

Inertial Upper Stage (IUS) Flight Procedures Handbook

Flight Activity Branch
Operations Division

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SECTION 1 INTRODUCTION

1.1 PURPOSE

This handbook presents inertial upper stage (IUS) systems descriptions as well as procedures rationale for the IUS Deploy Checklist. The 51-E IUS Deploy Checklist was used in conjunction with the procedure rationale.

This book is intended for use by Mission Operations Directorate (MOD) and Flight Crew Operations Directorate (FCOD) personnel as a source of information on deploy procedures rationale.

1.2 BACKGROUND

The IUS is a self-navigating, two-stage, solid-fueled boost vehicle designed and manufactured by Boeing Aerospace Corporation (BAC). It provides the capability to carry as many as four spacecraft per mission into high Earth orbits.

1.3 REFERENCES

IUS Orbital Operations Handbook, Rev E, Jan. 18, 1983, BAC D290-10554-1

51-E IUS Deploy Checklist, Final, Jan. 7, 1985

IUS Payload Systems Procedures Workbook, March 25, 1982

Shuttle Flight Operations Manual, Vol 18, BASIC, Rev A. Sept. 14, 1982, JSC-12770.

IUS Systems Handbook, Basic, Rev B-1, Dec. 21, 1984, JSC-17077

1.4 ACRONYMS/ABBREVIATIONS

A/G	air to ground
ACN	Ascension Island Tracking Station (STDN)
ADI	attitude director indicator
AFSCF	Air Force Satellite Control Facility
AFTA	aft frame tilt actuator
AGO	Santiago, Chile, Tracking Station (STDN)
ALT	alternate
AMP	amplifier
ANT	antenna
AOS	acquisition of signal
ASE	airborne support equipment
ATT	attitude
AUX	auxiliary

BAC	Boeing Aerospace Corporation	GTS	Guam Tracking Station (RTS)
bp	barberpole	GWM	Guam Tracking Station (STDN) - Guam Island, U.S.
C/L	checklist	HAW	Hawaii, Kauai, Tracking Station (STDN)
C/O	checkout	HTPB	hydroxy terminated polybutadrene binder
CAP	Crew Activity Plan	HTS	Hawaii Tracking Station (RTS) - Kaene Point, Oahu
cb	circuit breaker	I/F	interface
CCTV	closed-circuit television	I/O	input/output
CDC	confined detonating cord	IMU	inertial measurement unit
CDR	commander	IOS	Indian Ocean Tracking Station (STDN) - Mahe Island, Seychelles Tracking Station Indian Ocean Station (SGLS, RTS)
CIU	communications interface unit	IUS	Inertial Upper Stage
CMD	command	JSC	Johnson Space Center
comm	communications	kbps	kilobits per second
CRT	cathode ray tube	KSC	Kennedy Space Center
CRU	converter regulator unit	LOS	loss of signal
DAP	digital autopilot	MALF	malfunction
dB	decibel	MCC	Mission Control Center (Houston)
DB	deadband	MCDS	multifunction CRT display system
DMS	data management system	MDL	mission data load
DPLY	deploy	MDM	multiplexer/demultiplexer
DS	deep space	MET	mission elapsed time
DSBL	disable	MGA	medium gain antenna
EDU	environmental data unit	MIL	Merritt Island Tracking Station (STDN)
EEC	extendable exit cone (SRM)	MILA	Merritt Island Launch Area
EED	electro-explosive device	MOD	Mission Operations Directorate
EMI	electro-magnetic interference	MS	mission specialist
EMU	environmental measurement unit	ms	millisecond
ENA	enable	MSFC	Marshall Space Flight Center
EPS	electrical power system	MUX	multiplex(ing)
ESS	equipment support section	NASA	National Aeronautics and Space Administration
ETA	explosive transfer assembly	NAV	navigation
EVA	extravehicular activity	NIS	navigation initialization status
FLT	flight	NSP	network signal processor
FOV	field of view	OMS	orbital maneuvering system
FPS	feet per second	ops	operations
FWD	forward	ORD	ordnance
G	gravity	pbi	pushbutton indicator
G&N	guidance and navigation	PCP	power control panel
GN&C	guidance, navigation, and control	PCU	power control unit
GDS	Goldstone, California, Tracking Station (STDN)	PDI	payload data interleaver
GEO	geosynchronous Earth orbit	PDU	power distribution unit
GET	ground elapsed time	PET	phase elapsed time
GMT	Greenwich mean time		
GPC	general purpose computer		
GSE	ground support equipment		
GSFC	Goddard Space Flight Center		
GSTDN	Ground Satellite Tracking Data Network (NASA)		

PI payload interrogator (RF)
 P/L or PL payload
 PLB payload bay
 PLBD payload bay door
 PRCS primary reaction control system
 PRI primary
 PRLA payload retention latch actuator
 PSP payload signal processor
 PSU pyro switching unit
 PTU power transfer unit
 PWR power
 pyro pyrotechnic

 RCS reaction control system
 RCVR receiver
 REA rocket engine assembly
 REM rocket engine module
 RF radio frequency
 RFI radio frequency interference
 RHC rotation hand controller
 RIMU redundant inertial measurement unit
 RM redundancy management
 RTS Remote Tracking Station (USAF)

 S&A safe and arm (device)
 S/C spacecraft
 SCF Satellite Control Facility
 SCU signal conditioner unit
 SEP separation
 SGLS space ground link system/station
 SIU signal interface unit
 SM systems management
 SMAB Solid Motor Assembly Building
 SMDC shielded mild detonating cord
 SPEC specification
 SRM solid rocket motor
 SSP standard switch panel
 STBD starboard
 STC Satellite Test Center
 STDN Spaceflight Tracking and Data Network (includes the USB
 ground station, TDRSS, and TDRSS ground station)
 STS Space Transportation System
 SV state vector
 sw switch
 SYNC synchronous

 T-0 time minus zero
 tb talkback
 TCS thermal control subsystem
 TDRS Tracking and Data Relay Satellite
 TDRSS Tracking and Data Relay Satellite System
 TEMP temperature

TFL telemetry format load
 THC translation hand controller
 TLM or TM telemetry
 TT&C telemetry, tracking, and command
 TVA thrust vector actuator
 TVC thrust vector control

 UMB umbilical

 VCC vehicle/variable command count
 VDE valve driver electronics
 VRCS vernier reaction control system
 VTR video tape recorder
 VTS Vandenberg, California, Tracking Station (RTS)

 W watt
 WBDT wide band data interleaver
 WSGT White Sands Ground Terminal

 XMTR transmitter

 -ZLV -Z local vertical (-Z Orbiter body axis toward Earth)

 CL clear text and locked (TLM reception in sync)
 nL not locked (TLM reception not in sync)

SECTION 2 IUS VEHICLE OVERVIEW

The following sections are intended to give an overview of the IUS and its systems. For detailed system description, Boeing documentation should be referenced.

2.1 PHYSICAL DESCRIPTION

The IUS vehicle is cylindrical in shape and consists primarily of an aft skirt, interstage structure, first stage solid rocket motor (SRM-1), second stage solid rocket motor (SRM-2), equipment support section (ESS), and airborne support equipment (ASE), (figs. 2-1, 2-2, and 2-3).

The IUS first stage consists of the interstage structure and the SRM-1, which contains up to 21,400 pounds of propellant, and is attached to the ESS by pyrotechnic separation bolts used for staging.

The IUS second stage consists of SRM-2, which contains up to 6,000 pounds of propellant, and the ESS. The ESS is also attached to the spacecraft by pyrotechnic separation bolts used for staging. Contained within the ESS are the avionics needed for guidance and navigation (G&N); a data management system (DMS) to perform computations; signal conditioning; data processing and formatting associated with navigation (NAV), tracking, guidance control and data management functions, the reaction control system (RCS), the electrical power system (EPS), and the telemetry, tracking, and command (TT&C) system.

In addition to the IUS vehicle, the ASE is required to provide the mechanical (fig. 2-4) and electrical interfaces between the IUS and the Orbiter.

2.1.1 Aft Skirt

The aft skirt is a short cylindrical section which provides the structural interface and separation joint between the aft ring on the first stage motor and the aft ASE frame. It also contains the super-rip, a circumferential linear charge. Super-rip is detonated by the crew via the power control panel (PCP) to structurally separate the IUS from the Orbiter (figs. 2-5 and 2-6).

2.1.2 Interstage Structure

The interstage and SRM-1 form the IUS stage 1. The forward end of the interstage is connected to the ESS and SRM-1 by pyrotechnic separation bolts. The first stage batteries and the SRM-1 safe and arm (S&A) devices are mounted on the outside of the interstage. Once the IUS vehicle has been assembled in the Solid Motor Assembly Building (SMAB), there can be no access within the interstage.

2.1.3 Solid Rocket Motor

The propulsion system (fig. 2-3), consists of two solid rocket motors (SRM's) and their ignition devices. The stage 1 SRM is the larger motor, with an average thrust of 41,611 pounds; the stage 2 motor with the extendable exit cone (EEC) has an average thrust of 17,629 pounds. Each stage has a vectorable nozzle which is used to adjust the transfer trajectory of the IUS. Additional vernier velocity adjustments are made by the RCS system. The SRM propellant can be off-loaded to meet specific requirements.

2.1.4 Equipment Support Section

The ESS interfaces with the spacecraft and contains the following command and control systems:

- Propulsion system
- RCS
- Thrust vector control (TVC) system
- EPS
- TT&C system
- Thermal control system (TCS)
- Avionics for G&N system
- DMS

2.1.4.1 Propulsion System

The propulsion system provides the primary IUS vehicle propulsion and consists of two SRM's, each with a vectorable nozzle and an independent redundant motor ignition system. The propellant in both SRM's is cast in a tubular grain and is composed of 18 percent aluminum, 68 percent ammonium perchlorate, and 14 percent hydroxy terminated polybutadrene binder (HTPB). Following IUS deployment by the crew, the two first-stage S&A devices are armed and SRM-1 is ignited (~00:55 or 00:67 phase elapsed time (PET)). At burn completion, the IUS performs a vernier velocity correction maneuver with its RCS to compensate for SRM total impulse dispersions. After coasting for ~5 hours, the IUS approaches geosynchronous Earth orbit (GEO) altitude where staging occurs. The two second-stage S&A devices are then armed and SRM-2 is ignited to circularize the orbit at GEO altitude. At burn completion, the IUS again performs a vernier velocity correction maneuver and spacecraft separation is performed.

2.1.4.2 Reaction Control System

The RCS performs the thrust functions required for coast attitude control, SRM powered flight roll control, vehicle maneuvers, velocity vernier for SRM impulse uncertainty, and spacecraft separation maneuvers. The RCS is a monopropellant blowdown pressurized system and consists of two hydrazine fuel tanks (third tank is optional), a fuel manifold, and six rocket engine

modules (REM's). The REM's are installed on the outer second stage structure and provide three-axis attitude control throughout the flight. Thrusting is controlled by the DMS and associated software.

Each REM contains a redundant heater assembly to maintain the propellant passages above the freezing temperature of hydrazine and to keep the catalyst beds and control valves above their minimum operating temperatures.

2.1.4.3 Thrust Vector Control System

The TVC system provides the equipment to control the pitch and yaw position of each SRM nozzle. The equipment includes two thrust vector controllers located in the ESS and a set of two actuators and two potentiometers attached to each stage SRM nozzle. The system is electrically redundant with independent channels A and B. Control of the system is by the DMS and the associated software.

2.1.4.4 Electrical Power System

The EPS provides and distributes power to the IUS vehicle and the spacecraft. Power sources include ASE power and IUS stage 1 and 2 batteries.

There are seven buses for the IUS and a separate isolated bus for the spacecraft as follows:

- Avionics A and B (supplied by ASE and avionics batteries)
- Utility batteries A and B
- Utility A and B (supplied by utility batteries)
- Powerdown (supplied by ASE power)
- Spacecraft

The avionics bus provides power to the majority of IUS components, whereas the utility battery bus and utility bus are used for high-current short-duration switching loads; i.e., ordnance devices, motor driven switches, solenoids, actuators, etc. The powerdown bus (also known as the standby bus) is powered by the ASE and required to keep temperature-critical components warm. The system is redundant to ensure that a single failure cannot disable both avionics channels A and B. The power is distributed on several buses with separate buses for the IUS and spacecraft. The EPS also provides switching for ordnance events and other control and measurement functions for the DMS. The majority of the switching functions are controlled by the DMS. However, while the IUS is still in the Orbiter bay, power functions are controlled by the ASE.

2.1.4.5 Telemetry, Tracking, and Command System

The TT&C system provides for the transmission of telemetry (TLM), turnaround of ranging data, and reception of space/ground link system/station (SGLS) compatible commands. The TT&C system is configured into two individual

receive/transmit channels to provide operational redundancy; however, the redundant channel (B-string) is optional, and may not be installed for a particular mission. The TT&C system consists of S-band transponders, power amplifiers, diplexers, switches, and antennas. Encryption and decryption devices are installed for classified missions.

2.1.4.6 Thermal Control System

The TCS is comprised of both active and passive elements. Heaters are used on RCS components, batteries, and the redundant inertial measurement unit (RIMU). Passive thermal control is achieved by selective application of exterior coatings, blanket insulation, and thermal isolators. The computers, power amplifiers, and dc-dc converter regulator units (CRU's) are mounted in cutouts in the exterior ESS wall to expose their baseplates to space for thermal control purposes.

2.1.4.7 Guidance and Navigation System

The G&N system consists of the RIMU, star scanner, and associated software. The RIMU is a strap-down system using five gyroscopes and five accelerometers to obtain vehicle inertial attitude rate and acceleration measurements. These data are provided to the flight computers for guidance, navigation, and control (GN&C) computations. The star scanner is used with certain payloads to provide attitude initialization prior to deployment to compensate for accumulated drift errors.

The IUS vehicle uses an explicit guidance algorithm to generate SRM thrust steering commands, SRM ignition time, and RCS vernier thrust cutoff time. Prior to each SRM ignition and each RCS vernier, the vehicle is oriented to a thrust attitude based on nominal performance of the remaining propulsion stages. During SRM burn, the current state vector determined from the navigation function is compared to the desired state vector. The commanded attitude is adjusted to compensate for the buildup of position and velocity errors due to off-nominal SRM performance. The primary purpose of the vernier thrust is to compensate for velocity errors resulting from SRM impulse and cutoff-time dispersions. However, residual position errors remaining from the SRM burn and position errors introduced by impulse and cutoff-time dispersions are also removed by the RCS.

Attitude control in response to guidance commands is provided by TVC during powered flight and by RCS thrusters during coast. Measured attitude from the NAV subsystem is compared with guidance commands to generate error signals. During solid motor burn, these error signals drive the motor nozzle actuators and the resulting nozzle deflections produce the desired attitude control torques in pitch and yaw. Roll control is maintained by the RCS roll-axis thrusters. During coast flight, the error signals are processed in the computer to generate RCS thruster commands to maintain vehicle attitude or to maneuver the vehicle.

JSC-18392 2.2.4 SPEC 2002.2.2 Communications Interface Unit (L11)

The CIU (L11) provides the interface and control of the communication interfaces between the IUS and Orbiter.

S-band and GN&C command data validity are verified by the CIU checking for proper format, length, and parity. Invalid commands are rejected and the CMD REJECT error light will be illuminated.

The CIU can store up to 64 IUS formatted uplink commands, which can be sent via the front panel COMMAND section. TLM data (command text and execution feedback) are displayed after the associated uplink command is received by the IUS.

CIU software is unable to determine if IUS TLM is in 16 or 64 kbps. Thus the CIU will not lock onto the TLM stream if the PAYLOAD LINK switch is not in the corresponding position; i.e., for 64 kbps, the switch should be in HARDLINE 64 KBPS.

A select group of TLM data (16/64 kbps) is extracted by the CIU, decrypted (if classified mission), and displayed in the VERIFICATION windows on the front panel:

- Variable command count (VCC)
- Predeployment checkout status
- Spacecraft (S/C) discrete commands
- IUS mission status
- Safety status
- Navigation initialization status (NIS) bits
- REM heaters status

2.2.3 Standard Switch Panel (L12)

On the SSP (L12), there are three cb's, five switches, and three talkbacks that concern the IUS:

- SW PWR cb
- IUS ANT TB PWR cb
- PL TIMING BUFFER cb
- ACT ORD ARM switch and talkback
- ACT 1 DISENG switch
- IUS RF ANT E/D switch
- IUS RF ANT ENA talkback
- IUS RF ANT DSBL talkback
- ACT 2 DISENG switch
- ACT ORD PREARM switch

After the Orbiter general purpose computers (GPC's) are configured for on-orbit operations, SPEC 200 IUS/TDRS (fig. 2-11) will be available to the crew to monitor both safety and mission success information. There is only one item entry on this display and it is a toggle command. ITEM 1 EXEC will turn off and on the cyclic transfer of time-tagged Orbiter M50 attitude and state vector data from the Orbiter GPC to a buffer in the CIU. The display is initialized with the transfer OFF. When ON, an asterisk will appear.

This display provides monitor and control capabilities of key events prior to and during IUS deployment for integrated Orbiter/IUS/tracking and data relay satellite (TDRS) operations for nonsecure missions only.

The parameter status field for all parameters will be blank for normal operation or will display an M for missing data. For analog parameters, this field will also display an H or L for off-scale data. Some parameters displayed will be limit-sensed for systems management (SM) alerts or caution and warning alarms. For discrettes that are limit-sensed, an overbright + will be displayed in this field when the parameter is out of limits. For analogs that are limit-sensed, an overbright + or - will be displayed when the parameter exceeds either an upper or lower limit. The symbols driven in the parameter status field have the following display priority from highest to lowest: M, H, L, +, -.

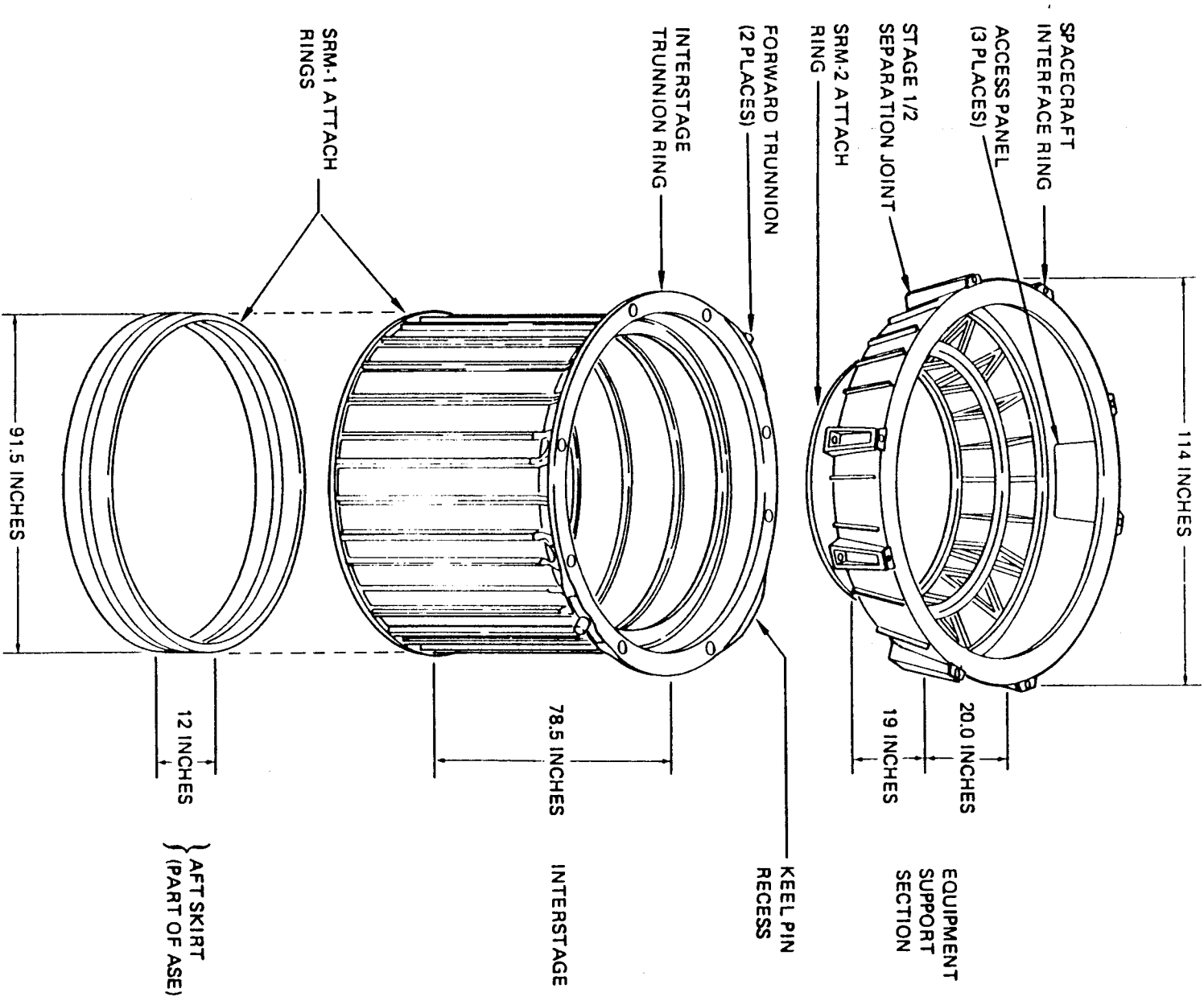


Figure 2-1.- IUS vehicle structure.

2-9

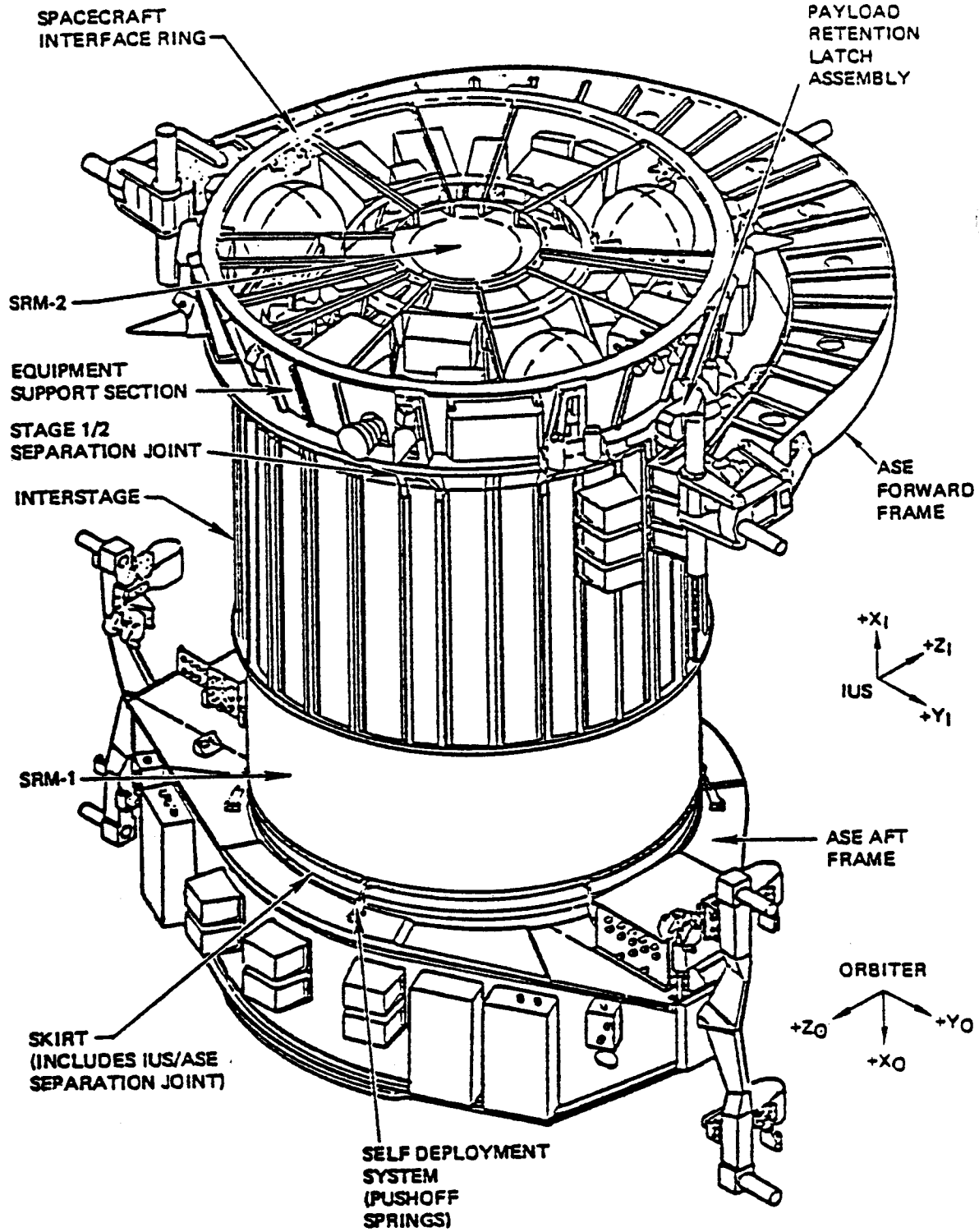


Figure 2-2.- IUS vehicle assembly.

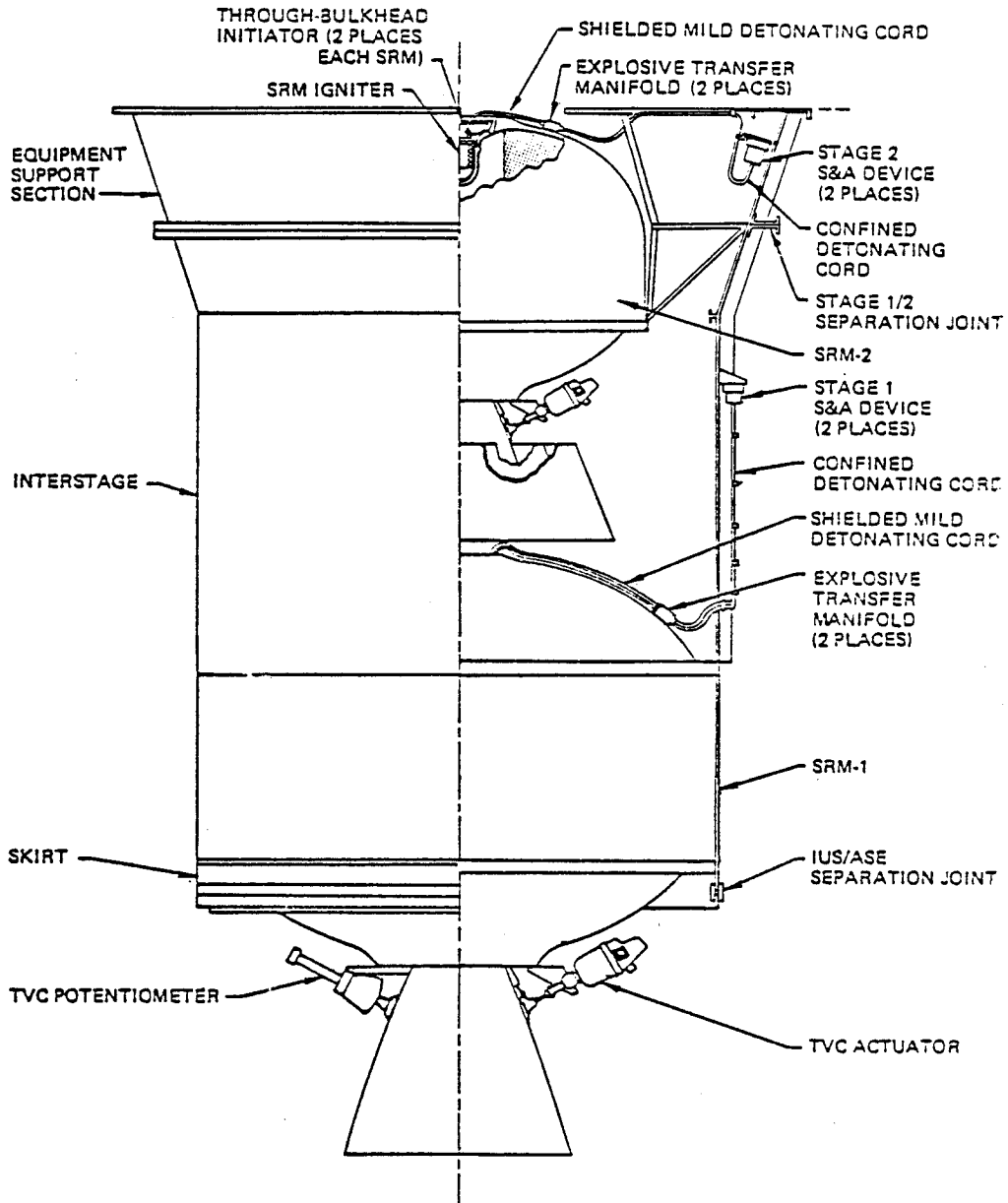


Figure 2-3.- IUS propulsion system.

2-12

10

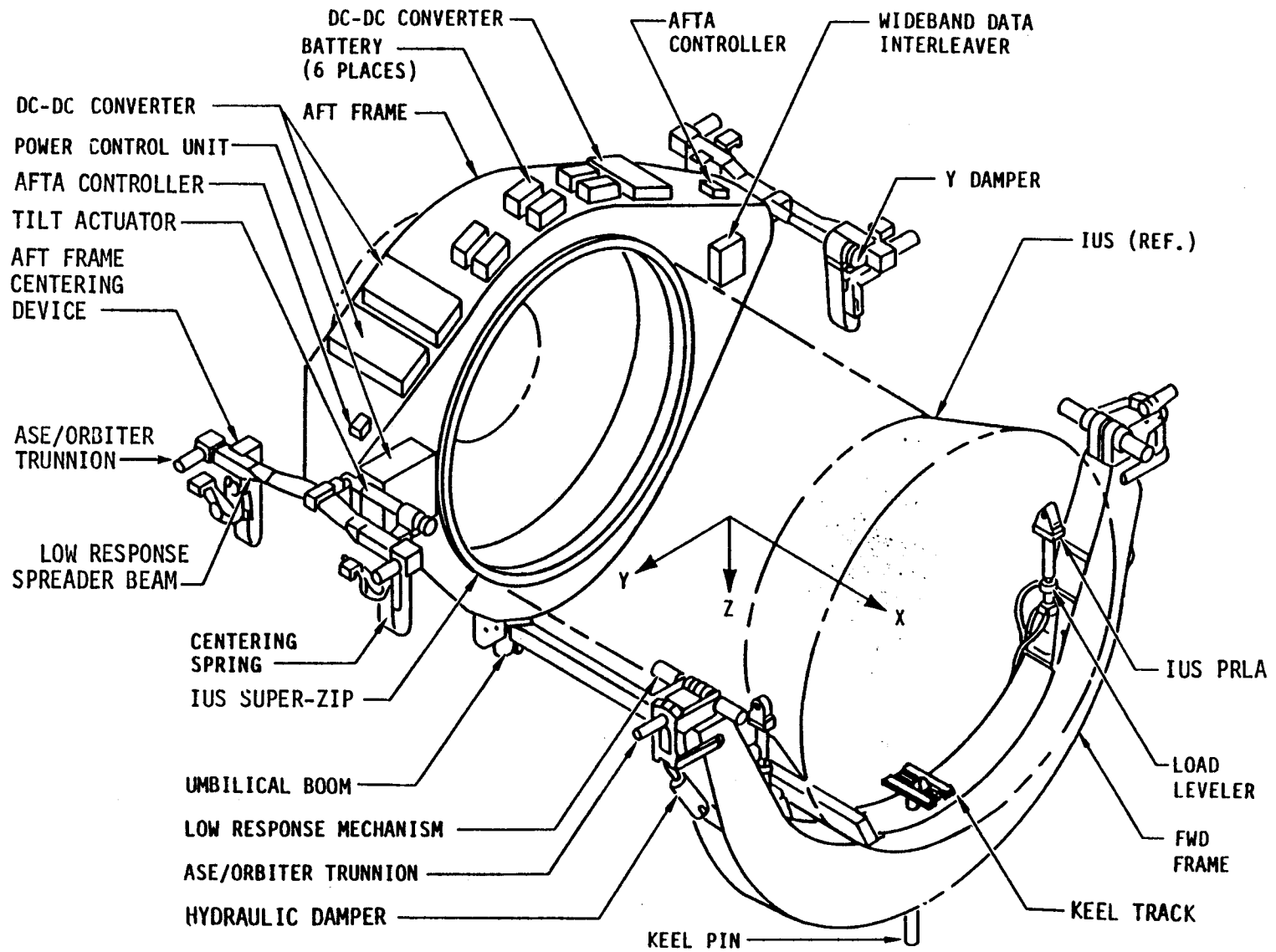


Figure 2-4.- IUS/Orbiter mechanical interface.

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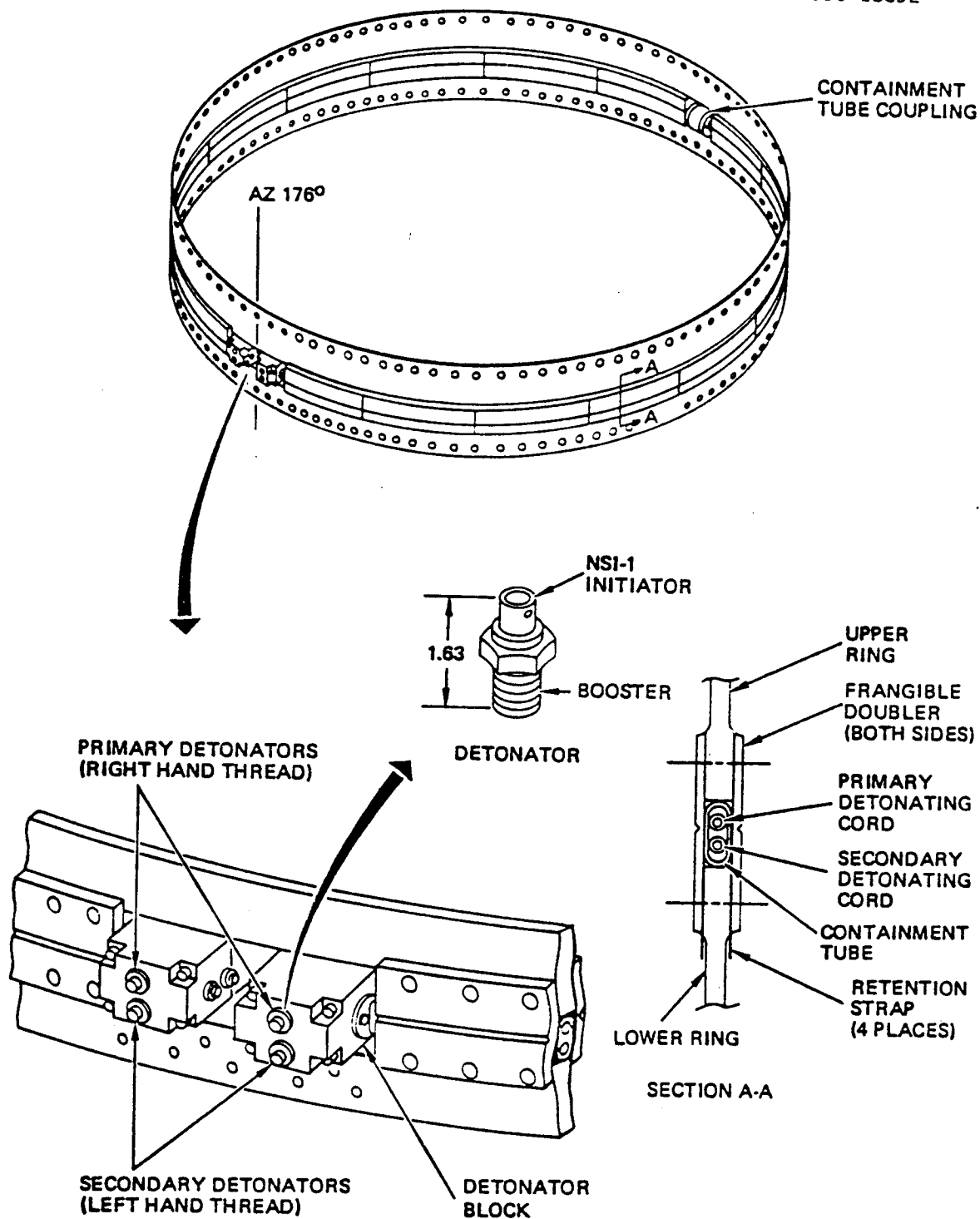
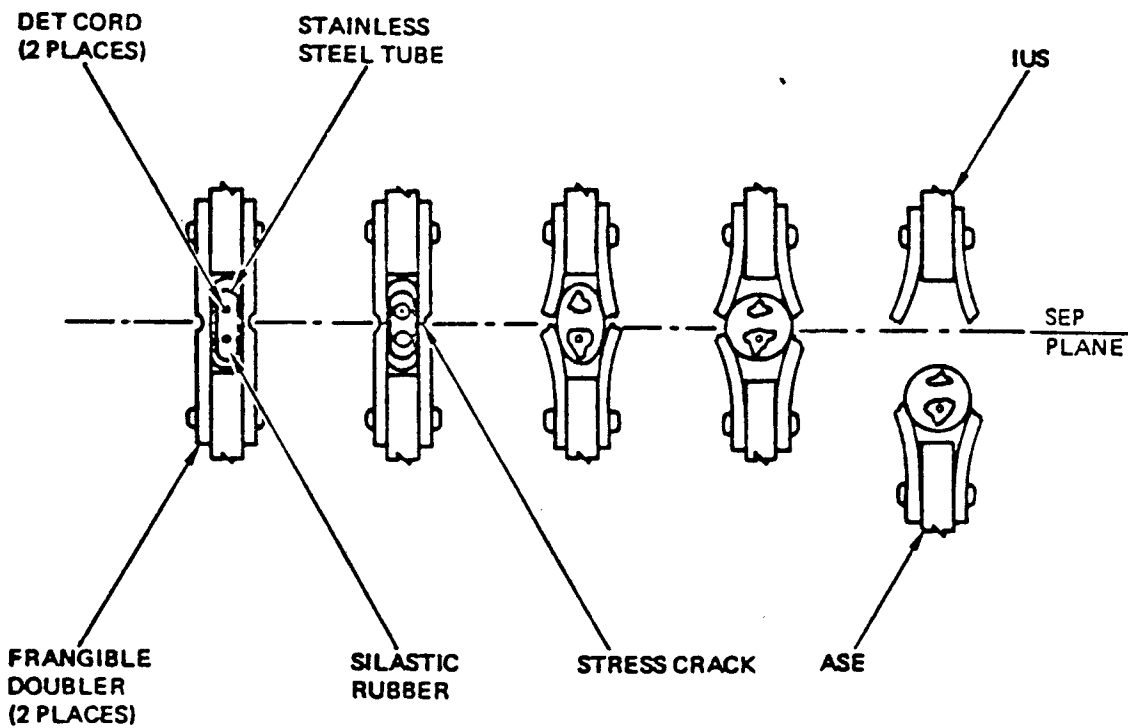


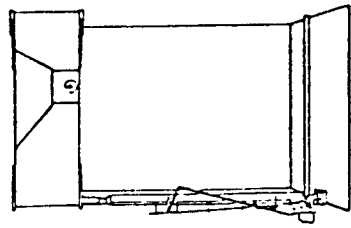
Figure 2-5.- Super-zip separation system.

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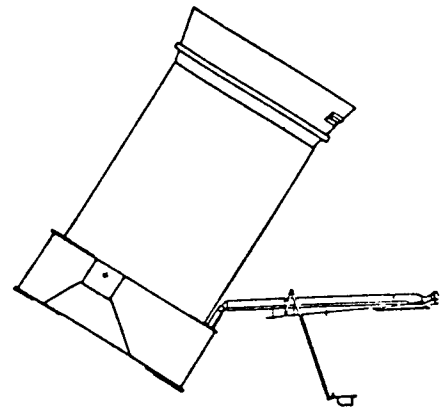


● DETONATOR BLOCKS AND STAINLESS STEEL TUBE WITH CONTAINED PRODUCTS OF COMBUSTION REMAIN WITH ASE.

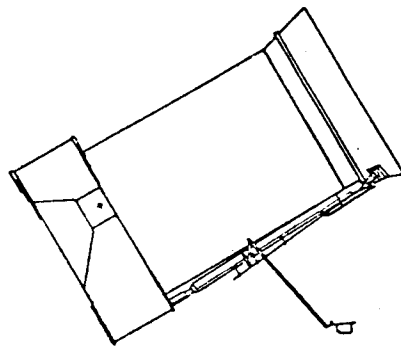
Figure 2-6.- Super-zip separation system operation.



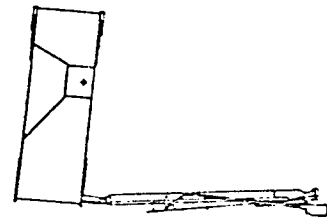
0°-LAUNCH AND STOWED POSITION



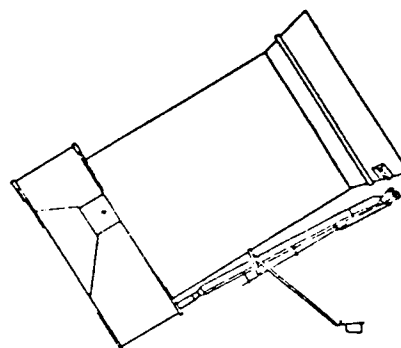
59°-DEPLOYMENT POSITION



29°-RF LINK CHECKOUT POSITION

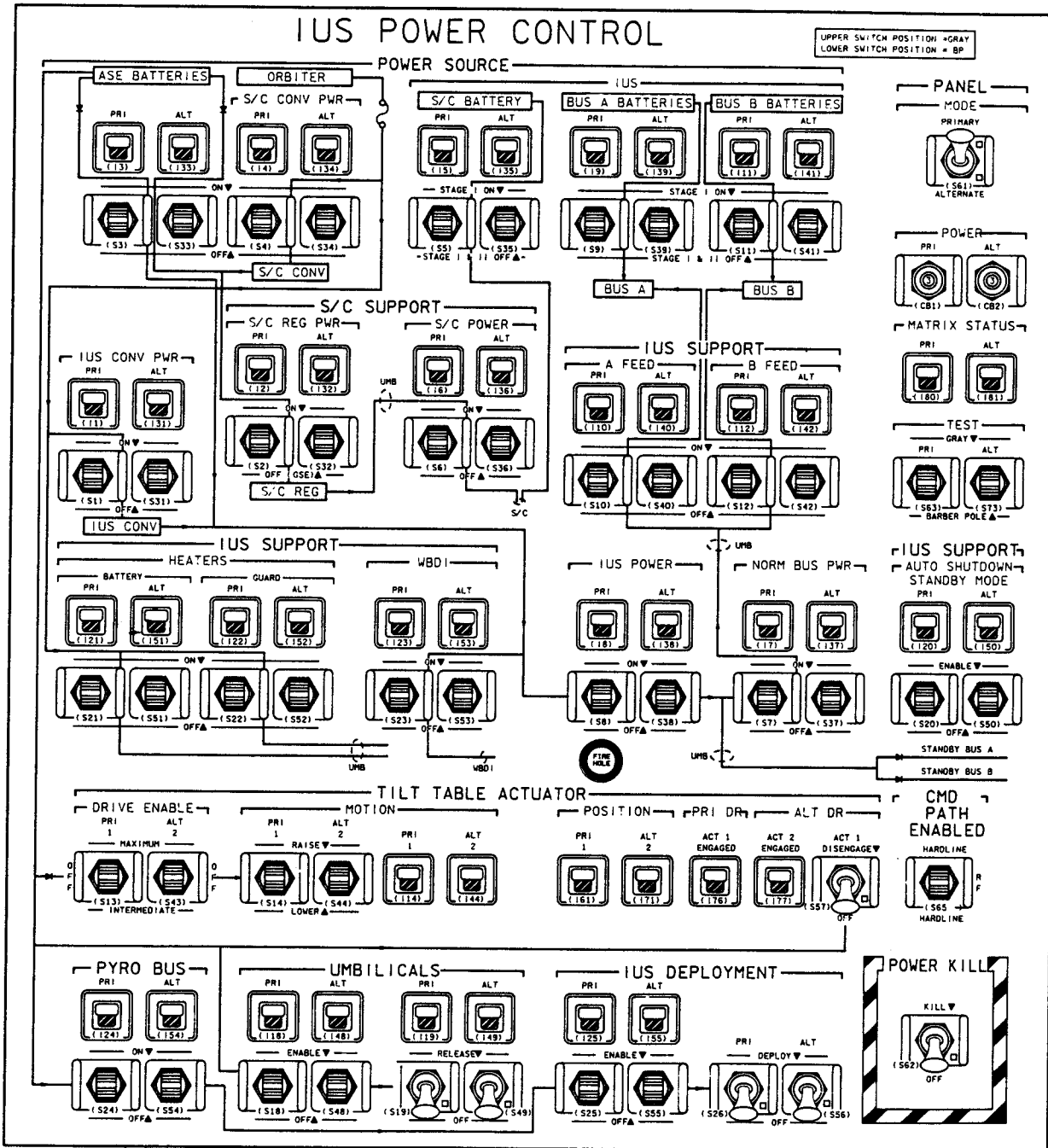


-6°-RETRACTED POSITION



29°-UMBILICAL SEPARATION

Figure 2-7.- Umbilical boom release sequence.



0878, ART. 2

Figure 2-8.- IUS POWER CONTROL panel (L10).

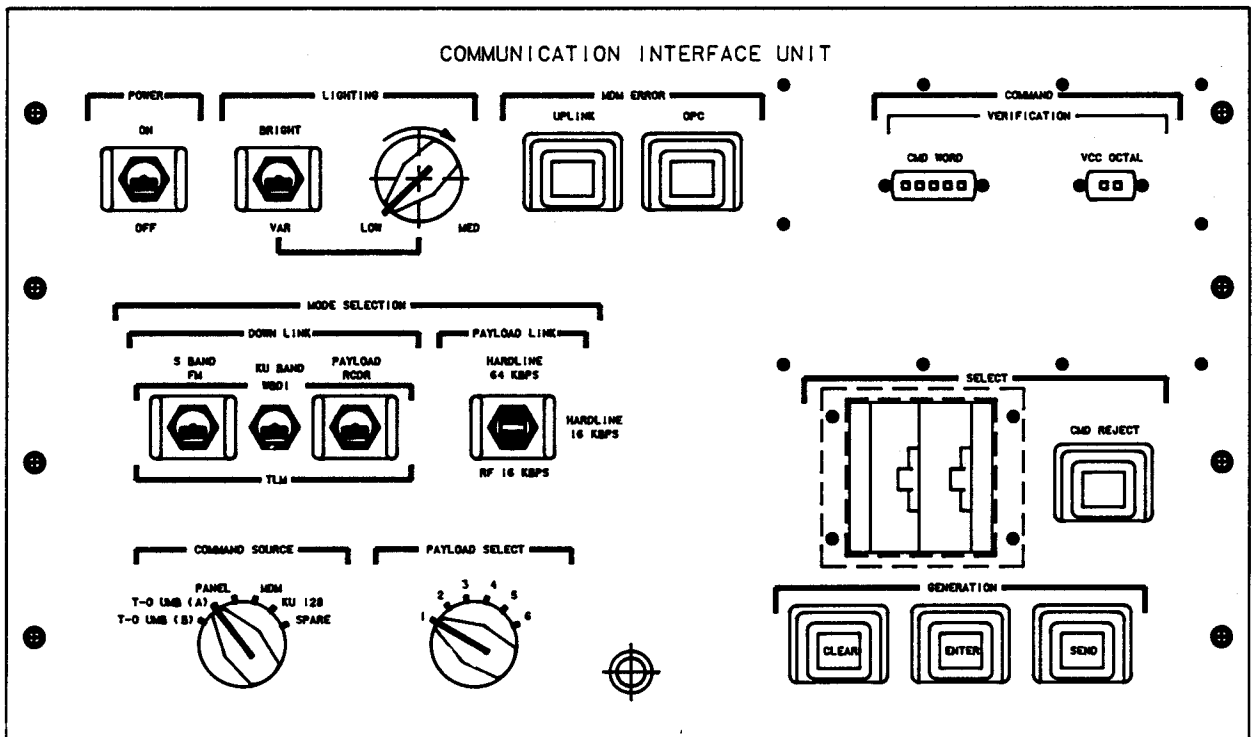
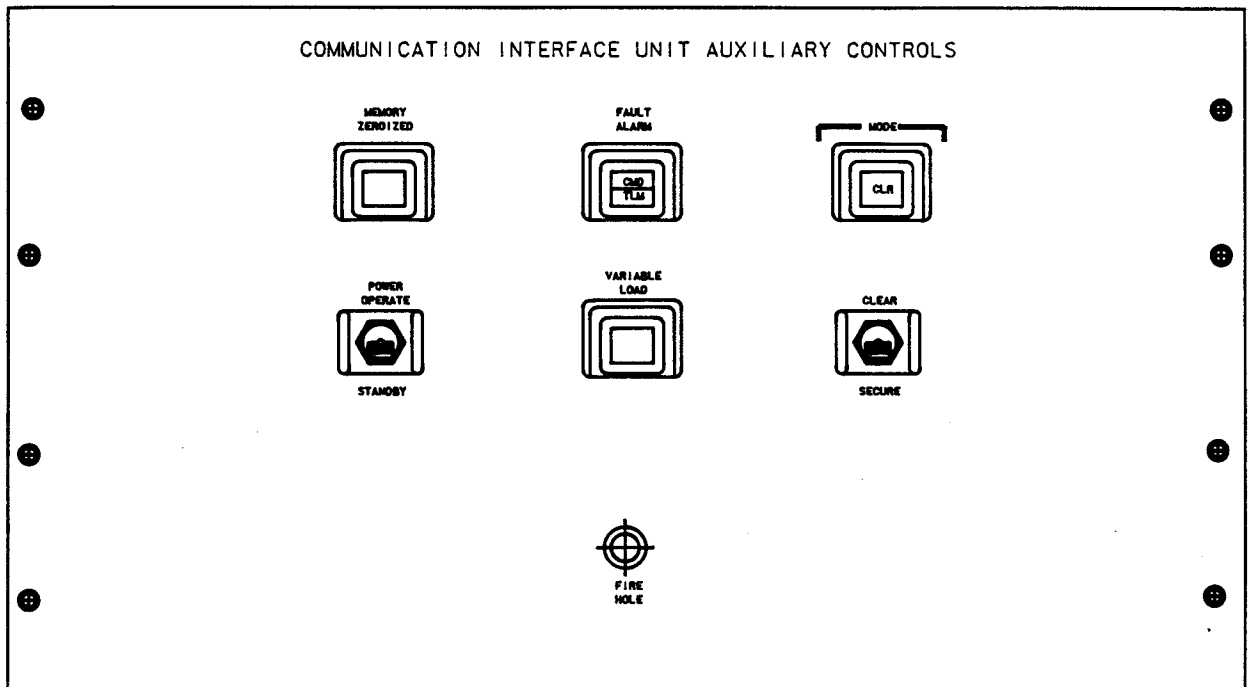
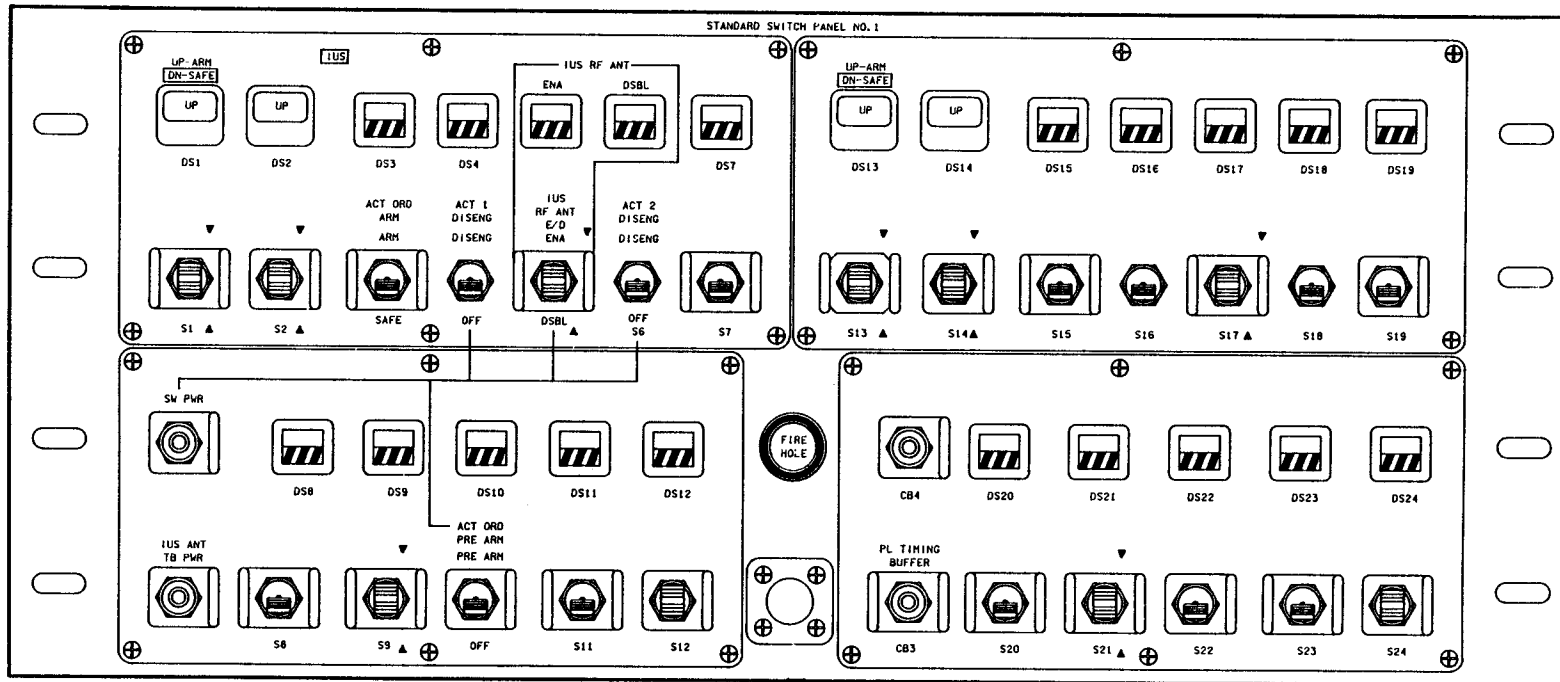


Figure 2-9.- CIU panel (L11).



2605. ART. I

Figure 2-10.- Standard switch panel (L12).

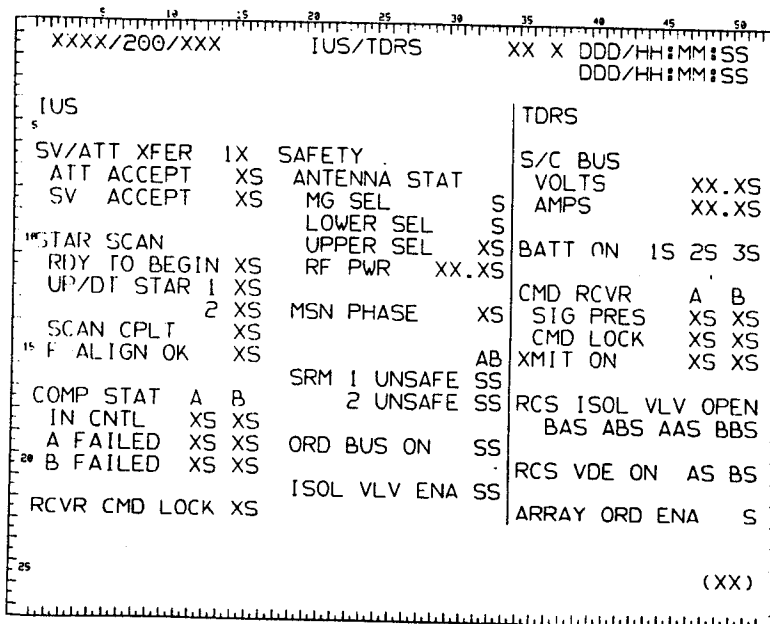


Figure 2-11 - IUS/TDRS display format.

POST-INSERTION OPS

PCP/CIU ACT C/O

1 CIU PANEL CONFIG

- MS1 R1 ✓PL AUX - ON
- ✓PL PRI MNC tb - ON _____ 1
- L11U ✓MODE - CLEAR _____ 2
- ✓PWR - STBY _____ 2
- L11L ✓PWR - ON
- ✓DNLK (three) - TLM
- ✓PL LK - HDLN 64 KBPS _____ 3
- CMD SOURCE - PNL _____ 4
- ✓PL SEL - 1 _____ 5
- ✓No ind lit
- ✓VCC-OCTAL ind - CL
- * If VCC OCTAL inL, continue; *
- * thermal shutdown may have *
- * occurred * _____ 6
- ✓No other ind lit
- * If MDM ERR GPC lt - on, then, *
- * CMD GEN CLEAR pb - CLEAR. *
- * Verify lt off and continue *
- * *
- * If MDM ERR GPC lt illuminates again, *
- * then continue and notify MCC * _____ 7

2 CIU C/O

- L11 CMD SEL tw (two) - 00
- GEN ENTER pb - ENTER (hold)
- ✓CMD WORD ind - 88888
- ✓VCC-OCTAL ind - 88
- ✓All ind lts on CIU & CIU AUX PNL are on _____ 8
- CMD GEN CLEAR pb - CLEAR
- ✓CMD WORD ind - blank
- ✓VCC-OCTAL ind - CL _____ 9
- NOTE
- If IUS had thermal shutdown
- VCC-OCTAL will indicate inL _____ 10
- ✓All ind lts on CIU & CIU AUX PNL are off. _____ 11

3.1.1 PCP/CIU ACT C/O

Overview: This procedure is used to activate and check out the PCP, CIU, and SSP, and to check the IUS safety status.

- (1) The PL AUX bus supplies Orbiter power to the PCP and CIU; the PRI PL bus supplies Orbiter power to the IUS/S/C systems.
- (2) This indicates a nonencrypted command path for non-Department of Defense (DOD) payloads. For DOD flights this switch must be in the SECURE position.
- (3) For DOD flights the PWR switch on the upper CIU panel is in the OPERATE position to supply power to the encrypter. This is not needed for non-DOD flights. The PWR switch on the lower CIU panel should be in the ON position to supply power to the CIU circuitry. The IUS is launched in 64 kbps; the CIU must be in 64 kbps to command the IUS and to receive IUS TLM.
- (4) Prior to launch, this rotary switch was in the T-0 UMB(A) position to give the launch team control of the CIU. Placing this switch to PANEL gives the crew control of the CIU.
- (5) This connects the CIU with IUS string A for hardline command and TLM.
- (6) CL indicates the CIU is locked onto the IUS TLM signal. Thermal shutdown powers down the IUS computers, resulting in a loss of TLM lock.
- (7) Nominally, this light illuminates if Orbiter state vector and attitude data fail a validation test by the CIU. However, a known anomaly exists such that this light may come on with the initial CIU activation. The CLEAR PBI may be used to clear this if it occurs.
- (8) CIU CMD 00 performs a CIU lamp test to verify all CIU lights are functioning.
- (9) The CLEAR PBI terminates the lamp test.
- (10) Loss of IUS TLM will occur if the IUS computers have been powered down.
- (11) All CIU indicator lights should nominally be off. Any illuminated lights could indicate a faulty CIU.

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3 DISPLAY IUS SAFETY STATUS

- * If VCC OCTAL in SAFETY STAT *
- * cannot be displayed, *
- * Go to step 4 * _____ 12

MS1 L11L ✓CMD SEL tw (two) - 01
 GEN ENTER pb - ENTER
 Rcd CMD WORD ind 3
 (NOM = 30000) _____ 13

WARNING

For any other CMD WORD display, IUS is unsafe (ignore leftmost digit). For unsafe status, XMIT MASTER SAFE CMD and notify MCC

_____ 14

4 ACTIVATE PCP

L10 ✓cb PNL PWR PRI,ALT (two) - op
 ✓All tbs - bp
 cb PNL PWR PRI,ALT (two) - cl _____ 15

Verify PCP configuration as shown on facing page

CAUTION

Do not use panel mode whose MATRIX STATUS ind is gray when no PCP switch actions are being made. Use other side if possible. If both sides gray, contact MCC

_____ 16

- * If NORM BUS PWR PRI,ALT (two) tb - bp, *
- * AUTO THERMAL SHUTDN has occurred. *
- * Continue; ✓MCC * _____ 17

- (12) IUS safety status cannot be obtained through the CIU without TLM lock.
- (13) CMD 01 determines the status of the IUS ordnance bus, RCS isolation valves, and SRM S&A devices. This command is not sent to the IUS but is entered into the CIU, instructing the CIU to check the necessary IUS TLM data for the safety status.
- (14) The MASTER SAFE CMD will command the IUS computers to inhibit the RCS system, terminate all mission sequencing functions, and inhibit software ordnance functions for SRM-1 ignition.
- (15) This applies PL AUX bus power to the PCP.
- (16) The MATRIX STATUS indicator is nominally gray only during PCP switch activity. If this indicator is gray at any other time it could be because of a faulty PCP switch control matrix.
- (17) AUTO THERMAL SHUTDOWN powers down the IUS computers and SCU if an overtemperature is detected. These must be powered back up to resume nominal deploy procedures.

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5 PCP C/O

* Perform PNL TEST. If status *
 * not correct, perform a second *
 * time. If not correct, switch *
 * PNL MODE to ALT and repeat *
 * test * _____ 18

MS1 L10 PNL TEST PRI - GRAY (hold)
 √all PRI tb - gray
 - BP (hold)
 √MATRIX STATUS PRI tb - gray _____ 19
 √TILT TBL POS PRI tb - gray _____ 20
 √all other PRI tb - bp
 PNL MODE - ALT
 TEST ALT - GRAY (hold)
 √all ALT tb - gray
 - BP (hold)
 √MATRIX STATUS ALT tb - gray _____ 19
 √TILT TBL POS ALT tb - gray _____ 20
 √all other ALT tb - bp
 PNL MODE - PRI .. _____ 21

* If AUTO THERMAL SHUTDN has occurred *
 * (NORM BUS PWR PRI,ALT (two) tb-bp) *
 * then, *
 * RECOVERY FROM POWERDOWN *
 * *
 * Verify PLBDs - open * _____ 22
 * *
 * L10 IUS B FEED PRI(ALT) - OFF *
 √PRI,ALT (two) tb - bp * _____ 23
 NORM BUS PWR PRI(ALT) - ON *
 √PRI,ALT (two) tb-gray *
 B FEED PRI(ALT) - ON *
 √PRI,ALT (two) tb-gray * _____ 24
 Record MET ____/____:____:____ * | _____ 25
 * L11 √VCC-OCTAL ind - CL *
 COARSE ATTITUDE XFER: _____ * _____ 26
 √IUS TLM rate HDLN 64 KBPS *
 √DAP: A1/AUTO/VERN .. *
 *
 *
 * If NO-GO for VERNs, use NORMs *

- (18) This verifies that all PCP talkbacks are functioning properly.
- (19) The MATRIX STATUS talkback is gray whenever a PCP switch is active. In this instance the PNL TEST switch is active.
- (20) The TILT TBL POS talkback does not respond to the panel test and hence will not go barberpole during the test.
- (21) The alternate panel mode is nominally used only for a primary mode failure.
- (22) Opening the payload bay doors (PLBD's) will cool the IUS to aid in thermal recovery.
- (23) The B FEED is turned off so that the IUS computer A will be in control when power is reapplied to the IUS.
- (24) After power is reapplied to the IUS avionics string A, the avionics string B may be brought up.
- (25) Internal IUS computer batteries supply power to the computer memories when the avionics power is removed. The mission elapsed time (MET) is recorded here to keep track of remaining computer battery life as well as to log the time power was reapplied to the IUS.
- (26) IUS attitude reference is lost when the computers are powered down. Thus new attitude data must be transferred from the GPC's to the IUS.

20

```

*
* CRT IGNC UNIV PTG - √ATT hold * _____ 27
* L12 √cb PL TIMING BUFFER - c1 * | _____ 28
* CRT SM 200 IUS/TDRS *
* US SV/ATT XFER - ITEM 1 EXEC (*) * _____ 29
*
* L11 √MDM ERR GPC 1t - off * _____ 7
* Send CIU CMD 10, IC001 *
* √CMD WORD ind | XX (within 5 sec) *
* 00 Unsuccessful *
* 01 Successful *
* CRT √SV/ATT XFER ATT ACCEPT - (*) *
* Record MET ___/___:___:___ * _____ 30
*
* SV TRANSFER: *
* √IUS TLM rate HDLN 64 KBPS *
* L11 Send CIU CMD 21, IA000 *
* √CMD WORD ind | XX (within 5 sec) *
* 41 Successful *
* All other ind *
* unsuccessful *
*
* CRT √SV/ATT XFER SV ACCEPT - (*) *
* Record MET ___/___:___:___ * _____ 31
*
* CRT SV/ATT XFER - ITEM 1 EXEC (no *) * _____ 32
*
* NOTE *
* Configure IUS TLM rate *
* per POST INSERT or CAP * _____ 33
*
* Perform DISPLAY IUS SAFETY STATUS, *
* step 3, PCP/CIU ACT C/O * | _____ 34

```

6 IUS BATT AND AFTA HEATER ACTIVATION

```

MS1 L10 IUS HTRS BATT PRI(ALT) - ON (mom)
      √PRI,ALT (two) tb - gray _____ 35

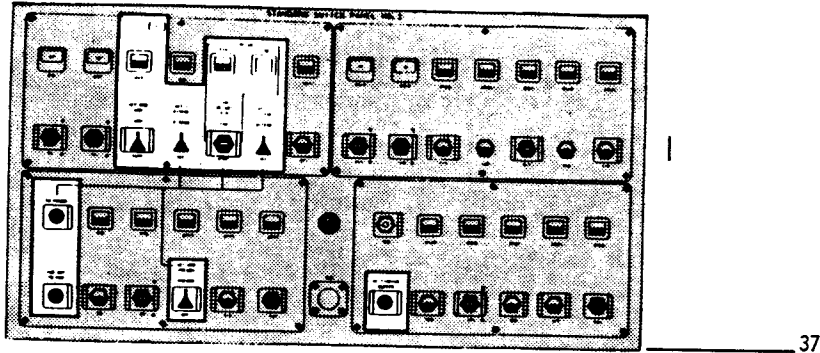
```

- (27) Attitude hold is necessary to transfer accurate attitude data to the IUS.
- (28) The PL TIMING BUFFER supplies the IUS computers with a clock signal in the event of a powerdown.
- (29) This transfers Orbiter attitude and state vector data from the GPC to the CIU.
- (30) CMD 10 transfers the attitude in the CIU buffer to the IUS computers.
- (31) CMD 21 transfers the state vector in the CIU buffer to the IUS computers.
- (32) Once attitude and state vector have been successfully transferred to the IUS, the transfer software is no longer needed. ITEM 1 EXEC turns off the state vector transfer.
- (33) This is the nominal TLM configuration.
- (34) This ensures that the IUS is in a safe configuration after the powerup.
- (35) IUS and ASE batteries and both AFTA's must be kept within temperature limits to function properly.

7 SSP C/O

MS1 L12U cb IUS SW PWR - c1
 cb IUS ANT TB PWR - c1 _____ 36

Verify SSP configuration as shown:



8 IUS/TDRS SPEC 200 C/O

CRT ISM 200 IUS/TDRS
 ✓ IUS COMP STAT A B
 IN CNTL * _____ 38
 ✓ IUS SAFETY UP SEL - (*)
 ✓ RF PWR - (-7.3) _____ 39
 ✓ MSN PHASE - 3 _____ 40
 ✓ TDRS S/C BUS VOLTS - 26.8 to 28.8
 ✓ AMPS - 7.0 to 16.0

* All other parameters should be *
 * blank. If not, notify MCC * _____ 41

9 DISABLE IUS AUTO SHUTDOWN

Verify PLBDs - open
 L10 IUS AUTO SHUTDN PRI(ALT) - OFF
 ✓ PRI,ALT (two) tb - bp _____ 42

10 IUS RF ANTENNA ENABLE

L12 IUS RF ANT E/D - ENA
 ✓ ENA tb - gray
 ✓ DSBL tb - bp _____ 43

- (36) This allows the IUS antennas to be enabled or disabled as necessary.
- (37) The SSP is configured such that the actuator ordnance is safe and the IUS antennas are disabled.
- (38) Computer A is nominally in control of the IUS.
- (39) This field will be negative when the IUS antennas are disabled. Only the upper IUS antenna should be selected to prevent radio frequency (RF) irradiation of the payload bay.
- (40) MSN PHASE 3 indicates the postlaunch/predeploy phase.
- (41) This would indicate an anomalous or possibly hazardous condition.
- (42) With IUS TLM available, it is no longer necessary to have the IUS automatically power down.
- (43) With the IUS RF ANT E/D switch in ENA, IUS transmitter output is routed to the IUS antenna. With the switch in DSBL, the IUS transmitter output is routed to a dummy load. This switch should be placed in DSBL if the IUS lower omni antenna is selected to prevent RF irradiation of the payload bay (PLB).

22

IUS C/O (EARLY)

1 PRECHECKS

<p>CAUTION MID flights may be on no longer than 15 min</p>

- MS2 A7 PL BAY FLOOD MID,AFT (four) - ON
 FWD BHD - ON

 Perform TV, VTR activation, TV/VTR
 (Cue Card)

 Insert new VTR Cassette

 VTR RCD - B or C
 MON 1 - C (IUS SRM nozzle)
 MON 2 - B (IUS SRM nozzle) _____ 1

- MS1 CRT IUS SAFETY - ANT STAT
 ✓MG SEL - blank
 ✓LWR SEL - blank
 ✓UP SEL - (*)
 ✓RF PWR - (-7.3)

 * If MG or LWR SEL show +, do *
 * not perform Predeploy Check. *
 * Go to PL SYS, PL MAL, 1.31 * _____ 2

- L10 ✓CMD PATH ENA - HDLN _____ 3

- L11 ✓IUS TLM rate HDLN 64 KBPS _____ 4

*****HTS AOS*****

3.2.1 IUS C/O (EARLY)

Overview: This procedure is used to check out the IUS subsystems and the ability of the ground to command the IUS.

- (1) This is because of TDRS thermal constraints.
- (2) PLB lighting and video tape recorder (VTR) are set up to record the IUS SRM nozzle gimbal check during the predeploy checkout.
- (3) Only the upper omni antenna should be selected to prevent RF irradiation of the PLB.
- (4) 64 kbps allows the ground to monitor the IUS during its checkout over the Hawaii Tracking Station, Kaene Point (HTS) ground site.

23

2 TRANSFER TO INTERNAL PWR

MS1 L10 At MCC go:
 ✓ASE BATT PRI,ALT (two) tb - gray _____ 5
 IUS CONV PWR PRI(ALT) - OFF (mom)
 ✓PRI,ALT (two) tb - bp

 IUS BUS A BATT PRI(ALT) - STAGE I ON (mom)
 ✓PRI,ALT (two) tb - gray

 Record MET ___/___:___:___ _____ 6
 ✓IUS A FEED PRI, ALT (two) tb - bp
 (after 40 sec)
 BUS B BATT PRI(ALT) - STAGE I ON (mom)
 ✓PRI,ALT (two) tb - gray
 ✓B FEED PRI,ALT (two) tb - bp
 (after 40 sec) _____ 7

- (5) ASE batteries provide power to the IUS while switching from Orbiter to IUS battery power. The ASE batteries also provide backup power in the event of IUS battery failure.
- (6) When the IUS internal batteries are first turned on, the MET is recorded to keep track of battery lifetime.
- (7) The SRM gimbal check performed during the predeploy checkout cannot be done on external power.
- (8) CMD 35 initiates the IUS predeploy checkout which activates the IUS power amplifier and transmitter, performs SRM gimbal checks to assure operation of the TVC, and tests the SCU relay drivers.

3 PREDEPLOYMENT CHECK

MS2 R11 VTR pb - PLAY, RCD (simo)
 ✓STBY - RUN

MS1 L11 Send CIU CMD 35, 0H720
 ✓CMD WORD ind - 13 within 5 sec

 * If not 13 within 5 sec, *
 * resend cmd. If same results, *
 * Go to PL SYS, PL MAL, 1.31 *

 ✓CMD WORD ind - 00 Comp A & B
 OK < 1:40 sec

 * other indications *
 * XX *
 * 0 Both comp OK *
 * 1 Comp A failed *
 * 2 Comp B failed *
 * 3 Both comp failed *
 * 1 Test in progress *
 * 0 Test complete *

 Record CMD WORD ind _____ 8

24

CAUTION
 Do not send any CIU CMDS
 for at least 60 sec after
 check complete

MS1 CRT ✓ IUS COMP STAT A B
 IN CNTL *
 ✓ A FAILED (blank)
 ✓ B FAILED (blank)
 ✓ IUS SAFETY RF PWR - 25.0 ± 5.0 _____ 9
 * If one or both computers *
 * failed, contact MCC *

MS2 R11 VTR pb - STOP
 Perform VTR, TV deact, TV/VTR (Cue Card)
 A7 PL BAY FLOODS - OFF _____ 10

4 TRANSFER TO ORBITER PWR

MS1 L10 IUS CONV PWR PRI(ALT) - ON (mom)
 ✓ PRI,ALT (two) tb - gray _____ 11
 IUS A FEED PRI(ALT) - ON (mom)
 ✓ PRI,ALT (two) tb - gray
 BUS A BATT PRI(ALT) - STAGE I&II OFF
 (mom)
 ✓ PRI,ALT (two) tb - bp
 B FEED PRI(ALT) - ON (mom)
 ✓ PRI,ALT (two) tb - gray
 BUS B BATT PRI(ALT) - STAGE I&II OFF
 (mom)
 ✓ PRI,ALT (two) tb - bp _____ 12
 Record MET ____/____:____:____ _____ 13
 ✓ MCC checkout complete

- (9) If the checkout was nominal it will take about 1 minute to reconfigure control of all systems to computer A.
- (10) PLB floods and VTR are not needed until later.
- (11) This routes regulated Orbiter power to the IUS.
- (12) IUS batteries are turned off to conserve their useful life once Orbiter power is applied to the IUS avionics buses.
- (13) The MET is recorded to keep track of remaining IUS battery life.

25

***** HTS LOS *****
 ***** VTS AOS *****
 ***** GDS AOS *****

5 IUS (DIRECT) _____ 14

MS1 L10

CMD PATH ENA - RF (✓MCC)

AFSCF sends cmds:
 IUS RF to coho
 1.7 MHz off
 64 → 16 KBPS

MCC reports AFSCF cmdg complete _____ 15

* If no ground call received *
 * by VTS LOS, then: *

* If IUS in 16 KPBS, assume *
 * AFSCF commanding complete. *
 * Go to Step 6 *

L10

* If IUS in 64 KPBS, *
 * CMD PATH ENA - HDLN. *
 * Perform XFER 64 → 16, *
 * REF DATA *

* Leave IUS transmitter on. *
 * Go to step 1, TDRS (PI) SETUP *
 * RF LINK CHECKS (EARLY) *

6 IUS (PI) LOCK

L11

✓ IUS TLM rate 16 KBPS _____ 17

CRT

PSP/PDI SETUP:
ISM 62 PCMMU/PL COMM
 I/O RESET PSP 1 - ITEM 6 EXEC (*)

Verify configuration of PDI

PDI	DECOM	INPUT	FMT
✓	1	2	18
✓	2	5	15
✓	3	5	16
✓	4	0	
✓	5-FPM		1 _____ 18

- (14) The IUS direct check is performed by the Air Force Satellite Control Facility (AFSCF) over the Vandenberg Tracking Station (VTS) site.
- (15) Taking the RF to coherent mode allows the ground to obtain range rate data from the IUS. The 1.7 MHz subcarrier contains IUS environmental data and is turned off. The TLM rate is taken back to 16 kbps in preparation for the upcoming IUS payload interrogator (PI) check.
- (16) The remaining IUS RF checks are performed if there is enough time before loss of signal (LOS). Otherwise, the PI is set up for the TDRS checks. The IUS PI check will be performed during the late RF check if necessary.
- (17) 16 kbps is the only RF TLM rate available for IUS/PI link.
- (18) This is the nominal payload data interleaver (PDI) setup for IUS/TDRS ops on 51-E.

MS1 AIL PI SETUP:
 ✓S-BD PL CNTL - CMD
 ✓ANT POLAR - R CIRC
 ✓XMTR PWR - MED
 ✓CH SEL INTRG 1,2 tw (six)-906,906 _____19
 MOD - ON
 ✓PWR SYS - 1
 ✓SEL - BOTH
 ✓PSP CMD OUTPUT - INTRG
 CNTL - PNL _____20

AIU SIG strength sel - S-BD PL
 Verify S/S > 1.43 volts
 CRT ✓PL INTRG PHASE LOCK - YES _____21

ISM 200 IUS/TDRS
 ✓IUS RCVR CMD LOCK (*) _____22

* If IUS RCVR not locked, then PI *
 * FREQ SWEEP - ON for up to 35 sec *
 * or until RCVR cmd lock indicated, *
 * then release * _____23

7 IUS (PI) LINK C/O

L11 PL LK - RF 16 KBPS
 ✓VCC-OCTAL ind - CL

NOTE

Crew will receive mom SM ALERT 'S62
 PDI DECOM FAIL' msg as a result of
 this sw action. Ignore message

Send CIU CMD 34, 12P11
 No CIU CMD feedback
 ✓VCC-OCTAL ind - nL _____24

NOTE

Crew will received SM ALERT 'S62
 PDI DECOM FAIL' as a result of
 Loss of IUS RF data. Ignore message

- (19) Channel 906 is used to communicate with the IUS.
- (20) This is the nominal PI setup for IUS/PI lock. The various PI switch settings do not take effect until the S-BD PL CNTL is taken to PNL.
- (21) This indicates that the PI is receiving the IUS transmitter signal.
- (22) This indicates that the IUS receiver is locked onto the PI signal.
- (23) This will tune the PI command signal to the proper IUS receiver frequency.
- (24) CMD 34 turns the IUS transmitter and power amplifier off. This also verifies the ability of the crew to command the IUS through the PI.

MS1 CRT IUS SAFETY RF PWR - (-7.3)

(25) Once the IUS/PI link checkout is complete and the PL link is back in HDLN, the PI is turned off as it is no longer needed.

L10 CMD PATH ENA - HDLN

L11 PL LK - HDLN 16 KBPS

Advise MCC IUS PI check complete and DNLK is off

At MCC GO or LOS:

AIL S-BD PL CNTL - CMD
PWR SEL - PSP
CNTL-PNL, then CMD _____ 25

***** GDS LOS *****

***** VTS AOS *****

RF LINK CHECKS (EARLY)

1 TDRS (PI) SETUP

CRT PSP/PDI SETUP:
ISM 62 PCMMU/PL COMM
 ✓ I/O RESET PSP 1 - ITEM 6 EXEC (*)

Verify configuration of PDI

PDI	DECOM	INPUT	FMT
✓	1	2	18
✓	2	5	15
✓	3	5	16
✓	4	0	
✓	5-FPM		1

MCC transmits PSP cmd load _____ 1

MSI A1L PI SETUP:
 ✓ S-BD PL CNTL - CMD
 ✓ ANT POLAR - R CIRC
 ✓ XMTR PWR - MED
 ✓ CH SEL INTRG 1,2 tw (six)-089,089 _____ 2
 ✓ MOD - OFF
 ✓ PWR SYS - 1
 SEL - BOTH
 ✓ PSP CMD OUTPUT - INTRG _____ 3
 CNTL - PNL _____ 4

CRT ISM 200 IUS/TDRS
 ✓ TDRS-RCVR SIG PRES A (*), B (*)
 * If TDRS RCVR SIG PRES A (blank) or *
 * B (blank), then PI FREQ SWEEP - ON *
 * for up to 90 sec until both TDRS * |
 * RCVR SIG PRES, then release * _____ 5

A1L S-BD PL MOD - ON

CRT ✓ TDRS RCVR CMD LOCK A (*), B (*) _____ 6

3.2.2 RF LINK CHECKS (EARLY)

Overview: These checks verify the ability of the ground to command the TDRS payload.

- (1) This is the nominal PDI setup for IUS/TDRS ops on 51-E. When Mission Control Center (MCC) transmits the payload signal processor (PSP) CMD load, it configures the PSP for TDRS command.
- (2) 089 is the channel used by the PI to communicate with the TDRS.
- (3) This is the nominal PI setup for TDRS/PI lock.
- (4) This causes the above PI switch settings to take effect.
- (5) This tunes the PI frequency to the TDRS receivers to allow communication between the two.
- (6) Turning the modulation on places command data on the PI transmitted output allowing command of TDRS.

29

NOTE

Up to 32 sec may be required for an indication of CMD LOCK. TDRS/PI Ops require at least one SIG PRES and one CMD LOCK indication _____ 7

2 TDRS (PI) LINK C/O _____ 8

CRT ✓TDRS RCVR SIG PRES A (*), B (*)
 ✓CMD LOCK A (*), B (*)

Advise MCC of TDRS lock status _____ 7

NOTE

MCC sends test cmd (2 min)

At MCC GO:
S-BD PL CNTL - CMD

MS1 ALL

MCC cmds PI _____ 9

* If LOS, and PI not turned *
* off by MCC then: *
* S-BD PL CNTL - CMD *
* PWR SEL - PSP *
* CNTL - PNL, then CMD * _____ 10

***** ACN AOS ***** |

NOTE

During TDRS (DIRECT) Check,
A/G COMM is UHF SPLX. Crew
xmit will inhibit UHF RCV

3 TDRS (DIRECT)

NOTE

WSGT sends test cmd (2 min) _____ 11

***** ACN LOS ***** |

- (7) At least one TDRS receiver must be locked onto the PI signal to permit commanding.
- (8) The TDRS/PI LINK C/O is performed over the TDRS-east satellite coverage.
- (9) MCC verifies the ability to command the TDRS S/C through the PI.
- (10) After commanding is complete, the PI must be turned off prior to Ascension Tracking Station (ACN) acquisition of signal (AOS) to prevent interference with the TDRS direct check.
- (11) The TDRS direct check verifies the ability of the ground to command the TDRS directly. Because the ACN S-band antennas are used for the direct check, Orbiter air-to-ground (A/G) comm is UHF if normal A/G comm through TDRS-east is not available.

30

ACTUATOR ENGAGEMENT

1 PRI(ALT) ACT ENGAGE

<p>CAUTION MID lights may be on no longer than 15 min</p>
--

- MS2 A7 PL BAY FLOOD MID,AFT (four) - ON | _____ 1
 FWD BHD - ON
 Perform TV, VTR activation, TV/VTR
 (Cue Card)
- VTR RCD - C |
 MON 2 - C (PRI ACT) |
- R11 VTR pb - PLAY, RCD (simo) _____ 2
 ✓STBY - RUN _____
- MS1 L10 TILT TBL DR ENA PRI(ALT) - INTERM _____ 3
 TILT TBL MOTION PRI(ALT) - RAISE (mom)
 (hold until MOTION PRI(ALT) tb - gray,
 start watch)
- * If MOTION tb stays bp, * _____ 4
 * Go to PL SYS, PL MAL, 1.3a * _____
- ✓TILT TBL POS PRI(ALT) tb - bp _____ 5

When

- TILT TBL PRI DR ENGAGED tb - gray (Approx
 1:40 sec, record time _____), then
- TILT TBL MOTION PRI(ALT) tb - bp
- * If PRI DR ENGAGED tb still bp * _____ 6
 * after 3:20 sec, TILT TBL *
 * DR ENA - OFF, then *
 * Go to PL SYS, PL MAL, 1.3b * _____
- TILT TBL DR ENA PRI(ALT) - OFF _____ 7

- MS2 R11 VTR pb - STOP
- Perform VTR, TV deact, TV/VTR (Cue Card)
- A7 PL BAY FLOODS - OFF |

3.2.3 ACTUATOR ENGAGEMENT

Overview: This procedure is used to engage the AFTA to the tilt table slip ring. The actuator was disengaged to prevent possible damage from launch loads.

- (1) This is because of TDRS thermal constraints.
- (2) Lighting and VTR are configured to record the engagement of the actuator to the slip ring.
- (3) The actuator drive motor is unlocked.
- (4) This could indicate a broken actuator or a problem with the MOTION talkback.
- (5) This indicates that the actuator has moved from the -13° 65 position.
- (6) Maximum drive time to actuator engagement is 3:20.
- (7) Taking the TILT TBL DR ENA to OFF locks up the actuator drive motor.

late checks

JSC-18392

IUS C/O (LATE)

1 PRECHECKS

MS2 A7 VTR RCD - B or C
 MON 1 - C (IUS SRM nozzle) |
 MON 2 - B (IUS SRM nozzle) _____ 1

MS1 L12 ✓IUS RF ANT ENA tb - gray
 ✓DSBL tb - bp

CRT IUS SAFETY - ANT STAT
 ✓MG SEL - blank
 ✓LWR SEL - blank
 ✓UP SEL - (*)
 ✓RF PWR - (-7.3) _____ 2

L10 ✓CMD PATH ENA - HDLN
 L11 ✓IUS TLM RATE HDLN 64 KBPS _____ 3

***** HAW AOS *****

2 TRANSFER TO INTERNAL PWR

At MCC GO:

L10 ✓ASE BATT PRI,ALT (two) tb - gray _____ 4
 IUS CONV PWR PRI(ALT) - OFF (mom)
 ✓PRI,ALT (two) tb - bp

IUS BUS A BATT PRI(ALT) - STAGE I ON
 (mom)
 ✓PRI,ALT (two) tb - gray

Record MET ___/___:___:___ _____ 5

✓IUS A FEED PRI,ALT (two) tb - gray
 (after 40 sec)

BUS B BATT PRI(ALT) - STAGE I ON
 (mom)
 ✓PRI,ALT (two) tb - gray
 ✓B FEED PRI,ALT (two) tb - gray
 (after 40 sec) _____ 6

32

3.3.1 IUS C/O (LATE)

Overview: The IUS is given a final health check before deployment.

- (1) The VTR is set up to record the IUS SRM nozzle gimbal check during the predeploy checkout.
- (2) Only the upper omni antenna should be selected to prevent RF irradiation of the PLB.
- (3) 64 kbps is used over ground sites for IUS TLM.
- (4) ASE batteries provide power to the IUS while switching from Orbiter to IUS internal battery power. The ASE batteries also provide backup power in the event of IUS battery failure.
- (5) When the IUS internal batteries are first turned on, the MET is recorded to keep track of battery lifetime.
- (6) The SRM gimbal check during the predeploy checkout cannot be done on external power.

3 PREDEPLOYMENT CHECK

MS2 R11 VTR pb - PLAY, RCD (simo)
 ✓STBY - RUN

MS1 L11 Send CIU CMD 35, 0H720
 ✓CMD WORD ind - 13 (within 5 sec)

- * If not 13 within 5 sec, *
- * resend cmd. If same results, *
- * Go to PL SYS, PL MAL, 1.31 *

✓CMD WORD ind - 00 Comp A & B
 OK < 1:40 sec

- * other indications *
- * XXI *
- * 0 Both comp OK *
- * 1 Comp A failed *
- * 2 Comp B failed *
- * 3 Both comp failed *
- * 1 Test in progress *
- * 0 Test complete * _____ 7

CAUTION

Do not send any CIU CMD
 for at least 60 sec after
 check complete

CRT ✓IUS COMP STAT A B
 IN CNTL *
 ✓A FAILED (blank)
 ✓B FAILED (blank)
 ✓IUS SAFETY RF PWR - 25.0 ± 5.0 _____ 8

- * If one or both computers *
- * failed, contact MCC *

- (7) CMD 35 initiates the IUS predeploy checkout which activates the IUS power amplifier and transmitter, performs SRM gimbal checks to assure operation of the TVC, and tests the SCU relay drivers.
- (8) If the checkout was nominal, it will take about 1 minute to reconfigure control of all systems to computer A.

33

MS2 R11 VTR pb - STOP
 Insert new VTR Cassette
 VTR - reset Counter

A7 PL BAY FLOODS - OFF _____ 9

4 TRANSFER TO ORBITER PWR

MS1 L10 IUS CONV PWR PRI(ALT) - ON (mom)
 ✓PRI,ALT (two) tb - gray _____ 10

IUS A FEED PRI(ALT) - ON (mom)
 ✓PRI,ALT (two) tb - gray
 BUS A BATT PRI(ALT) - STAGE I&II OFF
 (mom)
 ✓PRI,ALT (two) tb - bp

B FEED PRI(ALT) - ON (mom)
 ✓PRI,ALT (two) tb - gray
 BUS B BATT PRI(ALT) - STAGE I&II OFF
 (mom)
 ✓PRI,ALT (two) tb - bp _____ 11

Record MET ____/____:____:____ _____ 12

- (9) PLB floods and VTR are not needed until later.
- (10) This routes regulated Orbiter power to the IUS.
- (11) IUS batteries are turned off to conserve their useful life once Orbiter power is applied to the IUS avionics buses.
- (12) The MET is recorded to keep track of remaining IUS battery life.

***** HAW LOS *****

MNVR TO TDRS CHECK ATTITUDE

PLT CRT Change DAP to A8
 ✓DAP B set to B1 _____ 1

ISM 2 TIME
 Set CRT TIMER to count DN to DEPLOY time
 (___/___:___:___) _____ 2

CDR F6 ADI - as reqd

CRT MNVR OPTION:
 R 1 5 3.0 - - - : - - - : - - -
 P 2 8 4.0 - - - : - - - : - - -
 Y - - 2.0 - - - : - - - : - - -

< DAP: B1/AUTO/NORM **
 (___:___) Initiate MNVR

Record MET ___/___:___:___

When MNVR complete,
 DAP: A8/AUTO/VERN **
 DAP TRANS: NORM/NORM/NORM,LOW Z **
 DAP ROT: PULSE/PULSE/PULSE ** _____ 3

3.3.2 MNVR TO TDRS CHECK ATTITUDE

Overview: This attitude will point the TDRS S/C directly at the ground site for the upcoming RF checks at Hawaii, Kauai, Tracking Station (HAW).

- (1) DAP A8 is the nominal digital autopilot (DAP) for the IUS deploy; it keeps Orbiter attitude rates low. DAP B1 is used to maneuver to subsequent attitudes.
- (2) Several IUS deploy steps are time tagged.
- (3) Low Z is used to reduce plume impingement on the TDRS S/C when it is elevated.

35

TILT TABLE ELEVATION TO 29°

MS2 A7 VTR RCD - C
 MON 1 - C (STBD tilt indicator)
 MON 2 - D (Above PAM SS) _____ 1

PLT C3 ✓DAP: A8/AUTO/VERN ..

CAUTION
 If VERN failure, raise
 tilt table in free drift _____ 2

WARNING
 TILT TBL DR ENA must be
 INTERM or MAX prior to
 opening PRLAs

1 PRLA RELEASE _____ |

MS1 L10 TILT TBL DR ENA PRI(ALT) - INTERM _____ 3

MS2 A6U PL RETEN PL SEL - 1
 R13L BAY MECH PWR SYS 1,2 (two) - ON
 A6U RETEN LAT 1,2 (two) - REL
 LOGIC PWR SYS 1,2 (two) - ON _____ 4

After approx 30 sec,
 ✓PL RETEN LAT 1,2 (two) tb - REL
 ✓LAT RDY 1,2 (two) tb - bp
 LOGIC PWR SYS 1,2 (two) - OFF
 LAT 1,2 (two) - OFF

R13L PL BAY MECH PWR SYS 1,2 (two) - OFF _____ 5
 MS1 LIC ✓TILT TBL POS ALT(PRI) tb - bp

NOTE

IUS pushed up by keel pin
 springs when PRLAs opened.
 Normally sufficient to
 open keel pin switches

If ALT(PRI) POS tb - gray, keel pin sw
 still closed, continue _____ 6

3.3.3 TILT TABLE ELEVATION TO 29°

Overview: The IUS/TDRS is elevated to 29° to perform the final RF downlink checks.

- (1) The VTR is set up to record the IUS elevation to 29°.
- (2) Raising the tilt table in primary RCS (PRCS) could result in structural damage to the table.
- (3) This releases the locks on the actuator drive motor.
- (4) This applies power to the PRLA's so that the IUS may be released from the forward ASE.
- (5) Power is removed to prevent inadvertent PRLA closing and to reduce Orbiter electrical loads.
- (6) When the PRLA's have opened, the IUS is pushed up by a keel spring to overcome any static friction that may have existed between the IUS and forward ASE.

2 RAISE TO 29°

MS2 W9 When tilting starts,
16mm Camr - on
R11 VTR pb - PLAY, RCD (simo)
✓STBY - RUN

MS1 L10 TILT TBL MOTION PRI(ALT) - RAISE _____ 7
(start watch)

* If POS ALT(PRI) tb - gray, hold *
* motion sw until POS ALT(PRI) *
* tb - bp *
* *
* If MOTION PRI(ALT) tb - bp, hold *
* motion sw 5 sec max * _____ 8

At 29°, (~3:45)

* If MOTION PRI(ALT) tb - bp *
* before POS tb - gray and no *
* payload motion is observed, *
* Go to PL SYS, PL MAL, 1.3c * _____ 9

✓TILT TBL POS PRI(ALT) tb - gray
(Record Time ____ / ____ : ____ : ____)

✓TILT TBL MOTION PRI(ALT) tb - bp
DR ENA PRI(ALT) - OFF _____ 10

MS2 CCTV Visually inspect raised assembly

R11 VTR pb - STOP
16mm Camr - off

A7 PL BAY FLOOD MID,AFT (four) - ON
FWD BHD - ON

CAUTION
At 29° if VERN failure,
use NORMs (LOW Z)

_____ 11

- (7) The IUS/TDRS is elevated to the 29° position to allow the TDRS transmitter to be used for the final RF checks.
- (8) These talkbacks indicate whether or not the IUS has begun elevation to 29°.
- (9) This could result from a jammed tilt table, bad AFTA, or inadequate electrical drive.
- (10) This locks the actuator drive motor to hold the IUS at 29°.
- (11) Low Z reduces PRCS plume contamination of the elevated IUS/TDRS.

TRANSFER SV

```

MS1 L10  ✓CMD PATH ENA - HDLN
          |
          At MCC GO:
          SV/ATT XFER - ITEM 1 EXEC (*) _____ 1
          |
L11  ✓MDM ERR GPC lt - off
      * If MDM ERR GPC lt on, then *
      * CMD GEN CLEAR pb - CLEAR. *
      * Verify lt off *
      *
      * If MDM ERR GPC lt illuminates, then *
      * ISM 200 IUS/TDRS! *
      * SV/ATT XFER - ITEM 1 EXEC (no *) *
      * CMD GEN CLEAR pb - CLEAR *
      * SV/ATT XFER - ITEM 1 EXEC (*) *
      * CMD GEN CLEAR pb - CLEAR *
      *
      * If MDM ERR GPC lt illuminates, then *
      * Go to PL SYS, PL MAL, 1.3f * _____ 2

Send CIU CMD 21, IA000!
          |
          If in 64 KBPS, then
          ✓CMD WORD ind - XXI (within 5 sec) |
                        |
                        SV XFER
                        successful if
                        left digit ≥ 4 _____ 3

CRT  ✓SV/ATT XFER SV ACCEPT - (*) _____ 4
      * If left digit of CMD WORD display *
      * remains < 4, SV XFER unsuccessful. *
      * Resend CIU CMD 21. If still unsuc- *
      * cessful, ✓MCC and continue. *
      * Do not lock PI to IUS until MCC GO * _____ 5

Record MET ____ / ____ : ____ : ____
SV/ATT XFER - ITEM 1 EXEC (no *) _____ 6
    
```

3.3.4 TRANSFER SV

Overview: An updated state vector is needed by the IUS navigation system to propagate the transfer trajectory to GEO.

- (1) This transfers Orbiter attitude and state vector data from the GPC to the CIU.
- (2) The MDM ERR GPC light will illuminate if the Orbiter state vector fails a data validation test by the CIU. If this occurs, it is necessary to resend the state vector from GPC to CIU.
- (3) CMD 21 transfers the state vector from the CIU buffer to the IUS computers. 64 kbps is required to view the NIS BIT feedback on the CIU.
- (4) This field will display an * if the transfer was successful.
- (5) An accurate state vector is needed onboard the IUS for proper transfer trajectory computation.
- (6) After a successful state vector transfer to the IUS, the state vector transfer from GPC to CIU is disabled.

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RF CHECKS (LATE) PART I

1 TDRS (PI) SETUP

MS1 AIL ✓S-BD PL CNTL - CMD
 ✓ANT POLAR - R CIRC
 ✓XMTR PWR - MED
 ✓CH SEL INTRG 1,2 tw (six)-089,089 _____ 1
 MOD - OFF
 ✓PWR SYS - 1
 ✓SEL - BOTH
 ✓PSP CMD OUTPUT - INTRG _____ 2
 CNTL - PNL _____ 3

CRT ISM 200 TUS/TDRS
 ✓TDRS RCVR SIG PRES A (*), B (*)
 * If TDRS RCVR SIG PRES A (blank) or *
 * B (blank), then PI FREQ SWEEP - ON *
 * for up to 90 sec until both TDRS *
 * RCVR SIG PRES, then release * _____ 4

AIL S-BD PL MOD - ON
 CRT ✓TDRS RCVR CMD LOCK A (*), B (*) _____ 5

NOTE
 Up to 32 sec may be reqd for an
 indication of CMD LOCK. TDRS/PI
 Ops require at least one SIG PRES
 and one CMD LOCK indication _____ 6

***** IOS AOS *****

2 TDRS (PI) LINK C/O _____ 7

✓TDRS RCVR SIG PRES A (*), B (*)
 ✓CMD LOCK A (*), B (*)
 Advise MCC of TDRS lock status _____ 6

NOTE
 MCC sends TDRS PA - ON
 and coho drive - ENA cmds

CRT ✓TDRS XMIT on A (*) ↓
 A1 ✓SIGNAL STRENGTH change
 Expect SM ALERT (200 TDRS XMIT)

AIL At MCC GO or LOS:
 S-BD PL CNTL - CMD
 MCC cmds PI _____ 8

***** IOS LOS *****

3.3.5 RF CHECKS (LATE) PART I

Overview: The TDRS transmitter is turned on by ground control via the Orbiter PI.

- (1) 089 is the channel used by the PI to communicate with the TDRS.
- (2) This is the nominal PI setup for TDRS/PI lock.
- (3) This causes the above PI switch settings to take effect.
- (4) This tunes the PI frequency to the TDRS receivers to allow communication between the two.
- (5) This indicates the TDRS receiver is locked onto the PI signal.
- (6) At least one TDRS receiver must be locked onto the PI signal to permit commanding.
- (7) The ground will command the TDRS via the Orbiter over the Indian Ocean tracking station (IOS) ground site.
- (8) The ground commands the TDRS transmitter on and enables the coherent mode for the upcoming direct check.

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RF CHECKS (LATE) PART II

1 TDRS (DIRECT) _____ 1

MS1 L10 ✓CMD PATH ENA - RF

*****HAW AOS*****

NOTE
During TDRS (DIRECT) Check,
A/G COMM is UHF SPLX. Crew
xmit will inhibit RCV _____ 2

NOTE
WGST sends test cmd (2 min)

MCC updates Deploy Pad & Sep Burn Pad
MCC gives TDRS Direct Check status

* If HAW TDRS Direct Check not success- *
* ful or if no comm at HAW, then mnvr *
* per TDRS DIRECT CHECK ATTITUDE (pad) *
* to 9D AGO attitude and repeat TDRS *
* Direct Check. (The earliest deploy *
* will be 9D.) There can be no uplink *
* voice at AGO until TDRS Direct Check *
* is completed. The attitude at AGO is * _____ 3
* sun protected. If not successful a *
* AGO, then, mnvr to the 9D GWM *
* attitude per the TDRS DIRECT CHECK *
* ATTITUDE (pad) *
* *
* MNVR OPTION: *
* R _ _ _ . _ _ _ _ _ *
* P _ _ _ . _ _ _ _ _ *
* Y _ _ _ . _ _ _ _ _ *
* *
* DAP: AB/AUTO/VERN .. *
* Initiate MNVR .. *

MCC gives GO for DEPLOY _____ 4

*****HAW LOS*****

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3.3.7 RF CHECKS (LATE) PART II

Overview: The ability of the TDRS to transmit to the ground is verified.
Afterwards the PI is locked onto the IUS to allow for postdeploy
TLM and commanding.

- (1) The direct check must be done over a ground site.
(2) The S-band antennas at HAW are used for the TDRS direct check.
(3) The S-band antennas at Santiago Tracking Station (AGO) are used as an
alternate site for the TDRS direct check. AGO has no UHF station.
(4) If there is no go for deploy by HAW LOS, the deploy will be waved off a
rev.

2 IUS (PI) LOCK

MS1 L11 ✓IUS TLM rate HDLN 16 KBPS _____ 5

PI SETUP:

A1L ✓S-BD PL CNTL - CMD _____

 ✓ANT POLAR - R CIRC _____

 ✓XMTR PWR - MED _____

 CH SEL INTRG 1,2 tw (six)-906,906 _____ 6

 MOD - ON _____

 ✓PWR SYS - 1 _____

 ✓SEL - BOTH _____

 ✓PSP CMD OUTPUT - INTRG _____ 7

 CNTL - PNL _____ 8

A1U SIG STRENGTH sel - S-BD PL _____

 ✓S/S > 1.43 volts _____

CRT ✓PL INTRG PHASE LOCK - YES _____ 9

CRT SM 200 IUS/TDRS

 ✓IUS RCVR CMD LOCK (*) _____ 10

 * If IUS RCVR not locked, then PI *

 * FREQ SWEEP - ON for up to 35 sec *

 * until RCVR CMD LOCK indicated, *

 * then release _____ 11

A1L ✓S-BD PL MOD - ON _____

L11 PL LK - RF 16 KBPS _____

 ✓VCC-OCTAL ind - CL _____

NOTE

 Crew may receive ERR MSG - 'S62

 POI DECOM FAIL' as result of this

 switch action. Ignore message

CRT Crew advises MCC of IUS/PI lock status

 IUS RCVR cmd lock (*) _____ 12

- (5) IUS TLM rate should be 16 kbps in preparation for switching to the RF mode.
- (6) 906 is the channel used by the PI to communicate with the IUS.
- (7) This is the nominal PI setup for IUS/PI lock.
- (8) This causes the above PI switch settings to take effect.
- (9) This indicates that the PI is receiving the IUS transmitter signal.
- (10) This indicates that the IUS receiver is locked onto the PI signal.
- (11) This tunes the PI frequency to ensure IUS command lock.
- (12) The IUS link is taken to RF to allow commanding and TLM through the PI after the umbilicals have been released.

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MNVR TO DEPLOY ATTITUDE

CDR F6 ADI - as reqd

CRT TRK OPTION:
 TGT ID +4
 BODY VECTOR +5
 P 2 6 1.0 _____
 Y 0.0 _____
 OM 2 7 0.0 _____ 1

C3 ✓DAP: A8/AUTO/VERN ** _____ 2
 (:) Initiate TRK

CAUTION
 If VERN failure,
 use NORMs (LOW Z)

F7 ✓FLT CNTLR PWR - OFF _____ 4

3.4.1 MNVR TO DEPLOY ATTITUDE

Overview: This procedure points the Orbiter in the proper attitude for IUS deploy.

- (1) The Orbiter is set up to track the Sun with its belly to keep the IUS/TDRS shaded.
- (2) DAP A8 is the nominal DAP configuration for IUS deploy; it keeps Orbiter attitude rates low for the deploy.
- (3) Low Z reduces PRCS contamination of the elevated IUS/TDRS.
- (4) This prevents inadvertent maneuvering by removing power from the rotation hand controller (RHC) and translation hand controller (THC).

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DEPLOY COUNTDOWN

MS2 A7 PL BAY FLOOD MID, AFT (four) - ON |
 FWD BHD - ON

1 PI LOCKED TO IUS

CRT ✓IUS RCVR CMD LOCK (*)
ISM 62 PCMMU/PL COMM
 ✓PL INTRG PHASE LOCK - YES _____ 1

2 CYCLIC XFER OF SV TO CIU

CRT ISM 200 IUS/TDRS
 IUS SV/ATT XFER - ITEM 1 EXEC (*) _____ 2

L11 ✓MDM ERR GPC lt - off

* If MDM ERR GPC lt - on, then *
 * CMD GEN CLEAR pb - CLEAR. *
 * Verify lt off and continue *
 *
 * If MDM ERR GPC lt
 * illuminates again, then *
 * continue and ✓MCC * _____ 3

PLT/ F7/
 MS2 A4 ✓EVENT TIMER - Counting DN to DEPLOY

PLT ✓CRT EVENT TIMER - Counting DN to DEPLOY

MS1 L10 ✓CMD PATH ENA - RF _____ 4

MS2 CRT ✓IUS COMP STAT A B
 IN CNTL *
 ✓A FAILED (blank)
 ✓B FAILED (blank)

3.4.2 DEPLOY COUNTDOWN

Overview: The final steps prior to IUS deploy are performed.

- (1) The IUS transmitter/receiver must be locked onto the PI to allow commanding following umbilical release and to obtain IUS TLM.
- (2) This transfers attitude and state vector data from the GPC to the CIU.
- (3) The MDM ERR light will illuminate if the Orbiter state vector fails a data validation test by the CIU.
- (4) This allows RF commanding of the IUS through the CIU/PI.

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CAUTION
 ✓MCC of other indications.
 Do not deploy IUS until it is
 determined a healthy avionics
 string exists

5

3 ENABLE RNDZ NAV

MS2 CRT

IGNC 33 REL NAV

RNDZ NAV ENA - ITEM 1 EXEC (*) _____ 6

CDR

Move to MS station _____ 7

MM:SS

-20:00 <

4 XFER IUS TO INT PWR

MS1 L10

✓ASE BATT PRI,ALT (two) tb - gray _____ 8

IUS CONV PWR PRI(ALT) - OFF (mom)

✓PRI,ALT (two) tb - bp

IUS BUS A BATT PRI(ALT)-STAGE I ON (mom)

✓PRI,ALT (two) tb - gray

Record MET ____/____:____:____ _____ 9

✓IUS A FEED PRI,ALT (two) tb - bp
(after 40 sec) |

BUS B BATT PRI(ALT)-STAGE I ON (mom)

✓PRI,ALT (two) tb - gray

✓B FEED PRI,ALT (two) tb - bp
(after 40 sec) | _____ 10

5 XFER TDRS TO IUS PWR

IUS S/C BATT PRI(ALT) - STAGE I ON (mom)

✓PRI,ALT (two) tb - gray _____ 11

Record MET ____/____:____:____ _____ 12

✓S/C PWR PRI,ALT (two) - bp
(after 40 sec)

- (5) Without at least one healthy avionics string the IUS will not function properly.
- (6) This enables rendezvous navigation software for use in pointing the PI at the IUS postdeploy.
- (7) The commander (CDR) moves to assist the mission specialist (MS) in the deploy and to take evasive maneuvers if necessary.
- (8) ASE batteries provide the IUS with power during the switching between Orbiter power and IUS batteries.
- (9) When the IUS batteries are first brought on line the MET is recorded to keep track of remaining battery life.
- (10) The IUS must be on internal power prior to umbilical release.
- (11) The TDRS is transferred to IUS S/C batteries prior to umbilical release.
- (12) The MET is recorded to keep track of remaining IUS S/C battery life.

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CDR CRT Verify TDRS battery off
 (TDRS BATT ON 1, 2, 3 (blank))

- * If SPEC 200 shows *
- * TDRS BATT ON 1 (+) or 2 (+) *
- * or 3 (+), then ✓MCC. *
- * Continue with deployment * _____ 13

6 DEADFACE UMBILICALS

MSI L10 IUS HTRS BATT PRI(ALT) - OFF (mom)
 ✓PRI,ALT (two) tb - bp
 PWR PRI(ALT) - OFF (mom)
 ✓PRI,ALT (two) tb - bp
 S/C REG PWR PRI(ALT) - OFF(GSE) (mom)
 ✓PRI,ALT (two) tb - bp _____ 14

CAUTION	
Prior to Umbilical rel,	
CRT ✓For change in IUS COMP STAT	
since given GO for DEPLOY	
✓IUS RCVR CMD LOCK (*)	
✓TDRS XMIT ON A (*) or B (*)	
L10 ✓IUS BUS A,B BATT PRI,ALT	
(four) tb - gray	
✓IUS S/C BATT PRI,ALT (two)	
tb - gray	
✓CMD PATH ENA - RF	
L12 ✓IUS RF ANT ENA tb - gray ..	_____ 15
If change in IUS COMP STATUS and/or above indications cannot be confirmed, refer to ' <u>IUS GO/NO GO CHART</u> ' Cue Card	
	_____ 16

L12 cb IUS SW PWR - op
 cb IUS ANT TB PWR - op _____ 17

- (13) The TDRS batteries should remain off to preserve their power for IUS separation at GEO.
- (14) All IUS/TDRS systems still powered by the Orbiter/ASE are powered down to prevent electrical arcing or power spikes when the umbilicals are released.
- (15) The IUS RF ANT E/D must be ENA prior to umbilical release or there will be no IUS RF commanding or TLM available after umbilical release.
- (16) Prior to umbilical release, the IUS/TDRS must be on internal power, the IUS locked onto the PI signal, and the TDRS transmitter turned on.
- (17) This prevents the IUS antennas from being disabled prior to umbilical release.

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7 RELEASE UMBILICALS

MS1 L10 UMB ENA PRI(ALT) - ENA
 ✓PRI,ALT (two) tb - gray
 REL PRI(ALT) - REL
 ✓PRI,ALT (two) tb - gray
 IUS BATTS PRI, ALT (six) tbs - bp

NOTE

Crew should receive SM ALERT -
 'S62, PDI DECOM FAIL', as a
 result of loss of TDRS HDLN
 data. Ignore msg _____ 18

WARNING

If Cable Tray does not release,
 or UMB REL tb still bp, complete
 step 7. Then repeat step 7 in
 ALT. Regardless of Cable Tray
 release and UMB plug release
 status, attempt to raise to 59° _____ 19

L10 UMB ENA PRI(ALT) - OFF (mom) _____ 20
 ✓PRI,ALT (two) tb - bp
 IUS CONV PWR PRI (ALT) - ON
 ✓PRI,ALT (two) tb - gray
 HTRS BATT PRI(ALT) - ON (mom)
 ✓PRI,ALT (two) tb - gray _____ 21

8 OMS SEP BURN PREP

PLT CRT GNC, OPS 202 PRO
IGNC ORBIT MNVR EXEC
 Load SEP BURN TGT DATA per Burn Pad
 LOAD - ITEM 22 EXEC
 ✓Soluton per burn pad
Do not mnvr
 GNC, OPS 201 PRO
IGNC UNIV PTG _____ 22

- (18) All HDLN commanding and TLM are lost once the umbilicals are released.
- (19) The umbilical tray will mechanically release as the IUS is rotated through 35°.
- (20) This reduces the electrical load on the ASE batteries.
- (21) IUS batteries are used for tilt table elevation/lowering and must be kept within operating temperatures.
- (22) The postdeploy separation burn data is loaded into the GPCs to reduce the number of critical crew activities surrounding the deploy timeframe.

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9 RAISE TO 59°

MS2 16mm Camr - Install ASA 100 (DAYLIGHT) film mag and orange filter
 When tilting starts, 16mm Camr - on
 Take 70mm photos during tilting

A7 MON 1 - D (above PAM SS)
 MON 2 - C (STBD tilt indicator)
 VTR RCD - C _____ 23

NOTE
 Alternate between Camr C & D to record elevation

CAUTION
 If VERN failure, raise tilt table in free drift _____ 24

MS1 L10 TILT TBL DR ENA PRI(ALT) - MAX _____ 25
 TILT TBL MOTION PRI(ALT) - RAISE (hold until MOTION PRI(ALT) tb - gray, start watch) _____ 26
 ✓TILT TBL POS PRI(ALT) tb - bp

At 59° (~3:30),
 ✓TILT TBL POS PRI(ALT) tb - gray _____ 27

(Record MET ___/___:___:___)

* If MOTION PRI(ALT) tb - bp *
 * before POS tb - gray and no *
 * payload motion is observed, *
 * Go to PL SYS, PL MAL, 1.3c * _____ 28

✓TILT TBL MOTION PRI(ALT) tb - bp
 DR ENA PRI(ALT) - OFF _____ 29

CDR Verify from CCTV IUS at 59°

- (23) CCTV and VTR are set up to view IUS elevation to 59°.
- (24) Raising the tilt table in PRCS could result in structural damage to the aft ASE.
- (25) This releases the locks on the tilt table actuator drive motor.
- (26) The IUS is elevated to 59° in preparation for deploy.
- (27) These talkbacks indicate IUS position and motion.
- (28) This could result from a jammed tilt table, bad AFTA, or inadequate electrical drive.
- (29) This applies the locks to the tilt table actuator drive motor.

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MS2 R11 VTR pb - STOP
 16mm Camr - off
 Install ASA 320 film mag and remove orange filter

A7 MON 1 - B (IUS/TDRS)
 MON 2 - C (tilt table/IUS sep plane)

VTR RCD - C

CAUTION

If IUS elevation is < 45°, DO NOT DEPLOY. Go to PL SYS, PL MAL, 1.3f

30

CAUTION

If VERN failure, use NORMs (LOW Z)

31

10 SEP MNVR PREP

CDR A6 ADI ATT - REF
 ATT REF pb - PUSH
 ✓ADI - 0,0,0
 ✓SENSE - (-X)
 ✓FLT CNTLR PWR - OFF 32

11 XFER SV ORB TO TGT

CRT GNC 33 REL NAV
 ORB TO TGT - ITEM 10 EXEC
 ✓NAV GNG, R, Y, Y approx 0 33

MS2 R11 VTR pb - PLAY, RCD (simo)
 ✓STBY - RUN

Record Camr C until SRM nozzle clears ASE, then alternate recording between Camr B & D

-00:30
 CDR A6U ✓DAP TRANS: NORM/NORM/NORM,LOW Z **
 ✓DAP ROT: PULSE/PULSE/PULSE **
 DAP: AB/MAN/NORM ** 34

FLT CNTLR PWR - ON 35

MS2 16mm Camr - on

- (30) Minimum deploy angle is 40°.
- (31) Low Z reduces PRCS contamination of the IUS/TDRS.
- (32) The aft attitude director indicator is configured for the separation maneuver following the deploy.
- (33) The Orbiter state vector is transferred to the IUS slot in REL NAV prior to deploy to provide an accurate target state vector for GPC processing. This will allow the universal pointing software to point the PI at the IUS postdeploy.
- (34) The IUS is deployed in free drift.
- (35) Power is applied to the aft THC and RHC for postdeploy separation maneuvers.

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DEPLOY IUS/TDRS

1 DEPLOY IUS/TDRS

MS1 L10 ✓ IUS DPY ENA PRI(ALT) tb - bp
* If ENA tb - gray, do not *
* continue until deploy MET * _____ 1

PYRO BUS PRI(ALT) - ON (mom)
✓PRI,ALT (two) tb - gray
IUS DPY ENA PRI(ALT) - ENA (mom)
✓PRI(ALT) tb - gray _____ 2

CAUTION
Do not DEPLOY any later
than nominal time +2 min _____ 3

MM:SS
00:00 < IUS DPY PRI(ALT) - DPY (mom) _____ 4
(SM ALERT 200 MSN PHASE-Ignore msg)

Record MET ___/___:___:___ (actual
deploy time)

MS2 W10/
CCTV Visually verify deployment

* If failure to deploy after 2nd *
* attempt with PCP in PRI MODE, *
* continue procedure through *
* PYRO BUS - OFF, then PNL *
* MODE - ALT and repeat DEPLOY *
* IUS/TDRS procedure * _____ 5

MS1 L10 IUS DPY ENA PRI(ALT) - OFF (mom)
✓PRI,ALT two tb - bp
PYRO BUS PRI(ALT) - OFF (mom)
✓PRI,ALT (two) tb - bp _____ 6

3.4.3 DEPLOY IUS/TDRS

Overview: The IUS is deployed from the Orbiter PLB.

- (1) This reduces by one the number of pyro inhibits.
- (2) This enables the super-zip firing mechanism.
- (3) The deploy window closes 2 minutes past the nominal deploy time.
- (4) This fires the super-zip to release the IUS from the aft ASE.
- (5) Alternate panel power provides a backup means to deploy the IUS.
- (6) The pyro bus is powered off to preserve ASE batteries for tilt table lowering.

50

* If SM ALERT '62 PDI DECOM FAIL' *
 * msg received at deploy, verify *
 * IUS/PI link by SPEC 62 and CIU *
 * display *
 * *
 * If no lock after 30 seconds, then *
 * PI FREQ SWEEP - ON for up to 35 *
 * sec until PHASE LOCK ind and PL *
 * SIG S/S > 1.43, then release * _____ 7

- (7) There could be a loss of lock between the PI and IUS at deploy due to IUS antenna blockage.
- (8) This maintains Orbiter attitude to allow the crew to visually track the IUS through the overhead windows.
- (9) MSN PHASE 5 indicates postdeploy.
- (10) CMD 36 initiates the cyclic (once/minute) transfer of Orbiter state vector to the IUS. This allows the IUS to point the correct antenna at the Orbiter for comm.
- (11) This message may occur when the IUS selects its lower antenna for transmission.

+01:00 < THC -X (in), 8 sec (2.2 FPS)
 monitor pitch ~1°/sec

CDR A6U When P = 70° on REF BALL then,
 DAP ROT: DISC/DISC/DISC .. _____ 8
 FLT CNTLR PWR - OFF

MS2 16mm Camr - off |

R11 When IUS deploy recording complete,
 VTR pb - STOP

Insert new VTR Cassette
 Reset VTR Counter

+02:00 2 CYCLIC XFER SV TO IUS

CDR SM 200 IUS/TDRS

√ IUS SAFETY MSN PHASE 5

CAUTION If not in MSN PHASE 5, do not send CIU CMD 36	_____ 9
--	---------

MS1 L11 Send CIU CMD 36, IA000
 No CIU CMD feedback _____ 10

NOTE

Any CIU, ENTER, SEND, CLEAR
 pb operation will terminate
 SV XFER. Reinitiate with CIU
 CMD 36

+03:00 Possible SM ALERT (200 IUS ANT) -
 Ignore msg _____ 11

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LOWER TILT TABLE TO -6°

1 LOWER TILT TABLE TO -6°

MS2 A7 VTR RCD - B,NORM,NORM
 MON 1 - B (tilt table)
 MON 2 - C (STBD tilt ind)

NOTE
 Alternate recording Camrs B & C
 to cover tilt table stow

R11 VTR pb - PLAY, RCD (simo)
 ✓STBY - RUN _____ 1

MS1 L10 TILT TBL DR ENA PRI(ALT) - MAX _____ 2
 TILT TBL MOTION PRI(ALT) - LOWER (hold
 until MOTION PRI tb-gray, start watch) _____ 3
 ✓TILT TBL POS PRI,ALT (two) tb - bp

At -6° (~8:25, 16:50 max),
 ✓TILT TBL POS PRI,ALT (two) tb - gray _____ 4

* If both POS tb are bp *
 * when motion stops, *
 * Go to PL SYS, PL MAL, 1.3d * _____ 5

L10 ✓TILT TBL MOTION PRI(ALT) tb - bp
 (Record MET ___/___:___:___)

CCTV Verify tilt table at -6°
 TILT TBL DR ENA PRI(ALT) - OFF _____ 6

MS2 R11 VTR pb - STOP

3.5.1 LOWER TILT TABLE TO -6°

Overview: After IUS deploy, the tilt table is lowered to the -6° position and locked to prevent possible ASE damage during entry.

- (1) VTR and PLB cameras are configured to view the tilt table lowering.
- (2) This releases the locks on the actuator drive motor.
- (3) The crew watches the tilt table lowering for any anomalies.
- (4) These talkbacks indicate tilt table position and motion.
- (5) This could result from a jammed tilt table, bad AFTA, or inadequate electrical drive.
- (6) Tilt table drive is disabled to reduce ASE electrical loads.

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POSTDEPLOY SEPARATION MNVR

1 OMS BURN PREP

IGNC UNIV PTG

CDR CRT CNCL - ITEM 21 EXEC (*) _____ 1

GNC, OPS 202 PRO
IGNC ORBIT MNVR EXEC
IGNC SYS SUMM 2

PLT

2 OMS BURN PRE CHECKS

F7 ✓OMS PRESS He TK L,R > 750 psia
 ✓OMS PRESS N2 TK L,R > 523 psia

WARNING

If OMS N2 PRESS out of limits on either side, do $\Delta V = 40$ FPS burn on good engine. Xfeed at 1/2 ΔV total. If both OMS have N2 PRESS out of limits, do $\Delta V = 15$ FPS +X RCS burn. Perform ON-ORBIT RCS BURN, ORB OPS, RCS

3 LOAD OMS TGT AND BURN DATA

CAUTION

If tilt table will not be at -6° by OMS TIG, then stop tilt table motion and perform 1 ENG OMS burn. After OMS burn continue tilt table lowering

✓BURN DATA per Burn Pad
 LOAD - ITEM 22 EXEC
 TIMER - ITEM 23 EXEC

3.5.2 POSTDEPLOY SEPARATION MNVR

Overview: An orbital maneuvering system (OMS) burn is performed to increase the distance between the IUS and Orbiter prior to SRM-1 ignition. This burn also prevents recontact with the IUS due to the out-of-plane deploy.

- (1) Once the IUS has cleared the Orbiter, solar tracking is no longer necessary.
- (2) Low nitrogen pressure may not properly open the fuel/oxidizer lines to the OMS engines.
- (3) An OMS burn could damage the actuator or drive motor if the drive locks are not applied.

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C3 DAP: B1/AUTO/NORM ..
 ✓DAP TRANS: NORM/NORM/NORM,LOW Z ..
 CDR CRT
 +08:00 < MNVR - ITEM 27 EXEC (*) _____ 4
 (+02:30)
 +10:00 SM ALERT (CIU ISOL VLV) - Ignore msg _____ 5

***** IOS AOS *****

4 OMS BURN EXEC _____ 6

WARNING	
If TIG on time:	If unable to burn at least 15 FPS of ΔV TOTAL (OMS & RCS), XMIT MASTER SAFE CMD. Go to PL SYS, <u>PL MAL</u> , IUS SB
If TIG slips:	1) Reload TGTS for new TIG 2) If no burn by nominal deploy +23 min (DESC INJ) or +31 min (ASC INJ), XMIT MASTER SAFE CMD, then go to PL SYS, <u>PL MAL</u> , 1.3n, <u>6</u>

C3 DAP TRANS: NORM/NORM/NORM,no LOW Z

(TIG-2) Perform OMS 2/ORBIT OMS BURN Cue Card

***** IOS LOS *****

5 POST OMS BURN RECONFIG _____ 8

F7/F8 FLT CNTRL PWR (two) - OFF _____ 8
 08 L,R OMS He PRESS/VAP ISOL (four) - CL
 ✓XFEED (four) - CL (tb-CL)
 ✓TK ISOL (four) - OP (tb-OP) _____ 9

- (4) This maneuvers the Orbiter to the proper attitude for the OMS burn. Low Z is used to limit PRCS plume impingement on the IUS.
- (5) This indicates that the IUS RCS engines have been enabled.
- (6) The OMS burn is nominally done over a ground site so the ground can monitor the telemetry.
- (7) The Orbiter must be at least 10 n. mi. from the IUS by SRM-1 ignition.
- (8) This prevents inadvertent firings of the Orbiter RCS.
- (9) This is the nominal postburn OMS valve configuration.

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6 MNVR TO IUS VIEWING ATTITUDE

CDR CRT GNC, OPS 201 PRO
IGNC UNIV PTG

TRK OPTION:
 TGT ID +1
 BODY VECTOR +3 (-Z)
 OM +0.0

√DAP: B1/AUTO/NORM **
 Initiate TRK

When mnvr complete,
 DAP: B1/AUTO/VERN ** _____ 10

NOTE
 Final IUS/PI loss of lock
 will occur at DEPLOY +32:00

* If lock lost prior to DEPLOY ... *
 * +32:00, then PI FREQ SWEEP - ON *
 * for up to 35 sec until IUS RCVR *
 * CMD LOCK indicated (SPEC 200), *
 * then release * _____ 11

DPLY +33 < TURN OFF PI:
 MS1 A1 S-BD PL CNTL - CMD
 PWR SEL - PSP
 CNTL - PNL then, CMD

CRT SV/ATT XFER - ITEM 1 EXEC (no *) _____ 12
 7 MNVR TO PROTECT ATTITUDE

CDR CRT TRK OPTION:
 TGT ID +1
 BODY VECTOR +5
 P +3 0 5.0 _____
 Y + - 0.0 _____
 OM + - 0.0 _____

MM:SS DAP: B1/AUTO/NORM **
 +41:00 Initiate TRK
 (+10:30) DAP ROT: DISC/DISC/DISC

When MNVR complete,
 DAP: B1/AUTO/VERN

SRM-1 IGN DAP: B1/MAN/VERN _____ 13
 +55:00 IUS SRM-1 ignition
 (18A 67:00) Maintain orbiter attitude for at least
 8 1/2 min

- (10) This allows the crew to visually track the IUS through the Orbiter window and also keeps the PI pointed at the IUS.
- (11) The final IUS/PI loss of lock occurs when the Orbiter maneuvers to window-protect attitude.
- (12) After the final loss of lock, the PI is powered off and the cyclic state vector transfer to the CIU is disabled as it is no longer needed.
- (13) This attitude protects the Orbiter windows from IUS SRM plume impingement.

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CLOSEOUT

<p>WARNING To prevent tilt table damage during reentry, the tilt table must be locked at -6° or AFTA must stay connected</p>
--

- | | |
|----------------------------|--|
| | 1 |
| 1 <u>PRI ACT DISENGAGE</u> | |
| MS2 A7 | MON 1 - B (PORT Actuator)
MON 2 - C (STBD Actuator) |
| MS1 L10 | If using ALT ACT
VTR RCD - B
VTR pb - PLAY/RCD
✓STBY - RUN _____ 2
Perform DISENGAGE ALT ACT
Go to step 2 |
| | If using PRI ACT
VTR RCD - C
VTR pb - PLAY/RCD
✓STBY - RUN _____ 3
Perform DISENGAGE PRI ACT |
| | PNL MODE - ALT _____ 4
TILT TBL ACT 1 - DISENG (mom) |
| MS2 CCTV | ✓PRI ACT DISENG _____ 5 |

3.5.3 CLOSEOUT

Overview: This procedure disengages the tilt table actuator and removes power from all IUS-related controls.

- (1) Entry loads could cause structural damage to an unlocked tilt table.
- (2) VTR and monitors are set up to record the alternate tilt table actuator disengagement.
- (3) VTR and monitors are set up to record the primary tilt table actuator disengagement.
- (4) The PCP must be in the ALT mode to nominally disengage the primary actuator.
- (5) CCTV is used to verify primary actuator disengagement.

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MS1 L12U * If not disengaged, use pin pusher: *
 * cb IUS SW PWR - c1 *
 * * *
 * IUS ACT ORD PREARM - PREARM *
 * ARM - ARM *
 * (tb-gray) *
 * ACT 1 DISENG - DISENG *
 * * *
 * ✓PRI ACT DISENG on PCP: *
 L10 * ✓TILT TBL PRI ACT 1 ENGAGED *
 * tb - bp *
 * * *
 L12U * IUS ACT 1 DISENG - OFF *
 * ACT ORD ARM - SAFE *
 * PREARM - OFF *
 * * *
 * cb IUS SW PWR - op * _____ 6

R11 VTR pb - STOP
 L10 PNL MODE - PRI
 Go to step 3 _____ 7

- (6) If the actuator does not nominally disengage, the pin pusher is used to release it.
- (7) If the primary actuator was used for tilt table ops, the alternate actuator disengagement steps are not necessary.
- (8) The alternate actuator is released using the pin puller.

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2 DISENGAGE ALT ACT

L12U cb IUS SW PWR - c1 |
 IUS ACT ORD PREARM - PREARM
 ARM - ARM (tb-gray)
 ACT 2 DISENG - DISENG
 ✓ALT AFTA tilted up _____ 8
 IUS ACT 2 DISENG - OFF
 ACT ORD ARM - SAFE (tb-bp)
 PREARM - OFF
 cb IUS SW PWR - op

MS2 R11 VTR pb - STOP |

- MS1 L11 3 REMOVE CIU PWR
 CIU PWR - OFF
- L10 4 REMOVE PCP PWR
 IUS HTRS BATT PRI(ALT) - OFF
 ✓PRI,ALT (two) tb - bp
 WBDI PRI(ALT) - OFF
 ✓PRI,ALT (two) tb - bp
 CONV PWR PRI(ALT) - OFF
 ✓PRI,ALT (two) tb - bp
 ASE BATT PRI(ALT) - OFF (mom)
 ✓PRI,ALT (two) tb - bp
 ORB S/C CONV PWR PRI(ALT) - OFF (mom)
 ✓PRI,ALT (two) tb - bp
 cb PNL PWR PRI,ALT (two) - op
 ✓A11 PCP tbs - bp _____ 9
- CDR CRT 5 DESELECT RNDZ NAV
UNIV PTG
 CNCL - ITEM 21 EXEC
IGNC 33 REL NAVI
 RNDZ NAV ENA - ITEM 1 EXEC (no *) _____ 10
- PLT CRT 6 LOAD TFLS
ISM 62 PCMMU/PL COMM
 Load PCMMU formats 103/161 per ORB OPS
 Zero decom inputs for IUS/TDRS (3) _____ 11

- (9) Power is removed from ASE, PCP, and CIU to reduce Orbiter electrical loads.
- (10) After SRM-1 ignition and with the PI off, REL NAV is no longer needed to point the PI at the IUS.
- (11) The nominal on-orbit telemetry format loads (TFL's) are loaded.

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CONTINGENCY OPS

IUS COARSE ATTITUDE ALIGNMENT

MS1	L11	XFER IUS TLM rate to HDLN 64 KBPS (Cue Card)		
	L10	✓CMD PATH ENA - HDLN _____	1	
CDR	CRT	✓ATT hold _____	2	
MS1	CRT	✓SV/ATT XFER, ITEM 1 - (*) _____	3	
	L11	✓MDM ERR GPC lt - off _____	4	
		Send CIU CMD 10 <u>11C001</u> ✓CMD WORD ind - <u>XX</u> (within 5 sec) -01 Successful 00 Unsuccessful		
		Rcd MET ____/____:____:____ (✓MCC)	5	
CRT		SV/ATT XFER - ITEM 1 EXEC (no *) _____	6	

3.6.1 IUS COARSE ATTITUDE ALIGN

Overview: This procedure transfers the Orbiter attitude to the IUS in the event that the IUS has lost its attitude reference, such as after auto thermal shutdown.

- (1) HDLN is the preferred commanding when available; 64 kbps allows the CIU to display NIS BIT feedback.
- (2) For a good attitude transfer, the Orbiter should not be maneuvering.
- (3) This transfers the Orbiter attitude and state vector from the GPC to CIU buffer.
- (4) This light will illuminate if the attitude data fails a CIU validation test.
- (5) CMD 10 transfers the attitude from the CIU buffer to the IUS computers.
- (6) After a successful transfer, the attitude transfer from GPC to CIU is deactivated until it is required again.

IUS POWER KILL

WARNING
PWR KILL should be used only for mission abort or emergencies where crew safety is in jeopardy

MS1 L10

- If IUS Umbilical attached, _____ 1
PWR KILL - KILL (mom) _____ 2
- Verify PCP configuration as shown (on facing page) _____ 3
- NOTE**
Crew will receive SM ALERT - 'S62 PDI DECOM FAIL' as a result of loss of IUS HDLN data, and SM ALERT - '200 TDRS BATT' as a result of TDRS batteries coming on-line. Ignore messages _____ 4
- * If responses are not as expected, *
* PNL MODE sw to ALT pos and *
* repeat procedure. ✓MCC * _____ 5
- If IUS Umbilical released,

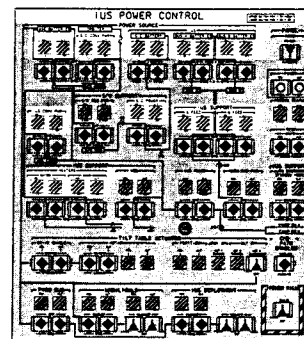
3.6.3 IUS POWER KILL

Overview: The IUS power kill quickly removes all power to the IUS. It should be used only in emergency situations where crew safety is in jeopardy.

- (1) Since all power to the IUS is removed, temperature-critical components could be damaged after long durations.
- (2) The PWR KILL switch sends the following commands simultaneously to the IUS:
 - S/C stage 1/2 batteries - off
 - S/C power - off
 - IUS bus A stage 1/2 batteries - off
 - IUS support A feed - off
 - IUS bus B stage 1/2 batteries - off
 - IUS support B feed - off

When ASE power is removed from the S/C, the following five commands are sent simultaneously:

- ASE batteries - off
 - S/C converter power - off
 - IUS battery heaters - off
 - IUS guard heaters - off
 - IUS converter power - off
- (3) All power-related talkbacks should now be barberpole.



- (4) When power is removed, all IUS TLM is lost. In addition, the TDRS batteries will come on line to supply power to the TDRS S/C.
- (5) This supplies alternate power to the PWR KILL switch if the primary mode is not functioning.

<p>WARNING Sending CMDs 50 and 51 with the Umbilical released and IUS in MSN PHASE 3 irrevocably disables the IUS. No powerup will be possible. These cmds cannot be sent Post-Deploy (MSN PHASE 5)</p>

MS1 L10
L11

✓CMD PATH ENA - RF _____ 6
 ✓PL LK - RF 16 KBPS _____ 7

Send CIU CMD 50, 02PP9
 No CIU CMD feedback _____ 8

Send CIU CMD 51, 02229
 No CIU CMD feedback _____ 9

NOTE
 Crew will receive SM ALERT -
 'S62 PDI DECOM FAIL' as a
 result of loss of IUS RF data.
 Ignore message

✓VCC-OCTAL ind - nL _____ 10

* If responses are not as *
 * expected, ✓MCC *

- (6) If IUS umbilicals are released, the power kill command must be sent by the CIU through the PI. Once this command is sent, the IUS cannot be powered back up.
- (7) This enables the transmission of RF CIU commands to the IUS.
- (8) CMD 50 turns the S/C bus stage 1 battery off.
- (9) CMD 51 turns the IUS avionics stage 1 battery off.
- (10) Once avionics bus power is removed, IUS TLM is no longer available.

RESTOW IUS (UMBILICAL ATTACHED)

CAUTION MID lights may be on no longer than 15 min

- 1 CAMERA PREP
- MS2 A7U PL BAY FLOOD MID,AFT (four) - ON
FWD BHD - ON
VTR RCD - C
MON 1 - B (tilt table)
MON 2 - C (tilt indicator)
✓Sufficient tape remaining_____2
- 2 IUS/TDRS TO ORBITER POWER
- If IUS on orbiter power,
Go to step 3
- If IUS on internal power,
✓ASE BATT PRI,ALT (two) tb - gray
✓IUS PWR PRI,ALT (two) tb - gray
IUS CONV PWR PRI,ALT - ON
✓PRI,ALT (two) tb - gray_____3
IUS A FEED PRI(ALT) - ON
✓PRI,ALT (two) tb - gray
BUS A BATT PRI(ALT)-STAGE I&II OFF
✓PRI,ALT (two) tb - bp
B FEED PRI(ALT) - ON
✓PRI,ALT (two) tb - gray
BUS B BATT PRI(ALT)-STAGE I&II OFF
✓PRI,ALT (two) tb - bp_____4
- Rcd MET ___/___:___:___ (✓MCC)_____5
- S/C REG PWR PRI(ALT) - ON
✓PRI,ALT (two) tb - gray
PWR PRI(ALT) - ON
✓PRI,ALT (two) tb - gray
IUS S/C BATT PRI(ALT) - STAGE I&II OFF
✓PRI,ALT (two) tb - bp_____6
- Rcd MET ___/___:___:___ (✓MCC)_____7

3.6.4 RESTOW IUS (UMBILICAL ATTACHED)

Overview: This procedure is used to restow the IUS for a much later than nominal deploy time (greater than two orbits) or mission abort.

- (1) This is because of TDRS thermal constraints.
- (2) VTR and monitors are set up to view tilt table lowering.
- (3) This routes regulated Orbiter power to the IUS.
- (4) IUS batteries are turned off to conserve their useful life once Orbiter power is applied to the IUS avionics buses.
- (5) The MET is recorded to keep track of remaining IUS battery life.
- (6) Orbiter power is applied to the TDRS S/C. IUS S/C batteries are turned off to conserve their useful life.
- (7) The MET is recorded to keep track of remaining IUS S/C battery life.

3 REM HEATERS OFF

MS1 L10 ✓CMD PATH ENA - HDLN
 L11 ✓PL LK - HDLN 16(64) KBPS _____ 8
 Send CIU CMD 44 OPC79
 No CIU CMD feedback _____ 9

4 IUS XMTR OFF

L10 ✓CMD PATH ENA - HDLN
 L11 ✓PL LK - HDLN 16(64) KBPS _____ 8
 Send CIU CMD 34 I2P11
 No CIU CMD feedback _____ 10

CDR CRT ISM 200 IUS/TDRS
 ✓IUS SAFETY RF PWR - (-7.3)
 Advise MCC IUS XMTR is OFF _____ 11

- (8) HDLN commanding is preferred when the umbilicals are attached. Either data rate may be used.
- (9) CMD 44 turns the REM heaters off.
- (10) CMD 34 turns off the IUS A and B encryptor (if applicable), transmitter, and 20 W power amplifier.
- (11) SPEC 200 may be used to verify that IUS RF power is off.

5 TDRS (PI) SETUP

MS1 AIL ✓S-BD PL CNTL - CMD
 ✓ANT POLAR - R CIRC
 ✓XMTR PWR - MED
 CH SEL INTRG 1,2 tw (six)-089,089
 MOD - OFF
 ✓PWR SYS - 1
 SEL - BOTH
 ✓PSP CMD OUTPUT - INTRG _____ 12
 CNTL - PNL

CDR CRT SM 200 IUS/TDRS
 ✓TDRS RCVR SIG PRES A (*), B (*)
 * If TDRS RCVR SIG PRES A (blank) or *
 * B (blank), then PI FREQ SWEEP - ON *
 * for up to 90 sec until TDRS RCVR *
 * SIG PRES, then release * _____ 13

MS1 AIL S-BD PL MOD - ON

CDR CRT ✓TDRS RCVR CMD LOCK A (*), B (*) _____ 14

- (12) The PI is set up so that the ground can command the TDRS transmitter off.
- (13) This tunes the PI frequency to the TDRS receivers to allow communication between the two.
- (14) When the PL modulation is turned on, the TDRS receivers will lock onto the PI command signal.

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7 LOWER TILT TABLE TO 0°

MS2 R11 VTR pb - PLAY, RCD (simo)
 ✓STBY - RUN

NOTE
 Alternate between recording
 Camr C & D to cover lowering
 of IUS/TDRS

MS1 A6U ✓PL RETEN LAT 1,2 tb (two) - REL _____ 18
 L10 TILT TBL DR ENA PRI(ALT) - MAX _____ 19
 MOTION PRI(ALT) - LOWER (hold
 until tb - gray, start watch)
 ✓POS PRI(ALT) tb - bp.

At 0° (~3:45 (7:30 max) from 29°)
 ✓TILT TBL POS PRI,ALT (two) tb - gray
 ✓MOTION PRI(ALT) tb - bp _____ 20

(Rcd time ____:__:__:__)

* If MOTION PRI(ALT) tb - bp prior *
 * to 0° or POS tb - bp at 0°, then *
 * Go to PL SYS, PL MAL, 1.3e * _____ 21

MS2 CCTV Visually verify tilt table at 0°

R11 VTR pb - STOP _____ 22

- (18) The PRLA's on the forward ASE must be open to allow reberthing of the IUS.
- (19) This unlocks the tilt table actuator drive motor.
- (20) These talkbacks verify tilt table motion and position.
- (21) This could be caused by a stalled tilt table, bad AFTA, or inadequate electrical drive.
- (22) Once the tilt table is at 0°, the VTR recording is stopped.

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8 ENGAGE PRLAs

CAUTION	
TILT TBL ACT DR ENA must be INTERM or MAX prior to closing PRLAs. If TILT TBL POS tb - bp, hold MOTION - LOWER while latching PRLAs or until TILT TBL POS tb - gray	

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MS2 A6U R13L A6U	✓PL RETEN PL SEL - 1 PL BAY MECH PWR SYS 1,2 (two) - ON PL RETEN LAT 1,2 (two) - LAT LOGIC PWR SYS 1,2 (two) - ON	24
------------------------	--	----

After approx 30 sec (60 sec max),
 ✓PL RETEN LAT 1,2 (two) tb - LAT
 ✓RDY 1,2 (two) tb - gray
 LOGIC PWR SYS 1,2 (two) - OFF
 LAT 1,2 (two) - OFF

R13L	PL BAY MECH PWR SYS 1,2 (two) - OFF	25
------	-------------------------------------	----

MS1 L10	TILT TBL DR ENA PRI(ALT) - OFF	26
---------	--------------------------------	----

CAUTION	
If there is to be another elevation attempt, do <u>not</u> proceed to disengage AFTA or CLOSEOUT	

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- (23) The actuator drive motor must be unlocked during PRLA capture to allow the IUS to move freely to the latched position.
- (24) This firmly latches the IUS to the forward ASE frame.
- (25) Once the PRLA's have latched, power is removed to reduce Orbiter electrical loads.
- (26) This locks the tilt table actuator drive motor to prevent any further actuator motion.
- (27) Disengaging the AFTA would prevent nominal tilt table elevation in the future. Performing closeout removes all power to the IUS, PCP, and CIU.

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9 ACT DISENGAGE

MON 1 - B (PORT Actuator)
 MON 2 - C (STBD Actuator)
 If using ALT ACT,
 VTR RCD - B
 VTR pb - PLAY, RCD (simo)
 ✓STBY - RUN _____ 28
 Go to step 10

If using PRI ACT,
 VTR RCD - C

MS2 A7

R11 VTR pb - PLAY, RCD (simo)
 ✓STBY - RUN _____ 29

MS1 L10 PNL MODE - ALT _____ 30
 TILT TBL ACT 1 - DISENG (mom)
 ✓PRI ACT tilted up

MS2 CCTV Visually verify PRI ACT disengaged _____ 31

MS1 L12U

* If not disengaged, use pin *
 * pusher: *
 * cb IUS SW PWR - c1 *
 * IUS ACT ORD PREARM - PREARM *
 * ARM - ARM *
 * (tb-gray) *
 * ACT 1 DISENG - DISENG *
 * *
 * ✓PRI ACT DISENG on PCP: *
 * ✓TILT TBL PRI ACT 1 ENGAGED *
 * tb - bp *
 * *
 * IUS ACT 1 DISENG - OFF *
 * ACT ORD ARM - SAFE (tb-bp) *
 * PREARM - OFF *
 * *
 * cb IUS SW PWR - op * _____ 32

MS2 R11 VTR pb - STOP

MS1 L10 PNL MODE - PRI _____ 33
 Go to step 11

- (28) VTR and monitors are set up to record the disengagement of the alternate (port) AFTA.
- (29) VTR and monitors are set up to record the disengagement of the primary (starboard (STBD)) AFTA.
- (30) The PCP must be in the ALT mode to nominally disengage the primary actuator.
- (31) When disengaged, the actuator will be tilted up from its nominal position. CCTV is used to verify this.
- (32) The pin pusher uses an explosive charge to release the AFTA if the nominal disengagement procedure fails. Using the pin pusher causes the actuator engaged talkback to go barberpole.
- (33) PRI is the nominal panel mode for the rest of the PCP operations.

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	10	<u>ALT ACT DISENGAGE</u>	
MS1 L12U		cb IUS SW PWR - c1 IUS ACT ORD PREARM - PREARM ARM - ARM (tb-gray) ACT 2 DISENG - DISENG	
CCTV/ WID		✓ALT AFTA tilted up IUS ACT 2 DISENG - OFF ACT ORD ARM - SAFE (tb-bp) PREARM - OFF cb IUS SW PWR - op	34
	11	<u>CLOSEOUT</u>	
MS1 L10		IUS HTRS BATT PRI(ALT) - OFF ✓PRI,ALT (two) tb - bp WBDI PRI(ALT) - OFF ✓PRI,ALT (two) tb - bp NORM BUS PWR PRI(ALT) - OFF ✓PRI,ALT (two) tb - bp	35
		<u>NOTE</u> Crew will receive SM ALERT 'S62 PDI DECOM FAIL' as a result of loss of IUS HDLN data, and SM ALERT - '200 TDRS BATT' as a result of TDRS batteries coming on-line. Ignore messages	36
		cb PNL PWR PRI,ALT (two) - op ✓All PCP tbs - bp	
L11		CIU PWR - OFF	37
		<u>NOTE</u> TDRS batteries will remain on until commanded off by the ground	38
		<u>LOAD TFLS</u>	
PLT CRT		<u>ISM 62 PCMMU/PL COMMI</u> Load PCMMU Formats 103/161 Load PCMMU Format (ORB OPS C/L)	39

- (34) The alternate AFTA may be disengaged only by using the explosive pin puller.
- (35) Power to IUS systems is removed to reduce Orbiter/ASE electrical loads.
- (36) IUS TLM is lost when IUS bus power is removed. Since the IUS S/C batteries are already powered down, the TDRS batteries will come on line once Orbiter power is removed.
- (37) Both PCP and CIU are powered down as they are no longer needed.
- (38) The ground can still command the TDRS directly through a ground site.
- (39) These are the nominal TFL's for on orbit.

RESTOW IUS (UMBILICAL RELEASED)

CAUTION MID lights may be on no longer than 15 min

1 CAMERA PREP

MS2 A7 PL BAY FLOOD MID,AFT (four) - ON
FWD BHD - ON
VTR RCD - C
MON 1 - B (tilt table)
MON 2 - C (tilt indicator)

✓Sufficient tape remaining _____ 2.

2 IUS (PI) SETUP

MS1 A1L PI SETUP:
✓S-BD PL CNTL - CMD
✓ANT POLAR - R CIRC
✓XMTR PWR - MED
CH SEL INTRG 1,2 tw(six)-906,906
MOD - OFF
✓PWR SYS - 1
SEL - BOTH
✓PSP CMD OUTPUT - INTRG
CNTL - PNL
A1U SIG STRENGTH sel - S-BD PL
Verify S/S > 1.43 volts

CRT SM 62 PCMMU/PL COMM
✓PL INTRG PHASE LOCK - YES _____ 3

SM 200 IUS/TDRS
✓IUS RCVR CMD LOCK (*)

* If IUS RCVR not locked, then PI *
* FREQ SWEEP - ON for up to 35 sec *
* until RCVR CMD LOCK indicated, *
* then release * _____ 4

A1L S-BD PL MOD - ON _____ 5

3.6.5 RESTOW IUS (UMBILICAL RELEASED)

Overview: This procedure is used to stow the IUS if the umbilical has been released. This would result in a mission abort.

- (1) This is because of TDRS thermal constraints.
- (2) VTR and monitors are set up to view tilt table lowering.
- (3) Without the umbilical, the PI must be used to transmit powerdown commands to the IUS. The PHASE LOCK and S/S indicate the PI is receiving IUS TLM.
- (4) The IUS receiver must be locked onto the PI signal to communicate with the CIU. CMD LOCK indicates the IUS receiver is locked onto the PI signal.
- (5) Turning on the PL modulation enables the CIU to command the IUS through the PI.

3 POWER KILL (RF)

MS1 L11

Send CIU CMD 50, 02PP9
No CIU CMD feedback _____ 6

Send CIU CMD 51, 02229
No CIU CMD feedback _____ 7

NOTE

Crew will receive SM ALERT -
'S62 PDI DECOM FAIL' as a
result of loss of IUS RF
data. Ignore message

AIU

SIG STRENGTH sel - S-BD PL
Verify S/S = 0.0 volts _____ 8

- (6) This turns the S/C bus stage 1 battery off.
- (7) This turns the IUS avionics stage 1 battery off.
- (8) Turning off the avionics battery causes loss of IUS TLM.

4 TDRS(PI) SETUP

MSI L11 PL LK - HDLN 16(64) KBPS _____ 9

PI SETUP:

AIL ✓S-BD PL CNTL - CMD
✓ANT POLAR - R CIRC
✓XMTR PWR - MED
CH SEL INTRG 1,2 tw(six)-089,089
MOD - OFF
✓PWR SYS - 1
SEL - BOTH
✓PSP CMD OUTPUT - INTRG
CNTL - PNL _____ 10

AIU SIG STRENGTH sel - S-BD PL
Verify S/S > 1.43 volts

CRT ✓PL INTRG PHASE LOCK - YES
✓ERR - not changing _____ 11

AIL S-BD FREQ SWEEP - ON (until PL
INTRG ERR (CRT) begins changing) _____ 12

S-BD PL MOD - ON _____ 13

5 TDRS XMTR OFF

CAUTION
TDRS XMTR must be OFF before
lowering Tilt Table _____ 14

***** STDN AOS *****

MCC will cmd TDRS XMTR off

AIL On MCC GO or LOS:
S-BD PL CNTL - CMD

MCC will cmd PI _____ 15

***** STDN LOS *****

- (9) This prevents any inadvertent RF commands being sent from the CIU through the PI.
- (10) This is the nominal setup for TDRS/PI link.
- (11) This verifies that the PI is receiving the TDRS signal.
- (12) This verifies that the TDRS receiver is locked onto the PI signal. The TDRS transmit frequency is proportional to its receiving frequency when in the coherent mode. This frequency changes as the PI frequency changes.
- (13) The PL modulation is turned on to allow communication between the TDRS and PI.
- (14) If the TDRS transmitter radiates into the PLB, its transmitter could overheat.
- (15) The ground turns the TDRS transmitter off through the PI over a ground site.

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6 LOWER TILT TABLE TO 0°

MS2 R11 VTR pb - PLAY, RCD (simo) |
 ✓STBY - RUN

NOTE

Alternate between recording
 Camr B & C to cover lowering
 of IUS/DRS

A6U ✓PL RETEN LAT 1,2 (two) - REL _____ 16
 MS1 L10 TILT TBL DR ENA PRI(ALT) - MAX _____ 17
 MOTION PRI(ALT) - LOWER (hold
 until tb-gray, start watch)
 ✓POS PRI(ALT) tb - bp

At 0° (~3:45 (7:30 max) from 29° or
 ~7:15 (14:30 max) from 59°)
 ✓TILT TBL POS PRI,ALT (two) tb - gray
 ✓MOTION PRI(ALT) tb - bp _____ 18

(Rcd time ____/____ : ____)

- * If MOTION PRI(ALT) tb - bp prior *
- * to 0° or POS tb - bp at 0°, then *
- * Go to PL SYS, PL MAL, 1.3e * | _____ 19

MS2 CCTV Visually verify tilt table at 0°
 R11 VTR pb - STOP

7 ENGAGE PRLAs

<p><u>CAUTION</u> TILT TBL ACT DR ENA must be INTERM or MAX prior to closing PRLAs. If TILT TBL POS tb - pb, hold MOTION - LOWER while latching PRLAs or until TILT TBL POS tb - gray</p>	<p>_____ 20</p>
--	-----------------

- (16) The PRLA's on the forward ASE must be open to allow reberthing of the IUS.
- (17) This unlocks the tilt table actuator drive motor.
- (18) These talkbacks verify tilt table motion and position.
- (19) This could be caused by a stalled tilt table, bad AFTA, or inadequate electrical drive.
- (20) The actuator drive motor must be unlocked during PRLA capture to allow the IUS to move freely to the latched position.

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MS2 A6U ✓PL RETEN PL SEL - 1
 R13L PL BAY MECH PWR SYS 1,2 (two) - ON
 A6U PL RETEN LAT 1,2 (two) - LAT
 LOGIC PWR SYS 1,2 (two) - ON _____ 21

 After approx 30 sec (60 sec max),
 ✓PL RETEN LAT 1,2 (two) tb - LAT
 ✓RDY 1,2 (two) tb - gray
 LOGIC PWR SYS 1,2 (two) - OFF
 LAT 1,2 (two) - OFF

R13L PL BAY MECH PWR SYS 1,2 (two) - OFF _____ 22

MS1 L10 TILT TBL DR ENA PRI(ALT) - OFF _____ 23

8 ACT DISENGAGE

 MON 1 - B (PORT Actuator)
 MON 2 - C (STBD Actuator)

MS1 If using ALT ACT,
 VTR RCD - B
 VTR pb - RCD, PLAY (simo)
 ✓STBY - RUN _____ 24
 Go to step 10

MS2 A7 If using PRI ACT,
 VTR RCD - C

R11 VTR pb - PLAY, RCD (simo)
 ✓STBY - RUN _____ 25

MS1 L10 PNL MODE - ALT _____ 26
 TILT TBL ACT 1 - DISENG (mom)

MS2 CCTV ✓PRI ACT tilted up _____ 27

- (21) This firmly latches the IUS to the forward ASE frame.
- (22) Once the PRLA's have latched, power is removed to reduce Orbiter electrical loads.
- (23) This locks the tilt table actuator drive motor to prevent any further actuator motion.
- (24) VTR and monitors are set up to record the disengagement of the alternate (port) AFTA.
- (25) VTR and monitors are set up to record the disengagement of the primary (STBD) AFTA.
- (26) The PCP must be in the ALT mode to nominally disengage the primary actuator.
- (27) When disengaged, the actuator will be tilted up from its nominal position. CCTV is used to verify this.

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MS1 L12U * If not disengaged, use pin *
 * pusher: *
 * cb IUS SW PWR - c1 *
 * IUS ACT ORD PREARM - PREARM *
 * ARM - ARM (tb-gray) *
 * ACT 1 DISENG - DISENG *
 * *
 * ✓PRI ACT DISENG on PCP: *
 L10 * ✓TILT TBL PRI ACT 1 ENGAGED *
 * (tb-bp) *
 L12U * IUS ACT 1 DISENG - OFF *
 * ACT ORD ARM - SAFE (tb-bp) *
 * PREARM - OFF *
 * *
 * cb IUS SW PWR - op * 28

(28) The pin pusher uses an explosive charge to release the AFTA if the nominal disengagement procedure fails.

(29) PRI is the nominal panel mode for the remaining PCP operations.

(30) The alternate AFTA may be disengaged only by using the explosive pin puller.

MS2 R11 VTR pb - STOP
 MS1 L10 PNL MODE - PRI 29
 Go to step 10

9 ALT ACT DISENGAGE

MS1 L12U cb IUS SW PWR - c1
 IUS ACT ORD PREARM - PREARM
 ARM - ARM (tb-gray)
 ACT 2 DISENGAGE - DISENGAGE
 MS2 CCTV ✓ALT AFTA tilted up
 MS1 L12U IUS ACT 2 DISENG - OFF
 ACT ORD ARM - SAFE (tb-bp)
 PREARM - OFF
 cb IUS SW PWR - op 30

10 CLOSEOUT

MSI L10 IUS HTRS BATT PRI(ALT) - OFF
 PRI,ALT (two) tb - bp
 WBDI PRI(ALT) - OFF
 ✓PRI,ALT (two) tb - bp
 ASE BATT PRI(ALT) - OFF
 ✓PRI,ALT (two) tb - bp
 ORB S/C CONV PWR PRI(ALT) - OFF
 ✓PRI,ALT (two)
 tb - bp
 CONV PWR PRI(ALT) - OFF
 ✓PRI,ALT (two) tb - bp _____ 31

cb PNL PWR PRI,ALT (two) - op
 ✓A11 PCP tbs - bp

L11 CIU PWR - OFF _____ 32

NOTE
 TDRS batteries will remain
 on until commanded off by
 the ground _____ 33

11 LOAD TFLS

PLT CRT SM62 PCMMU/PL COMM

Load PCMMU Formats 103/161
 Load PCMMU Formats (ORB OPS C/L) _____ 34

- (31) Power to IUS systems is removed to reduce Orbiter/ASE electrical loads.
- (32) Both PCP and CIU are powered down as they are no longer needed.
- (33) The ground can still command the TDRS directly through a ground site.
- (34) These are the nominal TFL's for on orbit.

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LOSS OF FWD RCS DEPLOY

Make the following changes to the nominal
deploy procedures:

- 1 Verify fwd manf closed
 - GNC 23 RCS
 - ✓FWD MANF 1,2,3,4,5 STAT OVRD - CL _____ 1
- 016 ✓RJD L5/F5/R5 DRIVER - OFF _____ 2
- 2 Use TAIL ONLY - JET OPT for P,Y
in all DAPs
 - GNC 20 DAP CONFIG
 - ✓JET OPT P,Y +3 (ITEM 12,13,26,27) _____ 3
- 3 No VERN or LOW Z DAP capability exists.
Select NORM jets and NORM Z for all DAP
callouts _____ 4
- 4 Raise(lower) tilt table in free drift _____ 5
- 5 Postdeploy, remain in free drift until
Deploy +5:00, then:
 - +5:00 THC +X (out) 14 sec (4 FPS)
 - monitor +pitch (tail up) ~.3°/sec

When TDRS/IUS LOS is near Orbiter tail,
DAP ROT: DISC/DISC/DISC _____ 6

3.6.6 LOSS OF FWD RCS DEPLOY

Overview: The following steps are used in the nominal deploy procedures for
tail-only RCS.

- (1) Since only aft RCS jets are used, the forward manifolds are closed.
- (2) This prevents any GPC-generated commands from firing the forward RCS
jets.
- (3) This configures the DAP for tail-only pitch and yaw.
- (4) Loss of forward verns results in poor tail-only attitude control; loss
of forward +X NORMs eliminates low Z capability.
- (5) Raising/lowering the tilt table using PRCS jets could cause structural
damage to the tilt table.
- (6) Discrete mode maintains Orbiter attitude hold.

DEPLOY WAVE-OFF

Maintain deploy attitude _____ 1

<p style="text-align: center;">CAUTION</p> <p>If both REM HTRs are on, turn off ASAP If only one REM HTR is on, no action is reqd</p>
--

MS1 L11 If reqd to turn off REM HTR, send CIU CMD 44, [OPC79] No CIU CMD feedback _____ 3

Record MET ___/___:___:___ _____ 4

If Umbilicals attached, transfer IUS/TDRS to orbiter power:

L10 IUS CONV PWR PRI(ALT) - ON (mom)
✓PRI,ALT (two) tb - gray _____ 5

✓PWR PRI,ALT (two) tb - gray

A FEED PRI(ALT) - ON (mom)

✓PRI,ALT (two) tb - gray

BUS A BATT PRI(ALT) - STAGE I&II OFF (mom)

✓PRI,ALT (two) tb - bp

B FEED PRI(ALT) - ON (mom)

✓PRI,ALT (two) tb - gray

BUS B BATT PRI(ALT) - STAGE I&II OFF (mom)

✓PRI,ALT (two) tb - bp _____ 6

L10 ✓S/C REG PWR PRI,ALT (two) tb - gray
PWR PRI(ALT) - ON (mom)
✓PRI,ALT (two) tb - gray
IUS S/C BATT PRI(ALT) - STAGE I & II OFF (mom)
✓PRI,ALT (two) tb- bp _____ 7

3.6.7 DEPLOY WAVE-OFF

Overview: This procedure is performed if the IUS deploy is postponed a rev. It is used to preserve IUS internal battery life.

- (1) This saves time and propellant.
- (2) REM heaters could cause the catalyst bed and RCS valves to overheat. The heaters may remain on indefinitely if only one string is active.
- (3) The CIU is the only means the crew has to deactivate the REM heaters.
- (4) The MET is recorded to keep track of how long the REM heaters are off to prevent RCS valves and propellant lines from freezing.
- (5) This supplies the IUS avionics bus with Orbiter power.
- (6) IUS internal batteries are powered down to preserve their useful life.
- (7) IUS S/C batteries are powered down to preserve their useful life.

LOSS OF COMM

NOTE

If no joy on MAL 2.3, S-8D/UHF,
1.1, COMM LOST (MULTI PNLS),
 proceed with this procedure

1 CONFIG CIU/IUS FOR 64 KBPS

Perform XFER 16 → 64, then:

L11L ✓DNLK PL RCDR - TLM _____ 1

2 CLEAR PAYLOAD RECORDER MDM INTERFACE

SM 1 DPS UTILITY

RTC (PL CREW UTILITY)

ITEM 13 +0 0 0 9 F F F F EXEC

CMD - ITEM 14 EXEC

A1R ✓PL RCDR PNL CNTL tb - gray _____ 2

3 CONFIG PL RCDR

A1R PL RCDR FUNC - MODE SEL
 SPEED - 2
 MODE - SERIAL RCD
 FUNC - OPERATE _____ 3

3.6.8 LOSS OF COMM

Overview: This procedure recovers payload data if comm is temporarily lost or if the wrong downlink format is loaded.

- (1) This ensures that payload TLM data are available at 64 kbps for the payload recorder.
- (2) This gives the crew control of the payload recorder.
- (3) This is the nominal setup for recording IUS data.

RTS CMDING SETUP

	If IUS DNLK ON, _____	1
L12U	✓IUS RF ANT ENA tb - GRAY	
	✓DSBL tb - bp _____	2
L11	PL LK - HDLN 16 KBPS	
A1U	S-BD PL MOD - OFF	
	PWR SYS - OFF	
	CNTL - PNL, then CMD	
	or	
CRT4	✓PL INTRG PHASE LOCK - NO	
	✓PL SIG STR - 0.00 _____	3
L10	✓CMD PATH ENA - RF _____	4
	If IUS DNLK OFF, _____	5
L11	✓PL LK - DNLK 16 (64) KBPS	
A1U	✓S-BD PL MOD - OFF	
	✓PWR SYS - OFF	
	CNTL - PNL, then CMD	
CRT4	✓PL INTRG PHASE LOCK - NO	
	✓PL SIG STR - 0.00 _____	3
L10	✓CMD PATH ENA - HDLN _____	6
L12U	✓IUS RF ANT ENA tb - gray	
	✓DSBL tb - bp _____	2
L11	Send CIU CMD 33, <u>12C11</u>	
	No CIU CMD feedback _____	7
L10	CMD PATH ENA - RF _____	4

3.6.9 RTS CMDING SETUP

Overview: This configuration allows direct Remote Tracking Station (RTS) commanding of the IUS.

- (1) The following steps assume that the IUS transmitter is on.
- (2) The IUS antenna must be enabled to permit commanding.
- (3) The PI should be off to permit the IUS receiver to lock onto the ground signal from an RTS site.
- (4) This sets up the proper signal path in the IUS for RF commanding.
- (5) The following steps assume that the IUS transmitter is off.
- (6) This sets up the proper signal path in the IUS for HDLN commanding.
- (7) CMD 33 turns on the IUS transmitter and power amplifier in preparation for direct RF commanding.