used to display various maskings for the S band PM system. Generally this menu is fairly static and does not change. There is a flight specific addition to this menu, which can very from flight to flight. There are 3 user-built masks for the S band menu. See section C for details on "Updating Masks". Each of these masks is located in the masks directory under the wams directory on the workstation high availability server.



## a. Multi-Pathing

When this option is selected the areas of expected S Band multi-pathing will be displayed as dark blue polygons in the plot area. If it is selected a second time the areas of multi-pathing will be removed from the plot area. (see section A part section 2 for an example of the Multi-pathing mask)

## b. Nose/Tail

When this option is selected the areas in the S band antenna pattern that represent low gain are displayed as dark blue polygons in the plot area. These are generally called "Off the Nose" and "Off the Tail". The area for "Off the Nose" is elevation angles greater than +85°. The area for "Off the Tail" is elevation angles of less than -70°. If this option is selected a second time the areas for "Nose/Tail" are removed from the plot area. (see section A part section 2 for an example of the Nose/Tail mask)

### c. Antennas

There are 8 individual antenna selections on this menu. The purpose of these masks is to indicate to the users which S Band quadrant and beam antenna is failed or has issues. When an antenna is selected that location in the antenna pattern of the plot area will turn dark blue. When that antenna is selected again the dark blue high light will disappear.

# d. User Defined Masks

There are 3 user-defined masks that can be used for the S Band system. Only one user-defined mask is in the example of the menu, "POST 113". See section C for the process to update the S Band masks.

### 5. Trends Menu

This menu is used to enable or disable the display of a target on the SM real-time plot area. These targets are the real-time targets downlinked from the SM GPC and not the ground calculated targets (see part 6 of this section for ground calculated targets). When a small marker is displayed in front of the option on the menu, it indicates the option is enabled and that target will be displayed in the plot area. The default state is for all options to be enabled. The following is a list of the options on this menu.

## a. SV 1 through SV6

These options represent the six TDRS state vector slots in the SM GPC antenna management software. When they are enabled the longitude of the TDRS satellite in the state vector slot will be displayed at the azimuth/elevation that is downlinked for that slot. These values are obtained from the wams\_comp application. (see section D)

## b. Ground-Site

This option represents the active Ground site in the SM software. If this option is enabled the label for the ground site will be displayed at the azimuth/elevation that is downlinked for the active ground site. The az/el telemetry is straight from the real time downlink but the label is processed in the wams\_comp named AMC\_SITESEL, which gets the site label from the comm\_sys\_comp W01G3210R, before it is displayed in the plot area.

V92H1069C – Site Azimuth V92H1068C – Site Elevation

V92 J10 54C	W01G3210R
0	NONE
1	MIL
2	NHS
2 3 4	OTS
4	DGS
5	GTS
6	HTS
7	VTS
8	DFR
9	CTS
10	JSC
11	MAD
12	GDX
13	CAN
14	WLP
15	15
16	16
Other	ERR

If the active ground site is the primary communications link to the orbiter, the label will be displayed in green but if it is only that the ground site is in view of the orbiter, the label will be displayed in cyan. This status is determined by using commsys\_comp (W06I0200R). The following is the logic used to determine the color of the label.

If W06I0200R = "TDRS" or "INVL" then the label is **CYAN** else the label is **GREEN**.

### c. Ku-Comm

This option is used to display the position of the Ku band Antenna when the Ku band system is in Comm mode vice RADAR mode. When this option is enabled, the Ku band antenna pointing position is represented by a small rectangle '□' at the real-time downlinked azimuth/elevation pair in the plot area. If the Ku band system is in RADAR mode the '□' target will be replaced by the 'T' target. This is determined by the following formula

V74X2583J = 1 then COMM mode Else RADAR mode

# d. Target

This option is used to display the position of the Ku band Antenna when the Ku band system is in RADAR mode vice Comm mode. When this option is enabled, the Ku band target is represented by a 'T' at the real-time downlinked azimuth/elevation pair in the plot area.

# 6. Grd Trgts

This menu is used to enable or disable the displaying of the ground calculated targets. These targets are represented on the real-time plot area as burnt orange characters with either the TDRS longitude plus a 'G' as the label or as the 3-letter designation for the ground site plus a 'G' as the label. Each target is displayed at the calculated azimuth/elevation pair. The azimuth/elevation pairs for each target are calculated in the moc\_comp. See section II B p. 32 for moc comp information.

### 7. COMP

This is an indicator light which shows the status of an application named moc\_comp. This application calculates the azimuth/elevation angles for TDRS satellites as well as several ground stations.

COMP – **Green** indicates running with no errors

**Red** indicates a failure to retrieve data from the trajectory server or the comp is not running.

Section II B p. 32 has a detailed discussion of the moc comp application.

## 8. GMT/MET Button

This button is used to switch between Greenwich Mean Time (GMT) and Mission Elapsed Time (MET) on the real time display as well as the predict events display. The parameters used for this are

M50Q0027HP – GMT M50Q0030HP - MET

For the simulation environment, the GMT will utilize the Simulated Greenwich Meantime (SGMT).

#### 9. DAP

Digital Auto Pilot (DAP) indicator is primarily used to warn the user of WAMS when the orbiter is in free drift so they will know the real-time targets will deviate from the predicted paths. The following matrix is used to determine what to display.

V72 X28 49X	V72 X28 68X	V72 X28 97X	V72 X28 50X	Value Displayed
1	0	0	0	INRTL (purple)
0	1	0	0	LVLH (yellow)
0	0	1	0	FREE (red)
0	0	0	1	AUTO (green)

#### 10. Clear All button

This button is used to clear the historical trends for the displayed targets.

#### 11. Plot Area

The plot area is the primary part of the SM real-time display, which is used to show where in the S Band antenna pattern the targets, and their historical trends, are located. It is used to display indications of the starboard radiator (deployed/stowed), the Ku Band gimbal stops, the S Band and Ku band masks as well as the RF protection boxes. The status of the starboard radiator is updated automatically by the downlinked telemetry. The RF protection boxes are automatically displayed when they are enabled in the SM antenna management software as indicated by the downlinked telemetry. The SM real-time display will also display any selected ground calculated targets. The TDRS or ground site that is being used as the primary link between MCC and the orbiter will be displayed with a Green label. Any TDRS or ground sites that are in view but are not the primary link will be displayed with a CYAN label. Any TDRS or ground sites that are not in view of the orbiter will be displayed with a Gray label. See WAMS comp (section II A) for details on the calculations used for the real-time targets as well as RF protection box locations.

V37 X35 10E	V37 X35 11E	Starboard Radiator Status
1	0	Deployed
0	1	Stowed

# 12. Digital Data Area

This is the lower half of the display, which includes the telemetry from the SM antenna management software as well as some S Band and Ku band telemetry. Some of these parameters are created as output from the wams\_comp application. See section II A p.31 for details of those computations.

### a. AZ EL

This part of the digital data area is used to display the TDRS State Vector information including: longitude, predicted and actual azimuth/elevation, predicted AOS and LOS times and the TDRS state vector slot being used as target A or B. The predicted AOS, LOS, azimuth and elevation come from the predict\_events file, which is generated by the Prediction display (section C). The longitude, actual azimuth and elevation are calculated in wams\_comp (section II A) because the data is sub-commutated in the SM downlist. The parameters used to display the data are:

Longitude	Azimuth	Elevation
LONG_TDRS_SV1	SV1AZ	SV1EL
LONG_TDRS_SV2	SV2AZ	SV2EL
LONG_TDRS_SV3	SV3AZ	SV3EL
LONG_TDRS_SV4	SV4AZ	SV4EL
LONG_TDRS_SV5	SV5AZ	SV5EL
LONG_TDRS_SV6	SV6AZ	SV6EL

### b. Ku-Band

The Ku band digital data is a mixture of real-time downlinked telemetry with ground-calculated data. The following are the parameters used to populate this part of the display.

	Actual	Commanded
<b>AZ</b> V74H2618J		V74H2648J
EL	V74H2619J	V74H2605J
Alpha	V92H0098C	Ku_desg_alpha
Beta	V92H0099C	Ku_desg_beta
Range	V74U2623J	V74U2651J

The "Bias" values are the difference between actual values – commanded values.

Ku Mode - V74X2583J - 1 = COMM (green), 0 = RADAR (red)

Ant Mode – W01G3202R from commsys\_comp is

V74 X25 85J	V74 X25 84J	V74 X25 86J	W01G3202R
1	0	0	DESIG
0	1	0	AUTO
0	0	1	ACQ
0	0	0	MAN
All other	combos	INVL	

GNC PTG - V93X6859X - 1 = ENA (yellow), 0 = DSBL (green)

Beta Mode - V74K2645J - 1 = BETA (green), 0 = BMSK (green)

Beta Angle - V74H2655J - actual value

RF Protect Angle – V92X5601X – 1 = BAD (red), 0 = GOOD (green)

Range Rate – V74R2621J – actual value

Scan Warn – V74X2614J – 1 = ON (yellow), 0 = OFF (green)

Obsc Ovrd - V74X2595J - 1 = ON (yellow), 0 = OFF (green)

Beta Flag -

V92 X01 04R	V92 X09 93X	AMC_BETA_FLAG output
1	0	STOP (red)
0	1	LIMIT (yellow)
0	0	Blank
1	1	ERR (gray)

Stop Cntr - V92Q0103C - actual value

## c. RF Protect Box

This part displays the coordinates, in azimuth/elevation pairs, for each of the 4 RF protect boxes and indicates if the box is enabled or not. The coordinates are calculated in wams\_comp (section II A).

Box ⇒	1	2	3	4
Roll 1	Rf_box1_roll1	Rf_box2_roll1	Rf_box3_roll1	Rf_box4_roll1
Roll 2	Rf_box1_roll2	Rf_box2_roll2	Rf_box3_roll2	Rf_box4_roll2
Pitch1	Rf_box1_pitch1	Rf_box2_pitch1	Rf_box3_pitch1	Rf_box4_pitch1
Pitch2	Rf_box1_pitch2	Rf_box2_pitch2	Rf_box3_pitch2	Rf_box4_pitch2

The box coordinates will turn from gray to green when each box is enabled. The MSIDs used to indicate if a box is enabled or not are:

Box 1 Status – V93X5606X – 1 = '1' is green (ENA), 0 = '1' is gray (INH)

Box 2 Status – V93X5621X – 1 = '2' is green (ENA), 0 = '2' is gray (INH)

Box 3 Status - V93X5623X - 1 = '3' is green (ENA), 0 = '3' is gray (INH)

Box 4 Status – V93X5624X - 1 = '4' is green (ENA), 0 = '4' is gray (INH)

## d. Body Rates

This part of the digital data area presents the rates (degrees/second) at which the orbiter is moving along with the dead band value (degrees).

Pitch – V72R0917C Yaw – V72R0918C Roll – V72R0916C

Dead Band - V90H2785C (SM only)

#### e. S-Band

 Major Function – defined in wams\_comp as the parameter AMC DATAMODE.

V98Q009C (BFS Format ID) status is GOOD then display "BFS" V93Q0022CY (SM format Id) status is GOOD then display "SM". Default is "SM" displayed in gold letters.

- Site Sel AMC\_SITESEL Displays the selected ground site from the BFS or SM antenna management software. Default is JSC. If AMC\_DATAMODE = BFS then display the output of W01G3211R (from commsys\_comp) but if AMC\_DATAMODE = SM then display the output of W01G3210R (from commsys\_comp).
- 3. **CMD Quad** AMC\_CMD\_QUAD -Displays which S-Band antenna is currently selected by whichever major function is down listing. If the major function is SM the display uses the output of W03I0603R in the commsys\_comp; but if the major function is BFS, wams\_comp uses the table in section A part 7. W03I0603R is defined as:

V74 K70 50Y	V74 K70 51Y	V74 K70 55Y	V74 K70 56Y	V74 K70 60Y	V74 K70 61Y	V74 K70 65Y	V74 K70 66Y	V74 K70 44Y	V74 K70 46Y	V74 K70 45Y	V74 K70 47Y	W03 I06 03R
1	1	0	0	0	0	0	0	1	1	0	0	ULF
0	0	1	1	0	0	0	0	1	1	0	0	URF
0	0	0	0	1	1	0	0	1	1	0	0	LLF
0	0	0	0	0	0	1	1	1	1	0	0	LRF
1	1	0	0	0	0	0	0	0	0	1	1	ULA
0	0	1	1	0	0	0	0	0	0	1	1	URA
0	0	0	0	1	1	0	0	0	0	1	1	LLA
0	0	0	0	0	0	1	1	0	0	1	1	LRA
Any other combination									ERR			

4. Hemi – Displays the actual S-band FM hemi selected per the table below

SM	BFS	V98 X07 03X	V98 X07 04X	W03 I02 00R	Selected FM ant
1	Х	Х	Χ	0	LO
1	Х	Х	Х	Х	UP
Х	1	1	0	Х	LO
Х	1	0	1	Χ	UP

5. TDRS Sel – This will display the longitude of the selected TDRS (comp W04G3210R in commsys\_comp) while using the SM major function but will only display SV1, SV2 or SV3 while the BFS major function is used.

The output of W04G3210R is:

V93 X10 86X	V93 X10 87X	V93 X10 88X	V93 X10 89X	V93 X56 68X	V93 X56 69X	V92 X23 49X	value of
1	0	0	0	0	0	0	V92H2354C
0	1	0	0	0	0	0	V92H2357C
0	0	1	0	0	0	0	V92H2361C
0	0	0	1	0	0	1	V92H2354C
0	0	0	0	1	0	1	V92H2357C
0	0	0	0	0	1	1	V92H2361C
0	0	0	0	0	0	Х	none

6. ANT PTG – This indicates if the SM or BFS is enabled to command the S-Band antennas or not.

SM	BFS	V93 X56 25X	V93 X56 26X	V98 X07 13X	Antenna Pointing State
1	Χ	1	0	Х	ENA (green)
1	Х	0	1	Х	INH (red)
1	Х	1	1	Х	ERR (gray)
1	Х	0	0	Х	ERR (gray)
0	1	X	X	1	ENA (green)
0	1	Х	Х	0	INH (red)

## f. Pri-Mode

This part of the digital area indicates if the 'A' target or the 'B' target will be the primary target for the S Band and the Ku band antenna pointing software in the SM GPC. S Band and Ku Band have separate pri modes. The following formula is used to display which pri mode is active for the S Band and the Ku band software.

V93 X56 48X	V93 X56 49X	V93 X56 50X	V93 X56 51X	Pri Mode
1	0	Χ	Χ	'A' - Ku Band
0	1	Χ	Χ	'B' - Ku Band
Χ	Χ	1	0	'A' - S Band
Χ	Χ	0	1	'B' - S Band

## g. Ground Sites

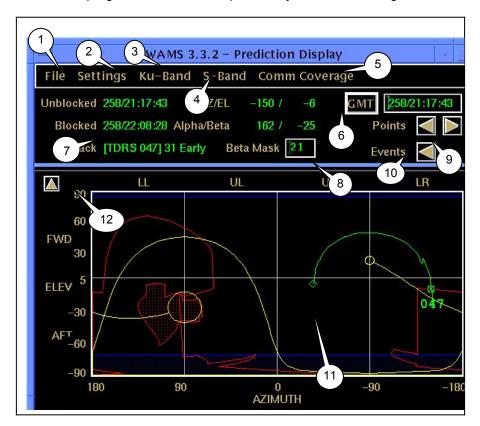
This part of the digital area indicates which ground site is being selected by either the SM or the BFS GPC antenna management software as well as giving the azimuth and elevation angles for that active site. (See section B.5.b for the SM sites and section A.5 for the BFS sites)

# 13. Shrinky-Dink

This is the small arrow button ' $\blacktriangle$ ' located just above the the Digital RF Protect box prediction data area. It is used to shrink the display by removing the Digital Prediction area from view. If the display is reduced to just the plot area the ' $\blacktriangledown$ ' can be pressed to restore the digital data area at the bottom of the display.

# C. Predict Display

The prediction display must be called up from either the SM or BFS real-time displays. This display is used to show the expected path that each TDRS satellite will take through the S Band antenna pattern during each orbit. This data is derived from the program named LOS. This program is owned and operated by the FAO Pointing console.



### 1. File Menu



The file menu is used to select the different displays available in WAMS as well as to close the individual display or the entire application. The options are:

# a. Real-time Display (ctrl+s)

This option will start the SM Real-time display, as a separate window.

## b. Predict Events (ctrl+b)

This option will start a window that lists the TDRS satellites that represent un-filtered vectors.

The geometric AOS and LOS of orbiter line-of-site is provided in GMT (or MET). A left mouse click on any one event followed by a click on the "Update" button will produce the predict path of that event on the Prediction Display. Multiple events can be displayed with a left mouse click and drag across 2 or more events.

### c. Print Predict

Selecting this option will print the Prediction Display as currently depicted.

### d. Close (ctrl+c)

This option will close the Prediction display but allow any other WAMS displays to remain active.

### e. Exit (ctrl+x)

This option closes all WAMS displays and background processes with the exception of WAMS comp.

## 2. Settings Menu



This menu is used to select the different sub displays that are used to configure the Predictions display. These are the options available:

### a. Set Base PET

This menu option allows the user to establish a baseline Phased Elapsed Time (PET) which could be different from the default Mission Elapsed Time (MET). If the user chooses to use this option they will not be using MET any longer in their active copy of WAMS.

### b. Step By Minute

This menu option allows the user to have the points on the predictions trends increment by minutes instead of the default prediction points option. By selecting this option the user can "click" the left or right POINTS buttons (see section C 9 p.30) and the marker on the prediction trend will move to the next minute location.

### c. All Blockge Areas

This option is mutually exclusive with the "All Blockage Areas" and the "S-Band Only" options on the Settings menu. A marker is placed in front of the active selection between these three choices.

## d. Ku-Band Only

This menu option is mutually exclusive with the "All Blockage Areas" and the "S-Band Only" options. It enables the Ku-Band masks and disables the S-Band masks. The Ku-Band masks displayed in the plot area are the orbiter obscuration mask (displayed as **red** lines), the Beta mask (displayed as a **yellow** curved line), the Beta stops (displayed as **yellow** circles at +85 and -75 Beta angles.), the Alpha stops (displayed as a **yellow** line connecting the two Beta stops), any RF protect boxes that are enabled (displayed as **red** hashed boxes) and any other Ku-Band user defined masks (displayed as **red** hashed areas)

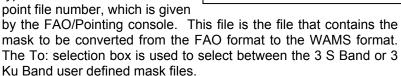
### e. S-Band Only

This menu option is mutually exclusive with the "All Blockage Areas" and the "Ku-Band Only" options. It enables the S-Band masks and disables the Ku-Band masks. The available S-Band masks (displayed as **dark blue** hashed boxes) are one for each of the 8 antennas, the "off the nose" area, the "off the tail" area and up to three user defined masks.

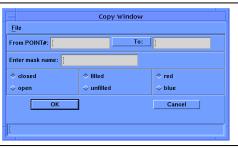
## f. Update Masks

This menu option starts up a display which can be used to update the user defined masks for both the S-Band and Ku-Band.

- 1. File menu This menu is used to quit the display.
- POINT # and To: The POINT# type in box is used to hold the point file number, which is given



- 3. Enter Mask Name: This type in box is used for the user defined name of the mask which will be displayed on the Ku Band or S Band menus depending on which user defined file is selected above.
- Closed/Open These mutually exclusive buttons are used to select if the mask will be closed (the last point drawn connects to the first point drawn) or open (the last point does not connect to the first point drawn)
- 5. Filled/unfilled These mutually exclusive buttons are used to select if the mask is filled (dots) or not.
- red/blue These mutually exclusive buttons are used to select the color that will be used when the mask is displayed in the plot areas. The current INCO trend is to depict S-Band masks as blue and Ku-Band masks as red.



- 7. OK/Cancel When the OK button is pressed, all the entered options and file names are used to generate a user defined mask file. When the Cancel button is pressed the data is cleared from the fields without building the mask file.
- 8. Message line This will display error messages or messages that the process has completed successfully.

Message List: TBD

# g. Set LOS Filename



This menu option starts up a small display that is used to establish the location of the predict data files. This PTG. File is the directory/file in which the POINTING discipline has stored the generated POINTING LOS predicts. WAMS automatically searches by flight ID and Activity type for the specific file to utilize predictions data display. This file path can be changed by the WAMS user to utilize data from other supports by typing in the specific name and directory path of the alternate file. The file change affects only the immediate user display. However, left unchanged, the default selection will access predict data files for the prime activity.

### h. Use Real-time Masks

This is a toggle between "Use Prediction Masks" and "Use Real-time Masks". When the user selects "Use Real-time Masks", the button will change to be "Use Prediction Masks". The Prediction display plot area will have the same masks visible as the Real-time display plot area. When "Use Prediction Masks" is selected, the button will change to be "Use Real-time Masks". The Prediction display plot area will revert to the masks that were last selected in the "Use prediction Masks" view. The user can select specific masks to correctly characterize the time frame of interest.

### i. TDRS Filter

This application allows the user to select and de-select specific TDRS satellites for prediction display. The advantage to the user is that scrolling through the predicts for long time periods goes much faster if the prediction data for TDRS that are not scheduled are not displayed. The user can left mouse click on the TDRS number to move the action box to the specific TDRS. A second left mouse click will select that TDRS for inclusion in the predicts display. A small



box will appear just left of the TDRS number to indicate this action. To de-select a TDRS, simply move the curser to that number and click once.

#### 3. Ku-Band Menu

This menu is used to display various maskings for the Ku band system. Generally this menu is changed from flight to flight since the configuration of the objects that must be masked from the Ku band system vary from flight to flight. There are 3 user-built masks for the Ku band menu See the section C2f above for details.



#### a. BETA + Mask Mode

This is a toggle between "Beta + Mask Mode" and "Beta Mode Only". If "Beta & Mask Mode" is selected the Predict display will indicate the curved yellow line of Beta plus Mask and the Ku-Band selection window will now offer "Beta Mode Only" as a selection. If "Beta Mode Only" is selected, the Predict display will indicate only the BETA protect area and the Ku-Band selection window will now offer the "BETA + Mask Mode" as a selection.

# b. Radiator deployed

This is a toggle between "Radiator Deployed" and "Radiator Stowed". If "Radiator Deployed is selected, radiator blockage depiction will be displayed on the Predict display and the Ku-Band selection window will now offer the "Radiator Stowed" selection. If the "Radiator Stowed" is selected, the radiator blockage is removed from the Predict display and the Ku-Band window will now offer the "Radiator Deployed" selection.

### c. SET RF Protect Box...



This application allows the user to create, enable, or disable RF Protect Boxes on the Predict display. This feature is particularly handy for predicting amount of communications coverage prior to a change in flight phase (i.e. Free-flight to dock, dock to undock etc.). The box coordinates can be entered from scratch, or, as long as the boxes are entered into the SM GPC on-board, the actual realtime values can be projected before they are enabled on-board. In turn, each box can then be enabled to the Predict Display by selecting the green square or disabled on the predict display by de-selecting the green square. For RF Protect Boxes while in a static docked state it would be easier to use "Settings" > "Use Realtime Masks".

### d. Three buildable mask slots

The next 3 selections on the Ku-Band drop are user-built masks. Examples might the "ODS", which we are obligated by Flight Rule to protect by not radiating Ku-Band with-in the masking and the ISS blockage profile when docked, adding to the possibility of "ratty comm" predictions through-out the mask area.

### 4. S-Band Menu

This menu is used to display various maskings for the S band PM system. Generally this menu is fairly static and does not change. The standard "Multi-Pathing" and "Nose/Tail" masks are selectable to the predict display. Each of the 8 antennas regions is included. This would be useful to project S-Band communication predicts if the antenna switch was not allowing selection of one of the antenna regions. There is a flight specific addition to this menu, which can vary from flight to flight. These are 3 user-built masks for the S band menu. Typically the ISS docked profile would be one of the mission specific masks. See this section for details on "Updating Masks". Each of these masks are located in the masks directory



under the wams directory on the workstation high availability server.

## 5. Comm Coverage Menu

The Comm Coverage menu contains the display options for creating a Communications Coverage memo from the Predictions Display. The following is a discussion about the parts of the Comm Coverage menu. See the Operational Procedures in section III F for building a Comm Coverage Memo.



## a. Ratty

This menu option starts a small display that can be used to select time ranges on the

prediction display that are considered to be poor for S-Band comm. The following steps can be used for the Ratty, Ku Avail, ZOE, GAP and TDZ displays.



- 1. Start The start button is pressed when the start time for ratty comm is selected on the prediction display. The time selected will appear in the start time type in box. The start time can not be entered manually.
- 2. Stop The stop button is pressed when the stop time for ratty comm is selected on the prediction display. The time selected will appear in the stop time type in box. The Stop time can not be entered manually.
- 3. Cancel The cancel button will clear the times and allow the user to select other times for start and stop
- 4. Close The close will simply close the small display without saving any times to the coverage window.
- 5. Save The save button will save the current set of times to the Coverage Window.

### b. Ku Avail



This menu option starts a small display that can be used to select time ranges on the prediction display that are considered to be good for Ku band comm. See steps above in Ratty. The save button will save the current set of times to the Coverage Window.

### c. ZOE



This menu option starts a small display that can be used to select time ranges on the prediction display that are considered to be times when there will be no signal with the orbiter due to no TDRS in view. See steps above in Ratty. The save button will save the current set of times to the Coverage Window.

# d. GAP



This menu option starts a small display that can be used to select time ranges on the prediction display that are considered to be times when there will be no signal with the orbiter due to no TDRS or ground site being available. See steps above in Ratty. The save button will save the current set of times to the Coverage Window.

### e. TDZ



This menu option starts a small display that can be used to select time ranges on the prediction display that are considered to be good times for the use of the TDRS Z satellite. See steps above in Ratty. The save button will save the current set of times to the Coverage Window.

# f. Coverage Window



This menu option will display a small report that shows all the accumulated time ranges that were developed by the other options on this menu, or more importantly, it will display the "Automatic Coverage" results from the final option on the Comm Coverage Menu (see below).

- 1. Orbit: Under the Orbit heading, the display shows the orbit number for the event. Orbit numbers are only obtained from the TDRS SHO file. The "Type" will be displayed next. The possible events consists of 4 types: Ku Available, Ratty, GAP and ZOE.
- 2. Ku Avail: This represents a time portion of a TDRS event that the Ku-Band antenna can radiate a return link.
  - a. Comm(GMT): This is the time frame between the Ku- Band TDRS target clearing any blockage (or start of event in the open) and the point were the Ku-Band target again enters blockage (or TDRS event ends). Blockage may be the Shuttle body hard-line, the Beta line or any enabled Ku-band masking on the Predict Display such as the RF Protect Boxes .
  - b. Delta: This is the cumulative time frame between Ku-Band target unblocked (or start of event unblocked) and the point at which the TDRS target enters blockage (or TDRS event terminates).
- 3. Ratty: This refers to "Ratty Comm", meaning that the S-Band PM system may be subject to drop-outs on the forward or return links. This scenario is predicted when the TDRS or ground site targets are in the Nose/Tail region or Multi-path regions (if enabled on the Predict display). This will also be listed if the TDRS S-Band target is predicted to enter the ISS S-Band Docking mask(if enabled). Note that a particular Ratty segment will not be listed, if while it would occur, the Ku-Band is unblocked (given that the user has selected "Ku-Band available" on the "Automatic Coverage" menu below).
  - a. COMM (GMT): This is the time frame between the S-Band TDRS target entering any blockage/interference region (or start of event in blockage) and the point were the S-Band target exits the area (or TDRS event ends). Again, keep in mind this occurrence will only be listed when Ku-Band is also blocked or the user has selected "Ku-Band unavailable" on the "Automatic Coverage" menu below.
  - b. Delta: This is the cumulative time frame between S-Band targets entering the interference region (or start of event in the obstruction) and the point at which the S-Band TDRS target exits the interference region (or TDRS event terminates).
- 4. GAP: This denotes any gap in the SHO (TDRS Scheduling Orders) file longer than 30 seconds. For example, if we were forced to give up 15 minutes support of a TW 171 event, the GAP would indicate this by looking at the updated SHO file on the LAN provided by GC and COMMAND positions. The COMM (GMT) and Delta for a GAP are direct indicators of the missing support times. Note that any "ZOE" period (see below) will also show as "GAP" unless the ZOE has been entered manually via the ZOE menu selection of the COMM Coverage.

5. ZOE: (Zone Of Exclusion) This is a GAP that is situated between the end of the TDRS East event and the start of the TDRS West event. In the example above, the user has entered a "ZOE" note by utilizing the ZOE application window and installing the selected times between end of TDRS East event and start of TDRS West. This step is necessary only if it is important to note that the GAP is also the ZOE. If not, the "Automatic Coverage" application will accurately list this outage as a "GAP".

The following buttons are found at the bottom of the "Coverage Window":

- 6. Delete The delete button is used to delete an event from the report that is high-lighted. Multiple events can be deleted by a left mouse click, "shift" key, and left mouse click. All events should be deleted on this display prior to running the next "Automatic Coverage" window, else any new set of times will be added to the list.
- 7. Create Report The create report button is used to create a text file that contains the events established by the Coverage Window. This report is then available for transmittal to the MCC PCs by means of the FTP application available on the Workstation DNAV. Once in the MCC PC, this report can be transformed to a Flight Note for distribution to all interested parties. (See Building a Comm Coverage Note procedure in section III, F. p.44).
- 8. Close The close button is used to close the coverage window.

## g. Automatic Coverage



This display represents an important feature in the WAMS prediction application. It allows the WAMS user to take advantage of the automatic software in v3.3.2 that will produce a concise summary of the comm coverage. The summary is displayed as the "Coverage Window" previously discussed.

1. Start time: This box allows the user to enter the start period for the Comm Coverage window report. The user can click in the box and manually enter the start time. It is best to start the period as the

beginning of a TDRS event (as seen on the electronic SHO schedule). Only GMT can be utilized in this box.

- 2. Stop time: This box allows the user to enter the stop period for the Comm Coverage window report. The user can click in the box and manually enter the stop time. It is best to stop the period as the end time of a TDRS event (as seen on the electronic SHO schedule). Only GMT can be utilized in this box.
- 3. Ku-Band available : This is a toggle function between "Ku-Band available" and "No Ku-band available". When "Ku-Band available" is selected, the Comm Coverage window will include prediction event time periods of Ku availability. The Ratty periods will also become less prevalent on the Coverage window because the Ku-Band may furnish good comm during otherwise ratty periods. If "Ku-Band available" is selected, the display will toggle to offer the "No Ku-Band available" selection.
- 4. Cancel: The cancel button will clear the times and allow the user to select other times for start and stop.
- 5. Close :This button will close the "Automatic Coverage" window.
- 6. Save : This button will start the automatic kick off of the application processes that produces the Coverage window. The application will consider only the blockage areas enabled on the Predict Display. Therefore a pop-up box will intercede to remind the user of boxes and masking that may be applicable during the requested predict time frame:



The user can **Cancel** at this point and enable any additional masking, or chose to **Proceed**, and generate the "Coverage Window".

### 6. GMT/MET

This is a button which toggles between GMT and MET. All times in WAMS are controlled from this button. If the user presses it when the label is GMT, all times will be displayed in MET and the button label will change to MET. The opposite response will happen if the button label is MET. The time to the right of the button is the time of the small square target located on one of the prediction tracks in the plot area. This time will change as the user selects different locations along one of the prediction tracks.

### 7. Digital Prediction Data

This area of the prediction display contains the information when the Ku band TDRS target.

- a. Unblocked: This is the earliest time in the TDRS event that the Ku-Band is not blocked from radiating a return link.
- b. Blocked: This is the earliest time in the TDRS event that the Ku-Band enters blockage of any kind (body blockage, Beta, masking).
- c. Track: This states the particular TDRS predict that the user has currently selected. This can be changed (for more than one predict displayed) by simply using the mouse to select an alternate predict path.
- d. AZ/EL: These figures will reflect the location of the TDRS target along the predict path as pin pointed by the mouse cursor.
- e. Alpha/Beta: These figures will reflect the location of the TDRS target in gimbel angles along the predict path as pin pointed by the mouse cursor.

## 8. BETA MASK

This type-in box allows the user to change the BETA mask being displayed on the prediction plot area. If the user has the prediction display configured to use the prediction masks and they type a new BETA mask angle into the type-in box, the yellow beta curve in the plot area will change to show the new angle.

## 9. Points Selection

There are up to two arrow buttons in this area of the display next to the Points label. They are used to move the small square target along the prediction event. The left pointing arrow button '◀' will move the target to the previous time position (if possible) on the event line. The right pointing arrow button '▶' will advance the target to the next time position on the event line. If the target on the event line is at the start of the event the '◄' will not be visible. If the target on the event line is at the end of the event, there will not be a right pointing arrow button. If more than one prediction event is visible and they have overlapping times, the user will see a small 'x' appear on the other prediction events when they are moving the small square around on the first prediction event. This indicates that both the events are in view at that same time.

### 10. Events Selection

There are up to two arrow buttons in this area of the display next to the Events label. They are used to select TDRS prediction events to be displayed in the prediction display plot area. The left pointing arrow button '◀' will select the earlier TDRS prediction (if possible). The right pointing arrow button '▶' will advance to the next TDRS prediction event (if possible). If the event being displayed is the first event in the prediction file the '◀' will not be visible. If the event being displayed is the last event in the prediction file the '▶' will not be visible.

### 11. Plot Area

The plot area is the part of the prediction display that shows the expected path a TDRS would pass through during an orbit. Multiple TDRS predictions can be displayed in this area at one time. Any or all of the available Ku band masks and S-Band masks are displayed in this area of the display. The user can select times on the prediction event trend lines by moving their mouse cursor over a spot on the trend line and pressing the left mouse button. The time for that spot on the line will appear in the upper right hand corner of the display.

# 12. Shrinky-Dink

This is the small arrow button ' $\blacktriangle$ ' located just below the plot area. It is used to shrink the display by removing the Digital Prediction area from view. If the display is reduced to just the plot area the ' $\blacktriangledown$ ' can be pressed to restore the digital data area at the top of the display.

### II. DISPLAY COMPS

# A. wams\_comp

wams\_comp is a background process that runs independent of the WAMS display itself. The purpose of the wams\_comp is to collect output from other computations and telemetry from the downlink and create the data that is required to make WAMS work well. Most of the wams\_comps are discussed in the real-time plot display sections (A and B). The following is a complete listing of the outputs from wams\_comp and what drives those outputs.

**1.** The following MSIDs from the ISP shuttle data stream are used to make calculations in the wams\_comp portion of the code:

V37X3510E - starboard radiator deployed flag

V37X3511E - starboard radiator stowed flag

V92H0545C - Roll 1

V92H0546C - Roll 2

V92H0547C - Pitch 1

V92H0548C - Pitch 2

V92J0899C - RF Protection Zone ID

V92X0104X - Ku-Band Beta Stop flag

V92X0993X - Ku-Band Beta Limit flag

V93Q0022CY - SM format

V93X5625X - S-Band Antenna Pointing, SM ENA

V98Q0009C - BFS format

V98X0701X - BFS TDRS selected

V98X0713X - S-Band antenna pointing - BFS

V98X0717X - Vector 1 TDRS select BFS

V98X0718X - Vector 2 TDRS select BFS

V98X0719X - Vector 3 TDRS select BFS

W01G3210R - S-Band site select - SM

W01G3211R - S-Band site select - BFS

W03I0603R - S-Band commanded quadrant - SM

Sband tdrs select – longitude of the TDRS selected for S-band

V75W3504D - GMT

V98H2344C - BFS X Coordinate

V98H2346C - BFS Y Coordinate

V98H2348C - BFS Z Coordinate

V93X5626X - S-Band Antenna Pointing, SM INH BFS\_CMD ANT

The following symbols are published by wams\_comp for use by the WAMS executable:

```
AMC ANTPTG - S-Band antenna pointing: 0- ERR, 1- ENA, 2- INH
AMC BETAFLAG - Ku-Band Beta flag: 0- ERR, 1- STOP, 2- LIMIT
AMC CMDQUAD - S-Band commanded quadrant
AMC DATAMODE - Real-time data mode: 0- undefined, 1- SM, 2- BFS
AMC RADIATOR - starboard radiator: 0- stowed, 1- deployed
AMC SITESEL - S-band Site Select
AMC TDRSSEL - S-Band TDRS select
RF BOX1 PITCH1 -
                     BOX 1 PITCH1
RF BOX1 PITCH2 -
                     BOX 1 PITCH2
RF BOX1 ROLL1 -
                     BOX 1 ROLL 1
RF BOX1 ROLL2 -
                     BOX 1 ROLL 2
RF BOX2 PITCH1 -
                     BOX 2 PITCH1
RF BOX2 PITCH2 -
                     BOX 2 PITCH2
RF_BOX2_ROLL1 -
                     BOX 2 ROLL 1
RF_BOX2_ROLL2 -
                     BOX 2 ROLL 2
RF BOX3 PITCH1 -
                     BOX 3 PITCH1
RF BOX3 PITCH2 -
                     BOX 3 PITCH2
RF BOX3_ROLL1 -
                     BOX 3 ROLL 1
RF BOX3 ROLL2 -
                     BOX 3 ROLL 2
RF BOX4_PITCH1 -
                     BOX 4 PITCH1
RF BOX4 PITCH2 -
                     BOX 4 PITCH2
RF BOX4 ROLL1 -
                     BOX 4 ROLL 1
RF BOX4 ROLL2 -
                     BOX 4 ROLL 2
```

# B. moc\_comp

The moc\_comp is a background process that runs independent of the WAMS display itself. The purpose of the moc\_comp is to collect output from the trajectory server as well as telemetry from the downlink and create some of the data that is required to make WAMS work well. The following is a complete listing of the outputs from moc\_comp and what drives those outputs.

1. The following MSIDs from the ISP shuttle data stream are inputs used to make calculations in the moc comp portion of the code:

```
V90U2240C - Quaternian 1 – PTM data stream
V90U2241C - Quaternian 2 – PTM data stream
V90U2242C - Quaternian 3 – PTM data stream
V90U2243C - Quaternian 4 – PTM data stream
M02T0001D – LAUNCH phase – EVN data stream
M02T0009D – OPS phase – EVN data stream
M02T0046D – LAND phase – EVN data stream
```

2. The following symbols are published by moc\_comp for use by the WAMS executable:

```
SV41G – TDRS 41 Ground calculated az,el
SV47G – TDRS 47 Ground calculated az,el
SV150G – TDRS 150 Ground calculated az,el
SV171G – TDRS 171 Ground calculated az,el
```

SV171HG - TDRS 171H Ground calculated az,el SV174G - TDRS 174 Ground calculated az,el SV275G - TDRS 275 Ground calculated az,el MILG - Ground calculated ground site az,el PDLG - Ground calculated ground site az,el JDIG - Ground calculated ground site az,el WLPS - Ground calculated ground site az,el NHSG - Ground calculated ground site az,el DGSG - Ground calculated ground site az,el GTSG - Ground calculated ground site az,el HTSG - Ground calculated ground site az,el VTSG - Ground calculated ground site az.el DFRG - Ground calculated ground site az,el CTSG - Ground calculated ground site az,el JSCG - Ground calculated ground site az,el SELG - Ground calculated ground site az,el

### III. OPERATIONAL PROCEDURES

This section is dedicated to explaining the procedures required to operate the WAMS displays.

# A. Starting display

- 1. From the INCO DNAV select 'AntMan"
  Under AntMan selections, select "Wams"
- 2. The WAMS window will appear, the arrow to compact the digital data will be available on the right center of the window. If the display remains unpopulated and static, this usually indicates Data Acq. Has not been started.

From the INCO DNAV select "DATA ACQ" Under DATA ACQ, select "Start Data" Re-select WAMs as described above in A.

## B. Stopping displays

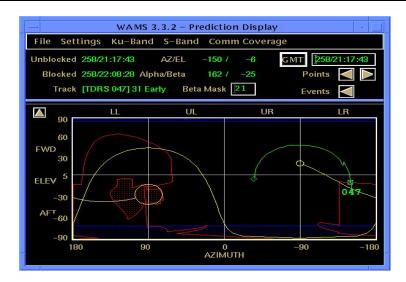
1. Under the "File" menu, selecting the "Close" will only close the Real-time display, any other WAMS display will remain present. Selecting the "Exit" function will closes all WAMS displays and functions.

# C. Utilizing Moc\_Comp

- 1. Starting Moc Comp
  - a. From the INCO DNAV, select AntMan, scroll to MOC COMP, select MOC COMP start
- 2. Cycling Moc\_Comp: Multiple runs during simulations require that Moc\_Comp is cycled between runs.
  - a. From the INCO DNAV, select AntMan, scroll to MOC COMP, select MOC COMP stop.
  - From the INCO DNAV, select AntMan, scroll to MOC COMP, select MOC COMP start

## D. Bringing up the Predict display

1. From the WAMS Realtime Display select "File". Under File select "Predict Display". The WAMS Prediction Display will appear. It will initiate at approximately 50% the size of the WAM Realtime display. This is normal, as the Predict display can be resized via corner mouse click and drag to suite the user.



## E. Utilizing Predicts

### 1. Events Track

Once the Predict Display is up, the POINTER files will automatically be accessed by WAMS. The user can manipulate the individual events to be viewed by selecting the "Events" arrows. This will display each event in sequence. The track will be represented by a curved line: Green for a target track concurrent with the TDRS scheduled for support of the shuttle, blue for the TDRS track in view of the shuttle, but not currently scheduled in the Electronic SHO File.

### 2. Mouse Cursor

The mouse cursor can be placed anywhere along the predicted target track and following a left mouse button click, will produce a GMT/MET in the upper right of the display. This is the time that the target will be in this location according to best predict information.

### 3. Points

The "Points" arrows can also be utilized to move the cursor forward or backwards along the track. The point increment is dependent on the POINTER file and is scaled to consider points of interest such as exiting blockage, entering blockage, and maneuvers. The location of these more important events will be defined with a closer series of points for scan. In areas that do not affect the coverage or do not represent a change in target direction, the default point movement is generally one minute between points.

### 4. Multiple Events

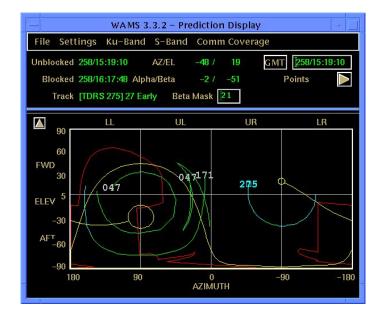
Multiple event tracks can be displayed by the user by selecting:

FILE > Predict Events

The following display will appear:



The user can then select more than one event by using the left mouse button to select an event and then holding down the "Shift" key on the key board and selecting a second event. Note that all events between the first selected event and the second selected event will be highlighted. This method is recommended for reviewing the predicts to consider Early vs. Normal handovers, or for the extended use of TDRS Z.



# F. Building a Comm Coverage Note

## 1. Automatic Coverage.

From the WAMS 3.3.2 Prediction Display select **Comm Coverage**. Drop cursor down and select **Automatic Coverage**.



- a. Start time: Click inside the Start Time box to manually enter the start time desired for the coverage in the comm note. It is best to start the period as the beginning of a TDRS event (as seen on the electronic SHO schedule). Only GMT can be utilized in this box.
- b. End time: Click inside the End Time box to manually enter the stop time desired for the coverage in the comm note. It is best to end the period as the end time of a TDRS event (as seen on the electronic SHO schedule). Only GMT can be utilized in this box.
- c. Ku-Band available: This is a toggle function to allow the application to consider a 2-way Ku-Band link as part of Comm Coverage. If Ku-Band is deployed and active in Comm Mode during the requested time period this button should be left as is, showing Ku-Band Available

If the K-Band will be stowed, powered down or in Radar Mode for the duration of the Comm Coverage Note select the box, toggle the box to Ku-Band Available

This will indicate the comm coverage will only consider the S-Band PM system. Expect more frequent periods of "Ratty Comm" in the **Coverage Window**.

d. Save: After the times have been entered and Ku-Band has been considered for support, select Save

The same button will start the automatic kick-off of the application processes that produce the **Coverage Window**. The application will consider only the blockage areas enabled on the Predict Display. Therefore a pop-up box will intercede to remind the user of boxes and masking that may be applicable during the requested predict time frame:



If the user is satisfied that the masking is correct on the Predict Display for the Comm Coverage time frame: select Proceed and skip to Part 3. Coverage Window p. 39.

# 2. Additional Masking

If the user has realized that there will be additional masking required for the comm coverage times, select Cancel at this point and proceed to add ISS blockage masks, RF Protect Boxes or S-Band Masking. This can be done on the WAMS Prediction Display by selecting Settings, "Use Predict Masks". At this point, the Realtime masking will disappear from the Prediction Display. The user can then taylor the Ku-Band and S-Band masking.

### a. Ku-Band Masking

From the Predict Display, select "Ku-Band". The following display will appear.



- Beta+Mask mode: This toggles between "Beta+Mask Mode" and "Beta Only". If there will be a RNDZ, docking or EVA during the desired Comm Coverage time frame, it would be best to check the Flight Rules to see if "Beta Only" is required and select accordingly.
- 2. Radiator deployed: This is a toggle between "Radiator Deployed" and "Radiator Stowed". If "Radiator Deployed" is selected, radiator blockage depiction will be displayed on the Predict display and the Ku-Band selection window will now offer the "Radiator Stowed" selection. The deployed radiator will, of course, reduce the "Ku Avail." periods and may increase the "Ratty Comm" periods in the Coverage Window.
- 3. Set RF Protect Box:



This application allows the user to create, enable, or disable RF Protect Boxes on the Predict display. The box coordinates can be entered from scratch, or, as long as the boxes are entered into the SM GPC on-board, the actual realtime values can be projected (before they are enabled on-board), by clicking the Use Realtime Values box. In turn, each box can then be enabled to the Predict Display by selecting the green square. Any RF Protect box can also be de-selected (Predict Display only), via the green square.

## 4. Three buildable mask slots

The next 3 selections on the Ku-Band drop are user-built masks. Examples might the "ODS", which we are obligated by Flight Rule to protect by not radiating Ku-Band with-in the masking and the ISS blockage profile when docked, adding to the possibility of "ratty comm" predictions through-out the mask area. The ISS Blockage mask will be named "Post XXX, (where the XXX equals the name of latest flight that the ISS has added installation structure).

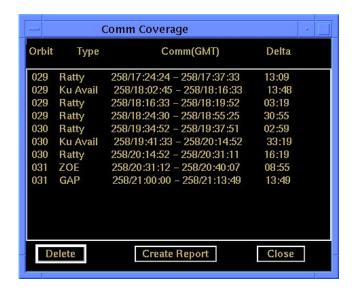
### b. S-Band Masks



- 1.The standard "Multi-Pathing" and "Nose/Tail" masks are selectable to the predict display. These should be selected (assuming S-Band is working) while in "Use Predict Masks" mode because they are always there with possible interference to the S-Band RF.
- 2.Each of the 8 antennas regions is included. These should not be selected unless there has been a failure in the antenna switch was not allowing selection of one of the antenna regions.
- 3.These are 3 user-built masks for the S band menu. Typically the ISS docked profile would be one of the mission specific masks titled "Post XXX", (where the XXX equals the name of latest flight that the ISS has added installation structure). For docked operations, this mask should be selected. This will accurately depict increased instances of "Ratty Comm" to the Coverage Window.

# 3. Coverage Window

From the WAMS Prediction Display select Comm Coverage. Drop cursor down and select "Coverage Window". The following window will appear:



a. The orbit, type of event, GMT and delta (length of each event) have been provided. The type of event is automatic and is based on only "Ku Avail", "Ratty" and "Gap". These are rounded to the appropriate full minute by the application in order to provide INCO a slight buffer on the advertised times. If the user is satisfied with the Coverage Window data, proceed to step b.

If the user would like to add additional data, this can be done by selecting Comm Coverage on the Predict Display.



Each of the first 5 lines can be selected to retrieve a small application display:



Each of the five displays will be identical except for the title. Each application display, when used correctly, will add an event line to **Coverage Window**. The following steps apply to all five manual displays.

- 1.Start The start button is pressed when the start time for ratty comm is selected, by cursor, on the prediction display. The time selected will appear in the start time type in box. The start time can not be entered manually.
- 2.Stop The stop button is pressed when the stop time for ratty comm is selected, by cursor, on the prediction display. The time selected will appear in the stop time type in box. The Stop time can not be entered manually.

- 3.Cancel The cancel button will clear the times and allow the user to select other times for start and stop
- 4.Close The close will simply close the small display without saving any times to the coverage window.
- 5.Save The save button will save the current set of times to the **Coverage Window**.

"Ratty", "Ku-Available" and "Gap" are already provided by the Automatic Coverage feature. However, the manual input can be used to tailor the comm coverage note. For example, if it becomes necessary to list the support times of TDRS Z this can be done with the TDZ manual application. If it is desirable to list the "GAP" between TDRS East and TDRS West as a "ZOE" on the Coverage Window, this can be done with the "ZOE" application. (Remember to "delete" the automatically provided GAP entries that this will replace).

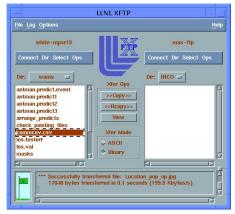
b. Create Report: When the user is satisfied with the Coverage Window, Create Report can be selected from the Coverage Window. This generates a Comm Coverage Data file in the inco/ DATA directory. The exact directory/file location is displayed in a pop- up window:



### 4. File Transfer Process (FTP)

This application allows the transfer of the Comm Coverage inco/DATA directory file to a location on the MCC PC LAN (V drive).

a. Pull up the FTP application: Master DNAV> TOOLS>MCC file Transfer (XFTP). Note that the application is divided into left side files and right side files.



- **b. Connect** to the right side as **Remote** by entering your log in and MCC PC password.
- c. Find INCO in right side window, double click.

If you get to the correct spot, the box on the right should be blank or have "commcov.csv" in it. (if you see the commcov.csv still there, perform step 4a, delete file, come back).

d. Navigate on the left side by double clicks to:

INCO\DATA\SSP-XXX(your flight upport)\cert\_apps\WAMS\commcov.csv

- e. Select commcoverage.csv
- **f. Select** >>> COPY>>> in the middle of the application. This will transfer the left box content, (commcoverage.csv), to right box location (V:\INCO\).
- g. **Select** "OK" in the pop-up box window. The Comm Coverage file is now in the PC V:\INCO\INCO OPSFTP shortcut on the PC.

### 5. PC V: FTP

- a. On the MCC PC, find the V drive, navigate to the FTP shortcut. Select shortcut
- b. Open the commcoverage.csv
- **c. Highlight** everything except the title bar containing Orbit, Ratty Comm, Ku available (GMT) and Delta.
- d. Copy

## 6. CommCoverage Template

a. Navigate on MCC PC to

S:\Divisions\DF\Private\DF24\WAMS\CommCoverage Template.xls. This template is pre-arranged to provide proper spacing for the Flight Note system text used later in the procedure.

- b. Open template, select the first open cell below ORBIT .
- **c. Paste Special** > without borders (should see all the note data now).
- **d. Highlight** all this time, (including ORBIT, Ratty Comm etc. row)
- e. Copy

# 7. Flight Note System

a. Open Flight Note system on PC:

Internet Explorer\sim1 (2,3)\STS Users\working note\new note

- **b.** Place curser in top left of open text field: **Paste**
- c. Enter a title in the title bar.
- d. Save as working note.
- e. Have INCO review the note for content and accuracy.
- **f. Edit** and **Save** as Flight Note.

### **TITLE**

A/E EVENT

### **GENERAL**

- A. The data displayed are real-time telemetry parameters used to monitor the COMM and DPS systems during the ascent and entry timeframe. A copy of the A/E EVENT display is shown in Figure 7.2-1.
- B. Pathname of display: INCO/INCO Displays/DDDs/Asc/Ent Events.
- C. Detailed display description.
  - 1. W02I0603R

SPECIAL COMP (ghostwhite on black)

This is a special comp of the S-band ANTENNA select (PM) special comp and the S-band SWITCH BEAM (FWD/AFT) selects. This comp is located in the upper right corner of the display.

W02I0603R is composed of W05I0200R, V74X7090E, V74X7091E, V74X7092E, V74X7093E, V74X7094E, V74X7095E, V74X7096E, and V74X7097E.

W05I	V74X								
0200R	7090E	7091E	7092E	7093E	7094E	7095E	7096E	7097E	
UL	1	0	Х	Х	Х	Х	Х	Х	ULF
UL	0	1	Х	X	Х	Х	Х	X	ULA
UR	X	Х	1	0	X	X	X	Х	URF
UR	Х	X	0	1	X	X	X	Х	URA
LL	Х	X	X	X	1	0	X	Х	LLF
LL	Х	X	X	Х	0	1	X	Х	LLA
LR	X	X	X	Х	X	X	1	0	LRF
LR	X	X	X	Х	X	X	0	1	LRA
ER	X	X	X	Х	X	Х	Х	Х	ER1
All other combinations output									ER2

2. V72X7011E

1 = GPC 1 FAIL (black on yellow)

0 = GPC 1 GOOD (darkslategray on black)

Indicates a GPC 1 failure.

3. V74X4790E

1 = SPREAD SPM OFF (darkslategray on black)

0 = SPREAD SPM ON (black on yellow)

Indicates the associated GCIL panel/command driver's status for this function.

4. V72X7012E 1 = GPC 2 FAIL 0 = GPC 2 GOOD (black on yellow) (darkslategray on black)

Indicates a GPC 2 failure.

5. V92X6082XX 1 = U/L BLOCK H/W 0 = U/L ENABL H/W (black on red) (darkslategray on black)

This parameter indicates that the crew's uplink switch is in the NSP BLOCK position and all uplink commands are inhibited. An NSP data bypass event also occurs on the previously operating NSP.

6. V72X7013E 1 = GPC 3 FAIL 0 = GPC 3 GOOD (black on yellow) (darkslategray on black)

Indicates a GPC 3 failure.

7. V92X6000XX 1 = U/L BLOCK GNC 0 = U/L ENABL GNC (black on red) (darkslategray on black)

This parameter indicates that the crew's uplink switch is in the GPC BLOCK position, as detected by the GNC GPC(s), and all uplink commands are blocked (not processed) in uplink software.

8. V72X7014E 1 = GPC 4 FAIL 0 = GPC 4 GOOD (black on yellow) (darkslategray on black)

Indicates a GPC 4 failure.

9. V98X4275X 1 = U/L BLOCK BFS 0 = U/L ENABL BFS (black on red) (darkslategray on black)

This parameter indicates that the crew's uplink switch is in the GPC BLOCK position, as detected by the BFS GPC, and all uplink commands are blocked in BFS uplink software.

10. V72X7015E 1 = GPC 5 FAIL 0 = GPC 5 GOOD (black on yellow) (darkslategray on black)

Indicates a GPC 5 failure.

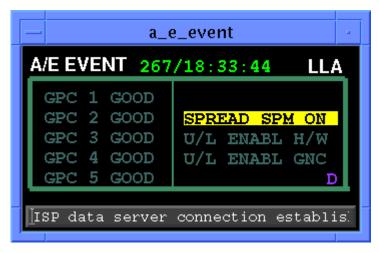


Figure 7.2-1. A/E EVENT display

#### **TITLE**

NSP BFS CONFIG V 1.2

## **GENERAL**

A. The data displayed are real-time parameters that affect the management and operation of the network signal processor (NSP) and the BFS GPC. A copy of the display of the NSP BFS CONFIG is shown in figure 7.3-1.

**REV G** 

9/1/2004:

- B. Pathname of display: INCO/INCO Displays/COMM Systems/bfs nsp.
- C. Detailed display description.

1. NSP 1 POWER V98X1336X 1 = ON 0 = (blank) (green)

ON indicates the associated ground control interface logic (GCIL) panel/command driver is on and 28 V dc is applied to the NSP no. 1.

2. NSP 1 DISC BYP V98X0933X 1 = BYP 0 = (blank) (red)

BYP indicates that the GPC has bypassed the NSP power discrete.

3. NSP 1 DATA BYP V98X0941X 1 = BYP 0 = (blank) (red)

BYP indicates that the GPC has bypassed the NSP SIO data output and is no longer receiving commands, command validity, or NSP status data.

4. NSP 2 POWER V98X1337X 1 = ON 0 = (blank) (green)

ON indicates the associated GCIL panel/command driver is on and 28 V dc is applied to NSP 2.

5. NSP 2 DISC BYP V98X0943X 1 = BYP 0 = (blank) (red)

BYP indicates that the GPC has bypassed the NSP power discrete.

6. NSP 2 DATA BYP V98X0935X 1 = BYP 0 = (blank) (red)

BYP indicates that the GPC has bypassed the NSP SIO data output and is no longer receiving commands, command validity, or NSP status data.

TRK indicates the backup flight software is tracking string 1 I/O profile as commanded by the PASS GNC GPC(s), and it will receive and process NSP 1 uplink data.

8. BFS TRK STRG 3 V98X2754X 1 = TRK 0 = LOSS (green) (yellow)

TRK indicates the backup flight software is tracking string 3 I/O profile as commanded by the PASS GNC GPC(s), and it will receive and process NSP 2 uplink data.

9. BFS ENGAGE V98X0643X 1 = ENGA 0 = (blank) (vellow)

ENGA indicates the backup flight software is in active control of the orbiter and the PASS guidance and navigation computers have been software halted. All flight-critical and payload buses are under control of the BFS GPC.

10. BFS BYP PL1 V98X0961X 1 = BYP 0 = (blank) (red)

BYP indicates backup flight software has inhibited the interface to the PL1 MDM.

11. BFS BYP PL2 V98X0965X 1 = BYP 0 = (blank) (red)

BYP indicates backup flight software has inhibited the interface to the PL2 MDM.

12. DATA READY V98X0231X 1 = YES 0 = NO (green) (yellow)

YES indicates that one command word in the 10-command double buffer has passed.

- BCH DECODER CHECK
- VALID VEHICLE ADDRESS CHECK (any nonzero address)
- BUFFER FILL TIME COMPLETE
- BRACKET DATA STATUS CHECK

NO indicates that no commands have been received or no valid commands have been received.

13. CMD BLOCKED V98X0232X 1 = YES 0 = NO (yellow) (green)

YES indicates panel C3, UPLINK BLOCK switch, is in the BLOCK ALL position and only word 1, the status word, is transmitted. The NSP will not allow the CMD words or word 32, the validity work, to be transmitted.

NO indicates panel C3, UPLINK BLOCK switch, is in the CRITICAL or NONE position or power was lost to the switch.

14. BIT SYNC V98X0233X 1 = LOSS 0 = LOCK (yellow) (green)

LOCK indicates that the NSP bit sync threshold detector has been exceeded and the bit sync is in lock. Lock occurs at > -5 dB SNR (1 x 10<sup>-2</sup> BER)

LOSS indicates that the NSP bit sync is out of lock one or more instances of bit synchronization loss.

15. FRAME SYNC V98X0234X 1 = LOSS0 = LOCK(yellow) (green)

LOCK indicates that the NSP frame sync lock logic has detected two consecutive frame sync correlations with three or less frame sync errors.

LOSS indicates that the NSP frame sync lock logic has detected three consecutive frame sync correlation failures, and the NSP forward link data processing is inhibited.

16. BRACKET DATA V98X0235X 1 = NO0 = YES(yellow) (green)

YES indicates that the NSP sync lock logic has indicated lock and has received two consecutive valid frame sync correlations, which means the data bracketed by the sync correlations are valid.

NO indicates that one or more frame sync correlation failures have occurred and NSP command and Doppler data processing is inhibited.

17. DEMUX V98X0236X 1 = FAIL0 = OK(red) (green)

FAIL indicates that a data overflow or underflow condition has been detected in one or both forward link voice buffers because of a timing or data transmission error.

OK indicates that both forward link buffers are operating properly in high or low data rate or no signal is present.

0 = OK18. MUX V98X0237X 1 = FAIL(red) (green)

FAIL indicates that a data overflow condition has been detected in one or both return link voice buffers because of a timing or data transmission error.

OK indicates all other conditions.

19. INTERNAL MODE V98X0238X 0 = YES1 = NO(red) (green)

NO indicates that the NSP has detected a failure of the PCMMU sync word in three successive frames or failure of the 100-pps sync signal or 1.52 MHz clock. In the internal mode, the NSP provides the data stream with a sync pattern and alternating 1's an 0's in the telemetry data blocks. Voice data is available in this mode.

YES indicates normal operation of the NSP.

20. SEC POWER V98X0239X 1 = FAIL0 = OK(red) (green)

FAIL indicates momentary loss of the NSP 10-V dc regulator output and that the NSP data during this time will be in error.

OK indicates that the 10-V dc regulator is operating properly.

21. RCD MODE MUX V98X0240X 1 = FAIL0 = OK(red) (areen)

FAIL indicates that one or more errors have been detected in bits 6 and 7 of the PCM frame sync pattern from the record mode processor circuitry in the record voice/data mode.

OK indicates that bit 6 is "0" and bit 7 is "1" and that they are Bi-O/encoded.

22. BIT SYNC QUAL 1 = LOSS0 = OKV98X0241X (red) (green)

LOSS indicates that the data level is below threshold level. Threshold levels are set at a given signal-to-noise ratio, depending on the mode selected:

**SCP 7.3** 

NASA CODED DOD CODED -0 dB LOCK -5 dB -3 dB (10<sup>-2</sup> BER) NASA UNCODED +4 dB DOD UNCODED +7 dB

OK indicates signal above mode threshold and bit sync is in lock.

23. BCH VAL V98X0242X 1 = VAL0 = (blank)(green)

VAL indicates that at least one correct decoded message has occurred since the last MDM polling. A logic "0" (NO) will be indicated when no command words pass the binary coded hexadecimal (BCH) combined parity check and the vehicle address is zero.

24. BCH INVAL V98X0243X 1 = INVL0 = (blank)(red)

INVL indicates that at least one incorrect decoded message has occurred since the last MDM polling. A logic "0" will be indicated when the command words pass the BCH parity check and vehicle address is nonzero or no commands were sent.

25. MODE PARITY EVEN V98X0244X 1 = EVEN0 = (blank)(green)

EVEN indicates that the mode logic equation is a logic 1.

(PS ENB + ENCODING) + (DECODING) + (DOD) + (RCV H1) = 1 NOTE: + means exclusive OR

26. PARITY ODD V98X0245X 1 = ODD0 = (blank)(green)

ODD is the inverse of V92X6094XX mode parity EVEN.

27. NSP STATUS V98X0246X 1 = FAIL0 = OK(red)

OK indicates the proper operation of the forward link voice buffers (bit 6), the return link voice buffers (bit 7), and that there has not been an NSP undervoltage condition (bit 9). Failure of any one of these functions for 0.5 sec or more will cause the parameter to indicate FAIL.

9/1/2004: REV G

BFS NSP CONFIG v	1.2	GMT XXX/XX:XX:XX			
NSP 1		BSR			
POWER	XX	1	DATA READY	XXX	
DISC BYP	xxx	2	CMD BLOCKED	XXX	
DATA BYP	xxx	3	BIT SYNC	XXXX	
		4	FRAME SYNC	XXXX	
BFS TRK STRG 1	xxxx	5	BRACKET DATA	XXX	
STRG 3	xxxx	6	DEMUX	XXXX	
		7	MUX	XXXX	
BFS ENAGE	xxxx	8	INTERNAL MODE	XXX	
		9	SEC POWER	XXXX	
BFS BYP PL1	xxx	10	RCD MODE MUX	XXXX	
PL2	xxx	11	BIT SYNC QUAL	XXXX	
		12	BCH VALID	XXX	
NSP 2	Ţ	13	BCH INVAL	XXXX	
POWER	xx	14	PARITY EVEN	XXXX	
DISC BYP	xxx	15	PARITY ODD	XXX	
DATA BYP	XXX	16	NSP STATUS	XXXX	

Figure 7.3-1. BFS NSP CONFIG display

## **TITLE**

### **CLOSED CIRCUIT TELEVISION V 1.1**

## **GENERAL**

- A. The data displayed are telemetry parameters affecting the management and operation of the CCTV system. A copy of the CCTV system display is shown in figure 7.4-1.
- B. Pathname of display: INCO/INCO Displays/COMM Systems/cctv.
- C. Detailed display description.

Cameras	Se	lected
Juliolas	$\sim$	

1. FLT Deck V74X0830E 1 = ON 0 = (blank) (green)

This parameter indicates that the flight deck camera is selected for downlink.

2. Mid Deck V74X0798E 1 = ON 0 = (blank) (green)

This parameter indicates that the middeck camera is selected for downlink.

3. A V74X0825E 1 = ON 0 = (blank) (green)

This parameter indicates that the A camera is selected for downlink.

4. B V74X0826E 1 = ON 0 = (blank) (green)

This parameter indicates that the B camera is selected for downlink.

5. C V74X0827E 1 = ON 0 = (blank) (green)

This parameter indicates that the C camera is selected for downlink.

6. D V74X0828E 1 = ON 0 = (blank) (green)

This parameter indicates that the D camera is selected for downlink.

7. Cabin 3 V74X0799E 1 = ON 0 = (blank) (green)

This parameter indicates that the cabin 3 camera is selected for downlink.

0 = (blank)

COMM/JSC-12829 9/1/2004: REV G

8. Port RMS V74X0829E 1 = ON (green)

This parameter indicates that the port RMS camera is selected for downlink.

9. Payload 1 V74X0795E 1 = ON 0 = (blank) (green)

This parameter indicates that the payload 1 camera is selected for downlink.

10. Payload 2 V74X0796E 1 = ON 0 = (blank) (green)

This parameter indicates that the payload 2 camera is selected for downlink.

11. Payload 3 V74X0797E 1 = ON 0 = (blank) (green)

This parameter indicates that the payload 3 camera is selected for downlink.

# **VCU Status**

12. Power

VCU POWER MNA V74X4880E 1 = MN A 0 = (blank) (green)

This parameter indicates the associated GCIL panel/command driver status for this function.

VCU POWER MNB V74X4881E 1 = MN B 0 = (blank) (green)

This parameter indicates the associated GCIL panel/command driver status for this function.

13. SYNC Generator V74X0782E 1 = A 0 = B (green) (yellow)

This parameter indicates which of the VCU sync generators is selected.

14. Sync Direction

SYNC NORMAL V74S0790E 1 = NORM 0 = (blank) (green)

This parameter indicates that the crew's sync normal/reverse switch is in the normal position.

SYNC REVERSE V74S0791E 1 = RVRS 0 = (blank) (green)

This parameter indicates that the crew's sync normal/reverse switch is in the reverse position.

DOWNLINK

0/COMM/JSC-12829 9/1/2004: REV G

1 = INH 0 = ENA (green) (yellow)

This parameter indicates the position of the crew's downlink inhibit/enable switch.

16. Overtemp Flag V74X0847E 1 = HIGH 0 = (blank) (red)

V74S0781E

This parameter indicates that the video switching unit has detected a camera overtemp.

ALC Mode

17. PEAK V74X0843E 1 = PEAK 0 = PEAK (green) (dim gray)

This parameter indicates that the ALC PEAK has been selected. In the auto iris mode, one of the three ALC parameters will be high, indicating the ALC mode. In the manual iris mode, one of the three ALC parameters will be low, indicating the ALC mode. If VSU is asynchronous or off, all three ALC parameters will be low.

18. NORM V74X0844E 1 = NORM 0 = NORM (green) (dim gray)

This parameter indicates that the ALC NORM has been selected. In the auto iris mode, one of the three ALC parameters will be high, indicating the ALC mode. In the manual iris mode, one of the three ALC parameters will be low, indicating the ALC mode. If VSU is asynchronous or off, all three ALC parameters will be low.

19. AVG V74X0845E 1 = AVG 0 = AVG (green) (dim gray)

This parameter indicates that the ALC AVG has been selected. In the auto iris mode, one of the three ALC parameters will be high, indicating the ALC mode. In the manual iris mode, one of the three ALC parameters will be low, indicating the ALC mode. If VSU is asynchronous or off, all three ALC parameters will be low.

**GAMMA** 

20. V74X0846E 1 = WHITE 0 = WHITE (green) (dim gray)

This parameter indicates that the gamma WHITE stretch mode is selected.

21. V74X0848E 1 = BLACK 0 = BLACK (green) (dim gray)

This parameter indicates that the gamma BLACK stretch mode is selected.

9/1/2004: REV G

Menu Sel

22. ALC V74X0843E 1 = ALC 0 = ALC (green) (dim gray)

A logic one indicates that ALC is the current MENU status for the downlinked TVC. This telemetry is valid only in SYNC mode for CTVs and ITVCs.

23. MAN GAIN V74X0844E 1 = MAN GAIN 0 = MAN GAIN (green) (dim gray)

A logic one indicates that MAN GAIN is the current MENU status for the downlinked TVC. This telemetry is valid only in SYNC mode for CTVs and ITVCs.

24. BAL / LITE V74X0845E 1 = BAL / LITE 0 = BAL / LITE (green) (dim gray)

A logic one indicates that BAL / LITE is the current MENU status for the downlinked TVC. This telemetry is valid only in SYNC mode for CTVs and ITVCs.

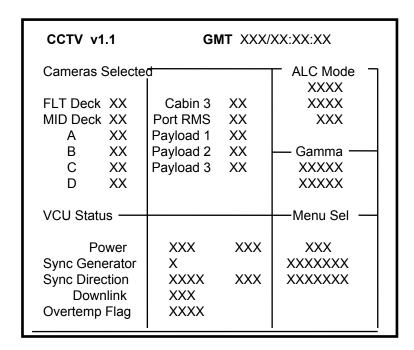


Figure 7.4-1. CCTV

# **COMMAND ERRORS V 1.0**

# **GENERAL**

A. The data displayed are real-time telemetry parameters that affect the management and operation of the commanding system. A copy of the COMMAND ERRORS display is shown in figure 7.5-1.

**REV G** 

B. Pathname of display: INCO/INCO Displays/COMM Systems/cmd error.

C. Detailed display description.

1. SM Comm Buff V92X0077X 1 = BUSY 0 = (blank) (yellow)

9/1/2004:

Indicates that the SM common buffer is busy.

2. TFL Load V92J0054C 1 = REJECT 0 = (blank) (red)

Indicates the TFL/DFL load has been rejected in the SM GPC.

3. Uplink Block V92X6082XX 1 = NSP 0 = (blank) (red)

This parameter indicates the crew's uplink switch is in the NSP BLOCK position and all uplink commands are inhibited. An NSP data bypass event will also occur on the previously operating NSP.

4. PL Uplink V92X1124X 1 = INVALID 0 = (blank) (red)

Indicates that an uplink command field is invalid or that an output to an interface cannot be processed because the specified interface is busy.

5. PSP Uplink V92X1127X 1 = REJECT 0 = (blank) (red)

Indicates that an uplink command has been rejected.

6. Two Stage Err V92X6134XY 1 = SM 0 = (blank) (red)

Indicates an error in the SM two-stage buffer.

7. TMBU V92J0660C 1 = REJECT 0 = (blank) (red)

Indicates that the last data set received by SM OPS 2 was rejected for one of the following reasons:

a. If class 2 limit change is requested and no class 2 limit set is defined for fault detection and annunciation (FDA) parameter

b. If class 0, 3, 4 limit change is requested and no class 0, 3, 4 limits are defined for FDA parameter

- 329 9/1/2004: REV G
- c. If class 0, 3, 4 limit change is requested and specified limit set does not exit
- d. If requested change is a high limit and changed parameter is a discrete
- e. If parameter of a limit change is not processed by FDA
- f. If analog of engineering units (EU's) limit value exceeds allowable range
- g. If parameter of a constant change is not a valid constant parameter

Or, the entire load may have been rejected for either of the following reasons:

- a. If TM Spec 60 is already called up in a display electronics unit (DEU) when the load reaches the application
- b. If the number of data sets is less than 1 or greater than 10

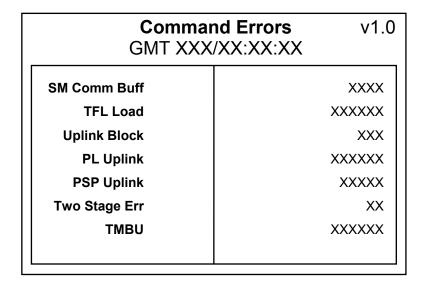


Figure 7.5-1. Command Errors display

0 = GPC 1 GOOD

9/1/2004: REV G

#### TITLE

### **COMM EVENTS V 1.2**

#### **GENERAL**

A. The data displayed are real-time telemetry parameters that affect the management and operation of the communications systems. A copy of the COMM EVENTS display is shown in Figure 7.6-1.

1 = GPC 1 FAIL

- B. Pathname of display: INCO/INCO Displays/DDDs/Comm Events.
- C. Detailed display description.

V/72X7011F

Parameters 1-5 are displayed in column 1, 6-10 in column 2, and 11-14 in column 3.

1.	V/2X/011E	(black on yellow)	(darkslategray on black)
	Indicates a GPC 1 failure.		
2.	V72X7012E	1 = GPC 2 FAIL (black on yellow)	0 = GPC 2 GOOD (darkslategray on black)
	Indicates a GPC 2 failure.		
3.	V72X7013E	1 = GPC 3 FAIL (black on yellow)	0 = GPC 3 GOOD (darkslategray on black)
	Indicates a GPC 3 failure.		
4.	V72X7014E	1 = GPC 4 FAIL (black on yellow)	0 = GPC 4 GOOD (darkslategray on black)
	Indicates a GPC 4 failure.		
5.	V72X7015E	1 = GPC 5 FAIL (black on yellow)	0 = GPC 5 GOOD (darkslategray on black)
	Indicates a GPC 5 failure.		
6.	V91X2256XX	1 = Ku RADAR BYPS (black on red)	0 = Ku RADAR GOOD (darkslategray on black)
	Indicates that Ku-band data acqu FF-3 MDM Serial Input/Output (S		nd Navigation (G&N) GPC via the
7	VOOVEDEOV	1 - CNC DOINTING	O - CNIC DOINTING

7. V93X6859X 1 = GNC POINTING 0 = GNC POINTING (black on ghostwhite) (darkslategray on black)

Indicates that the pointing data interface from the GNC computer for rendezvous targeting data is enabled to the SM antenna management program.

8. V74X2595J 1 = OBSCURATN OVR 0 = OBSCURATN OVR (black on ghostwhite) (darkslategray on black)

Indicates that the TWT is enabled to transmit even if the antenna is pointed into the obscuration zone. The state of the primary acquisition mode bit determines whether the TWT will transmit if the forward link is lost.

9/1/2004: REV G

9. V93X5647X

1 = TDRS MODE OVR 0 = TDRS MODE OVR (black on yellow) (darkslategray on black)

In the case of an override, the transponder is forced to TDRS mode.

10. V93X5626X

1 = SM ANT INHIBIT

0 = SM ANT ENABLE

(black on yellow)

(darkslategray on black)

Indicates that the SM antenna management program output to the ANT ELECT switch is inhibited and the ground is capable of selecting antennas (if the S-band antenna switch, PNL C3, is in GPC). This function also inhibits SM antenna management quad FAIL annunciator.

11. V74X4790E

12.

1 = SPREAD SPM OFF 0 = SPREAD SPM ON (darkslategray on black) (black on yellow)

(authoratogray of black) (black of your

V92X6082XX

1 = U/L BLOCK H/W

0 = U/L ENABL H/W

(black on red)

(darkslategray on black)

Indicates that the crew's uplink switch is in the NSP BLOCK position and all uplink commands are inhibited. An NSP data bypass event will also occur on the previously operating NSP.

Indicates the associated GCIL panel/command driver's status for this function.

13. V92X6000XX

1 = U/L BLOCK GNC

0 = U/L ENABL GNC

(black on red)

(darkslategray on black)

Indicates that the crew's uplink switch is in the GPC BLOCK position as detected by the GNC GPC(s) and all uplink commands are blocked (not processed) in uplink software.

14. W02I0603R

SPECIAL COMP (ghostwhite on black)

This is a special comp of the S-band ANTENNA select (PM) special comp and the S-band SWITCH BEAM (FWD/AFT) selects.

W02I0603R is composed of W05I0200R, V74X7090E, V74X7091E, V74X7092E, V74X7093E, V74X7094E, V74X7095E, V74X7096E, and V74X7097E.

W05I	V74X	V74X	V74X	V74X	V74X	V74X	V74X	V74X	
0200R	7090E	7091E	7092E	7093E	7094E	7095E	7096E	7097E	
UL	1	0	Х	Х	X	X	X	X	ULF
UL	0	1	X	X	X	X	X	X	ULA
UR	X	X	1	0	X	X	X	X	URF
UR	X	X	0	1	X	X	X	X	URA
LL	X	X	Χ	X	1	0	X	X	LLF
LL	X	X	Χ	X	0	1	X	X	LLA
LR	X	X	Χ	X	X	X	1	0	LRF
LR	X	X	Χ	X	X	X	0	1	LRA
ER	X	X	Х	Χ	X	Х	X	X	ER1
All other co	ombinations	s output							ER2

W05I0200R is a special comp of frequency and transponder selected and the quad antenna select relays S1, S2, S3, or S4 to determine the selected quad antenna.

W05I0200R is composed of V74X7070E, V74X7072E, V74X7074E, V74X7076E, V74X7078E, V74X7080E, V74X7082E, V74X7084E, V74X4780E, V74X4781E, V74X4779E, and V74X4778E.

V74X	V74X	V74X	V74X	V74X	V74X	V74X	V74X	V74X	V74X	V74X	V74X	
7070E	7072E	7074E	7076E	7078E	7080E	7082E	7084E	4780E	4781E	4782E	4783E	
1	0	Х	Х	Х	Х	0	1	1	0	0	0	U R
0	1	0	1	Х	Х	Х	Х	0	1	0	0	U R
1	0	Х	Х	Х	Х	1	0	0	0	1	0	U R
0	1	1	0	X	Х	Х	Х	0	0	0	1	U R
X	Х	Х	Х	0	1	1	0	1	0	0	0	ĹŘ
X	X	1	0	1	0	Х	Х	0	1	0	0	LR
X	Х	Х	Х	0	1	0	1	0	0	1	0	LR
X	Х	0	1	1	0	X	X	0	0	0	1	LR
X	Х	Х	Х	1	0	1	0	1	0	0	0	LL
X	Х	1	0	0	1	X	X	0	1	0	0	LL
X	Х	Х	X	1	0	0	1	0	0	1	0	LL
X	X	0	1	0	1	Х	Х	0	0	0	1	LL
0	1	Х	Х	Х	Х	0	1	1	0	0	0	UL
1	0	0	1	Х	Х	Х	Х	0	1	0	0	UL
0	1	Х	Х	Х	Х	1	0	0	0	1	0	UL
1	0	1	0	Х	Х	X	X	0	0	0	1	UL
All othe	r combina	ations out	tput	1	1			1				ER



Figure 7.6-1. COMM EVENTS display

9/1/2004: REV G

#### **TITLE**

### **COMMAND CONFIG V 1.1**

#### **GENERAL**

- A. The data displayed are real-time telemetry parameters affecting the management and operation of the COMMAND system. A copy of the COMMAND CONFIG display is shown in Figure 7.8-1.
- B. Pathname of display: INCO/INCO Displays/COMM Systems/commands.
- C. Detailed display description.

1. UP-GPC BLOCK (GPC) V92X6000XX 1 = GNC (red) 0 = GNC (dimgray)

This parameter indicates that uplink software processing is inhibited, as determined by the GNC GPCs. All uplink command capability, RTCs, and loads are inhibited.

2. UP-GPC BLOCK (NSP) V98X4275X 1 = BFS 0 = BFS (red) (dimgray)

This parameter indicates that uplink software processing is inhibited, as determined by the BFS GPC. All uplink command capability, RTCs, and loads are inhibited.

3. UP-NSP BLOCK (GPC) V92X6082XX 1 = GNC (red) 0 = GNC (dimgray)

This parameter indicates that the uplink switch is in the NSP block position. This inhibits the GPC from getting command data from the NSP.

4. UP-NSP BLOCK (NSP) V98X0232X 1 = BFS 0 = BFS (red) (dimgray)

This parameter indicates that the uplink switch is in the NSP block position. This inhibits the GPC from getting command data from the NSP.

5. TEC BUFFER FULL V92X1125X 1 = YES 0 = NO (yellow) (dimgray)

This parameter indicates that the time execute command (TEC) buffer in SM software contains its maximum number of command loads (25).

6. TEC COUNT V92J1126C DECIMAL (vellow)

This parameter indicates the number of active command loads in the TEC buffer.

7. SPC WORD LOST V92X6128XY 1 = YES 0 = NO (yellow) (yellow)

This parameter indicates that an SPC destined for the SM SPC buffer has not been accepted by SM software because of a full SPC buffer.

9/1/2004: REV G

8. SPC WORD LOST V98X4272X

1 = YES 0 = NO (yellow)

This parameter indicates that an SPC destined for the BFS SPC buffer has not been accepted by BFS software because of a full SPC buffer.

9. SPC COUNT V92U6105C DECIMAL (yellow)

This parameter indicates the number of SPCs in the SM computer.

10. SPC COUNT W01G5200L DECIMAL (vellow)

This MOC COMP indicates the number of SPCs in the BFS computer by computing the decimal number from V98J4298C.

11. DPS UTIL U/L V93X5543XY 1 = AUTO 0 = (blank) (vellow)

This parameter indicates that the uplink software automatically processes uplink data if a TDRS or STDN site is in view and inhibits uplink data processing if the vehicle is in LOS. The "in-view" information is provided to all active GPCs by the SM GPC via ICC data transfer. The control of this function and the ENA and INH (81 and 82) are from DPS utility Spec 1.

12. DPS UTIL U/L V93X5544XY 1 = ENA 0 = (blank) (yellow)

This parameter indicates that the auto ENA/INHIBIT of uplink processing has been forced to the enable state and all uplink data will be processed, regardless of the state of the SM "site-in-view" indicator.

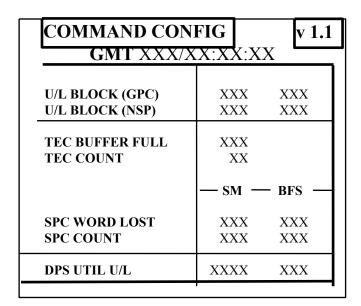


Figure 7.8-1. COMMAND CONFIG display

COMSEC V 1.0

# **GENERAL**

- A. The data displayed are real-time telemetry parameters affecting the management and operation of the NSP configuration in the secure mode and the communications security (COMSEC) equipment. A copy of the COMSEC display is shown in figure 7.9-1. All parameters are OI.
- B. Pathname of the display: INCO/INCO Displays/COMM Systems/comsec.
- C. Detailed display description.

1. NSP 1 ENCRYPT RCV V74X5390E 1 = RCV 0 = OFF (green) (yellow)

9/1/2004:

This parameter indicates that the NSP 1 uplink is in the encrypted mode.

2. NSP 1 ENCRYPT XMIT V74X5391E 1 = XMT 0 = (blank) (green)

This parameter indicates that the NSP 1 downlink is in the encrypted mode.

3. NSP 1 ENCRYPT RECORD V74X5392E 1 = RCD 0 = (blank) (green)

This parameter indicates that the NSP 1 record data are being encrypted.

4. NSP 2 ENCRYPT RCV V74X5590E 1 = RCV 0 = OFF (green) (yellow)

This parameter indicates that the NSP 2 uplink is in the encrypted mode.

5. NSP 2 ENCRYPT XMIT V74X5591E 1 = XMT 0 = (blank) (green)

This parameter indicates that the NSP 2 downlink is in the encrypted mode.

6. NSP 2 ENCRYPT RECORD V74X5592E 1 = RCD 0 = (blank) (green)

This parameter indicates that the NSP 2 record data are being encrypted.

7. COMSEC 1 POWER RPC A V76X3065E 1 = ON 0 = OFF (green) (red)

This parameter indicates that main A power is being applied to COMSEC 1. (MNA FPC 1)

8. COMSEC 2 POWER RPC A V76X3067E 1 = ON 0 = OFF (green) (red)

This parameter indicates that main A power is being applied to COMSEC 2. (MNA FPC 1)

9. COMSEC 1 POWER RPC B V76X3066E

1 = ON (green)

0 = OFF (red)

This parameter indicates that main B power is being applied to COMSEC 1. (MNB FPC 2)

**REV G** 

10. COMSEC 2 POWER RPC B V76X3068E

1 = ON (green)

0 = OFF (red)

This parameter indicates that main B power is being applied to COMSEC 2. (MNB FPC 2)

11. COMSEC 1 ALARM

V74X5017E

9/1/2004:

1 = ALRM (red) 0 = (blank)

This is the COMSEC 1 alarm condition status indicator. This parameter indicates that the KGX-60 is not operating properly, or there is a failure of the unit or a failure of the memory.

12. COMSEC 2 ALARM

V74X5018E

1 = ALRM

0 = (blank)

(red)

This is the COMSEC 2 alarm condition status indicator. This parameter indicates that the KGX-60 is not operating properly, or there is a failure of the unit or a failure of the memory.

13. COMSEC 1 XMIT OPER

V74X5013E

1 = XMT (green)

0 = OFF (red)

This is the COMSEC 1 transmit full operate status indicator. This parameter indicates that the COMSEC 1 is in the transmit or downlink stage and is fully operable.

14. COMSEC 2 XMIT OPER

V74X5014E

1 = XMT (areen)

0 = OFF (red)

This is the COMSEC 2 transmit full operate status indicator. This parameter indicates that the COMSEC 2 is in the transmit or downlink stage and is fully operable.

15. COMSEC 1 RCV OPER

V74X5015E

1 = RCV (areen)

0 = OFF (red)

This is the COMSEC 1 receive full operate status indicator. This parameter indicates that COMSEC 1 is in the receive or uplink stage and is fully operable.

16. COMSEC 2 RCV OPER

V74X5016E

1 = RCV (green)

0 = OFF (red)

This is the COMSEC 2 receive full operate status indicator. This parameter indicates that COMSEC 2 is in the receive or uplink stage and is fully operable.

17. COMSEC 1 CVM ZERO

V74X5011E

1 = ZERO

0 = (blank)

(red)

This is the COMSEC 1 crypto variable memory (CVM) zeroized status indicator. This parameter indicates that the COMSEC CVM has been zeroized or erased and the unit is not operable.

COMSEC 2 CVM ZERO

V74X5012E

9/1/2004:

1 = ZERO 0 = (blank) (red)

This is the COMSEC 2 CVM zeroized status indicator. This parameter indicates that the COMSEC CVM has been zeroized or erased and the unit is not operable.

**REV G** 

19. COMSEC 1 MASTER BITE V74X5003E

1 = OK

0 = FAIL

(green)

(red)

This is the COMSEC 1 master bite status indicator. This parameter indicates a failure of an SRU within the LRU. Failure of either XMIT or RCV operate results in a MSTR bite.

20. COMSEC 2 MASTER BITE V74X5004E

1 = OK

(green)

0 = FAIL (red)

This is the COMSEC 2 master bite status indicator. This parameter indicates a failure of an SRU within the LRU. Failure of either XMIT or RCV operate results in a MSTR bite.

21. COMSEC 1 FRAME SYNC

V74X5019E

1 = SYNC

0 = (blank)

(green)

This is the COMSEC 1 frame sync status indicator. Sync indicates that the data prior to authentication has been frame synchronized. The frame sync logic has detected two consecutive frame sync correlations with three or less frame sync errors.

22. COMSEC 2 FRAME SYNC

V74X5020E

1 = SYNC

0 = (blank)

(green)

This is the COMSEC 2 frame sync status indicator. Sync indicates that the data prior to authentication has been frame synchronized. The frame sync logic has detected two consecutive frame sync correlations with three or less frame sync errors.

23. PWR SWITCH

V74S5005E

1 = ON

0 = OFF

(green) (red)

This parameter indicates the position of the crew's COMSEC power switch. ON indicates that both COMSECs are powered.

24. ENCRYPT

V74S5007E

1 = ZEROIZED

0 = (blank)

(red)

This parameter indicates the position of the crew's ZEROIZE switch. ZEROIZED indicates COMSEC is in the ZEROIZE position. (CNTL CA2)

NSP COMSEC v1.0	GMT XXX/X	X:XX:XX
NSP	1	2
ENCRYPT RCV XMIT RECORD	XXX XXX XXX	XXX XXX XXX
COMSEC	1	2
POWER RPC A RPC B	XXX XXX	XXX XXX
ALARM XMIT OPER RCVR OPER CVM ZERO MASTER BITE FRAME SYNC	XXXX XXX XXX XXXX XXXX	XXXX XXX XXX XXXX XXXX
PWR SWITCH ENCRYPT	XXX XXXX	

Figure 7.9-1. NSP COMSEC display

GNC NSP V 1.0

## **GENERAL**

- A. The data displayed are real-time telemetry parameters that affect the management and operation of the NSP GNC. A copy of the GNC NSP display is shown in figure 7.10-1.
- B. Pathname of display: INCO/INCO Displays/COMM Systems/gnc nsp.
- C. Detailed display description.

1. NSP 1 POWER V92X6097XX 1 = ON 0 = OFF (green) (yellow)

This parameter indicates the associated GCIL panel/command driver's status for this function.

2. NSP 1 BIT SYNC (OI) V74X5188E 1 = BIT 0 = (blank) (green)

BIT indicates that the NSP's bit sync lock detector reached threshold after integrating for 2<sup>14</sup> symbol times. The bit lock detector threshold changes for each mode, DOD or NASA, decoding ON or OFF.

3. NSP 1 FRM SYNC (OI) V74X5176E 1 = FRM 0 = (blank) (green)

FRM indicates that the NSP had two consecutive frame sync patterns pass the pattern check and will remain locked until three consecutive frame sync patterns fail the pattern check.

The absence of FRM indicates that the NSP frame sync lock logic has detected three consecutive frame sync correlation failures and that NSP forward link data processing is inhibited.

4. NSP 1 BITE (OI) V74X5184E 1 = FAIL 0 = (blank) (red)

FAIL indicates a failure of the forward link voice buffers (bit 6), a failure of the return link voice buffers (bit 7), or an NSP undervoltage condition (bit 9).

5. NSP 1 DISC BYP V91X2900XX 1 = BYP 0 = OK (red) (green)

BYP indicates that the GPC has bypassed the NSP power discrete.

6. NSP 1 DATA BYP V91X2902XX 1 = BYP 0 = OK (red) (green)

BYP indicates that the GPC has bypassed the NSP SIO data output and is no longer receiving commands, command validity, or NSP status data.

**NSP 2 POWER** 

7.

V92X6098XX 1 = ON

1 = ON 0 = OFF (green) (yellow)

This parameter indicates the associated GCIL panel/command driver's status for this function.

8. NSP 2 BIT SYNC (OI) V74X5189E 1 = BIT 0 = (blank) (green)

BIT indicates that the NSP's bit sync lock detector reached threshold after integrating for 2<sup>14</sup> symbol times. The bit lock detector threshold changes for each mode, DOD or NASA, decoding ON or OFF.

9. NSP 2 FRM SYNC (OI) V74X5177E 1 = FRM 0 = (blank) (green)

FRM indicates that the NSP had two consecutive frame sync patterns pass pattern check and will remain locked until two consecutive frame sync patterns fail the pattern check.

The absence of FRM indicates the NSP frame sync lock logic has detected three consecutive frame sync correlation failures, and the NSP forward link data processing is inhibited.

10. NSP 2 BITE (OI) V74X5185E 1 = FAIL 0 = (blank) (red)

FAIL indicates a failure of the forward link voice buffers (bit 6), a failure of the return link voice buffers (bit 7), or an NSP undervoltage condition (bit 9).

11. NSP 2 DISC BYP V91X2901XX 1 = BYP 0 = OK (red) (green)

BYP indicates that the GPC has bypassed the NSP power discrete.

12. NSP 2 DATA BYP V91X2903XX 1 = BYP 0 = OK (red) (green)

BYP indicates that the GPC has bypassed the NSP SIO data output and is no longer receiving commands, command validity, or NSP status data.

YES indicates that one command word in the 10-command double buffer has passed:

- BCH DECODER CHECK
- VALID VEHICLE ADDRESS CHECK (any nonzero address)
- BUFFER FILL TIME COMPLETE
- BRACKET DATA STATUS CHECK

NO indicates no commands received or no valid commands received

CMD BLOCKED

/COMM/JSC-12829 9/1/2004: REV G

V92X6082XX

1 = YES (yellow)

0 = NO (green)

YES indicates panel C3, UPLINK BLOCK switch, in the BLOCK ALL position and only word 1, the status word, is transmitted. The NSP will not allow the CMD words or word 32, the validity word, to be transmitted.

NO indicates panel C3, UPLINK BLOCK switch, in the CRITICAL or NONE position, or power was lost to the switch.

15. BIT SYNC

V92X6083XX

1 **=** LOSS

0 = LOCK

(green)

(green)

LOCK indicates that the NSP bit sync threshold detector threshold has been exceeded and the bit sync is in lock. Lock occurs at > -5 DB SNR (1 x 10<sup>-2</sup> BER).

LOSS indicates that the NSP bit sync is out of lock one or more instances of bit synchronization loss.

16. FRAME SYNC

V92X6084XX

1 = LOSS

0 = LOCK

(green) (green)

LOCK indicates that the NSP frame sync lock logic has detected two consecutive frame sync correlations with three or less frame sync errors.

LOSS indicates that the NSP frame sync lock logic has detected three consecutive frame sync correlation failures and the NSP forward link data processing is inhibited.

17. BRACKET DATA

V92X6085XX

1 = NO

0 = YES

(yellow)

(green)

YES indicates that the NSP sync lock logic has indicated lock, that it has received two consecutive valid frame <u>sync correlations</u>, and that the data bracketed by the sync correlations are valid.

NO indicates that one or more frame sync correlation failures have occurred and NSP command and Doppler data processing is inhibited.

18. DEMUX

V92X6086XX

1 = FAIL

0 = OK

(red) (green)

FAIL indicates that a data overflow or underflow condition has been detected in one or both forward voice buffers because of a timing or data transmission error.

OK indicates that both forward link voice buffers are operating properly in HDR or LDR or no signal is present.

19. MUX

V92X6087XX

1 = FAIL

0 = OK (green)

(red)

FAIL indicates that a data overflow condition has been detected in one or both return link voice buffers because of a timing or data transmission error.

OK indicates all other conditions.

20. INTERNAL MODE

V92X6088XX

9/1/2004: REV G

1 = NO 0 = (blank) (red)

NO indicates that the NSP has detected a failure of the PCMMU sync word in three successive frames, or a failure of the 100-pps sync signal or 1.152-MHz clock. In the internal mode, the NSP provides the data stream with a sync pattern and alternating 1's and 0's in the telemetry data blocks. Voice data are available in this mode.

21. SEC POWER

V92X6089XX

1 = FAIL

0 = OK

(red)

(green)

FAIL indicates a momentary loss of the NSP 10 V dc regulator output and the NSP data during this time will be in error.

OK indicates that the 10-V dc regulator is operating properly.

22. RCD MODE MUX

V92X6090XX

1 = FAIL

0 = OK

(red)

(green)

FAIL indicates one or more errors have been detected in bits 6 and 7 of the PCM frame sync pattern from the record mode processor circuitry in the record data/voice mode.

OK indicates that bit 6 is "0" and bit 7 is "1," and that they are Bi-O/encoded.

23. BIT SYNC QUAL

V92X6091XX

1 = LOSS

O = OK

(red) (green)

LOSS indicates that the data level is below threshold level. Threshold levels are set at a given signal-to-noise ratio, depending on the mode selected:

LOCK -5 dB

NASA CODED

-3 dB

DOD CODED

-0 dB

(10<sup>-2</sup> BER)

NASA UNCODED

+4 dB

DOD UNCODED

+7 dB

OK indicates signal above mode threshold and bit sync is in lock.

24. BCH VALID

V92X6092XX

1 = VAL (green)

0 = (blank)

VAL indicates that at least one correct decoded message has occurred since the last MDM polling. A logic "0" (blank) will be indicated when no command words pass the BCH combined parity check, and the vehicle address is zero.

25. BCH INVAL

V92X6093XX

1 = INVL

0 = (blank)

\_\_\_\_\_\_

V92A0093AA

(red)

INVL indicates that at least one incorrect decoded message has occurred since the last MDM polling. A logic "0" (blank) will be indicated when the command words pass correctly the BCH parity check, and vehicle address is nonzero or no commands were sent.

26. PARITY EVEN

V92X6094XX

1 = EVEN

0 = (blank)

(green)

EVEN indicates that the mode logic equation is a logic 1.

(PS + ENCODING) + (DECODING + DOD) + (RCV H1) = "1"

27. PARITY ODD

V92X6095XX

1 = ODD

0 = (blank)

(green)

ODD is the inverse of V92X6094XX mode parity EVEN.

9/1/2004: REV G

OK indicates the proper operation of the forward link voice buffers (bit 6), the return link voice buffers (bit 7), and that there has not been an NSP undervoltage condition (bit 9). Failure of any one of these functions for 0.5 sec or more will cause the parameter to indicate FAIL.

GNC NSP v1.0		GMT XXX/	XX:XX:XX
NSP 1		BSR	
POWER	XXX	1 DATA READY	XXX
BIT SYNC	XXX	2 CMD BLOCKED	XXX
FRM SYNC	XXX	3 BIT SYNC	XXXX
		4 FRAME SYNC	XXXX
BITE	XXXX		
		5 BRACKET DATA	XXX
DISC BYP	XXX	6 DEMUX (U/L)	XXXX
DATA BYP	XXX	7 MUX (D/L)	XXXX
		8 INTERNAL MODE	XXX
NSP 2			
POWER	XXX	9 SEC POWER	XXXX
BIT SYNC	XXX	10 RCD MODE MUX	XXXX
FRM SYNC	XXX	11 BIT SYNC QUAL	XXXX
		12 BCH VALID	XXX
BITE	XXXX		
		13 BCH INVAL	XXXX
DISC BYP	XXX	14 PARITY EVEN	XXXX
DATA BYP	XXX	15 PARITY ODD	XXX
		16 NSP STATUS	XXXX

Figure 7.10-1. GNC NSP display

KU-BAND COMM (SM) V1.8

## **GENERAL**

A. The data displayed are real-time telemetry parameters that affect the management and operation of the Ku-band system. A copy of the Ku-band comm display is shown in figure 7.11-1.

**REV G, PCN-1** 

B. Pathname of display: INCO/INCO Displays/COMM Systems/ku comm.

5/23/2005:

C. Detailed display description.

1. GMT V75W3504D TIME (green)

Greenwich Mean Time.

# **System Status**

2. Signal STRG V74E2508A FLOATING POINT (green)

Indicates the radar or comm received signal strength in volts (radar) or dBm (comm). Nominal is about -95 dBm in comm mode.

3. RF Power Out V74E2511A FLOATING POINT (green)

Indicates the radar or comm RF output power in watts; nominal is about 24 watts.

4. COMM Power V74X4818E 1 = ON 0 = (blank) (green)

This parameter indicates the associated GCIL panel/command driver's status for this function.

5. COMM STBY V74X4807E 1 = STBY 0 = (blank) (yellow)

This parameter indicates the associated GCIL panel/command driver's status for this function. Indicates that the comm system is powered to STANDBY.

6. Fail Safe V74X4809E 1 = ENBL 0 = DSBL (green) (green)

Indicates whether the fail to S-band circuitry in the GCIL is enabled/disabled.

7. ACQ Mode V74K2639J 1 = ALT 0 = PRI (green) (yellow)

Indicates which acquisition mode the system is in.

8. System Sel V74X2593J 1 = B 0 = A (yellow) (green)

12829 5/23/2005: REV G, PCN-1

Indicates which system is selected. It should always be Ku-band system A.

9. Link MOD V74K2641J 1 = 216 0 = 72 (green) (yellow)

Indicates the bit rate mode selected on the Ku-band forward link.

10. SPRD Spectrum V74K2634J 1 = OFF 0 = ON (yellow) (green)

Indicates that the forward link Ku-band receiver has been configured to receive a spread spectrum signal.

11. Angle Track V74X2603J 1 = TRACK 0 = TRACK (green) (darkslategray)

Indicates that antenna is angle-tracking the forward link signal in comm in GPC and AUTO TRACK antenna steering modes. In the radar mode, it is angle-, angle-rate-, range-, and range-rate-tracking in GPC and AUTO TRACK antenna steering modes or range- and range-rate-tracking in GPC DESIG and MANUAL SLEW antenna steering modes.

12. Frame SYNC V74X2612J 1 = LOCK 0 = NO LK (green) (yellow)

Indicates that the comm signal processor has acquired bit and frame synchronization of the forward link 216-kbps signal.

13. Data Good V74X2613J 1 = GOOD 0 = (blank) (green)

Indicates comm carrier detected (costas lock), modulation detected (data on the carrier), and if operating in the spread spectrum mode, PN lock.

14. Return MOD V74K2638J 1 = CMD 0 = AUTO (yellow) (green)

Indicates that the return link modulation is controlled by command (on/off) or automatically, depending on the antenna steering mode and the acquisition mode. Modulation will be on in GPC DESIG and MANUAL SLEW or when tracking TDRS in GPC or AUTO TRACK.

15. MOD Command V74K2637J 1 = ON 0 = OFF (yellow) (green)

If modulation ON is commanded, the return link carrier with modulation on will be enabled for all antenna steering modes. If modulation is commanded OFF, then return link modulation will be disabled for all antenna steering modes.

# **Antenna Mode**

16. DESIG V73X2585J 1 = DESIG 0 = DESIG (green) (darkslategray)

Indicates that antenna pointing is being designated by angle data received via PF1.

17. AUTO V73X2584J 1 = AUTO 0 = AUTO (green) (darkslategray)

Indicates that antenna pointing is being driven by automatic tracking of the signal received from the target when the signal is present and is not being driven when the signal is absent.

18. ACQ V73X2586J 1 = ACQ 0 = ACQ (green) (darkslategray)

Indicates that antenna pointing is being driven by automatic tracking of the signal received from the target when the signal is present, but when the signal is lost, it uses the angle data received via PF1 to initiate a search routine.

# **Data Sources, HDR (CH 3)**

19. ANLG V74X4828E 1 = ANLG 0 = ANLG (HDR PL ANALOG) (green) (darkslategray)

Indicates that payload analog data have been selected as the input to the FM HDR channel. This parameter indicates the associated GCIL panel/command driver status for this function.

20. DIGI V74X4829E 1 = DIGI 0 = DIGI (HDR PL DIGITAL) (green) (darkslategray)

Indicates that payload digital data have been selected as the input to the FM HDR channel. This parameter indicates the associated GCIL panel/command driver status for this function.

21. TV V74X4830E 1 = TV 0 = TV (HDR TV) (green) (darkslategray)

Indicates that CCTV has been selected as the input to the FM HDR channel. This parameter indicates the associated GCIL panel/command driver status for this function.

22. MAX V74X4831E 1 = MAX 0 = MAX (HDR PL MAX) (green) (darkslategray)

Indicates that Spacelab high-rate data has been selected as the input to the PM HDR channel. This parameter indicates the associated GCIL panel/command driver status for this function.

23. INTG V74X4832E 1 = INTG 0 = INTG (HDR PL INTGR) (green) (darkslategray)

Indicates that the payload interrogator output has been selected as the input to the FM HDR channel. This parameter indicates the associated GCIL panel/command driver status for this function.

# Data Sources, LDR (CH 2)

24. SSR1 V74X3448E 1 = SSR1 0 = SSR1 (LDR SSR1) (green) (darkslategray)

Indicates that the SSR1 recorder has been selected as the input to the FM/PM LDR channel. This parameter indicates the associated GCIL panel/command driver status for this function.

25. SSR2 V74X3449F 1 = SSR2 0 = SSR2

SHUTTLE OPS INCO/COMM/JSC-12829

5/23/2005: REV G, PCN-1

KU-BAND COMM SCP 7.11

(LDR SSR2) (green) (darkslategray)

Indicates that the SSR2 recorder has been selected as the input to the FM/PM LDR channel. This parameter indicates the associated GCIL panel/command driver status for this function.

26. DIGI V74X4839E 1 = DIGI 0 = DIGI (LDR PL DIGITAL) (green) (darkslategray)

Indicates that payload digital data has been selected as the input to the FM/PM LDR channel. This parameter indicates the associated GCIL panel/command driver status for this function.

27. INTG V74X4836E 1 = INTG 0 = INTG (LDR PL INTGR) (green) (darkslategray)

Indicates that the payload interrogator output has been selected as the input to the FM/PM LDR channel. This parameter indicates the associated GCIL panel/command driver status for this function.

# **TDRS Pointing**

28. ACT AZ V74H2618J FLOATING POINT (green)

Actual azimuth pointing angle of the antenna.

29. ACT EL V74H2619J FLOATING POINT

(green)

Actual elevation pointing angle of the antenna.

30. DESIG AZ V74H2648J FLOATING POINT (green)

SM GPC antenna-management-designated (computed) azimuth pointing angle of the antenna.

31. DESIG EL V74H2650J FLOATING POINT (green)

SM GPC antenna-management-designated (computed) elevation pointing angle of the antenna.

32. ACT TDRS SEL

a) kuband\_tdrs\_select SPECIAL COMP (green)

5/23/2005: REV G, PCN-1

This field displays the TDRS currently selected by SM antenna management for Ku pointing, computed on the parameters per the following table; the output of this comp is a TDRS longitude number, such as 171, 174, 49, 47, 41, or 275.

	value of	V92X	V93X	V93X	V93X	V93X	V93X	V93X
		2349X	5667X	5666X	1085X	1084X	1083X	1082X
	V92H2354C	0	0	0	0	0	0	1
	V92H2357C	0	0	0	0	0	1	0
	V92H2361C	0	0	0	0	1	0	0
	V92H2354C	1	0	0	1	0	0	0
	V92H2357C	1	0	1	0	0	0	0
	V92H2361C	1	1	0	0	0	0	0
NONE	-	_	0	0	0	0	0	0
INVL				ions	ombinati	other c	Any	

b) SV number

MULTIFUNCTION DISPLAY (green)

This field displays the state vector number currently being selected by SM antenna management based on the MULTI described in the table below.

V93X	V93X	V93X	V93X	V93X	V93X	Display
1082X	1083X	1084X	1085X	5666X	5667X	
1	0	0	0	0	0	SV1
0	1	0	0	0	0	SV2
0	0	1	0	0	0	SV3
0	0	0	1	0	0	SV4
0	0	0	0	1	0	SV5
0	0	0	0	0	1	SV6
		All value	s set to 0			
	More	e than one	value set	to 1		+++++

33.	Ku	Band	PRI
-----	----	------	-----

A V93X5648X 1 = A 0 = A (green) (gray)

Indicates that SM antenna management is prioritizing the TDRS designated "A" as the primary target in case of overlap between TDRS coverages.

B V93X5649X 1 = B 0 = B (yellow) (gray)

Indicates that SM antenna management is prioritizing the TDRS designated "B" as the primary target in case of overlap between TDRS coverages.

34. ALPHA GMBL V92H0098C FLOATING POINT (green)

SHUTTLE OPS 5/23/2005: REV G, PCN-1

KU-BAND COMM SCP 7.11

Indicates the alpha gimble.

35. BETA GMBL V92H0099C FLOATING POINT (green)

Indicates the beta gimble.

36. BETA FLAGS

a) BETA Stop Flag V92X0104X 1 = STOP 0 = STOP

(yellow) (darkslategray)

A logic 1 indicates that the Ku antenna line of sight has entered the Beta stop protected zone. The positive Beta stop zone is at 74.5° and the negative stop zone is at -83.5°. If the line of sight exits this zone in less than 4 minutes, the stop flag will reset to a logic 0. If it remains in the zone for longer than 4 minutes, the stop flag will also be reset to a logic 0.

b) BETA Limit Flag V92X0993X 1 = LIMIT 0 = LIMIT (red) (darkslategray)

A logic 1 indicates that the line of sight has remained in the Beta stop protected zone for more than 4 minutes. The limit flag will be reset to 0 when the line of sight exits the protected zone.

37. STOP CNTR V92Q0103C FLOATING POINT (green)

The counter will start to count up to 125 once the Ku antenna line of sight has entered the Beta stop protected zone. It will reset once the line of site exits the zone or if it remains in the zone for more than 4 minutes. The 125 counts correspond to 4 minutes.

### **EVA Protect**

There are four RF protect boxes or zones utilized by SM. Each RF protect box is defined by uplink TMBU of two azimuth and two elevation angles. Whenever the antenna pointing is inside of an RF protect box, the SM will turn off the TWT until the target exits the protect box. The downlinked angles that define each box are multiplexed into a set of SM D/L MSIDs, as described below.

38. Box# V92J0899C INTEGER (green)

Indicates the numeric identification of the RF protect box whose limits are currently being downlinked (downlisted)

39. AZ (roll) V92H0545C FLOATING POINT Min (green)

Indicates the value of minimum azimuth angle (downlisted)

40. AZ (roll) V92H0546C FLOATING POINT Max (green)

Indicates the value of maximum azimuth angle (downlisted).

A logic 1 indicates the Ku-Band EVA protect angles are valid. The parameter will be set to one when V92H0546C > V92H0545C and V92H0548C > V92H0547C. If the uplink angles are not valid, the last valid set of angles will be used to control the TWT.

44. Ena Status

1 V93X5606X 1 = 1 0 = 1 (green) (gray)

This parameter indicates if the RF protect mode for RF protect box 1 has been enabled or disabled. When the discrete is set to one, the SM antenna management program will monitor the actual azimuth/elevation angles to determine whether the antenna line of sight is pointing into the EVA protect zone. If the TMBUs set of EVA angles is valid, the TWT will be turned off when the Ku-band antenna is pointing into the protect box, and turned on when the antenna is pointing outside the protect box. This is a downlisted parameter.

2	V93X5621X	1 = 2 (green)	0 = 2 (gray)
Enable status for RF pro	otect box 2		
3	V93X5623X	1 = 3 (green)	0 = 3 (gray)
Enable status for RF pro	otect box 3		
4	V93X5624X	1 = 4 (green)	0 = 4 (gray)

Enable status for RF protect box 4



Figure 7.11-1. KU-COMM display

KU STOW/DPY V1.1

# **GENERAL**

A. The data displayed are real-time telemetry parameters that affect Ku-band mechanical system. A copy of the Ku stow/dpy display is shown in figure 7.12-1.

B. Pathname of display: INCO/INCO Displays/COMM Systems/ku mechanical.

C. Detailed display description.

1. MECH PWR 1 V76S2875E 1 = ON 0 = OFF (yellow) (green)

Indicates the status of payload bay mechanical power system no. 1.

2. MECH PWR 2 V76S2878E 1 = ON 0 = OFF (yellow) (green)

Indicates the status of payload bay mechanical power system no. 2.

3. R13L DPY/GND/STO sw V54S0003E 1 = DEPLOY 0 = (blank) (yellow)

Indicates switch on panel R13L is in the DEPLOY command position.

4. R13L DPY/GND/STO sw V54S0007E 1 = STOW 0 = (blank) (yellow)

Indicates switch on panel R13L is in the STOW command position.

5. Ku MODE V74X2583J 1 = RADAR 0 = COMM (yellow)

Indicates if the Ku-band system is in the radar or comm mode.

6. COMM PWR V74X4818E 1 = ON 0 = OFF (green) (darkslategray)

This parameter indicates the associated GCIL panel/command driver's status for this function.

7. COMM STBY V74X4807E 1 = YES 0 = NO (yellow) (darkslategray)

This parameter indicates the associated GCIL panel/command driver's status for this function. A logic 1 indicates that the comm system is powered to STANDBY.

8. ARM COMMAND V76S0901E 1 = JETT 0 = SAFE (red) (green)

A logic 1 indicates the switch on panel A14 is in ARM. A logic 0 indicates it is in the SAFE position.

16. DA fully DEPLOYD V54X0010E 1 = YES 0 = (blank) MMC4 (green) (yellow)

Indicates the deployed assembly is fully deployed (indication no. 2).

17. AZ (-125.0) V74H2618J FLOATING POINT ACT (green)

Actual azimuth pointing angle of the antenna.

18. AZ (-125.0) V74H2648J FLOATING POINT CMD (green)

SM GPC antenna-management-designated (computed) azimuth pointing angle of the antenna.

19. EL (-29.0) V74H2619J FLOATING POINT ACT (green)

Actual elevation pointing angle of the antenna.

20. EL(-29.0) V74H2650J FLOATING POINT CMD (green)

SM GPC antenna-management-designated (computed) elevation pointing angle of the antenna.

21. GLTN VOLTS V76V0911A FLOATING POINT A (green)

Indicates Ku-band antenna A GLTN CAP VOLTS (A).

22. GLTN VOLTS V76V0912A FLOATING POINT B (green)

Indicates Ku-band antenna A GLTN CAP VOLTS (B).

23. BOLT VOLTS V76V0921A FLOATING POINT A (green)

Indicates Ku-band antenna A BOLT CAP VOLTS (A).

24. BOLT VOLTS V76V0922A FLOATING POINT B (green)

Indicates Ku-band antenna A BOLT CAP VOLTS (B).

Ku STOW/DPY v1.1	GMT xxx MET xxx		
STO	OW / DEPLOY —		
MECH PWR1 xxx	PINS	XXXX	xx
MECH PWR 2 xxx	WIGGLE TEST	XXXX	
		MMC	2 MMC4
R13L DPY/GND/STO sw	DA fully STOW	ED xx	x xxx
XXXXX XXXX	DA fully DEPLO		
Ku MODE xxxxx		ACT	CMD
COMM PWR xxx	AZ(-125.0)	XXX	xxx
COMM STBY xxx	EL(-29.0)	XXX	xxx
J	ETTISON		
	1	Α	В
ARM COMMAND			
	GLTN VOLTS	XX	xx
xxxx	BOLT VOLTS	XX	XX

Figure 7.12-1. Ku-STOW/DPY display

**KU-BAND RADAR V1.1** 

### **GENERAL**

- A. The data displayed are real-time telemetry parameters that affect the management and operation of the Ku-band system. A copy of page 1 of the Ku-band radar system display is shown in figure 7.13-1.
- B. Pathname of display: INCO/INCO Displays/COMM Systems/ku radar.
- C. Detailed display description.

1. SIGNAL STRGH V74E2508A FLOATING POINT (green)

Indicates the radar or comm received signal strength in dBm. Nominal is about -90 dBm in comm mode.

2. RF POWER OUT V74E2511A FLOATING POINT (green)

Indicates the radar or comm RF output power in watts; nominal is about 25 watts.

3. MODE V74X2583J 1 = RDR 0 = COMM (green) (yellow)

Indicates if the Ku-band system is in the radar or comm mode.

4. ANT MODE W01G3202R SPECIAL COMP (green)

Computation that indicates the antenna steering mode selected; i.e., GPC, GPC DESIG, AUTO TRACK, or MANUAL SLEW. This special comp is composed of the following MSIDs: V74X2584J, V74X2585J, and V74X2586J.

V74X2585J	V74X2584J	V74X2586J	
1	0	0	DESIG
0	1	0	AUTO
0	0	1	ACQ
0	0	0	(blank)
A 11 41		18 13 71	

All other combination output INVL

5. ANG & DATA V74X2603J 1 = TRCK 0 = (blank) (green)

Indicates that antenna is angle-tracking the forward link signal in comm in GPC and AUTO TRACK antenna steering modes. In the radar mode, it is angle-, angle-rate-, range-, and range-rate-tracking in GPC and AUTO TRACK antenna steering modes, or range- and range-rate-tracking in GPC DESIG and MANUAL SLEW antenna steering modes.

6. MODE COOP

V74S2419E

1 = COOP (yellow) 0 = (blank)

Indicates that the radar is in the cooperative (transponder) mode. This mode is not used.

7. PASS

V74S2420E

1 = PASS

0 = (blank)

(green)

Indicates that the radar is in the passive (skin track) mode. This is the normal radar mode. Indicates that the Ku-band MODE switch is in the RADAR PASSIVE position.

8. POWER OUTPUT

V74S2496E

1 = HI

0 = (blank)

(green)

Indicates that high radar output power; i.e., maximum output power, has been selected via the Ku-band radar output switch. If neither medium nor high power is selected, then low has been selected; i.e., 24 dB below high power.

9. POWER OUTPUT

V74S2495E

1 = MED

0 = (blank)

(yellow)

Indicates that medium radar output power; i.e., 12 dB below high power, has been selected via the Ku-band radar output switch.

10. RANGE

V93X5641X

1 = MIN

0 = (blank)

(green)

Indicates that the antenna management program in the SM GPC is outputting a fixed range of 2500 ft. This mode is used for close-in acquisition.

11. RANGE

V93X5642X

1 = AUTO

0 = (blank)

(green)

Indicates that the antenna management program in the SM GPC is computing the range to the selected radar target when in AUTO.

12. AGC THRESHOLD

V74X2594J

1 = VAR

0 = FXD

(green)

(yellow)

FXD - Indicates that a fixed receiver threshold has been selected to aid in detection of a target in clutter (noise).

VAR - Indicates that the receiver threshold is variable; i.e., a function of the range and the constant false alarm ratio (CFAR), which is one false alarm per hour (normal operating mode).

13. ACT RANGE

V74U2623J

FLOATING POINT

(green)

Indicates measured target range in feet. Range is 0 to 2,621,440 ft (~440 n. mi.).

14. DES RANGE

V74U2651J

FLOATING POINT

(green)

Indicates designated target range in feet. Range is 10 to 2,621,440 ft (~440 n. mi.).

15. ACT RANGE RATE

V74R2621J

FLOATING POINT (green)

KU BAND RADAR SCP 7.13

Indicates measured range rate in + ft/sec. Range is 0.1 to 1,638 ft/sec. A plus indicates opening range and a minus indicates closing range.

16. ACT AZ ANGLE V74H2618J FLOATING POINT (green)

Actual antenna azimuth pointing angle. Range is +180°. Plus is toward the orbiter -Y axis; minus is toward the orbiter +Y axis.

17. DES AZ ANGLE V74H2648J FLOATING POINT (green)

Designated antenna azimuth pointing angle computed by the SM GPC antenna management program.

18. ACT EL ANGLE V74H2619J FLOATING POINT (green)

Actual antenna elevation pointing angle. Range is +90°. Plus is toward the orbiter +X axis; minus is toward the orbiter -X axis.

19. DES EL ANGLE V74H2650J FLOATING POINT (green)

Designated antenna elevation pointing angle computed by the SM GPC antenna management program.

20. ACT AZ ANGLE RATE V74R2626J FLOATING POINT (green)

Indicates measured antenna azimuth rate in + deg/s. Range is 0 to 16.4 deg/s. Plus is an angle rate toward the orbiter -Y axis; minus is an angle rate toward the orbiter +Y axis.

21. ACT EL ANGLE RATE V74R2628J FLOATING POINT (green)

Indicates measured antenna elevation rate in + deg/s. Range is 0 to 16.4 deg/s. Plus is an angle rate toward the orbiter +X axis; minus is an angle rate toward the orbiter -X axis.

22. S33 ITEM 2 (GNC PTG) V93X6859X 1 = ENA 0 = DIS (green) (yellow)

Indicates that the pointing data interface from the GNC computer for rendezvous targeting data is enabled to the SM antenna management program.

23. RANGE DATA V74X2615J 1 = GOOD 0 = INVL (green) (yellow)

Indicates that the range tracking loop is locked up and outputting good data.

24. RNG RATE DATA

V74X2616J

**REV G** 

1 = GOOD 0 = INVL(green) (yellow)

Indicates that the range rate tracking loop is locked up and outputting good data.

25. ANGLE DATA

V74X2590J

1 = GOOD (green)

0 = INVL(yellow)

Indicates that the angle tracking loop is locked up and outputting good data.

26. ANG RATE DATA

V74X2591J

1 = GOOD (green)

0 = INVL(yellow)

Indicates that the angle-rate circuits are operating properly and outputting good data.

27. SELF TEST

V74X2592J

1 = IN WORK (yellow)

0 = OFF(green)

Indicates that the radar is performing a system self-test (test runs about 3 min).

28. EA-1

V74X2605J

1 = PASS(green)

0 = FAIL(yellow)

Indicates the results of the radar self-test as regards the circuits tested in the interface and control unit (EA-1).

29. EA-2

V74X2607J

1 = PASS(green)

0 = FAIL(yellow)

Indicates the results of the radar self-test as regards the circuits tested in the radar signal processor (EA-2).

30. DA

V74X2606J

1 = PASS (green)

0 = FAIL(vellow)

Indicates the results of the radar self-test as regards the circuits tested in the deployed assembly (DEA and DMA).

31. SYSTEM

V74X2608

1 = PASS (green)

0 = FAIL(yellow)

This is an ANDing of the EA-1, EA-2, and the DA status signals.

9/1/2004: REV G

u Band RADAR v1.1		GMT XXX/XX:XX:X			
SIGNAL STRGH		XXX	X		
RF POWER OUT		XX	X		
MODE		XXX	ΚX		
ANT MODE		XXXX	<b>«</b> Χ		
ANG & DATA		XXX	ΚX		
MODE COOP		XXX	ΚX		
PASS		XXX	ΚX		
POWER OUTPUT		XX	XXX		
RANGE		XXX	XXXX		
AGC THRSHOLD		XX	ΚX		
		ACT	DESG		
RANGE	X	XXXXXX	xxxxxx		
RANGE RATE		XXXX.X			
AZ ANGLE		XXXX.X	XXXX.X		
EL ANGLE		XXXX.X	XXXX.X		
AZ ANG RATE		XX.X			
EL ANG RATE		XX.X			
33 ITEM 2 (GNC PTG)		XXX			
ANGE DATA		XXXX	,		
NG RATE DATA		XXXX	,		
NGLE DATA		XXXX	,		
NG RATE DATA		xxxx	,		
ELF TEST EA-1	EA-2	DA	SYSTEM		
xxxxxx xxxx x	ΧΧΧ	XXXX	XXXX		

Figure 7.13-1. Ku Band RADAR display

## **NSP CONFIGURATION V1.1**

# **GENERAL**

- A. The data displayed are real-time telemetry parameters that affect the management and operation of the NSP configuration. A copy of the NSP CONFIG display is shown in figure 7.14-1. All parameters are OI.
- B. Pathname of display: INCO/INCO Displays/COMM Systems/nsp config.
- C. Detailed display description.

1. UPLINK DATA SOURCE V74X4795E 1 = S-BD 0 = (blank) (green)

This parameter indicates the associated GCIL panel/command driver status for this function.

2. UPLINK DATA SOURCE V74X4758E 1 = KU 0 = (blank) (green)

This parameter indicates the associated GCIL panel/command driver status for this function.

3. UPLINK DATA RATE V74X4794E 1 = HDR 0 = (blank) (green)

This parameter indicates that the NSP is configured to receive high-data-rate uplink: two voice channels of 32 kbps each and command link of 8 kbps. This parameter indicates the associated GCIL panel/command driver's status for this function.

4. UPLINK DATA RATE V74X4756E 1 = LDR 0 = (blank) (vellow)

This parameter indicates that the NSP is configured to receive low-data-rate uplink: one voice channel of 24 kbps and command link of 8 kbps. This parameter indicates the associated GCIL panel/command driver status for this function.

5. UPLINK CODING V74X4796E 1 = ON 0 = (blank) (green)

This parameter indicates that the NSP is configured for convolutional-coded uplink. The decoder is powered on. This parameter indicates the associated GCIL panel/command driver status for this function.

6. UPLINK CODING V74X4752E 1 = OFF 0 = (blank) (green)

This parameter indicates the associated GCIL panel/command driver status for this function.

7. DOWNLINK DATA RATE V74X4753E 1 = HDR 0 = (blank) (green)

This parameter indicates that the NSP output is selected to the 192 kbps rate: 128 kbps of telemetry and two 32-kbps voice channels. This parameter indicates the associated GCIL panel/command driver status for this function.

8. DOWNLINK DATA RATE

V74X4754E

9/1/2004:

1 = LDR (yellow)

This parameter indicates that the NSP output is selected to the 96 kbps rate: 64 kbps of telemetry and one 32-kbps voice. This parameter indicates the associated GCIL panel/command driver status for this function.

**REV G** 

9. DOWNLINK CODING

V74X4797E

1 = ON

0 = (blank)

0 = (blank)

(green)

This parameter indicates that the NSP is configured to encode the downlink telemetry. This parameter indicates the associated GCIL panel/command driver status for this function.

10. DOWNLINK CODING

V74X4751E

1 = OFF (green)

0 = (blank)

This parameter indicates the associated GCIL panel/command driver status for this function.

11. DATA VOICE 1/2

V74X4798E

1 = OFF

0 = (blank)

(green)

This parameter indicates that the NSP is configured to record 128-kbps telemetry data only. This parameter indicates the associated GCIL panel/command driver status for this function.

12. DATA VOICE 1/2

V74X4799E

1 = ON

0 = (blank)

(yellow)

This parameter indicates that the NSP is configured to record 128-kbps telemetry data and two 32-kbps voice channels. This parameter indicates the associated GCIL panel/command driver status for this function.

13. PSS VOICE

V74S5090E

1 = ENBL

0 = DSBL

(red)

(green)

ENBL indicates that payload station voice is enabled and the audio central control unit (ACCU) is disabled.

14. NSP BIT (1)

V74X5188E

1 = SYNC

0 = --

(green)

(red)

SYNC indicates that the NSP's bit sync lock detector reached threshold after integrating for 2<sup>14</sup> symbol times. The bit lock detector threshold changes for each mode, DOD or NASA, decoding ON or OFF.

15. NSP BIT (2)

V74X5189E

1 = SYNC

0 = --

(green)

(red)

SYNC indicates that the NSP's bit sync lock detector reached threshold after integrating for 2<sup>14</sup> symbol times. The bit lock detector threshold changes for each mode, DOD or NASA, decoding ON or OFF.

16. NSP FRAME (1) V7

V74X5176E

9/1/2004: REV G

1 = SYNC (green)

0 = -- (red)

SYNC indicates that the NSP had two consecutive frame sync patterns pass the pattern check, and will remain locked until three consecutive frame sync patterns fail the pattern check.

17. NSP FRAME (2)

V74X5177E

1 = SYNC

0 = --

(green)

(red)

SYNC indicates that the NSP had two consecutive frame sync patterns pass the pattern check, and will remain locked until two consecutive frame sync patterns fail the pattern check.

18. COMSEC FRM (1)

V74X5019E

1 = SYNC

0 = --

(green)

(red)

This is the COMSEC 1 frame sync status indicator. Sync indicates that the data prior to authentication has been frame synchronized. The frame sync logic has detected two consecutive frame sync correlations with three or fewer frame sync errors.

19. COMSEC FRM (2)

V74X5020E

1 = SYNC

0 = --

(green)

(red)

This is the COMSEC 2 frame sync status indicator. Sync indicates that the data prior to authentication has been frame synchronized. The frame sync logic has detected two consecutive frame sync correlations with three or fewer frame sync errors.



Figure 7.14-1. NSP-CONFIG display

#### **TITLE**

S-BAND PM PRE & PWR V1.0

# **GENERAL**

- A. The data displayed are real-time telemetry parameters that affect the management and operation of the S-band PM preamp and power amp. A copy of the S-BAND PM PRE & PWR display is shown in figure 7.15-1.
- B. Pathname of display: INCO/INCO Displays/COMM Systems/power amp.
- C. Detailed display description.

1. PRE AMP (1) V74X4776E 1 = ON 0 = (blank) (green)

This parameter indicates the associated GCIL panel/command drivers status for this function. The S-band preamp no. 1 is selected.

2. PREAMP (2) V74X4777E 1 = ON 0 = (blank) (green)

This parameter indicates the associated GCIL panel/command drivers status for this function. S-band preamp no. 2 is selected.

3. HTR PWR (1) V74X4707E 1 = ON 0 = (blank) (green)

This parameter indicates the associated GCIL panel/command driver's status for this function. The S-band preamp heater no. 1 is selected.

4. HTR PWR (2) V74X4708E 1 = ON 0 = (blank) (green)

This parameter indicates the associated GCIL panel/command driver's status for this function. The S-band preamp heater no. 2 is selected.

5. PWR AMP (1) V74X4784E 1 = ON 0 = (blank) (green)

This parameter indicates the associated GCIL panel/command driver status for this function.

6. PWR AMP (2) V74X4785E 1 = ON 0 = (blank) (green)

This parameter indicates the associated GCIL panel/command driver status for this function.

7. STBY (1) V74X4747E 1 = ON 0 = (blank) (green)

This parameter indicates the associated GCIL panel/command driver status for this function.

STBY (2)

8.

9/1/2004: REV G

V74X4749E

1 = ON 0 = (blank) (green)

This parameter indicates the associated GCIL panel/command driver status for this function.

9. RF OUT (1)

V74E4512A FLOATING POINT (green)

This is an analog parameter that indicates the power amplifier output in watts.

10. RF OUT (2)

V74E4513A FLOATING POINT (green)

This is an analog parameter that indicates the power amplifier output in watts.

11. RF RFL (1)

V74E4540A FLOATING POINT (green)

This is an analog parameter that indicates the reflected power of power amplifier no. 1 in watts.

12. RF RFL (2)

V74E4541A FLOATING POINT (green)

This is an analog parameter that indicates the reflected power of power amplifier no. 2 in watts.

13. TEMP (1)

V74T4514A FLOATING POINT (green)

This is an analog parameter that indicates the temperature of power amplifier no. 1 in degrees Fahrenheit.

14. TEMP (2)

V74T4515A FLOATING POINT (green)

This is an analog parameter that indicates the temperature of power amplifier no. 2 in degrees Fahrenheit.

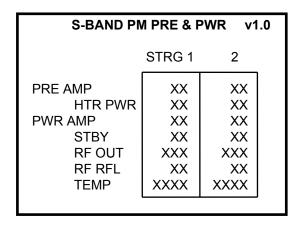


Figure 7.15-1. S-BAND PM PRE & PWR display

9/1/2004: REV G

#### TITLE

#### KU RADAR/COMM STAT V1.2

# **GENERAL**

- The data displayed are real-time telemetry parameters that affect the management and operation of the Ku-band system. A copy of the Ku RADAR/COMM STAT display is shown in figure 7.16-1.
- Pathname of display: INCO/INCO Displays/COMM Systems/radar comm.
- Detailed display description.

V75W3504D TIME 1. **GMT** (green)

Indicates Greenwich mean time.

0 = PNL2. Control Switch V74S2430E 1 = CMD(green) (red)

Indicates whether the Ku-band system is under ground or crew control. (MNA/C R11 and 15)

MODE 1 = RDR0 = COMM3. V74X2583J (yellow) (green)

Indicates whether the Ku-band system is in the radar or comm mode.

**AGC** V74E2508A FLOATING POINT 4. (green)

Indicates the radar or comm received signal strength in dBm. Nominal is about -90 dBm in comm mode.

5. **RF OUT** V74E2511A **DECIMAL** (green)

Indicates the radar or comm RF output power in watts. Nominal is about 50 watts.

TXT PWR OUT CMD 1 = OFF 0 = ON6. V74K2644J (green) (red)

Indicates that the TWT has been turned off by command vice being inhibited by pointing the antenna into the obscuration zone.

7. **SCAN WARNING** V74X2614J 1 = LMT0 = (blank)(yellow)

Indicates that the antenna line of sight is pointing into the obscuration (protected) zone. This is the area enclosed by the dashed lines on the Antenna Management display.

8. OBSC Override

V74X2595J

9/1/2004: REV G

1 = OVRD

0 = (blank)

Indicates that the Ku-band obscuration procedure has been overridden, and the TWT will remain on in accordance with the antenna steering mode and acquisition mode limitations.

9. INERT STAB GPC DESIG

V74K2640J

1 = BODY (green)

(red)

0 = INRT (vellow)

Indicates, in the GPC designate antenna steering mode, that antenna pointing is referenced to the body or to an inertial coordinate system.

10. MASK SELECT

V74K2645J

1 = BETA (vellow)

0 = BMSK (green)

If BETA is selected, the TWT will be shut off only when the antenna beta angle is greater (positively) than the beta angle selected. If BMSK (beta mask) is selected, the TWT will be shut off only when the antenna beta angle is greater (positively) than the beta angle selected, and the antenna line of sight is pointing within the Ku-band obscuration zone. (The obscuration zone is displayed as a background plot on antenna displays MSK 901 and 902.)

11. BETA ANGLE

V74H2655J

FLOATING POINT (green)

This angle is selectable via uplink command and has a range of -85° < BETA < 75°.

12. BETA LIMIT

V92X0992X

1 = OUT (vellow)

0 = IN (green)

Indicates whether the uplinked or crew input beta angle is in or out of limits ( $-85^{\circ} < BETA < +75^{\circ}$ ).

13. COMM BYPS PF-1

V92X0324X

1 = BYPS

0 = (blank)

(red)

Indicates that Ku-band data acquisition by the SM GPC via the PF-1 MDM SIO is bypassed.

14. RADAR BYPS FF-3

V91X2256XX

1 = BYPS

0 = (blank)

(red)

Indicates that Ku-band data acquisition by the G&N GPC via the FF-3 MDM SIO is bypassed.

15. SM SIO PARITY

V74X2587J

1 = ERR

0 = OK

(red) (green)

Indicates a parity error on the SM GPC SIO output to the Ku-band via the PF-1 MDM.

16. SYNC

V74X2588J

1 = ERR (red) 0 = OK (green)

Indicates a sync error on the SM GPC SIO output to the Ku-band via the PF-1 MDM.

17. VALIDTY

V74X2589J

1 = ERR

0 = OK

(red)

(green)

Indicates that a nonvalid manchester code has been detected on the SM GPC SIO output to the Ku-band via the PF-1 MDM.

# **ANTENNA MODE**

18. GPC V74X4820E 1 = GPC 0 = (blank) (green)

9/1/2004: REV G

Indicates that the GPC antenna steering mode has been selected in the comm mode or panel in the radar mode. This parameter indicates the associated GCIL panel/command driver's status for this function.

19. (GCIL) DESIG V74X4822E 1 = DESG 0 = (blank) (green)

Indicates that the GPC DESIGNATE antenna steering mode has been selected in the comm mode or panel in the radar mode. This parameter indicates the associated GCIL panel/command driver's status for this function.

20. (GCIL) AUTO V74X4824E 1 = AUTO 0 = (blank) (green)

Indicates that the AUTO TRACK antenna steering mode has been selected in the comm mode or panel in the radar mode. This parameter indicates the associated GCIL panel/command driver's status for this function.

21. MANUAL V74X4810E 1 = MAN 0 = (blank) (vellow)

Indicates that the MANUAL SLEW antenna steering mode has been selected in the comm mode or panel in the radar mode. This parameter indicates the associated GCIL panel/command driver's status for this function.

### **SYSTEM STATUS**

22. OPERATE V74X2604J 1 = OPER 0 = (blank) (green)

Indicates that the TWT has warmed up (3.5-min timeout), no faults have been detected, COMM/RDR is on, and the TWT is outputting an RF signal.

23. SEARCH V74X2601J 1 = SRCH 0 = (blank) (yellow)

Indicates that the antenna is in a programmed spiral search.

24. DETECT V74X2602J 1 = DET 0 = (blank) (green)

Indicates costas lock (carrier lock) in the comm mode or when a target is detected, and the tracking sequence is initiated in the radar mode.

25. TRACK V74X2603J 1 = TRCK 0 = (blank) (green)

Indicates antenna is angle-tracking the forward link signal in GPC comm mode and AUTO TRACK antenna steering modes; in the radar mode it is angle-, angle-rate-, range-, and range-rate-tracking in GPC and AUTO TRACK antenna steering modes or range- and range-rate-tracking in GPC DESIG and MANUAL SLEW antenna steering modes.

# **TEMPS**

26. TWT V74T2497A FLOATING POINT (green)

Indicates temperature in the vicinity of the TWT (DEA). Minimum operating =  $5^{\circ}$  F; maximum operating =  $171^{\circ}$  F.

27. RECEIVER V74T2961A FLOATING POINT (green)

Indicates temperature in the vicinity of the receiver (DEA). Minimum operating = 5° F; maximum operating = 156° F.

28. ANT FEED V74T2963A FLOATING POINT (green)

Indicates temperature of the antenna feed (monopulse comparator (DMA)). Minimum operating = 5° F; maximum operating = 186° F.

29. ALPHA GIM V74T2965A FLOATING POINT (green)

Indicates temperature of the A-axis gimbal housing (DMA). Minimum operating =  $5^{\circ}$  F; maximum operating =  $150^{\circ}$  F.

30. BETA GIM V74T2969A FLOATING POINT (green)

Indicates temperature of the B-axis gimbal housing (DMA). Minimum operating = 5° F; maximum operating = 166° F.

31. GYRO V74T2967A FLOATING POINT (green)

Indicates temperature of the gyro package (rate sensor assembly (DMA)). Minimum operating =  $5^{\circ}$  F; maximum operating =  $155^{\circ}$  F.

9/1/2004: REV G

Ku RADAR/COMM ST	AT v1.2	GMT XXX/XX:XX			
Control Status		Antenna Mode			
Control Switch	XXX	GPC	xxx		
Mode	XXXX	(GCIL)DESIG	XXXX		
AGC	XXXX	(GCIL)Auto	XXXX		
RF Out	XX	Manual	XXX		
TXT PWR Out CMD	XXX	System Status ———			
Scan Warning	XXX	Operate	xxxx		
OBSC Override	XXXX	Search	XXXX		
NERT STAB GPC DESIG	XXXX	Detect	xxx		
Mask Select	XXXX	Track	XXXX		
Beta Angle	XXX	TEMPS —			
Beta Limit	XXX	TWT	XXXX		
Computer Interface		RECEIVER	xxxx		
COMM BYPS PF-1	XXXX	ANT FEED	XXXX		
RADAR BYPS FF-3	XXXX	ALPHA GIM	xxxx		
SM SIO Parity	XXX	BETA GIM	xxxx		
SYNC	XXX	GYRO	xxxx		
Validity	XXX				

Figure 7.16-1. Ku RADAR/COMM STAT display

#### TITLE

S-BAND ANTENNA V1.1

### **GENERAL**

- A. The data displayed are real-time telemetry parameters that affect the management and operation of the COMM SM downlist. A copy of the S-Band Antenna display is shown in figure 7.17-1.
- B. Pathname of display: INCO/INCO Displays/COMM Systems/sb antenna.
- C. Detailed display description.
  - 1. SEL ANTENNA W02I0603R SPECIAL COMP (green)

This is a special comp composed of two inputs. The S-BD ANT SEL (PM) comp and the switch beam selects FWD/AFT signals. The S-BD ANT SEL (PM) comp is composed of

- a. The transponder directs signals
- b. The preamp frequency (HI or LOW) signals
- c. The antenna select relays S1, S2, S3, and S4 signals

All of these inputs are used to determine the selected antenna (ULA, ULF, URA, URF, LLA, LLF, LRA, or LRF).

This special comp is composed of W05I0200R, V74X7090E, V74X7091E, V74X7092E, V74X7093E, V74X7094E, V74X7095E, V74X7096E, V74X7097E.

W0	V7	V7	V7	V7	V7	V7	V7	V7	
02	70	70	70	70	70	70	70	70	
50	49	49	49	49	49	49	49	49	
IO	XO	X1	X2	X3	X4	X5	X6	X7	
<u>-R</u>	<u>-E</u>	<u>-E</u> 0	<u>-E</u>	<u>-E</u>	<u>-E</u>	<u>-E</u>	<u>-E</u>	<u>-E</u>	
UL	1	0	Χ	Χ	Χ	Χ	Χ	Χ	ULF
UL	0	1	Χ	Χ	Χ	Χ	Χ	Χ	ULA
UR	Χ	Χ	1	0	Χ	Χ	Χ	Χ	URF
UR	Χ	Χ	0	1	Χ	Χ	Χ	Χ	URA
LL	Χ	Χ	Χ	Χ	1	0	Χ	Χ	LLF
LL	Χ	Χ	Χ	Χ	0	1	Χ	Χ	LLA
LR	Χ	Χ	Χ	Χ	Χ	Χ	1	0	LRF
LR	Χ	Χ	Χ	Χ	Χ	Χ	0	1	LRA
ER	Χ	Χ	Χ	Χ	Χ	Χ	Χ	Χ	ER1
All oth	ner com	binatio	ns outp	ut					ER2

WO5I0200R S-BD ANT SEL (PM)

This comp is composed of

- a. The transponder directs signal bits, V74X4780E, V74X4781E
- b. The preamp frequency (HI or LOW) signal bits, V74X4779E, V74X4778E

c. the antenna select relays S1, S2, S3, and S4 signal bits, V74X7070E, V74X7072E,V74X7074E, V74X7076E, V74X7078E, V74X7080E, V74X7082E, V74X7084E.

V7	V4	V4	V4	V4								
70	70	70	70	70	70	70	70	77	77	77	77	
47	47	47	47	47	48	48	48	48	48	47	47	
X0	X2	X4	X6	X8	X0	X2	X4	X0	X1	X9	X8	
<u>-E</u>												
1	0	Χ	Χ	Χ	Χ	0	1	1	0	0	0	UR
0	1	0	1	Χ	Χ	Χ	Χ	0	1	0	0	UR
1	0	Χ	Χ	Χ	Χ	1	0	0	0	1	0	UR
0	1	1	0	Χ	Χ	Χ	Χ	0	0	0	1	UR
Χ	Χ	Χ	Χ	0	1	1	0	1	0	0	0	LR
Χ	Χ	1	0	1	0	Χ	Χ	0	1	0	0	LR
Χ	Χ	Χ	Χ	0	1	0	1	0	0	1	0	LR
Χ	Χ	0	1	1	0	Χ	Χ	0	0	0	1	LR
Χ	Χ	Χ	Χ	1	0	1	0	1	0	0	0	LL
Χ	Χ	1	0	0	1	Χ	Χ	0	1	0	0	LL
Χ	Χ	Χ	Χ	1	0	0	1	0	0	1	0	LL
Χ	Χ	0	1	0	1	Χ	Χ	0	0	0	1	LL
0	1	Χ	Χ	Χ	Χ	0	1	1	0	0	0	UL
1	0	0	1	Χ	Χ	Χ	Χ	0	1	0	0	UL
0	1	Χ	Χ	Χ	Χ	1	0	0	0	1	0	UL
1	0	1	0	Χ	Χ	Χ	Χ	0	0	0	1	UL
All o	ther c	ombir	nation	s outp	out							ER

2. SM ACT QUAD

W02G3210R SPECIAL COMP (green)

This is a special comp of the three quad select bits from the SM antenna management, indicating which quad antenna the hardware has selected (UR, LR, UL, or LL).

This special comp is composed of the following MSID V92J1057C:

V92J1057C 001 UR 010 LR 100 UL 011 LL

All other bit configurations blank

3. SM ACT BEAM W12I0603R SPECIAL COMP (green)

This is a special comp of the two switch beam select bits from the SM antenna management, indicating which beam the hardware has selected (FWD or AFT).

This special comp is composed of the following MSID V92J1062C:

V92J1062C 01 FWD 10 AFT 9/1/2004: REV G

4. SM CMD BEAM W03I0603R SPECIAL COMP (green)

This is a special comp of the SM commanded S-band PM antenna (quad and beam) selected, using the SM downlist telemetry. This telemetry indicates the antenna commanded by the SM GPC antenna management program.

This special comp is composed of V74K7050Y, V74K7051Y, V74K7055Y, V74K7056Y, V74K7060Y, V74K7061Y, V74K7065Y, V74K7066Y, V74K7044Y, V74K7046Y, V74K7045Y, and V74K7047Y.

V7	V4	V4	V4	V4								
70	70	70	70	70	70	70	70	70	70	70	70	
45	45	45	45	46	46	46	46	44	44	44	44	
K0	K1	K5	K6	K0	K1	K5	K6	K4	K6	K5	K7	
<u>Y</u>												
1	1	0	0	0	0	0	0	1	1	0	0	ULF
0	0	1	1	0	0	0	0	1	1	0	0	URF
0	0	0	0	1	1	0	0	1	1	0	0	LLF
0	0	0	0	0	0	1	1	1	1	0	0	LRF
1	1	0	0	0	0	0	0	0	0	1	1	ULA
0	0	1	1	0	0	0	0	0	0	1	1	URA
0	0	0	0	1	1	0	0	0	0	1	1	LLA
0	0	0	0	0	0	1	1	0	0	1	1	LRA
All othe	r comb	ination	S									ERR

5. HEMI W04I0603R SPECIAL COMP (green)

This is a special comp of the SM commanded S-band FM antenna (hemi) selected, using the SM downlist telemetry. This telemetry indicates the hemi antenna commanded by the SM GPC antenna management program.

This special comp is composed of V74K6515Y, V74K6516Y, V74K6510Y, and V74K6511Y.

V6	V6	V6	V6	
75	75	75	75	
41	41	41	41	
K5	K6	K0	K1	
<u>Y</u>	<u>Y</u>	<u>Y</u>	<u>Y</u>	
1	1	0	0	LOW
0	0	1	1	UP
All othe	er combi	nations		ERR

6. ANT ELEC 1 V74X4782E 1 = ON 0 = (blank) (green)

This parameter indicates the associated GCIL panel/command driver's status for this function.

7. BEAM ASSY 1 V74X6491E 1 = ON 0 = (blank) (green)

This parameter indicates that the switch-beam control assembly 1 is powered ON. (MNB FLC2)

8. ANT ELEC 2

V74X4783E

**REV G** 

9/1/2004:

1 = ON (green)

0 = (blank)

This parameter indicates the associated GCIL panel/command driver's status for this function.

9. BEAM ASSY 2

V74X6492E

1 = ON

0 = (blank)

(green)

This parameter indicates that the switch-beam control assembly 2 is powered ON. (MNC FLC3)

10. ANT ROTARY

V74S7214E

1 = GPC

0 = MAN

(green) (red)

This parameter indicates that the crew's antenna selector switch is in the GPC position.

11. LLF

V74S7217E

1 = LLF

0 = (blank)

(yellow)

This parameter indicates that the crew's antenna selector switch is in the lower left forward position.

12. LLA

V74S7317E

1 = LLA

0 = (blank)

(yellow)

This parameter indicates that the crew's antenna selector switch is in the lower left aft position.

13. ULF

V74S7215E

1 = ULF (yellow)

0 = (blank)

This parameter indicates that the crew's antenna selector switch is in the upper left forward position.

14. ULA

V74S7315E

1 = ULA

0 = (blank)

(yellow)

This parameter indicates that the crew's antenna selector switch is in the upper left aft position.

15. URF

V74S7216E

1 = URF

0 = (blank)

(yellow)

This parameter indicates that the crew's antenna selector switch is in the upper right forward position.

16. URA

position.

V74S7316E

1 = URA (yellow) 0 = (blank)

This parameter indicates that the crew's antenna selector switch is in the upper right aft

17. LRF

9/1/2004: REV G

V74S7218E 1 = LRF

0 = (blank)

This parameter indicates that the crew's antenna selector switch is in the lower right forward position.

18. ANT SW POS S1A

V74X7070E

1 = ON

(yellow)

0 = (blank)

(green)

This parameter indicates that antenna select relay S1 is in the A position. (MNB/C FLC 2/3)

19. ANT SW POS S1B

V74X7072E

1 = ON (green)

0 = (blank)

This parameter indicates that antenna select relay S1 is in the B position. (MNB/C FLC 2/3)

20. ANT SW POS S2A

V74X7074E

1 = ON

0 = (blank)

(green)

This parameter indicates that antenna select relay S2 is in the A position. (MNB/C FLC 2/3)

21. ANT SW POS S2B

V74X7076E

1 = ON (green)

0 = (blank)

This parameter indicates that antenna select relay S2 is in the B position. (MNB/C FLC 2/3)

22. ANT SW POS S3A

V74X7078E

1 = ON (green)

0 = (blank)

This parameter indicates that antenna select relay S3 is in the A position. (MNB/C FLC 2/3)

23. ANT SW POS S3B

V74X7080E

1 = ON

0 = (blank)

(gre

(green)

This parameter indicates that antenna select relay S3 is in the B position. (MNB/C FLC 2/3)

24. ANT SW POS S4A

V74X7082E

1 = ON

0 = (blank)

(green)

This parameter indicates that antenna select relay S4 is in the A position. (MNB/C FLC 2/3)

25. ANT SW POS S4B

V74X7084E

1 = ON (green) 0 = (blank)

This parameter indicates that antenna select relay S4 is in the B position. (MNB/C FLC 2/3)

26. FREQ LOW

9/1/2004: REV G

V74X4778E

1 = LOW 0 = (blank) (green)

This parameter indicates the antenna electronic switch GCIL panel/ command driver status for this function.

27. FREQ HIGH

V74X4779E

1 = HIGH

0 = (blank)

(green)

This parameter indicates the antenna electronic switch GCIL panel/ command driver status for this function.

28. BEAM SELECT UL FWD

V74X7090E

1 = ULF (green)

0 = (blank)

This parameter indicates that the forward beam has been selected in the upper left quad antenna. (CNTL BC1)

29. BEAM SELECT UR FWD

V74X7092E

1 = URF

0 = (blank)

(green)

This parameter indicates that the forward beam has been selected in the upper right quad antenna. (CNTL BC1)

30. BEAM SELECT LL FWD

V74X7094E

1 = LLF

0 = (blank)

(green)

This parameter indicates that the forward beam has been selected in the lower left quad antenna. (CNTL BC1)

31. BEAM SELECT LR FWD

V74X7096E

1 = LRF (green)

0 = (blank)

This parameter indicates that the forward beam has been selected in the lower right quad antenna. (CNTL BC1)

32. BEAM SELECT UL AFT

V74X7091E

1 = ULA (green)

0 = (blank)

This parameter indicates that the aft beam has been selected in the upper left quad antenna. (CNTL BC1)

33. BEAM SELECT UR AFT

V74X7093E

1 = URA (green)

0 = (blank)

This parameter indicates that the aft beam has been selected in the upper right quad antenna. (CNTL BC1)

34. BEAM SELECT LL AFT

V74X7095E

1 = LLA (green)

0 = (blank)

This parameter indicates that the aft beam has been selected in the lower left quad antenna. (CNTL BC1)

9/1/2004: REV G

35. BEAM SELECT LR AFT V74X7097E 1 = LRA 0 = (blank) (green)

This parameter indicates that the aft beam has been selected in the lower right quad antenna. (CNTL BC1)

S-Band Antenna v1.1 GMT XXX/XX:XX							
SEL Antenna (OI)	XXX	ANT SW POS S1A	XX				
SM ACT QUAD SM ACT BEAM	XX	S1B S2A	XX				
SM CMD BEAM	XXX	S2A S2B	XX				
HEMI	XXX	S3A	XX				
	7001	S3B	XX				
ANT ELEC 1	XX	S4A	XX				
BEAM ASSY 1	XX	S4B	XX				
ANT ELEC 2	XX						
BEAM ASSY 2	XX	FREQ LOW	XXX				
		HIGH	XXXX				
ANT ROTARY	XXX	BEAM SELECT					
LLF	XXX	UL FWD	XXX				
LLA	XXX	UR FWD	XXX				
ULF	XXX	LL FWD	XXX				
ULA	XXX	LR FWD	XXX				
URF	XXX	UL AFT	XXX				
URA	XXX	UR AFT	XXX				
LRF	XXX	LL AFT	XXX				
		LR AFT	XXX				

Figure 7.17-1. S-Band Antenna display

#### **TITLE**

SM STDN ANTENNA V1.0

### **GENERAL**

- A. The data displayed are real-time telemetry parameters that affect the management and operation of the COMM SM downlist. A copy of the SM STDN ANTENNA display is shown in figure 7.18-1.
- B. Pathname of display: INCO/INCO Displays/COMM Systems/stdn\_antenna.
- C. Detailed display description.

1. GMT V75W3504D TIME (green)

Displays Greenwich mean time.

2. QUAD SELECT W02G3210R SPECIAL COMP (green)

This is a special comp of the three quad select bits from the SM antenna management, indicating which quad antenna the hardware has selected (UR, LR, UL, or LL).

This special comp is composed of the following MSID V92J1057C:

V92J1057C

001 UR

010 LR

100 UL

011 LL

All other bit configurations blank

3. QUAD FAIL V92X1049X 1 = FAIL 0 = (blank) (red)

This parameter indicates that the SM antenna management cannot compare the commanded quad to the actual selected quad antenna.

4. HEMI SELECT W03G3210R SPECIAL COMP (green)

This is a special comp of the two hemi select bits from the SM antenna management, indicating which hemi antenna the hardware has selected (upper or lower).

This special comp is composed of the following MSID V92J1056C:

V92J1056C

01 UP 10 LO

All other bit combinations blank

5. HEMI FAIL V92X1050X 1 = FAIL 0 = (blank) (red)

This parameter indicates that the SM antenna management cannot compare the commanded hemi to the actual selected hemi antenna.

SITE SELECT

6.

9/1/2004: REV G

W01G3210R SPECIAL COMP (green)

This is a special comp of the four site select bits to determine which site the SM antenna management program is using in computing the line-of-sight pitch and roll angles.

This special comp is composed of the following MSID V92J1054C (S-BD SEL SIT):

IOS

**OTS** 

**DKR** 

V92J1054C LSB	
XXXX XXXX XXXX 0001	
0010	

MAD 0011 NHS 0100 VAN 0101 BDA 0110 MIL 0111 HTS 1000 **GTS VTS** 1001 1010 **DGS** 1011 **CTS** 1100 CAN **DFR** 1101 **GDX** 1110

XXXX XXXX XXXX 0000

1111

7. STDN ROLL ANG

V92H1069C FLOATING POINT (green)

This is an analog parameter indicating the roll look angle to the STDN site computed by the onboard SM antenna management program.

8. STDN PITCH ANG

V92H1068C FLOATING POINT (green)

This is an analog parameter indicating the pitch look angle to the STDN site computed by the onboard SM antenna management program.

9. SM BYP PL 1

V92X0323X

1 = BYP

0 = (blank)

(red)

Indicates that the SM GPC has bypassed the payload MDM (PF 1) and that the SM will not send commands via PF 1.

10. SM BYP PL 2

V92X0327X

1 = BYP

0 = (blank)

(red)

Indicates that the SM GPC has bypassed the payload MDM 2 (PF 2) and that the SM will not send commands via PF 2.

SHUTTLE OPS		SM STDN ANTENNA
INCO/COMM/JSC-12829	9/1/2004: REV G	SCP 7.18

11. SITE IN VIEW V92X1053XY 1 = YES 0 = NO (green) (yellow)

This parameter indicates that SM antenna management has found an STDN/SGLS site or TDRS in view and is providing an enable indication to uplink processing.

12. S-BD SEL SIT V92J1054C FLOATING POINT (green)

Displays the four site select bits in decimal to determine which site the SM antenna management program is using in computing the line-of-sight pitch and roll angles.

V92J1054C LSB	
XXXX XXXX XXXX	IOS
0001	
0010	MAD
0011	NHS
0100	VAN
0101	BDA
0110	MIL
0111	HTS
1000	GTS
1001	VTS
1010	DGS
1011	CTS
1100	CAN
1101	DFR
1110	GDX
1111	OTS
XXXX XXXX XXXX 0000	DKR

13. SEL FWD/AFT W12I0603R SPECIAL COMP (green)

This is a special comp of the two switch beam select bits from the SM antenna management, indicating which beam the hardware has selected (FWD or AFT).

This special comp is composed of the following MSID V92J1062C:

V92J1062C 01 FWD 10 AFT 9/1/2004:

**REV G** 

V93X5647X 1 = YES 0 = (blank)

(yellow)

In case of an override, the transponder is forced to TDRS mode.

15. SM ANTENNA PTG

14. ANT MODE OVRD

**ENA** V93X5625X 1 = ENA 0 = (blank)

(green)

This parameter indicates that the SM antenna management program output to the antenna electronic switches is enabled and the onboard software is selecting antennas.

INH V93X5626X 1 = INH 0 = (blank)

(vellow)

This parameter indicates that the SM antenna management program output to the antenna electronic switches is inhibited and the antennas are being selected via uplink command.

16. SITE SELECT

0 = (blank)**AUTO** V93X5620X 1 = AUTO

(green)

This parameter indicates that SM antenna management is selecting STDN sites automatically.

**NEXT** V93X5622X 1 = NEXT 0 = (blank)

(green)

This parameter indicates that SM antenna management has been requested to scan the STDN/SGLS site table for the next site in the table that is in view. If no site is found, it will revert to the auto state.

17. IOS V92X0976X 1 = INH0 = (blank)(yellow)

This parameter indicates that the IOS inhibit flag is set and the SM antenna management program is inhibited from using it.

V92X0977X 1 = INH 18. MAD 0 = (blank)(yellow)

This parameter indicates that the MAD inhibit flag is set and the SM antenna management program is inhibited from using it.

19. NHS V92X0978X 1 = INH 0 = (blank)(yellow)

This parameter indicates that the GDS inhibit flag is set and the SM antenna management program is inhibited from using it.

20. VAN V92X0979X 1 = INH0 = (blank)(yellow)

This parameter indicates that the VAN inhibit flag is set and the SM antenna management program is inhibited from using it.

9/1/2004:

**REV G** 

1 = INH0 = (blank)(yellow)

This parameter indicates that the BDA inhibit flag is set and the SM antenna management program is inhibited from using it.

22. MIL

21. BDA

V92X0981X

V92X0980X

1 = INH

(yellow)

This parameter indicates that the MIL inhibit flag is set and the SM antenna management program is inhibited from using it.

23. HTS

V92X0982X

1 = INH (yellow) 0 = (blank)

0 = (blank)

This parameter indicates that the HTS inhibit flag is set and the SM antenna management program is inhibited from using it.

24. GTS

V92X0983X

1 = INH(vellow) 0 = (blank)

This parameter indicates that the GTS inhibit flag is set and the SM antenna management program is inhibited from using it.

25. VTS

V92X0984X

1 = INH(yellow) 0 = (blank)

This parameter indicates that the VTS inhibit flag is set and the SM antenna management program is inhibited from using it.

26. DGS

V92X0985X

1 = INH(yellow) 0 = (blank)

This parameter indicates that the DGS inhibit flag is set and the SM antenna management program is inhibited from using it.

27. CTS

V92X0986X

1 = INH(yellow) 0 = (blank)

This parameter indicates that the CTS inhibit flag is set and the SM antenna management program is inhibited from using it.

28. CAN

V92X0987X

1 = INH

0 = (blank)

(vellow) This parameter indicates that the CAN inhibit flag is set and the SM antenna management

29. DFR

program is inhibited from using it.

V92X0988X

1 = INH(yellow) 0 = (blank)

This parameter indicates that the DFR inhibit flag is set and the SM antenna management program is inhibited from using it.

30. GDX

V92X0989X

1 = INH

0 = (blank)

(yellow)

This parameter indicates that the GDX inhibit flag is set and the SM antenna management program is inhibited from using it.

31. OTS V92X0990X 1 = INH 0 = (blank) (yellow)

This parameter indicates that the OTS inhibit flag is set and the SM antenna management program is inhibited from using it.

32. DKR V92X0991X 1 = INH 0 = (blank) (yellow)

This parameter indicates that the DKR inhibit flag is set and the SM antenna management program is inhibited from using it.

SM STDN GMT XXX		
QUAD SELE QUAD FAIL HEMI SELE HEMI FAIL SITE SELE STDN ROLL STDN PITCI SM BYP PL SM BYP PL SITE IN VIE S-BD SEL S SEL FWD/A ANT MODE SM ANTENI SITE SELE	CT ANG H ANG 1 2 W IT FT OVRD NA PTG	XX XXXX XX XXX XXX XXX XXX XXX XXX XXX
MAD NHS VAN BDA MIL HTS	XXX XXX XXX XXX XXX XXX XXX	VTS XXX DGS XXX CTS XXX CAN XXX DFR XXX GDX XXX OTS XXX DKR XXX

Figure 7.18-1. STDN ANTENNA display

#### **TITLE**

S BAND XPNDR V1.2

### **GENERAL**

- A. The data displayed are real-time telemetry parameters that affect the management and operation of the S-band PM transponder. A copy of the S Band XPNDR display is shown in figure 7.20-1.
- B. Pathname of display: INCO/INCO Displays/COMM Systems/transponder.
- C. Detailed display description.

1. GMT V75W3504D TIME (green)

Indicates Greenwich mean time.

# XPNDR 1

2. POWER V74X4745E 1 = ON 0 = OFF (green) (gray)

This parameter indicates the associated GCIL panel/command driver status for this function. (XPNDR 1 )

3. DIRECT V74X4780E 1 = DIR 0 = OFF (green) (gray)

This parameter indicates the antenna switch GCIL panel/command driver status for this function. (XPNDR 1)

4. AGC S/S V74E4080A FLOATING POINT (green)

This parameter indicates the uplinked signal strength received by the S-band transponder 1 (-115 to -30 dBm).

5. SPE V74B4086A FLOATING POINT (green)

This is an analog parameter indicating the frequency offset of transponder 1 receiver VCO (-90 to +90 kHz).

6. COHRENT V74X4516E 1 = LOCK 0 = NOLK (green) (gray)

This parameter indicates that transponder 1 has switched to the coherent mode.

7. PH LOCK V74X4090E 1 = LOCK 0 = NOLK (green) (gray)

This parameter indicates that transponder 1 is phase locked.

8. RF OUT V74E4088A FLOATING POINT (green)

This is an analog parameter indicating that the RF output power in transponder 1 is in the SGLS or STDN LO mode (0 to 5 watts).

XPNDR 2

**POWER** 9. 1 = ON0 = OFFV74X4746E

(green) (gray)

This parameter indicates the associated GCIL panel/command driver status for this function. (XPNDR 2)

10. DIRECT V74X4781E 0 = OFF1 = DIR(green) (gray)

This parameter indicates the antenna switch GCIL panel/command driver status for this function. (XPNDR 2)

11. AGC S/S V74E4081A FLOATING POINT (green)

This parameter indicates the uplinked signal strength by the S-band transponder 2 (-115 to -30 dBm).

12. SPE FLOATING POINT V74B4087A (green)

This is an analog parameter indicating the frequency offset of transponder 2 receiver VCO (-90 to +90 kHz).

13. COHRENT V74X4517E 1 = LOCK 0 = NOLK(green) (gray)

This parameter indicates that transponder 2 has switched to the coherent mode.

14. PH LOCK V74X4091E 1 = LOCK0 = NOLK(green) (gray)

This parameter indicates that transponder 2 is phase locked.

15. RF OUT V74E4089A FLOATING POINT (green)

This is an analog parameter indicating that the RF output power in transponder 2 is in the SGLS or STDN LO mode (0 to 5 watts).

# **Common Data**

MODE

This field of the display incorporates a tool labeled a MULTI. A MULTI allows you to compact your data by assigning several different MSIDs and their associated outputs into one slot on the display. If you click on the field, a display box will pop up to show the logic behind the output field of the MULTI. This box displays each possible output and the associated MSIDs. Notice that if all values are set to 0.0 then six dashed lines (-----) will be displayed to indicate that no mode is currently selected. If more than one value is set to 1.0, then six plus symbols (++++++) will appear, indicating an error. If only one of the MSIDs is = 1, then the following values will be displayed:

V74X4786E **TDRS** V74X4787E STDN-LO V74X4788E STDN-HI V74X4789E SGLS

17 FREQ

This field is another MULTI like the one above. The defining parameters and outputs are as follows:

V74X4792E LOW V74X4793E HIGH

14. SPRD SPEC V74X4790E 1 = OFF 0 = ON (green) (green)

This parameter indicates the associated GCIL panel/command driver status for this function.

15. RANGING V74X4791E 1 = OFF 0 = ON (yellow) (green)

This parameter indicates the associated GCIL panel/command driver status for this function.

16. R/L DATA V74X4735E 1 = ON 0 = OFF (green) (red)

This parameter indicates the associated GCIL panel/command driver status for this function.

19. XMIT/RCV

This field is another MULTI like the ones above. The defining parameters and outputs are as follows:

V74X4741E T/R V74X4743E RCV 9/1/2004: REV G



Figure 7.20-1. S Band XPNDR display

### **TITLE**

BIOMED V 1.0

### **GENERAL**

- A. The data displayed are real-time telemetry that affect the management and operation of the BIOMED system. A copy of the BIOMED system display is shown in figure 7.22-1.
- B. Pathname of display: INCO/INCO Displays/INST Systems/bio med.
- C. Detailed display description.

1. CHAN 1 - MS V67X0110E 1 = MS 0 = (blank) (green)

This parameter indicates that the channel 1 biomedical instrumentation switch is in the MS position, enabling electrocardiogram (ECG) data to be obtained from the mission specialist.

2. CHAN 2 - MS V67X0210E 1 = MS 0 = (blank) (green)

This parameter indicates that the channel 2 biomedical instrumentation switch is in the MS position, enabling ECG data to be obtained from the mission specialist.

3. CHAN 1 - PS V67X0112E 1 = PS 0 = (blank) (green)

This parameter indicates that the channel 1 biomedical instrumentation switch is in the PS position, enabling ECG data to be obtained from the pilot.

4. CHAN 2 - PS V67X0212E 1 = PS 0 = (blank) (green)

This parameter indicates that the channel 2 biomedical instrumentation switch is in the PS position, enabling ECG data to be obtained from the pilot.

5. CHAN 1 - MD LEFT V67X0114E 1 = MD-L 0 = (blank) (green)

This parameter indicates that the channel 1 biomedical instrumentation switch is enabled to the MID DECK BIOMED panel, left connector.

6. CHAN 2 - MD LEFT V67X0214E 1 = MD-L 0 = (blank) (green)

This parameter indicates that the channel 2 biomedical instrumentation switch is in the MID DECK BIOMED panel, left connector.

7. CHAN 1 - MD CENTER V67X0116E 1 = MD-C 0 = (blank) (green)

This parameter indicates that the channel 1 biomedical instrumentation switch is enabled to the MID DECK BIOMED panel, center connector.

......

V67X0216E

1 = MD-C (green) 0 = (blank)

This parameter indicates that the channel 2 biomedical instrumentation switch is in the MID DECK BIOMED panel, center connector.

9. CHAN 1 - MD RIGHT

CHAN 2 - MD CENTER

V67X0118E

1 = MD-R (green) 0 = (blank)

This parameter indicates that the channel 1 biomedical instrumentation switch is enabled to the MID DECK BIOMED panel, right connector.

10. CHAN 2 - MD RIGHT

V67X0218E

1 = MD-R (green) 0 = (blank)

This parameter indicates that the channel 2 biomedical instrumentation switch is in the MID DECK BIOMED panel, right connector.

11. CHAN 1 - EVA 1

V67X0120E

1 = EVA (green)

0 = (blank)

This parameter indicates that the channel 1 biomedical instrumentation switch is enabled to the 259.7 MHz EVA/ATC XCVR.

12. CHAN 2 - EVA 1

V67X0220E

1 = EVA (green)

0 = (blank)

This parameter indicates that the channel 2 biomedical instrumentation switch is enabled to the 279.0 MHz EVA/ATC XCVR.

BIOMED v 1.0		XXX/XX:XX:XX					
	CHANNEL						
DATA SOURCE	1	2					
MS	XX	XX					
PS	XX	XX					
MD LEFT	XXXX	XXXX					
MD CENTER	XXXX	XXXX					
MD RIGHT	XXXX	XXXX					
EVA1	XXX	XXX					

Figure 7.22-1. BIOMED display

# COMM/JSC-12829 8/3/2007:

### **TITLE**

#### COMM/INST BYPASS V 1.1

#### **GENERAL**

A. The data displayed are real-time telemetry parameters affecting the COMM and DPS software systems. A copy of the COMM/INST BYPASS display is shown in figure 7.23-1. Refer to PCMMU Element Bypass and the flight-specific PMU element bypass list for further analysis of the PCMMU element bypass indications.

**REV G, PCN-6** 

- B. Pathname of display: INCO/INCO Displays/INST Systems/comm\_bypass.
- C. Detailed display description.

1. PMU RC1 TIO V92X0585X 1 = BYP 0 = (blank) (red)

This is a discrete parameter that indicates that the SM GPC has encountered 2 consecutive errors on at least 1 of the 48 elements of SM/PCMMU TIMER READ CYCLE 1 and has bypassed that element(s). Refer to INCO/COMM Systems Brief 36 for definition of PCMMU TIO reads.

2. PMU RC1 SVC V92X0586X 1 = BYP 0 = (blank) (red)

This is a discrete parameter indicating that the SM GPC has encountered 2 consecutive errors on at least 1 of the 48 elements of SM/PCMMU supervisor call (SVC) read cycle 1 and has bypassed that element(s). Refer to INCO/COMM Systems Brief 36 for definition of PCMMU SVC reads.

3. PMU RC2 TIO V92X0587X 1 = BYP 0 = (blank) (red)

Same as V92X0585X, except PCMMU TIMER read cycle 2.

4. PMU RC2 SVC V92X0588X 1 = BYP 0 = (blank) (red)

Same as V92X0586X, except PCMMU SVC read cycle 2.

5. PMU RC3 TIO V92X0589X 1 = BYP 0 = (blank) (red)

Same as V92X0585X, except PCMMU TIMER read cycle 3.

6. PMU RC3 SVC V92X0590X 1 = BYP 0 = (blank) (red)

Same as V92X0586X, except PCMMU SVC read cycle 3.

7. PMU RC4 TIO V92X0591X 1 = BYP 0 = (blank) (red)

Same as V92X0585X, except PCMMU TIMER read cycle 4.

Same as V92X0586X, except PCMMU SVC read cycle 6.

13. ID LAST ERROR V92U0597C **BINARY** (green)

This parameter is a binary readout, indicating the read cycle ID of the last error encountered by the SM GPC when reading PCMMU data. This parameter is used in conjunction with V92U0599C and V92U0600C to determine the current error processing status of the SM GPC on PCMMU reads.

**SCP 7.23** 

ERROR COUNT V92U0600C **DECIMAL** (green)

This parameter is a decimal readout, indicating how many errors have occurred on SM GPC reads of PCMMU data since SM initialization. This integer counter will roll over after it reaches 999 error counts. This counter will enable the MCC to see how many errors have occurred since the last sight-in-view period.

15. ELEM NUMB V92U0599C **DECIMAL** (green)

This parameter is a decimal representation of the element number in the read cycle defined by V92U0597C where the SM GPC last encountered an error on PCMMU data reads.

16. PF1 PDI SW MATRIX V92X0908X 1 = BYP0 = (blank)(red)

This is a discrete parameter indicating that the SM GPC has encountered two consecutive errors on the payload bus 1 (PF1) transaction read of the PDI switch matrix data and has bypassed that read.

17. PF1 RTN V92X0323X 1 = BYP0 = (blank)(red)

0 = (blank)

This is a discrete parameter indicating that the SM GPC has encountered an error on some previous PL 1 MDM transaction plus a RETURN WORD echo check fail, and that SM has bypassed all elements (read transactions) for PL 1 MDM.

18. PF1 KU-B V92X0324X 1 = BYP

(red)

This is a discrete parameter indicating that the SM GPC has encountered two consecutive read errors on its read transaction with the PL MDM1 serial I/O interface to the Ku-band signal processor and has bypassed that transaction.

19. PF1 PSP 1 V92X0325X 1 = BYP0 = (blank)(red)

This is a discrete parameter indicating that the SM GPC has encountered two consecutive read element errors on the GPC's read transaction with the PL MDM 1 serial I/O interface to payload signal processor 1 and has bypassed that read element. SM applications reacts uniquely to this bypass by terminating the entire output, input, and process in response to the bypass by system software.

20. PF2 RTN V92X0327X 1 = BYP0 = (blank)(red)

This is a discrete parameter indicating that an error and bypass of PL 2 MDM read elements have occurred. Same as V92X0323X, except PL2 MDM.

21. PF2 PSP 2 V92X0329X 1 = BYP0 = (blank)(red)

Same as V92X0325X, except PSP 2 and PL MDM 2.

22. 1 BCE EL V92J4325CY **DECIMAL** (green)

This parameter is a decimal number indicating the BCE element number (which uniquely identifies an LRU that may be bypassed by software action) of the LRU that was being accessed when the I/O error occurred as logged in I/O error log entry 1. This number can be decoded using the PASS User's Guide, USA002869, Table 8.2-8 (95 = PDI SW Matrix read).

23. 1 BCE ID V92J4326CY **DECIMAL** (green)

This parameter is a decimal number indicating the device ID/transaction ID (which identifies the unique device such as a PSP or NSP or identifies a transaction such as a PLBD data read) of the device function that was being accessed when the I/O error occurred as logged in I/O error log entry 1. This number can be decoded using the PASS User's Guide, USA002869, Table 8.2-7 (10 = PCMMU).

24. 1 BCE OP CODE V92J4327CY **DECIMAL** (green)

This parameter is a decimal number that identifies the OP code (parameter used to further define/identify a device/transaction ID) of a device that was being accessed when I/O error log entry 1 occurred. This number can be decoded using the PASS User's Guide, USA002869, Table 8.2-7 (9 = OI/PL RAM read).

8/3/2007: REV G, PCN-6

25. 2 BCE EL V92J4402CY DECIMAL (green)

Same as V92J4325CY, except I/O error log entry 2.

26. 2 BCE ID V92J4403CY DECIMAL (green)

Same as V92J4326CY, except I/O error log entry 2.

27. 2 BCE OP CODE V92J4404CY DECIMAL (green)

Same as V92J4327CY, except I/O error log entry 2.

28. 3 BCE EL V92J4479CY DECIMAL (green)

Same as V92J4325CY, except I/O error log entry 3.

29. 3 BCE ID V92J4480CY DECIMAL (green)

Same as V92J4326CY, except I/O error log entry 3.

30. 3 BCE OP CODE V92J4481CY DECIMAL (green)

Same as V92J4327CY, except I/O error log entry 3.

31. 4 BCE EL V92J4552CY DECIMAL (green)

Same as V92J4325CY, except I/O error log entry 4.

32. 4 BCE ID V92J4553CY DECIMAL (green)

Same as V92J4326CY, except I/O error log entry 4.

33. 4 BCE OP CODE V92J4554CY DECIMAL (green)

Same as V92J4327CY, except I/O error log entry 4.

34. 5 BCE EL V92J4622CY DECIMAL (green)

Same as V92J4325CY, except I/O error log entry 5.

35. 5 BCE ID V92J4623CY DECIMAL (green)

Same as V92J4326CY, except I/O error log entry 5.

COM	COMM/INST BYPASS v1.1 GMT XXX/XX:XX								
PCMMU				PF1			PF2		
RC	TIO	SVC		PSP	1 XX	PSP 2	XX		
1	XX	XX	PDI	SW Matri	x XX	RTN	XX		
2	XX	XX		KU-	B XX				
3	XX	XX		RT	N XX				
4	XX	XX	BCE	ELEM	ID#	OP CODE			
5	XX	XX	1	Χ	Χ	X			
6	XX	XX	2	Χ	Χ	X			
ID Las	st Error	XX	3	Χ	Χ	X			
Error	Count	XX	4	Χ	Χ	X			
Elem.	Numb	XX	5	X	Х	Х			
			•						

Figure 7.23-1. COMM/INST BYPASS display

#### **TITLE**

DSC RAW DATA V1.7

### **GENERAL**

- A. This MSKVIEW display is used to identify and troubleshoot any suspected OI Dedicated Signal Conditioner (DSC) failures. The display consists of telemetry parameters that are all processed through OI DSCs. There are 4 to 7 parameters for each of the 14 OI DSCs. These parameters are the PCM counts and not the analog value of the relatively dynamic measurements. This display will allow the user to identify any suspected OI DSC failures (in which case the measurements from that DSC would go to zero), or any suspected OI MDM failures (in which case the measurements from that MDM would become static values). This display is used for all flights as shown in figure 7.24-1.
- B. Pathname of display: INCO>DISPLAYS>INST SYSTEMS>RAW DATA.
- C. Detailed display description.

V45P1100A

1. GMT M50Q0027HP TIME green

Indicates Greenwich Mean Time.

### OF1

2. V76V1500A INTEGER V76V0121A green V61P2115A V61T2627A

Indicates the measurements in PCM counts of the given parameters that are processed through DSC OF1.

# OF2

3. V76V1600A INTEGER V76V0221A green V61P2405A V45Q1205A

Indicates the measurements in PCM counts of the given parameters that are processed through DSC OF2.

# OF3

4. V76V1700A INTEGER V76V0321A green V61P2700A

V45T0213A

V61T2631A

Indicates the measurements in PCM counts of the given parameters that are processed through DSC OF3.

# OF4

5. V42T1304A INTEGER V42T1504C green V09T1514A

Indicates the measurements in PCM counts of the given parameters that are processed through DSC OF4.

# OR1

V42P1112C

6. V43T5704A INTEGER
V42T3204A green
V43T5708A
V42P3110C
V42P3114C
V42T3506C
V42T3508C

Indicates the measurements in PCM counts of the given parameters that are processed through DSC OR1.

# OR2

7. V43T5711A INTEGER
V43T5706A green
V43T5642A
V43T5215A
V42P3112C

V42P3310C V42T3518C

Indicates the measurements in PCM counts of the given parameters that are processed through DSC OR2.

# <u>OM1</u>

10. V45V0100A INTEGER V45T1107A green V45C0201A

V45C0201A V46T1172A V46T1272A

Indicates the measurements in PCM counts of the given parameters that are processed through DSC OM1.

# <u>OM2</u>

11. V45V0200A INTEGER V45V0300A green V45T0313A

V58T1700A V78T9607A

Indicates the measurements in PCM counts of the given parameters that are processed through DSC OM2.

# <u>OM3</u>

12. V46T1274A INTEGER V46P0205A green V46T1275A V45T0113A

Indicates the measurements in PCM counts of the given parameters that are processed through DSC OM3.

# OA1

V63T1404A

13. V58Q0102A INTEGER V46T0174A green V46T0108A V63T1209A

Indicates the measurements in PCM counts of the given parameters that are processed through DSC OA1.

# OA2

14. V58T0222A INTEGER
V46T0104A green
V63T1207A
V43T6219A

Indicates the measurements in PCM counts of the given parameters that are processed through DSC OA2.

# OA<sub>3</sub>

15. V76V3093A INTEGER
V46T0308A green
V63T1760A
V43T6242A

Indicates the measurements in PCM counts of the given parameters that are processed through DSC OA3.

# <u>OL1</u>

16. V43T4704A INTEGER
V42T2204A green
V43T4708A
V42P2110C
V42P2114C

V42T2506C V42T2508C

Indicates the measurements in PCM counts of the given parameters that are processed through DSC OL1.

# OL2

17.	V43T4711A	INTEGER
	V43T4706A	green
	V43T4642A	_
	V42P2112C	
	V42P2310C	
	V42T2518C	

Indicates the measurements in PCM counts of the given parameters that are processed through DSC OL2.



Figure 7.24-1: DSC RAW DATA V1.7

#### **TITLE**

DSC/MDM STATUS V 1.2

## **GENERAL**

A. This is a telemetry display that is used to identify and troubleshoot any suspected OI dedicated signal conditioner (DSC) or MDM failures. A copy of the DSC/MDM parameters display is shown in figure 7.25-1.

DSC/MDM PARAMETERS consists of 66 analog telemetry parameters that are all processed through OI DSCs. There are 3 to 5 parameters for each of the 16 OI DSCs. All of the 66 parameters are analog measurements that read some value other than zero and are relatively dynamic (voltages, currents, and temperature measurements). This configuration will allow the user to identify any suspected OI DSC failures (in which case the measurements from that DSC would go to zero), or any suspected OI MDM failures (in which case the measurements from that MDM would become static values).

- B. Pathname of display: INCO/INCO Displays/INST Systems/dsc\_status.
- C. Detailed display description.

1. GMT V75W3504D TIME green

Indicates Greenwich mean time.

# DSC

The 16 different OI DSCs are listed in the two columns marked DSC. There are eight DSCs listed in the first column on the left side of the display (OF1, OF2, OF3, OF4, OR1, OR2, OP1, and OP2). The other eight are listed in the second column (OM1, OM2, OM3, OA1, OA2, OA3, OL1 and OL2). A BITE status indication is displayed for all DSCs except OF4, OR1, OR2, OL1 and OL2.

2. OF1 V75X2171E 1 = OF1 0 = OF1 wheat black black yellow

This parameter indicates the state of the two OF1 DSC power supplies (DSC OF1 BITE). If either supply fails or is out of tolerance (0.5 percent of 17 V) or if one of the 28-V power sources powering the DSC is lost, the parameter will indicate a logic 0. A logic 1 indicates good power supplies.

3. OF2 V75X2172E 1 = OF2 0 = OF2 wheat black black yellow

Same as OF1 DSC BITE for OF2 DSC.

4. OF3 V75X2173E 1 = OF3 0 = OF3 wheat black black yellow

Same as OF1 DSC BITE for OF3 DSC.

SHUTTI INCO/C	LE OPS OMM/JSC-12829	9/1/2004: REV G			STATUS SCP 7.25
5.	OP1	V75X2184E	1 = OP1 wheat black	0 = OP1 black yellow	
	Same as OF1 DSC BITE	for OP1 DSC.			
6.	OP2	V75X2185E	1 = OP2 wheat black	0 = OP2 black yellow	
	Same as OF1 DSC BITE	for OP2 DSC.			
7.	OA1	V75X2174E	1 = OA1 wheat black	0 = OA1 black yellow	
	Same as OF1 DSC BITE	for OA1 DSC.			
8.	OA2	V75X2175E	1 = OA2 wheat black	0 = OA2 black yellow	
	Same as OF1 DSC BITE	for OA2 DSC.			
9.	OA3	V75X2176E	1 = OA3 wheat black	0 = OA3 black yellow	
	Same as OF1 DSC BITE	for OA3 DSC.			
10.	OM1	V75X2181E	1 = OM1 wheat black	0 = OM1 black yellow	
	Same as OF1 DSC BITE	for OM1 DSC.			
11.	OM2	V75X2182E	1 = OM2 wheat black	0 = OM2 black yellow	
	Same as OF1 DSC BITE	for OM2 DSC.			
12.	OM3	V75X2183E	1 = OM3 wheat black	0 = OM3 black yellow	

DSC/MDM

Same as OF1 DSC BITE for OM3 DSC.

# MDM

Next to each DSC column is a column marked MDM. This column identifies which MDM is processing the particular parameters that are listed for each DSC. All seven of the OI MDMs (OF1, OF2, OF3, OF4, OA1, OA2, and OA3) are represented on the display. The MDMs are represented by various parameters that may be scattered around in different locations on the display, depending on which DSC the measurement is coming from. An MDM WRAP on a particular MDM will result in changing the corresponding text under the MDM column to red at every place it is represented. It

will also affect the DSC column by changing the color of the text to purple for all the DSCs to which the particular MDM is linked.

# **MDM WRAP Indications**

13. OF1 OF1\_MDM\_WRAP 1 = OF1 0 = OF1 tan black black red

This special comp in OIMON2 evaluates the bus link between the PCMMU and the OF1 MDM. An 8-bit OI validation word from OF1 MDM is received at 10 samples/second to test the link. This comp checks to see whether two consecutive samples complement each other. A logic 0 indicates that two consecutive samples are not complements of each other and therefore failed. A logic 1 indicates they are complements and the link is good.

Same as OF1\_MDM\_WRAP for OF2 MDM.

Same as OF1\_MDM\_WRAP for OF3 MDM.

16. OF4 OF4\_MDM\_WRAP 1 = OF4 0 = OF4 tan black black red

Same as OF1 MDM WRAP for OF4 MDM.

17. OA1 OA1\_MDM\_WRAP 1 = OA1 0 = OA1 tan black black red

Same as OF1 MDM WRAP for OA1 MDM.

\_ \_ \_

18. OA2 OA2\_MDM\_WRAP 1 = OA2 0 = OA2 tan black

black red

Same as OF1 MDM WRAP for OA2 MDM.

19. OA3 OA3\_MDM\_WRAP 1 = OA3 0 = OA3

tan black black red

Same as OF1 MDM WRAP for OA3 MDM.

20. AC 1 Ph A V76V1500A FLOATING POINT CNTL AB2 V76V0121A green

O2 SYS 1 Reg V61P2115A Loop1 AV 2 V61T2627A Cabin HX Out-Air Temp V61T2635A

Indicates the analog measurements of the given parameters that are processed through DSC OF1.

# SHUTTLE OPS INCO/COMM/JSC-12829 9/1/2004: REV G

AC 2 Ph A CNTL BC2 OPS 1 OPS 2	V76V0221A V75T2517A V75T2617A	FLOATING POINT green
Loop2 AV 3A	V61T2631A	
	CNTL BC2 OPS 1 OPS 2	CNTL BC2 V76V0221A OPS 1 V75T2517A OPS 2 V75T2617A

Indicates the analog measurements of the given parameters that are processed through DSC OF2.

22.	AC 3 Ph A	V76V1700A	FLOATING POINT
	CNTL CA2	V76V0321A	green
	Loop2 Pump	V61P2700A	
	FC 2 Stack	V45T0213A	

Indicates the analog measurements of the given parameters that are processed through DSC OF3.

23.	FRCS Fill Line	V42T1304A	FLOATING POINT
	FRCS Ox Line	V42T1206A	green
	FWD Fus RCS Skin	V09T1514A	•
	FRCS Bkup Line	V42T1308A	

Indicates the analog measurements of the given parameters that are processed through DSC OF4.

24.	R-OMS Ox Drain	V43T5704A	FLOATING POINT
	R-RCS Ox Man	V42T3204A	green
	R-OMS Ox/He FTG	V43T5708A	-

Indicates the analog measurements of the given parameters that are processed through DSC OR1.

25.	R-RCS HSG Vrn	V43T5711A	FLOATING POINT
	R-OMS GSE Panel	V43T5706A	green
	R-OMS Feedline	V43T5642A	
	R-OMS Ox Tack	V43T5215A	

Indicates the analog measurements of the given parameters that are processed through DSC OR2.

26.	PRSD O2 Tk 6	V45P3100A	FLOATING POINT
	PRSD O2 Tk 6 Htr	V45T3107A	green
	PRSD O2 Tk 7 Fld	V45T3201A	•
	PRSD H2 Tk 8 Htr	V45T4307A	

Indicates the analog measurements of the given parameters that are processed through DSC OP1.

27.	PRSD O2 Tk 7	V45P3200A	FLOATING POINT
	PRSD O2 Tk Htr	V45T3207A	green
	PRSD H2 Tk 7 Htr	V45T4207A	_
	PRSD O2 Tk 6 Htr	V45T3109A	

Indicates the analog measurements of the given parameters that are processed through DSC OP2.

FC #1		FLOATING POINT
PRSD O2 Tk Htr	V45T1107A	green
FC #2	V45C0201A	
APU 1 Heat Sink	V46T1172A	
APU 2 Heat Sink	V46T1272A	
	PRSD O2 Tk Htr FC #2 APU 1 Heat Sink	PRSD O2 Tk Htr V45T1107A FC #2 V45C0201A APU 1 Heat Sink V46T1172A

Indicates the analog measurements of the given parameters that are processed through DSC OM1.

29.	FC #2	V45V0200A	FLOATING POINT
	FC #3	V45V0300A	green
	FC #3 Stack	V45T0313A	_
	LMG Brake Line	V58T1700A	
	MADS Shelf	V78T9606A	

Indicates the analog measurements of the given parameters that are processed through DSC OM2.

30.	APU 2 ISO Valve B	V46T1274A	FLOATING POINT
	APU 2 Fuel Outlet	V46P0205A	green
	APU 2 ISO Valve A	V46T1275A	
	FC #1 Stack	V45T0113A	
	Sys 2 N2 Tk 3	V61T2422A	

Indicates the analog measurements of the given parameters that are processed through DSC OM3.

31.	Hyd Sys 1 Vol	V58Q0102A	FLOATING POINT
	APU 1 Inj Tube	V46T0174A	green
	APU 1 Fuel Line 1	V46T0108A	
	FCL 1 Rad Inlet	V63T1209A	

Indicates the analog measurements of the given parameters that are processed through DSC OA1.

32.	Hyd Sys 2 RTN	V58T0222A	FLOATING POINT
	APU 1 Fuel Line 2	V46T0104A	green
	FCL 1 Evap Out	V63T1207A	_
	R-OMS Aft XFD	V43T6219A	

Indicates the analog measurements of the given parameters that are processed through DSC OA2.

33.	Aft PCA-6	V76V3093A	FLOATING POINT
	APU 3 Fuel Line	V46T0308A	green
	FES B H20 Supply	V63T1760A	
	OMS XFD Ox Line	V43T6242A	

Indicates the analog measurements of the given parameters that are processed through DSC OA3.

34.	L-OMS Ox Drain	V43T4704A	FLOATING POINT
	L-RCS AFT Ox Man	V42T2204A	green
	L-OMS Ox/He FTG	V43T4708A	· ·

Indicates the analog measurements of the given parameters that are processed through DSC OL1.

35. L-OMS RCS Vrn V43T4711A FLOATING POINT L OMS GSE Panel V43T4706A green V43T4642A

Indicates the analog measurements of the given parameters that are processed through DSC OL2.

## **DSC Power Switch Status**

This parameter indicates the power switch status for DSCs OL 1 and 2. In the ON position, an enable is provided to the OL 1 and 2 DSC RPC.

This parameter indicates the power switch status for DSCs OR 1 and 2. In the ON position, an enable is provided to the OR1 and 2 DSC RPCs.

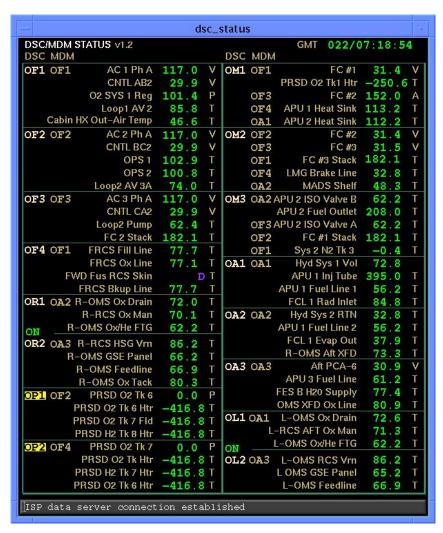


Figure 7.25-1. DSC/MDM Status display

#### **TITLE**

S-BAND FM CONFIG V1.1

## **GENERAL**

A. The data displayed are real-time telemetry parameters that affect the management and operation of the S-band FM system. A copy of the FM CONFIG V1.1 display is shown in figure 7.26-1.

**REV G** 

- B. Reserved
- C. Detailed display description.

1. FM SYSTEM ON (1) V74X6120E 1 = 1 0 = (blank) (green)

This parameter indicates that the S-band FM transmitter 1 and signal processor 1 have 28 V dc applied.

2. FM SYSTEM ON (2) V74X6121E 1 = 2 0 = (blank) (green)

This parameter indicates that the S-band FM transmitter 2 and signal processor 2 have 28 V dc applied.

3. RF OUT (1) V74E6650A FLOATING POINT (green)

This is an analog parameter indicating the FM 1 transmitter RF power output in watts. The normal output is 15 watts.

4. RF OUT (2) V74E6651A FLOATING POINT (green)

This is an analog parameter indicating the FM 2 transmitter RF power output in watts. The normal output is 15 watts.

5. ANTENNA SEL V74S6505E 1 = UP 0 = (blank)

(vellow)

V74S6506E 1 = LOW 0 = (blank) (green)

(gree

These parameters indicate that the crew's hemi antenna selector switch is in the upper or lower position.

6. ANT MODE SEL W0210200R SPECIAL COMP (green)

This is a special comp of the crew's hemi switch positions to determine if the switch is in the manual or GPC position.

This special comp is composed of MSIDs V74S6505E and V74S6506E

V74S6505E	V74S6506E		
1	0	MAN	
0	1	MAN	
0	GPC		
All other combinations output INV			

This parameter indicates that the antenna SEL relay S5 is in the A position and that the upper hemi has been selected.

This parameter indicates that the antenna SEL relay S5 is in the B position and that the lower hemi has been selected.

# 9. DATA MODE MULTI

This portion of the display incorporates a tool labeled a MULTI. A MULTI allows you to compact your data by assigning several different MSIDs and their associated outputs into one slot on the display. Shown in figure 7.26-2 is a display box that will pop up when the user rightor center-mouse-clicks on the output field of the MULTI. This box displays each possible output and the associated MSIDs. Notice that if all values are set to 0.0 then six dashed lines (-----) will be displayed to indicate that no mode is currently selected. If more than one value is set to 1.0, then six plus symbols (+++++++) will appear, indicating an error.

The following are the possible modes for the FM system:

PL ANLG	V74X4804
	E
PL DIGI	V74X4803
	E
SSR1	V74X3447
	E
SSR2	V74X3446
	E
TV	V74X4806
	E
DOD	V74X4805
	E
ME	V74X4801
	E

Indicates the position of the CMD control switch, which provides the command control 28 V dc transfer control from the panel drivers to the uplink command drivers of the S-band FM subsystem.



Figure 7.26-1: FM CONFIG v1.1

```
message_box_popup
          MULTI DISPLAY DATA
   ) @ 000/00:00:00 value=1.00 = SSR 2
             ) @ 018/22:42:27 value=0.00 = TV
V74X4806E (
               @ 018/22:42:27 value=0.00 = PL ANLG
V74X4804E
             ) @ 018/22:42:27 value=0.00 = PL DIGI
) @ 018/22:42:27 value=0.00 = SSR 1
V74X4803E (
V74X3447E (
V74X3446E (
            ) @ 018/22:55:36 value=1.00 = SSR 2
V74X4801E ( ) @ 018/22:42:27 value=0.00 = ME
V74X4805E ( ) @ 018/22:42:27 value=0.00 = DOD
All values set to 0.0 =
More than one value > 0.0 = ++++++
                         OK
```

Figure 7.26-2: "MULTI" POPUP BOX

## 4/2/98: REV G

#### TITLE

OI MDM/DSC (BITES) V1.4

# **GENERAL**

- A. This is a telemetry display that is used to identify and troubleshoot any suspected operational instrumentation (OI) dedicated signal conditioners (DSCs) that provide acquisition and conditioning of vehicle data and the OI MDMs, which receive these data and output serial digital data to the PCMMU upon request. A copy of the OI MDM/DSC (BITES) display is shown in figure 7.29-1.
- B. Pathname of display: INCO/INCO Displays/INST Systems/mdm\_dsc.
- C. Detailed display description.

1. GMT M50Q0027HP TIME green

Indicates Greenwich mean time.

# **DSC BITE**

2. V75X2171E 1 = OF1 0 = OF1 darkslategray white black red

This parameter indicates the state of the two OF1 DSC power supplies. If either supply fails or is out of tolerance (0.5 percent of 17 V), or if one the 28 V-power sources powering the DSC is lost, the parameter will indicate a logic 0. A logic 1 indicates good power supplies.

V75X2172E 1 = OF2 0 = OF23. darkslategray white black red Same as OF1 DSC BITE for OF2 DSC. 1 = OF3 4. V75X2173E 0 = OF3darkslategray white black red Same as OF1 DSC BITE for OF3 DSC. 1 = OP1 V75X2184E 0 = OP1darkslategray white black red Same as OF1 DSC BITE for OP1 DSC. V75X2185E 1 = OP20 = OP2darkslategray white black red Same as OF1 DSC BITE for OP2 DSC. 7. V75X2174E 1 = OA10 = OA1darkslategray white black red

Same as OF1 DSC BITE for OA1 DSC.

This field displays the hexadecimal value of the OF2 MDM BITE word. It is usually zero, but if not, consult System Brief 28 for translation of the failure.

15. OF3 V72M8060P BITE VALUE

green black

This field displays the hexadecimal value of the OF3 MDM BITE word. It is usually zero, but if not, consult System Brief 28 for translation of the failure.

16. OF4 V72M8080P BITE VALUE

green black

This field displays the hexadecimal value of the OF4 MDM BITE word. It is usually zero, but if not, consult System Brief 28 for translation of the failure.

SHUTTLE OPS OI MDM/DSC (BITES) INCO/COMM/JSC-12829 4/2/98: REV G SCP 7.29

17. OA1 V72M8100P BITE VALUE

green black

This field displays the hexadecimal value of the OA1 MDM BITE word. It is usually zero, but if not, consult System Brief 28 for translation of the failure.

18. OA2 V72M8120P BITE VALUE

green black

This field displays the hexadecimal value of the OA2 MDM BITE word. It is usually zero, but if not, consult System Brief 28 for translation of the failure.

19. OA3 V72M8140P BITE VALUE

green black

This field displays the hexadecimal value of the OA3 MDM BITE word. It is usually zero, but if not, consult System Brief 28 for translation of the failure.

#### **WRAP**

20. OF1\_MDM\_WRAP 1 = MDM OF1 0 = MDM OF1 darkslategray white

black red

This special comp in OIMON2 evaluates the bus link between the PCMMU and the OF1 MDM. An 8-bit OI validation word from OF1 MDM is received at 10 samples/second to test the link. This comp checks to see whether two consecutive samples complement each other. A logic 0 indicates that two consecutive samples are not complements of each other and, therefore, failed. A logic 1 indicates they are complements and the link is good.

21. OF2\_MDM\_WRAP 1 = MDM OF2 0 = MDM OF2 darkslategray white

darkslategray white black red

Same as OF1\_MDM\_WRAP for OF2 MDM.

darkslategray white black red

Same as OF1\_MDM\_WRAP for OF3 MDM.

darkslategray white black red

Same as OF1\_MDM\_WRAP for OF4 MDM.

24. OA1\_MDM\_WRAP 1 = MDM OA1 0 = MDM OA1 darkslategray white

darkslategray white black red

Same as OF1\_MDM\_WRAP for OA1 MDM.

25.	OA2_MDM_WRAP  Same as OF1_MDM_WRAP for OA2 MDM.	1 = MDM OA2 darkslategray black	0 = MDM OA2 white red
26.	OA3_MDM_WRAP	1 = MDM OA3 darkslategray black	0 = MDM OA3 white red

Same as OF1\_MDM\_WRAP for OA3 MDM.

# **PWR SW**

27. V75S2801E 1 = MDM OA 0 = MDM OA darkslategray white black red

This parameter indicates the power switch status for MDMs OA 1, 2, and 3. In the ON position, an enable is provided to the OA 1, 2, and 3 MDM RPCs.

28. V75S2157E 1 = DSC OA 0 = DSC OA darkslategray white black red

This parameter indicates the power switch status for DSCs OA 1, 2, and 3. In the ON position, an enable is provided to the OA 1, 2, and 3 DSC RPCs.

29. V75S2160E 1 = DSC OL 0 = DSC OL darkslategray white black red

This parameter indicates the power switch status for DSCs OL 1 and 2. In the ON position, an enable is provided to the OL 1 and 2 DSC RPC.

30. V75S2165E 1 = DSC OR 0 = DSC OR darkslategray white black red

This parameter indicates the power switch status for DSCs OR 1 and 2. In the ON position, an enable is provided to the OR1 and 2 DSC RPCs.

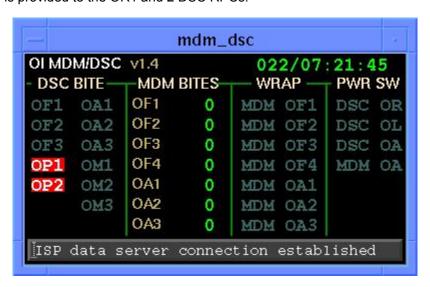


Figure 7.29-1. MDM DSC display

#### TITLE

PCMMU EVENTS V 1.1

## **GENERAL**

- A. The data displayed are real-time telemetry parameters that affect the management and operation of the PCMMU. A copy of the PCMMU EVENTS display is shown in figure 7.30-1
- B. Pathname of display: INCO/INCO Displays/DDDs/PCMMU Events.
- C. Detailed display description.

1. V92X0585X 1 = TIO 1 BYPS 0 = TIO 1 BYPS (black on red) (darkslategray on black)

Indicates that two consecutive errors have occurred on the transaction indicated. Refer to read element table for the element or elements in error.

2. V92X0586X 1 = SVC 1 BYPS 0 = SVC 1 BYPS (black on red) (darkslategray on black)

Indicates that two consecutive errors have occurred on the transaction indicated. Refer to read element table for the element or elements in error.

3. V75X2136D 1 = TFL FMT PRGRM 0 = TFL FMT FIXED (darkslategray on black) (black on red)

Indicates that the PCM is either in the fixed or the program format mode, respectively.

4. V92X0587X 1 = TIO 2 BYPS 0 = TIO 2 BYPS (black on red) (darkslategray on black)

Indicates that two consecutive errors have occurred on the transaction indicated. Refer to read element table for the element or elements in error.

5. V92X0588X 1 = SVC 2 BYPS 0 = SVC 2 BYPS (black on red) (darkslategray on black)

Indicates that two consecutive errors have occurred on the transaction indicated. Refer to read element table for the element or elements in error.

6. V92J0054C 1=TFL LD REJECT 0=TFL LD REJECT (black on red) (darkslategray on black)

Indicates the TFL/DFL load has been rejected in the SM GPC.

7. V92X0589X 1 = TIO 3 BYPS 0 = TIO 3 BYPS (black on red) (darkslategray on black)

Indicates that two consecutive errors have occurred on the transaction indicated. Refer to read element table for the element or elements in error.

V92X0590X

PCMMU EVENTS SCP 7.30

1 = SVC 3 BYPS 0 = SVC 3 BYPS (black on red) (darkslategray on black)

Indicates that two consecutive errors have occurred on the transaction indicated. Refer to read element table for the element or elements in error.

**REV G** 

9. V92X0064X

1=TFL IN PRGRES 0=TFL IN PRGRES (black on yellow)(darkslategray on black)

Indicates the TFL/DFL load is in progress in the SMGPC.

9/1/2004:

10. V92X0591X

1 = TIO 4 BYPS 0 = TIO 4 BYPS (black on red) (darkslategray on black)

Indicates that two consecutive errors have occurred on the transaction indicated. Refer to read element table for the element or elements in error.

11. V92X0592X

1 = SVC 4 BYPS 0 = SVC 4 BYPS (black on red) (darkslategray on black)

Indicates that two consecutive errors have occurred on the transaction indicated. Refer to read element table for the element or elements in error.

12. V75S2107E

1 = PCMMU 1 ON0 = PCMMU 1 OFF (black on red) (darkslategray on black)

Indicates PCMMU 1 is either on or off, respectively.

13. V92X0593X

1 = TIO 5 BYPS 0 = TIO 5 BYPS (black on red) (darkslategray on black)

Indicates that two consecutive errors have occurred on the transaction indicated. Refer to read element table for the element or elements in error.

14. V92X0594X

1 = SVC 5 BYPS 0 = SVC 5 BYPS (black on red) (darkslategray on black)

Indicates that two consecutive errors have occurred on the transaction indicated. Refer to read element table for the element or elements in error.

15. V75S2109E

1 = PCMMU 2 ON0 = PCMMU 2 OFF (black on green)(darkslategray on black)

Indicates that PCMMU 2 is either on or off, respectively.

16. V92X0595X

1 = TIO 6 BYPS 0 = TIO 6 BYPS (black on red) (darkslategray on black)

Indicates that two consecutive errors have occurred on the transaction indicated. Refer to read element table for the element or elements in error.

17. V92X0596X

1 = SVC 6 BYPS 0 = SVC 6 BYPS (black on red) (darkslategray on black)

Indicates that two consecutive errors have occurred on the transaction indicated. Refer to read element table for the element or elements in error.

18. V92X0077X

1=SM COM BFR BS 0=SM COM BFR BS (black on yellow)(darkslategray on black)

Indicates that the SM common buffer is busy.

TIO 1 BYPS SVC 1 BYPS TFL FMT xxxxx TIO 2 BYPS SVC 2 BYPS TFL LD REJECT TIO 3 BYPS SVC 3 BYPS TFL IN PRGRES TIO 4 BYPS SVC 4 BYPS PCMMU 1 xxx TIO 5 BYPS SVC 5 BYPS PCMMU 2 xxx	PCMMU EVENTS v1.1 GMT XXX/XX:XX:XX					
TIO 6 BYPS   SVC 6 BYPS   SM COM BFR BS	TIO 2 BYI TIO 3 BYI TIO 4 BYI TIO 5 BYI	PS PS PS	SVC 2 BYPS SVC 3 BYPS SVC 4 BYPS SVC 5 BYPS	TFL LD REJECT TFL IN PRGRES PCMMU 1 xxx PCMMU 2 xxx		

Figure 7.30-1. PCMMU EVENTS display

#### **TITLE**

**PDI V1.4** 

# **GENERAL**

- A. The data displayed are real-time telemetry parameters that affect the management and operation of the Payload Data Interleaver (PDI). A copy of the PDI display is shown in figure 7.31-1.
- B. DNAV LOCATION: INCO> DISPLAYS> INST SYSTEMS> PDI
- C. Detailed display description.

1. POWER SWITCH V75S5100E 1 = ON 0 = OFF (green) (red)

This parameter indicates the PNL A1L PDI PWR switch position. Excitation for this parameter is provided by CNTL BC1.

2. RPC A V76X4376E 1 = ON 0 = OFF (green) (red)

This parameter indicates that 28 V dc from main A (FPC1) via RPC A is applied to the PDI.

3. C V76X4378E 1 = ON 0 = OFF (green) (red)

This parameter indicates that 28 V dc from main C (FPC3) via RPC C is applied to the PDI.

4. PDI WRAP PDI\_WRAP 1 = PASS 0 = FAIL (green) (red)

This special COMP evaluates successive samples of V75X4007D. Each sample of V75X4007D should be the 1 complement of the previous sample. If this is the case, the COMP will output GOOD. If V75X4007D stops updating, the PDI WRAP parameter will indicate FAIL.

5. SM LINK V92X0908X 1 = BYPS 0 = OK (red) (green)

The PDI switch matrix read (PSMR) is performed cyclically by the (S2 or G9) SM GPC at a 1-Hz rate. The PSMR special SM process is initialized with the IPL. Once the PSMR is initialized, the SM GPC will bypass the process and issue an S62 BCE BYP PDI message if the switch matrix read cannot be accomplished. Such a response would most likely indicate a breakdown in the SM GPC-TO-PDI link. The PSMR process can be restarted with a PDI I/O RESET (SPEC 62, item 8).

6. SW MATRIX V75M5110P HEX (green)

Hex parent word for the switch matrix connections for decom strings to input port. Word layout is as follows:

Bits 1 through 3 of the 12-bit code define the switch matrix input to which the bit sync 1 switch matrix output is connected, as follows.

Bits

# 123 Input function

- 000 No connection
- 001 Payload input #1
- 010 Payload input #2
- 011 Payload input #3
- 100 Payload input #4
- 101 Payload input #5
- 110 PSP input
- 111 Special test input

Bits 4 through 6 of the 12-bit code define the switch matrix input to which the bit sync 2 switch matrix output is connected, as shown below.

#### Bits

# 456 Input function

- 000 No connection
- 001 Payload input #1
- 010 Payload input #2
- 011 Payload input #3
- 100 Payload input #4
- 101 Payload input #5
- 110 PSP input
- 111 Special test input

Bits 7 through 9 of the 12-bit code define the switch matrix input to which the bit sync 3 switch matrix output is connected, as shown below.

#### Bits

# 789 Input function

- 000 No connection
- 001 Payload input #1
- 010 Payload input #2
- 011 Payload input #3
- 100 Payload input #4
- 101 Payload input #5
- 110 PSP input
- 111 Special test input

Bits 10 through 12 of the 12-bit code define the switch matrix input to which the bit sync 4 switch matrix output is connected, as shown below.

## Bits

# 10 11 12 Input function

- 000 No connection
- 001 Payload input #1
- 010 Payload input #2
- 011 Payload input #3
- 100 Payload input #4
- 101 Payload input #5
- 110 PSP input
- 111 Special test input

Bits 13 through 16 are unused.

7. SM LOAD STATUS

V92J0110CY MSKVIEW COMP (green)

This 2-bit parameter indicates the status of the current or last DFL or FPM load process.

BINARY VALUE	DECIMAL VALUE	VALUE MEANING	DISPLAYED
00	0	NO LOAD SINCE SM INITIALIZATION	NONE
01	1	LOAD IN PROGRESS	IN PR
10	2	LAST LOAD COMPLETE	GOOD
11	3	LAST LOAD FAILED	FAIL

8. SM FPM ID

V92J0078CY FLOATING POINT (green)

Integer value of the last FPM loaded. If no load has been performed on the current SM GPC, this parameter will indicate zero. In this case, the PDI may be loaded and functioning, but SPEC 62 and SM downlist parameters will indicate zero

9. OI DECOM 1 FMT

V75J5132D FLOATING POINT

(green)

Integer value of the DFL currently loaded in decom 1.

10. OI DECOM 2 FMT

V75J5152D FLOATING POINT

(green)

Integer value of the DFL currently loaded in decom 2.

11. OI DECOM 3 FMT

V75J5172D FLOATING POINT

(green)

Integer value of the DFL currently loaded in decom 3.

12. OI DECOM 4 FMT

V75J5192D FLOATING POINT

(green)

Integer value of the DFL currently loaded in decom 4.

13. OI SOURCE 1

V75J5111D FLOATING POINT

(green)

Integer value of decom 1 switch matrix input source.

0 = No connection

1 = Port 1

2 = Port 2

3 = Port 3

4 = Port 4

5 = Port 5

6 = Port 6 (PSP ports 1 and 2)

7 = Test port

15. OI SOURCE 3 V75J5113D FLOATING POINT (green)

Same as item 13 for decom 3.

Same as item 13 for decom 2.

16. OI SOURCE 4 V75J5114D FLOATING POINT (green)

Same as item 13 for decom 3.

17. SM DECOM 1 FMT V92J0111CY FLOATING POINT (green)

Integer value of the last DFL loaded by the SM GPC into decom 1; will be zero if not loaded by current SM GPC.

18. SM DECOM 2 FMT V92J0112CY FLOATING POINT (green)

Same as item 17 for decom 2.

19. SM DECOM 3 FMT V92J0113CY FLOATING POINT (green)

Same as item 17 for decom 3.

20. SM DECOM 4 FMT V92J0114CY FLOATING POINT (green)

Same as item 17 for decom 4.

Shows enabled or inhibited status of SM GPC PDI decom fault detection and annunciation (FDA) software.

22. SM DECOM 2 FDA V93X5577X 1 = ENA 0 = INH (green) (yellow)

Same as item 21 for decom 2.

23. SM DECOM 3 FDA V93X5578X 1 = ENA 0 = INH (green) (yellow)

Same as item 21 for decom 3.

24. SM DECOM 4 FDA V93X5579X 1 = ENA 0 = INH (green) (yellow)

Same as item 21 for decom 4.

25. PDI BITE WORD 1

V75M6400P

HEX (green)

Hex parent word for PDI BITE WORD 1. Items 26 through 41 describe the composition of this 16-bit word.

26. D1 MF LK

V75X6401D

1 = D1 MF LK

0 = D1 MF LK

(green)

(yellow)

This parameter is bit 1 of PDI BITE WORD 1 and indicates master frame lock on decom 1 data. If the incoming data are formats 1, 2, or 3, then this bit signifies that frame sync has been achieved. If the incoming data is in format 4, then this bit has no significance and is set to 1.

27. D1 WD LK

V75X6402D

1 = D1 WD LK

0 = D1 WD LK

(green)

(vellow)

This parameter is bit 2 of PDI BITE WORD 1 and indicates word lock on decom 1 data. If the incoming data are formats 1, 2, or 3, then this bit signifies that word sync has been achieved by detecting the imbedded sync word or words in the bit stream. If the incoming data is in format 4, then this bit signifies that the word sync is grouping 8 bits of data and transferring this to the word selector.

28. D1 BIT LK

V75X6403D

1 = D1 BIT LK

0 = D1 BIT LK

(green)

(yellow)

This parameter is bit 3 of PDI BITE WORD 1 and indicates bit lock on decom 1 data. If the incoming data are formats 1, 2, or 3, then this bit signifies that bit lock has been achieved, code detection is correct, and the bit rate is within tolerance. If the incoming data is in format 4, then word sync will be forced. This bit is forced to zero during a DCM load.

29. D1 BR ACC

V75X6404D

1 = D1 BR ACC 0 = D1 BR ACC

(green)

(vellow)

This parameter is bit 4 of PDI BITE WORD 1 and indicates bit-rate accuracy on decom 1 data. This bit signifies that the incoming bit stream is within the ±3.25 percent of the expected bit If the bit rate is not within tolerance, this will not inhibit data. rate.

30. D2 MF LK

V75X6405D

1 = D2 MF LK

0 = D2 MF LK

(green)

(yellow)

This parameter is bit 5 of PDI BITE WORD 1 and indicates master frame lock on decom 2 data. The same format rules apply as stated in item number 26.

31. D2 WD LK

V75X6406D

1 = D2 WD LK

0 = D2 WD LK

(green)

(yellow)

This parameter is bit 6 of PDI BITE WORD 1 and indicates word lock on decom 2 data. The same format rules apply as stated in item number 27.

32. D2 BIT LK

V75X6407D

1 = D2 BIT LK (green)

0 = D2 BIT LK

(yellow)

This parameter is bit 7 of PDI BITE WORD 1 and indicates bit lock on decom 2 data. The format rules apply as stated in item number 28. same

33. D2 BR ACC V75X6408D 1 = D2 BR ACC 0 = D2 BR ACC (green) (yellow)

This parameter is bit 8 of PDI BITE WORD 1 and indicates bit-rate accuracy on decom 2 data. The same rules apply as stated in number 29.

34. D3 MF LK V75X6409D 1 = D3 MF LK 0 = D3 MF LK (green) (yellow)

This parameter is bit 9 of PDI BITE WORD 1 and indicates master frame lock on decom 3 data. The same format rules apply as stated in item number 26.

35. D3 WD LK V75X6410D 1 = D3 WD LK 0 = D3 WD LK (green) (yellow)

This parameter is bit 10 of PDI BITE WORD 1 and indicates word lock on decom 3 data. The same format rules apply as stated in item number 27.

36. D3 BIT LK V75X6411D 1 = D3 BIT LK 0 = D3 BIT LK (green) (yellow)

This parameter is bit 11 of PDI BITE WORD 1 and indicates bit lock on decom 3 data. The same format rules apply as stated in item number 28.

37. D3 BR ACC V75X6412D 1 = D3 BR ACC 0 = D3 BR ACC (green) (yellow)

This parameter is bit 12 of PDI BITE WORD 1 and indicates bit-rate accuracy on decom 3 data. The same rules apply as stated in number 29.

38. D4 MF LK V75X6413D 1 = D4 MF LK 0 = D4 MF LK (green) (yellow)

This parameter is bit 13 of PDI BITE WORD 1 and indicates master frame lock on decom 4 data. The same format rules apply as stated in item number 26.

This parameter is bit 14 of PDI BITE WORD 1 and indicates word lock on decom 4 data. The same format rules apply as stated in item number 27.

40. D4 BIT LK V75X6415D 1 = D4 BIT LK 0 = D4 BIT LK (green) (yellow)

This parameter is bit 15 of PDI BITE WORD 1 and indicates bit lock on decom 4 data. The same format rules apply as stated in item number 28.

41. D4 BR ACC V75X6416D 1 = D4 BR ACC 0 = D4 BR ACC (green) (yellow)

This parameter is bit 16 of PDI BITE WORD 1 and indicates bit-rate accuracy on decom 4 data. The same rules apply as stated in number 29.

V75M6420P

HEX (green)

Hex parent word for PDI BITE WORD 2. Items 43 through 58 describe the composition of this 16 bit word.

43. NO RESP PCM2

42. PDI BITE WORD 2

V75X6421D 1 = NO RESP PCM2

0 = NO RESP PCM2

(green)

(yellow)

This parameter is bit 1 of PDI BITE WORD 2 and indicates the occurance of a no response on the data bus port shared with PCMMU 2.

44. DATA INVL PCM2

V75X6422D 1 = DATA INVL PCM2

0 = DATA INVL PCM2

(green)

(yellow)

This parameter is bit 2 of PDI BITE WORD 2 and indicates an input data invalid on a command data word on the data bus port shared with PCMMU 2.

45. NO RESP PCM1

V75X6423D 1 = NO RESP PCM1

0 = NO RESP PCM1

(green)

(yellow)

This parameter is bit 3 of PDI BITE WORD 2 and indicates the occurrence of a no response on the data bus port shared with PCMMU 1.

46. DATA INVL PCM1

V75X6424D 1 = DATA INVL PCM1

0 = DATA INVL PCM1

(green) (yellow)

This parameter is bit 4 of PDI BITE WORD 2 and indicates an input data invalid on a command data word on the data bus port shared with PCMMU 1.

47. NO RESP GPC

V75X6425D 1 = NO RESP GPC

0 = NO RESP GPC

(green)

(vellow)

This parameter is bit 5 of PDI BITE WORD 2 and indicates the occurrence of a no response on the data bus port shared with the SM GPC.

48. DATA INVL GPC

V75X6426D 1 = DATA INVL GPC

0 = DATA INVL GPC

(green)

(yellow)

This parameter is bit 6 of PDI BITE WORD 2 and indicates an input data invalid on a command data word on the data bus port shared with the SM GPC.

49. TB PARITY

V75X6427D

1 = TB PARITY 0 = TB PARITY

(green)

(vellow)

This parameter is bit 7 of PDI BITE WORD 2 and indicates a parity error has been detected in the PDI toggle buffer.

50. RAM PARITY

V75X6428D

1 = RAM PARITY 0 = RAM PARITY

(green)

(yellow)

This parameter is bit 8 of PDI BITE WORD 2 and indicates that a RAM parity error has been detected on a read request.

IM/JSC-12829 9/1/2004: REV G

51. FPM PARITY V75X6429D 1 = FPM PARITY 0 = FPM PARITY (green) (yellow)

This parameter is bit 9 of PDI BITE WORD 2 and indicates that a parity error has been detected during a read from Fetch Point Memory.

52. D1 PARITY V75X6430D 1 = D1 PARITY 0 = D1 PARITY (green) (yellow)

This parameter is bit 10 of PDI BITE WORD 2 and indicates a parity error detected during a read from the decommutator in DCM 1.

53. D2 PARITY V75X6431D 1 = D2 PARITY 0 = D2 PARITY (green) (yellow)

This parameter is bit 11 of PDI BITE WORD 2 and indicates a parity error detected during a read from the decommutator in DCM 2.

54. D3 PARITY V75X6432D 1 = D3 PARITY 0 = D3 PARITY (green) (yellow)

This parameter is bit 12 of PDI BITE WORD 2 and indicates a parity error detected during a read from the decommutator in DCM 3.

55. D4 PARITY V75X6433D 1 = D4 PARITY 0 = D4 PARITY (green) (yellow)

This parameter is bit 13 of PDI BITE WORD 2 and indicates a parity error detected during a read from the decommutator in DCM 4.

56. MTU IRIG V75X6434D 1 = MTU IRIG 0 = MTU IRIG (green) (yellow)

This parameter is bit 14 of PDI BITE WORD 2 and indicates the detection of an IRIG time code format error or the absence of an IRIG signal.

57. PCM 1.152 V75X6435D 1 = PCM 1.152 0 = PCM 1.152 (green) (yellow)

This parameter is bit 15 of PDI BITE WORD 2 and indicates that the 1.152 MHz time has been lost from the active PCMMU and that the PDI is operating on internal time.

58. PWR INT V75X6436D 1 = PWR INT 0 = PWR INT (green) (yellow)

This parameter is bit 16 of PDI BITE WORD 2 and indicates that a power loss of greater than 400 ns has occurred.



Figure 7.31-1. PDI display

#### **TITLE**

PI V1.1

# **GENERAL**

- A. The data displayed are real-time telemetry parameters that affect the management and operation of the P/L INTRGTR. A copy of page 1 of the PI display is shown in figure 7.32-1.
- B. Pathname of display: INCO/INCO Displays/INST Systems/pi.
- C. Detailed display description.

1. POWER (1) V74X4323E 1 = ON 0 = OFF green dimgray

This parameter indicates the ON/OFF state of the payload interrogator no. 1 GCIL driver.

2. POWER (2) V74X4353E 1 = ON 0 = OFF green dimgray

Same as item 1, except for payload interrogator no. 2.

3. RF POWER OUT (1) V74E5625A FLOATING POINT (green)

This parameter indicates the RF power output level (0.0 to 10.0 watts) of payload interrogator no. 1.

4. RF POWER OUT (2) V74E5626A FLOATING POINT (green)

Same as item 3, except for payload interrogator no. 2.

5. PHASE LOCK (1) V74X5627E 1 = LOCK 0 = NO LK (green) (red)

This parameter indicates whether payload interrogator no. 1 has achieved a PHASE LOCK condition.

6. PHASE LOCK (2) V74X5628E 1 = LOCK 0 = NO LK (green) (red)

Same as item 3, except for payload interrogator no. 2.

7. AGC SS (1) V74E5658A FLOATING POINT (green)

This parameter indicates the signal strength value of payload interrogator no. 1 in dBm (-120 to -30 dBm).

8. AGC SS (2) V74E5659A FLOATING POINT (green)

Same as item 7, except for payload interrogator no. 2.

9. LOOP STRESS (1) V74B5655A FLOATING POINT (green)

This parameter indicates the loop stress (phase error) for payload interrogator no. 1 (-87 to + 87 kHz).

10. LOOP STRESS (2) V74B5656A FLOATING POINT (green)

Same as item 9, except payload interrogator no. 2.

11. CHANNEL SEL W01G3205C FLOATING POINT (green)

This parameter is a special comp that indicates the selected frequency of both payload interrogators. Note: This is an OR function and will read (channel no. for PI 1) + (channel no. for PI 2).

This special comp is composed of the following parameters:

<u>MSID</u>		<u>MSID</u>		<u>MSID</u>	
V74X5629E	PI #1 CH 1	V74X5637E	PI #1 CH 10	V74X5645E (C1)	PI #1 CH 100
(A1)		(B1)			
V74X5630E	PI #2 CH 1	V74X5638E	PI #2 CH 10	V74X5646E (C2)	PI #2 CH 100
(A2)		(B2)			
V74X5631E	PI #1 CH 2	V74X5639E	PI #1 CH 20	V74X5647E (C3)	PI #1 CH 200
(A3)		(B3)			
V74X5632E	PI #2 CH 2	V74X5640E	PI #2 CH 20	V74X5648E (C4)	PI #2 CH 200
(A4)		(B4)			
V74X5633E	PI #1 CH 4	V74X5641E	PI #1 CH 40	V74X5649E (C5)	PI #1 CH 400
(A5)		(B5)			
V74X5634E	PI #2 CH 4	V74X5642E	PI #2 CH 40	V74X5650E (C6)	PI #2 CH 400
(A6)		(B6)			
V74X5635E	PI #1 CH 8	V74X5643E	PI #1 CH 80	V74X5651E (C7)	PI #1 CH 800
(A7)		(B7)			
V74X5636E	PI #2 CH 8	V74X5644E	PI #2 CH 80	V74X5652E (C8)	PI #2 CH 800
(A8)		(B8)			

```
If A1 = 1 or A2 = 1 then X1 = 1, else X1 = 0
                                                Units = X1(2^0) + X2(2^1) + X3(2^2) + X4(2^3),
If A3 = 1 or A4 = 1 then X2 = 1, else X2 = 0
If A5 = 1 or A6 = 1 then X3 = 1, else X3 = 0
                                                if U>9, U = blank
If A7 = 1 or A8 = 1 then X4 = 1, else X4 = 0
If B1 = 1 or B2 = 1 then Y1 = 1, else Y1 = 0
                                                Tens = Y1(2^0) + Y2(2^1) + Y3(2^2) + Y4(2^3),
If B3 = 1 or B4 = 1 then Y2 = 1, else Y2 = 0
                                                if T>9. T = blank
If B5 = 1 or B6 = 1 then Y3 = 1, else Y3 = 0
If B7 = 1 or B8 = 1 then Y4 = 1, else Y4 = 0
If C1 = 1 or C2 = 1 then Z1 = 1, else Z1 = 0
                                                Hundreds
                                                = Z1(2^{0}) + Z2(2^{1}) + Z3(2^{2}) + Z4(2^{3}),
If C3 = 1 or C4 = 1 then Z2 = 1, else Z2 = 0
                                                if H>9, H = blank
If C5 = 1 or C6 = 1 then Z3 = 1, else Z3 = 0
If C7 = 1 or C8 = 1 then Z4 = 1, else Z4 = 0
W01G3205C = H*100 + T*10 + U
```

W01G3205C = H\*100 + T\*10 + U Example: Ch 581 =>  $(1*2^0 + 1*2^2)*100 + (1*2^3)*10 + (1*2^0)$  12. FREQ Sweep V74X4300E 1 = ON 0 = OFF (green) (yellow)

This parameter indicates the state of the selected payload interrogator frequency sweep.

13. GCIL (FREQ Sweep) V74X4901E 1 = ON 0 = OFF (green) (yellow)

This parameter indicates the state of the selected payload interrogator frequency sweep as commanded by the GCIL.

14. Band Width V74X4301E 1 = WIDE 0 = WIDE (green) (dimgray)

This parameter indicates that the selected payload interrogator is in the WIDE frequency sweep mode. This is the default sweep mode for the PI.

15. Band Width V74X4302E 1 = NARR 0 = NARR (yellow) (dimgray)

Same as item 15, except in the NARROW frequency sweep mode.

16. RF POWER V74X4313E 1 = HI 0 = HI (green) (dimgray)

This parameter indicates that the selected payload interrogator is in the high power mode.

17. RF POWER V74X4314E 1 = MED 0 = MED (yellow) (dimgray)

Same as item 17, except in the MED power mode.

18. RF POWER V74X4315E 1 = LOW 0 = LOW (yellow) (dimgray)

Same as item 17, except in the LO power mode.

19. MODULATION V74X4320E 1 = ON 0 = OFF (green) (yellow)

This parameter indicates that the selected payload interrogator S-band MOD IS ON.

20. GCIL (Modulation) V74X4903E 1 = ON 0 = OFF (green) (yellow)

This parameter indicates that the selected payload interrogator MOD has been commanded OFF by the GCIL.

21. Panel Sw V74S5600E 1 = CMD 0 = PNL (green) (red)

This parameter indicates the position of the payload control switch.

## **Antenna Switch**

22. 
$$V74X5603E 1 = 1 LHCP/ 2 RHCP 0 = 1 LHCP/ 2 RHCP$$
 (green) (dimgray)

This parameter indicates which payload interrogator is using which antenna polarization.

23. 
$$V74X5604E = 2 LHCP/ 1 RHCP = 0 = 2 LHCP/ 1 RHCP$$
 (green) (dimgray)

Same as item 23, except reversed.

24. SW SEL INTR V74S3207E 1 = ON 0 = OFF (green) (yellow)

This is the panel A1L S-BD PAYLOAD POWER SELECT switch selected to the PI position. If BOTH or PSP is selected, this will be 0.

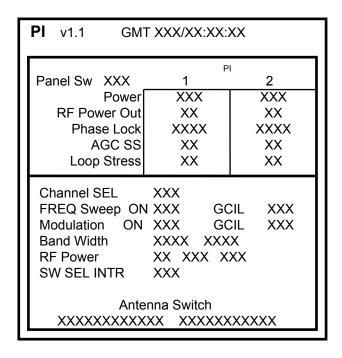


Figure 7.32-1. Pl display

#### **TITLE**

**PSP V1.2** 

## **GENERAL**

- A. The data displayed are real-time telemetry parameters that affect the management and operation of the INST PSP. A copy of the PSP display is shown in figure 7.33-1.
- B. Pathname of display: INCO/INCO Displays/INST Systems/psp.
- C. Detailed display description.

**TELEMETRY** 

1. POWER (1) V74X4890E 1 = ON 0 = (blank) (green)

This parameter indicates whether PSP 1 is powered or is OFF.

2. POWER (2) V74X4891E 1 = ON 0 = (blank) (green)

Same as item 1, except indication is for PSP 2.

3. FRAME SYNC (1) V74X6000E 1 = LOCK 0 = (blank) (green)

This parameter indicates whether PSP 1 has frame sync lock.

4. FRAME SYNC (2) V74X6001E 1 = LOCK 0 = (blank) (green)

Same as item 3, except indication is for PSP 2.

5. BIT SYNC (1) V74X6002E 1 = LOCK 0 = (blank) (green)

This parameter indicates whether PSP 1 has bit sync lock.

6. BIT SYNC (2) V74X6003E 1 = LOCK 0 = (blank) (green)

Same as item 5, except indication is for PSP 2.

7. BYPASS (1) V92X0325X 1 = BYP 0 = (blank) (red)

This parameter indicates that PSP 1 is bypassed from the GPCs. (PSP and GPC are not communicating with each other.)

8. BYPASS (2) V92X0329X 1 = BYP 0 = (blank) (red)

Same as item 7, except indication is for PSP 2.

9. DATA TYPE W11I0603R SPECIAL COMP (green)

This is a special comp indicating selected PSP (software) TLM data type.

2004. INEV O

V92J0816C selected PSP TLM data type

		LSB			
0	0	1	B1	PH	L
0	1	0	B1	PH	M
0	1	1	B1	PH	S
1	0	0	NRZ	L	
1	0	1	NRZ	M	
1	1	0	NRZ	S	

Any other combination output invalid.

10. DATA RATE W03G3203R SPECIAL COMP (green)

This is a special comp indicating selected PSP (software) TLM RATE.

V92J0815C selected PSP TLM RATE

	LSB			
0	0	1	1	kbps
0	1	0	2	kbps
0	1	1	4	kbps
1	0	0	8	kbps
1	0	1	16	kbps

Any other combination invalid.

11. FRAME LENGTH V92J0823C FLOATING POINT (green)

This parameter indicates the selected PSP (software) frame length.

12. BIT SYNC SW V92X0819X 1 = LOCK 0 = (blank) (green)

This parameter indicates that the selected PSP has bit sync lock.

13. FRAME SYNC SW V92X0820X 1 = LOCK 0 = (blank) (green)

This parameter indicates that the selected PSP has frame sync lock. It is part of the SM downlist.

FRAME WORD

14.

9/1/2004: REV G

W02G3203R

SPECIAL COMP (green)

This is a special comp indicating the number of bits in the frame sync word. The inputs come from PSP configuration message word 3, bits 12-14.

12	13	14	
0	0	1	8 bits
0	1	0	16 bits
0	1	1	24 bits
1	0	0	32 bits

Any other combination output invalid.

15. DATA SRC PI

V92X0813X

1 = YES (green)

0 = (blank)

This parameter indicates that the TLM signal from the payload interrogator has been selected.

16. GSE

V92X0814X

1 = YES

0 = (blank)

(green)

This parameter indicates that the TLM input from the Ground Support Equipment (GSE) has been selected.

17. PI/UMB SEL

W05G3203R

SPECIAL COMP (green)

This is a special comp indicating which PSP output has been selected.

**COMM OUTPUT SELECT** 

V92X0810X Selected PSP PL INTGTR OUTPUT SELECT V92X0811X Selected PSP PL UMB OUTPUT SELECT V92X0812X Selected PSP GSE OUTPUT SELECT

V92X0810	V92X0810	V92X0810	
0	0	0	BLANK
0	0	1	GSE UMB
0	1	0	P/S UMB
0	1	1	BTH UMB
1	0	0	INTEROG
1	0	1	INT UMB
1	1	0	INT P/L
1	1	1	ALL

18. STAT WORD 1 V92M0289P HEX (green)

This is the first of three 16-bit PSP status words retrieved by the GPC during each transaction. This word represents the following data:

Bit	1	new data
Bit	2	busy
Bit	3	repeat
Bit	4	config error
Bit	5	config initialized
Bit	6	p/l cmd error
Bit	7	new config
Bits	8-11	p/I cmd rate
Bit	12	spare
Bit	13	idle pattern enabled
Bit	14	p/l interrogator out
Bit	15	p/l umbilical out
Bit	16	GSE out

19. STAT WORD 2 V92M0290P HEX (green)

This is the second of three 16-bit PSP status words retrieved by the GPC during each transaction. This word represents the following data:

Bit	1	p/l interrogator input
Bit	2	GSE input
Bits	3-5	TLM rate
Bit	6	spare
Bit	7	bit sync lock
Bit	8	frame sync lock
Bits	9-11	p/l umbilical selected
Bits	12-13	p/l cmd data type
Bits	14-16	TLM data type

20. STAT WORD 3 V92M0291P HEX (green)

This is the third of three 16-bit PSP status words retrieved by the GPC during each transaction. This word represents the following data:

Bits	1-11	TLM frame length
Bits	12-14	frame sync word length
Bits	15-16	spares

21. FRAME SYNC 1 V92J0821C HEX (green)

This is a 4-bit hex indication of the first 16 bits of the 32-bit TLM frame sync word expected by the PSP.

22. FRAME SYNC 2

V92J0822C

9/1/2004: REV G

HEX (green)

This is the indication of the second 16 bits of the 32-bit TLM frame sync word. If the frame sync word is less than 32 bits, the remaining bits will be filled with zeros.

# **GPC INTERFACE**

23. Command Load Status (SM) V92J1119CY FLOATING POINT (green)

This indicates the status (via SM) of the PSP Command Load. The numerical value indicates the status as follows:

Value	Status of load
0	Configuration Message 0 - 5 has been successfully initiated
1	Reinitialization configuration message has completed successfully
2	Configuration message ID = 1-5 has completed successfully
3	Config msg ID = 0-5 did not complete successfully because of a PSP BCE
	bypass
4	A load was terminated while in progress because a config msg ID=0 was executed
5	Config Msg ID=0-5 did not complete because an Illegal Status error was received
6	OPS transition occurred during load; load did not complete
7	A load was terminated because the retry count was exceeded
8	A load was rejected because the PSP command output port reconfiguration failed

24. Item 6 V93X5584X 1 = \* 0 = (blank) (green)

This indicates if an I/O reset has been established between the SM GPC and PSP 1.

25. Item 7 V93X5585X 1 = \* 0 = (blank) (green)

This indicates if an I/O reset has been established between the SM GPC and PSP 2.

## **COMMAND**

26. COMMAND RATE W01G3203R SPECIAL COMP (green)

This is a special comp indicating selected PSP command rate.

V92J0807C LSB 0 1 0 0 125/16 0 1 0 1 125/8 0 1 1 0 125/4 0 125/2 1 1 1 0 0 0 125 1 0 0 1 250 1 500 1 0 1 0 0 1 1 1000 0 0 2000

Any other combination output invalid.

PSP 9/1/2004: REV G SCP 7.33

27. DATA TYPE

W04G3203R SPECIAL COMP (green)

This is a special comp indicating the selected PSP command data type.

V92J0808C	LSB	
0	1	NRZ L
1	0	NRZ M
1	1	NRZ S
0	0	INVL

28. BUFF AVAIL V92X0800X 1 = (blank) 0 = RDY (yellow)

This parameter indicates the availability of the selected PSP buffer.

This parameter indicates the status of the selected PSP buffer.

30. IDLE PATTERN V92X0809X 1 = ENA 0 = DIS (green) (yellow)

This is a logic 1 when the idle pattern is enabled for transmission and when there are no command data being transmitted. This is a logic 0 for all other conditions, including initialization.

31. P/L CMD ERR V92X0805X 1 = ERR 0 = (blank) (red)

This is a logic 1 only when the payload command message received from the PL MDM failed to meet the data validation criteria defined in item 8. It is a logic 0 for all other conditions. It is initialized to logic 0.

32. REPEAT MSG V92X0802X 1 = ERR 0 = (blank) (red)

This is a logic 1 only when the PSP received erroneous configuration and/or command/data messages. This is a logic 0 for all other conditions, including initialization.

33. GCIL CMD OUT V74X4894E 1 = INTG 0 = (blank) (green)

This parameter indicates that the GCIL has selected the PSP output to the payload interrogator.

34. GCIL CMD OUT V74X4895E 1 = UMB 0 = (blank) (green)

This parameter indicates that the GCIL has selected the umbilical PSP output.

35. UMB SELECT

W02G3202R SPECIAL COMP (green)

This is a special comp indicating the selected PSP umbilical selected.

V92J0817C		LSB	
0	0	0	(Blank)
0	0	1	UMB 1
0	1	0	UMB 2
0	1	1	UMB 3
1	0	0	UMB 4
1	0	1	UMB 5

Any other combination output valid.

#### **SM REJECTS FLAGS**

36. PSP LOAD REJ V92X1102X 1 = PSP LOAD REJ 0 = PSP LOAD REJ (yellow) (darkslategray)

PSP LOAD REJECTED. There are three different cases for which this parameter will be set to a logic 1.

Case 1: This is set to a logic 1 if a command request is received while communication with the PSP has been disabled via I/O error. The command will be rejected. This parameter will be reset to 0 when a subsequent command load is accepted by the PSP.

Case 2: This shall be set to a logic 1 if the software has issued a GCIL command and the GCIL command bits that are acquired from the PCMMU do not match the configuration message. The PSP Port Mode Reject Flag will also be set (V92X1140X). The command will be rejected. This parameter will be reset to a zero after any subsequent PSP command load (that does not have config msg ID = 0) is initiated.

Case 3: This is set to a logic 1 and the load rejected if a CC SPEC or uplink command load is received for transfer to the PSP while a transfer is in progress. It is reset to a logic 0 when a subsequent command load is accepted by the PSP.

The appropriate flag – TEC (V92X1120X), U/L (V92X1127X), GNC (V92X1128X), CC (V92X1129X), PCS (V92X1121X) or PORT (V92X1140X) – will be set to indicate the source of the rejected command.

37. PSP XFER INC V92X1116X 1 = PSP XFER INC 0 = PSP XFER INC (yellow) (darkslategray)

PSP CMD LOAD TRANSFER INCOMPLETE. This is set to a logic 1 if a complete load has not been transmitted to the PSP because of a reinitialize configuration message output request, a PSP status message BCE bypass, an OPS transition or because the SM has received 16 requests to retransmit the load. This reject flag is reset to a logic 0 when a subsequent command load (non-reinitialize load) transfer is initiated.

The appropriate flag – TEC (V92X1120X), U/L (V92X1127X), GNC (V92X1128X), CC (V92X1129X), PCS (V92X1121X) or PORT (V92X1140X) – will be set to indicate the source of the rejected command.

38. ILL STAT MSG

V92X1115X

1 = ILL STAT MSG (yellow) 0 = ILL STAT MSG (darkslategray)

PSP ILLEGAL STATUS MSG. This is set to a logic 1 if, after three retries, the SM continues to receive an illegal status message from the PSP. When the status message is valid, it is reset to a logic 0. Illegal status messages are status messages with:

NEW DATA	BUSY	REPEAT
0	0	0
0	0	1
0	1	1

39. CONF MSG INV

V92X1124X

1 = CONF MSG INV 0 = CONF MSG INV (yellow) (darkslategray)

UPLINK INVALID REQUEST. This shall be set to a logic 1 if a new configuration message is received (to update the configuration message in the SM) and the reinitialize bit is set to 1 or if the configuration message to be changed is configuration message 0. The configuration message load will be rejected. This parameter will be reset to zero when a configuration message load is accepted. This is set to a logic 1 when any uplinked command field is invalid or if an output to an interface cannot be processed because the specified interface is busy with a previous request of this type. It is reset to a logic 0 when a subsequent PL data uplink is successfully processed.

40. TEC

V92X1120X

1 = TEC

0 = TE

(yellow) (darkslategray)

PSP TEC REJECT FLAG. If a PSP load is rejected (V92X1102X) or a PSP command load transfer is incomplete (V92X1116X) and the load was from a Time-Executed Command (TEC), this bit is set to a logic 1. It is reset to 0 when any subsequent PSP command (that does not contain config msg ID = 0) is initiated.

41. U/L

V92X1127X

1 = U/L (yellow)

0 = U/L (darkslategray)

PSP UPLINK REJECT FLAG. If a PSP load is rejected (V92X1102X) or a PSP command load transfer is incomplete (V92X1116X) and the load was from ground uplink, this bit is set to a logic 1. It is reset to 0 when any subsequent PSP command (that does not contain config msg ID = 0) is initiated.

42. GNC

V92X1128X

1 = GNC (yellow)

0 = GNC (darkslategray)

PSP GN&C XFER REJECT FLAG. If a PSP load is rejected (V92X1102X) or a PSP command load transfer is incomplete (V92X1116X) and the load was from a IUS GNC or standard GNC transfer, this bit is set to a logic 1. It is reset to 0 when any subsequent PSP command (that does not contain config msg ID = 0) is initiated.

43. CC

V92X1129X

1 = CC

0 = CC

(yellow)

(darkslategray)

PSP CC SPEC REJECT FLAG. If a PSP load is rejected (V92X1102X) or a PSP command load transfer is incomplete (V92X1116X) and the load was from a CC SPEC, this bit is set to a logic 1. It is reset to 0 when any subsequent PSP command (that does not contain config msg ID = 0) is initiated.

**PCS** 

44.

V92X1121X 1 = PCS(yellow)

9/1/2004: REV G

0 = PCS (darkslategray)

PSP SEQUENCE REJECT FLAG. If a PSP load is rejected (V92X1102X) or a PSP command load transfer is incomplete (V92X1116X) and the load was from the Payload Control Supervisor, this bit is set to a logic 1. It is reset to 0 when any subsequent PSP command (that does not contain config msg ID = 0) is initiated.

45. PORT

V92X1140X 1 =

1 = PORT (vellow)

0 = PORT (darkslategray)

PSP PORT MODE REJECT FLAG. This shall be set to a 1 if the SM has issued a GCIL command for the PSP Port Mode and the GCIL command bits that are acquired from the PCMMU do not match the configuration message (for example, the configuration message specifies PI, but the GCIL command bits select PL UMB). The Load Reject flag will also be set (V92X1102X). The command will be rejected. This parameter will be reset to a zero after any subsequent PSP command load (that does not have config msg ID = 0) is initiated.

46. COUNTER

V92J1104C

FLOATING POINT (green)

PSP LOAD REJECT/INC COUNTER. This indicates a total count of the number of PSP loads that were rejected or output incompletely and maintained by the PSP software.

#### **CONFIG MSG**

47. INITIALIZE

V92X0804X

1 = READY

0 = (blank)

(green)

This parameter indicates the status of the selected PSP initial configuration state.

48. LAST ID

V92J1103C

FLOATING POINT

(green)

This parameter indicates the last configuration message ID the selected PSP has received.

49. NEW ID

V92X0806X

1 = NEW

0 = (blank)

(green)

This is a logic 1 only when the configuration message received is different from the present configuration while the PSP is still processing payload commands. It is a logic 0 for all other conditions.

50. CONFIG MESSAGE

V92X0803X

1 = ERR (red)

0 = OK

This is a logic 1 only when the configuration message received from the PL MDM failed to meet the following data validation.

- The bit orientation in the received waveform reflects a valid biphase code, such that only 10 or 01 patterns occur and that only the proper number of received threshold transitions occur within each bit time.
- Each word has exactly 20 bits: 3 sync, 16 data, and 1 odd parity bit.
- Standard parity bit verification.
- Legal "payload umbilical select" bit even when PI is selected.

PSP v1.2			GMT XX	X/XX:XX:XX
TELE	METRY	<i></i>	COMMAND	
PSP	1	2	Command Rate	XXXX
			Data Type	XXXX
Power	XX	XX	Buff Available	XXX
Frame SYNC	XXXX	XXXX	Buff Busy	XXXX
BIT SYNC	XXXX	XXXX	Idle Pattern	XXX
Bypass	XXX	XXX	P/L CMD ERR	XXX
			REPEAT MSG	XXX
Data Type	XXX	XX	GCIL CMD OUT	XXXX
Data Rate	XXXX	XX	UMB Select	XXXX
Frame Length	XX	XX		
Bit SYNC SW	XX	XX ·	——SM REJECT FLAGS ——	
Frame SYNC SW	XX	XX	PSP LOAD REJ	
Frame Word		XX	PSP XFER INC	
Data SRC PI	X	XX	ILL STAT MSG	
GSE	X	XX	CONF MSG INV	
PI/UMB SEL	XXX	XX	Source	
STAT Word 1	XX	XX	TEC U/L GNC	CC PCS
STAT Word 2	XX	XX	PORT	
STAT Word 3	XX	XX	Counter XXX	
Frame SYNC 1	XXXX		CONFIG MSG	
Frame SYNC 2 XXXX		Initialize XXXXX		
GPC INTÉRFACE ——			Last ID X	
SM Load Status XX			New ID XXX	
Item 6 * Item 7 *			Config Message	XXX

Figure 7.33-1. PSP display

### TITLE

ORBITER INTERFACE UNIT (OIU) DISPLAY V1.5

#### **GENERAL**

- A. This display's primary purpose is to enable the monitoring of the OIU configuration and status. The display is made up of one main and two lower level displays. One of the lower level displays is the OIU status display and the other is the OIU error display. The primary users of this display will be the INCO and PAYLOADS positions. A copy of the main OIU display is shown Figure 7.35-1. A copy of the Status subdisplay is shown in Figure 7.35-2. A copy of the Errors subdisplay is shown in Figure 7.35-3.
- B. Pathname of display: INCO/INCO Systems/OIU
- C. Detailed display description of the main OIU display:

**TOP SECTION** - The top eighth of the display contains the following:

1. TEMP 1 P50T4000V FLOATING POINT (green)

The power supply temperature of OIU 1. A value of 140° F indicates a PCM value of zero, which indicates no power to the OIU represented by a temperature of 140° F.

Indicates the power supply temperature for OIU 1. This signal is an analog differential signal with a voltage range of +5 V dc to -5 V dc.

The calibration curve is: OIU TEMP = V(32.0929) + 140.60854

Note that the zero-voltage (OIU "OFF") temperature reading is 140.6° F.

2. TEMP 2 P50T4001V FLOATING POINT (green)

Same as TEMP (1) for OIU 2.

3. STS M50Q0003HP DECIMAL (green)

(9100

The flight number.

4. M50Q0005HP DECIMAL (green)

The vehicle ID.

5. MET M50Q0030HP TIME (green)

The current downlisted mission elapsed time.

6. GMT M50Q0027HP TIME (green)

The current downlisted Greenwich mean time.

7. OIU P50U4100D mm/dd/yy hh:mm:ss

(green if incrementing) (red if not incrementing)

Indicates the timer being kept in the OIU, synchronized with but independent from the orbiter time, converted to mm/dd/yy hh:mm:ss.

8. BC P50U4110D mm/dd/yy hh:mm:ss

(green if incrementing)
(red if not incrementing)

Time data received by the OIU from a Bus Controller (BC) when the OIU is a remote terminal.

9. GMT - OIU SPECIAL COMP hh:mm:ss (green)

This is the computed value of the difference between the downlinked OIU time P50U4100D and the downlisted orbiter GMT M50Q0027HP.

**PCMMU/PDI/OCC SECTION** - The next fourth of the display (to the left of the BIC section) contains the following:

10. TFL (HDR) V75X4070D DECIMAL (green)

The high data rate Telemetry Format Load (TFL) in the Pulse Code Modulation Master Unit (PCMMU).

11. (LDR TFL) V92J0052CY DECIMAL (green)

The low data rate TFL in the PCMMU.

12. PDI 1 (DECOM FMT) V75J5132D FLOATING POINT

(green)

Integer value of the decom format currently loaded in decom 1.

13. PDI 2 (DECOM FMT) V75J5152D FLOATING POINT (green)

Same as item 12 for decom 2.

14. PDI 3 (DECOM FMT) V75J5172D FLOATING POINT

(green)

Same as item 12 for decom 3.

15. PDI 4 (DECOM FMT) V75J5192D FLOATING POINT

(green)

Same as item 12 for decom 4.

16. PDI 1 (SOURCE) V75J5111D FLOATING POINT (green)

Integer value of decom 1 switch matrix input source.

0 = No connection

1 = Port 1

2 = Port 2

3 = Port 3

4 = Port 4

5 = Port 5

6 = Port 6 (PSP ports 1 and 2)

7 = Test port

17. PDI 2 (SOURCE) V75J5112D FLOATING POINT (green)

Same as item 16 for decom 2.

18. PDI 3 (SOURCE) V75J5113D FLOATING POINT (green)

Same as item 16 for decom 3.

19. PDI 4 (SOURCE) V75J5114D FLOATING POINT (green)

Same as item 16 for decom 4.

20. (DECOM 1 BIT LOCK) V75X6403D 1 = B 0 = (blank) (green)

Bit sync locked for decom 1.

Word sync locked for decom 1.

22. (DECOM 1 MF LOCK) V75X6401D 1 = F 0 = (blank) (green)

Master frame lock for decom 1.

Bit rate accuracy is within  $\pm 3.25$  percent of expected bit rate for decom 1.

24. (DECOM 2 BIT LOCK) V75X6407D 1 = B 0 = (blank) (green)

Bit sync locked for decom 2.

Word sync locked for decom 2.

		· · · · · · · · · · · · · · · · · · ·			
26.	(DECOM 2 MF LOCK)	V75X6405D	1 = F (green)	0 = (blank)	
	Master frame lock for deco	m 2.			
27.	(DECOM 2 ACCURACY)	V75X6408D	1 = A (green)	0 = (blank)	
	Bit rate accuracy is within	±3.25 percent of expec	ted bit rate for	decom 2.	
28.	(DECOM 3 BIT LOCK)	V75X6411D	1 = B (green)	0 = (blank)	
	Bit sync locked for decom	3.			
29.	(DECOM 3 WORD LOCK)	V75X6410D	1 = W (green)	0 = (blank)	
	Word sync locked for deco	m 3.			
30.	(DECOM 3 MF LOCK)	V75X6409D	1 = F (green)	0 = (blank)	
	Master frame lock for deco	m 3.			
31.	(DECOM 3 ACCURACY)	V75X6412D	1 = A (green)	0 = (blank)	
	Bit rate accuracy is within	±3.25 percent of expec	ted bit rate for	decom 3.	
32.	(DECOM 4 BIT LOCK)	V75X6415D	1 = B (green)	0 = (blank)	
	Bit sync locked for decom	4.			
33.	(DECOM 4 WORD LOCK)	V75X6414D	1 = W (green)	0 = (blank)	
	Word sync locked for deco	m 4.			
34.	(DECOM 4 MF LOCK)	V75X6413D	1 = F (green)	0 = (blank)	
	Master frame lock for decom 4.				
35.	(DECOM 4 ACCURACY)	V75X6416D	1 = A (green)	0 = (blank)	
	Bit rate accuracy is within	±3.25 percent of expec	ted bit rate for	decom 4.	

bit rate accuracy is within ±3.23 percent of expected bit rate for decon

36. FPM V92J0078CY FLOATING POINT (green)

Integer value of the Fetch Pointer Memory (FPM) memory load sent to the PDI by SM2 GPC by SPEC 62. This value does not reflect what is loaded, but it is the last load sent by SM2.

37. (SM LINK BYPASS) V92X0908X 1 = BYPASS 0 = BYPASS (red) (gray)

Indicates that the PDI switch matrix did not respond to two consecutive switch matrix READ commands from the SM GPC. Under these conditions, the switch matrix cannot be loaded and will remain at the last values selected.

38. (PDI WRAP TEST) PDI\_WRAP 1 = WRAP 0 = WRAP (gray) (red)

For OI validation, the ground processor stores and compares two sets of two 8-bit words. If the ground processing does not receive the complement of alternate ones and zeros for the PDI, the PDI WRAP will be set on the display. If PDI WRAP remains set on the display, it indicates loss of communication between the PDI and the PCMMU. Communication may be recovered with the PDI by selecting the alternate PCMMU, which in effect selects the alternate data bus.

38a. (OIU S/N) SPECIAL COMP STRING (tan)

This is a special comp, displayed under the PDI block, that uses the ID number (P50U4011D) of the OIU generating the telemetry data stream and the OIU input file to determine which OIU is being used. The OIU input file for STS-91 is displayed in Figure 7.35-4.

If P50U4011D = the OIU 1 ID number specified in the file, OIU 1 is displayed. If P50U4011D = the OIU 2 ID number specified in the file, OIU 2 is displayed. If P50U4011D does not match either number specified in the file, it displays a blank.

**OCC** - The OIU Controller Card (OCC) block displays the status of the OCC as follows:

39. FORMAT P50U4010A DECIMAL (green)

The currently loaded OIU format.

40. ERR LOG LAST ENT P50U4170D DECIMAL (green)

Displays the OIU error log counter (0-255).

41. MULTI RT P50X4254E 1 = MULTI RT 0 = MULTI RT (red) (gray)

RECON data indicate that the OIU is assigned as an RT on more than one bus.

42. FL POINT P50X4288E 1 = FL POINT 0 = FL POINT (red) (gray)

A floating point conversion error was detected.

43. CFG CMD P50X4287E 1 = CFG CMD 0 = CFG CMD (red) (gray)

An invalid configuration command was detected.

44. ERROR OCC\_ERR 1 = ERROR 0 = ERROR (red) (gray)

Indicates an error exists in the OCC.

OCC\_ERR = MSID no. 1+2+3+4+5+6+7+8+9+10+11+12+13 +14+15+16+17+18+19+20+21+22+23+24+25

No.	MSID	Description
1	P50X4211E	Illegal instruction error (does not match a valid instruction)
2	P50X4212E	Fame overrun error (unable to process instruction in allocated time)
3	P50X4213E	Check instruction error (fails while "check register against bounds")*
4	P50X4214E	Bus error (read/write time-out)
5	P50X4218E	Address error (attempted to access an odd address)
5	P50X4221E	Max Error Log Write Wait Err (EEPROM write time is excessive)
6	P50X4222E	Line 1111 error (processor recognizes 1111 pattern in instruction)*
7	P50X4223E	Line 1010 error (processor recognizes 1010 pattern in instruction)*
8	P50X4224E	Level 7 autovector error (there is no level 7 autovector in OIU)*
9	P50X4225E	Invalid GSE error (fails to detect valid handshake in GSE mode)
10	P50X4226E	Invalid DUART interrupt error (associated with level 2 autovector)*
11	P50X4227E	Invalid BIC2 interrupt error (there is no BIC2 in OIU)*
12	P50X4234E	OCC SRAM error (Power-On Self-Test (POST) read from/write to SRAM)
13	P50X4235E	OCC register error (POST read from/write to OCC CPU register)
14	P50X4237E	OCC EEPROM error (POST read from/write to EEPROM)
15	P50X4261E	Trace error (trace bit enabled in status register)*
16	P50X4262E	Spurious interrupt error (bus error while processing an interrupt)
17	P50X4263E	Transaction subframe error (too many 1553 transaction in a subframe)
18	P50X4264E	RECON EEPROM faulty (bad table tag or checksum)
19	P50X4268E	Privilege violation (privileged instruction attempted in user mode)*
20	P50X4274E	Divide by zero attempted
21	P50X4275E	Unused exception error (unused or unassigned interrupt detected)
22	P50X4276E	Uninitialized interrupt vector (must be initialized to register number)
23	P50X4277E	Trap X error (trap 0 to 15 instruction exception)*
24	P50X4278E	Trap V error (overflow occurs during TRAPV execution)*
25	P50X4288E	Floating point conversion error (same as FL POINT, above)

<sup>\*</sup>Indicates error is unexpected because this function is not being implemented in OIU.

**PSP** - The PSP block displays the status of the PSP as follows:

45. PSP (PWR)

SPECIAL COMP

**STRING** 

Displays which PSP is currently powered up. V92J1103C is tested against the variable OIU\_PSP\_CFG, which is defined in a flight-specific file to define the background color of this box.

V92J1103C	V74X4890E	V74X4891E	COLOR	STRING
= OIU PSP CFG	0	0	Green on black	(blank)
= OIU_PSP_CFG	0	1	Green on black	2
= OIU_PSP_CFG	1	0	Green on black	1
= OIU_PSP_CFG	1	1	Red on black	ERR
≠ OIU PSP CFG	0	0	Black on yellow	(blank)
≠ OIU PSP CFG	0	1	Black on yellow	2
≠ OIU PSP CFG	1	0	Black on yellow	1
≠ OIU PSP CFG	1	1	Red on yellow	ERR

46. CFG V92J1103C DECIMAL (green)

This parameter indicates the last configuration message ID the selected PSP has received.

47. UMB V92J0817C DECIMAL (green)

Indicates in decimal form which PSP umbilical is selected.

48. CMD SPECIAL COMP STRING

SM parameter indicating which PSP output has been selected, Payload Umbilical or Payload Interrogator.

V92X0810X	V92X0811X	COLOR	STRING
0	0		(Blank)
0	1	Green	UMB
1	0	Green	INT
1	1	Red	ERR

49. I/O SPECIAL COMP STRING

Indicates the state of I/O between the PSP and the SM GPC.

Let PSP 1 BYP = V92X0325X PSP 2 BYP = V92X0329X

ITEM 6 = V93X5584X ITEM 7 = V93X5585X

If (ITEM 7 • NOT(PSP 2 BYP)) + (ITEM 6 • NOT(PSP 1 BYP)) = 1 Then STRING = OK (green)

Else STRING = NO (red)

PTB - static box, no MSID.

OIC - The Orbiter Interface Card (OIC) block displays the status of the OIC as follows:

50. PDI ERROR

OIC\_PDI\_ERR

1 = ERROR

0 = ERROR

(red)

(gray)

Indicates an error in the OIC's interface to the PDI.

OIC\_PDI\_ERR = MSID no. 1+2+3+4+5+6+7+8+9+10+11+12

No.	MSID	Description
1	P50X4231E	OIC PDI EEPROM error (SRAM/EEPROM POST checksum
		mismatch)
2	P50X4232E	OIC C51 PDI error (POST C51 register read/write mismatch)
3	P50X4233E	OIC PDI arbitration error (PDI SRAM access denied for >30 ms)
4	P50X4244E	OIC PDI WRAP error (POST PDI stream/SRAM data mismatch)
5	P50X4245E	OIC PDI SRAM error (POST mismatch written to/read from
		SRAM)
6	P50X4246E	OIC PDI POST incomplete ( (POST) did not complete)
7	P50X4247E	OIC PDI POST error (when any PDI POST error occurs)
8	P50X4248E	OIC PDI interrupt error (unused or invalid interrupt message)
9	P50X4251E	OIC PDI SRAM read/write error (during POST)
10	P50X4252E	PDI SRAM access error (PDI frame write during POST)
11	P50X4284E	OIC PDI sync error (PDI data loss from OCC)
12	P50X4302E	PDI buffer not clear (with new data to be written)

51. CMD CTR P50U4130D

This parameter is incremented when the OIU receives a valid command. This parameter indicates the number of properly formatted commands that the OIU has received since initialization or reinitialization. The Command Counter indicates that a command was received and the OIU attempted to process the command.

DECIMAL (green)

52. BAD RTG CODE P50X4306E 1 = BAD RTG CODE 0 = BAD RTG CODE (red) (gray)

This parameter is set high if the OIU receives a routing code that does not match a valid code in the Reconfiguration Table. This parameter is also known as a UNIMPLEMENTED RC ERR. This flag remains high until the next command having a valid routing code is processed.

53. PSP SIGNAL P50X4283E 1 = PSP SIGNAL 0 = PSP SIGNAL (red) (gray)

This parameter, also known as OIC PSP Command LOS Err, is set if a loss of the PSP carrier signal is detected by the OIU. This flag is cleared when the PSP carrier signal is detected at the interface.

54. PSP SYNC P50X4297E 1 = PSP SYNC 0 = PSP SYNC (red) (gray)

This error flag is set if both OIC command buffers are full when the OIU attempts to store a new command. Because of the lack of buffer space, the command is lost.

55. CMD PARITY P50X4281E 1 = CMD PARITY 0 = CMD PARITY (red) (gray)

This error flag, also known as OIC PSP Parity Err, is set when the parity check fails on the command received by the OIU. The command failing the parity check is rejected. The OIU uses odd byte parity. This error flag remains high until the next command is received and processed.

56. PTB SIGNAL P50X4296E 1 = PTB SIGNAL 0 = PTB SIGNAL (red) (gray)

This error flag, also known as OIC PTB LOS Err, occurs when OIC does not receive a valid PTB signal transition from the PTB interface within 16 ms. This bit remains set until the condition is cleared.

57. PTB SYNC P50X4295E 1 = PTB SYNC 0 = PTB SYNC (red) (gray)

This error is caused by OIC not receiving a valid PTB pulse width within 11 ms. This bit remains set until the condition is cleared.

58. ERROR OIC\_PSP\_ERR 1 = ERROR 0 = ERROR (red) (gray)

Indicates an error in the OIC's interface to the PSP. Clicking on ERROR brings up the OIU Error subdisplay.

OIC PSP ERR = MSID no. 1+2+3+4+5+6+7+8+9+10+11+12

No.	MSID	Description
1	P50X4238E	NO PSP CMD (OCC received interrupt, but OIC does not see the
		cmd)
2	P50X4241E	OIC PSP EEPROM error (SRAM/EEPROM POST checksum
		mismatch)
3	P50X4242E	OIC PSP C51 error (POST C51 register read/write mismatch)
4	P50X4243E	OIC PSP arbitration error (PSP SRAM access denied for >30 ms)
5	P50X4255E	OIC PSP SRAM error (POST mismatch written to/read from
		SRAM)
6	P50X4256E	OIC PSP POST incomplete (POST did not complete)
7	P50X4257E	OIC PSP POST error (when any OIC PSP POST error occurs)
8	P50X4258E	OIC PSP interrupt error (unused or invalid interrupt message)
9	P50X4265E	PSP SRAM read/write error (during POST)
10	P50X4266E	PSP PTB SRAM access error (Not granted SRAM access during
		POST)
11	P50X4267E	PSP in Wrong Buffer (Expected cmd in Buffer 1(2) but in buffer
		2(1))
12	P50X4298E	OIC PSP PTB Health error (Has failed three consecutive checks)

**BLOCK STATUS WORDS** - This section can display up to six Block Status Words (BSW). BSWs indicate the success or failure of individual MS1553B transactions. See the Systems Brief or Block Status Word section in part D (the OIU Status subdisplay description) of this SCP for a more detailed description of the BSWs.

59. Title (1-6)

SPECIAL PROC

**STRING** 

This is a special process that uses the OIU input file to determine the title of the BSWs. The OIU input file for STS-91 is described in Figure 7.35-4.

Title	STRING
1	BSW1 NAME from input file
2	BSW2_NAME from input file
3	BSW3_NAME from input file
4	BSW4_NAME from input file
5	BSW5_NAME from input file
6	BSW6 NAME from input file

Note that the title will be blank if BSW name is not defined in the file.

60. HEX (1-6)

SPECIAL PROC

HEX (green)

This is a special process that uses the real-time data value of the corresponding BSW MSID (from the flight-specific input file) and displays it as a four-character hex value.

Example: if BSW1 MSID= P50U4493D, P50U4493D is displayed in hex for BSW1.

MSID	BSW MSID
1	BSW1_MSID from input file
2	BSW2_MSID from input file
3	BSW3_MSID from input file
4	BSW4_MSID from input file
5	BSW5_MSID from input file
6	BSW6_MSID from input file

Note that the HEX column for a given BSW will be blank if that BSW MSID is not defined in the file.

61. CHANNEL (1-6)

SPECIAL PROC

STRING (green)

This is a special process that uses bit 13 of the real-time BSW (1-6) to determine the channel on which the last message was processed. It finds BSW (1-6) using the BSW MSID (1-6) from the OIU input file.

BSW (1-6) bit 13	STRING
0	Α
1	В

Note that the channel will be blank if BSW MSID is not defined in the file.

62.

ERROR (1-6)

OMM/JSC-12829 3/31/2006: REV G, PCN 3

SPECIAL PROC

This is a special process that uses bits from the real-time BSW (1-6), defined by the BSW MSID (1-6) in the OIU input file, to determine if there is an error in the MS1553B transaction.

**STRING** 

If Bit 0 (LSB) + Bit 1 + Bit 2 + Bit 3 + Bit 5 + Bit 8 + Bit 9 + Bit 10 + Bit 11 + Bit 12 = 1 (for any real-time BSW (1-6))

Then STRING = ERROR (red) Else STRING = ERROR (gray)

**SSOR** - The Space-to-Space Orbiter Radio (SSOR) block displays the state of the OIU's interface with the SSOR as follows:

63. SYNC P50X4293E 1 = SYNC 0 = SYNC (red) (gray)

This flag is set high when two consecutive frame counts are not received from the SSOR. The OIU checks the frame count in each minor frame received from the SSOR. When the frame count does not increment correctly in two or more consecutive frames, the OIU will set this bit high and resume operations under internal timing control.

64. FRM SEQ P50X4305E 1 = FRM SEQ 0 = FRM SEQ (red) (gray)

This flag is set high when one frame count is not received from the SSOR. The OIU checks the frame count in each minor frame received from the SSOR. When the frame count does not increment correctly and only one frame count is "skipped," the OIU will set this bit high and will continue program execution.

**ISS** - The ISS block displays the status of the OIU-to-ISS interface as follows:

65. INT TIME P50X4286E 1 = INT TIME 0 = INT TIME (red) (gray)

This error flag, also known as ISS BC No Comm Status, indicates that the OIU was communicating with an ISS BC MDM and the OIU BIA no longer "sees" ISS BC transmissions on that bus. This error can be caused either by the ISS BC MDM's stopping transmission or by the BIA's being reconfigured such that it stops receiving the ISS BC MDM transmissions. Following this error, the OIU will reinitialize and resume operation under internal timing control.

66. CMD FAIL P50X4291E 1 = CMD FAIL 0 = CMD FAIL (red) (gray)

This flag, also known as PSP RETRIES FAILED, is set high when the OIU made three attempts to transmit a command to a RT and all three attempts failed. The OIU rejects the command.

67. SYNC FAIL P50X4294E 1 = SYNC FAIL 0 = SYNC FAIL (red) (gray)

This flag, also known as ISS LOST SYNC, is set high when the OIU loses frame sync with the ISS BC MDM. The OIU checks the frame count in each minor frame received from the ISS BC MDM. When the frame count does not increment correctly in two or more consecutive frames, the OIU will set this bit high. It will also set this bit high if it cannot obtain 3 consecutive frame counts within 10 frames. Following this error, the OIU will reinitialize and resume operation under internal timing control.

68. FRAME SEQ P50X4304E 1 = FRAME SEQ 0 = FRAME SEQ (red) (gray)

This flag, also known as ISS FRAME COUNT OUT OF ORDER, is set high when one frame count is not received from the ISS BC MDM. The OIU checks the frame count in each minor frame received from the ISS BC MDM. When the frame count does not increment correctly and only one frame count is "skipped," the OIU will set this bit high and will continue program execution.

**BIC Section** - The Bus Interface Controller (BIC) block displays the status of the four Bus Interface Adapters (BIAs) as follows:

69. BC/RT (BIA no. 1) P50X4021E 1 = BC 0 = RT (green) (yellow if RT on all BIAs) (else green)

This is a discrete parameter indicating the BC/RT status for bus no. 1. A value of 1 indicates that the OIU is in Bus Controller (BC) mode on that bus, and a value of 0 indicates that the OIU is in Remote Terminal (RT) mode on that bus.

70. BC/RT (BIA no. 2) P50X4022E 1 = BC 0 = RT (green) (yellow if RT on all BIAs) (else green)

Same as BC/RT (BIA no. 1) for bus no. 2.

71. BC/RT (BIA no. 3) P50X4023E 1 = BC 0 = RT (green) (yellow if RT on all BIAs) (else green)

Same as BC/RT (BIA no. 1) for BIA no. 3.

72. BC/RT (BIA no. 4) P50X4024E 1 = BC 0 = RT (green) (yellow if RT on all BIAs) (else green)

Same as BC/RT (BIA no.1) for BIA no. 4.

73. Channel (BIA no. 1) P50X4041E 1 = B 0 = A (green) (green)

This is a discrete parameter indicating the primary channel selected for bus no. 1. A value of 1 indicates that channel B is selected as the prime channel on that bus, and a value of 0 indicates that channel A is selected as the prime channel on that bus. Note that the primary channel displayed is not necessarily the channel actually in use.

0.101122 0.0			0.	O D.O. E/ \ .
INCO/COMM/JSC-12829	3/31/2006: RE\	/ G, PCN 3		SCP 7.35
74. Channel (BIA no	. 2) P50X4042E	1 = B (green)	0 = A (green)	
Same as channe	el (BIA no. 1) for bus no.	2.		
75. Channel (BIA no	. 3) P50X4043E	1 = B (green)	0 = A (green)	
Same as channe	el (BIA no. 1) for bus no.	3.		
76. Channel (BIA no	. 4) P50X4044E	1 = B (green)	0 = A green)	
Same as channe	el (BIA no. 1) for bus no.	4.		

**OIU DISPLAY** 

77. LOCK (BIA no. 1) SPECIAL COMP STRING

SHUTTLE OPS

This special comp indicates the sync status of BIA no. 1. This computation uses a value extracted from the H&S DEV1 (Phys) Code/Sync Status Byte (MSID P50M4050P). This particular H&S field consists of eight bits. The last two bits indicate the sync status:

P50M4050P	AD1_LOCK_COMP
XXXXXX00	NONE
XXXXXX01	YES
XXXXXX10	NO
XXXXXX11	N/A

Where X is "Don't Care."

Use the same table to create AD2\_LOCK\_COMP except using P50M4060P. Use the same table to create AD3\_LOCK\_COMP except using P50M4070P. Use the same table to create AD4\_LOCK\_COMP except using P50M4080P.

```
If P50U4055D = 1, then let STRING = AD1_LOCK_COMP If P50U4065D = 1, then let STRING = AD2_LOCK_COMP If P50U4075D = 1, then let STRING = AD3_LOCK_COMP If P50U4085D = 1, then let STRING = AD4_LOCK_COMP Else, let STRING be blank.
```

If STRING = NO, then let the color be red. Else, let the color be green.

If the OIU is BC on a bus, then LOCK will show N/A with the following caveat. If the OIU is BC for the SSOR, LOCK will show YES or NO based on if it is locked to the SSSR's clock.

If the OIU is RT on a bus and achieves sync with the BC, the indication will be YES and application initialization ends. YES indicates the OIU is in sync with the device and is using its frame count to drive telemetry processing and MS1553B traffic on other buses.

If the OIU cannot achieve sync within ten 100-ms frames, the OIU ISS LOST SYNC error (P50X4283E) is set, this LOCK indication will be NO, interrupts are disabled on the BIA OIU for the bus, and if during application initialization, application initialization ends. The OIU will internally generate the frame count to drive telemetry and MS1553B traffic. Subsequent broadcast messages from the Command and Control MDM will be ignored. The OIU will not try to get in sync with the BC until application initialization is run again. Note that an OIU format reload will cause application initialization to run.

# 78. LOCK (BIA no. 2) SPECIAL COMP STRING

Same LOCK (BIA no. 1) except for the STRING is set as follows:

If P50U4055D = 2, then let STRING = AD1\_LOCK\_COMP If P50U4065D = 2, then let STRING = AD2\_LOCK\_COMP If P50U4075D = 2, then let STRING = AD3\_LOCK\_COMP If P50U4085D = 2, then let STRING = AD4\_LOCK\_COMP Else, let STRING be blank.

## 79. LOCK (BIA no. 3)

Same LOCK (BIA no. 1) except for the STRING is set as follows.

```
If P50U4055D = 3, then let STRING = AD1_LOCK_COMP If P50U4065D = 3, then let STRING = AD2_LOCK_COMP If P50U4075D = 3, then let STRING = AD3_LOCK_COMP If P50U4085D = 3, then let STRING = AD4_LOCK_COMP Else, let STRING be blank.
```

If STRING = NO, let the color be red. Else, let the color be green.

## 80. LOCK (BIA no. 4)

Same LOCK (BIA no. 1) except for the STRING is set as follows: If P50U4055D = 4, then let STRING = AD1\_LOCK\_COMP If P50U4065D = 4, then let STRING = AD2\_LOCK\_COMP If P50U4075D = 4, then let STRING = AD3\_LOCK\_COMP If P50U4085D = 4, then let STRING = AD4\_LOCK\_COMP Else. let STRING be blank.

If STRING = NO, then let the color be red. Else. let the color be green.

# 81. PD (BIA no. 1) SPECIAL COMP STRING (green)

This special comp indicates the Physical Device Code assigned to the Logical Device for BIA no. 1. This computation uses a value extracted from the H&S DEV(1-4) (Phys) Code/Sync Status Byte (MSID P50M4050P, 60P, 70P, 80P). This particular H&S field consists of eight bits. Bits 5, 4, 3, and 2 of the field are used to indicate the Physical Device Code:

3/31	/2006-	REV G.	PCN 3

P50M4050P	AD1_PD_COMP
XX0000XX	(blank)
XX0001XX	GNC-1
XX0010XX	GNC-2
XX0011XX	SSOR-1
XX0100XX	SSOR-2
XX0101XX	MPLM-1
XX0110XX	MPLM-2
XX0111XX	N1-1
XX1000XX	N1-2
XX1001XX	FGB-1
XX1010XX	FGB-2
XX1011XX	AMS-1
XX1100XX	AMS-2

Where X is "Don't Care."

Use the same table to create AD2\_PD\_COMP except using P50M4060P. Use the same table to create AD3\_PD\_COMP except using P50M4070P. Use the same table to create AD4\_PD\_COMP except using P50M4080P.

```
If P50U4055D = 1, then let STRING = AD1_PD_COMP If P50U4065D = 1, then let STRING = AD2_PD_COMP If P50U4075D = 1, then let STRING = AD3_PD_COMP If P50U4085D = 1, then let STRING = AD4_PD_COMP Else, let STRING be blank.
```

82. PD (BIA no. 2) SPECIAL COMP STRING (green)

Same as PD (BIA no. 1) except for BIA no. 2/bus no. 2 and the STRING is set as follows:

```
If P50U4055D = 2, then let STRING = AD1_PD_COMP If P50U4065D = 2, then let STRING = AD2_PD_COMP If P50U4075D = 2, then let STRING = AD3_PD_COMP If P50U4085D = 2, then let STRING = AD4_PD_COMP Else, let STRING be blank.
```

83. PD (BIA no. 3) SPECIAL COMP STRING (green)

Same as PD (BIA no. 1) except for BIA no. 3/bus no. 3 and the STRING is set as follows:

```
If P50U4055D = 3, then let STRING = AD1_PD_COMP If P50U4065D = 3, then let STRING = AD2_PD_COMP If P50U4075D = 3, then let STRING = AD3_PD_COMP If P50U4085D = 3, then let STRING = AD4_PD_COMP Else. let STRING be blank.
```

84. PD (BIA no. 4) SPECIAL COMP STRING (green)

Same as PD (BIA no. 1) except for BIA no. 4/bus no. 4 and the STRING is set as follows:

If P50U4055D = 4, then let STRING = AD1\_PD\_COMP If P50U4065D = 4, then let STRING = AD2\_PD\_COMP If P50U4075D = 4, then let STRING = AD3\_PD\_COMP If P50U4085D = 4, then let STRING = AD4\_PD\_COMP Else. let STRING be blank.

85. ERROR BIC\_ERR 1 = ERROR 0 = ERROR (red) (gray)

Indicates an error exists in the BIC.

 $BIC\_ERR = MSID$  no. 1+2+3+4

No.	MSID	Description
1	P50X4215E	POST SRAM (BIC SRAM initialization values are different from
		expected)
2	P50X4216E	POST SELF TEST (POST self-test failure for one of the four BIAs)
3	P50X4217E	POST REGISTER (BIC register initialization values different from
		expected)
4	P50X4228E	INVAL BIC 1 INTR (Autovector w/ BIC 1 generated for invalid reason)

86. BUS NAME (1-4) SPECIAL PROC STRING (tan)

The buses graphically coming out of the BIC block of the display have names displayed directly beneath the bus. These names are defined by the flight-specific OIU data file, as follows:

Bus no.	STRING
1	BUS1_NAME from input file
2	BUS2_NAME from input file
3	BUS3_NAME from input file
4	BUS4_NAME from input file

**DISPLAY CONTROLS** - The ERROR LATCH buttons (ALL/OIC/OCC/BIC/BSW/ISS/SSOR), when selected, latch errors in the associated blocks of this display. The LATCH CLEAR buttons, when pressed, clear any errors which have been latched in the past. Some of the Latch Controls (ISS and SSOR) do not necessarily latch the errors in their blocks because of the definition of these errors inside other blocks of the Errors subdisplay. To avoid confusion, the best practice is to LATCH ALL.



Figure 7.35-1. OIU main display

D. Detailed display description of the OIU Status display:

**FORMAT SECTION** - The upper left corner of the display contains the following:

1. Format P50U4010A DECIMAL (green)

Indicates the current OIU format.

# **ACTIVE DEVICE SECTION -**

2. PD (AD1) SPECIAL COMP STRING (green)

This special comp indicates the Physical Device Code assigned to the Logical Device for Active Device 1. This computation uses a value extracted from the H&S DEV1 (Phys) Code/Sync Status Byte (MSID P50M4050P). This particular H&S field consists of eight bits. Bits 5, 4, 3, and 2 of the field are used to indicate the Physical Device Code as follows:

P50M4050P	STRING
XX0000XX	(blank)
XX0001XX	GNC-1
XX0010XX	GNC-2
XX0011XX	SSOR-1
XX0100XX	SSOR-2
XX0101XX	MPLM-1
XX0110XX	MPLM-2
XX0111XX	N1-1
XX1000XX	N1-2
XX1001XX	FGB-1
XX1010XX	FGB-2
XX1011XX	AMS-1
XX1100XX	AMS-2

Where X is "Don't Care."

3. PD (AD2)

SPECIAL COMP

STRING (green)

Same as PD (AD1) except for AD no. 2 and using the H&S DEV2 (Phys) Code/Sync Status Byte (MSID P50M4060P).

4. PD (AD3)

SPECIAL COMP

STRING (green)

Same as PD (AD1) except for AD no. 3 and using the H&S DEV3 (Phys) Code/Sync Status Byte (MSID P50M4070P).

5. PD (AD4)

SPECIAL COMP

STRING (green)

Same as PD (AD1) except for AD no. 4 and using the H&S DEV4 (Phys) Code/Sync Status Byte (MSID P50M4080P).

6. PD no. (AD1)

SPECIAL COMP

HEX (green)

This special comp indicates the Physical Device number assigned to the Logical Device for Active Device 1. This computation uses a value extracted from the H&S DEV1 (Phys) Code/Sync Status Byte (MSID P50M4050P). This particular H&S field consists of eight bits. Bits 5, 4, 3, and 2 of the field are used to indicate the Physical Device number in hex as follows:

P50M4050P	HEX
XX0000XX	00
XX0001XX	01
XX0010XX	02
XX0011XX	03
XX0100XX	04
XX0101XX	05
XX0110XX	06
XX0111XX	07
XX1000XX	08
XX1001XX	09
XX1010XX	0A
XX1011XX	0B
XX1100XX	0C

Where X is "Don't Care."

7. PD no. (AD2)

SPECIAL COMP

HEX (green)

Same as PD no. (AD1) except for AD no. 2 and using the H&S DEV2 (Phys) Code/Sync Status Byte (MSID P50M4060P).

8. PD no. (AD3)

SPECIAL COMP

HEX (green

(green)

Same as PD no. (AD1) except for AD no. 3 and using the H&S DEV3 (Phys) Code/Sync Status Byte (MSID P50M4070P).

9. PD no. (AD4)

SPECIAL COMP

HEX (green)

Same as PD no. (AD1) except for AD no. 4 and using the H&S DEV4 (Phys) Code/Sync Status Byte (MSID P50M4080P).

10. BUS no. (AD1)

P50U4055D

HEX (green)

Indicates the number of the bus that the AD 1 is on. This value is extracted from the H&S DEV1 Bus/RT Number Byte. This particular H&S field consists of eight bits. The first three bits of the field indicate the bus number.

11. BUS no. (AD2)

P50U4065D

HEX (green)

Same as bus no. (AD1) for Active Device 2.

12. BUS no. (AD3)

P50U4075D

HEX (green)

Same as BUS no. (AD1) for Active Device 3.

13. BUS no. (AD4)

P50U4085D

HEX green)

Same as BUS number (AD1) for Active Device 4.

14. LOCK (AD1)

SPECIAL COMP

STRING

This special comp indicates the sync status of AD no. 1. This computation uses a value extracted from the H&S DEV1 (Phys) Code/Sync Status Byte (MSID P50M4050P). This particular H&S field consists of eight bits. The last two bits are used indicate the sync status as follows:

P50M4050P	STRING
XXXXXX00	NONE
XXXXXX01	YES
XXXXXX10	NO
XXXXXX11	N/A

Where X is "Don't Care."

If STRING = NO, then let the color be red. Else, let the color be green.

If the OIU is BC on a bus, then LOCK will show N/A.

If the OIU is RT on a bus and achieves sync with the BC, this indication will be YES and application initialization ends. YES indicates the OIU is in sync to the device and is using the frame count from this device to drive telemetry processing and MS1553B traffic on other buses.

If the OIU cannot achieve sync within ten 100 ms frames, the OIU ISS LOST SYNC error (P50X4283E) is set, this LOCK indication will be NO, interrupts are disabled on the BIA OIU for the bus, and, if during application initialization, application initialization ends. The OIU will internally generate the frame count to drive telemetry and MS1553B traffic. Subsequent broadcast messages from the Command and Control MDM will be ignored. The OIU will not try to get in sync with the BC until application initialization is run again. Note that an OIU format reload will cause application initialization to run.

15. LOCK (AD2)

SPECIAL PROC

**STRING** 

Same as LOCK (AD1) except for AD no. 2 and using the H&S DEV2 (Phys) Code/Sync Status Byte (MSID P50M4060P).

16. LOCK (AD3)

SPECIAL PROC

**STRING** 

Same as LOCK (AD1) except for AD no. 3 and using the H&S DEV3 (Phys) Code/Sync Status Byte (MSID P50M4070P).

17. LOCK (AD4)

SPECIAL PROC

**STRING** 

Same as LOCK (AD1) except for AD no. 3 and using the H&S DEV4 (Phys) Code/Sync Status Byte (MSID P50M4080P).

18. AD RT (AD1) P50U4056D DECIMAL (green)

Indicates the RT number for active device 1. This value is extracted from the H&S DEV1 Bus/RT number byte. This particular H&S field consists of eight bits. The last five bits of the field indicate the RT number.

19. AD RT (AD2) P50U4066D DECIMAL (green)

Same as AD RT (AD1) for Active Device 2.

20. AD RT (AD3) P50U4076D DECIMAL (green)

Same as AD RT (AD1) for Active Device 3.

21. AD RT (AD4) P50U4086D DECIMAL (green)

Same as AD RT (AD1) for Active Device 4.

22. OIU RT (BUS1) P50U4059D DECIMAL (green)

Indicates the OIU RT address if the OIU is an RT on bus no. 1. This value is extracted from the H&S Dev Data Start Byte/OIU RT number bus no. 1 bytes. This particular H&S field consists of 16 bits. The last six bits of the field indicate the OIU RT number.

23. OIU RT (BUS2) P50U4069D DECIMAL (green)

Same as OIU RT (BUS1) for bus no. 2.

24. OIU RT (BUS3) P50U4079D DECIMAL (green)

Same as OIU RT (BU1) for bus no. 3.

25. OIU RT (BUS4) P50U4089D DECIMAL (green)

Same as OIU RT (BUS1) for bus no. 4.

26. START WORD (AD1) P50U4058D HEX (green)

Indicates the byte number in the PDI minor frame where the device no. 1 format ID data start. This value is extracted from the H&S Dev Data Start Byte/OIU RT number bus no. 1 bytes. This particular H&S field consists of 16 bits. The first 10 bits of the field indicate the byte number.

27. START WORD (AD2) P50U4068D HEX (green)

Same as START WORD (AD1) for active device no. 2.

28. START WORD (AD3) P50U4078D HEX (green)

Same as START WORD (AD1) for active device no. 3.

29. START WORD (AD4) P50U4088D HEX (green)

Same as START WORD (AD1) for active device no. 4.

**BUS CONFIGURATION SECTION -** This section displays whether the OIU is functioning as a BC or an RT on each of the four MS1553B buses currently used. It also indicates the prime selected channel of each of the four OIU BIAs.

30. BC/RT (bus no. 1) P50X4021E 1 = BC 0 = RT (green) (green)

This is a discrete parameter indicating the BC/RT status for bus no. 1. A value of 1 indicates that the OIU is in BC mode on that bus, and a value of 0 indicates the OIU is in RT mode on that bus.

31. BC/RT (bus no. 2) P50X4022E 1 = BC 0 = RT (green) (green)

Same as BC/RT (bus no. 1) for bus no. 2.

32. BC/RT (bus no. 3) P50X4023E 1 = BC 0 = RT (green) (green)

Same as BC/RT (bus no. 1) for bus no. 3.

33 BC/RT (bus no. 4) P50X4024E 1 = BC 0 = RT (green) (green)

Same as BC/RT (bus no. 1) for bus no. 4.

34. A/B (bus no. 1) P50X4041E 1 = B 0 = A (green) (green)

This is a discrete parameter indicating the primary channel selected for bus no. 1. A value of 1 indicates that channel B is selected as the prime channel on that bus, and a value of 0 indicates that channel A is selected as the prime channel on that bus. Note that the primary channel displayed is not the channel actually in use.

35. A/B (bus no. 2) P50X4042E 1 = B 0 = A

(green) (green)

Same as A/B (bus no. 1) for bus no. 3.

36. A/B (BUS no. 3) P50X4043E 1 = B 0 = A (green) (green)

Same as A/B (bus no. 1) for bus no. 3.

37. A/B (BUS no. 4) P50X4044E 1 = B 0 = A

(green) (green)

Same as A/B (bus no. 1) for bus no. 4.

#### **TEMPERATURE AND S/N SECTION**

38. TEMP (1) P50T4000V FLOATING POINT (green)

Indicates the power supply temperature for OIU 1. This signal is an analog differential signal with a voltage range of +5 V dc to -5 V dc.

The calibration curve is: OIU TEMP = V(32.0929) + 140.60854

Note that the zero-voltage (OIU "OFF") temperature reading is 140.6° F.

39. TEMP (2) P50T4001V FLOATING POINT (green)

Same as TEMP (1) for OIU 2.

40. OIU S/N SPECIAL COMP STRING (green)

This is a special comp that uses the ID number (P50U4011D) of the OIU generating the telemetry data stream and the OIU input file to determine which OIU is being used. The OIU input file for STS-91 is displayed in Fgure 5.135-4.

If P50U4011D = the OIU 1 ID number specified in the file, OIU 1 is displayed. If P50U4011D = the OIU 2 ID number specified in the file, OIU 2 is displayed. If P50U4011D does not match either number specified in the file, it displays a blank.

**HEALTH AND STATUS SECTION** - This section displays the 10 OIU status bytes in binary form. Each parent MSID is composed of eight bits, and each bit represents the occurrence of an error. Whenever a particular bit is set to one, it indicates that a corresponding error occurred at some time in the 10 frames prior to the beginning of this 10-frame cycle. The OIU Generated Error Table in Appendix 38.B of the INCO Systems Brief gives a detailed description of the individual errors. All status errors are displayed individually in the OIU Errors display.

41. WORD 1 P50M4210P BINARY (green)

Displays status byte 1 in binary.

The eight bits represent the following errors:

```
(MSB) BIT 7 - (P50X4211E) - Illegal Instruction
BIT 6 - (P50X4212E) - Frame Overrun
BIT 5 - (P50X4213E) - Check Instruction
BIT 4 - (P50X4214E) - Bus
BIT 3 - (P50X4215E) - BIC Post SRAM
BIT 2 - (P50X4216E) - BIC Post Self Test
BIT 1 - (P50X4217E) - BIC Post Register
(LSB) BIT 0 - (P50X4218E) - Address
```

42. WORD 2 P50M4220P BINARY (green)

Displays status byte 2 in binary.

The eight bits represent the following errors:

```
(MSB) BIT 7 - (P50X4221E) - Max Error Log Write Wait BIT 6 - (P50X4222E) - Line 1111
BIT 5 - (P50X4223E) - Line 1010
BIT 4 - (P50X4224E) - Level 7 Autovector
BIT 3 - (P50X4225E) - Invalid GSE
BIT 2 - (P50X4226E) - Invalid DUART Interrupt
BIT 1 - (P50X4227E) - Invalid BIC2 Interrupt
(LSB) BIT 0 - (P50X4228E) - Invalid BIC1 Interrupt
```

43. WORD 3 P50M4230P BINARY (green)

Displays status byte 3 in binary.

The eight bits represent the following errors:

```
(MSB)

BIT 7 - (P50X4231E) - OIC PDI EEPROM
BIT 6 - (P50X4232E) - OIC PDI C51
BIT 5 - (P50X4233E) - OIC PDI ARB
BIT 4 - (P50X4234E) - OCC SRAM
BIT 3 - (P50X4235E) - OCC Register
BIT 2 - (P50X4236E) - Reserved
BIT 1 - (P50X4237E) - OCC EEPROM
(LSB)
BIT 0 - (P50X4238E) - No PSP Command
```

44. WORD 4 P50M4240P BINARY (green)

Displays status byte 4 in binary.

The eight bits represent the following errors:

```
(MSB)

BIT 7 - (P50X4241E) - OIC PSP EEPROM

BIT 6 - (P50X4242E) - OIC PSP C51

BIT 5 - (P50X4243E) - OIC PSP ARB

BIT 4 - (P50X4244E) - OIC PDI WRAP

BIT 3 - (P50X4245E) - OIC PDI SRAM

BIT 2 - (P50X4246E) - OIC PDI POST Incomplete

BIT 1 - (P50X4247E) - OIC PDI POST
```

(LSB) BIT 0 - (P50X4248E) - OIC PDI Interrupt

45. WORD 5 P50M4250P BINARY (green)

Displays status byte 5 in binary.

The eight bits represent the following errors:

```
(MSB)

BIT 7 - (P50X4251E) - PDI SRAM R/W

BIT 6 - (P50X4252E) - PDI SRAM Access

BIT 5 - (P50X4253E) - Reserved

BIT 4 - (P50X4254E) - OIU RT on Multiple Bus

BIT 3 - (P50X4255E) - OIC PSP SRAM

BIT 2 - (P50X4256E) - OIC PSP Post Incomplete

BIT 1 - (P50X4257E) - OIC PSP Post

(LSB)

BIT 0 - (P50X4258E) - OIC PSP Interrupt
```

46. WORD 6 P50M4260P BINARY (green)

Displays status byte 6 in binary.

The eight bits represent the following errors:

```
(MSB)

BIT 7 - (P50X4261E) - Trace

BIT 6 - (P50X4262E) - Spurious Interrupt

BIT 5 - (P50X4263E) - Recon No. Trans Subframe

BIT 4 - (P50X4264E) - Recon EEPROM Faulty

BIT 3 - (P50X4265E) - PSP SRAM R/W

BIT 2 - (P50X4266E) - PSP/PTB SRAM access

BIT 1 - (P50X4267E) - CMD in Wrong Buffer

(LSB)

BIT 0 - (P50X4268E) - Privilege Violation
```

47. WORD 7 P50M4270P BINARY (green)

Displays status byte 7 in binary.

The eight bits represent the following errors:

```
(MSB)

BIT 7 - (P50X4271E) - Reserved

BIT 6 - (P50X4272E) - Reserved

BIT 5 - (P50X4273E) - Reserved

BIT 4 - (P50X4274E) - Zero Divide

BIT 3 - (P50X4275E) - Unused Exception

BIT 2 - (P50X4276E) - Uninit Interrupt vector

BIT 1 - (P50X4277E) - TRAP X

(LSB)

BIT 0 - (P50X4278E) - TRAP V
```

48. WORD 8 P50M4280P BINARY (green)

Displays status byte 8 in binary.

The eight bits represent the following errors:

```
(MSB)

BIT 7 - (P50X4281E) - OIC PSP Parity Error
BIT 6 - (P50X4282E) - OIC PTB Time
BIT 5 - (P50X4283E) - OIC PSP LOS Err
BIT 4 - (P50X4284E) - OIC PDI Sync
BIT 3 - (P50X4285E) - Reserved
BIT 2 - (P50X4285E) - ISS BC No Comm Status
BIT 1 - (P50X4287E) - Invalid config cmd
(LSB)

BIT 0 - (P50X4288E) - Floating point conversion

WORD 9

P50M4290P

BINARY
```

49. WORD 9 P50M4290P BINARY (green)

Displays status byte 9 in binary.

The eight bits represent the following errors:

```
(MSB) BIT 7 - (P50X4291E) - PSP Retries Failed Err
BIT 6 - (P50X4292E) - PSP Cmd Count Out of Bound Err
BIT 5 - (P50X4293E) - OIU SSOR Lost Sync Err
BIT 4 - (P50X4294E) - OIU ISS Lost Sync Err
BIT 3 - (P50X4295E) - OIC PTB Sync Err
BIT 2 - (P50X4296E) - OIC PTB LOS Err
BIT 1 - (P50X4297E) - OIC PSP Sync Err
(LSB) BIT 0 - (P50X4298E) - OIC PSP PTB Health Err
```

50. WORD 10 P50M4300P BINARY (green)

Displays status byte 10 in binary.

The eight bits represent the following errors:

```
(MSB)

BIT 7 - (P50X4301E) - Reserved

BIT 6 - (P50X4302E) - PDI Buffer not clear Err

BIT 5 - (P50X4303E) - OIC PSP byte count Err

BIT 4 - (P50X4304E) - ISS frame nonconsecutive Err

BIT 3 - (P50X4305E) - SSOR frame nonconsecutive Err

BIT 2 - (P50X4306E) - Unimplemented RC Err

BIT 1 - (P50X4307E) - Unfinished BC Frame Err

(LSB)

BIT 0 - (P50X4308E) - PTB not available Err
```

**BLOCK STATUS WORD SECTION** - This section displays up to six BSWs. BSWs indicate the success or failure of individual MS1553B transactions. Each BSW is composed of 16 bits, and each bit represents a given status. Bit 15 is defined as the MSB and bit 0 is defined as the LSB.

51. Title (1-6) SPECIAL PROC STRING

This is a special process that uses the OIU input file to determine the title of the BSWs. The OIU input file for STS-91 is described in Figure 7.35-4.

Title	STRING
Row 1	BSW1_NAME from input file
Row 2	BSW2_NAME from input file
Row 3	BSW3_NAME from input file
Row 4	BSW4_NAME from input file
Row 5	BSW5_NAME from input file
Row 6	BSW6_NAME from input file

Note that the title will be blank if BSW name is not defined in the file.

52. MSID (1-6) SPECIAL PROC STRING

This is a special process that uses the OIU input file to determine the MSIDs that correspond to the BSWs.

MSID	STRING
Row 1	BSW1_MSID from input file
Row 2	BSW2_MSID from input file
Row 3	BSW3_MSID from input file
Row 4	BSW4_MSID from input file
Row 5	BSW5_MSID from input file
Row 6	BSW6_MSID from input file

Note that the MSID column for a given BSW will be blank if that BSW MSID is not defined in the file.

53. HEX (rows 1-6) SPECIAL PROC HEX

This is a special process that uses the real-time data value of the corresponding BSW MSID and displays it as a four-character hex value.

Example: If BSW1\_MSID = P50U4493D, P50U4493D is displayed in hex for BSW1.

Note that the HEX column for a given BSW will be blank if that BSW MSID is not defined in the file.

54. EOM (rows 1-6) SPECIAL PROC STRING

This is a special process that uses bit 15 of each of the BSWs.

EOM	STRING
Row 1	"X" if Bit 15 of BSW1_MSID = 1, else blank
Row 2	"X" if Bit 15 of BSW2_MSID = 1, else blank
Row 3	"X" if Bit 15 of BSW3_MSID = 1, else blank
Row 4	"X" if Bit 15 of BSW4_MSID = 1, else blank
Row 5	"X" if Bit 15 of BSW5_MSID = 1, else blank
Row 6	"X" if Bit 15 of BSW6_MSID = 1, else blank

In both BC and RT mode, Bit 15 is set (logic 1) at the completion of the message, regardless of whether there were any errors in the message.

Bit 15 set (logic 1) is an expected nonerror BC or RT mode status.

55. SOM (rows 1-6) SPECIAL PROC STRING

This is a special process that uses bit 14 of each of the BSWs.

SOM	STRING
Row 1	"X" if Bit 14 of BSW1_MSID = 1, else blank
Row 2	"X" if Bit 14 of BSW2_MSID = 1, else blank
Row 3	"X" if Bit 14 of BSW3_MSID = 1, else blank
Row 4	"X" if Bit 14 of BSW4_MSID = 1, else blank
Row 5	"X" if Bit 14 of BSW5_MSID = 1, else blank
Row 6	"X" if Bit 14 of BSW6 MSID = 1, else blank

In both BC and RT mode, bit 15 is set (logic 1) at the start of the message and cleared at the end of the message.

56. CH B (rows 1-6) SPECIAL PROC STRING

This is a special process that uses bit 13 of each of the BSWs.

CH B	STRING
Row 1	"X" if Bit 13 of BSW1_MSID = 1, else blank
Row 2	"X" if Bit 13 of BSW2_MSID = 1, else blank
Row 3	"X" if Bit 13 of BSW3_MSID = 1, else blank
Row 4	"X" if Bit 13 of BSW4_MSID = 1, else blank
Row 5	"X" if Bit 13 of BSW5_MSID = 1, else blank
Row 6	"X" if Bit 13 of BSW6_MSID = 1, else blank

In both BC and RT mode, bit 13 will be a logic 0 if the message was processed on channel A or a logic 1 if processed on channel B.

# 57. ERR (rows 1-6) SPECIAL PROC STRING

This is a special process that uses bit 12 of each of the BSWs.

ERR	STRING
Row 1	"X" if Bit 12 of BSW1_MSID = 1, else blank
Row 2	"X" if Bit 12 of BSW2_MSID = 1, else blank
Row 3	"X" if Bit 12 of BSW3_MSID = 1, else blank
Row 4	"X" if Bit 12 of BSW4_MSID = 1, else blank
Row 5	"X" if Bit 12 of BSW5_MSID = 1, else blank
Row 6	"X" if Bit 12 of BSW6_MSID = 1, else blank

In both BC and RT mode, bit 12 will be set (logic 1) if there was an error in the message. The exact error is specified in the remaining bits.

58. BC STAT (rows 1-6) SPECIAL PROC STRING

This is a special process that uses bit 11 of each of the BSWs.

BC STAT	STRING
Row 1	"X" if Bit 11 of BSW1_MSID = 1, else blank
Row 2	"X" if Bit 11 of BSW2_MSID = 1, else blank
Row 3	"X" if Bit 11 of BSW3_MSID = 1, else blank
Row 4	"X" if Bit 11 of BSW4_MSID = 1, else blank
Row 5	"X" if Bit 11 of BSW5_MSID = 1, else blank
Row 6	"X" if Bit 11 of BSW6_MSID = 1, else blank

In RT mode, bit 11 is not applicable.

In BC mode, bit 11 is set (logic 1) if an RT MS1553B Status Word received from a responding RT contained an incorrect RT address field or one of the lower 11 bits contained an unexpected value. Detailed information on MS1553B status words is located in Section 38.8.2 of the INCO Systems Brief.

59. FMT ERR (rows 1-6) SPECIAL PROC STRING

This is a special process that uses bit 10 of each of the BSWs.

FMT ERR	STRING
Row 1	"X" if Bit 10 of BSW1_MSID = 1, else blank
Row 2	"X" if Bit 10 of BSW2_MSID = 1, else blank
Row 3	"X" if Bit 10 of BSW3_MSID = 1, else blank
Row 4	"X" if Bit 10 of BSW4_MSID = 1, else blank
Row 5	"X" if Bit 10 of BSW5_MSID = 1, else blank
Row 6	"X" if Bit 10 of BSW6 MSID = 1, else blank

In both BC and RT mode, bit 10 will be set (logic 1) if message contained one or more violations of the MS1553B message validation criteria (sync, encoding, parity, bit count, word count, etc.).

60. BC NO RESP (rows 1-6) SPECIAL PROC STRING

This is a special process that uses bit 9 of each of the BSWs.

3/31/2006:	REV G	. PCN 3
------------	-------	---------

BC NO RESP	STRING
Row 1	"X" if Bit 9 of BSW1_MSID = 1, else blank
Row 2	"X" if Bit 9 of BSW2_MSID = 1, else blank
Row 3	"X" if Bit 9 of BSW3_MSID = 1, else blank
Row 4	"X" if Bit 9 of BSW4_MSID = 1, else blank
Row 5	"X" if Bit 9 of BSW5_MSID = 1, else blank
Row 6	"X" if Bit 9 of BSW6_MSID = 1, else blank

In RT mode, bit 9 is not applicable.

In BC mode, bit 9 is set (logic 1) if the RT either has not responded or has responded later than the BC No Response Timeout time (50.5 ms).

61. LOOP FAIL (rows 1-6) SPECIAL PROC STRING

This is a special process that uses bit 8 of each of the BSWs.

LOOP FAIL	STRING
Row 1	"X" if Bit 8 of BSW1_MSID = 1, else blank
Row 2	"X" if Bit 8 of BSW2_MSID = 1, else blank
Row 3	"X" if Bit 8 of BSW3_MSID = 1, else blank
Row 4	"X" if Bit 8 of BSW4_MSID = 1, else blank
Row 5	"X" if Bit 8 of BSW5_MSID = 1, else blank
Row 6	"X" if Bit 8 of BSW6 MSID = 1, else blank

In BC mode, bit 8 set (logic 1) indicates that the BC loop test has failed.

In RT mode, bit 8 set (logic 1) indicates that the RT loop test has failed.

62. RT WD CNT (rows 1-6) SPECIAL PROC STRING

This is a special process that uses bit 5 of each of the BSWs.

RT WD CNT	STRING
Row 1	"X" if Bit 5 of BSW1_MSID = 1, else blank
Row 2	"X" if Bit 5 of BSW2_MSID = 1, else blank
Row 3	"X" if Bit 5 of BSW3_MSID = 1, else blank
Row 4	"X" if Bit 5 of BSW4_MSID = 1, else blank
Row 5	"X" if Bit 5 of BSW5_MSID = 1, else blank
Row 6	"X" if Bit 5 of BSW6_MSID = 1, else blank

In BC mode, bit 5 is not applicable.

In RT mode, bit 5 is set (logic 1) if the BC did not transmit the correct number of data words, as specified in the MS1553B command word.

# 63. RT BAD SYNC (rows 1-6) SPECIAL PROC STRING

This is a special process that uses bit 4 of each of the BSWs.

RT BAD SYNC	STRING
row 1	"X" if Bit 4 of BSW1_MSID = 1, else blank
row 2	"X" if Bit 4 of BSW2_MSID = 1, else blank
row 3	"X" if Bit 4 of BSW3_MSID = 1, else blank
row 4	"X" if Bit 4 of BSW4_MSID = 1, else blank
row 5	"X" if Bit 4 of BSW5_MSID = 1, else blank
row 6	"X" if Bit 4 of BSW6_MSID = 1, else blank

In RT mode, bit 4 set (logic 1) indicates that the BC transmitted a Command Sync in a data word. **If not in RT mode**, disregard this column of the status display.

64. BC GOOD BLOCK (rows 1-6) SPECIAL PROC STRING

This is a special process that uses bit 4 of each of the BSWs.

BC GOOD BLOCK	STRING
Row 1	"X" if Bit 4 of BSW1_MSID = 1, else blank
Row 2	"X" if Bit 4 of BSW2_MSID = 1, else blank
Row 3	"X" if Bit 4 of BSW3_MSID = 1, else blank
Row 4	"X" if Bit 4 of BSW4_MSID = 1, else blank
Row 5	"X" if Bit 4 of BSW5_MSID = 1, else blank
Row 6	"X" if Bit 4 of BSW6 MSID = 1, else blank

In BC mode, bit 4 set (logic 1) indicates that a valid (error free) RT-to-BC transfer or a "receive mode code with data" message has been completed. Bit 4 is set to 0 for a BC-to-RT transfer, or a "receive mode code without data" message. **If not in BC mode**, disregard this column of the status display. Bit 4 set is an expected nonerror BC mode transmit status.

65. BC NO GAP (rows 1-6) SPECIAL PROC STRING

This is a special process that uses bit 3 of each of the BSWs.

BC NO GAP	STRING
Row 1	"X" if Bit 3 of BSW1_MSID = 1, else blank
Row 2	"X" if Bit 3 of BSW2_MSID = 1, else blank
Row 3	"X" if Bit 3 of BSW3_MSID = 1, else blank
Row 4	"X" if Bit 3 of BSW4_MSID = 1, else blank
Row 5	"X" if Bit 3 of BSW5_MSID = 1, else blank
Row 6	"X" if Bit 3 of BSW6_MSID = 1, else blank

In RT mode, bit 3 is not applicable.

In BC mode, bit 3 is set (logic 1) if either or both of the following occur:

- a. The RT address field of a responding RT does not match the RT address in the MS1553B command word.
- b. An RT responds with a response time less than 4 ms (minimum intermessage time gap).

# 66. BC BAD CNT (rows 1-6) SPECIAL PROC STRING

This is a special process that uses bit 2 of each of the BSWs.

BC BAD CNT	STRING
Row 1	"X" if Bit 2 of BSW1_MSID = 1, else blank
Row 2	"X" if Bit 2 of BSW2_MSID = 1, else blank
Row 3	"X" if Bit 2 of BSW3_MSID = 1, else blank
Row 4	"X" if Bit 2 of BSW4_MSID = 1, else blank
Row 5	"X" if Bit 2 of BSW5_MSID = 1, else blank
Row 6	"X" if Bit 2 of BSW6_MSID = 1, else blank

In RT mode, bit 2 is not applicable.

In BC mode, bit 2 is set (logic 1) if a responding RT did not transmit the correct number of data words. Bit 2 is set to a logic 0 for BC-to-RT and "receive mode code" transfers.

# 67. BC SYNC TYPE (rows 1-6) SPECIAL PROC STRING

This is a special process that uses bit 1 of each of the BSWs.

BC SYNC TYPE	STRING
Row 1	"X" if Bit 1 of BSW1_MSID = 1, else blank
Row 2	"X" if Bit 1 of BSW2_MSID = 1, else blank
Row 3	"X" if Bit 1 of BSW3_MSID = 1, else blank
Row 4	"X" if Bit 1 of BSW4_MSID = 1, else blank
Row 5	"X" if Bit 1 of BSW5_MSID = 1, else blank
Row 6	"X" if Bit 1 of BSW6_MSID = 1, else blank

In RT mode, bit 1 is not applicable.

In BC mode, bit 1 is set (logic 1) if an RT responds with a Data Sync in a Status Word and/or a Command/Status Sync in a Data Word.

## 68. RT CW CNT (rows 1-6) SPECIAL PROC STRING

This is a special process that uses bit 0 of each of the BSWs.

RT CW CNT	STRING
Row 1	"X" if Bit 0 of BSW1_MSID = 1, else blank
Row 2	"X" if Bit 0 of BSW2_MSID = 1, else blank
Row 3	"X" if Bit 0 of BSW3_MSID = 1, else blank
Row 4	"X" if Bit 0 of BSW4_MSID = 1, else blank
Row 5	"X" if Bit 0 of BSW5_MSID = 1, else blank
Row 6	"X" if Bit 0 of BSW6_MSID = 1, else blank

In RT mode, bit 0 set (logic 1) indicates that a received Command Word is not defined in accordance with MIL-STD-1553. **If not in RT mode,** disregard this column of the status display.

## 69. BC INV IND (rows 1-6) SPECIAL PROC STRING

This is a special process that uses bit 0 of each of the BSWs.

BC INV IND	STRING
1	"X" if Bit 0 of BSW1_MSID = 1, else blank
2	"X" if Bit 0 of BSW2_MSID = 1, else blank
3	"X" if Bit 0 of BSW3_MSID = 1, else blank
4	"X" if Bit 0 of BSW4_MSID = 1, else blank
5	"X" if Bit 0 of BSW5_MSID = 1, else blank
6	"X" if Bit 0 of BSW6 MSID = 1, else blank

In BC mode, bit 0 set (logic 1) indicates that an RT responded with one or more words containing one or more of the following error types: sync field error, Manchester encoding error, and/or bit count error. **If not in BC mode**, disregard this column of the status display.

## TIME AND COMMAND COUNTER SECTION

70. OIU TIME P50U4100D mm/dd/yy hh:mm:ss green if incrementing) (red if not incrementing)

Indicates the timer being kept in the OIU, synchronized with, but independent from, the orbiter time converted to mm/dd/yy hh:mm:ss.

71. BC TIME P50U4110D mm/dd/yy hh:mm:ss

(green if incrementing) (red if not incrementing)

Indicates the broadcast time received by the OIU from a BC, when the OIU is a remote terminal.

72. CMD CNT P50U4130D DECIMAL (green)

Indicates the total number of PSP commands received by the OCC since poweron.

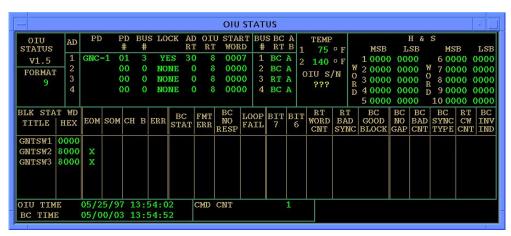


Figure 7.35-2. Example of OIU STATUS display

E. Detailed display description of the OIU Errors display:

**DISPLAY CONTROLS** - The ERROR LATCH buttons (ALL/OIC/OCC/BIC/CMD), when selected, latch errors in the associated blocks of this display. The LATCH CLEAR buttons, when pressed, clear any errors that have been latched in the past.

**COMMAND** - The Command block displays OIU command errors as follows:

1. PSP SIGNAL P50X4283E 1 = PSP SIGNAL 0 = PSP SIGNAL (red) (gray)

3/31/2006: REV G, PCN 3

This parameter, also known as OIC PSP Command LOS Err, is set if a loss of the PSP carrier signal is detected by the OIU. This flag is cleared when the PSP carrier signal is detected at the interface.

2. PSP SYNC P50X4297E 1 = PSP SYNC 0 = PSP SYNC (red) (gray)

This error flag is set if both OIC command buffers are full when the OIU attempts to store a new command. Because of the lack of buffer space, the command is lost.

3. PARITY P50X4281E 1 = PARITY 0 = PARITY (red) (gray)

This error flag, also known as OIC PSP Parity Err and CMD PARITY, is set when the parity check fails on the command received by the OIU. The command failing the parity check is rejected. The OIU uses odd byte parity. This error flag remains high until the next command is received and processed.

4. BYTE COUNT P50X4303E 1 = BYTE COUNT 0 = BYTE COUNT (red) (gray)

This error flag, also known as OIC PSP Byte Count Err, is set when the byte count in a received command is invalid. A valid byte count number is greater than 4 (04h) and less than 126 (7Eh). This flag remains set until the next valid command is received and processed. The command is rejected.

5. 1553 RETRY P50X4291E 1 = 1553 RETRY 0 = 1553 RETRY (red) (gray)

This flag, also known as PSP RETRIES FAILED and CMD FAIL, is set high when the OIU has made three attempts to transmit a command to an RT and all three attempts have failed. The OIU rejects the command.

6. ROUTING CODE P50X4306E 1 = ROUTING 0 = ROUTING CODE CODE (red) (gray)

This parameter is set high if the OIU receives a routing code that does not match a valid code in the Reconfiguration Table. This parameter is also known as an UNIMPLEMENTED RC ERR. This flag remains high until the next command with a valid routing code is processed.

7. WRONG BFR P50X4267E 1 = WRONG BFR 0 = WRONG BFR (red) (gray)

This parameter is set high if the OIC expects the command to be in buffer 1, but it is in buffer 2 (or vice versa). This error is also known as PSP in Wrong Buffer Err.

8. COUNTER OB P50X4292E 1 = COUNTER OB 0 = COUNTER OB (red) (gray)

This error flag (Command Count Out of Bounds) is set if the OIU receives three or more commands before one is processed. The first two commands will be processed and the third (or more) command(s) will be lost.

**ERROR LOG COUNTERS** - The Error Log Counters section of the display keeps a status of the number of errors that have occurred as follows:

9. PDI WRAP P50U4160D DECIMAL (green)

This field represents the number of PDI error log wrap cycles. The PDI error log can hold 100 entries. When the PDI error log wraps around, this parameter is incremented by one. This parameter has a range of 0-65535. When the error log wraps around, it wraps from entry no. 100 to entry no. 11 so that the first 10 entries and last 90 entries are saved. The PDI error log can be dumped on the ground at KSC. Endurance for the EEPROM holding the error log is specified as a minimum of 10,000 writes for each byte.

10. PSP WRAP P50U4150D DECIMAL (green)

This field represents the number of PSP/PTB error log wrap cycles. The PSP/PTB error log can hold 100 entries. When the PSP/PTB error log wraps around, this parameter is incremented by one. This parameter has a range of 0-65535. When the error log wraps around, it wraps from entry no. 100 to entry no. 11, so that the first 10 entries and last 90 entries are saved. The PSP/PTB error log can be dumped on the ground at KSC. Endurance for the EEPROM holding the error log is specified as a minimum of 10,000 writes for each byte.

11. OCC WRAP P50U4140D DECIMAL (green)

This field represents the number of OCC error log wrap cycles. The OCC error log can hold 100 entries. When the OCC error log wraps around, this parameter is incremented by one. This parameter has a range of 0-65535. When the error log wraps around it wraps from entry no. 100 to entry no. 11 so that the first 10 entries and last 90 entries are saved. The OCC error log can be dumped on orbit (OIU FMT 254). Endurance for the EEPROM holding the error log is specified as a minimum of 10,000 writes for each byte.

12. OCC LATEST ENTRY P50U4170D DECIMAL (green)

This is the OCC error log entry number that was last written by OCC firmware. OCC error log entry numbers range from 1 to 100. A value of 0 indicates that the error log is empty.

OIC HARDWARE - This block displays errors in the OIC hardware as follows:

13. PSP EEPROM P50X4241E 1 = PSP EEPROM 0 = PSP EEPROM (red) (gray)

3/31/2006: REV G, PCN 3

This flag indicates that an error was detected with the OIC PSP EEPROM. This can be identified when the SRAM checksum does not match the OIC PSP EEPROM checksum. This comparison is completed during the PSP POST.

14. PSP C51 P50X4242E 1 = PSP C51 0 = PSP C51 (red) (gray)

This error flag is set during PSP POST when data are unsuccessfully written or read from one of the internal registers on the PSP/PTB 80C51FC microcontroller. A specified value is written to an internal C51 register. A read is done to verify that the value is set. If the read back fails, this error condition is flagged.

15. PSP ARBIT P50X4243E 1 = PSP ARBIT 0 = PSP ARBIT (red) (gray)

This error flag is set by the OIC if the arbitration of the shared SRAM is found to be in error. SRAM is shared between the OIU Flight Software in the OCC and the firmware that controls the PSP/PTB interface. The memory arbitration is controlled by a programmable logic device on the OIC. If a request for shared SRAM is not granted within 30 ms, this flag is set high. This flag is also set high if memory is not immediately available during POST.

16. PSP INTERRUPT P50X4258E 1 = PSP 0 = PSP INTERRUPT (red) (gray)

This flag is set by the OIC when an unused PSP interrupt location is accessed and cleared by the OCC.

17. PSP POST P50X4257E 1 = PSP POST 0 = PSP POST (red) (gray)

This flag is set if OIC PSP/PTB errors occurred during the OIC PSP/PTB POST.

18. PSP POST INC P50X4256E 1 = PSP POST INC 0 = PSP POST INC (red) (gray)

This flag is set if the OIC did not complete the OIC PSP/PTB POST.

19. PSP SRAM P50X4255E 1 = PSP SRAM 0 = PSP SRAM (red) (gray)

This flag is set by the OIC during POST when data written to SRAM do not match data read from SRAM.

20. PSP SRAM R/W P50X4265E 1 = PSP SRAM R/W 0 = PSP SRAM R/W (red) (gray)

This flag is set high during OIC PSP/PTB POST if the OIC is unsuccessful in reading from or writing to the shared SRAM.

21. PSP SRAM ACCESS P50X4266E 1 = PSP SRAM 0 = PSP SRAM ACCESS ACCESS (red) (gray)

3/31/2006: REV G, PCN 3

This flag is set if the OCC is not granted a memory request during POST or if the OIC cannot read a PSP command from the SRAM.

22. PTB LOST SIGNAL P50X4296E 1 = PTB LOST 0 = PTB LOST SIGNAL (red) (gray)

This error flag occurs when OIC does not receive a valid PTB signal transition from the PTB interface within 16 ms. This bit remains set until the condition is cleared. This bit is displayed as PTB SIGNAL on the main OIU display.

23. PTB SYNC P50X4295E 1 = PTB SYNC 0 = PTB SYNC (red) (gray)

This error is caused by OIC not receiving a valid PTB pulse width within 11 ms. This bit remains set until the condition is cleared.

24. PTB TIME P50X4282E 1 = PTB TIME 0 = PTB TIME (red) (gray)

This error is set high when the OIC detects at least one value in the PTB time field that is not valid. This bit remains set until the condition is cleared.

25. PTB NOT AVAIL P50X4308E 1 = PTB NOT AVAIL 0 = PTB NOT AVAIL (red) (gray)

This flag is set high if PTB time is still not available 2.5 seconds after it was requested.

26. PDI EEPROM P50X4231E 1 = PDI EEPROM 0 = PDI EEPROM (red) (gray)

This flag indicates that an error was detected with the OIC PDI EEPROM. This can be identified when the SRAM checksum does not match the OIC PDI EEPROM checksum. This comparison is completed during the PDI POST.

27. PDI C51 P50X4232E 1 = PDI C51 0 = PDI C51 (red) (gray)

This error flag is set during PDI POST when data are unsuccessfully written or read from one of the internal registers on the PDI 80C51FC microcontroller. A specified value is written to an internal C51 register. A read is done to verify the value is set. If the read back fails, this error condition is flagged.

28. PDI ARBIT P50X4233E 1 = PDI ARBIT 0 = PDI ARBIT (red) (gray)

This error flag is set by the OIC if the arbitration of the shared SRAM is found to be in error. SRAM is shared between the OIU Flight Software in the OCC and the firmware that controls the PSP/PTB interface. The memory arbitration is controlled by a programmable logic device on the OIC. If a request for shared SRAM is not granted within 30 ms, this flag is set high. This flag is also set high if memory is not immediately available during POST.

29. PDI INTERRUPT P50X4248E 1 = PDI 0 = PDI INTERRUPT (red) (gray)

This flag is set by the OIC when an unused PDI interrupt location is accessed and cleared by the OCC.

30. PDI POST P50X4247E 1 = PDI POST 0 = PDI POST (red) (gray)

This flag is set if OIC PDI errors occurred during the OIC PDI POST.

31. PDI POST INC P50X4231E 1 = PDI POST INC 0 = PDI POST INC

This flag is set if the OIC did not complete the OIC PDI POST.

32. PDI SRAM P50X4245E 1 = PDI SRAM 0= PDI SRAM (red) (gray)

This flag is set by the OIC during POST when data written to SRAM do not match data read from SRAM.

33. PDI SRAM R/W P50X4251E 1 = PDI SRAM R/W 0 = PDI SRAM R/W (red) (gray)

This flag is set high during OIC PDI POST if the OIC is unsuccessful in reading from or writing to the shared SRAM.

34. PDI SRAM ACCESS P50X4252E 1 = PDI SRAM 0 = PDI SRAM ACCESS (red) (gray)

This flag is set if the OCC is not granted a memory request for SRAM during POST or if the OIC is not granted memory to the shared SRAM when constructing the PDI frame.

35. PDI CARD SYNC P50X4284E 1 = PDI CARD 0 = PDI CARD SYNC SYNC (red) (gray)

It is the responsibility of the OIU Flight Software in the OCC to make sure one SRAM PDI buffer is full before it is transmitted to the PDI by the OIC. If the buffer is not full before it is transmitted, this flag is set high by the OIC. This will result in a loss of sync at PDI decom.

36. PDI CARD WRAP P50X4244E 1 = PDI CARD 0 = PDI CARD WRAP (red) (gray)

This flag indicates the status of the OIC's interface to the PDI. The OIC compares data read from the shared SRAM and data read back from the PDI data stream. If they do not compare, this flag is set high.

37. PDI BFR NOTCLR P50X4302E 1 = PDI BFR 0 = PDI BFR NOT CLR (red) (gray)

This bit is set high if the OIC determines that the buffer that is to be written to is still full.

3/31/2006: REV G, PCN 3

38. OIC HEALTH P50X4298E

1 = OIC HEALTH (red)

0 = OIC HEALTH (gray)

A failure is detected from the PSP/PTB Health and Status bit. It is expected to toggle and has failed to do so on three consecutive checks.

**OCC HARDWARE** - The status of the OCC Hardware errors is displayed as follows:

39. R/T ON MULTI BUS P50X4254E

1 = R/T ON MULTI 0 = R/T ON MULTI

BUS (red)

BUS (gray)

Recon data indicate that the OIU is assigned as an RT on more than one bus.

40. TRACE ERROR P50X4261E

1 = TRACE ERROR

0 = TRACE ERROR (gray)

(red)

This bit is set high when tracing is enabled via the trace bit in the OCC status register. However, tracing is not used in the current design. Therefore, this flag is unexpected.

41. SPURIOUS INTR P50X4262E

1 = SPURIOUS INTR 0 = SPURIOUS INTR

(red) (gray)

This bit is set high when a bus error occurs while processing an interrupt.

42. 80 HZ SUBFRM P50X4263E

1 = 80 HZ SUBFRM

0 = 80 HZ SUBFRM(gray)

(red)

This flag is set high when more than 15 MS1553B transactions are detected in a subframe for a given bus.

43. RECON EEPROM

P50X4264E

1 = RECON EEPROM

0 = RECON **EEPROM** 

(red)

(gray)

This flag is set high when the subroutine loading the flight-specific RECON data into the RECON data tables detects a bad table or checksum.

44. **PRIV VIOLATION**  P50X4268E

1 = PRIV**VIOLATION**  0 = PRIV

(red)

**VIOLATION** (gray)

This flag is generated when attempting to execute a privileged instruction when in the user mode. However, user mode is not used by OIU FSW. OIU FSW is always in supervisor mode. Therefore, this flag is unexpected.

**DIVIDE BY ZERO** 45.

P50X4274E

1 = DIVIDE BY

0 = DIVIDE BY

**ZERO** (red)

**ZERO** (gray)

This flag is generated when the processor attempts to divide by zero.

3/31/2006: REV G, PCN 3

46. UNUSED EXCEPT P50X4275E 1 = UNUSED 0 = UNUSED EXCEPT (red) (gray)

This flag is set high when an unused, reserved, unassigned, or user interrupt vector is generated.

47. UNINIT INTR VECT P50X4276E 1 = UNINIT INTR 0 = UNINIT ITR VECT VECT (red) (gray)

This flag is set high when an interrupt occurs and the interrupting device has not initialized its appropriate vector register number.

48. TRAP X P50X4277E 1 = TRAP X 0 = TRAP X (red) (gray)

This flag is generated when a TRAP instruction (numbered 0 to 15) is executed. TRAP instructions, however, are not used in the current design; therefore, this flag is unexpected.

49. INVAL CFG CMD P50X4287E 1 = INVAL CFG 0 = INVAL CFG CMD CMD (red) (gray)

This flag is set high when an invalid configuration command is received.

50. FLT PT CONV P50X4288E 1 = FLT PT CONV 0 = FLT PT CONV (red) (gray)

This flag is set high when a floating point conversion error is detected.

51. ADDRESS P50X4218E 1 = ADDRESS (red) (gray)

This flag is generated when the processor attempts to access a word, operand, or instruction at an odd address.

52. TRAP OVERFLOW P50X4278E 1 = TRAP 0 = TRAP OVERFLOW (red) (gray)

This flag is generated when a runtime overflow condition occurs and the TRAPV instruction has been executed; however, the TRAPV instruction is not used by the OIU FSW. Therefore, this error is unexpected.

53. LINE 1010 P50X4223E 1 = LINE 1010 0 = LINE 1010 (red) (gray)

This flag is set high when the processor recognizes the 1010 bit pattern within the instruction. This instruction (1010) is not used by the OIU FSW; therefore, this flag is unexpected.

54. LINE 1111 P50X4222E 1 = LINE 1111 0 = LINE 1111 (red) (gray)

3/31/2006: REV G, PCN 3

This flag is set high when the processor recognizes the 1111 bit pattern within the instruction. However, this instruction (1111) is not used by the OIU FSW. Therefore, this flag is unexpected.

55. LEVEL 7 AUTOVECTOR P50X4224E

1 = LEVEL 7 AUTOVECTOR

0 = LEVEL 7**AUTOVECTOR** 

(red)

(gray)

This flag is set high when the Level 7 Autovector interrupt is invoked. However, the Level 7 Autovector interrupt is not used by the OIU FSW (or even implemented in hardware).

56. **INVAL GSE**  P50X4225E

1 = INVAL GSE (red)

0 = INVAL GSE

(gray)

This flag is set high when the OIU detects invalid handshake, or no handshake, when GSE connection has been detected during system startup.

57. **DUART INTR**  P50X4226E

used in current design. Therefore, this flag is not expected.

1 = DUART INTR 0 = DUART INTR

(red) (gray)

This flag is set high if the OCC processor detects a DUART interrupt. The DUART interrupt is associated with the Level 2 Autovector. However, DUART interrupts are not

58. **SRAM** 

P50X4234E

1 = SRAM (red)

0 = SRAM(gray)

This flag is set high if the OCC encounters problem reading/writing to/from OCC SRAM during POST.

59. REGISTER

P50X4235E

1 = REGISTER (red)

0 = REGISTER

(gray)

This flag is set high if the OCC encounters problem reading/writing to/from OCC CPU Register(s) during POST.

60. **EEPROM** 

P50X4237E

1 = EEPROM

0 = EEPROM (gray)

(red)

This flag is set high if the OCC reads an invalid value from any one of three EEPROM banks in OCC during POST.

61. ILLEGAL INSTR P50X4211E

1 = ILLEGAL INSTR

0 = ILLEGAL INSTR

(red)

(gray)

This flag is set high if the OCC processor fetches an instruction that does not match any legal instruction patterns.

62. FRM OVERRUN P50X4212E

1 = FRM OVERRUN (red)

0 = FRM OVERRUN

(gray)

This flag is set high when the OIU firmware has detected a 100 ms processing frame overrun. In other words, the OIU has taken longer than 100 ms to get all of its work done.

63. CHECK INSTR P50X4213E

1 = CHECK INSTR

0 = CHECK INSTR

(red)

(gray)

This flag is set high when the Check Register Against Bounds instruction fails. However, this Check Instruction is not used in the current design.

64. BUS P50X4214E 1 = BUS 0 = BUS (red) (gray)

This flag is set high when an external read/write times out.

65. ERROR LOG WRITE P50X4221E 1 = ERROR LOG 0 = ERROR LOG WRITE WRITE (red) (gray)

This flag is set high when the maximum time to complete an EEPROM write has been exceeded.

66. NO CMD RCVD P50X4238E 1 = NO CMD RCVD 0 = NO CMD RCVD (red) (gray)

This flag is set high if the OCC receives an interrupt indicating a command is being sent, but both OIC PSP/PTB register data received bits are 0, indicating there is no PSP command.

**BIC HARDWARE** - The BIC Hardware errors are displayed as follows:

67. INT TIME P50X4286E 1 = INT TIME 0 = INT TIME (red) (gray)

This error flag, also known as ISS BC No Comm Status, indicates the OIU was communicating with an ISS BC MDM and the OIU BIA no longer "sees" ISS BC transmissions on that bus. This error can be caused by ISS BC MDM's stopping transmission or by BIA's being reconfigured such that it stops receiving the ISS BC MDM transmissions. Following this error, the OIU will reinitialize and resume operation under internal timing control.

68. SSOR LOST SYNC P50X4293E 1 = SSOR LOST 0 = SSOR LOST SYNC SYNC (red) (gray)

This flag is set high when two consecutive frame counts are not received from the SSOR. The OIU checks the frame count in each minor frame received from the SSOR. When the frame count does not increment correctly in two or more consecutive frames, the OIU will set this bit high and resumes operation under internal timing control.

69. ISS LOST SYNC P50X4294E 1 = ISS LOST 0 = ISS LOST SYNC SYNC (red) (gray)

This flag is set high when the OIU loses frame sync with the ISS BC MDM. The OIU checks the frame count in each minor frame received from the ISS BC MDM. When the frame count does not increment correctly in two or more consecutive frames, the OIU will set this bit high. It will also set this bit high if it cannot obtain 3 consecutive frame counts within 10 frames. Following this error, the OIU will reinitialize and resume operation under internal timing control.

70. ISS FRAME SEQ P50X4304E 1 = ISS FRAME 0 = ISS FRAME SEQ SEQ (red) gray)

This flag, also known as ISS FRAME COUNT OUT OF ORDER, is set high when one frame count is not received from the ISS BC MDM. The OIU checks the frame count in each minor frame received from the ISS BC MDM. When the frame count does not increment correctly and only one frame count is "skipped," the OIU will set this bit high and continue program execution.

71. SSOR FRAME SEQ P50X4305E 1 = SSOR FRAME 0 = SSOR FRAME SEQ SEQ (red) (gray)

This flag is set high when one frame count is not received from the SSOR. The OIU checks the frame count in each minor frame received from the SSOR. When the frame count does not increment correctly and only one frame count is "skipped," the OIU will set this bit high and continue program execution.

72. UNFINISHED BC FR P50X4307E 1 = UNFINISHED 0 = UNFINISHED BC FR BC FR (red) (gray)

This flag is set high when the BC frame on a bus that the OIU is BC on did not finish before the BIA was told to send another.

73. POST SRAM P50X4215E 1 = POST SRAM 0 = POST SRAM (red) (gray)

This flag is set high during POST when the OIU firmware determines that BIC SRAM contents do not equal expected values (i.e., what they should be after initialization).

74. POST SELF TEST P50X4216E 1 = POST SELF 0 = POST SELF TEST TEST (red) (gray)

This flag is set high during POST if the OIU firmware detects a self-test failure for any one of the four BIAs.

75. POST REGISTER P50X4217E 1 = POST 0 = POST REGISTER (red) (gray)

This flag is set high during POST if the OIU firmware determines that BIC register contents do not equal expected values (i.e., what they should be after initialization).

76. INVAL BIC 1 INTR P50X4228E 1 = INVAL BIC 0 = INVAL BIC 1 INTR (red) (gray)

This flag is set high if the autovector associated with the BIC1 interrupt has been generated for an invalid reason (i.e., NOT a "Broadcast Sync With Data" 100 ms interrupt).

77. INVAL BIC 2 INTR P50X4227E 1 = INVAL BIC 0 = INVAL BIC 2 INTR (red) (gray)

This flag is set high if the autovector associated with the BIC2 interrupt has been generated. There is no BIC2 installed in the OIU.

SHUTTLE OPS OIU DISPLAY INCO/COMM/JSC-12829 3/31/2006: REV G, PCN 3 SCP 7.35



Figure 7.35-3. OIU ERRORS subdisplay

BUS1_NAME	notused
BUS2_NAME	notused
BUS3_NAME	notused
BUS4_NAME	AMS
BSW1_NAME	AMSTSW1
BSW2_NAME	AMSTSW2
OIU1_SN	162
OIU2_SN	168
BSW1_MSID	P50U4493D
BSW2_MSID	P50U4494D
OIU_PSP_CFG	1

Figure 7.35-4. STS-91 OIU input file

#### **TITLE**

SSOR V1.3

#### **GENERAL**

- A. The data displayed are real-time telemetry parameters that affect the management and operation of the Space-to-Space Orbiter Radio (SSOR). Figure 7.36-1 shows a copy of the SSOR display.
- B. Pathname of display: INCO/INCO Displays/COMM Systems/ssor.
- C. Detailed display description.

# SSOR TELEMETRY (Left side of display)

1. Power (EVA Mode) V74S2032E 1 = ON 0 = OFF (green) (yellow)

When this parameter is high, it indicates that the UHF mode switch is in the EVA position. This switch activates the SSOR.

2. Freq V74S2040E 1 = 417.1 0 = 414.2 (green) (green)

This parameter indicates the position of the frequency select switch on the O6 panel.

3. Power Amp V74S2016E 1 = OFF 0 = ON (green) (green)

This parameter indicates the position of the UHF SPLY PWR AMP switch on the O6 panel.

4. Current V74C2047A FLOATING POINT (green)

This parameter indicates the current consumption of the SSOR on the power distribution board. This provides a status on either string 1 or string 2 of the SSOR. It is expected to be between 0 and 5 amps. The measurement is capable of measuring from 0 to 7 amps.

5. RF Out V74E2045A FLOATING POINT (green)

This parameter indicates the RF power output at the duplexer. This measurement ranges from 15 to 45 dBm; *21* dBm is nominal for low power during missions, due to incorrect calibration coefficients. Engineering has promised to update the calibration coefficients for this MSID.

6. Encrypt V74S2048E 1 = ON 0 = OFF (green) (green)

When this parameter is high, the ENCRYPT switch on panel O6 is in the ON position. When this parameter is low, the ENCRYPT switch on panel O6 is in the OFF position.

329 5/23/2005: REV G, PCN-1

7. String Sel (1) V74S2049E 1 = 1 0 = 1 (green) (gray)

When this parameter is high, the STRING SELECT switch on panel O6 is in the position to select string 1. When this parameter is low, the STRING SELECT switch on panel O6 is in the position to select string 2.

8. String Sel (2) V74S2049E 1 = 2 0 = 2 (green) (gray)

When this parameter is high, the STRING SELECT switch on panel O6 is in the position to select string 1. When this parameter is low, the STRING SELECT switch on panel O6 is in the position to select string 2.

9. Sig Proc (1) V74X2051E 1 = ON 0 = OFF (green) (gray)

When this parameter is high, the signal processor on string 1 has a good status.

10. Sig Proc (2) V74X2052E 1 = ON 0 = OFF (green) (gray)

When this parameter is high, the signal processor on string 2 has a good status.

11. Frame (1) V74X2050E 1 = LK 0 = No (green) (gray)

When this parameter is high, the SSOR has acquired frame synchronization with at least one other user on string 1.

12. Frame (2) V74X2053E 1 = LK 0 = No (green) (gray)

When this parameter is high, the SSOR has acquired frame synchronization with at least one other user on string 2.

# SSSR TELEMETRY (Right side of display)

13. UHF Sel (UHF1) LADP01MDB07TJ 1 = 1 2 or 0 = no (green) (green)

When this parameter is high, the STRING SELECT switch on the ISS is in the position to select string 1.

14. UHF Sel (UHF 3) LADP01MDB07TJ 2 = 2 1 or 0 = no (green) (green)

When this parameter is high, the STRING SELECT switch on the ISS is in the position to select string 3.

SHUTTLE OPS INCO/COMM/JSC-12829	<i>5/23/2005</i> : REV G	, PCN-1		SSOR SCP 7.36	
15. I/O (UHF 1)	LADP01MDAVT2J	1 = ENA (green)	0 = INH (green)		
16. I/O (UHF 3)	LADP01MDAW1BJ	1 = ENA (green)	0 = INH (green)		
17. RPC (UHF 1)	LAPR57FC1023J	1 = ON (green)	0 = OFF (green)	3 = FAILED (red)	
This parameter indicates the status of the ISS RPCs powering SSSR string 1. Station can command these RPCs therefore they have telemetry to indicated the status.					
18. RPC (UHF 3)	LAPR04FC1019J	1 = ON (green)	0 = OFF (green)	3 = FAILED (red)	
Same as above for RF	PC (UHF 3).				
19. Freq	LACU03FC0013J	1 = 417.1 (green)	0 = 414.2 (green)		
This parameter indica	tes the position of the ISS	S frequency select s	switch.		
20. Power Amp	LACU03FC0011J	1 = High (green)	0 = Low (green)		
This parameter indica	tes the current power leve	el of the power amp	being used f	or the SSSR.	

21. SR Key# LACU03FC0017U FLOATING POINT VALUE (green)

This parameter indicates the Key # used for commanding through the SSSR.

22. Current LACU03FC0009C FLOATING POINT VALUE (green)

This parameter indicates the current consumption of the SSOR on the power distribution board. This provides a status on either string 1 or string 2 of the SSOR. It is expected to be between 0 and 5 amps. The measurement is capable of measuring from 0 to 7 amps.

23. Mode LACU03FC0015J 3 = EVA 7 = Orbiter (green) (green)

SSOR SCP 7.36

This parameter indicates the current mode of the ISS SSSR.

24. RF (dBm) LACU03FC0010E FLOATING POINT VALUE (green)

This parameter indicates the RF power output at the duplexer. This measurement ranges from 15 to 45 dBm. See section 5 above for further explanation.

25. Encrypt LACU03FC0016J 1 = ON 0 = OFF (green) (green)

When this parameter is high, the ENCRYPT switch on ISS is in the ON position. When this parameter is low, the ENCRYPT switch on ISS is in the OFF position

26. Frame LACU03FC0019J 1 = LOCK 0 = UNLOCK (green) (green)

This parameter indicates frame lock by the SSSR.



Figure 7.36-1. SSOR display

SHUTTLE OPS

9/1/2004:

**REV G** 

INCO/COMM/JSC-12829

#### **TITLE**

SSR1(2) MANAGEMENT V1.9.8

#### **GENERAL**

A. These applications are used to monitor the Modular Memory Unit (MMU) Solid State Recorders (SSR) and manage the data stored on them. There are three versions of each display: one for DATACOMM only that writes to the details database and log file (described herein), and two versions that do not write. Of the two versions that do not write, one is for an INCO user connected to the command server that is able to read commands to update the display, and another version is for the public DNAV that does not connect to the server. The version that DATA COMM uses utilizes a current checkpoint file and a current log file. When this version is selected from the DNAV, the user must select whether or not to keep the existing files or start with fresh files (see figure 7.37-1).





Figure 7.37-1: Checkpoint & Logfile questions at start-up

- B. DNAV location: INCO> Displays> DATACOMM Systems> SSR1(2) MGMT
- C. Detailed display description (see figure 7.37-2):

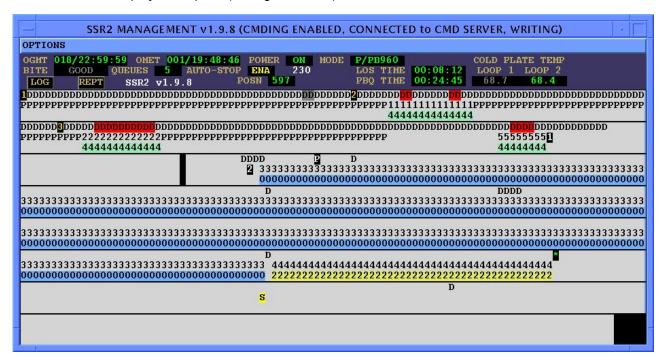


Figure 7.37-2: SSR2 Management display

SHUTTLE OPS MMU/SSR MANAGEMENT

INCO/COMM/JSC-12829 9/1/2004: REV G SCP 7.37

1. MODE SPECIAL COMP (green on black)

These are special computations of the SSR1(2) MODE telemetry, found in INCO computation ssr\_COMP.

SSR1 MODE is decoded from the six discrete bits: V75X2966E (MSB), V75X2965E, V75X2957E, V75X2956E, V75X2955E, V75X2944E (LSB).

SSR2 MODE is decoded from the six discrete bits: V75X2866E (MSB), V75X2865E, V75X2857E, V75X2856E, V75X2855E, V75X2844E (LSB).

Table 7.37-1 shows the available SSR modes, given a decimal equivalent value.

2. POSN POSITIVE INTEGER = 0 – 810 green on black

POSITION is the value of the functional address or location of the recording operation, while recording, or the PB operation while dumping without recording. The maximum valid value of POSITION is 810.

SSR1 POSN is the decimal equivalent of the ten discrete bits V75X2949E (MSB), V75X2948E, V75X2947E, V75X2934E, V75X2933E, V75X2921E, V75X2913E, V75X2911E, V75X2909E, V75X2905E (LSB).

SSR2 POSN is the decimal equivalent of the ten discrete bits V75X2849E (MSB), V75X2848E, V75X2847E, V75X2834E, V75X2833E, V75X2821E, V75X2813E, V75X2811E, V75X2809E, V75X2805E (LSB).

3. QUEUES HEXADECIMAL = 0 – F (green on black)

QUEUES is the total number of PB queue definition slots currently held in the SSR.

SSR1 QUEUES is the hexadecimal equivalent of the four discrete bits: V75X2941E (MSB), V75X2940E, V75X2931E, V75X2929E (LSB).

SSR2 QUEUES is the hexadecimal equivalent of the four discrete bits: V75X2841E (MSB), V75X2840E, V75X2831E, V75X2829E (LSB).

4. AUTO-STOP 1 = ENA 0 = CLR (yellow on black) (dark-slate-gray on black)

AUTO-STOP indicates whether or not an auto-stop position has been defined (enabled) or cleared (inhibited) for the applicable SSR(s).

V75X2959E indicates status of auto-stop function for SSR1.

V75X2859E indicates status of auto-stop function for SSR2.

Table 7.37-1: SSR Available Modes

VAL	MODE	DESCRIPTION	
0	NONE	MMU pre-POST (NONE = yellow on black)	
1	STBY	Standby, no record or playback or maintenance operation in process	
2	RCDA	Recording Serial A, NSP1(NSP2) data or data and voice	
3	RCDB	Recording Serial B, payload input	
4	RCDE	Recording main engine or payload data at the EIU1(2)(3) inputs	
5	RCDP	Recording three EIU inputs and Serial A input	
6	PB2048	Dumping at 2048 Kbps	
7	PB1024	Dumping at 1024 Kbps	
8	PB960	Dumping at 960 Kbps	
9	PB192	Dumping at 192 Kbps	
10	PB128	Dumping at 128 Kbps	
11	PB64	Dumping at 64 Kbps	
12	PB32	Dumping at 32 Kbps	
13	PBME	Dumping all EIU data in 1,2,3 order at 960 Kbps	
14	PB E1	Dumping EIU1 data at 60 Kbps	
15	PB E2	Dumping EIU2 data at 60 Kbps	
16	PB E3	Dumping EIU3 data at 60 Kbps	
17	PBQ2048	Dumping all data slots queued at 2048 Kbps in order defined	
18	PBQ1024	Dumping all data slots queued at 1024 Kbps in order defined	
19	PBQ960	Dumping all data slots queued at 960 Kbps in order defined	
20	PBQ192	Dumping all data slots queued at 192 Kbps in order defined	
21	PBQ128	Dumping all data slots queued at 128 Kbps in order defined	
22	A/PB2048	Simultaneously recording Serial A data and dumping per mode 17	
23	A/PB1024	Simultaneously recording Serial A data and dumping per mode 18	
24	A/PB960	Simultaneously recording Serial A data and dumping per mode 19	
25	A/PB192	Simultaneously recording Serial A data and dumping per mode 20	
26	A/PB128	Simultaneously recording Serial A data and dumping per mode 21	
27	B/PB2048	Simultaneously recording Serial B data and dumping per mode 17	
28	B/PB1024	Simultaneously recording Serial B data and dumping per mode 18	
29	B/PB960	Simultaneously recording Serial B data and dumping per mode 19	
30	B/PB192	Simultaneously recording Serial B data and dumping per mode 20	
31	B/PB128	Simultaneously recording Serial B data and dumping per mode 21	
32	P/PB2048	Simultaneously recording per mode 5 and dumping per mode 17	
33	P/PB1024	Simultaneously recording per mode 5 and dumping per mode 18	
34	P/PB960	Simultaneously recording per mode 5 and dumping per mode 19	
35	P/PB192	Simultaneously recording per mode 5 and dumping per mode 20	
36	P/PB128	Simultaneously recording per mode 5 and dumping per mode 21	
37	E/PB2048	Simultaneously recording per mode 4 and dumping per mode 17	
38	E/PB1024	Simultaneously recording per mode 4 and dumping per mode 18	
39	E/PB960	Simultaneously recording per mode 4 and dumping per mode 19	
40	E/PB192	Simultaneously recording per mode 4 and dumping per mode 20	
41	E/PB128	Simultaneously recording per mode 4 and dumping per mode 21	
42	ERASE	Erasing all non-volatile memory (NVM) (maintenance function)	
43	REMAP	Destructive remapping of NVM to exclude bad segments (maintenance)	
44	TEST	Non-destructive in-depth self-testing (maintenance function)	
45	POST	Power-on self-test mode	
>45	INVAL	Values of 46 through 63 are invalid (INVAL = yellow on black)	

5. BITE

SPECIAL COMP

GOOD

(dark-slate-gray on black)

Operational Self Test (OST) results are continuously displayed in this field. The following table defines the OST BITE:

SSR1	SSR2	DISPLAYED CONDITIONS			
V75X2943E	V75X2843E	0	1	1	1
V75X2942E	V75X2842E	0 or 1	0	1	1
V75X2960E	V75X2860E	0 or 1	0 or 1	0	1
		CBF	NCBF	REJ	GOOD

CBF = Critical BITE Failure (red on black)

NCBF = Non-Critical BITE Failure (yellow on black)

REJ = Command Rejected (yellow on black)

#### GRAPHICAL DATA MANAGEMENT DISPLAY AREA, GENERAL DESCRIPTION

This area of the application is used to display the current status of each segment of the memory area, per figure 7.37-2.

When first started, the display defaults to the smallest possible size: all the SSR telemetry on the upper part of the display is visible, and there is a partial row (or "slice") of data positions displayed on the data management area. When the display is expanded horizontally, up to 102 positions appear. 102 positions make up a "slice" of memory for the purpose of describing this display. When the display is expanded vertically, a new slice is displayed below the current slice, with each position exactly 102 positions beyond the position above it. More slices (up to 8) can be viewed as the display is expanded vertically, until all of the memory codes can be seen in one window. Since the total memory (811 positions) cannot be divided evenly by the slice size, there are blank segment areas at the bottom right of the fully expanded display.

For each slice, there are three rows, or lines, of information. In the top line of each slice is a code for the input data recorded at that position, and below that are two lines of status. Different types of status indicators will have a different background color as noted later. Where there is no status indicator, the background of the status line will be white (with a faint gray shade), to match the surrounding non-status area.

There is a field (white number on black background), located in the top portion of the display (next to the auto-stop status), which shows the position number of the mouse pointer location, as it moves across the graphical area of the display. When the mouse pointer is situated over a particular position's input or status code, the number of that position is displayed in the mouse pointer location field. Each position will contain detailed information, to be described later, which can be viewed in a daughter window, called "Position Details" when the mouse pointer moves over the associated position segment (see figure 7.37-3). When the position indicator increments in record mode, the details for that position are updated to reflect the new information.

Figure 7.37-3: Position Details window

#### DATA SOURCE CODE

D, V, A, B, E, \* or (black on specified backgrounds or reverse)

**D** indicates data recorded from the Serial A input when NSP RCD Voice V74X4799E = 0 and V74X4798E = 1, indicating OFF. Default background is white (faint gray), and when new data is recorded on a segment, the background turns or stays white. If a segment is recorded with four or more total seconds of LOS data, the background will turn red for that segment. See section 9 for more LOS requirement definitions. After the application determines that the LOS segment was dumped, the red background will turn orange. The application determines that the data was dumped when (1) that segment is included in a non-queued PB (verified by that segment number appearing in the telemetry while in the PB mode) and (2) when a queue is cleared while in a PB Q mode. If the Data Source Code field is right-mouse clicked or swiped, a dialog box will pop up entitled "Data Source Options" (see figure 7.37-4), and the Data Source Code line for the clicked or swiped segment(s) will be highlighted in purple.



Figure 7.37-4: Data Source Options window

Seven options will be presented in the "Data Source Options" dialog box: verify data, build commands, delete slot, data source color, data source value, replace queue value, and cancel. If verify data is clicked, the data source code background will change to light gray for the selected (swiped) segments. The build commands operation (see figure 7.37-5) is explained in SCP 3.22. The delete slot option will delete all queues in contact with the selected area, in order to allow the flight controller to get the display back in sync with the SSR after an SPC initiated dump. Selecting data source color (see figure 7.37-6) will allow the user to select a red, orange, green, or white (faint gray) background for the data source code in the positions selected. Selecting data source value (see figure 7.37-7) will allow the user to change previously written data source codes in the selected area to D, V, or B. Selecting replace queue value (see figure 7.37-8) allows the user to change the value of the previously written queue number of the queue within which the right mouse selection was initiated. Cancel allows the user to close the window without selecting anything.



Figure 7.37-5. Command Build window



Figure 7.37-6. Data Source Color Select window



Figure 7.37-7. Data Source Value window



Figure 7.37-8. Replace Queue Value window

**V** indicates data recorded from the Serial A input when NSP RCD Voice V74X4799E = 1 and V74X4798E = 0, indicating ON. Background color and mousing behavior for "D" code also apply to "V, A, E, and B" codes.

**A** indicates data recorded from the Serial A input when V74X4799E equals V74X4798E, indicating an error condition. Serial A (D or V) data is also being recorded in all the "P" record modes. Background color and mousing behavior for "D" code also apply to "V, A, E, and B" codes.

"D" code also apply to "V, A, E, and B" codes.

**B** indicates data recorded from the Serial B input. Background color and mousing behavior for

E indicates data recorded from the parallel E inputs. If the Engine Position (EPOS) indicator is inhibited when parallel recording is started via the RCD PAR command (confirmed by mode telemetry) the total E area (0-161) will be indicated as E. The exact positions of each Engine data area and duration of each segment recording are listed in the Systems Brief. LOS and dumped status are not indicated for E data unless EPOS is enabled; however, after recording in parallel mode, when the Parallel Protect bit (see next section) goes low, each E segment background will turn light gray and remain that way until the segment is overwritten. Since the "E" modes cannot be commanded directly, without going through a "P" mode, the E data source codes will only be initiated by the application when in any P mode; the E codes will persist until overwritten by a new data source code, one segment at a time. If the EPOS is enabled when parallel recording is started, the EPOS indicators (1, 2, and 3) will appear for all three engines and track the actual position of recorded SSME data; when EPOS leaves a position, it will write the E source code as well as details in the database. Background color and mousing behavior for "D" code also apply to "V, A, E, and B" codes.

indicates the current value of the position indicator. The position indicator moves to the next position when the position telemetry increments. If the position indicator freezes in one position for 40 seconds while in a serial record mode, the star will turn red to alert the user to a potential malfunction.

indicates the position of a queued playback when the telemetry position indicator is indicating the record position.

#### 8. DATA STATUS CODE

q/r, S, **1**, **2**, P (black on light backgrounds or reverse)

**q/r** is the number of the defined dump *queue* and dump *rate* for that defined segment. Since there is no telemetry to indicate which queue is being dumped (although there is an indication of number of queues), individual queue numbers are tracked by the application. There are zero defined queues following a maintenance mode operation. There are four ways to modify queue numbers. These rules apply to all dump rates.

- When the operator sends a set of commands to define the start and end of a playback queue, and the queue count telemetry subsequently increments, the updated queue count equals the number of the latest queue defined. This application will read the queue definitions from the queue start, queue end, and rate values in the uplinked command's title.
- 2. When the operator sends a command to dump queued data at a particular rate and the SSR subsequently signifies successful completion of a playback by decrementing the queue count, the queue definition of the played back segment is deleted, and the queue numbers greater than the deleted slot are decreased by one (e.g., if queue 5 is dumped and deleted, queue 6 is renumbered to 5, queue 7 becomes queue 6, etc.). Note that the PB QUE 1024 command causes the eventual dumping and undefining of all the predefined 1024 queues (lowest queue number first) unless a STOP PB is commanded. If the dump sequence is stopped, any partially dumped queue (and definition) will remain.
- 3. When the operator sends a command to clear queue N, that queue will be deleted, and the higher queue numbers will be decremented. Also note that the queue can be cleared by the mousing operation previously described in section 7.

INCO/COMM/JSC-12829 9/1/2004: **REV G** 

> 4. When the operator sends a command to clear all queues, all queue definitions will be deleted.

Queue values are 0 through F<sub>H</sub>. Rate codes are marked below the queue values. Each of the five rate codes has a different background color, and accordingly, all the queue of a certain rate will show the same background color for the rate code. The following rate codes apply:

0 = 960 (light blue) 1 = 128 (pink)2 = 192 (yellow-green) 4 = 1024 (light green) 8 = 2048 (light blue-green)

- **S** (black on vellow) indicates that an auto-stop has been enabled at that position. When the auto-stop is cleared, the S will disappear (the S will show only when the enable telemetry bit = 1). This application will get the position of the auto-stop from the uplink real-time command (RTC) title. If the auto-stop position is commanded to a protected area (or defined queue), the auto-stop will revert to the last unprotected segment before the protected area. This status indicator will be shown in the foreground, superceding any other status designator.
- (white on black) indicates that position register 1 is storing the indicated position. The application will get the position from the current position indicator when uplinked. This position will remain stored until another position is defined for position register 1. This status indicator will be shown in the foreground, superceding any other status designator except for S. The command to store position will be accepted by the SSR only when in the standby mode.
- 2 (white on black) indicates that position register 2 is storing the indicated position in the same manner described for position register 1. This status indicator will be shown in the foreground. superceding all status designators except the S and 1.
- P (black on white) indicates that the E data region protect telemetry bit = 1. The segment numbers covered by this protection are always positions 0 through 161. This status indicator is in the background and superceded by all other status. V75X2950E indicates status of main engine data region protection for SSR1 and V75X2850E indicates this status for SSR2.

#### 9. DATA SEGMENT DETAILED DATA

When the mouse is situated over a particular position, a "details" window will appear and persist with the following information (see figure 7.37-3):

- 1. Functional position number (e.g., Position 555)
- Start time of recording in this segment position (e.g., Start OGMT DDD:HH:MM:SS)
- 3. Number of seconds of AOS data in this segment (e.g., 12 sec AOS data)
- 4. Number of seconds of LOS data in this segment (if applicable)

This application will project LOS data and fill in the LOS details for D or V data source codes only. When NSP RCD Voice is ON (V code), segment time is 21.8 seconds; when NSP RCD Voice is OFF (D code), segment time is 32.8 seconds. Positions with A or B data source codes will show AOS times but not LOS times. If AOS appears at an advanced position, the application will also fill in any non-projected LOS gaps with a continuation of the same data source codes with a red background, deleting previously stored details at these filled-in LOS positions. The information contained in the Position Details window will update automatically as the mouse moves across the memory segments in the graphical area of the application. Positions with E data will not contain these details, other than position number, unless EPOS was enabled when parallel recording commenced.

10. LOG BUTTON

There is a log button on the display, which can be clicked to bring up a daughter window (see figure 7.37-9). The window can be expanded and scrolled. The log data is automatically updated, and the log file is saved after each entry; the log file is not deleted when the application is closed normally or abnormally and can be deleted or appended (optionally) when the application is restarted. The log window has a print menu with start/stop time limits for printing log entries. The log adds an OGMT time entry, current mode, and current position indicator on most line items, per the following list:



Figure 7.37-9. Log File window

- 1. Start of any LOS period of 4 or more seconds
- 2. End of any LOS period of 4 or more seconds
- 3. Any mode change
- 4. Any change in OST BITE status
- 5. Any change in MMU power telemetry status
- 6. Any change in status of MMU inputs to Ku or FM systems
- 7. Uplink of any SSR1(2) command (display specific)
- 8. Any change in FM system power status
- (OGMT/MODE/POSN Restarted SSR1(2) MGMT APP) Start/restart of the SSR management application
- (OGMT/MODE/POSN Time discontinuity) OGMT discontinuity, adding >1 hour or subtracting >1 minute, signifying start of another SIM run
- 11. (OGMT/MODE/POSN NSP Voice OFF(ON)) Change in D/V codes

The user can edit the field to the right of a log entry. The user entries will be saved and printed along with the automatic log.

11. POWER 1 = ON 0 = OFF (green on black) (yellow on black)

V72S7185E indicates switch status of the input power to MMU1.

V72S7186E indicates switch status of the input power to MMU2.

12. OPTIONS MENU

OPTIONS	
Self Test SSR1	
Build Commands	
Clear Status Codes	
Clear ALL Data Codes	
Zeroize LOS Time	
☐ Enable EPOS	
Manual Mode >	Enter Mode
KEY	Enter Data Source Code
	Enter Number of Queues (1-15)
	Enter Position Indicator

Figure 7.37-10. Options Menu.

Self Test SSR1(2) will bring up the appropriate Self Test monitoring display. Build

Commands

in SCP 3.22 (and shown in the display. **Clear ALL Data** selected, it will clear all data will bring up the SSR command build window, which is described figure 7.37-4). **Clear Status Codes** will clear all status codes on **Codes** will pop up a worry box (see figure 7.37-11); then if OK is codes on the display.

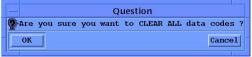


Figure 7.37-11. Clear All worry box

**Zeroize LOS Time** will reset the displayed LOS time, which appears in the upper portion of the display, to zero. **Enable EPOS** is a toggling enable/inhibit function with an indicator button that appears indented when EPOS is enabled. **Key** will bring up a window showing the definition of all symbols on this display (see figure 7.37- 12).

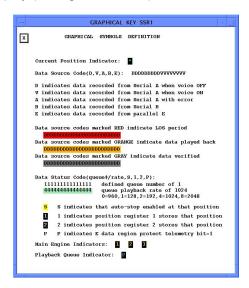


Figure 7.37-12. Graphical Key

SHUTTLE OPS

INCO/COMM/JSC-12829 9/1/2004: REV G

**Manual Mode** will pop up the submenu shown in figure 7.37-10. On the submenu, **Enter Mode** (shown in figure 7.37-13) allows the user to override the MODE telemetry for use in automatically defining the graphical data area. An important note is that the MODE telemetry in the upper portion of the display will not change to reflect the override that the user performed by using this Manual Mode feature. **Enter Data Source Code** (shown in figure 5.37-14) allows the user to override the telemetry driving the source code to be written on the display as the position advances.



Figure 7.37-13. Optional Mode Override



Figure 7.37-14. Optional Data Source Override

**Enter Number of Queues (1-15)** (shown in figure 7.37-15) allows the user to set the value of the number of the next queue to be built; the number of queues must be entered in decimal instead of hexadecimal due to limitations in the program. **Enter Position Indicator** (shown in figure 7.37-16) allows the user to override the position telemetry at a point in time; from then on, the display will increment the position indicator one position every time it sees a change in position telemetry.



Figure 7.37-15. Optional Queue Value Override



Figure 7.37-16. Optional Position Number Override

13. REPT BUTTON

This button calls the Dump FEP Report application. This application is described in SCP 9.4.

SHUTTLE OPS MMU/SSR MANAGEMENT

INCO/COMM/JSC-12829 9/1/2004: REV G SCP 7.37

#### 14. COLD PLATE TEMP

LOOP 1

LOOP 2

These are analog temperature measurements for cold plates in AV BAY 1 (SSR1) and 2 (SSR2). LOOP 1 uses V61T2615A for SSR1 and V61T2618A for SSR2. LOOP 2 uses V61T2616A for SSR1 and V61T2619A for SSR2. Loop 1 Pump Flow Rate is V61R2742A; Loop 2 Pump Flow Rate is V61R2722A.

The following logic drives the colors:

If a particular loop temp (either or both) is <34, make color of applicable loop temp yellow

Else, If a particular loop pump flow rate is <501 and the other is >500, make the color of the first (low rate) loop temp gray

If both loop pump flow rates are <501, make both loop temps yellow

Else, if a particular loop pump flow rate is >500, the following temp values drive the color:

34 to 119 loop temp = green

120 to 129 loop temp = yellow

>129 loop temp = red

15. LOS TIME HH:MM:SS (green on black)

The application totals and displays the D and V combined times of non-dumped LOS data.

16. PBQ TIME HH:MM:SS (green on black)

The application totals and displays the D and V combined queued PB times. PB queues are identified with a PB rate: A rate of 960 takes 4.4 seconds per position, while a rate of 1024 takes 4.1 seconds per position. PBQ TIME decrements during a PB as each queue is deleted.

#### **TITLE**

**GCIL BIT DISPLAY** 

#### **GENERAL**

The GCIL BIT display is a tool to calculate which of nine GCIL command bits have failed and to determine the affect of uplinking any other GCIL commands. Figure 7.38-1 is a description of the display and how it works.

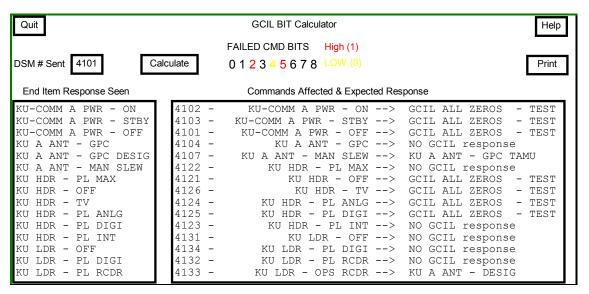


Figure 7.38-1. GCIL BIT calculator

## **DISPLAY DESCRIPTION**

The buttons and scrolled lists on this display are described as follows. A series of lights is used to show which bits have failed. These lights are described also.

- A. **Quit** The Quit button is used to terminate the execution of the program and to clean up the workstation memory used by the program upon termination.
- B. **Help** The Help button is used to open a small window that gives the user information about how to use the program.
- C. Calculate This button is used to start the process of determining which command bits have failed (high or low). Once this button is pressed, the application compares the command bits from the DSM that was typed in against the command bits of the end item response selected from the list. When the comparison is completed, the rest of the GCIL commands are laid against those bits to determine if they are affected or not. If they are affected, the end item response for those commands is determined and displayed.
- D. **Print** When this button is pressed, a printout of the report just created by the Calculate button is generated. If there was a problem with the calculation in step C, the printout may be an old report or no report at all. If there is not a "gcilbit output" file, there is no report at all.
- E. **End Item Response** This scrolling list contains all the possible responses to the commands that can be sent to the GCIL. These data are read from the data file. It is the command title field in the file. The user selects from the list by pressing the left mouse button when pointing to the desired response.

- F. **Failed Cmd Bits** These nine digits are activated after a failure has been determined. If the bit is failed high, the digit for that bit turns red. If the bit is failed low, the digit is yellow. If the bit did not fail either direction, the digit is gray.
- G. **Commands Affected & Expected Response** This scrolled list shows the report generated by the program. The part of each line farthest left is the DSM, followed by the command title and the expected response to the command being uplinked. If the GCIL does not execute the command because the bit failure combination would cause an invalid command, the report displays "NO GCIL response."
- H. Error Messages There are several error messages that can be generated by this display. Only one of them is caused by a fatal problem with the program. A listing of those messages and where they can be seen follows.
  - "gcilbit NO data file found" This message can be seen on the dxconsole window when attempting to start the display. The reason for this message is that no data file was supplied to the display at run start. The display will never run as long as there is no data file supplied.

The following messages appear in the Commands Affected & Expected Response scrolled list.

"No DSM was entered!" - The user did not type in a DSM number.

"DSM xxxx not found in the GCIL database!" - The user types in a DSM number "xxxx" that is not a valid GCIL command DSM number or is not in the data file read at run start.

"No End Item was Selected!" - The user did not select an end item response from the list.

"No Calculations Done" - The user has not attempted to calculate a command bit failure pattern.

"The correct end item response for the CMD was seen" - The user selected the normally expected end item response for the DSM entered.

#### **TITLE**

SELF TEST RESULTS SSR 1(2) v1.0

## **GENERAL**

A. The purpose of these MSKVIEW displays is to view the results of self-test data obtained from the Solid State Recorders. The recorders will output this data following a Power On Self Test (POST), initiated upon MMU power-up, or a Comprehensive Self Test (CST), initiated by command. This data is output from the recorders briefly before returning to STBY mode. POST results are output for two seconds following a 70-second internal test and CST results are output for 10 seconds following a 140- to 150-second internal test.

9/1/2004: REV G

A comp (ssr\_COMP) was generated to capture this data and retain these results for future reference. When the recorders output the test results they utilize the same MSIDs that would normally be used for status/telemetry. For this reason, ISP Symbols were generated based off of the MSIDs to substitute for the alternate meaning of this telemetry stream during the self-test data output time. Listed below in Section C are the ISP Symbols and their original respective MSID drivers that are used by the COMP to show the results of the tests.

The display is shown in figure 7.39-1 and is set up in such a way that the POST parameters are on top and are referred to in numbers 2 through 6 in this SCP. The CST parameters are on the bottom portion of the display and are subdivided into the hardware cards that make up the SSR. Numbers 7 through 17 detail Input/Output Card parameters, 18 through 22 detail Single Board Computer parameters, and 23 through 28 detail Flash Memory parameters. The initial state for the display is set up in such a way that four yellow dashes (----) will be displayed for all parameters (except GMT) until self-test results are produced with the comp active. The comp is connected to the INCO workstation and will start when INCO logs in. The parameter colors for this display will become active when the ISP LIMIT MANAGER is started.

- B. Location of Displays: INCO>DISPLAYS>DATA COMM SYSTEMS>SELF TEST SSR 1(2)
- C. Detailed display description:

1. GMT M50Q0027HP TIME (green)

This parameter indicates the current Greenwich Mean Time.

2. Single Board Computer  $SBC_1$  1 = GOOD 0 = FAIL (V75X2943E) (green) (red)

This parameter indicates the status of the SSR 1 Single Board Computer following a POST. The SBC initiates a test of itself, stores these results in its memory and then initiates a test of the I/O Card and Flash Memory Card. SBC\_2 (V75X2843E) is used for this SSR 2 parameter.

3. Input/Output Card  $I_O_CARD_1$  1 = GOOD 0 = FAIL (V75X2942E) (green) (red)

This parameter indicates the status of the SSR 1 Input/Output Card following a POST. Specifically the I/O Card's outputs are routed to the inputs for bit pattern testing. I\_O\_CARD\_2 (V75X2842E) is used for this SSR 2 parameter.

0 = FAIL

(red)

This parameter indicates the status of the SSR 1 Flash Memory Card following a POST. Specifically, the Flash Memory Read/Write and Block Transfer functions are tested. MEM\_CARD\_2 (V75X2841E) is used for this SSR 2 parameter.

5. Available Memory Positions POST\_POSN\_1 1 = GOOD (SSR1 POSITION) (green)

9/1/2004: REV G

This parameter indicates the number of available memory segments following a POST. POST POSN 2 (SSR2 POSITION) is used for this SSR 2 parameter.

6. LAST POST GMT POST\_STBY\_GMT\_SSR1 TIME (V75W3504D) (green)

This parameter indicates the last Greenwich Mean Time (GMT) that Power On Self Test (POST) results were obtained. POST\_STBY\_GMT\_SSR2 (V75W3504D) is used for this SSR 2 parameter.

7. ENGINE 1 ENGINE1\_1 1 = GOOD 0 = FAIL (V75X2943E) (green) (red)

This parameter indicates the status of the EIU 1 input (data from the center Main Engine) into the SSR I/O Card following a CST. ENGINE1\_2 (V75X2843E) is used for this SSR 2 parameter.

8. ENGINE 2 ENGINE2\_1 1 = GOOD 0 = FAIL (V75X2942E) (green) (red)

This parameter indicates the status of the EIU 2 input (data from the left Main Engine) into the SSR I/O Card following a CST. ENGINE2\_2 (V75X2842E) is used for this SSR 2 parameter.

9. ENGINE 3 ENGINE3\_1 1 = GOOD 0 = FAIL (V75X2941E) (green) (red)

This parameter indicates the status of the EIU 3 input (data from the right Main Engine) into the SSR I/O Card following a CST. ENGINE3\_2 (V75X2841E) is used for this SSR 2 parameter.

10. SOURCE A1 SOURCE\_A1\_1 1 = GOOD 0 = FAIL (V75X2940E) (green) (red)

This parameter indicates the status of the A1 input (data from NSP 1) into the SSR I/O Card following a CST. SOURCE\_A1\_2 (V75X2840E) is used for this SSR 2 parameter.

11. SOURCE A2 SOURCE\_A2\_1 1 = GOOD 0 = FAIL (V75X2931E) (green) (red)

This parameter indicates the status of the A2 input (data from NSP 2) into the SSR I/O Card following a CST. SOURCE\_A2\_2 (V75X2831E) is used for this SSR 2 parameter.

12. SOURCE B SOURCE\_B\_1 1 = GOOD 0 = FAIL (V75X2929E) (green) (red)

This parameter indicates the status of the B input (payload data) into the SSR I/O Card following a CST. SOURCE B 2 (V75X2829E) is used for this SSR 2 parameter.

13. SOURCE MDM SOURCE\_MDM\_1 1 = GOOD 0 = FAIL (V75X2927E) (green) (red)

SHUTTLE OPS INCO/COMM/JSC-12829 9/1/2004: REV G

This parameter indicates the status of the command input and status output of the SSR I/O Card following a CST. SOURCE\_MDM\_2 (V75X2827E) is used for this SSR 2 parameter.

14. ADRSS RGST ADRSS\_RGST\_1 1 = GOOD 0 = FAIL (V75X2923E) (green) (red)

This parameter indicates the status of the SSR I/O Card address registers following a CST. ADRSS RGST 2 (V75X2823E) is used for this SSR 2 parameter.

This parameter indicates the status of the SSR I/O Card VME (back pane) interface registers following a CST. In general, this is how the I/O Card communicates through the back pane with the SBC and Memory Card. VME\_INTFCE\_2 (V75X2822E) is used for this SSR 2 parameter.

16. SRAM SRAM\_1 1 = GOOD 0 = FAIL (V75X2960E) (green) (red)

This parameter indicates the status of the SSR I/O Card Static Random Access Memory (SRAM) following a CST. In general the SRAM is the link between data received by the I/O Card from an input source (A1, A2, B, etc...) and the data's positional destination on the SSR Memory Card. SRAM is also used as a link from the Memory Card back to the I/O Card for dumping of the data. SRAM\_2 (V75X2860E) is used for this SSR 2 parameter.

This parameter indicates the status of the SSR I/O Card Interrupt Request Protocol following a CST. In general, the I/O Card uses an Interrupt method of requesting and sending information between sources. INTERRUPT\_2 (V75X2859E) is used for this SSR 2 parameter.

18. SBC INTFACE SBC\_INTFCE\_1 1 = GOOD 0 = FAIL (V75X2950E) (green) (red)

This parameter indicates the status of the SSR Single Board Computer (SBC) Tundra VME interfaces following a CST. In general, this is how the SBC Card communicates through the back pane with the I/O Card and Memory Card. SBC\_INTFCE\_2 (V75X2850E) is used for this SSR 2 parameter.

19. TIMERS TIMERS\_1 1 = GOOD 0 = FAIL (V75X2949E) (green) (red)

This parameter indicates the status of the SSR SBC Card User & Combined Timers following a CST. TIMERS\_2 (V75X2849E) is used for this SSR 2 parameter.

20. DRAM ADRSS DRAM\_1 1 = GOOD 0 = FAIL (V75X2948E) (green) (red)

This parameter indicates the status of the SSR SBC System DRAM Memory Data/Address following a CST. DRAM 2 (V75X2848E) is used for this SSR 2 parameter.

21. ECC LOGIC ECC\_LOGIC\_1 1 = GOOD 0 = FAIL (V75X2947E) (green) (red)

This parameter indicates the status of the SSR SBC ECC Logic following a CST. ECC\_LOGIC\_2 (V75X2847E) is used for this SSR 2 parameter.

## SHUTTLE OPS INCO/COMM/JSC-12829

22. EEPROM

ICO/COMM/JSC-12829 9/1/2004: REV G

1 = GOOD 0 (green) (r

0 = FAIL (red)

This parameter indicates the status of the SSR SBC EEPROM Check-Sum following a CST. In general the EEPROM is the location where the SBC software resides and executes. EEPROM\_2 (V75X2834E) is used for this SSR 2 parameter.

23. REGISTERS

MEM\_RGSTS\_1 (V75X2921E)

EEPROM 1

(V75X2934E)

1 = GOOD (green)

0 = FAIL (red)

This parameter indicates the status of the SSR Flash Memory Registers following a CST. MEM RGSTS 2 (V75X2821E) is used for this SSR 2 parameter.

24. REMAP CIRCUIT

MEM\_REMAP\_1 (V75X2913E)

1 = GOOD (green)

0 = FAIL (red)

This parameter indicates the status of the SSR Flash Memory Remap Circuit following a CST. MEM\_REMAP\_2 (V75X2813E) is used for this SSR 2 parameter.

25. BLOCK TRNSFR

BLK\_TRNSFR\_1 (V75X2911E)

1 = GOOD (green)

0 = FAIL (red)

This parameter indicates the status of the SSR Flash Memory Block Transfer D64BLT following a CST. In general, Block Transfer is the method used by the SSR to read and write data from the Flash Memory Card. BLK TRNSFR 2 (V75X2811E) is used for this SSR 2 parameter.

26. EDAC LOGIC

EDAC\_LOGIC\_1 (V75X2909E)

1 = GOOD

(green)

0 = FAIL (red)

This parameter indicates the status of the SSR Flash Memory EDAC Logic following a CST. EDAC LOGIC 2 (V75X2809E) is used for this SSR 2 parameter.

27. EEPROM

MEM\_EEPROM\_1 (V75X2905E)

1 = GOOD (green)

0 = FAIL (red)

This parameter indicates the status of the SSR Flash Memory Image EEPROM Check-Sum following a CST. MEM\_EEPROM\_2 (V75X2805E) is used for this SSR 2 parameter.

28. LAST CST GMT

TEST\_STBY\_GMT\_SSR1 (V75W3504D)

TIME (green)

This parameter indicates the last Greenwich Mean Time (GMT) that Comprehensive Self Test (CST) results were obtained. TEST\_STBY\_GMT\_SSR2 (V75W3504D) is used for this SSR 2 parameter.

9/1/2004: REV G

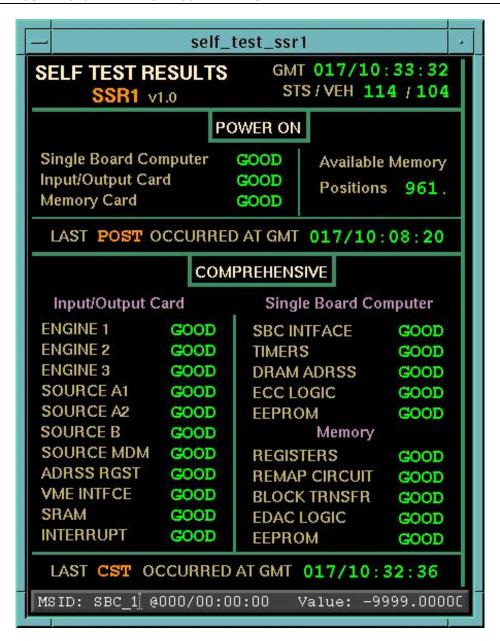


Figure 7.39-1: SELF TEST SSR 1 Display

#### **TITLE**

COMMAND CONFIGURATION DISPLAY

#### **GENERAL**

This command display is the tool for uplinking commands once the command system has been configured. The display Figure 7.40-1 is made up of two lower level displays. One of the lower level displays is the command configuration display, and the other is the Multiple Command Matrix (MCM). The primary users of this display are the INCO, COMMAND, and PAYLOADS positions.

**REV G** 

9/1/2004:



Figure 7.40-1. Example of the Command Config DSM display

#### **DISPLAY DESCRIPTION**

The following discussion is divided into three major sections. The first section discusses the parts of the display that are common to both of the lower level displays. The second section discusses the command configuration display in detail. The third section details the parts of the MCM display.

### A. Top Section

The top section (Figure 7.40-2) contains some general information about the users of the display and their ability to uplink commands.

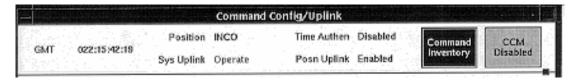


Figure 7.40-2. Example of the top section

**GMT** - The current GMT is displayed here. The update rate is every 5 seconds.

**Position -** The position that was selected at the startup of the command manager on the workstation. The available positions are INCO, RF COMM, INST, DATACOMM, INCO01, and INCO02.

9/1/2004: REV G

**Sys Uplink -** The uplink state of the command system. Operate (green) indicates that commands are being uplinked to the orbiter. Safe (red) indicates that commands are not leaving the MCC.

**Time Authen -** This indicator displays whether time authentication is enabled (green) or disabled (yellow).

**Posn Uplink** - This indicator displays the uplink state of the workstation. Enabled (green) means the workstation has permission to send commands or command configuration changes to the server to be uplinked. Disabled (red) means the workstation does not have permission to send commands or command configuration changes to the server. See SCP 5.1 for the procedure to initialize the workstations for command.

**Command Inventory -** This button pops up a display that lists commands by Digital Select Matrix (DSM) number. There is more discussion on the command inventory later in this briefing.

**CCM Disable -** This button toggles between allowing the workstation to send commands (enabled - green) and not allowing the workstation to send commands (disabled - red).

# A. Command Config

The bottom of the display is the command config or MCM. This section discusses the command config part of the display (see Figure 7.40-3).

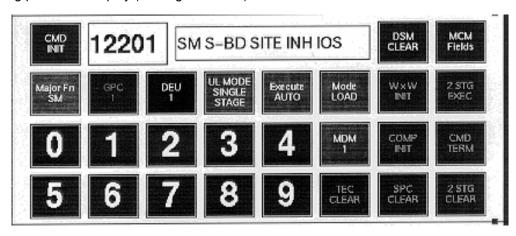


Figure 7.40-3. Command config display

There are several parts to the command config section of the display. Just under the top common section is the first row of buttons that are unique to the command config section.

The first row of buttons has five selection choices.

**CMD INIT** - This button is used to request the uplink of the DSM located in the DSM number box to the right. The button is orange when a DSM is selected and uplink is enabled. The button is gray with black text when no DSM is selected or uplink is disabled.

**DSM Number box** - The blue box to the right of the CMD INIT button is where the DSM selected for uplink is displayed. The user can select from the Command Inventory popup window or "dial in" the DSM number from the keypad provided on the display. If the command number entered is safed, the DSM number, as well as the command title, is displayed in red characters. If the command load is nonexistent, the DSM is displayed in red characters, but no title is displayed.

**DSM Title box** - Once a valid DSM number has been entered, the title for the command is displayed in the label box to the right of the DSM box.

9/1/2004: REV G

**DSM CLEAR** - This button clears the DSM number and title selected. If the command is safed, nonexistent, if the command server is safed, or if the server has a System Error (SYSE), this button turns red.

**MCM Fields** - This button changes the middle part of the display to the MCM section. At startup, the command config section is displayed in the middle. If the user does not want to have to switch back and forth with the MCM/DSM button in the upper right-hand side of the display, he/she needs to start a second copy of the display.

The second row of buttons has eight selections.

**Major Fn** - This button is used to select the orbiter software major function to which the commands are to be sent. The following is a list of the possible major functions.

SM - green BFS - yellow P/L - gray GNC - red

**GPC** - This button is used to select a particular General Purpose Computer (GPC) to which to send a command. When this button is pressed, the Major function button is grayed out. When the Major function button is pressed again, the GPC button is grayed out. The list of possible labels displayed on the button are GPC 1, GPC 2, GPC 3, GPC 4, GPC 5, and GPC ALL. When this button is active, the background is blue-gray with black text.

**DEU** - This button is used to select the Display Electronics Unit (DEU) to which a DEU equivalent command will be sent. For a DEU equivalent command to execute correctly, the user must select the correct major function for that DEU. The list of DEUs is as follows: DEU 1, DEU 2, DEU 3, and DEU 4. When this button is active, the background is yellow with black text. This button is always yellow, but does not affect any uplinked commands, except DEU equivalents, because other command types do not affect what state this button is in.

**UL MODE** - This button is used to select the mode of the uplink (single or two stage). Single-stage commands do not require a comparison by the command server, while two-stage commands do. When single stage is selected, the button label is green and shows UL MODE SINGLE STAGE. When two stage is selected, the button is yellow and shows UL MODE TWO STAGE.

**Execution Mode** - This button is used to select between auto execution or manual execution of two-stage commands. When AUTO is selected, the button is green. When MANUAL is selected, the button is red.

**CMD Type** - This button is used to select between RTC and LOAD type commands. When RTC is selected, the "Command Inventory" popup display shows only the RTC commands in the command server, and the button is yellow. When LOAD is selected, the "Command Inventory" automatically changes to display the load type commands and the button is green. If a DSM is displayed and the CMD Type button is pressed, the DSM number and title disappear. The user is not be allowed to enter a DSM number larger than four characters while in RTC mode or five characters while in LOAD mode.

**WxW INIT** - This button is not active (red) until a DATA REJECT is detected on a two-stage command on the GNC, SM, or GPC 1 - ALL. For the BFS major function, the button does not light up. The button is grayed out the rest of the time.

9/1/2004: REV G

- **2 STG EXEC** This button is not active (red) until a two-stage command is uplinked in manual execute mode or a two-stage command is uplinked with some reject indicated. The button is grayed out the rest of the time.
- **0 4** These buttons are used for "dialing" in a command DSM number.
  - **MDM 1** This button is used to select the payload MDM to which the uplinked commands are passed. The options are MDM 1 (green) and MDM 2 (yellow).
  - **COMP INIT** This button becomes active (red) when a TLM REJECT is detected on a two-stage command. The button is grayed out the rest of the time.
  - **CMD TERM** This button allows the user to terminate a two-stage command while it is being uplinked. It is red-colored as long as the panel is enabled for uplink, otherwise it is grayed out.
- **5 9** These buttons are used for "dialing" in a command DSM number.
  - **TEC CLEAR** This button is active (green) once the user is enabled for uplink by the COMMAND position and they CCM Enable themselves. The button is grayed out otherwise. The button sends the command to clear the time-executed command buffer.
  - **SPC CLEAR** This button is active (green) once the user is enabled for uplink by the COMMAND position and they CCM Enable themselves. The button is grayed out otherwise. The button sends the command to clear the stored program command buffer in the major mode that is selected on button row 2.
  - **2 STG CLEAR** This button is active (green) once the user is enabled for uplink by the COMMAND position and they CCM Enable themselves. The button is grayed out otherwise. The button sends the command to clear the two-stage button in the major mode that is selected on button row 2.

# B. MCM

The top of the MCM display (Figure 7.40-4) is the same as the command config display. The bottom section contains four rows of buttons. The topmost row is used to select a set or field of commands. The bottom three rows are command buttons. The button configuration file is the same as the hardware command panel. When a change is needed to the configuration of the fields, the user should refer to the Hardware Command Panel User's Guide located in the INCO Console Handbook.



**REV G** 

9/1/2004:

Figure 7.40-4. Example of an MCM panel section

**Field Select Row** - The top row of buttons is used to select the field of commands that are displayed in the bottom three rows of buttons. The rightmost button in this row is used to switch back to the command config display, which is also called the Digital Select Matrix, or DSM. Each button on this row represents two fields of commands, as noted by the two rows of field names on each button. When a field select button is pressed, the top field name is highlighted and the field of commands is displayed in the three rows below. If the same button is pressed again, the bottom field name is highlighted and its field of commands is displayed in the three rows below.

**Command Field** - The bottom three rows contain the commands that can be sent from the selected field of commands. The button images are taken straight from the hardware command panel database. The difference between the hardware panel database and the images shown on these buttons is that the DSM number is added to the bottom of each command button. When a command is safed, the button associated with the command turns red, but when the command is unsafed, the button returns to the default gray color.

**Command Inventory** - This subdisplay (Figure 7.40-5) is used to select from the command inventory in the command server. There are several features of this small popup display that are discussed in the following section.

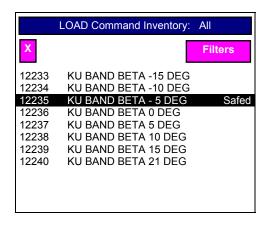


Figure 7.40-5. Load Command Inventory display

**Inventory Label** - At the top of the command inventory display is the command type and filter applied. The command types are LOAD or RTC. There are several types of filters that can be applied to the command inventory (see the discussion later in this SCP), but the name of the filter is added to the label at the top of the display.

9/1/2004: REV G

**Exit** - The button to close this popup display is located on the left-hand top of the display. The little "X" is the exit button.

**Filters** - This button opens a menu of filters that can be used to filter out commands that the user is not interested in viewing. There are several filters on various INCO systems, but there is one specialized filter available to filter partial DSM numbers. See Table 7.40-1 for the list of filters.

The DSM filter can be used by pressing the DSM filter button in the Filters menu. A type-in box appears between the filter button and the exit button. Type in the partial DSM number to search for, followed by an "\*" character, and the display shows all commands in the server that start with the partial DSM number. See Figure 7.40-6.

Once the user has selected from the command inventory popup display by pressing the left mouse button when the mouse cursor is located over the command desired, the display disappears. The next time the display is called up, the same filter setting apears.

Table 7.40-1. Filter list

Filter types							
DSM							
All	All DSM numbers						
For LOAD mode							
MSPCs	12101 - 50						
SPCs	10101 - 12050						
TFL/DFLs	12501 - 99						
TECs	13401 - 50						
Prestored TMBUs	12201 - 50						
For RTC mode							
S Band	4470 - 4475						
	4709 - 4756						
Antenna	4676 - 4707						
NSP	4758 - 4779						
Ku Band	4101 - 4154						
FM	4780 - 4794						
OPS 1	4300 - 4359						
OPS 2	4400 - 4458						
PLR	4500 - 4574						
MADS	4600 - 4632						
	5701 - 5767						
PL Comm	4800 - 4845						
CCTV	4185 - 4293						
GCIL	4370 - 4376						
HRM	6101 - 6186						
HDRR	6201 - 6241						
VAS	6001 - 6054						
VCR	6250 - 6277						



Figure 7.40-6. Example of command inventory

Note: A server restart or synchronization notification may appear in the form of a popup box that states, "Please wait while the command inventory is obtained from the Command Manager after this Server Restart or Server Synchronization." The position is not able to uplink commands from the software panel while the popup message is displayed. However, DSMs dialed into the Software Panel while the message is up are displayed on the command config display after the server notification disappears.

#### **TITLE**

**UPLINK VERIFY DISPLAY V1.3** 

## **GENERAL**

The Uplink Verify display (Figure 7.41-1) includes all possible two-stage command buffer information for all the major functions available in the orbiter software.

# **DISPLAY DESCRIPTION**

This display is divided into several sections. The main sections of the display are the header and the GNC, SM, Ops 0, and BFS data sections. Each part will be discussed separately, but there are some generic parts that are common to each section.



The header area of the display includes a menu (Options) for selecting the major function sections that can be viewed. The current GMT time is displayed in this area along with the display title, version number, STS number, and vehicle number. The header is the only thing that is displayed when the display is started up. The user will have to select the major functions to view (maximum of two).

Each section contains a button in the upper left-hand corner that is used to close the section. There is a title that describes the major function that is being displayed. The command number (DSM no.) that is being uplinked to that major function is displayed with the number of command words that are being uplinked.

In the lower right-hand corner of the section is a button that calls up a small display with indications as to what errors were detected during uplink. All the command words uplinked are displayed in the middle of the section with the downlinked command words from that major function. The following is a table of the MSIDs that are downlinked for each major function:

Command words	GNC	SM	Ops 0	BFS
1	V92U6140CX	V92U6140CY	V92U6140CZ	V98U0021C
2	V92U6141CX	V92U6141CY	V92U6141CZ	V98U0022C
66	V92U6205CX	V92U6205CY	V92U6205CZ	V98U0086C
67	V92U6206CX	V92U6206CY	V92U6206CZ	V98U0087C

When there is no active uplink taking place or there are no data in the downlink telemetry, there is nothing displayed for uplinked data in the middle part of the section (refer to the GNC section of Figure 7.41-1). If for some reason the uplink and downlinked command words do not match, the GCS will set a flag on the command words with the problem. The uplink\_verify display will indicate which command words had a miscompare by changing the background color to red and the foreground color to white. The most common causes of miscompares are

- A. **Telemetry reject** Caused by missing downlinked command words. This is seen as all the command words turning red on the display. The reason for this rejection is that the major function being commanded to is not being downlinked at the current time or the orbiter is in a loss-of-signal period. Refer to Figure 7.41-2.
- B. **Data reject** Caused by some of the words miscomparing. This is seen as some, but not usually all, command words turning red. The reason for this reject is usually a weaker than normal radio

communications link that causes some of the bits in the command words to be garbled. Refer to Figure 7.41-3.

Each section contains a small display that will pop up when a command error occurs for the major function being commanded to. The description of these displays follows.

# **GN Major Function Command Errors Display**

The GN major function can transmit several indicators to help the user determine the cause of a command uplink problem. At the top of the GNC Command Errors table is the GPC number (V93Q0018CX) and the format (V93Q0022CX) currently downlinking the data on the major function. There are several boxes in the table that light up to show the user the problem. The following list provides the boxes and their associated MSIDs and meanings:

GPC/MF Check	V92X6125XX - A 1 (red) value indicates that the uplinked command did not pass the major function check.
Illegal Op	V92X6132XX - A 1 (red) value indicates that the uplinked command did not pass the operation code check for that major function.
Veh Add Error	V92X5997XX - A 1 (red) value indicates that the major function found that the vehicle address in the command was not correct.
EX PAR BUF	V92X5998XX - A 1 (red) value indicates that a two-stage buffer execute was attempted without a valid last command word flag.
U/L Act	V92X5032XX - A 1 (green) value indicates that the GPC is currently processing an uplinked command.
MDM Add Error	V92X5996XX - A 1 (red) value indicates that the MDM address in the command is out of the bounds of the valid address table.
TSC Error	V92X6134XX - A 1 (red) value indicates that a two-stage error was detected.
U/L Skip	V92X6126XX - A 1 (red) value indicates that the previous cycle of the uplink process was skipped or not completed and a previously uplinked command may not have been processed.

**FW/LW Error** V92X5995XX - A 1 (red) value indicates that a first or last command word error was detected.

# **SM Major Function Command Errors Display**

The SM major function can transmit several indicators to help the user determine the cause of a command uplink problem. At the top of the SM Command Errors table is the GPC number (V93Q0018CY) and format (V93Q0022CY) currently downlinking the data on the major function. There are several boxes in the table that light up to show the user the problem. The following is a list of the boxes and their associated MSIDs and meanings:

**GPC/MF Check** V92X6125XY - A 1 (red) value indicates that the uplinked command did not

pass the major function check.

Illegal Op V92X6132XY - A 1 (red) value indicates that the uplinked command did not

pass the operation code check for that major function.

Veh Add Error V92X5997XY - A 1 (red) value indicates that the major function found that the

vehicle address in the command was not correct.

**EX PAR BUF** V92X5998XY - A 1 (red) value indicates that a two-stage buffer execute was

attempted without a valid last command word flag.

SPC Full V92X6128XY - A 1 (red) value indicates that an attempt was made to put a

stored command into a full SPC buffer (10 command maximum for OI-25 and

25 command maximum for OI-26).

MDM Add Error V92X5996XY - A 1 (red) value indicates that the MDM address in the

command is out of the bounds of the valid address table.

TSC Error V92X6134XY - A 1 (red) value indicates that a two-stage error was detected.

TEC Full V92X1125X - A 1 (red) value indicates that an attempt was made to put a time

executed command in a full TEC buffer (25 commands maximum).

**FW/LW Error** V92X5995XY - A 1 (red) value indicates that a first or last command word

error was detected.

TMBU REJ V92J0660C - Indicates (red) that the uplinked TMBU has some error in it. If

the MSID value is between 1 and 10, the possible problems are

1. If class 2 limit change is requested and no class 2 limit set is defined for FDA parameter

2. If class 0, 3, 4 limit change is requested and no class 0, 3, 4 limits are defined for FDA parameter

- 3. If class 0, 3, 4 limit change is requested and specified limit set does not exist
- If requested change is a high limit and changed parameter is a discrete
- 5. If parameter of a limit change is not processed by FDA
- 6. If analog or EU limit value exceeds allowable range
- 7. If parameter of a constant change is not a constant parameter. If the MSID value is equal to 11, the possible problems are
  - a. If TM SPEC is active when the load reaches the application
  - b. If the number of data sets is less than 1 or greater than 10

PL UL INV V92X1124X - A 1 (red) value indicates that either the contents of a payload

command were in error or the destination interface (PSP or SSI) was busy. This flag is also set when an uplink command is sent to an SM application that is not active (e.g., PDRS); also set when a TEC or R/T load attempts to inhibit

a vector currently in use.

U/L Act V92X5032XY - A 1 (greeen) value indicates that the GPC is currently

processing an uplinked command.

# **BFS Major Function Command Errors Display**

Illegal Op

**NR OUT BD** 

The BFS major function can transmit several indicators to help the user determine the cause of a command uplink problem. At the top of the display is the GPC number (V98Q0012C) and format (V98Q0009C) currently downlinking the data on the major function. There are several boxes in the display that light up to show the problem to the user. The following is a list of the boxes and their associated MSIDs and meanings:

**GPC/MF Check** V98X0211X - A 1 (red) value indicates that the uplinked command did not pass the major function check.

V98X0214X - A 1 (red) value indicates that the uplinked command did not pass the operation code check for that major function.

**Veh Add Error** V98X4272X - A 1 (red) value indicates that the major function found that the vehicle address in the command was not correct.

V98X4273X - Indicates (red) that a number in the command was out of bounds. The following is a list of the reasons for this error flag:

- 1. An MDM Single, MDM Multiple, or SPC Multiple command load contains an MDM number that is 0 or greater than 14.
- 2. The number of command groups in an MDM Multiple or SPC Multiple command load is 0 or greater than 10.
- 3. The number of words to be written in a G-MEM Contiguous command load is 0 or greater than 64.
- 4. The starting address of a G-MEM Contiguous command load, plus the number of words to be written, minus 1, is greater than 33FFF (hex).
- 5. The number of address and word pairs in a G-MEM Scatter command load is 0 or greater than 32.
- 6. A G-MEM Scatter command load contains a memory address that is greater than 33FFF (hex).
- 7. The number of data sets in a TMBU command load is 0 or greater than 10.
- 8. There is an illegal data set type in a TMBU command load.
- 9. There is an illegal parameter interpretation in a TMBU command load.
- A displacement in a TMBU command load exceeds the length of the table for which its data set is intended or causes a full work parameter to be written to an odd address.
- 11. A parameter value in a TMBU command load exceeds the limits specified for its interpretation.
- 12. The landing site table slot in a "deorbit landing site parameters" command load is less than 19 or greater than 21.
- 13. The Tactical Air Navigation (TACAN) table slot ID in 01 Deorbit TACAN Parameters command load is less than 51 or greater than 60.

V98X4272X - A 1 (red) value indicates that an attempt was made to put a stored command into a full SPC buffer (10 command maximum for OI-25, 25 command maximum for OI-26).

MDM Add Error V98X4271X - A 1 (red) value indicates that the MDM address in the command

is out of the bounds of the valid address table.

TSC Error V98X0215X - A 1 (red) value indicates that a two-stage error was detected.

U/L Skip V98X0212X - A 1 (red) value indicates that the previous cycle of the uplink

process was skipped and a previously uplinked command may not have been

processed.

FW/LW Error V98X4270X - A 1 (red) value indicates that a first word/last word error was

detected and an RTC or a command load was rejected (ref. Comm Systems

Brief 1, paragraph 1.4.8).

GPC Block V98X4275X - A 1 (red) value indicates that all uplink commands (both single

and two stage) are blocked.

**TK STR 3** V98X2754X - A 1 (green) value indicates that the BFS major function is

tracking the transactions on flight-critical bus number 3. If the BFS is not

tracking string 3, the color is red.

# **Ops 0 Major Function Command Errors Display**

The Ops 0 major function can transmit several indicators to help the user determine the cause of a command uplink problem. At the top of the display is the GPC number (V93Q0018CZ) and format (V93Q0022CZ) currently downlinking the data on the major function. There are several boxes in the display that light up to show the user the problem. The following paragraphs list the boxes and their associated MSIDs and meanings:

Data Ready V92X6081XZ - A 1 (green) value indicates that at least 1 command word in

the 10-word command buffer is valid.

GPC/MF Check V92X6125XZ - A 1 (red) value indicates the uplinked command did not pass

the major function check.

Illegal Op V92X6132XZ - A 1 (red) value indicates that the uplinked command did not

pass the operation code check for that major function.

GPC BLK V92X6000XZ - A 1 (red) value indicates that the panel C3 Uplink Block switch

is in the GPC block position. These data are gathered by the GPC by reading the NSP status word. If both this and the NSP BLK lights are not red, the

panel C3 Uplink Block switch is in the Enable position.

NSP BLK V92X60082XZ - A 1 (red) value indicates that the panel C3 Uplink Block

switch is in the NSP block position.

SS Error V92X6126XZ - A 1 (red) value indicates a single-stage command error has

been detected

**SPC Full** V92X6128XZ - A 1 (red) value indicates that the stored program command

buffer is full and that any attempt to put more commands into the buffer will be rejected (10 command maximum for OI-25, 25 command maximum for OI-26).

U/L Act V92X5032XZ - A 1 (green) value indicates that there is currently activity on

the command buffer processor and that the new command uplinked is

rejected.

TSC Error V92X6134XZ - A 1 (red) value indicates that a two-stage error was detected.

SHUTTLE OPS U/L VERIFY INCO/COMM/JSC-12829 9/1/2004: REV G SCP 7.41

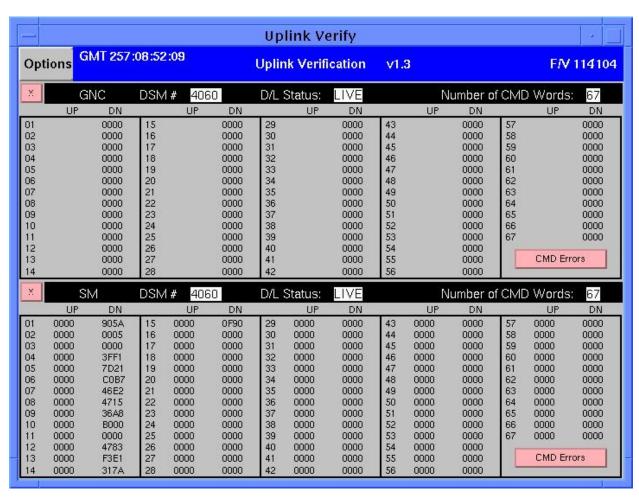


Figure 7.41-1. Example of the Uplink Verification display with the GNC and SM major functions shown



Figure 7.41-2. Pop-up Error Warning for Telemetry Reject

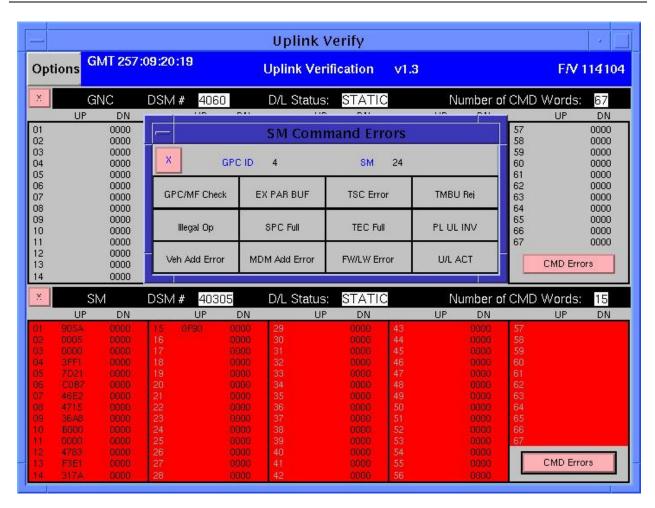


Figure 7.41-3. Pop-up Error Warning for Data Reject

# **TITLE**

INST COMMAND BUILD DISPLAY V1.4

## **GENERAL**

The INST command build display is used to build the command loads that are generally controlled by the Instrumentation Officer.

9/1/2004: REV G

This display is divided into several sections. The top of the display is the title, version number, current time (GMT), and the flight /vehicle number for the command server to which the display is attached. Below the title information is the menu bar that contains all the pulldown menus available to manipulate the parts of the display. The middle of the display changes, depending on the type of command to be built. The bottom of the display shows any advisories from the command server itself.

## **DISPLAY DESCRIPTION**

The top of this display contains general information about the display itself. The data displayed here are the current time (GMT), the title of the display, the version number, the flight number, and the vehicle number of the command server to which the display is attached. At initial startup of the display, the only parts of the display that are visible are the title information section, the menu bar, and the Advisory Messages section.



# Example of the initial display

The menu bar, located just below the title information, is used to manipulate the rest of the display. There are four menus on

the menu bar. The File menu contains all the options to manipulate the storage file structure of the application and to exit the display. The CMD Type menu changes the middle of the display to allow the user to build different commands. This menu contains all the possible command types that can be built from this application. The Operation menu is used to interface with the command server to submit or delete command loads. The last option on the menu bar is the Help option. This option creates a window with helpful information on how to use the display.

File - This menu contains the commands for saving or recalling commands from files on the workstation.

**Save** (Ctrl + s) - This option is used to save the currently displayed command load to a file on the workstation. A standard popup file selection box is displayed for the user to enter a file name. Once the command data have been saved to a file, the user can recall it at any time.

**Recall (Ctrl + r)** - This option is used to recall a command data file from the workstation. A standard popup file selection box is displayed from which the user can request a file. Once the user has requested the file, it fills in the middle of the display, as long as the file requested is appropriate to the displayed command type (otherwise, the recall request will be rejected). The user can then edit the data and submit it to the command server for later uplink to the orbiter.

**Clear (Ctrl + c)** - This option is used to clear the contents of a currently displayed command build type. It is used once a command type is selected or a file is recalled from the workstation.

**Batch Submit** - This option is used to select several command files that are submitted to the command server at the same time. This option will save the INST time because all of the commands needed can be submitted in one lump.

9/1/2004: REV G

**Exit** (Ctrl + x) - This option is used to terminate the display and close any open files associated with the application.

**CMD Type** - This menu contains all the types of orbiter commands that can be created, viewed, or edited from this display. The following sections describe these options.

**TFL/DFL** - This option is used to build, view, edit, or delete TFL and DFL commands. When this option is selected, the middle of the display changes to reflect the data that must be entered to create a TFL/DFL load. The title of the display changes to show that the TFL/DFL option has been selected. If the user did not recall TFL/DFL from the workstation, the display will not have anything selected on the left side, but the right side should initialize with the first command in the 125 DSM class (generally 12538).



Example of Batch Submit

The display is divided into four major sections. Below the menu bar are the type-in boxes used to enter the DSM sequence number for a command and the title for that command load. The TFL/DFL selection menus are located below the TFL/DFL DSM type-in box. The command data in the command server for the DSM in the TFL/DFL type-in box is located below the GMT GEN text box. A button to delete the last Data Set entered is placed under the command data box. At the bottom of the display is the Advisory Messages section. Below is a detailed description of each part of the TFL/DFL display and an example of the filled out display.

**TFL/DFL type-in box** - This type-in box is located just after the TFL/DFL label. It starts out with "125" displayed in the box. This information cannot be changed. If there are any TFL/DFLs stored in the command server or if the user recalled a TFL/DFL file from the workstation, the last two digits will be filled in with the sequence number for this type of command. The valid range is 01 to 99. DSM numbers 12538 through 12550 are prestored and cannot be edited or deleted. If the user presses the right mouse button while the mouse cursor is located in the type-in box, a list of the TFL/DFLs stored in the command server will be displayed from which the user can select.

**Up/down arrowheads** - These two buttons are used to access the TFL/DFLs that are stored in the command server (one at a time). When a user pushes the up arrow, the next higher TFL/DFL DSM number will be displayed, if there is one stored in the command server. If the user pushes the down arrow, the next lower TFL/DFL DSM number will be displayed, if there is one stored in the server.

**Title** - This type-in box is used to enter a title for the command load. It can be any combination of characters (except; [] and |) up to 21 characters long.

**GMT GEN** - This box contains the last time the displayed TFL/DFL was updated in the command server. If the load has not been submitted to the command server or has been edited, this box will be blank. The user cannot type into this box.

**EDITED** - This box will display the word EDITED (on a green background) when the currently displayed command load is changed in any way. If the command has been submitted to the command server previously, the GMT GEN box will be blank and the EDITED box will light up. Once the command displayed is submitted to the command server, the EDITED box disappears.

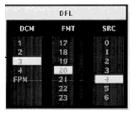
TFL selection box - These two selection boxes are located under the TFL label below the TFL/DFL DSM type-in box. The High Data Rate (HDR) format numbers are in the selection column on the left. A scroll bar is available to allow the user to see all the format numbers that are listed in the GCS. The Low Data Rate (LDR) format numbers are in the selection column to the right. To build a TFL, all the user needs to do is select the format number to put into the command load. The right side of the display will change to display the data that will be stored in the load.



I/O RESET/DCM FDA box - This area of the display contains several buttons used for special purposes. There are four buttons for selecting I/O resets and four buttons for decommutator fault detection enables and disables.



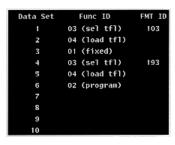
**DFL selection box** - These three selection boxes are located under the DFL label below the Title type-in box. The DCM numbers are in the selection column to the left. The next selection column to the right is the DFL, labeled as FMT (Format). There is a scroll bar available to allow the user to see all the format numbers that are listed in the GCS. To the right of the FMT selection column is the Source (SRC) selection column. To build a DFL, the user needs to select a



DCM number, an FMT number, and an SRC number (if needed). Fetch Pointer Memory (FPM) formats can be selected from this section of the display. To create an FPM command, select FPM from the DCM column. The FMT column will change to show only the valid FPM format numbers. Select an FPM format number.

**Data Set display box** - This section of the display shows the command data that are stored in a command load. There are 10 rows of command data that can be stored into a TFL/DFL. There are three columns in this section. The first column is the data set number and the second is the function ID, which means the item entry that occurs when the command is executed onboard the orbiter. The function IDs are automatically added to the display when the user selects from one of the selection columns to the left of this section. A description of the function ID is placed just to the right of the number. Example: 02 (program). The following is a listing of the function ID descriptions.

Function ID	<u>Description</u>		
01	Selects the fixed HDR		
	formatter (TFL = $129$ )		
02	Selects the programmable		
	HDR formatter		
03	Selects a TFL number		
04	Actually loads the selected TFL		
05	PCMMU I/O reset		
06	PSP 1 I/O reset		
07	PSP 2 I/O reset		
08	PDI I/O reset		
09	Selects the PDI decom		
10	Selects the PDI decom format		
11	Actually loads the selected DFL		
12	Selects the input source		

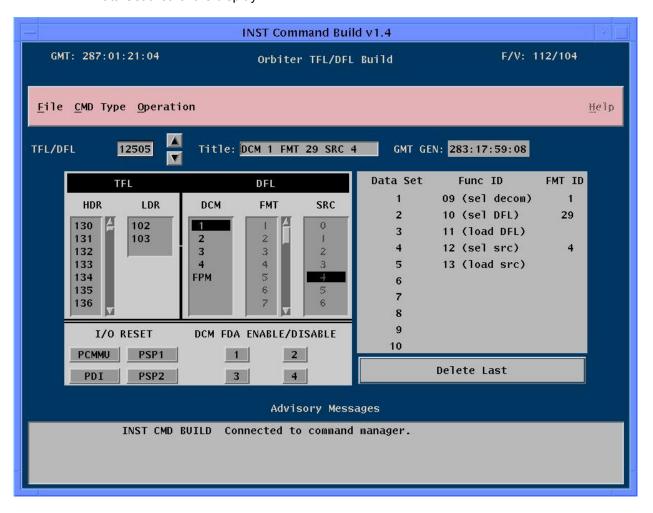


- 13 Actually loads the source
- Toggles the FDA enable/disable bit for decoms 1-4, respectively.

**Delete Last** - This button is used to delete the last Data Set function entry. When a user selects a TFL, there are at least three Data Set rows filled. The Delete Last button deletes the whole TFL command data set of functions. An example of a DFL source select would be:

09 (select) 003 12 (sel src) 000 13 (load src)

When the user presses the delete button, all three of the lines above are deleted from the Data Set area of the display.



# Example of the TFL/DFL display

**PSP Config** - This option is used to build, view, edit, or delete payload signal processor configuration commands. When this option is selected, the middle of the display changes to reflect the data that must be entered to create a PSP Config load. The title of the display changes to

show that the PSP Config option has been selected. If the user did not recall an PSP Config from a workstation file, the display will not have anything selected (highlighted with a black background).

The display is divided into four major sections. Below the menu bar are the type-in boxes used to enter the DSM sequence number for a command and the title for that command load. The Payload command selection menus are located below the PSP config DSM type-in box. The telemetry selection menus are located to the right of the command selection menus. A set of type-in boxes is included in the telemetry section. At the bottom of the display is the Advisory Messages section. A detailed description of each part of the PSP Config display and an example of the filled out display follow.

**PSP Config type-in box** - This type-in box is located just after the PSP Config label. It starts out with "132" displayed in the box. This information cannot be changed. If there are any PSP Configs stored in the command server or if the user recalled an PSP Config file from the workstation, the last two digits will be filled in with the sequence number for this type of command. The valid range is 01 to 50. If the user presses the right mouse button while the mouse cursor is located in the type-in box, then a list of the PSP Configs stored in the command server is displayed from which the user can select.

**Up/down arrowheads** - These two buttons are used to access the PSP Configs that are stored in the command server (one at a time). When a user pushes the up arrow, the next higher PSP Config DSM number will be displayed if there is one stored in the command server. If the user pushes the down arrow, the next lower PSP Config DSM number will be displayed, if there is one stored in the server.

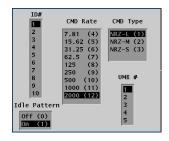
**Title** - This type-in box is used to enter a title for the command load. It can be any combination of characters (except; [] and |) up to 21 characters long.

**GMT GEN** - This box contains the last time the displayed PSP Config was updated in the command server. If the load has not been submitted to the command server or has been edited, this box will be blank. The user cannot type into this box.

**EDITED** - This box will display the word EDITED (on a green background) when the currently displayed command load is changed in any way. If the command has been submitted to the command server previously, the GMT GEN box will be blank and the EDITED box will light up. Once the command displayed is submitted to the command server, the EDITED box will be blank again.

**Command Config Section** - The section below the PSP config DSM type-in box is the Command configuration section. It is used to set up the required data for sending commands through the PSP. There are five selection boxes in this section of the display. Each selection box contains the actual values used by the PSP and the Payload Management Flight Software Requirements (PM FSR) values in parenthesis for ease of translation.

**ID#** - This selection box is used to select the PSP configuration identification number that will be used with this command. Once a configuration is uplinked and stored in the SM major function on an orbiter GPC, it can be used to configure the PSP. The configuration is attached to a payload command at the time it is passed through the SM major function so that the PSP will know where and how to route the command data to a payload. This config ID also includes the telemetry configuration of



the PSP. These data will tell the PSP how to format the payload data that are coming in and where the data are coming from.

**CMD Rate** - This selection box is used to select the rate at which commands can be clocked out of the PSP and sent to the payload.

**CMD Type** - This selection box is used to select the structure of the payload command words that are to be transmitted to the payload.

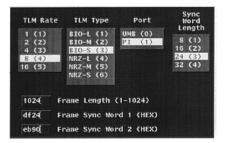
**Idle Pattern** - This selection box is used to turn on and off the idle pattern. Some payloads require that it receive a constantly modulated link so that it can process incoming commands, and some do not.

**UMB #** - This selection box is used to determine which umbilical port to send the payload commands out on if the umbilical is selected.

**Telemetry Config Section** - The section below the GMT GEN label is the telemetry configuration section. This section contains the command data required to configure the PSP to handle the incoming payload telemetry data. There are four selection boxes and three type-in boxes.

**TLM Rate** - This selection box is used to select the rate at which data will be transmitted to the PSP so that the PSP can know how to process the incoming stream of data.

**TLM Type** - This selection box is used to determine what type of data is being shipped from the payload to the PSP.



**Port** - This selection box is used to select the path the payload data will take to the PSP. There are two possible selections. The UMB selection must be associated with an umbilical number in the command config section. PI stands for payload interrogator.

**Sync Word Length** - This selection box is used to determine which of four different data word lengths the PSP must use to be able to bit sync to the payload data coming in.

**Frame Length** - This type-in box is used to set the size of a frame of payload data coming into the PSP. This will tell the frame sync module in the PSP where to look for a new frame of data once it has bit synched on the data stream.

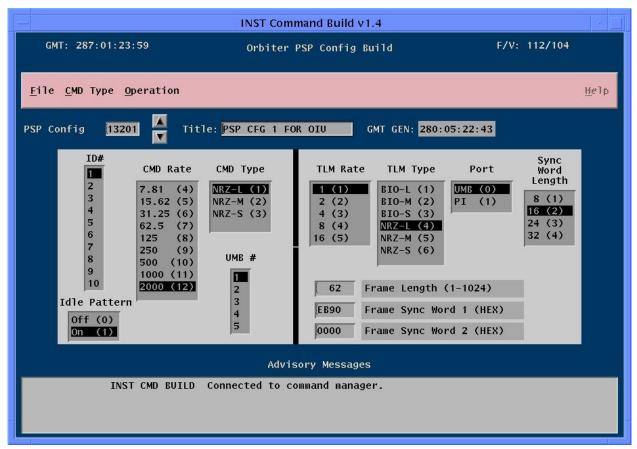
**Frame Sync Word 1** - This type-in box is used to set the pattern of the data in the first frame sync word. The frame sync module will look for this pattern of 0's and 1's to be able to frame sync lock on the payload data.

**Frame Sync Word 2** - This type-in box is used to set the pattern of the data in the second frame sync word (if required).

**GEN Payload** - This option is used to build, view, edit, or delete general payload command loads. INCO's primary use of this display is to build general payload load commands to push the PSP configuration in the SM major function into the PSP. When this option is selected, the middle of the display changes to reflect the data that must be entered to create a general payload load command. The title of the display changes to show that the general payload option has been selected. If the user did not recall a general payload command file from the workstation, the display will be mostly blank.

The display is divided into three major sections. Below the menu bar are the type-in boxes used to enter the DSM sequence number for a command and the title for that command load. The command data selection is located below the row of type-in boxes. It contains three option menus for determining the destination of the command and in what mode the command will go up (default is two stage). Below the selection boxes are the type-in boxes for entering the hexadecimal command data words. At the bottom of the display is the Advisory Messages section. A detailed description of each part of the general payload load display and an example of the display filled out follow.

**Gen Payload type-in box** - This type-in box is located just after the Gen Payload label. It starts out with "133" displayed in the box. This information cannot be changed. If there are any general payload load commands stored in the command server or if the user recalled a general payload load file from the workstation, the last two digits will be filled in with the sequence number for this type of command. The valid range is 01 to 50. If the user presses



**Example of PSP Config display** 

the right mouse button while the mouse cursor is located in the type-in box, a list of the general payload loads stored in the command server will be displayed from which the user can select.

**Up/down arrowheads** - These two buttons are used to access the general payload loads that are stored in the command server (one at a time). When a user pushes the up arrow, the next higher general payload load DSM number will be displayed, if there is one stored in

the command server. If the user pushes the down arrow, the next lower general payload load DSM number will be displayed, if there is one stored in the server.

**Title** - This type-in box is used to enter a title for the command load. It can be any combination of characters (except; [] and |), up to 21 characters long.

**GMT GEN** - This box contains the last time the displayed general payload load was updated in the command server. If the load has not been submitted to the command server or has been edited, this box will be blank. The user cannot type into this box.

**EDITED** - This box will display the word EDITED (on a green background) when the currently displayed command load is changed in any way. If the command has been submitted to the command server previously, the GMT GEN box will be blank and the EDITED box will light up. Once the command displayed is submitted to the command server, the EDITED box will be blank again.

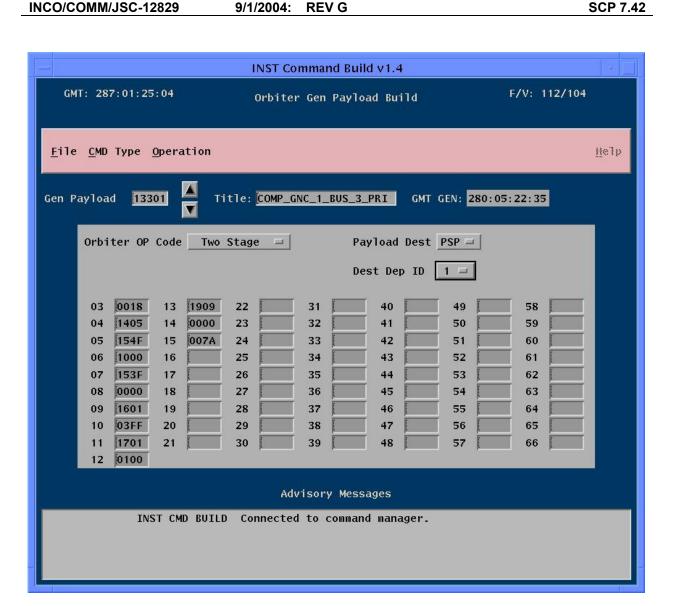
**Command data selection** - This section of the display contains all the information that is required to build a general payload load command. There are four major components of this part of the display. They are discussed in detail in the following paragraphs.

**Orbiter Op Code** - This is a selection menu used to choose in which mode the command will be uplinked. The default is two stage, but the other option is single stage (which means the command will go through the payload throughput buffer).

**Payload Dest** - This is a selection menu used to choose the system to which the command will be sent. The default is PSP, but the other options are SSI (Standard Serial Interface).

**Dest Dep ID** - This is a selection menu used to choose the identification number of the destination for the command. The options are 0 to 5 for the PSP and 1 to 8 for SSI.

**03-66 command data words** - These type-in boxes are used to enter the command data words in four hexadecimal characters. The display will take either upper or lowercase characters as inputs. It will convert all the characters to uppercase. The number of command data words available depends on the payload destination selected above. For PSP, the available command words are 3 to 66. For SSI, the available command words are 3 to 34. The display will limit the user to the correct number of command data words.



**Example of General Payload Build display** 

## TITLE

RF COMMAND BUILD DISPLAY V2.4

## **GENERAL**

The Command Build display is used to build the command loads that generally are used by the RF Communications Officer. This display is divided into several sections. The top of the display is the title, version number, current time (GMT), and the flight /vehicle number for the command server to which the display is attached. Below the title information is the menu bar that contains all the "pull down" menus available to manipulate the parts of the display. The middle of the display changes, depending on the type of command to be built. The bottom of the display will show any advisories from the command server itself.

9/1/2004: REV G

## **DISPLAY DESCRIPTION**

The top of this display contains general information about the display itself. The data displayed here are the current time (GMT), the title of the display, the version number, the flight number, and the vehicle number of the command server to which the display is attached. At initial startup of the display, the only parts of the display that are visible are the title information section, the menu bar, and the advisory messages section.

The menu bar, located just below the title information, is used to manipulate the rest of the display. There are four menus on the menu bar. The "FILE" menu contains all the



Example of the initial display

options to manipulate the storage file structure of the application and to exit the display. The "CMD Type" menu changes the middle of the display to allow the user to build different commands. This menu contains all the possible command types that can be built from this application. The "Operation" menu is used to interface with the command server for submitting or deleting of command loads and to change phase elapsed time (PET). The last option on the menu bar is the "Help" option. This will create a window with helpful information on how to use the display.

**File** - This menu contains the commands for saving or recalling commands from files on the workstation.

**Save** (Ctrl + s) - This option is used to save the currently displayed command load to a file on the workstation. A standard popup file selection box will be displayed for the user to enter a file name. Once the command data have been saved to a file, the user can recall it at any time.

**Recall (Ctrl + r)** - This option is used to recall a command data file from the workstation. A standard popup file selection box will be displayed for the user to request a file. Once the user has requested the file, it will fill in the middle of the display, provided that it is the same "CMD Type" as that selected on the display. The user can then edit the data and submit the information to the command server for later uplink to the orbiter.

**Clear (Ctrl + c)** - This option is used to clear the contents of a currently displayed command build type. It is used once a command type is selected or a file is recalled from the workstation.

**Exit** (Ctrl + x) - This option is used to terminate the display and close any open files associated with the application.

**CMD Type** - This menu contains all the types of orbiter commands that can be created, viewed, or edited from this display. The following are detailed descriptions of these options.

9/1/2004: REV G

**MSPC** - This option is used to build, view, edit, or delete multiple stored program commands (MSPCs). When this option is selected or a file from the workstation is selected that contains MSPC build information, the middle of the display changes to reflect the data that must be entered to create an MSPC load. The title of the display changes to show that the MSPC option has been selected. If there are not any MSPCs already in the command server and the user did not recall an MSPC from the workstation, the display will be mostly blank. Below is a detailed description of each part of the MSPC display and an example of the display filled out.

# NOTE:

MSPCs are made up of two or more RTCs. For a single stored program command (SPC), use the SPC single menu option.

**MSPC type-in box** - This type-in box is located just after the MSPC label. It starts out with "121" displayed in the box. This information cannot be changed. If there are any MSPCs stored in the command server or if the user recalled an MSPC file from the workstation, the last two digits will be filled in with the sequence number for this type of command. The valid range is 01 to 50. Example: 12105. If the user presses the right mouse button while the mouse cursor is located in the type-in box, then a list of the MSPCs stored in the command server will be displayed from which the used can select.

**Up/Down Arrows** - These two buttons are used to access the MSPCs that are stored in the command server (one at a time). When a user pushes the up arrow, the next higher MSPC DSM number will be displayed if there is one stored in the command server (example 12102 to 12103). If the user pushes the down arrow, the next lower MSPC DSM number will be displayed if there is one stored in the server (example 12103 to 12102). The MSPCs are in a circular list, so continuing to press the arrow buttons will eventually end up at the DSM number with which you started.

**Title** - This type-in box is used to enter a title for the command load. It can be any combination of characters (*except* ; [ ] and | ), up to 21 characters long. A title longer than 21 characters will generate an error message.

**GMT GEN** - This box contains the last time the displayed MSPC was updated in the command server. If the load has not been "submit"ed to the command server or has been edited, this box will be blank. The user cannot type into this box.

**EDITED** - This light will turn on (green) whenever the command being viewed has been changed from the values that are in the command server. It is an indication to the user that if anyone else is looking at the same command, they will be seeing the values that are in the command server and not what the edited version is. As soon as the user editing the command "Submits" the command to the server, the "EDITED" light will disappear.

**Load Information** - This section of the display is used to type in the command information that will be contained in the MSPC. The user must supply the DSM number, a title, the MDM to send the command through, and an execution time. Although 25 commands can be stored in the SPC buffer of both the BFS and the

C-12829 9/1/2004: REV G

SM, only 10 commands can be built in one MSPC at a time because of NSP command buffer size limitations. Each of the 10 rows is exactly the same. The following is a detailed description of the parts to this section of the display.

**DSM** - This type-in box is used to enter the real-time command (RTC) ID number. The user can press the right mouse button while the mouse cursor is located over the DSM type-in box to display the available DSM numbers. They can scroll through the list and select the DSM number to put in the type-in box by pressing the left mouse button while the mouse cursor is located over the desired command. See the **DSM Popup** discussion later in this brief for more details. Pressing the Tab key will send the cursor to the next DSM box.

**Title** - This box will be filled in automatically by the command server once the user has selected the DSM number.

**Safed** - This box will display the safe status of the command requested for this row. If the command is safed (cannot be uplinked) in the command server, the word "Safed" will appear in that column. The DSM, title, and safed fields will turn red if the command is safed.

**MDM** - This type-in box is used to determine which of the two payload MDMs the command data are going to pass through. The default is MDM 1, but it can be changed by typing a 2 in the box. The MDM selection must be there. The display will not allow deletion of the values in the MDM boxes. A 1 will be displayed if an attempt to delete the value is made.

**GMT** - This is a menu selection. The options are GMT, PET1, or PET2. Once the user has selected which option they want to build with, it will affect all the rows on the display. See the discussion about **PET Set** later in this brief for more details on how PET works.

**Exec Time** - This type-in box displays the time that the command in the load will execute onboard the orbiter. The time must be entered with the following format:

## DDD:HH:MM:SS

but the ":" can be replaced with a space, and leading zeros are not required (example: 23 12 4 9 would display as 023:12:04:09). The space key is used to delimit the time sections. If 0 days is the input, simply press the space key and 000 days will be displayed.

This box can be typed into only if the GMT option was selected from the previous discussion. If the user has selected one of the PET options, this time box will reflect the addition of the PET time, plus the offset time. The default time is 000:00:00:00. Each of the rows will be defaulted to increment the execution time by 1 second.

**Offset Time** - This type-in box displays the time that the command's execution time will be offset from some other time reference (PET1 or PET2). This will allow the user to update one time (PET1 or PET2) and have it reflected in the all the execution times of the commands in the MSPC. See the discussion about the use of **PET Set** later in this brief. The default offset time is 000:00:00:00.

**Ripple Up Button** - This button will "ripple up" or decrement the "Exec Time" or "Offset Time" (depending on which time is selected from the GMT/PET

button). The ripple process will be from the selected command row up when the button is pressed.

**Ripple Down Button** - This button will "ripple down" or increment the "Exec Time" or "Offset Time" (depending on which time is selected from the GMT/PET button). The ripple process will be from the selected command row down when the button is pressed.

**Zero Offsets Button** - When the reference time button (GMT/PET) is selected to PET1 or PET2, the "Zero Offsets" button is pressed and the Offset time column will go to 000:00:00:00.



Example of the MSPC Build display

**SPC** - This option is used to build, view, edit, or delete single SPCs. When this option is selected, the middle of the display changes to reflect the data that are currently in the command server. Below the SPCs that are in the command server is the area for editing or creating a new SPC. The title of the display changes to show that the SPC option has been selected. If there are not any SPCs already in the command server, the display will be mostly blank. The following discussion is a detailed description of each part of the SPC display and an example of the display filled out.

Current Command Server SPCs - This middle section of the display shows the SPCs that are currently in the command server. Each must have a valid DSM number, a title, an RTC number, a payload MDM selected, RTC title, a reference time, an execution time or an offset time, and a safe status. If there are more SPCs than can be displayed at one time, a scroll bar will appear on the right side of the display. Press the left mouse button when the mouse cursor is located over the SPC that is to be edited, and the data will appear in the type-in boxes below this section.

**SPC** - This type-in box is used to enter a valid DSM number for a single SPC. The valid DSMs are 101 to 120, with valid sequence numbers of 01 to 50.

Example: 10124 12003

The user can select the SPC by either pressing the left mouse button while the mouse cursor is located over the SPC in the current command server SPCs or by typing a valid SPC DSM number in the edit area.

9/1/2004: REV G

**Title** - This type-in box is used to edit the title of the SPC. The title can be any character (*except*; [] and |), up to 21 characters long.

**Safed** - This will display a red SAFED if the DSM selected is safed in the server. Once the command is unsafed, the SAFED flag will disappear.

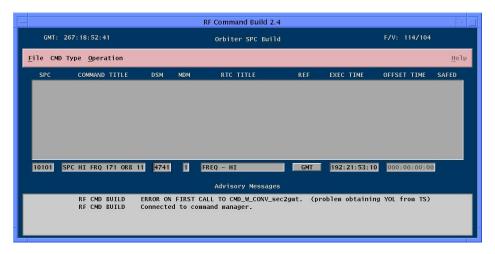
**DSM** - This type-in box is for the selection of the real-time command to be stored in the command load. The number can be typed in or selected from a list by pressing the right mouse button while the mouse cursor is located over the DSM edit box. See **DSM Pop up** for a discussion on this feature.

**MDM** - This type-in box contains the payload MDM that the command will pass through. The valid numbers are 1 and 2. The default is 1.

**RTC Title** - This field contains the title of the RTC selected in the DSM type-in box above. The title is taken from the command server and cannot be edited by the user.

**GMT** - This selection box is used to determine if an offset time is to be used. The valid options are GMT, PET1, or PET2. The default value is GMT. See the discussion on **PET Set** for more information on offset times.

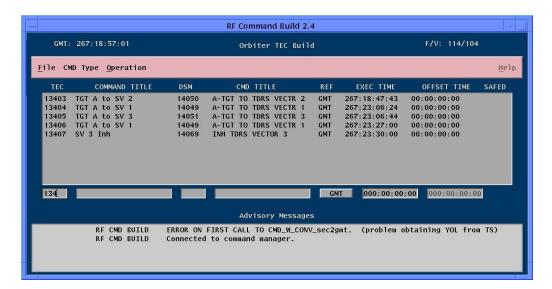
**Exec Time** - This type-in box indicates the time that the RTC will execute onboard the orbiter. If the GMT option was selected above, the execution time must be edited here. If one of the PET options was selected, this box will reflect the PET time, plus the offset time entered in the next type-in box.



Example of the SPC Build display

**Offset Time -** This type-in box is used to enter an offset execution time from some event. A time can be entered in this box only if one of the PET options was selected earlier.

**TEC** - This option is very much like the SPC option. The primary difference is that the time executed command (TEC) load type uses other command loads as the command to be executed onboard the orbiter. The valid TEC DSM numbers are 13401 to 13450. The display will prohibit the user from entering a load class that cannot be built into a TEC command load.



# Example of the TEC Build display

MRTC - This option is used to build, view, edit, or delete multiple real-time commands (MRTCs). When this option is selected, or a file from the workstation is selected that contains MRTC build information, the middle of the display changes to reflect the data that must be entered to create an MRTC load. The title of the display changes to show that the MRTC option has been selected. If there are not any MRTCs already in the command server, the display will be mostly blank. Below is a detailed description of each part of the MRTC display and an example of the display filled out.

MRTC Type-in Box - This type-in box is located just after the MRTC label. It starts out with "15" displayed in the box. This information cannot be changed. If there are any MRTCs stored in the command server, the last two digits will be filled in with the sequence number of this type of command. The valid range is 00 to 50. Example: 1501. If the user presses the right mouse button while the mouse cursor is located in the type-in box, a list of the buildable MRTCs stored in the command server will be displayed from which the user can select.

**Up/Down Arrow** - These two buttons are used to access the MRTCs that are stored in the command server (one at a time). When a user pushes the up arrow, the next higher MRTC DSM number will be displayed if there is one stored in the command server. If the user pushes the down arrow, the next lower MRTC DSM number will be displayed if there is one stored in the server.

**Title** - This type-in box is used to type in a title for the command load. It can be any combination of characters (*except*; [] and |), up to 21 characters long.

**Safed -** This will display a red SAFED if the DSM selected is safed in the server. Once the command is unsafed, the SAFED flag will disappear.

**Stage -** This type-in box is defaulted to 2. The 2 means that the command will be uplinked via the two-stage process. The value can be changed to 1 but cannot be deleted. It will reset to 2 if an attempt to delete the value is made.

**GMT GEN** - This box contains the last time the displayed MRTC was updated in the command server. If the load has not been submitted to the command server or has been edited, this will be blank. The user cannot type into this box.

**EDITED** - This light will turn on (green) whenever the command being viewed has been changed from the values that are in the command server. It is an indication to the user that if anyone else is looking at the same command, they will be seeing the values that are in the command server and not what the edited version is. As soon as the user editing the command "Submits" the command to the server, the "EDITED" light will disappear.

**MRTC Contents -** The middle of the display contains the RTCs that are included in the MRTC command "chain." These commands are combined into one command structure and uplinked as a unit. The required command data to build an MRTC are described below.

**DSM** - These are the RTC numbers to be contained in the MRTC. The number can be typed into the box, or the right mouse button can be pressed when the mouse cursor is located over the DSM type-in box, and a list of possible RTC DSM numbers will pop up.

**Title** - This box displays the title of the RTC selected in the DSM box. These data come from the command server and cannot be edited.

**Safed** - This box displays the safe status of the RTC. It will display the word "Safed" if the command has been inhibited from uplink. The whole line will turn red when the RTC is safed.



Example of MRTC Build display

RTC - This option is used to build, view, edit, or delete RTCs. When this option is selected, the middle of the display changes to reflect the data that must be entered to create an RTC load. The title of the display changes to show that the RTC option has been selected. If there are not any user-built RTCs already in the command server, the display will be mostly blank. Below is a detailed description of each part of the RTC display and an example of the filled out display.

**Current Command Server RTCs** - This middle section of the display shows the RTCs that are currently in the command server. If there are more RTCs than can be displayed at one time, a scroll bar will appear on the right side of the display. Press the left mouse button when the mouse cursor is located over the RTC that is to be edited, and the data will appear in the type-in boxes below this section.

**DSM** - This type-in box contains the DSM number for the command to be built or edited. If a command that is currently stored in the command server is to be edited, the user can select the command by pressing the left mouse button while the mouse cursor is located over the command DSM number in the middle section of the display, or they can type in the DSM number. The valid range for buildable RTCs is 1000 to 1099. The default value in the type-in box is 10. The last two digits of the DSM must be entered in the box, but the first two are fixed and cannot be edited. If a currently stored command is selected for editing and is safed from uplink, the type-in boxes will turn red.

**COMMAND TITLE** - This type-in box contains the title of the command being built or modified. The title can be any characters (*except*; [] and |) in any combination up to 21 characters long.

**ADDR** - This type-in box contains the payload MDM address to which the command will be sent for execution. This hex number must contain a module, channel, and MDM address values.

# **WARNING**

Some error checking is done by the system to verify that the hex information is reasonable, but the system will not prevent the user from typing a valid but wrong address.

RESET This type-in box contains the command bits to reset the previously defined address in preparation of the new bit information that will cause change to some line replaceable unit (LRU) on the The valorbiter. ues allowable for hex information are 0000 to FFFF.



Example of RTC Build display

**ADDR** - This type-in box contains the payload MDM address to which the set command bits will be sent. See the previous ADDR discussion.

**SET** - This type-in box contains the command bits that will cause the change to the LRU. The values allowable for this hex information are 0000 to FFFF.

**SAFED** - This will display a red SAFED if the DSM selected is safed in the server. Once the command is unsafed, the SAFED flag will disappear.

**TDRS** - This option is used to build, view, edit, or delete TDRS state vector commands. When this option is selected, the top of the display changes to reflect commands that have already been stored in the command server. The middle of the display is the location for editing or building new TDRS state vector commands. If there are not any TDRS commands built the display will be mostly blank.

**Current Command Server TDRS Commands** - This middle section of the display shows the TDRS state vector commands that are currently in the command server. Each must have a valid DSM number, a title, State vector slot number, a Longitude, inclination, GMT of ascending node, position vector of magnitude, a GMT of command generation and a safe status. If there are more TDRS commands than can be displayed at one time, a scroll bar will appear on the right side of the display. Press the left mouse button when the mouse cursor is located over the command that is to be edited, and the data will appear in the type-in boxes below this section.

**DSM type-in box** - This type-in box is located just after the DSM label. It starts out with "403" displayed in the box. This information cannot be changed. If there are any TDRS state vectors stored in the command server or if the user recalled an TDRS file from the workstation, the last two digits will be filled in with the sequence number for this type of command. The valid range is 01 to 50. Example: 40305.

**Up/Down Arrows** - These two buttons are used to access the TDRS vectors that are stored in the command server (one at a time). When a user pushes the up arrow, the next higher DSM number will be displayed if there is one stored in the command server (example 40301 to 40302). If the user pushes the down arrow, the next lower DSM number will be displayed if there is one stored in the server (example 40303 to 40302). The TDRS vectors are in a circular list, so continuing to press the arrow buttons will eventually end up at the DSM number with which you started.

**Title** - This type-in box is used to enter a title for the command load. It can be any combination of characters (*except*; [] and |), up to 21 characters long. A title longer than 21 characters will generate an error message. This title is automatically filled in by the application after the SLOT NUMBER and the TDRS LONGITUDE buttons are selected.

**GMT GEN** - This box contains the last time the displayed TDRS vector was updated in the command server. If the load has not been "submit"ed to the command server or has been edited, this box will be blank. The user cannot type into this box.

**EDITED** - This light will turn on (green) whenever the command being viewed has been changed from the values that are in the command server. It is an indication to the user that if anyone else is looking at the same command, they will be seeing the values that are in the command server and not what

and the discount of the American and the second of the

9/1/2004: REV G

the edited version is. As soon as the user editing the command "Submits" the command to the server, the "EDITED" light will disappear.

**SLOT NUMBER Buttons**— This area of the display is located just below the DSM/Title part of the display. It is used to select which of the 4 available slots to put the new TDRS state vector data into. The SM major function allows all 4 slots to be used but the BFS only contains 3 slots. This means that the user must be careful when building TDRS state vectors for the BFS. The BFS will reject, without a warning, any command that attempts to modify the forth slot.

**TDRS Longitude Buttons**— This area of the display is located just to the right of the Slot number area. It is used to select between the different TDRS satellites, referenced by their longitude (41, 47, 171, 174 and 275). After selecting the SLOT NUMBER, the user selects the satellite that will be placed in the slot. Once the button for that satellite is selected, the title is automatically filled in, and a request is transferred to the FDO workstation for the vector data at the current SGMT time. If the FDO ephemeris for that TDRS satellite contains the SGMT time requested, it will return the current location (state vector) data to the display. This data is discussed in the next sub-sections.

**State Vector Data** – This area of the display is located just below the Slot number and longitude buttons. Once the slot number and longitude are selected the display will request the data for this area from the FDO workstation files. There are four elements to the TDRS state vector displayed in this area.

**Longitude of Ascending Node**— This element of the TDRS state vector represents the location of the satellite in the East/West directions (angle in degrees from 0 located in England). i.e. –174 West is over the Pacific ocean.

**Inclination of Orbital Plane**— This element of the TDRS state vector represents the location of the satellite in the North/South directions (angle above or below the equator).

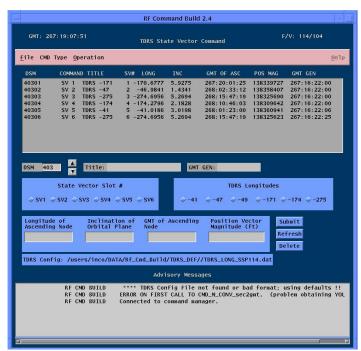
**GMT of Ascending Node** – This element of the TDRS state vector represents the closest time in GMT when the satellite has crossed or will cross the equator on a Northern track (ascending node).

**Position Vector of Magnitude** – This element of the TDRS state vector represents the altitude (ft.) of the satellite at the GMT of Ascending Node.

**Submit** – This button is used to submit the command that is displayed to the command server.

**Refresh** – This button is used to request fresh data at the current SGMT for the command displayed in the build area of the display.

**Delete** – This button is used to delete the command that is displayed in the build area.



Example of TDRS Build display

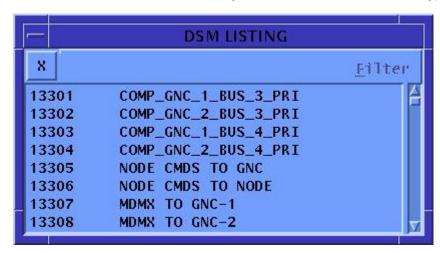
**PET SET Popup** - This option is used to set a PET so that MSPCs, SPCs, and TECs can be built with an offset time instead of the actual GMT of execution. The primary reason for this capability is to support commands that are tied to an activity and the activity time is not tied to GMT. The user will enter the GMT of the PET to reference and press the "submit" button on the popup window. There are two PETs that can be set. Any commands that are tied to a PET will be automatically updated to reflect the time reference change.



Example of how PET works: PET1 = 123:12:13:00 Offset = 000:00:05:00 123:12:18:00

**DSM Popup** - This popup window will appear whenever the user presses the right mouse button when the mouse cursor is located over a DSM type-in box. There are two forms of this popup window dependent on the DSM type-in box that is used. The following are descriptions of the two forms.

**Loads** - If the popup window is called because the right mouse button was pressed for an MSPC, SPC, or TEC command load, the only DSMs in the popup window are those types of commands. The user will not be able to view any command load DSM outside of the ones that would normally be available for that command type.



Example of the Load DSM Listing popup window

RTCs - If the popup window is called because the right mouse button was pressed for an RTC, a listing of all the RTC DSMs will be in the popup window. With this form of the popup window comes a menu to filter out unwanted DSM numbers. The filter menu is based on the orbiter LRUs and will filter out all commands that do not manipulate the selected LRU. The following is a listing of the filters and the associated DSM numbers that are available from those filters.

<u>Filter</u>	DSM R	ang	<u>e</u>			
ALL	All DSM numbers					
S-band	4470	-	4475,	4640 -	4766	
NSP	4758	-	4764,	4767 -	4779	
Ku-band	4101	-	4141			
FM	4780	-	4794			
OPS 1	4300	-	4395			
OPS 2	4400	-	4458			
PLR	4500	-	4574			
MADS	4600	-	4632,	5701 -	5767	
OARE	7001	-	7006			
PL comm	4800	-	4845			
CCTV	4185	-	4293			
GCIL	4370	-	4376			





Example of the RTC DSM Listing popup window

## **TITLE**

COMMAND BUFFERS DISPLAY V4.0

## **GENERAL**

The command buffers display can display all the command buffers that are available in any of the software major functions of the orbiter.

This display is divided into several sections. The top of the display is the menu bar that contains all the pulldown menus available to manipulate the parts of the display. The middle part of the display shows the stored commands and future GMT of execution. The lower part of the display allows the user to manually delete commands from the command server. The bottom of the display shows any advisories from the command server itself.

# **DISPLAY DESCRIPTION**

The top of this display (Figure 7.44-1) has the menus for manipulating the contents of the display. The following is a description of each of these menus and the options available on them.

- A. **File** This menu currently contains only the EXIT button for terminating the display.
- B. **Sort** This menu contains the options for sorting a buffer window. The following list is the descriptions of the available options.
  - 1. **Execution Time** This option will sort the buffer window by the time the commands in the buffer will execute. The first command to execute will be located at the top of the list, and the last will be at the bottom. This is the default sort type.
  - 2. **Load Number** This option will sort by the type of commands in the buffers. Example: 12101 will be displayed before 12102, etc.
  - 3. **Title** This option will sort the buffers window alphabetically by the name of the commands in the buffer. Example: Ku-band before S-band commands.
  - 4. **Entry Number** This option will sort the list of commands by their entry index number, which is related to the position in the loads that were uplinked.
- C. **Help** This menu option will display a help file to assist the user with the operation of the display.
- D. Window Pane The primary purpose of the display is to show the commands that are stored in buffers on the orbiter. There are three command buffers available on the orbiter. This display will display a sorted version of all the commands that the command server calculates are awaiting execution onboard. The following is a description of the three types of commands for the onboard buffers.
  - 1. **SM SPC** SM stored program commands that are awaiting execution.
  - 2. **SM TEC** SM time executed commands that are awaiting execution.
  - 3. **BFS SPC -** BFS stored program commands that are awaiting execution.

SHUTTLE OPS CMD BUFFERS INCO/COMM/JSC-12829 9/1/2004: REV G SCP 7.44

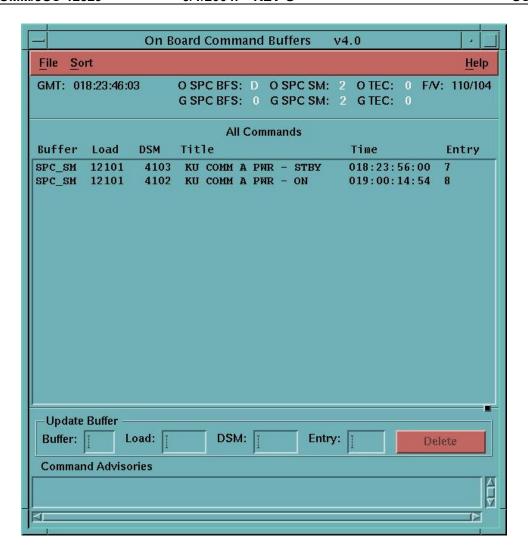


Figure 7.44-1. Com buff display

- 4. **Window Configuration** Each of the windows is built the same way. The following discussion explains the components of each window pane.
  - a. **Buffer Title** The type of command displayed. Example: SPC\_SM, TEC, or SPC\_BFS.
  - b. **Load** The digital select matrix (DSM) number of the command load used to put the command onboard the orbiter. Example: 12101 or 13401.
  - c. **DSM** The number that represents the command in the buffer. Example: 4102.
  - d. Title The title of the command in the buffer. Example: KU COMM PWR ON.
  - e. **Time** The time (in GMT) that the command will execute onboard.
  - f. **Entry** This is the index number for the commands in the GCS pending command table.

g. Sizing Button - The command window pane has a small square located in the lower right-hand side of the window. This square is used to resize the window. The window can be resized to take up almost all of the displays space, but at least a small visible area will be there for the other buffer windows. If the buffer window is made too small to display all the commands that need to be displayed, a scroll bar appears on the right side of the window. This scroll bar can be used to see the commands that are not currently visible.

## E. Update Buffer

Since this display is driven by what is uplinked and does not reflect what is actually in the command buffers onboard, a way was needed to delete any commands from the display that were not really onboard. This section of the display is used for that purpose. The following list is a description of data displayed when a command is selected for deletion from a buffer.

- 1. **Buff** This box displays the command buffer from which a command is to be deleted. Example: SPC SM, SPC BFS, or TEC.
- 2. **Load** This box displays the DSM number of the command load to be deleted from the display.
- 3. **DSM** This box displays the DSM number of the command to be deleted from the display.
- 4. **Entry** This box displays the Entry number for the command to be deleted from the display.

The only way the user can select a command to be deleted from the display is by pressing the left mouse button while the mouse cursor is located over a command line in the buffer window pane. The command information will appear in the Update Buffer area. Once the command data is filled in, the DELETE button will be active so that the delete operation can take place. The commands to be deleted will not be deleted until this button is pressed. The only personnel who have the capability to delete commands from the buffers display are INCO and Command groups.

At the bottom of the display is the Command Advisories section. This part of the display will inform the user of any messages from the command server of the display itself. It contains a scrolled list of messages so that the user can look back for old messages.

All copies of the display will be kept up to date by the command server. When a command is uplinked, the display will update as the buffer compare happens on the command and before the buffer execute command is uplinked. As command execution times pass, the displays will be refreshed. If a user deletes a command from one of the buffers, the other copies of the display will be updated to reflect the change.

## **TITLE**

SHUTTLE AND STATION FREQUENCY AND POWER SPECIFICATIONS AND ANTENNA LOCATIONS

## **PURPOSE**

To provide tabulated specifications for all transmitters and receivers onboard the shuttle and station; also, to show the locations of all antennas. The transmitters and receivers are not only for Comm, but also for GNC systems.

## FREQUENCY AND POWER SPECIFICATIONS

#### A. **Shuttle**

Effective: In use System: Ku-BAND

Mode	XMIT FREQ. (GHz)	RCV FREQ. (GHz)	PWR OUT (W)	Modulation
COMM	15.0034	13.7750	50.0	PSK
RADAR	13.779-13.879	13.779-13.879	50.0 max. ®	N/A

<sup>&</sup>lt;sup>®</sup> Power is much less during rendezvous operations.

System: RADAR ALTIMETER Effective: In use

Mode	XMIT FREQ. (MHz)	RCV FREQ. (MHz)	PWR OUT (W)	Modulation
N/A	4290-4310	4290-4310	200	PTM

System: S-BAND FM Effective: In use

Mode	XMIT FREQ. (MHz)	RCV FREQ. (MHz)	PWR OUT (W)	Modulation
ALL	2250.0	2250.0 <sup>©</sup>	15.0	FM

<sup>&</sup>lt;sup>®</sup> EMU camera signal.

System: S-BAND PI Effective: In use

Mode	XMIT FREQ. (MHz)	RCV FREQ. (MHz)	PWR OUT (W)	Modulation
N/A	1759.7-2120.1	1197.5-2302.4	10.6 max.	PM

#### **SHUTTLE OPS** INCO/COMM/JSC-12829 9/1/2004: REV G SCP 8.1

System: S-BAND PM Effective: In use

Mode	XMIT FREQ. (MHz)	RCV FREQ. (MHz)	PWR OUT (W)	Modulation
SGLS (LOW FREQ.)	2217.5	1775.733	8.4	PSK
SGLS (HIGH FREQ.)	2287.5	1831.787	8.4	PSK
STDN LO (LOW FREQ.)	2217.5	2041.947	8.4	PM/PSK
STDN LO (HIGH FREQ.)	2287.5	2106.406	8.4	PM/PSK
TDRS/STDN HI (LOW FREQ.)	2217.5	2041.947	144-151 <sup>©</sup>	PM/PSK
TDRS/STDN HI (HIGH FREQ.)	2287.5	2106.406	144-151 <sup>©</sup>	PM/PSK

<sup>&</sup>lt;sup>0</sup> Varies with transmit frequencies.

System: SHUCS Effective: In use

Mode	XMIT FREQ. (MHz)	RCV FREQ. (MHz)	PWR OUT (W)	Modulation
N/A	1626.5-1646.5	1525.0-1545.0	15.0 max.	QPSK

System: SSOR <sup>♂</sup> Effective: 6A

Mode	XMIT FREQ. (MHz)	RCV FREQ. (MHz)	PWR OUT (W)	Modulation
LOW	414.2	414.2	0.25	FSK
HI	417.1	417.1	5.00	FSK

EVA can also use UHF frequencies (see UHF system below).

System: TACAN Effective: In use

Mode	XMIT FREQ. (MHz)	RCV FREQ. (MHz)	PWR OUT (W)	Modulation
X Channels-RCV	N/A	962-1024 <sup>©</sup> 1151-1213 <sup>©</sup>	800 max.	PCM
X Channels- XMIT/RCV	1025-1087 <sup>%</sup> 1088-1150 <sup>%</sup>	962-1024 <sup>©</sup> 1151-1213 <sup>©</sup>	650 max.	PCM
X Channels-AIR/AIR	1025-1087 <sup>%</sup> 1088-1150 <sup>%</sup>	1088-1150 <sup>∜</sup> 1025-1087 <sup>⁴</sup>	500 max.	PCM
Y Channels- XMIT/RCV	1025-1087 <sup>%</sup> 1088-1150 <sup>%</sup>	1088-1150 <sup>%</sup> 1025-1087 <sup>%</sup>	650 max.	PCM
Y Channels-AIR/AIR	1025-1087 <sup>%</sup> 1088-1150 <sup>%</sup>	1088-1150 <sup>∜</sup> 1025-1087 <sup>⁴</sup>	500 max.	PCM

<sup>&</sup>lt;sup>♥</sup> Channels 1 through 63.

<sup>&</sup>lt;sup>♠</sup> Channels 64 through 128.

# SHUTTLE OPS

INCO/COMM/JSC-12829 9/1/2004: REV G SCP 8.1

System: <u>UHF</u> Effective: In use

Mode	XMIT FREQ. (MHz)	RCV FREQ. (MHz)	PWR OUT (W)	Modulation
EVA	296.8	296.8 (V <sup>A</sup> )	0.25	AM
		259.7(V+D <sup>⊕</sup> )		
		279.0 (V+D)		
	259.7	259.7(V)		
		296.8 (V)		
SIMPLEX	296.8	296.8 (V)	0.25 or 10.0	AM
	259.7	259.7 (V)		
SIMPLEX + G <sup>®</sup>	296.8	296.8 (V)	0.25 or 10.0	AM
		243.0 (V)		
	259.7	259.7 (V)		
		243.0 (V)		
G T/R	243.0	243.0 (V)	0.25 or 10.0	AM

 <sup>∀</sup>oice.

System: VHF<sup>♦</sup> Effective: In use

	XMIT FREQ. (MHz)	RCV FREQ. (MHz)	PWR OUT (W)	Modulation
VHF 2 <sup>st</sup>	121.750	130.167	0.1 or 5.0 or 10.0*	FM
VHF 1 <sup>D</sup>	139.208	143.625	0.1 or 5.0 or 10.0*	FM

<sup>◆</sup> Operation frequency range is 115MHz-174MHz, tunable in increments of 25KHz OR 12.5KHz.

## B. Station

System: **EARLY COMM (ECS)** Effective: 2A

Mode	XMIT FREQ. (MHz)	RCV FREQ. (MHz)	PWR OUT (W)	Modulation
LOW/HI	2287.5	2106.4	10.0	BPSK

System: **INTERIM CONTROL MODULE (ICM)** Effective: 2A.1°

Mode	XMIT FREQ. (MHz)	RCV FREQ. (MHz)	PWR OUT (W)	Modulation
MA	2287.5	2106.4	15.8	BPSK
S-BAND SA	N/A	2106.4	15.8	BPSK

<sup>&</sup>lt;sup>®</sup> May be 7A.1.

<sup>&</sup>lt;sup>₠</sup> Data.

<sup>&</sup>lt;sup>
→</sup> Guard.

<sup>&</sup>lt;sup>■</sup> Contingency frequencies; antenna designed to radiate at 139.208MHz.

<sup>□</sup> Nominal frequencies and modulation.

<sup>\*</sup> Low, medium, and high power settings.

## SHUTTLE OPS

INCO/COMM/JSC-12829 9/1/2004: REV G SCP 8.1

System: **Ku-BAND** Effective: 6A

Mode	XMIT FREQ. (GHz)	RCV FREQ. (GHz)	PWR OUT (W)	Modulation
N/A	15.003	13.775	10.0	BPSK <sup>®</sup>

<sup>&</sup>lt;sup>©</sup> For return link, UQPSK for forward link.

System: **S-BAND** Effective: 4A<sup>o</sup>

Mode	XMIT FREQ. (MHz)	RCV FREQ. (MHz)	PWR OUT (W)	Modulation
LOW/HI	2265.00	2085.70	21.0	BPSK

<sup>&</sup>lt;sup>o</sup> Low data rate is operational at 4A while high data rate is operational at 5A.

System: <u>UHF (or SSSR)</u> Effective: 6A

Mode	XMIT FREQ. (MHz)	RCV FREQ. (MHz)	PWR OUT (W)	Modulation	
LOW	414.2	414.2	0.25	CPFSK	
HI	417.1	417.1	5.00	CPFSK	

System: WIRELESS VIDEO SYSTEM (WVS) Effective: 4A

Mode	XMIT FREQ. (MHz)	RCV FREQ. (MHz)	PWR OUT (W)	Modulation
N/A	N/A	400.2♂	min 0.250	GMSK
N/A	2410 <sup>♥</sup> 2470 <sup>♠</sup>	N/A	0.125-0.250	GMSK

Commands and UHF to EMUs.

<sup>&</sup>lt;sup>⋄</sup> Video signals from EMUs.

<sup>&</sup>lt;sup>♠</sup> S-band, center frequency.

## **ANTENNA LOCATIONS**

A. Shuttle (see Figure 8.1-1 and Figure 8.1-2)

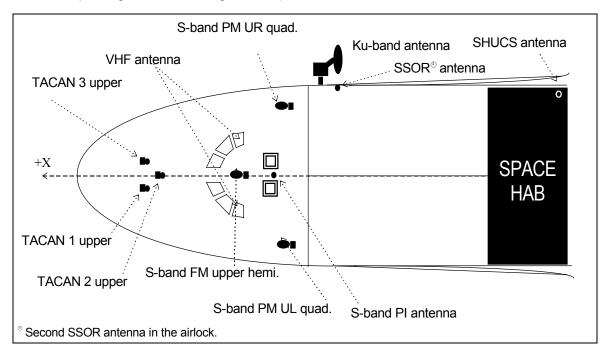


Figure 8.1-1. Top view of the shuttle vehicle/antenna locations

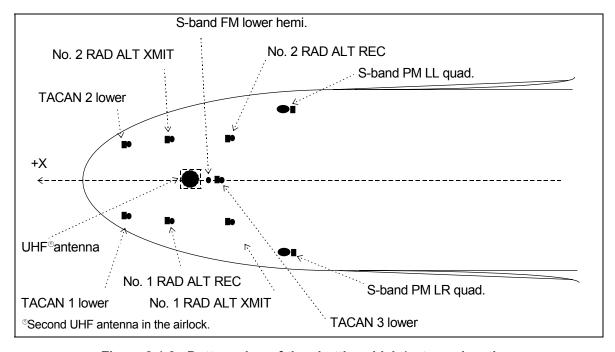


Figure 8.1-2. Bottom view of the shuttle vehicle/antenna locations

B. Station (See Figure 8.1-3 through Figure 8.1-7)

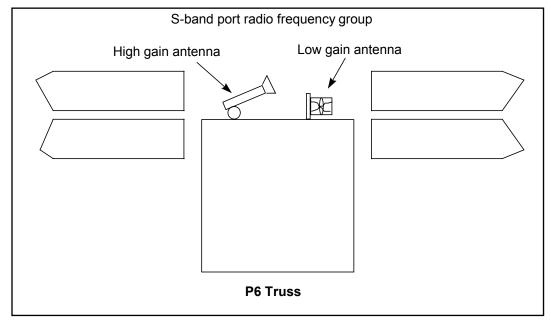


Figure 8.1-3. S-band antenna locations

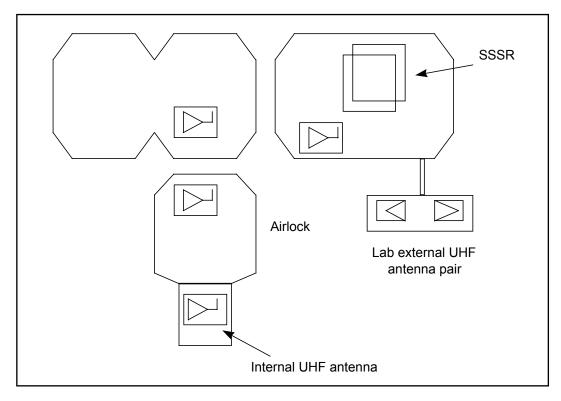


Figure 8.1-4. UHF antenna locations

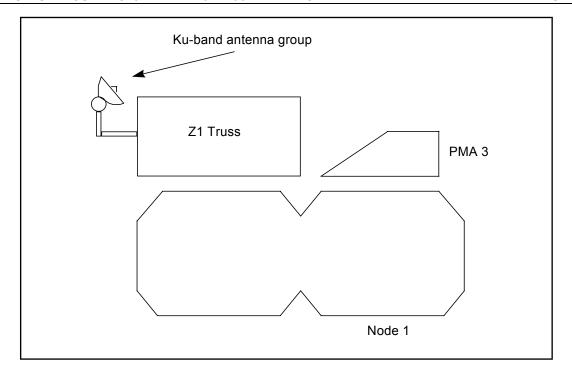


Figure 8.1-5. Ku-band antenna location

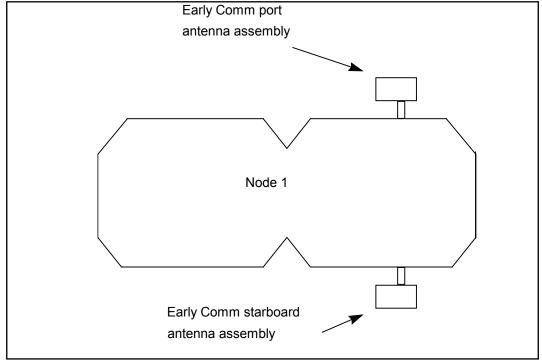


Figure 8.1-6. ECS antenna locations

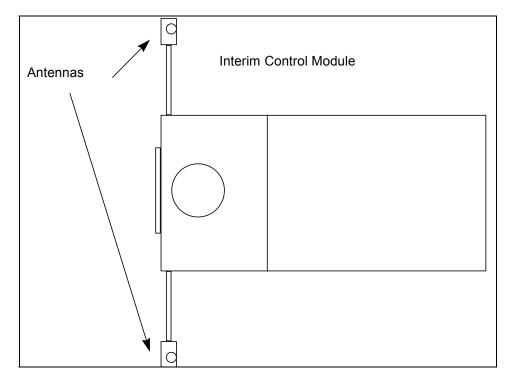


Figure 8.1-7. ICM antenna location

## TITLE

**GROUND SITE USAGE AND CAPABILITIES** 

#### **PURPOSE**

This procedure provides a list of ground sites available for nominal support and some contingency support. A list of each site's capability is also included.

## NOTE

This SCP does not include ALL possible sites. In an emergency, INCO should confirm with GC about the NexT POSSIBLE site. Most sites that were ORIGINALLY used can't be immediately available but GC can coordinate with the site and engineers to establish a link.

## **GENERAL**

These sites can provide real time or delayed Solid State Recorder (SSR) dumps, analog TV downlink, two-way S-band communication, and two-way UHF communication. There are two types of sites that we use during shuttle missions: STDN and RTS sites. Space Tracking and Data Network (STDN) sites are NASA owned and support during normal hours of 8am - 5pm. Remote Tracking Station (RTS) sites are Air Force owned and provide 24 hour support.

The Electronic Systems Test Laboratory (ESTL) at JSC is not a part of the STDN network and does not normally support real-time Shuttle recorder dump operations; therefore, additional time might be required to call them up for support. Hardline from ESTL to MCC can throughput 1 Mbps. The Deep Space Network cannot support Shuttle missions without extensive hardware and software reconfiguration and therefore should not be considered for near-term contingency support. Also, in case of a contingency where 2 Mbps throughput is needed, all sites will be able to receive and record the 2 Mbps dump if amply forewarned but will play it back post-dump at 1Mbps (MCC FEPs are not able to process dump streams at 2 Mbps).

## **PROCEDURE**

Scheduled STDN and RTS Sites:

DFE/GC should provide a list of upcoming sites for the next several orbits. These sites are ready to support, and no coordination should be necessary to have them configured and waiting. However, INCO/INST should ask DFE to confirm that the site is ready to support. Prior to flight, Lead INST should contact the Lead GC for operator names to be included for the updated STDN and RTS site listings.

## Non-Scheduled STDN and RTS sites:

If an off-nominal situation arises and more site support is needed for an extended period of time (such as a Ku-band failure), INCO/INST can ask GC (not DFE) to bring up more ground sites: at least one per rev.

If only a specific ground site is needed (i.e. for a priority dump while Kband is in blockage), then INCO/INST should still talk to GC about having that site ready to support.

## Release of STDN and RTS sites:

INST will use the Internal Note system for notify GC to release a RTS site. This should be done 24 hours before the site is in view. If needed, INST can wait up to 5 hours before site acquisition to release a site, but this is not recommended since a fee will be charge.

OTDN: '' ''I'I I I I' II

STDN sites will be released in the same manner with Internal Note. Although there are no fees for releasing these sites, please give a 5 hour notice prior to acquisition.

The following tables list the S-band FM sites which will provide nominal and contingency support.

5/31/2007: REV G, PCN-5

5/31/2007: REV G, PCN-5

Table 8.2-1: STDN sites and capabilities

Call Sign	Software ID	Site ID	Location	Type of Support	Real Time SSR Dump Throughput	Real Time FM TV DNLK	UHF Capability
MILA	MIL	MILS/MILX	Merrit Island, Florida	Nominal/ Contingency	Yes	Yes	Yes
Dryden	DFR	DFRS	Dryden Flight Research Facility, Edwards Air Force Base, CA	Nominal/ Contingency	Yes	Yes	Yes
Wallops	WLP	WLPS	Wallops IS, VA	Nominal/ Contingency	Yes		Yes
ESTL	JSC	STLS	Electronic Systems Test Lab, JSC B44	Contingency	Yes	Yes	
AGO	AGO	AGOS	Santiago, Chile	Nominal	Yes		_

Table 8.2-2: RTS sites and capabilities

Call Sign	Software ID	Site ID	Location	Nominal Support	Real Time SSR Dump Throughput	Real Time FM TV DNLK	UHF Capability
СООК	VTS	VTSS	Vandenberg Air Force Base, CA	Nominal/ Contingency	Yes		
PIKE	CTS	CTSS	Colorado Springs, CO	Nominal/ Contingency	Yes		
BOSS	NHS	NHSS	New Boston, NH	Nominal/ Contingency	Yes		
LION	OTS	TCSS (OTSS)	Oakhanger, UK	Nominal/ Contingency	Yes		
REEF	DGS	DGSS	Diego Garcia, BIOT	Nominal/ Contingency	Yes		
GUAM	GTS	GTSS	North End of Guam	Nominal/ Contingency	Yes		
HULA	HTS	HTSS	North Shore OAHU, HI	Nominal/ Contingency	Yes		

## Note:

1. Nominal = Sites are normally schedule for support.

Contingency = If site is not nominally scheduled, it can be requested to support if an emergency or off nominal situation occurs. The request should be made at least 45 minutes prior to AOS of the site.

2. All sites capable of Real Time SSR downlink do so at 1 Mbps throughput.

#### **TITLE**

GENERAL PROCEDURE FOR CERTIFICATION OF DISPLAYS AND APPLICATIONS IN THE MCC

9/1/2004: REV G

## **PURPOSE**

This procedure documents some basic standard information that is required in the documentation used to certify MCC displays and applications.

#### **GENERAL**

A standard for what is required for the documentation of verification tests of applications and displays in the MCC. This SCP is divided into the primary types of application and display certification (first time cert, no change recert, and minor change recert). The suggestions in this SCP are general. The user should try to include as much data as possible when certifying applications and displays.

## FIRST TIME/MAJOR CHANGE CERTIFICATION

First time certification means the application or display has never been certified before in the MCC. Every possible combination of states that the display or application can have must be tested and documented. The following are some suggested data to collect and how to prove that the states of the application or display were tested.

- A. Start the display or application without any data flowing (if it uses data at all). This will verify that the program does not die when there is no data for it to process. Hard copy all applicable displays and mark up the printouts to indicate this condition.
- B. Systematically proceed through each state of each part of the application or display. Document via hard copies each state possible. Mark the hard copies with the state tested. A good way to document the states in the verification report is to use a matrix or table that was prebuilt by the developer of the primary tester and simply check off each state as it is seen.
- C. Write up a verification report using the example in Figure 9.1-1.
- D. Sign the verification report and the application notebook cover sheet and return the application notebook to the Discipline Technical Representative (DTR).
- E. The DTR will review the documentation and inform the tester of any missing data that is required before the application or display can be certified.
- F. The DTR will review the application notebook and forward it to the Software Management Board (SMB) chairman for final approval before the application or display is transferred to the certification directories in the MCC.

## **Verification Test**

**Application Name:** General Payload Load **Version #**: 1.0

Tester's Name: Steve Sides

**Test Date:** 06/21/95

## Comments:

I have tested the General Payload Load display during an Ops comp run. The following are the steps that I used to test this display.

- 1. I made hard copies of the display and the EDTE display (MSK980) with no data in them. I tried go to the next page. ERROR general payload load display lets the user change pages when there are not any more pages. An Ops note explaining this problem must be supplied.
- 2. I built 5 PSP dummy commands using the MED emulator application and sent them to the MOC.
- 3. I made hard copies of the Xbuilder display and MSK 980 for all the commands built. I included the printouts with this report.
- 4. I verified that the display returned to page 1 after the last command in the list.

I recommend this application for recertification and promotion to mission support.



#### NO CHANGE CERTIFICATION

No change certification will be done when there is a change to the MCC baseline services and the application or display has been recompiled/relinked to support those changes to the baseline. The tests for this level of certification are not as detailed as a first time certification. Only the major modules of the displays or applications need to be verified.

**REV G** 

9/1/2004:

- A. Start the display with data flowing, if needed.
- B. Systematically check each major part of the display or application to verify that the application or display still works the same as it did before the baseline change.
- C. Write up a verification report like example 9.1-1 but with less data required.
- D. Sign the verification report and the applications notebook cover sheet and return it to the DTR.
- E. The DTR will review the document and inform the tester of any missing data that is required before the application or display can be certified.
- F. The DTR will review the application notebook and forward it to the SMB chairman for final approval before the application or display is transferred to the certification directories in the MCC.

#### MINOR CHANGE CERTIFICATION

Minor change certification will be done when there is a small change to application or display. Small change means a change that does not greatly affect the operation of the display or application. The tests for this level of certification are not as detailed as a first time certification but are more detailed than the no change certification. Major modules of the displays or applications need to be verified, as well as the documented changes to the display or application.

- A. Start the display with data flowing, if needed, unless the change was to the data acquisition interface.
- B. Systematically check each major part of the display or application to verify that the application or display still works the same as it did before the baseline change.
- C. Write up a verification report like example 9.1-1 but with less data required.
- D. Sign the verification report and the applications notebook cover sheet and return it to the MCC lead.
- E. The DTR lead will review the document and inform the tester of any missing data that is required before the application or display can be certified.
- F. The DTR will review the application notebook and forward it to the SMB chairman for final approval before the application or display is transferred to the certification directories in the MCC.

9/1/2004: BASIC, REV G

#### TITLE

COMMAND SYSTEM: HARDWARE PANEL CONFIGURATION MANAGEMENT PROCESS

#### **PURPOSE**

To define a standard procedure required for modification of the hardware panel database.

## **GENERAL**

Whenever there is a change required to the hardware panel database, the user will need to follow some very carefully constructed steps so that there cannot be any chance of an error in the database.

## **PROCEDURE**

- A. Log on to a workstation in the Consolidated Development Environment (CDE).
- B. Open an xterm and start the hardware panel cm tool. See the hardware panel certification notebook for the procedure to start the cm tool.
- C. Edit the database per the cm tool users guide.
- D. Run the verification report per the cm tool users guide.
- E. Manually verify all the warning messages generated by the cm tool verification task. There will be some warning messages associated with buildable loads and MRTCs. The cm tool will ask the user to verify or not verify the report, since there are some warnings. If the user accepts the verification report, the cm tool will set the checksum so that any more changes will be rejected by the hardware panel background process.
- F. Contact an INCO Group Administrator (GA) for transfer of the new database to the ops side. The GA is

James McCarroll713-648-2885

- G. Once the GA has moved the database to the ops side, the user will need to verify that the changed database is in the correct place. During a comp run, set up the new database and press all the commands that were changed during the editing process.
- H. Repeat step G by having two independent testers verify that the changes were made.
- I. Generate the test reports and the application cover sheet for signoff by management.
- J. Fill out the application notebook cover sheet and the Joint Evaluation Team (JET) form. When both of these forms have been signed off by the Discipline Technical Representative (DTR), the DTR should get the software management board chairman's signature before submitting the forms to the JET.
- K. Inform an INCO GA that the database needs to be promoted to the certification directories for flight support. See step F for the list of GAs.

## **TITLE**

#### DATA ACQUISITION IN THE MCC

#### **PURPOSE**

SHUTTLE OPS

To define a standard procedure for initialization and operation of the data acquisition system in the MCC.

## **GENERAL**

This procedure explains how the DATA ACQ function works on the INCO workstations in the MCC and how to manually start and stop data flow to the workstations.

## **PROCEDURE**

## How to Start DATA ACQ.

The data source that is used by the INCO displays is called Information Sharing Protocol (ISP). The process that collects the data for display is named "ispdacq." The ispdacq server automatically starts on the normal INCO workstations in the white-fcr. These workstations are white -fcr5 and white-fcr24. The best way to make sure that the ispdacq application is running on the most efficient workstation (whitefcr24 is to log onto this workstation before logging on to the other INCO workstation. If the normal INCO workstations are not being used for the activity, data acq will have to be started manually. The following steps explain the procedure for manually starting data acg so that INCO displays have telemetry and computational data.

- From the INCO DNAV, select DATA ACQ/START DATA. A.
- B. Repeat step 1 on the workstation to be used as the backup to the prime workstation that is running the ispdacq program.
- Start up some of the real-time displays to verify that DATA ACQ has started. The user can also C. note the DATA ACQ-related messages that will be generated in the advisory services window.

## How To Tell If DATA ACQ Is Working.

Generally, the times at the top of each of the displays will increment as long as DATA ACQ is working (exception is LOS periods).

## What To Do If DATA ACQ Quits

When there is a workstation problem that causes the ispdacg program to terminate, another application will automatically move the ispdacq program to the backup workstation.

- When DATA ACQ guits on both the prime and backup workstations, it has been a very bad day for Α. INCO. DATA ACQ will have to be started on a third workstation. If the normal workstations are being used, the backup to both of the FCR workstations is the INST workstation (white-mpsr5). The How to Start DATA ACQ procedure should be followed to recover data to the displays. All the displays should automatically reconnect to the new DATA ACQ server. The reconnection might take a minute, so be patient.
- B. If the workstation displays are not changing (GMT and MET not updating), that workstation may have fallen off the LAN. Verify that the DATA ACQ workstations are processing data by asking INCO or looking at another INCO workstation. If none of the INCO workstations is processing any data updates, there is a very serious problem with the MCC LAN network that will have to be worked by the workstation systems supervisor (WSS) on the WSS call loop. They will tell you what should be done to recover data flow.

#### How to Stop DATA ACQ

Normally, there is no need to stop data flow on the INCO workstations, but if it is started on one of the other workstations as a backup to the INCO workstations, the following procedure should be used when that backup is not needed any longer.

A. From the INCO DNAV, select DATA ACQ/STOP DATA. This will start the automatic process to gracefully shut down all the DATA ACQ-related processes on the workstation.

Some of the displays that are used by the INCO group start their own data flowing when they are started from the DNAV menu. If these displays do not show good data, they must be dropped so that the DATA ACQ background processes will quit. If there is more than one copy of a display of this type running, all of the copies will have to be dropped before the background process will quit.

## What to Do When a Comp Does Not Work

Sometimes comps will stop processing data to the displays. An "M" will be displayed for the parameter that is computed in the comp. The following procedure can be used to restart individual comps on the workstation where they are running.

- A. From the INCO DNAV, select DATA ACQ/SHOW CONNECTIONS. Look for the computation that is failed and determine on which workstation it is running. This is usually white-fcr5 or white-fcr24.
- B. From the MASTER DNAV, on the workstation on which the comp is running, select GLOBAL/AUTOPANEL. The autopanel display will appear.
- C. Locate the comp name on the display. Press the left mouse button when the cursor is located over the comp name. This will select the comp.
- D. Press the right mouse button to view a small menu. Select Restart. A worry box will pop up. Select the YES option to restart the comp. Once the comp is restarted, the M's on the displays should be replaced by valid data, if there are data flowing to the workstations.

## To Restart All the Comps on a Workstation

Sometimes none of the comps on a workstation are running correctly. Use the following procedure to restart all the comps that are running on the workstation.

A. From the INCO DNAV on the workstation with the failed comps, select DATA ACQ/RESTART COMPS. All the M's on the displays should be replaced by valid data, if there are data flowing to the workstations.

## How to Start Oimon Server

Oimon is a special process that is used to determine the health and status of the OI MDMs and DSCs. Normally, the Oimon server will start automatically on the INST workstation (white-mpsr5). The way to tell if it started automatically on the workstation is to call up one of its displays. The best one to call up is the "raw data" display. This display is located on the INCO DNAV under the DISPLAYS/INST SYSTEMS/raw data menu option. If oimon is not running, the following procedure should be used to start it.

A. From the INCO DNAV, select DATA ACQ/INST Workstation Only/Start oimon server. A small display will pop up on the lower right hand side of the monitor of the workstation on which it is started. This display will tell when the program is running and where. It will beep in the headset of the DVIS that is plugged into the workstation when oimon server quits.

## How To Stop Oimon Server

Oimon should not have to be stopped, but if there is some reason to, the following step should be taken.

A. From the INCO DNAV, on the workstation that oimon is running on, select DATA ACQ/INST Workstation Only/Stop oimon. There will be a beep in the headset that is connected to the workstation that oimon was running on and all the MDM wrap parameters will change to "M".

## When All Else Fails!

- A. Contact WSS on the WSS call loop for help and write a DR. Do not let them try to troubleshoot too long. Tell them to reboot the workstation so that INCO can get back to work.
- B. Contact an INCO Group Administrator (GA). The GA is

James McCarroll713-648-2885

## **TITLE**

DUMP REPORT PROGRAM USER'S GUIDE

#### **PURPOSE**

This procedure documents how the user will execute the dmp\_rpt program to process a dump Front End Processor (FEP) report.

9/1/2004: REV G

## **GENERAL**

The dump FEP generates a report that details each second that is dumped to the ground from the orbiter operational recorders. The workstation file generated can be very large and difficult to review for data segments. This program will read the dump FEP report and generate a smaller report that includes the start and stop times of the data segments that contain at least the user defined number of minor frames per major frames.

## **PROCEDURES**

- A. From the INCO DNAV select Ground Displays/Dump Report.
- B. A small window will open that lists the files available to process. Ask DFE which report file is from the dump that you want to process (Figure 9.4-1). The format of the file name should be <site> <rev #>

```
Xterm

gts51 mil43 tde55 tdw123

Enter the name of the report to process:
```

Figure 9.4-1. Report to process screen

C. The program will ask you for a report filename to process, followed by the number of minor frames per major frame that are considered to be a valid dump (Figure 9.4-2).

```
xterm
gts51 mil43 tde55 tdw123
>>dmp_rpt
Enter the name of the report to process: gts51
Enter minimum acceptable frame count: 100
213:12:34:05 to 213:12:50:13
213:12:55:23 to 213:13:18:35
```

Figure 9.4-2. Frame count screen

D. Once the operation is complete, the user can close the window by pressing the Return key. To process another report, simply start at step 1 again.

## To delete files from the dump directory

The directory on the workstation that contains the files that the dump report processes periodically will get full and should be cleaned out. Use the following procedure to delete the files from this directory:

- From the INCO DNAV, select Ground Displays/Delete Dump Files
- The files in the dump directory will be deleted

## Error messages

There are several possible messages that the program can generate. These messages are displayed in the window. The following is a list of the messages and the meaning of each:

- A. dmp\_rpt can't find the <report name> TERMINATING This message means that the program could not locate the report name that was entered. The file either does not exist or is located in another directory. Contact DFE to find out in what directory they stored the report.
- B. Using 99 for frame count This message means that the user did not enter a frame count number. The normal number is between 0 and 100.

#### **TITLE**

X WORLD MAP USERS GUIDE (VERSION 2.0)

#### **GENERAL**

The x world map suite is a set of applications used in the Mission Control Center (MCC). There are four modules in the x world map suite. The first is the world map display, which shows the position of the orbiter and other satellites over the Earth. The second is the world map daemon (xmadsd), which is a background process used for collecting statistical data on telemetry drop outs. This module collects the data and makes it available to the real-time display (xvwm) statistics (xskaps) and S-band quad antenna (xsqad) modules. The scope of this users guide is for the world map display only.

## **OVERALL DISPLAY**

There are several parts to the world map display but the general look and feel of the display is in the following figure.

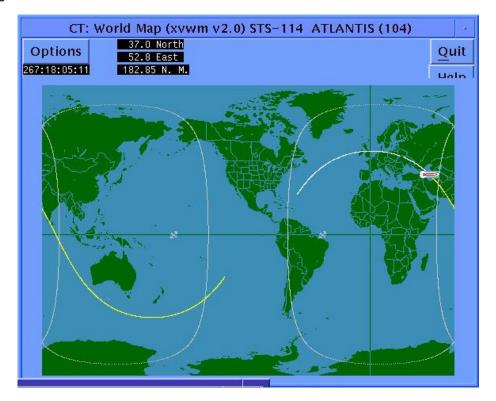


Figure 9.5-1. x world map

The top part of the display contains all the controls for the application. The options button will list all the actions that the user can take to modify the world map. The quit button will terminate the execution of the application. The help button opens a window with the help file in it. The following sections will explain the use of each of these buttons in more detail.

The map part of the display is where all the work is done. The position of the orbiter is generated by processing the Systems Management (SM) telemetry from the orbiter for the data. If the orbiter data is lost, the program will continue to update by propagating the position from the last good data. All data losses are marked on the display with a red line along the path the orbiter followed. This gives a graphical representation of where there were data drop outs.

#### THE OPTIONS MENU

The options menu has 10 options. The options are explained as follows:

A. Resize Map - This option will allow the user to select from three different sizes. The choices are

Small size Medium size Large size

- B. Clear Data Point This option clears all the LOS data points for the world map display.
- C. Orbit Number This option allows the user to set the orbit number.
- D. Color Key This option displays the color key for all the possible combinations of lines over backgrounds.
- E. Statistics If the world map daemon is running, this option will display a window with the statistics on the S-band antennas and how and where data drop outs occurred.
- F. Ground Stations This option opens a display with the list of available sites that can be displayed on the world map. These sites will be displayed with their associated masking for the altitude of the orbiter. The user selects all the sites they want to display and presses the Apply button. If they do not want to make any changes, then they press the Cancel button.
- G. Satellites This option opens a display with the list of available satellites to display. The user selects all the satellites they want to display and presses the Apply button. If they do not want to make any changes, then they press the Cancel button.
- H. TDRS Footprints This option allows the user to select which TDRSS satellite will show its "footprint" on the world map. The footprint is used to determine when a TDRS satellite is in view of the orbiter. There are three choices

TDRSS East TDRSS Spare TDRSS West

The user selects all the satellites they want to display and presses the Apply button. If they do not want to make any changes, then they press the Cancel button.

- I. Show SAA This option allows the user to show the South Atlantic Anomaly (SAA) on the world map display.
- J. Show Sun Terminator This option allows the user to show the locations over the world where the Sun will be shining. There are two sets of terminator lines displayed. One is for ground Sun raise and set, and the other is for orbiter Sun raise and set.

## **QUIT BUTTON**

This button is used to terminate the execution of the display.

#### **HELP BUTTON**

This button will open a display with a help file in it.

## TITLE

MEWS USERS GUIDE FOR INCO USERS

## **PURPOSE**

To provide a procedure for using the Mission Evaluation Workstation System (MEWS) program for collecting and displaying Operational Data Reduction Complex (ODRC) data on the MCC INCO team member's workstation.

### **GENERAL**

This users guide is designed to assist the user in operating some of the more simple functions that are available in the MEWS suite of programs. See the MEWS Users Guide for assistance on the other functions for MEWS or call the ODRC help desk at 483-ODRC for assistance on any problem in pulling ODRC data.

#### **COMMON PROCEDURES**

To select a box or button - Move the mouse cursor over the box or button, then press and release the left mouse button.

To type text in a "type-in box" - Move the mouse cursor into the box, select the box but leave the mouse cursor in the box, then type in the text.

#### TO START MEWS

- A. Select Master Display Navigation (DNAV) and Global APPS.
- B. Slide the mouse cursor down to the MEWS/ODRC option and release the left mouse button.
- C. The following window should appear (Figure 9.6-1).

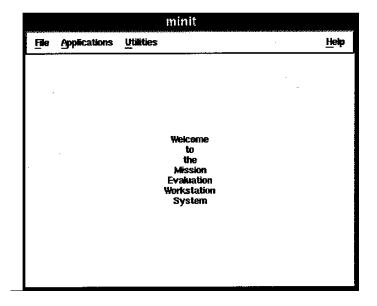


Figure 9.6-1. Welcome window

## /COMM/JSC-12829 9/1/2004: REV G

#### TO GET ODRC DATA

- A. Follow the procedure, TO START MEWS, then select Applications.
- B. Select ODRC Interface. Wait a few seconds and a window will open (Figure 9.6-2).



Figure 9.6-2. ODRC interface

C. Verify that the correct flight ID is at the top of the window.

If the flight ID is not the correct one from which the data will be requested, follow the procedure TO CHANGE THE FLIGHT ID. Note that in ODRC, simulations are numbered with the basic flight ID or with the flight ID and an additional letter (ask the ODRC Help Desk at 483-ODRC). On a flight, MEWS will default to the flight number, but a sim number must be selected when supporting a sim.

- D. Select Request and Operational Downlink to request data from the ODRC host.
  - For a Tab format that is already built for INCO.
    - a. Select Tab Format under "Item Type" (Figure 9.6-3).
    - b. Select the List Files button.
    - c. Click on one or more format names in the pop-up window (selected file names will turn white) and click on "Done" (the pop-up window will disappear).
    - d. Type in the start and stop times for the request by selecting each box and entering the appropriate values.
    - e. In the Update Rate box, type in a sample rate:
      - "0" will request full rate data
      - "1" will request 1 second/sample
      - "2" will request 2 seconds/sample
    - f. In the Filename box, type in a file name for the data to be written into.

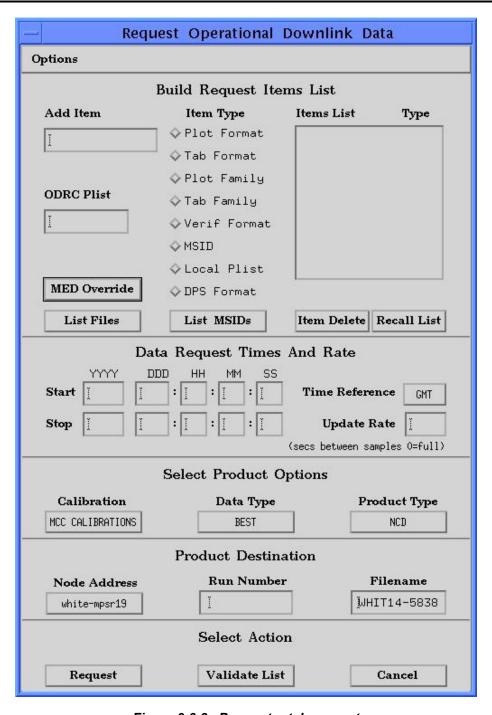


Figure 9.6-3. Parameter tab request

- g. For SIMs, select a run number. Orbit SIM runs are numbered by local Julian date and 2-digit run number (e.g., the first run for a particular SIM starting on November 30th would be 33401). Run numbers are not used for flight support.
- h. Select the Request button.
- Messages will appear at the bottom of the window. Verify that the request completed without errors. If there are error messages, the request can be canceled and/or resubmitted.

- M/JSC-12829 9/1/2004: REV G
- 2. There is a way to create a parameter list and send that list to the ODRC host computer. This procedure is not covered in this SCP, but the MEWS Users Guide contains a way to build a parameter list and send it to the ODRC host. These formats can be used by MEWS to request data.
- E. Once the data file is on the workstation, exit or minimize the ODRC Interface window.
- F. To view Tab format data, select Applications and Tab on the MEWS Welcome (minit) window.
  - 1. Verify or change flight number.
  - 2. Select Format using the Select Format menu option. Select the same tab format used above in step D. The selected tab format will change to white.
  - 3. Select Done. The window will disappear.
  - 4. Select Data using the Select Data Source menu option. Select the same filename you used in step D. The selected filename will change to white.
  - 5. Select Done. The window will disappear.
  - 6. Select Tab and Tab to Screen.

## **TO PLOT DATA**

- A. Make the ODRC request as above, but request a Plot format instead of a Tab format (Figure 9.6-3).
- B. From the MEWS Welcome window, select Applications and Plot.
- C. Verify that the correct flight is shown at the top of the window. If it is not, follow the procedure, TO CHANGE THE FLIGHT ID.
- D. Select Data to pick the data file to plot using the Select Data menu option. Select the appropriate data file from the list displayed. The data file name will change to white letters when it is selected.
- E. Select Done. The window will disappear.
- F. Select Format using the Select Format menu option. Select the same plot format as used in the data request from the list displayed. The selected plot format will change to white.
- G. Select Done. The window will disappear.
- H. Select Plot and View Plot. The plot will display in the window (Figure 9.6-5).

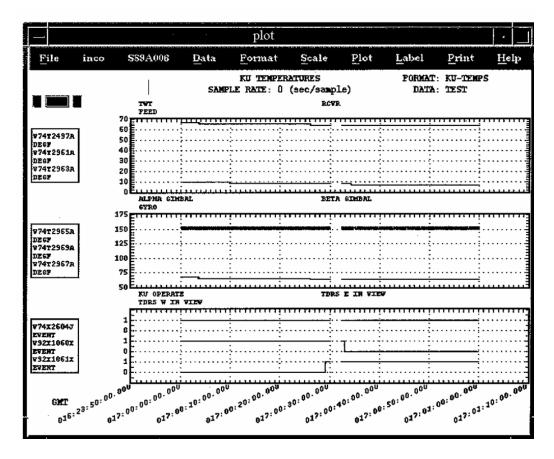


Figure 9.6-4. Plotted data

## TO CREATE A NEW PLOT FORMAT

- A. Follow the procedure, TO START MEWS, then select Application.
- B. Select Plot.
- C. Select Format.
- D. Select Create Format.
- E. Type in a unique file name for the new plot format file and select Create (Figure 9.6-6).

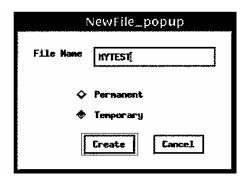


Figure 9.6-5. Assign name

- 9/1/2004: REV G
- F. Wait a few seconds and a new window will open (Figure 9.6-7).
- G. Type in a title in the TITLE box.
- H. Select the GRID box and type in a grid number (1 to 3). This will determine where the data for an MSID will be placed.
- I. Select the MSID box and type in the MSID to display data.
- J. Select the NOMENCLATURE box and type a short description of the MSID.
- K. Select Apply. The MSID and the nomenclature will show up in the box for the plot grid selected.
- L. If the MSID to be plotted is a discrete, then press the GRID x ANALOG button to toggle to the GRID x DISCRETE condition.

Note: Analog and discrete data cannot be plotted in the same grid.

- M. If the MSID is analog, enter the Low and High scale limits.
- N. Enter a Low and High value for limit lines (optional). This will display a line on the plot grid at the requested level.
- O. Repeat steps H through K for all the MSIDs to be plotted in the same grid.
- P. Repeat steps H through O for each grid to be plotted.
- Q. Select SAVE to save all the work to a file. The window will disappear.

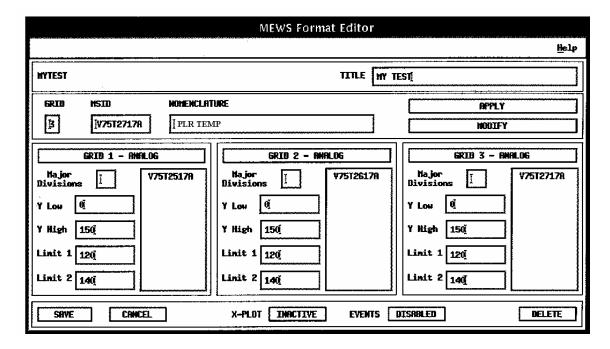


Figure 9.6-6. Build plot template

## TO CHANGE A PLOT'S SCALE

- A. Follow the procedure, TO PLOT DATA.
- B. Once the data is displayed, select Scaling.
- C. Select Y-Axis Zoom (mouse). A small circle will replace the shuttle as the mouse cursor.
- D. Select the upper and lower bounds to plot by moving the mouse cursor to a spot and pressing the left mouse button.

Note: The current value of the position of the mouse cursor is displayed in a small box in the upper left-hand corner of the window.

- E. Select Plot.
- F. Select View Plot.
- G. Verify that the Y-scale had changed for the plot grid requested (note changes in Figure 9.6-8).
- H. This same procedure can be followed for changing the X-axis scale (time).

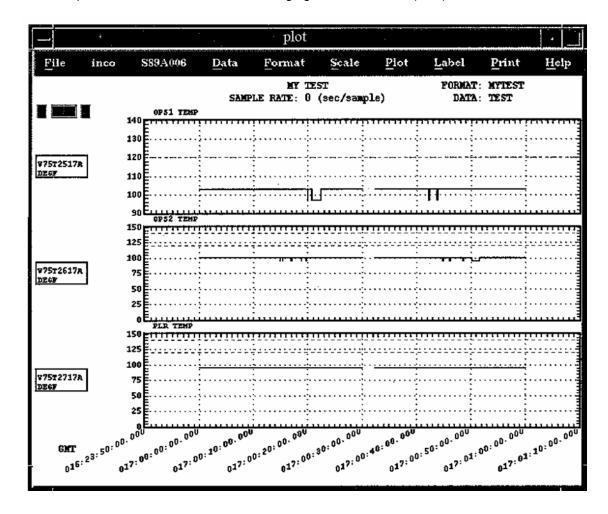


Figure 9.6-7. Plot with modified Y-axis

## **TO PRINT A PLOT**

- A. Follow the procedure, TO PLOT DATA.
- B. Select Print.
- C. Select Hardcopy.
- D. An hourglass will replace the shuttle cursor while the plot's printer data is being collected.
- E. Wait a few minutes, and the plot should print on the laser printer behind the INST console.

## TO CHANGE THE FLIGHT ID

- A. Select the STS-1xx Flight number.
- B. Select Change Flight.
- C. Select a flight from the list of flights (Figure 9.6-9).
- D. Select OK. The window will disappear.
- E. Verify that the flight ID has changed at the top of the window.

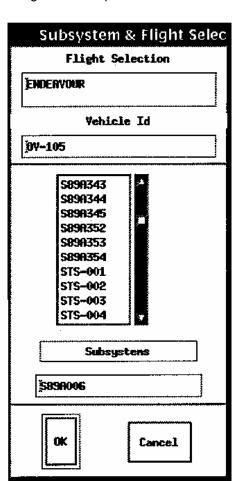


Figure 9.6-8. Select flight

#### TITLE

elog - EVENT LOGGER

## **DESCRIPTION**

The program provides a means of logging telemetry events in real time. An event is defined as the comparison (greater than, equal to, etc.) of an MSID value to a constant. When the comparison is true, the event, time tagged by GMT and MET, is logged to a file and to the program window. A text message (color and content defined by the user) represents the logged event. Events are assigned to a class group or groups for easier manipulation. These classes define the display windows for the events. The program allows for acknowledging an event; counters are displayed showing the number of unacknowledged events and total events by class to aid in event tracking. An information mode provides the user with a means of examining and changing event parameters from within the program.

#### **PROCEDURES**

The program can log events only while real-time data are available; previously logged events can be checked even if real-time data is not active. The program uses three data files: (1) event, (2) log, and (3) configuration. The event file describes the events; i.e., the comparisons, update rates, filter values, messages, and colors for each event. The log file is generated by the program at startup if not already existing. If present, this file is checked for previously logged events, and the program display is updated accordingly. The configuration file contains class window position information and is generated by the program via user request. This information is used to restore the class configuration for subsequent sessions. The event file is required; the configuration file is optional. Additionally, the program writes a temporary file, **elog.temp**, to the current directory when a print command is issued. This file is erased when the program exits.

The user is allowed to change a number of the program parameters. These parameters, and their default values, are as follows:

Parameter Default Event file name DATA/elog.event Log file name DATA/elog.log Configuration file name DATA/elog.config Title bar name **Event Logger** Class window width 80 columns Class window rows 5 rows Move class/icon outlines **TRUE** Start iconified **FALSE** 100% Alert tone volume Font name 9x15 Icon font name 8x13 Background color Black Border color White Border width 2 pixels

Window size and position 9/10 screen size

Display name/ID NULL Log initial events FALSE

Two methods are available for changing the parameter default values, command line inputs and entries in the **.Xdefaults** file.

The **.Xdefaults** file, found in the user's home directory, can contain parameter values for a number of programs. The syntax for a parameter setting in this file for the **elog** program is as follows:

elog\*<parameter name>: <value>

<parameter name> is one of the valid parameter names and <value> is the new value of the parameter. The parameter names are the same as the command line options (without the preceding character; see below); however, the abbreviated forms cannot be used in the .Xdefaults file. The following is an example entry to set the background color:

## elog\*background: midnightblue

The command line options to change the parameter defaults can appear in any order on the command line. The syntax for these commands is as follows:

## -event (or -e) <event file name>

Instructs the program to use the file, <event file name>, as the event file.

## -log (or -l) <log file name>

Instructs the program to use the file, <log file name>, as the log file.

## -config (or -c) <configuration file name>

Instructs the program to use the file, <configuration file name>, as the configuration file.

## -name (or -n) "<name>"

Causes the main title bar to display <name>. If the name contains any spaces, it must appear in quotes as shown.

## -classwidth (or -cw) <number of columns>

Changes the initial character width of the class windows. A configuration file overrides this command.

## -classrows (or -cr) <number of rows>

Changes the initial number of rows of the class windows. A configuration file overrides this command.

## -moveoutline (or -mo) <FALSE>

Instructs the program to move the classes/icons instead of their outlines when (re)positioning the classes/icons with the mouse.

## -snapshot (or -s) <TRUE or FALSE>

If TRUE, the program logs any events that evaluate TRUE at program startup (rate and filter applies). If FALSE, the program ignores the initial state and begins logging only when changes occur.

#### -iconic (or -i) <x,y>

Instructs the window manager to iconify the program window initially; the x-y coordinates specify the location of the icon.

### -volume (or -v) <volume>

Sets the volume of the alert tone given whenever a dialog box is generated. The volume should be from 0 (no tone) to 100 (full volume) percent; values outside this range are adjusted to the nearest valid value.

#### -font (or -fn) <font name>

The program uses the font specified for drawing the main title bar, command menu, and help, commonality, and reference mode displays.

#### -iconfont (or -ifn) <icon font name>

The program uses the font specified to draw the icon window text.

## -background (or -bg) <background color>

Specifies the background color of the main window. RGB values are accepted.

## -bordercolor (or -bd) <border color>

Specifies the color of the main window border. RGB values are accepted.

## -borderwidth (or -bw) <border width>

Specifies the width, in pixels, of the main window border.

## -geometry (or -gm) <widthxheight+x+y>

Instructs the program to set the initial main window size (in pixels) and/or position. The entire set of values need not be specified (e.g., just the size could be set). For initial main window size the precedence is (lowest to highest): the default size, the **-geometry**-specified size, the mouse-selected size (using the middle mouse button), then the size saved in the configuration file. The window can be resized as desired using the mouse once the program is running. The window manager will prevent sizing the window smaller than the area required to display the main title bar and all the classes in an iconified state.

## -display (or -ds) <display name/ID>

Sets the display on which the program window is shown. The display name is in the X-windows format (e.g., local:1.0 or ursa:0.0). This command is valid only on the command line (i.e., ignored in the .Xdefaults file).

#### **EVENT FILE FORMAT**

Each event defined is placed on a single line in the event file. The format for an event definition is as follows:

The individual parameters in the event definition are described below.

- A. **Class** An event must be assigned to at least one class and can belong to as many classes as desired. The program uses these class names to define the class windows for receiving events. Only those events of a particular class can be displayed in that class window. If an event is assigned to multiple classes, it is shown in each class window to which it belongs. If more than one class is defined in the event file, the program automatically generates a class named 'All,' to which all events are assigned. The class designations are used in the program for manipulating event display, rates, filters, acknowledgement, and enabled status of event groups.
- B. **MSID** This is the MSID whose value is checked in the event. An MSID can be used in as many events as required. Text characters in MSID's must be capitalized.
- C. **Operator** The operator defines the comparison between the MSID and the constant. The valid operators are > (greater than), < (less than), = (equal to), and % (bit mask). Certain operators may be combined: >= (greater than or equal to) and <= (less than or equal to). The NOT operator (~) may precede any of these operators (not greater than, not equal to, etc.). The bit mask operator allows testing of individual bits within parent word and natural unsigned parameters. Constants following this operator are assumed to be in hexadecimal (one or two words of up to eight digits each; if less than eight digits are in a word, leading zeros are assumed). For example, V72M7919P % 10a evaluates TRUE if the second, fourth, and ninth bits of the MSID are ON (hex 10a = binary 100001010). The ~% operator evaluates TRUE if none of the bits specified by the constant are ON in the MSID. For text comparisons the character/string must be bounded by double quotes (= "text"). Only the = operator can be used in text comparisons. The text string can be from one to eight characters in length.

- D. **Constant** The constant is the value (or bit mask or text) to which the MSID is compared. The constant is read as a floating point number except when following a bit mask operator, in which case a hexadecimal number is assumed (see above for format), or if a double quote follows an equal operator, in which case a text string is assumed.
- E. **Update rate** The update rate is the rate at which the MSID value is obtained from the real-time data stream in seconds per sample. The update rate cannot be less than 1. The program allows for changing the rate of individual events, or classes of events, while the program is running.
- F. Filter The filter value specifies the number of sequential times that the event must evaluate as TRUE before being annunciated. This can be used to eliminate or reduce spurious events causes by data hits. The filter must be 1 or greater. When an event is logged, the GMT/MET time at which it occurred (based on the event update rate) is displayed versus the actual display time (i.e., the filter will not cause the time to be offset). The filter value is also used to reset an event: The event must evaluate FALSE sequentially a number of times equal to the filter value before it can be annunciated again.
- G. **Text message** The text message, along with the GMT and MET times, is displayed in the appropriate class window(s) when the event occurs. If the text message contains a comma, it must be single or double quoted. Also, a message beginning with a quote must be bounded by the alternate quote mark.
- H. **Text color** The text color specifies the color in which the text and times of an unacknowledged event are displayed. The valid color format is described below.
- I. Background color The background color specifies the color of the background box on which the message and times of an unacknowledged event are displayed. When an event is acknowledged, the text is displayed in this background color and the background is changed to black. The valid color format is described below.

The text and background colors must either be a name from the standard X-Windows color database or be an RGB value. For a listing of the standard color database look in the file /use/lib/ X11/rgb/rgb.txt on the machine being used; color names from this database are case insensitive. An RGB value is used to set the actual red/green/blue intensities. The RGB format (signified by a leading # character) must be #RGB, #RRGGGBBB, or #RRRRGGGBBBB, where R, G, and B are single-digit hexadecimal values representing the red, green, and blue intensities (the higher the number, the stronger the color). Values are automatically filled out to 12 digits by adding trailing zeros so that #RGB becomes #ROOOGOOOBOOO, etc.

Spaces can be inserted in the event definition between parameters. Blank lines can be used to separate event definitions for clarity. Lines with the @ character in the first column are ignored and are used to denote comment lines. Maximum line length in the event file is limited to 300 characters. A sample event file is shown in Figure 9.7-1.

#### **EXAMPLES**

The following is an example of an event file.

@ Example event file

@ First event belongs to 2 classes, APU and APU 1 APU:APU 1, V46P0100A<107, 5, 1, APU 1 low tank press, black, yellow

@ This event belongs only to class APU 1 APU 1, V46R0135A >= 129, 1, 1, "APU 1 overspeed", white, red

@ Example bit mask comparisons PLBD; V72M7919P%8000000,1,1,STBD DR open cmd 1 ON,black,#00d000 PLBD,V72M7894P%8000000,1,1,PLBD sw close A ON,black,coral

Figure 9.7-1. Example event file

### **CONFIGURATION FILE FORMAT**

The configuration file is created/updated by the program when the user selects the Save Config option from the command menu (described below). The program saves the total number of classes, the main window width and height, and for each class it saves the iconification state, class/icon x-y coordinates, and class window size. When the program is executed, it looks for the configuration file (either the default or the user-specified file name). If found, the file is read, and the saved window size and class/icon size/positions are restored; otherwise, the classes are initially iconified and placed along the right side of the main window.

## **PROGRAM OPERATION**

When the program is executed, the user is allowed to position/size the main program window using the mouse (unless the **-iconic** option is used; the program icon appears in this case). There is a brief delay while the program reads the event, log, and configuration file contents and checks for errors. If no errors are detected, then the main window header is displayed containing the program name, title, and the command menu title. The classes are positioned as described above in 'Configuration File Format'. The class icons show the number of unacknowledged events/total events for that class and the class name. The mouse pointer turns into an orbiter while within the main program window.

Error and warning messages are displayed in a dialog box that appears, as required, centered over the program window. When a dialog box is displayed, no further processing is possible until the message is acknowledged. See Dialog box OKAY/NO button descriptions below.

The mouse button and keyboard now perform the following functions (other pointer/button/keyboard combinations are ignored by the program).

Location : Class logged event

Button : Left or middle button

Action : The "acknowledge" status of the logged event indicated is toggled. If the event is

acknowledged, the background color is changed to black, the text color assumes the previous background color, and the unacknowledged event count is decre-mented. If the event is unacknowledged, then the original colors are restored and the counter is

incremented.

Location : Class logged event area

Button Right button

Action

If the button is held, then the pointer turns into a lower/ right-hand corner arrow, and a full-sized dashed outline of the class appears. The mouse can then be used to resize the class. The class outline cannot be moved such that any portion of the class extends outside the main program window or is smaller than the minimum class size. Releasing the button returns the pointer to its previous shape and the class is drawn. The class window is raised to the top of the class stack if it is overlapped by another class.

If the main program window is sized smaller than a deiconified class then that class is automatically resized to fit within the window. If the new main window size is too small (insufficient to contain the class at size 3 rows plus header by 50 columns), then the class is iconified and a warning message issued.

Class logged event Location

**Button** Left and middle button

Any button

Action

The selected event is deleted from each class to which it belongs (regardless of the class from which it was selected) if the user verifies the deletion via the dialog box that appears. The event total and unacknowledged counters are updated for the relevant classes. The event is not removed from the event file, but is instead flagged as deleted. The program will also ignore these flagged events when restarted. The events can be restored by editing the file and changing the 2 in the first column to a 0 or 1.

Location Class icon Button

Action

This "deiconifies" a class; the icon is removed and the class it represents is displayed. If the button is held, then the pointer turns into a four-pointed arrow, and a full-sized dashed outline of the class appears. The mouse can then be used to position the deiconified class. The class outline cannot be moved such that any portion of the class extends outside the main program window or over the main window header. Releasing the button returns the pointer to its previous shape and the class is drawn. The class window is raised to the top of the class stack if it is overlapped by another class. If insufficient window space is available, then a dialog box to this effect is displayed and the class remains in icon form.

If the control key was pressed in unison with the button, then instead of deiconifying the class, the icon itself enters the "move" mode. The icon's outline is displayed and can be repositioned as described above for the class. The icon window is placed at the bottom of the stack of classes/icons (if applicable).

Location : Class iconify box

Button : Any button

Action : When the pointer is positioned over the iconify box (located at the right side of the

class header), then the box is highlighted. Pressing a button at this point causes the class to be reiconified. (It returns to its former icon position.) The icon window is

**ELOG** 

SCP 9.7

placed at the bottom of the stack of classes/icons (if applicable).

Location : Class header

Button : Any button

Action : If the button is pressed and held, then the pointer turns into a four-pointed arrow, and a

full-sized outline of the class appears. The mouse can then be used to reposition the class. The class outline cannot be moved such that any portion of the class extends outside the main program window or over the main window header. Releasing the button returns the pointer to its previous shape and moves the class to the outline's

position.

The class window is raised to the top of the class stack if it is overlapped by another

class.

If the control key was pressed in unison with the button, then the pointer can be anywhere within the class window for repositioning to take place as described.

Location : Command menu title (Commands) in main window header

Button : Any button

Action : When the pointer is positioned over Commands (located at the right side of the main

window header), then the text is highlighted. If a button is then pressed, the command pulldown menu appears and the pointer turns into a hand. (The button must be held down.) Position the pointer over one of the commands (only those commands that highlight can be executed) and release the button pressed to initiate the command. See below for descriptions of the various commands. Releasing the button elsewhere performs no action. The pull-down menu is erased and pointer restored in either case.

**ELOG** SCP 9.7 9/1/2004: REV G

Command menu item "Event Info" Location

Button Any button

Action

The Commands menu is removed, and the pointer changes into a diamond/cross hair. A class is selected by positioning the pointer over the class/class icon desired and pressing any button. The classes are removed and the information for each event belonging to the class selected is displayed. This information includes MSID, operator, constant, active rate and filter, default rate and filter, text message, event disabled status, and all the classes to which the event belongs. The colors in which this information is displayed reflect the event text and background colors. The information header displays the class name, the total number of events definitions in the class, and whether the class is enabled or disabled. A scroll bar appears at the right-hand side of the information window and is used to display any events that will not fit in the window. (See the scroll bar descriptions below.)

The main header changes to reflect that the information mode is in effect. The command menu item Event Info changes to Info Off (see below).

Location Command menu item "Info Off"

Button Any button

Action

Information mode is turned off and the normal mode is resumed (the classes/icons reappear). Pressing the control key and any button simultaneously while the pointer is in the information display area also terminates information mode.

The main header changes to reflect that the main mode is in effect. The command menu item Info Off changes to Event Info.

Command menu item "Enable" - main mode Location

Button Any button

Action

The "Commands" menu is removed, and the pointer changes into a diamond/cross hair. A class is selected by positioning the pointer over the class/class icon desired and pressing any button. The class selected has all events which belong to it enabled for real-time data processing. If the "All" class is selected, then all classes/events are enabled. The disable status shown in the class header is removed, and the color of the class icon name is changed from red to green.

Command menu item "Enable" - information mode Location

Button Any button

Action

The Commands menu is removed, and the pointer changes into a diamond/cross hair. An event is selected by positioning the pointer over the event desired and pressing any button. The event selected is enabled for real-time data processing. The disable status shown in the event description is removed. Any changes made do not take effect until the information mode is exited; the program then pauses to incorporate these changes.

Location : Command menu item "Disable" - main mode

Button : Any button

Action : The Commands menu is removed, and the pointer changes into a diamond/cross hair.

A class is selected by positioning the pointer over the class/class icon desired and pressing any button. The class selected has all events which belong to it and are not enabled by another class disabled for real-time data processing. If the All class is selected, then all classes/ events are disabled. The disable status is displayed in the class header and the color of the class icon name is changed from green to red.

**ELOG** 

SCP 9.7

Location : Command menu item "Disable" - information mode

Button : Any button

Action : The Commands menu is removed, and the pointer changes into a diamond/cross hair.

An event is selected by positioning the pointer over the event desired and pressing any button. The event selected is disabled for real-time data processing in every class to which it belongs. The disable status is displayed in the event description. Any changes made do not take effect until the information mode is exited; the program then

pauses to incorporate these changes.

Location : Command menu item "Update Rate" - main mode

Button : Any button

Action : The Commands menu is removed, and the pointer changes into a diamond/cross hair.

A class is selected by positioning the pointer over the class/class icon desired and pressing any button. A dialog box is generated with an input window showing the current real-time data acquisition rate in seconds per sample for the class selected (the input box is blank if the class has no rate). To change the class rate, a value is entered and the "OKAY" box selected. The update rate for all the events belonging to that class is changed to the new value. If the All class has been assigned a rate then changes to other classes are ignored. If the DEFAULT box is selected, then the

default update rates are restored for all the events belonging to that class.

Location : Command menu item "Update Rate" - information mode

Button : Any button

Action : The Commands menu is removed, and the pointer changes into a diamond/cross hair.

An event is selected by positioning the pointer over the event desired and pressing any button. A dialog box is generated with an input window showing the current real-time data acquisition rate in seconds per sample for the event selected. To change the event rate, a value is entered and the OKAY box selected. The update rate is changed to the new value. If the DEFAULT box is selected, then the default rate is resorted for the event selected. Any changes made do not take effect until the information mode is

exited; the program then pauses to incorporate these changes.

Command menu item "Filter" - main mode Location

Button Any button

The Commands menu is removed, and the pointer changes into a diamond/cross hair. Action

> A class is selected by positioning the pointer over the class/class icon desired and pressing any button. A dialog box is generated with an input window showing the current filter value for the class selected (the input box is blank if the class has no filter). To change the class filter, a value is entered and the OKAY box selected. The filter value for all the events belonging to that class is changed to the new value. If the All class has been assigned, a filter then changes to other classes are ignored. If the DEFAULT box is selected, then the default filter values are restored for all the events

**ELOG** 

belonging to that class.

Location Command menu item "Filter" - information mode

Button Any button

The Commands menu is removed, and the pointer changes into a diamond/cross hair. Action

> An event is selected by positioning the pointer over the event desired and pressing any button. A dialog box is generated with an input window showing the current filter value for the event selected. To change the event filter, a value is entered and the OKAY box selected. The filter is changed to the new value. If the DEFAULT box is selected, then

the default filter value is restored for the event selected.

Command menu item "Acknowledge" - main mode Location

Button Any button

The Commands menu is removed, and the pointer changes into a diamond/cross hair. Action

A class is selected by positioning the pointer over the class/class icon desired and pressing any button. A dialog box is generated requesting the user to verify the command. If verified, all events in the class selected are acknowledged. If any of the events belong to other classes then they are acknowledged in these classes also. The

unacknowledge counters of all relevant classes are updated.

Command menu item "Acknowledge" - information mode Location

Button Any button

The Commands menu is removed, and the pointer changes into a diamond/cross hair. Action

An event is selected by positioning the pointer over the event desired and pressing any

button.

A dialog box is generated requesting the user to verify the command. If verified, the event selected is acknowledged in all classes to which it belongs. The unacknowledge

counters of all relevant classes are updated.

Location : Command menu item "Print Log"

Button : Any button

Action : The Commands menu is removed, and the pointer changes into a diamond/cross hair.

A class is selected by positioning the pointer over the class/class icon desired and pressing any button. All the events logged for the class selected are output to the

printer in the same format shown in the class window.

Location : Command menu item "Print Info"

Button : Any button

Action : The contents of the information display are output to the printer. (Items truncated due

to the size of the program window will be printed.)

Location : Command menu item "Save Config"

Button : Any button

Action : The user is asked to verify this command via a dialog box before continuing. If

verified, the current main window size and class state/position information is saved to the configuration file (either the file name specified with the command line option, the

.Xdefaults file, or the default file name, DATA/elog.config.).

Location : Command menu item "Clear Log"

Button : Any button

Action : This command, available only while in the information mode, cannot be selected if no

events have been logged. The user is asked to verify this command via a dialog box before continuing. If verified, the program then asks if a backup of the log file is desired (.sav is appended to the log file name); otherwise, the program deletes the log file. The log is then cleared (all event counters are zeroed) and processing continues.

Location : Command menu item "Exit ELOG"

Button : Any button

Action : The user is asked to verify this command via a dialog box before continuing. If

verified, the program window is erased and the program exits.

Location : Dialog box "OKAY" button

Button : Any button

Action : Acknowledging a dialog box message is done by placing the pointer (which now

resembles a hand) over the OKAY button (which highlights to show its selection) and pressing any button. For rate/filter value changes, selecting OKAY indicates that the value shown in the input box is to be used. The dialog box disappears and the program continues (or exits, depending on the circumstances). See <a href="ERROR\_MESSAGES">ERROR</a> below for a description of the dialog box error and warning messages.

Pressing the RETURN or ENTER key is equivalent to selecting the OKAY button.

Location : Dialog box "NO" button

Button : Any button

Action : The NO button is displayed when the dialog box requires a yes-or-no answer to the

dialog box message. Selecting the NO box indicates a negative response to the message (for rate/filter values the input box is ignored and no changes are made) and is done by placing the pointer (which now resembles a hand) over the NO button (which highlights to show its selection) and pressing any button. The dialog box disappears, and the program continues (or exits, depending on the circumstances).

Location : Dialog box "DEFAULT" button

Button : Any button

Action : The DEFAULT button is displayed when the dialog box requires a rate or filter value.

Selecting the DEFAULT box indicates that the initial, default rate/filter value for the event(s) selected should be used. This is done by placing the pointer (which now resembles a hand) over the DEFAULT button (which highlights to show its selection) and pressing any button. The dialog box disappears and the program continues.

Location : Dialog box input box

Button : Any button

Action : The input box is displayed when the dialog box requires a rate or filter value. Placing

the pointer within the input box and pressing any button causes the text cursor to jump to the pointer position. The following keys are valid for the input box: 0-9 (including the keypad), space, left and right arrows, backspace and delete, and escape and tab (these cause the input box to be cleared). The pointer may be anywhere on the

screen during text input.

Location : Scroll bar up button

Button : Any button

Action : Pressing a button will cause the list displayed (logged events for class windows or

events descriptions for the information mode) to scroll up one list item unless the last item has been reached. The scroll bar slide box position is updated accordingly (see below). The scroll bar up button highlights briefly when the mouse button is pressed.

Location : Scroll bar down button

Button : Any button

Action : Pressing a button will cause the list displayed (logged events for class windows or

events descriptions for the information mode) to scroll down one list item unless the first item has been reached. The scroll bar slide box position is updated accordingly (see below). The scroll bar down button highlights briefly when the mouse button is

pressed.

Location : Scroll bar slide box

Button : Any button

Action : When a button is pressed and held, the pointer changes to the shape of a hand and

the slide box can be moved. Moving the slide box causes the items displayed to be scrolled accordingly. Releasing the button stops slide box movement. The scroll bar

slide box highlights while the mouse button is pressed.

Location : Scroll bar slide area

Button : Any button

Action : If the pointer is positioned outside the scroll bar slide box but within the area that the

box can move and a button is pressed, then the scroll area pages (forward if the pointer was below the slide box, backward if the pointer was above the slide box). The

slide box is repositioned, as required.

Each class window possesses a scroll bar for reviewing logged events that will not fit in the class window. If the log file contains events at program startup, then the classes display the latest events logged. As events are logged, the class will automatically scroll only if the last event in that class is displayed (or would be displayed if the class was deiconified). The slide size/position is updated as events are logged.

The timetags associated with each logged event represent GMT and MET. Prior to launch, MET is equivalent to GMT. After lift-off, any events logged previously will display a negative MET (time before lift-off).

The X-Windows window manager can be used to move, resize, and (de)iconify the entire **elog** program window. Depending on the window manager, the window cannot be sized smaller than is allowed to contain the main header information and the "Commands" menu. When a resize occurs, the classes and icons are moved an amount proportional to the window size change. If the control key is pressed and held during resizing, the icons are positioned along the right side of the window. If the window is sized too small to contain a class at minimum size, then a dialog box message is issued and the class is automatically reiconified. When the entire program is iconified, the main window disappears and is replaced by the **elog** icon with the program name underneath. When deiconified, the main window returns with all the classes unchanged.

#### **ERROR MESSAGES**

The following error and warning messages can be generated within the program. Causes and corrective actions are given. The error messages are listed below in alphabetical order.

ERROR: <MSID name> is not a valid MSID

Cause: The MSID specified is not recognized by the MOC. Program terminates.

Resolution: Correct or delete the MSID in the event file.

ERROR: Bad color <color name> RGB format in event definition

Cause: The RGB color definition specified is in the wrong format (too many/few R. G. and/or B

values). Program terminates.

Resolution: Correct the RGB format.

ERROR: Bad rate or filter in event definition (<line number>)

Cause: The event defined on line < line number > contains an update rate less than 0 or a filter

value less than 1. Program terminates.

Resolution: Correct the bad event definition.

**ERROR:** Cannot access MSID keys

Cause: The ds getkeys() call to obtain MSID information for real-time data access was

unsuccessful. Program terminates.

Resolution: Check real-time data source status and MSID names.

ERROR: Cannot connect to X server

Cause: Program executed outside of the X-Windows environment, or server error. Program

terminates. Since the program window is never displayed, this message does not appear in

a dialog box but in the standard output window (if it exists).

Resolution: Execute the program while in X-Windows.

ERROR: Cannot open event file <file name>

Cause: Event file cannot be opened. Program terminates. Resolution: Check for correct file name spelling and path.

ERROR: Cannot open log file <file name>

Cause: Log file cannot be opened. Program terminates. Resolution: Check for correct file name spelling and path.

ERROR: Cannot open <font name> font

Cause: The font listed cannot be found. Program terminates.

Resolution: Check current font path (to make sure all available font directories are included) and font

name spelling.

ERROR: Character string missing in event definition (enumber>)

Cause: The event defined on line < line number > is missing the character string. Program

terminates.

Resolution: Correct the bad event definition.

**ERROR:** Character string too long in event definition (enumber>)

Cause: The event defined on line <ine number> has a character string longer than 8 characters.

Program terminates.

Resolution: Correct the bad event definition.

ERROR: Class name missing in event definition (<line number>)

Cause: The event defined on line < line number > is missing the class designation(s). Program

terminates.

Resolution: Correct the bad event definition.

ERROR: Color <color name> undefined in event definition

Cause: The color name shown cannot be found in the standard color database or the "#" character

was left off the RGB format. Program terminates.

Resolution: Check spelling/syntax (add '#' to RGB format).

ERROR: Color(s) missing in event definition (<line number>)

Cause: The event defined on line < line number > is missing the text and/or background colors.

Program terminates.

Resolution: Correct the bad event definition.

ERROR: Configuration file <configuration file name> data missing

Cause: The number of class data sets in the configuration file does not match the total number of

classes. Program terminates.

Resolution: Remove the configuration file or save the current configuration.

ERROR: Constant missing in event definition (<line number>)

Cause: The event defined on line < line number> is missing the comparison constant. Program

terminates.

Resolution: Correct the bad event definition.

ERROR: Event message ending quote missing in event definition (enumber>)

Cause: The event defined on line line number> is preceded by a quote (single or double) but has

no ending quote. Program terminates.

Resolution: Correct the bad event definition.

ERROR: Excess characters in event definition (enumber>)

Cause: The event defined on line line number> contains characters after the event definition.

Program terminates.

Resolution: Correct the bad event definition.

ERROR: Illegal command line option/syntax

Cause: Excess character(s) or no value listed after option on command line, or illegal command line

option. Program terminates.

Resolution: Correct the command line syntax.

**ERROR:** Insufficient memory space available

Cause: Insufficient memory could be allocated for program variables. Program terminates.

Resolution: Terminate other processes and/or clear some disk space.

ERROR: Mask value missing in event definition (<line number>)

Cause: The event defined on line <ine number> is missing the mask value. Program terminates.

Resolution: Correct the bad event definition.

ERROR: Mask value too large in event definition (<line number>)

Cause: The event defined on line line number> has a mask word value larger than eight digits.

Program terminates.

Resolution: Correct the bad event definition.

ERROR: MSID < MSID name > has invalid type

Cause: An MSID does not return with a binary, integer, floating point, or parent word value.

Program terminates.

Resolution: Remove the MSID specified from the files.

ERROR: MSID name missing in event definition (<line number>)

Cause: The event defined on line **line number>** is missing the MSID. Program terminates.

Resolution: Correct the bad event definition.

ERROR: MSID name too long in event definition (enumber>)

Cause: The MSID on line < line number > of the event file contains too many characters (10

characters maximum). Program terminates.

Resolution: Correct the MSID specified.

ERROR: No events in event file <file name>

Cause: The event file specified contains no event definitions.

Resolution: Check file and path name(s), or select a file containing event definitions.

**ERROR:** No room in color map

Cause: The color map is full and no new colors can be defined (text or background). Program

terminates.

Resolution: Reduce the number of colors defined. Try to use names from the standard color database,

if possible, to increase the chance of interclient color sharing.

**ERROR:** Operator missing in event definition (enumber>)

Cause: The event defined on line **line number>** is missing the operator. Program terminates.

Resolution: Correct the bad event definition.

ERROR: Rate or filter missing in event definition (enumber>)

Cause: The event defined on line < line number > is missing the update rate or filter value. Program

terminates.

Resolution: Correct the bad event definition.

WARNING: Bad input value; ignored

Cause: A number entered in the input dialog box is incorrectly formatted (embedded spaces or no

value entered) or is less than 1. The bad value is ignored and the dialog box is removed.

Resolution: Reenter the constant value correctly.

WARNING: Cannot connect to data source; continue (no real-time)?

Cause: The ds connect() call to connect to the real-time data source was unsuccessful. If the

dialog OKAY box is selected, then the program continues operation, but no real-time data is

processed. If NO is selected then the program terminates.

Resolution: Check real-time data source status.

WARNING: Cannot initialize WEX; continue (no real-time)?

Cause: The EXwexinit() call to initialize WEX was unsuccessful. If the dialog OKAY box is selected.

then the program continues operation, but no real-time data is processed. If NO is selected,

then the program terminates.

Resolution: Execute program in the WEX environment.

WARNING: Cannot obtain flight number; continue (no real-time)?

Cause: The EXflight() call to obtain the current flight number was unsuccessful. If the dialog OKAY

box is selected, then the program continues operation, but no real-time data is processed. If

NO is selected, then the program terminates.

Resolution: Select a flight number for real-time data access.

WARNING: Cannot open configuration file <file name>

Cause: Configuration file cannot be opened. Program continues operation (configuration is not

saved).

Resolution: Bad subdirectory; check file path name.

WARNING: Cannot open output file "elog.temp"

Cause: The temporary output file used for print requests could not be opened. No output is

generated. Program continues operation.

Resolution: Reattempt request. Possible Unix problem.

WARNING: Configuration file <file name> data mismatch

Cause: The number of classes saved in the configuration file does not match the number of class

definitions in the event file. Program continues operation (the configuration file is ignored).

Resolution: Remove the configuration file, save the current configuration, or specify another

configuration file name on the command line.

WARNING: Insufficient window size for class <class name>

Cause: The size of the main window is too small to contain the class (at minimum size of 3 rows

plus header by 50 columns) when deiconified. Program continues operation (the class

iconifies/remains iconified).

Resolution: Resize the main window larger.

WARNING: Main window too small

Cause: The program window is too small to contain the main window header or the largest icon.

The program continues operation.

Resolution: The window manager should prevent resizing the window too small to contain the header or

largest icon. Start the program with a larger window size, or shorten the main title or class

name(s).

WARNING: No log entries for class <class name>

Cause: The class selected for the Print Log option has no events logged. No output is generated.

Program continues operation.

Resolution: Select a class containing logged events.

## **USAGE NOTES**

Except for error checking noted above, the program expects to find correct file syntax. Incorrect syntax could produce unexpected results (program hangs, error messages, etc.).

#### TITLE

**BFSANT** 

### **GENERAL**

To provide a standard procedure for operating the bfs ant program on the console workstation.

### **BACKGROUND**

The bfs\_ant program is designed to provide the user the information necessary to build a backup flight system command load to inhibit antenna pointing. This program will allow the user to create any combination of site inhibits in one command load. The user will enter the information that is created by this program into the TMBU program and review the results that are in the server.

### **PROCEDURE**

- A. To start bfs ant
  - 1. Press and hold the right mouse button while the mouse cursor is over the background.
  - 2. Drag the mouse cursor down to the option labeled "bfs ant."
  - 3. Release the mouse button.
  - 4. Place the window on the screen by pressing then releasing the left mouse button when the window outline is in the desired location.
- B. To stop bfs\_ant
  - 1. Press then release the left mouse button when the mouse cursor is over the menu option labeled "Quit." The window will disappear.
- C. To calculate an inhibit command load
  - 1. Press then release the left mouse button while over each of the ground sites that are to be inhibited in the BFS site table.
  - 2. Press then release the Build Command button located at the bottom of the site table. The text boxes above the site table will be filled with data, and an output file will be created.
- D. To print a command load
  - 1. After calculating a command load, press and hold the left mouse button when the mouse cursor is over the Utilities option.
  - 2. Drag the mouse cursor down to the Print option.
  - 3. Release the left mouse cursor.
- E. Possible error messages and their meanings
  - 1. **"Cannot find Ip"** There is not a printer driver or printer connected to the workstation when a print was attempted. To print the command data, the user will have to move to a workstation with a printer and recalculate the command load.
  - 2. "bfs\_ant cannot connect to X server" The program is being run on a remote workstation, and it does not know where to display the window. The user can set the environment variable DISPLAY to tell X windows where to display bfs\_ant.

- 3. "bfs\_ant ERROR: Cannot open helvetica-18 font" The workstation that bfs\_ant is trying to run on does not have the correct font to display the text. The user will need to call the systems administrator to correct this problem.
- 4. "bfs\_ant cannot find the site list TERMINATING!" The file that contains the site list is missing from the directory that the program is running from. The user can look for the site list file or create it from scratch or tell the systems administrator to fix the problem.
- 5. **"ERROR bfs\_ant not able to write command output to a file"** The output file "bfs\_ant.prt" is write protected. Ask the systems administrator to correct the problem.

#### **TITLE**

**GCILBIT** 

## **PURPOSE**

This procedure gives an outline of the GCILBIT program format and provides a simple user's guide to do a GCIL failure analysis.

- A. Once the command "gcilbit" is entered, an introduction to the program is displayed to continue the user must enter any key and press <cr>.
- B. A menu selection of DSM or BIT will appear enter dsm or bit for the appropriate analysis.
  - 1. For DSM
    - a. Enter the valid DSM# that was sent.
    - b. Enter the valid DSM# that was executed.
    - c. The program will respond with a message.
  - 2. For BIT
    - a. The user is asked to input how many bits have failed (1-9).
    - b. Then enter the failed bit number reading from R to L.
    - c. Finally enter the status of the failed bit.
    - d. The steps in boldface are repeated for an analysis of more than one bit failure.
- C. A printout selection will appear and the user must choose one of the following:
  - 1. 's'creen for output to the crt with directions for screen output control (i.e., control C for exit, space bar for page advance, and <cr> for one space advance).
  - 2. 'p'rint for output to line printer.
  - 3. 'file for output to file with a cursor response to input a new filename to print to.
  - 4. 'x' for exit.

Note: The output lists the number of bad commands, the failed bits and their respective status, and a list of bad commands with a list of their executed commands.

- D. Would you like to go back to printout screen? yes or no
- E. Do you care to do another analysis? yes or no

#### **TITLE**

CONFIGURABLE REAL-TIME ANALYSIS SYSTEM (CRANS) USER'S GUIDE

#### **PURPOSE**

SHUTTLE OPS

To provide a ready reference for the console operator.

### **OVERVIEW**

The Configurable Real-Time ANalysis System (CRANS) provides a means of representing logically interconnected items in a matrix format. A matrix consists of rows and columns of item names with colored backgrounds that show the item's logic status (failed/on or not-failed/off). CRANS allows for toggling of an item's logic status by selection of the item within a matrix via the mouse device. Upon selection of an item, the entire logic framework is tested for further status changes, and results of these changes are displayed in the matrix or matrices as appropriate. A "help" mode and a reference check provide the user with a means of exploring an item's underlying logic from within the program. A commonality check determines single-point failures for an item or group of items. In WEX 2.5, real-time telemetry can be accessed by the program for use in the logic (i.e., MSID's can be logic items). Examples of CRANS applications include orbiter system failure analysis, runway selection, and flight rule location.

The CRANS program uses four data files: (1) logic, (2) matrix, (3) help, and (4) configuration. The logic file describes the logic tree; i.e., how all the logic items are interconnected. The matrix file defines the placement of the logic items in the matrices. The help file contains text messages associated with a logic item that are displayed in the program's help mode. The configuration file contains matrix position information and is generated by the program via user request. This information is used to restore the matrix configuration for subsequent sessions. The logic and matrix files are required; the help and configuration files are optional. Additionally, the program writes a temporary file, crans.temp, to the current directory when a print command is issued. The temporary file is erased when the program exits.

## **PROGRAM OPERATION**

CRANS is an executable WEX program. The following procedure will execute CRANS:

- Depress and hold the right mouse button and move the cursor down the WEX Applications Α. pulldown menu to the CRANS entry. Release the right mouse button when the cursor is on the CRANS selection. The cursor will change into the upper left corner of the CRANS program window.
- Position the program window left corner near the screen's upper left edge and depress the left mouse button. A blank window will appear, and there is a brief delay while the program reads the logic, matrix, and configuration file contents and checks for errors. If no errors are detected, the main window header is displayed, containing the program name, the user-specified title (from the matrix file), and the command menu. The matrices and/or icons are positioned as described in the configuration file. The matrix icons show the matrix group name (if any) and the matrix name (from the matrix definition). The mouse pointer turns into an orbiter while within the main program window.
  - If there are errors in the data files, error and warning messages are displayed in a dialog box that appears, as required, centered over the program window. When a dialog box is displayed, no further processing is possible until the message is acknowledged. See dialog box "OKAY:/:NO" button descriptions in Mouse Button and Keyboard Functions, paragraphs A.4.b (23) and (24).
- C. CRANS is now ready for user inputs. Inputs are made using the mouse device. CRANS features, mouse button, and keyboard functions are described below.

#### MOUSE BUTTON AND KEYBOARD FUNCTIONS

Pointer/button/keyboard combinations not described in this SCP have no impact on CRANS operation. Note that these actions must take place inside the CRANS application window, unless stated otherwise. WEX actions can and will be executed if you attempt the following functions outside the CRANS program window (i.e., in the root window).

The X-Windows window manager can be used to move, resize, and (de)iconify the entire CRANS application window. Depending on the window manager, the window cannot be sized smaller than is allowed to contain the main header information and all the matrices in icon form. When a resize occurs, the icons are repositioned along the right side of the window, and the matrices are moved an amount proportional to the window size change. If the window is sized too small to contain a matrix, then a dialog box message is issued, and the matrix is automatically reiconified. When the entire program is iconified, the main window disappears and is replaced by the CRANS icon with the icon name (defined in the matrix file) underneath. When deiconified, the main window returns with all the matrices unchanged.

Except for error checking noted below, the program expects to find correct data file syntax. Incorrect syntax could produce unexpected results (program hangs, error messages, etc.).

### A. Mouse device operation

#### 1. Left mouse button

a. Location: Matrix logic item box

Action: If the box is multilevel, see matrix multilevel pop up menu on logic item selection. In either case (multilevel or single-item box), the logic item selected has its fail state toggled (off  $\rightarrow$  on or on  $\rightarrow$  off) if the item has not been hard-fail protected in the matrix box definition. The box color changes, depending on the box definition in the matrix file, to reflect the new logic state (not-failed or failed). An "\*" character is displayed in the first column of the box if the item displayed is hard-failed in this manner. (The "\*" is removed when the fail state is toggled off.) A logic check is performed to reflect changes in the logic states of other items. Failed items that are tagged (see matrix logic item box - Right button paragraph A.3) have the tag removed. The results are reflected immediately in the matrices and the matrix icons. (The icon name color is green if no items in the matrix are failed, and red otherwise.)

b. Location: Help mode logic item

Action: The logic item selected has its fail state toggled (off  $\rightarrow$  on or on  $\rightarrow$  off). An item that is hard-fail protected in a matrix can be hard-failed in this mode. A logic check is performed to reflect changes in the logic states of other items, and the results are reflected immediately in the help display.

## 2. Middle button

a. Location: Matrix logic item box

Action: If the box is a multilevel, see matrix multilevel pop up menu on logic item selection. In either case (multilevel or single-item box), the help mode is initiated for the item selected. A box that does not contain an item name cannot be selected. The main header changes to reflect that the help mode is in effect. The command menu item Save Config changes to Help Off (see below). The matrices are erased, and the display shows the logic item with its associated logic (or sub-items) underneath, similar to its arrangement in the logic file ("or" is used in place of |, etc., to improve readability). The color of the item names reflects the item's fail state: green = not-failed, red = failed. Hard-fail and tag status is shown as in the matrices (\* and ~ characters). Constant values are shown in white. If real-time data are active, then

MSID items are displayed with their current values beside them. If the help file exists and contains a reference for the logic item selected, then the text message is displayed to the right side of the logic. To review a item's logic tree, see paragraph A.2.b, help mode logic item, middle button.

# b. Location: Help mode logic item

Action: To travel forward through a logic item's logic tree, position the pointer over one of the subitems displayed (an outline surrounds the subitem name), and press a button. The program window is cleared, and the subitem selected has its logic displayed as previously described. Repeat this procedure to continue down the logic tree. Selecting the item name itself has no effect. To travel back through the tree, see paragraph A.4.b (2), help mode BACK box. An item's entire logic tree can be examined in this way.

### c. Location: Commonality mode logic item

Action: The help mode (as described above) is initiated for the item selected (an outline surrounds the item name). The BACK box, if present, is removed. To return to the commonality mode, see Command menu item Commonality.

## d. Location: Reference mode logic item

Action: The help mode (as described above) is initiated for the item selected (an outline surrounds the item name). The BACK box, if present, is removed. To return to the reference mode, see Command menu item Reference.

## 3. Right button

## a. Location: Matrix logic item box

Action: If the box is multilevel, see matrix multilevel pop up menu on logic item selection. In either case (multilevel or single-item box), the selected logic item's tagged state is toggled on/off if the item is not failed. A box that does not contain a name cannot be tagged. A character is displayed in the last column of the box when it is tagged (the is removed when the fail status it toggled on). The tag determines which item(s) is used for a commonality or reference check. See Command menu item Commonality and Command menu item Reference for instructions to perform these checks.

## b. Location: Help mode logic item

Action: The selected logic item's tagged state is toggled on/off if the item is not failed. A character is displayed at the end of the item name when it is tagged. The tag determines which item(s) is used for a commonality or reference check. See Command menu item Commonality and Command menu item Reference for instructions to perform these checks.

## c. Location: Commonality mode logic item

Action: The selected logic item's tagged state is toggled on/off. A  $\sim$  character is displayed at the end of the item name when it is tagged. The tag determines which item(s) is used for a commonality or reference check. See Command menu item Commonality and Command menu item Reference for instructions to perform these checks.

d. Location: Reference mode logic item

Action: The selected logic item's tagged state is toggled on/off. A  $\sim$  character is displayed at the end of the item name when it is tagged. The tag determines which item(s) is used for a commonality or reference check. See Command menu item Commonality and Command menu item Reference for instructions to perform these checks.

#### 4. Miscellaneous

a. Two or more buttons simultaneously

Location: Matrix logic item box

Action: The box suppression state is toggled on/off. When a box is "suppressed," the text color is changed to the background color, and the background color is changed to black. Reselecting the box restores the normal color configuration. If a box is suppressed and the item or items (if the box is a multilevel) driving that box change logic state, then the normal color mode takes effect. The box can then be resuppressed, if desired. Box suppression is a means of acknowledging a failure and helps to unclutter a "busy" matrix.

# b. Any button

(1) Location: Matrix multilevel pop up menu

Action: If a multilevel box is selected, then a pop up menu showing all the items represented by the box is displayed. The pointer is used to indicate the item desired (the item is highlighted), and the mouse button is released to select the item. Some items may not be selectable, depending on which button is pressed. Items that are hard-fail protected cannot be selected if the left button is pressed, and failed items are not taggable with the right button. Empty (no item name) positions specified in the multilevel are not selectable.

(2) Location: Help mode BACK box

Action: When a subitem is selected, the BACK box appears to the left of the logic information. When this box is selected, the preceding logic item from which the current item was chosen is redisplayed. Repeat this procedure to continue back up the logic tree. When the original item is reached, the BACK box will disappear. This box is also removed if either the reference or commonality mode is entered.

(3) Location: Help mode constant value

Action: Constant values (not including filter numbers used in fractional AND statements) can be changed while the program is operating. Select a constant by placing the pointer over the number (an outline surrounds it), and press a button. A dialog box appears that displays the current value. The keyboard is then used to change the constant. Using the pointer, select the dialog box OKAY button to accept the change or the NO button to ignore it. The logic is then reevaluated, and the help display is updated to reflect the change.

(4) Location: Commonality mode BACK box

Action: When a commonality check is performed from within the commonality mode (and the item(s) tagged have changed), the BACK box appears to the left

of the commonality information. When this box is selected, the preceding commonality check is reinstated (the former tags are restored). Repeat this procedure to continue back up the commonality tree. When the originally performed check is reached, the BACK box will disappear. This box is also removed if either the reference or help mode is entered.

### (5) Location: Reference mode BACK box

Action: When a reference check is performed from within the reference mode (and the item(s) tagged have changed), the BACK box appears to the left of the reference information. When this box is selected, the preceding reference check is reinstated (the former tags are restored). Repeat this procedure to continue back up the reference tree. When the originally performed check is reached, the BACK box will disappear. This box is also removed if either the commonality or help mode is entered.

## (6) Location: Matrix icon

Action: This "deiconifies" a matrix; the icon is removed and the matrix it represents is displayed. If the button is held, the pointer turns into a four-pointed arrow, and a full-sized, dashed outline of the matrix appears. The mouse can then be used to position the deiconified matrix. The matrix outline cannot be moved such that any portion of the matrix extends outside of the main program window or over the main window header. Releasing the button returns the pointer to its previous shape, and the matrix is drawn. The matrix window is raised to the top of the matrix stack if it is overlapped by another matrix. If insufficient window space is available, a dialog box to this effect is displayed, and the matrix remains in icon form.

If the control key was pressed in unison with the button, instead of deiconifying the matrix, the icon itself enters the "move" mode. The icon outline is displayed and can be repositioned as previously describe for the matrix. The icon window is placed at the bottom of the stack of matrices/icons, if applicable.

### (7) Location: Matrix iconify box

Action: When the pointer is positioned over the iconify box (located at the right side of the matrix header), the box is highlighted. Pressing a button at this point causes the matrix to be iconified (it returns to its former, or original, icon position). The icon window is placed at the bottom of the stack of matrices/icons, if applicable.

#### (8) Location: Matrix header

Action: If the button is pressed and held, the pointer turns into a four-pointed arrow, and a full-sized outline of the matrix appears. The mouse can then be used to reposition the matrix. The matrix outline cannot be moved such that any portion of the matrix extends outside of the main program window or over the main window header. Releasing the button returns the pointer to its previous shape and moves the matrix to the outline's position. The matrix window is raised to the top of the matrix stack if it is overlapped by another matrix.

If the control key was pressed in unison with the button, the pointer can be anywhere within the matrix window for repositioning to take place as previously described.

### (9) Location: Command menu tile (Commands) in main window header

Action: When the pointer is positioned over Commands (located at the right side of the main window header), the text is highlighted. If a button is then pressed, the command pull-down menu appears, and the pointer turns into a hand (the button must be held down). Position the pointer over one of the commands (only the commands that are highlighted can be executed) and release the button pressed to initiate the command. See the following for descriptions of the various commands. Releasing the button elsewhere performs no action. The pull-down menu is erased, and pointer restored in either case.

## (10) Location: Command menu item Commonality

Action: If at least one item is tagged, a check is performed to determine if any single-point failures exist for the tagged item or common to the tagged items (see matrix logic item box - right button, paragraph A.3.a. The program takes into account the current failure state of all the logic items when searching for single-point failures (i.e., an item that normally is not a single-point failure for the item(s) tagged could become so if other failures are input). The matrices are replaced (if the normal mode is active) by a window showing the item(s) tagged and the single-point failures. ("None" is displayed if there are no single-point failures.) Only the lowest common items are shown; common items further up the logic tree are not displayed (see previous Commonality mode logic item - right button on how to tag items and continue down a commonality tree). If a commonality check is performed from within the commonality mode (and the item(s) tagged have changed), the BACK box appears to the left of the commonality information (see commonality mode BACK box, paragraph A.4.b (4)).

The main header changes to reflect that commonality mode is in effect. The command menu item Save Config changes to Common Off (see the following paragraphs).

## (11) Location: Command menu item Common Off

Action: Commonality mode is turned off, and the normal mode is resumed (the matrices/ icons reappear). Pressing the control key and any button simultaneously while the pointer is in the commonality display area also terminates commonality mode.

## (12) Location: Command menu item Reference

Action: If a least one item is tagged, then all logic items that directly reference all the tagged items are displayed ("None" is displayed if the tagged item(s) is not referenced by any of the logic items in the logic file). Note that the tagged item is not necessarily a single point failure for the items displayed. (See paragraph A.3.d, reference mode logic item - right button, on how to tag items and continue down a reference tree.)

If a reference check is performed from within the reference mode (and the item(s) tagged have changed), the BACK box appears to the left of the reference information (see paragraph A.4.b (5), reference mode BACK box).

The color of the item name reflects the item's fail state: green = not-failed, red = failed (by definition the tagged item(s) cannot be in a failed state). The main

header changes to reflect that reference mode is in effect. The command menu item Save Config changes to Refer Off (see paragraph below).

(13) Location: Command menu item Refer Off

Action: Reference mode is turned off, and the normal mode is resumed (the matrices/icons reappear). Pressing the control key and any button simultaneously while the pointer is in the commonality display area also terminates reference mode.

(14) Location: Command menu item Help Off

Action: Help mode is turned off, and the normal mode is resumed (the matrices/icons reappear). Pressing the control key and any button simultaneously while the pointer is in the help display area also terminates help mode.

(15) Location: Command menu item Clear Fails

Action: The user is asked to verify this command via a dialog box before continuing. If verified, all failure statuses are set to "not-failed," and a logic test is performed to reset the logic states. The results are reflected immediately in the matrices, the matrix icons, and the help or reference modes (if active).

(16) Location: Command menu item Clear Tags

Action: All tagged statuses are reset (to untagged). The results are reflected immediately in the matrices. If the help mode is active, then any tags shown are removed. If the commonality or reference mode is in effect, then the normal mode is resumed (the matrices/icons reappear).

(17) Location: Command menu item Print Data - Main mode

Action: A summary of input and resultant failed item names is output to the printer. If real-time data are active, then the current MSID values are also output.

(18) Location: Command menu item Print Data - Help mode

Action: The contents of the help display are output to the printer. (Items truncated due to the size of the program window will be printed.)

(19) Location: Command menu item Print Data - Commonality mode

Action: The contents of the commonality display are output to the printer. (Items truncated due to the size of the program window will be printed.)

(20) Location: Command menu item Print Data - Reference mode

Action: The contents of the reference display are output to the printer. (Items truncated due to the size of the program window will be printed.)

(21) Location: Command menu item Save Config

Action: The user is asked to verify this command via a dialog box before continuing. If verified, the current main window size and matrix state/position information is saved to the configuration file (either the file name specified with the command line option or the default file name, DATA/crans.config).

### (22) Location: Command menu item Exit CRANS

Action: The user is asked to verify this command via a dialog box before continuing. If verified, the program window is erased and the program exits.

## (23) Location: Dialog box OKAY button

Action: A dialog box message is acknowledged by placing the pointer (which now resembles a hand) over the OKAY button (which highlights to show its selection) and pressing any button. The dialog box disappears, and the program continues (or exits, depending on the circumstances). See section A.5, error messages, for a description of the dialog box error and warning messages.

### (24) Location: Dialog box NO button

Action: The NO button is displayed when the dialog box requires a yes or no answer to the dialog box message. Selecting the NO box indicates a negative response to the message and is done by placing the pointer (which now resembles a hand) over the NO button (which highlights to show its selection) and pressing any button. The dialog box disappears, and the program continues (or exits, depending on the circumstances).

## (25) Location: Command menu item Update Rate

Action: If real-time data are being taken by the program, a dialog box is generated with an input window showing the current real-time data acquisition rate in seconds per sample. The user types in the new rate and selects the OKAY box to accept it or selects the OKAY box to keep the current acquisition rate.

### 5. Error messages

The following error and warning messages can be generated within the program. Causes and corrective actions are given. The error messages are listed below in alphabetical order.

a. Bad color <color name> RGB format in matrix file <file name>

Cause: The RGB color definition shown is in the wrong format (too many/few R's. G's. and/or B's). Program terminates.

Resolution: Correct the RGB format.

### b. Cannot access MSID keys

Cause: The ds\_getkeys() call to obtain MSID information for real-time data

access was unsuccessful. Program terminates.

Resolution: Check real-time data source status and MSID names.

#### c. Cannot connect to X server

Cause: Program executed outside of the X-Windows environment, or server

error. Program terminates. Since the program window is never displayed, this message does not appear in a dialog box, but in the

standard output window (if it exists).

Resolution: Execute the program while in X-Windows.

## d. Cannot open file <file name>

Cause: The logic or matrix file specified could not be opened. Program

terminates.

Resolution: Check for correct file name spelling and path.

e. Cannot open <font name> font

Cause: The font listed cannot be found. Program terminates.

Resolution: Check current font path (to make sure all available font directories are

included) and font name spelling.

f. Color <color name> undefined in matrix file <file name>

Cause: The color name shown cannot be found in the standard color database

or the "#" character was left off the RGB format. Program terminates.

Resolution: Check spelling/syntax (add "#" to RGB format).

g. Color map syntax error in matrix file <file name>

Cause: The matrix file color map has incorrect syntax (too few or too many color

names). Program terminates.

Resolution: Correct the color map syntax.

h. Configuration file <file name> data missing

Cause: The number of matrix data sets in the configuration file does not match

the total number of matrices. Program terminates.

Resolution: Remove the configuration file or save the current configuration.

i. Illegal command line option/syntax

Cause: Excess character(s) or no file name listed after option on command line,

or illegal command line option. Program terminates.

Resolution: Correct the command line syntax.

j. Infinite loop found

Cause: Logic that would result in an infinite loop (e.g., A is failed by NOT A) has

been detected. This is determined in the program by the logic routine being unable to converge within a specified number of loops. This can

occur only with the use of inverse (NOT) logic.

Resolution: Remove the logic causing the infinite loop from the logic file.

k. Insufficient memory space available

Cause: Insufficient memory could be allocated for program variables. Program

terminates.

Resolution: Terminate other processes and/or clear some disk space.

I. Item <name> mask value too large in logic file <file name>

Cause: The logic statement of the item indicated contains a mask word value

larger than eight digits. Program terminates.

Resolution: Correct the bad logic statement.

m. Item <name> filter value < 2 in logic file <file name>

Cause: The filter value for the item named is less than 2. Program terminates.

Resolution: Increase the filter value.

n. Item <name> has illegal <operator> in logic file <file name>

Cause: The logic statement for the item named contains the operator shown in

an illegal context. Program terminates.

Resolution: Correct the logic syntax.

o. Item <name> has illegal ending operator in logic file <file name>

Cause: The logic string for the item referenced is terminated with an operator

that is illegal in that context. Program terminates.

Resolution: Correct the logic syntax.

p. Item <name> has illegal item name in logic file <file name>

Cause: A logic item name is placed illegally in the logic for the item named.

Program terminates.

Resolution: Correct the logic syntax.

q. Item <name> has illegal MSID item in logic file <file name>

Cause: An MSID item name is placed illegally in the logic for the item named.

Program terminates.

Resolution: Correct the logic syntax.

r. Item <name> has illegal constant in logic file <file name>

Cause: A filter number or constant value is placed illegally in the logic item

named. Program terminates.

Resolution: Correct the logic syntax.

s. Item <name> has no name following quote in logic file <file name>

Cause: An item name was expected following a single or double quote in the

logic file. Program terminates.

Resolution: Delete the quote or put an item name after it.

t. Item <name> has too few ('s in logic file <file name>

Cause: The number of right parentheses exceeds the number of left

parentheses at some point in the logic string for the item named (reading

left to right). Program terminates.

Resolution: Add/subtract parentheses as required to correct syntax.

u. Item <name> has too few )'s in logic file <file name>

Cause: The number of left parentheses exceeds the number of right

parentheses at some point in the logic string for the item named (reading

left to right). Program terminates.

Resolution: Add/subtract parentheses as required to correct syntax.

v. Item <name> undefined in logic file <file name>

Cause: A subitem is not listed as separate item in the logic file. Program

terminates.

Resolution: Put an entry for the item in the logic file or check spelling.

w. Item <name> is not a valid MSID in logic file <file name>

Cause: An MSID logic item name (an item beginning with a "#" is not a valid

MSID. Program terminates.

Resolution: Correct the item name indicated.

x. Item <name> mask value missing in logic file <file name>

Cause: The logic statement of the item indicated is missing the required mask

value. Program terminates.

Resolution: Correct the bad logic statement.

y. Matrix <matrix name> box definition color name missing in matrix file <file name>

Cause: Insufficient color names are given in a box definition in the matrix

indicated.

Resolution: Provide a fail color for each item represented in the matrix box in addition

to a single not-fail color.

aa. Matrix <matrix name> box definition syntax error in matrix file <file name>

Cause: A box definition in the matrix indicted contains too many color names or

has excess characters.

Resolution: Remove the excess characters.

bb. Matrix <matrix name> color <color name> undefined in matrix file <file name>

Cause: The color name in the specified matrix has not been defined in the matrix

file color map. Program terminates.

Resolution: Add an entry for the color or check spelling.

cc. Matrix <matrix name> font name missing in matrix file <file name>

Cause: The matrix indicated does not have a font name specified.

Resolution: Provide the missing font name.

dd. Matrix <matrix name> has no boxes defined in matrix file <file name>

Cause: No box definitions exist in the matrix file for the matrix specified.

Program terminates.

Resolution: Define boxes for the matrix or remove the matrix command.

ee. Matrix <matrix name> item <item name> in matrix file <file name> undefined in logic file

Cause: Matrix item specified in matrix file could not be found in the logic file.

Program terminates.

Resolution: Add entry in logic file for matrix item, delete matrix item, or check

spelling.

ff. Matrix <matrix name> rows have unequal number of columns in matrix file <file name>

Cause: Number of columns in one row of a matrix does not equal the number of

columns in the preceding rows of that matrix. Matrices must be

symmetrical. Program terminates.

Resolution: Fill out columns with empty boxes (no name, and not-fail/fail colors set to

black).

gg. Matrix definition name missing in matrix file <file name>

Cause: A matrix definition does not include a matrix name.

Resolution: Provide the missing matrix name.

hh. MSID <MSID name> has invalid type

Cause: An MSID logic item does not return with an binary, integer, floating point,

or parent word value. Program terminates.

Resolution: Remove the MSID specified from the files.

ii. MSID item name <MSID name> too long in logic file <file name>

Cause: The MSID portion of the MSID logic item (items beginning with a "#"

character are assumed to be MSID's) indicated contains too many

characters (10 characters maximum). Program terminates.

Resolution: Correct the MSID logic item name specified.

jj. No color map defined before matrix definition

Cause: A matrix definition precedes the color map, or no color map is present in

the matrix file. Program terminates.

Resolution: Place the color map ahead of any matrix definitions in the file.

kk. No logic items defined in logic file(s)

Cause: The logic file(s) does not contain any logic item definitions (item names

beginning in the first column). Program terminates.

Resolution: Supply correctly formatted logic file.

II. No matrices defined in matrix file(s)

Cause: No matrix definitions were found in the matrix file. Program terminates.

Resolution: Add at least one matrix definition to the matrix file.

mm. No room in color map

Cause: The color map is full and no new colors can be defined (box or text).

Program terminates.

Resolution: Reduce the number of colors defined. Try to use names from the

standard color database, if possible, to increase the chance of interclient

color sharing.

nn. Syntax error in matrix file <file name>

Cause: A line in the matrix file that is not an identifier or a comment line was

found. Program terminates.

Resolution: Delete excess lines.

## 6. Warning messages

a. Bad input value; ignored

Cause: A number entered in the input dialog box is incorrectly formatted

(embedded spaces, improperly placed decimal points, or minus signs).

The bad value is ignored, and the dialog box is removed.

Resolution: Reenter the constant value correctly.

b. Cannot connect to data source; continue (no real-time)?

Cause: The ds\_connect () call to connect to the real-time data source was unsuccessful. If the dialog OKAY box is selected, then the program continues operation, but no real-time data are processed. (All MSID logic items are initialized to not-failed.) If NO is selected, then the

program terminates.

Resolution: Check real-time source status.

c. Cannot initialize WEX; continue (no real-time)?

Cause: The EXwexinit () call to initialize WEX was unsuccessful. If the dialog OKAY box is selected, then the program continues operation, but no

real-time data are processed. (All MSID logic items are initialized to not-

failed.) If NO is selected, then the program terminates.

Resolution: Execute program in the WEX 2.5 environment.

d. Cannot obtain flight number; continue (no real-time)?

Cause: The EXflight () call to obtain the current flight number was unsuccessful.

If the dialog OKAY box is selected, then the program continues

operation, but no real-time data are processed. (All MSID logic items are initialized to not-failed.) If NO is selected, then the program terminates.

Resolution: Select a flight number for real-time data access.

e. Cannot open output file crans.temp

Cause: The temporary output file used for print requests could not be opened.

No output is generated. Program continues operation.

Resolution: Reattempt request. Possible Unix problem.

f. Configuration file <file name> data mismatch

Cause: The number of matrices saved in the configuration file does not match

the number of matrix definitions in the matrix file. Program continues

operation (the configuration file is ignored).

Resolution: Remove the configuration file, save the current configuration, or specify

another configuration file name on the command line.

g. Insufficient window size to display all information

Cause: The program window size is too small to contain all the help,

commonality, or reference display information (which is truncated). The

program continues operation.

Resolution: Resize the program window larger.

h. Item <name> in logic file <file name> already defined; continue (ignore)?

Cause: A logic item has two (or more) definitions in the logic file(s). If the dialog OKAY box is selected, then the program continues operation and the duplicate entry is ignored. If NO is selected, then the program

terminates.

Resolution: Remove duplicate logic item entries from the logic file(s). The option "-

shadowduplicates FALSE" will inhibit this warning message.

i. Main window too small

Cause: The program window is too small to contain the main window header or

the largest icon. Program continues operation.

Resolution: The window manager should prevent resizing the window too small to

contain the header or largest icon. Start the program with a larger

window size or shorten the main title or matrix name(s).

j. Insufficient window size for matrix <matrix name>

Cause: The size of the main window is too small to contain the matrix when

deiconified. Program continues operation (the matrix remains iconified).

Resolution: Resize the main window with a larger window size.

k. Cannot open configuration file <file name>

Cause: Configuration file cannot be opened. Program continues operation

(configuration is not saved).

Resolution: Bad subdirectory; check file pathname.

## A ACRONYMS AND ABBREVIATIONS

A/D Analog to Digital A/G Air to Ground

ACCU Audio Central Control Unit

ACIP Aerodynamic Coefficient Instrumentation Package

ADI Attitude Direction Indicator

ADPE Automatic Data Processing Equipment

AED **Analog Event Distribution** AES Analog Event System AGC **Automatic Gain Control** ALC **Automatic Level Control** AM Antenna Management AOA Abort-Once-Around Acquisition of Signal AOS Attitude Timeline ATL Audio Terminal Unit ATU

AZ Azimuth

BCE Bus Control Element
BCH Binary Coded Hexadecimal
BFS Backup Flight System
BOT Beginning of Tape
BSR Bite Status Register
BSU Bit String Unsigned
BTU Bus Terminal Unit

BUC Buckhorn Stdn Tracking Station

C&D Control and Display CAP Crew Activity Plan

CCM Configuration Control Module CCTV Closed Circuit Television

CDAT Communication and Data Activity Timeline
CDMS Command and Data Management Subsystem

CFAR Constant False Alarm Ratio

CMD Command

CMOS Complementary Metal-Oxide Semiconductor

COMM Communication

CRP Configuration Requirements Processor

CSG Cover Sequence Generator CVM Crypto Variable Memory

DCC Data Computation Complex

DDD Digital Display Driver
DDH Dump Data Handler
DEU Display Electronics Unit
DFE Data Flow Engineer

DFI Development Flight Instrumentation

DFL Decom Format Load

DFRC Dryden Flight Research Center

DI Data Interrogator

DMC Data Management Checklist
DOD Department of Defense
DPS Data Processing System
DQM Data Quality Monitor
DR Discrepancy Report

DRK Display Request Keyboard
DRM Direct Readout Module
DSC Dedicated Signal Conditioner

DSM Digital Select Matrix
DSN Deep Space Network
DTE Digital Television Equipment

DTO Detailed Test Objective
DTV Digital Television
DVS Digital Voice System

DYN Dynamics

E&D Engineering and Development

ECG Electrocardiogram

ECIO Experiment Computer Input/Output Processor ECOS Experiment Computer Operating System

ED Engineering Directorate

EDE EMCC Documentation Engineer

EECOM Electrical, Environmental, Consumables, and Mechanical Systems

EGIL Electrical, General Instrumentation, and Lighting Engineer

El Entry Interface EL Elevation

EMCC Emergency Mission Control Center

EMU Extravehicular Mobility Unit

EOT End of Tape

EPSAT Entry Predicted Site Acquisition Table
ERAU Experiment Remote Acquisition Unit
ESTL Electronic Systems Test Laboratory

ET External Tank
ETF Even Track Forward
EU Engineering Unit
EVA Extravehicular Activity
EXC Experiment Computer

FAO Flight Activities Officer

FC Fuel Cell

FCOH Flight Controllers Operational Handbook

FCR Flight Control Room FD Flight Director

FDA Fault Detection and Annunciation

FDF Flight Data File

FDM Frequency Division Multiplexer FDO Flight Dynamics Officer FES Flash Evaporator System

FIFO First In - First Out

FIMS Fault Isolation Monitoring System

FM Frequency Modulated

FMT Format

FOD Flight Operations Directorate
FPM Fetch Pointer Memory
FRR Flight Readiness Review

G&C Guidance and Control G&N Guidance and Navigation

GC Ground Control

GCIL Ground Control Interface Logic
GCMR Ground Control Message Request

GLS Ground Launch Sequence (Sequencer)

GMT Greenwich Mean Time GN Ground Network

GNC Guidance, Navigation, and Control

GND Ground

GPC General Purpose Computer
GSE Ground Support Equipment
GSFC Goddard Space Flight Center

GSTDN Ground Spaceflight Tracking and Data Network

HAL High Order Assembly Language

HDR High Data Rate

HDRR High-Data-Rate Recorder

HOSC Huntsville Operations Support Center

HRM High-Rate Multiplexer

I/O Input/Output

Intercomputer Communication ICC **ICD** Interface Control Document Interface Control Module ICM **ICMS** Intercom Master Station IF Intermediate Frequency **IFM** In-Flight Maintenance Initial Load Capabilities ILC IMU Inertial Measurement Unit

INCO Instrumentation and Communications Officer

INST Instrumentation
IOM Input/Output Module
IOS Instructor Operator Station

IPCL Instrumentation Program and Component List

IPS Inches Per Second

IRIG Interrange Instrumentation Group

IUS Inertial Upper Stage
IVT Integrated Verification Test

JSC Lyndon B. Johnson Space Center

KSC John F. Kennedy Space Center

LAN Local Area Network
LCA Launch Control Amplifier

LDR Low Data Rate

LHCP Left-Hand Circular Polarization Lock-On, Local Oscillator

LOS Loss of Signal

LRU Line Replaceable Unit

LW Last Word

MADS Modular Auxiliary Data System

MAL Malfunction

MAR Mission Action Request MCC Mission Control Center

MCIU Master Controller Interface Unit
MCM Multiple Command Module
MDM Multiplexer/Demultiplexer
MDRF Mission Data Request Form

MECO Main Engine Cutoff
MER Mission Evaluation Room
MET Mission Elapsed Time
MIA Multiplexer Interface Adapter

MITS Master Instrumentation and Timing Subsystem

MM Mass Memory

MMDB Master Measurement Database Master Measurement List MML Modular Memory Unit MMU **MPSR** Multipurpose Support Room Maneuver Planning Table MPT Multiple Real-Time Commands **MRTC** Marshall Space Flight Center **MSFC** Measurement Stimulus Identifier MSID

MSK Manual Select Keyboard

MSPC Multiple Stored Program Command

MTU Master Timing Unit

MUX Multiplexer

NASCOM Nasa Communications Network

NCC Network Control Center
NSC Next Station Contacts
NSP Network Signal Processor

OA Operations Analyst

ODDS Operational Data Delivery Services

ODM Operational Data Message
Ol Operational Instrumentation

OMI Operation and Maintenance Instructions
OPS Operations Sequence, Operations

OST Operations Support Team

OTF Odd Track Forward

P/L Payload Power Amplifier

PAD Preliminary Advisory Data PAM Payload Assist Module PAO Public Affairs Office

PASS Primary Avionics Software System

PBI Pushbutton Indicator
PCA Point of Closest Approach
PCAP Premission Crew Activity Plan

PCL Pocket Checklist PCM Pulse-Code Modulation

PCMMU Pulse-Code Modulation Master Unit

PCMU Pulse-Code Modulation Unit
PDI Payload Data Interleaver
PDIP Payload Data Interface Panel

PDL Payload Data Load PET Phase Elapsed Time

PGM Program

PI Payload Interrogator
PIP Payload Integration Plan

PLB Payload Bay

PLT Pilot

PM Phase Modulated

PMU Pulse-Code Modulation Master Unit

PNL Panel

POCC Payload Operations Control Center

POR Point of Resolution

POWG Payload Operations Working Group

PRM Parameter

PROM Programmable Read-Only Memory
PSAT Predicted Site Acquisition Table
PSDP Payload Station Distribution Panel

PSP Payload Signal Processor PTL Payload Throughput Load

R/T Real Time

RAAB Remote Amplification and Advisory Box

RAM Random Access Memory RAU Remote Acquisition Unit

RCDR Recorder

RCU Remote Control Unit RELMAT Relative Matrix RF Radio Frequency

RHCP Right-Hand Circular Polarization

RI Record Identification, Rockwell International

RMS Redundancy Management System

RMU Remote Multiplex Unit
RPC Remote Power Controller
RSA RTC Storage Area
RSS Range Safety System
RTC Real-Time Command
RTLS Return to Launch Site

S/W Software

SAIL Shuttle Avionics Integration Laboratory

SAT Satellite Acquisition Table

SCAP Shuttle Configuration Analysis Processor SCOS Subsystem Computer Operating System

SCR Strip Chart Recorder SCT Site Contacts Table

SCU Service and Cooling Umbilical SDL Software Development Laboratory

SDP Shuttle Data Processor

SEADS Shuttle Entry Air Data System
SGLS Space/Ground Link System
SGSC Strain Gauge Signal Conditioner

SHO Scheduling Order

SILTS Shuttle Infrared Leeside Temperature Sensor

SIO Serial Input/Output

SIPS Spacelab Input Processing System

SL Spacelab

SM Systems Management SMS Shuttle Mission Simulator

SN Space Network
SPAN Spacecraft Analysis
SPAS Shuttle Pallet Satellite
SPC Stored Program Command
SRB Solid Rocket Booster

SRU Shop Replaceable Unit S-Band Signal Access SSA Subsystem Computer SSC SSI Standard Serial Interface SSME Space Shuttle Main Engine SSMM Solid State Mass Memory

Spacelab Stored Program Command **SSPC** Staff Support Room, Solid State Recorder SSR

Space Tracking and Data Network STDN Space Transportation System STS

Shuttle Upper Atmosphere Mass Spectrometer SUMS

Supervisor Call SVC Status Word SW

**TACAN Tactical Air Navigation** Test and Graphics Subsystem TAGS

Transatlantic Abort Landing **Terminal Count Demonstration Test TCDT** 

TDM Tracking Data Messages, Time Division Multiplexing

**TDRS** Tracking and Data Relay Satellite

Tracking and Data Relay Satellite System **TDRSS** 

TEC Time Execute Command TFL Telemetry Format Load

TLM Telemetry

TAL

**TMBU** Table Maintenance Block Update

TN TDRS Network

**Test Operations Control Center** TOCC

Two-Stage Buffer **TSB** 

TV Television

**TVC Television Camera** TWT Traveling Wave Tube

UHF Ultrahigh Frequency UPF Universal Patch Format **USAF** United States Air Force

VAS Video Analog Switch VCU Video Control Unit

VDB Vandenberg Air Force Base

VED Video Editor

Verification Flight Instrumentation VFI

**VLVS** Valves

VPU Video Processing Unit Video Switching Unit VSU Video Tape Recorder VTR

**WBSC** Wide-Band Signal Conditioner

WSC White Sands Center

**WSGT** White Sands Ground Terminal White Sands Test Facility WSTF WTR Western Test Range WVS Wireless Video System

**XMTR** Transmitter Distribution for JSC-12829, Rev. G, PCN-6 Total paper copies: 52

NASA - JSC DA83/MOD Library DS2/J. P. Jason DS23/M. Williamson (29)

(plus CD ROM provided by DS23 for

EMCC) DS25/Library (3)

(plus 1 CD ROM provided by DS23)

DV12/A. Garcia DO5/J. McKenna EV211/B. Embrey NC62/S. Moran

**BOEING** 

HZ1-10/C. J. Stafford M. May (3)

USA USH-636L/M. Fulton USH-635K/K. Bimage

USH-430A/S. Blair, label "for STIC update" (CD ROM provided by DS23)

<u>Lockheed-Martin</u> LM12-L1K-1DO/R. Kraesig

(plus 1 CD ROM provided by DS23)

NASA/GSFC Greenbelt, MD 20771 Code 592/M. Steiner

NASA/KSC/VAB
PH-F1/R. Rogers
PH-F2/INST/S. Green (2)
USK-194/C. Reiber
R. Brown

TDRSS--White Sands Center
PO Box 9000
Las Cruces, NM 88004
WSC Library/G. Taylor
(plus 2 CD ROMs provided by DS23)