JSC–11174

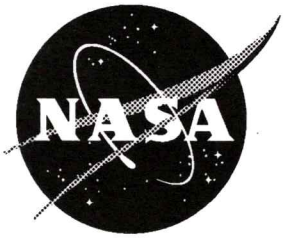
Space Shuttle Systems Handbook

Volume II – Sections 10 through 15

Mission Operations Directorate
Systems Division

Revision E, DCN–6

August 14, 1996

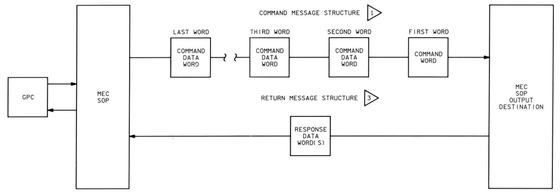


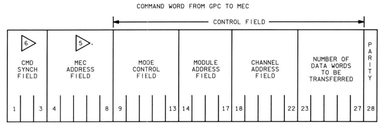
National Aeronautics and
Space Administration

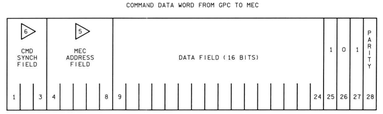
Lyndon B. Johnson Space Center
Houston, Texas

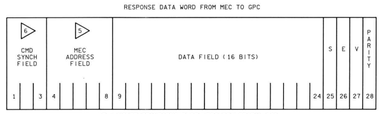
DATE	NAME	VERSION
DATE= 09/19/90	NAME= BJT	VERSION= IML7

DATE	NAME	VERSION
DATE= 01/25/90	NAME= PAH	VERSION= IMPL2
DATE= 05/01/90	NAME= PAH	VERSION= IML6
DATE= 09/19/90	NAME= BJT	VERSION= IML7









S = POWER TRANSIENT FLAG, SET TO LOGICAL '1'
E = ERROR FLAG, SET TO LOGICAL '0'
V = VALIDITY FLAG, SET TO LOGICAL '1'

MEC 1 NON-CRITICAL COMMAND DATA WORDS

HEX DECODING LOGIC

HEX CODE	COMMAND DATA WORD 9 10 11 12	13 14 15 16	17 18 19 20	21 22 23 24	COMMAND LETTER	MSID	COMMAND DESCRIPTION
8000	1 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	RES TEST	V76K7001B	PIC RESISTANCE TEST
4000	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	A	V76K7002B	L SRB POWER A
2000	0 0 1 0	0 0 0 0	0 0 0 0	0 0 0 0	B	V76K7003B	R SRB POWER A
1000	0 0 0 1	0 0 0 0	0 0 0 0	0 0 0 0	C	V76K6955B	SRB IGN FIRE 3
0800	0 0 0 0	1 0 0 0	0 0 0 0	0 0 0 0	D	V76K4612B	L T-O UMB REL FIRE 3
0400	0 0 0 0	0 1 0 0	0 0 0 0	0 0 0 0	E	V76K7006B	L SRB RSS POWER OFF
0200	0 0 0 0	0 0 1 0	0 0 0 0	0 0 0 0	F	V76K7007B	R SRB RSS POWER OFF
0100	0 0 0 0	0 0 0 1	0 0 0 0	0 0 0 0	G	V76K6960B	SRB SEP FIRE 3
0080	0 0 0 0	0 0 0 0	1 0 0 0	0 0 0 0	H	V76K4625B	ET/UMB UNLATCH FIRE 3
0040	0 0 0 0	0 0 0 0	0 1 0 0	0 0 0 0	I	V76K9003B	ET DFI POWER ON ▷
0020	0 0 0 0	0 0 0 0	0 0 1 0	0 0 0 0	J	V76K7011B	L SRB POWER C
0010	0 0 0 0	0 0 0 0	0 0 0 1	0 0 0 0	K	V76K7012B	R SRB POWER C
0008	0 0 0 0	0 0 0 0	0 0 0 0	1 0 0 0	L	V76K7013B	ATVC 2 SRB IVD A PWR ON
0004	0 0 0 0	0 0 0 0	0 0 0 0	0 1 0 0	M	V76K7014B	ATVC 4 SRB IVD B PWR ON
0002	0 0 0 0	0 0 0 0	0 0 0 0	0 0 1 0	N	V76K4657B	ET/UMB RETR FIRE 3
0001	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 1	O	V76K6921B	ET/ORB STRUCT SEP FIRE 3

MEC 2 NON-CRITICAL COMMAND DATA WORDS

HEX DECODING LOGIC

HEX CODE	COMMAND DATA WORD 9 10 11 12	13 14 15 16	17 18 19 20	21 22 23 24	COMMAND LETTER	MSID	COMMAND DESCRIPTION
8000	1 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	RES TEST	V76K7101B	PIC RESISTANCE TEST
4000	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	A	V76K7102B	L SRB POWER B
2000	0 0 1 0	0 0 0 0	0 0 0 0	0 0 0 0	B	V76K7103B	R SRB POWER B
1000	0 0 0 1	0 0 0 0	0 0 0 0	0 0 0 0	C	V76K6965B	SRB IGN FIRE 3
0800	0 0 0 0	1 0 0 0	0 0 0 0	0 0 0 0	D	V76K4616B	L T-O UMB REL FIRE 3
0400	0 0 0 0	0 1 0 0	0 0 0 0	0 0 0 0	E	V76K7106B	L SRB RSS POWER OFF
0200	0 0 0 0	0 0 1 0	0 0 0 0	0 0 0 0	F	V76K7107B	R SRB RSS POWER OFF
0100	0 0 0 0	0 0 0 1	0 0 0 0	0 0 0 0	G	V76K6970B	SRB SEP FIRE 3
0080	0 0 0 0	0 0 0 0	1 0 0 0	0 0 0 0	H	V76K4626B	ET/UMB UNLATCH FIRE 3
0040	0 0 0 0	0 0 0 0	0 1 0 0	0 0 0 0	I	V76K9103B	ET DFI POWER ON ▷
0020	0 0 0 0	0 0 0 0	0 0 1 0	0 0 0 0	J	V76K7111B	L SRB POWER C
0010	0 0 0 0	0 0 0 0	0 0 0 1	0 0 0 0	K	V76K7112B	R SRB POWER C
0008	0 0 0 0	0 0 0 0	0 0 0 0	1 0 0 0	L	V76K7113B	ATVC 1 SRB IVD A PWR ON
0004	0 0 0 0	0 0 0 0	0 0 0 0	0 1 0 0	M	V76K7114B	ATVC 3 SRB IVD B PWR ON
0002	0 0 0 0	0 0 0 0	0 0 0 0	0 0 1 0	N	V76K4661B	ET/UMB RETR FIRE 3
0001	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 1	O	V76K6922B	ET/ORB STRUCT SEP FIRE 3

MEC 1 AND MEC 2 COMMAND WORDS

COMMAND WORD CONTROL FIELD: MODE CONTROL FIELD 9 10 11 12 13	MODULE ADDRESS FIELD 14 15 16 17	CHANNEL ADDRESS FIELD 18 19 20 21 22	NUMBER OF WORDS FIELD 23 24 25 26 27	MEC 1 MSID	MEC 2 MSID	COMMAND DESCRIPTION
0 1 0 1 0	0 0 0 0	X 1 0 1 1	1 0 0 0 1	V76K8351B	V76K8851B	PRE-FLIGHT BITE TEST RESULT CMD
0 1 0 0 0	0 0 0 0	X 0 0 0 0	0 0 0 0 0	V76K8371B	V76K8871B	NON-CRIT DATA VERIF SEND CMD
0 1 0 1 0	0 0 0 0	X 1 1 1 0	0 0 0 0 0	V76K8372B	V76K8872B	NON-CRIT DATA VERIF RETURN CMD
0 0 1 0 0	0 0 0 1	X 0 0 0 0	0 0 0 0 0	V76K8400B	V76K8900B	PIC SIM CAP VOLT ENABLE CMD
0 1 0 0 1	1 1 1 1	X 0 0 0 0	0 0 0 0 1	V76K7099B	V76K7199B	OPER PIC CAPACITOR VOLT READ CMD
0 1 0 0 1	1 1 1 1	X 1 0 0 0	0 0 0 0 1	V76K7059B	V76K7159B	PIC LOAD/RESISTANCE TEST STATUS
0 1 0 1 0	0 0 0 0	X 1 0 1 1	0 0 0 0 0	V76K7097B	V76K7197B	OPER BITE TEST RESULT CMD
0 1 0 0 0	1 0 1 1	X 0 0 0 0	0 0 0 0 0	V76M7000P	V76M7100P	SET NON-CRITICAL CMD
0 1 0 0 0	0 1 1 1	X 0 0 0 0	0 0 0 0 0	V76M7019P	V76M7119P	RESET NON-CRITICAL CMD
0 1 0 0 0	0 0 0 0	X 0 0 0 0	0 0 0 Y Y	N/A	N/A	SET CRITICAL CMD
0 1 0 1 1	0 0 0 0	X 0 0 0 0	0 0 0 0 0	V76K7098B	V76K7198B	MASTER RESET (RESET CRIT) CMD

X = EITHER 1 OR 0
Y = FUNCTION OF THE NUMBER OF WORDS

MEC 1 CRITICAL COMMAND DATA WORDS

HEX DECODING LOGIC

HEX CODE	COMMAND DATA WORD 9 10 11 12	13 14 15 16	17 18 19 20	21 22 23 24	MSID	COMMAND DESCRIPTION
3EAC	0 0 1 1	1 1 1 0	1 0 1 0	1 1 0 0	V76K6951B	SRB IGNITION ARM
3E6A	0 0 1 1	1 1 1 0	0 1 1 0	1 0 1 0	V76K6953B	SRB IGNITION FIRE 1
3E42	0 0 1 1	1 1 1 0	0 1 0 0	0 0 1 0	V76K6954B	SRB IGNITION FIRE 2
3154	0 0 1 1	0 0 0 1	0 1 0 1	0 1 0 0	V76K6956B	SRB SEPARATION ARM
316A	0 0 1 1	0 0 0 1	0 1 1 0	1 0 1 0	V76K6958B	SRB SEPARATION FIRE 1
3198	0 0 1 1	0 0 0 1	1 0 0 1	1 0 1 1	V76K6959B	SRB SEPARATION FIRE 2
C121	1 1 0 0	0 0 0 1	0 0 1 0	0 0 0 1	V76K4617B	ET/UMB UNLATCH ARM
C162	1 1 0 0	0 0 0 1	0 1 1 0	0 0 1 0	V76K4619B	ET/UMB UNLATCH FIRE 1
C193	1 1 0 0	0 0 0 1	1 0 0 1	0 0 1 1	V76K4623B	ET/UMB UNLATCH FIRE 2
7463	0 1 1 1	0 1 0 0	0 1 1 0	0 0 1 1	V76K4655B	ET/UMB RETRACT FIRE 1
7498	0 1 1 1	0 1 0 0	1 0 0 1	1 0 0 0	V76K4656B	ET/UMB RETRACT FIRE 2
E117	1 1 1 0	0 0 0 1	0 0 1 1	0 1 1 1	V76K6909B	ET/ORB STRUCT SEP ARM
E168	1 1 1 0	0 0 0 1	0 1 1 0	1 0 0 0	V76K6913B	ET/ORB STRUCT SEP FIRE 1
E199	1 1 1 0	0 0 0 1	1 0 0 1	1 0 0 1	V76K6914B	ET/ORB STRUCT SEP FIRE 2
CEDC	1 1 0 0	1 1 1 0	1 1 0 1	1 1 0 0	V76K4609B	L T-O UMB RELEASE ARM
CE6A	1 1 0 0	1 1 1 0	0 1 1 0	1 0 1 0	V76K4610B	L T-O UMB RELEASE FIRE 1
CE9A	1 1 0 0	1 1 1 0	1 0 0 1	1 0 1 0	V76K4611B	L T-O UMB RELEASE FIRE 2
EBC2	1 1 1 0	1 0 1 1	1 1 0 0	0 0 1 0	V76K7504B	ET TUMBLE ARM
EB68	1 1 1 0	1 0 1 1	0 1 1 0	1 0 0 0	V76K7508B	L SRB RSS SAFE 1
EB95	1 1 1 0	1 0 1 1	1 0 0 1	0 1 0 1	V76K7509B	R SRB RSS SAFE 2
EC86	1 1 1 0	1 1 0 0	1 0 1 1	0 1 1 0	V76K7505B	ET TUMBLE FIRE
EC68	1 1 1 0	1 1 0 0	0 1 1 0	1 0 0 0	V76K7515B	ATVC 2 SRB 26V DEAD FACE
EC9D	1 1 1 0	1 1 0 0	1 0 0 1	1 1 0 1	V76K7516B	ATVC 4 SRB 26V DEAD FACE

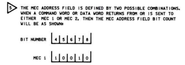
MEC 2 CRITICAL COMMAND DATA WORDS

HEX DECODING LOGIC

HEX CODE	COMMAND DATA WORD 9 10 11 12	13 14 15 16	17 18 19 20	21 22 23 24	MSID	COMMAND DESCRIPTION
3EAC	0 0 1 1	1 1 1 0	1 0 1 0	1 1 0 0	V76K6961B	SRB IGNITION ARM
3E6A	0 0 1 1	1 1 1 0	0 1 1 0	1 0 1 0	V76K6963B	SRB IGNITION FIRE 1
3E42	0 0 1 1	1 1 1 0	0 1 0 0	0 0 1 0	V76K6964B	SRB IGNITION FIRE 2
3154	0 0 1 1	0 0 0 1	0 1 0 1	0 1 0 0	V76K6966B	SRB SEPARATION ARM
316A	0 0 1 1	0 0 0 1	0 1 1 0	1 0 1 0	V76K6968B	SRB SEPARATION FIRE 1 & RECOVERY ON
3198	0 0 1 1	0 0 0 1	1 0 0 1	1 0 1 1	V76K6969B	SRB SEPARATION FIRE 2 & RECOVERY ARM
C121	1 1 0 0	0 0 0 1	0 0 1 0	0 0 0 1	V76K4618B	ET/UMB UNLATCH ARM
C162	1 1 0 0	0 0 0 1	0 1 1 0	0 0 1 0	V76K4620B	ET/UMB UNLATCH FIRE 1
C193	1 1 0 0	0 0 0 1	1 0 0 1	0 0 1 1	V76K4624B	ET/UMB UNLATCH FIRE 2
7463	0 1 1 1	0 1 0 0	0 1 1 0	0 0 1 1	V76K4659B	ET/UMB RETRACT FIRE 1
7498	0 1 1 1	0 1 0 0	1 0 0 1	1 0 0 0	V76K4660B	ET/UMB RETRACT FIRE 2
E117	1 1 1 0	0 0 0 1	0 0 1 1	0 1 1 1	V76K6911B	ET/ORB STRUCT SEP ARM
E168	1 1 1 0	0 0 0 1	0 1 1 0	1 0 0 0	V76K6915B	ET/ORB STRUCT SEP FIRE 1
E199	1 1 1 0	0 0 0 1	1 0 0 1	1 0 0 1	V76K6916B	ET/ORB STRUCT SEP FIRE 2
CEDC	1 1 0 0	1 1 1 0	1 1 0 1	1 1 0 0	V76K4613B	R T-O UMB RELEASE ARM
CE6A	1 1 0 0	1 1 1 0	0 1 1 0	1 0 1 0	V76K4614B	R T-O UMB RELEASE FIRE 1
CE9A	1 1 0 0	1 1 1 0	1 0 0 1	1 0 1 0	V76K4615B	R T-O UMB RELEASE FIRE 2
EBC2	1 1 1 0	1 0 1 1	1 1 0 0	0 0 1 0	V76K7604B	ET TUMBLE ARM
EB68	1 1 1 0	1 0 1 1	0 1 1 0	1 0 0 0	V76K7608B	R SRB RSS SAFE 1
EB95	1 1 1 0	1 0 1 1	1 0 0 1	0 1 0 1	V76K7609B	L SRB RSS SAFE 2
EC86	1 1 1 0	1 1 0 0	1 0 1 1	0 1 1 0	V76K7605B	ET TUMBLE FIRE
EC68	1 1 1 0	1 1 0 0	0 1 1 0	1 0 0 0	V76K7615B	ATVC 1 SRB 26V DEAD FACE
EC9D	1 1 1 0	1 1 0 0	1 0 0 1	1 1 0 1	V76K7616B	ATVC 3 SRB 26V DEAD FACE

▷ THE COMMAND SYNCHRONIZATION FIELD IS A THREE BIT TIME NON-VALID MANCHESTER SYNCHRONIZATION CODE, THUS, EACH WORD HAS A 3 MICROSECOND CODE, WITH THE FIRST 1 1/2 MICROSECONDS IN THE "1" OR "0" POSITION AND THE NEXT 1 1/2 MICROSECONDS IN THE "0" OR "OFF" POSITION

▷ THE MEC ADDRESS FIELD IS DEFINED BY TWO POSSIBLE COMBINATIONS. IF THE COMMAND WORD OR DATA WORD RETURNED FROM OR IS SENT TO EITHER MEC IS OF MEC 2, THEN THE MEC ADDRESS FIELD BIT COUNT WILL BE AS SHOWN



4. REFER TO TABLE 10.II FOR VENDOR DRAWING REFERENCES

▷ NOT EVERY COMMAND STRING WILL HAVE A RESPONSE DATA WORD. ALL RESPONSE DATA WORDS ARE USED ONLY FOR PRE-FLIGHT CHECKS AS RESPONSE DATA WORDS ARE TRANSFORMED DURING ACTUAL FLIGHT

▷ THE "ET DFI POWER ON" COMMANDS ARE NON-EXISTANT IN THE CURRENT MEC SOP. THEY MAY BE REINSTATED AT A LATER DATE

NOTE3▷ REFERENCE COMMAND MESSAGE OUTPUTS IN DRAWING 10.II MASTER EVENTS CONTROLLER OVERVIEW

1 MEC CMD TBL

SIGNATURE	DATE
DSGN: RICHARD A. GILLESPIE	8/29/87
CHK: RICHARD A. GILLESPIE	8/29/87
CHK: A.S. SHIFFLETT	11/30/90
CHK: [signature]	11/30/90
APP: [signature]	11/30/90
APP: [signature]	12-7-90

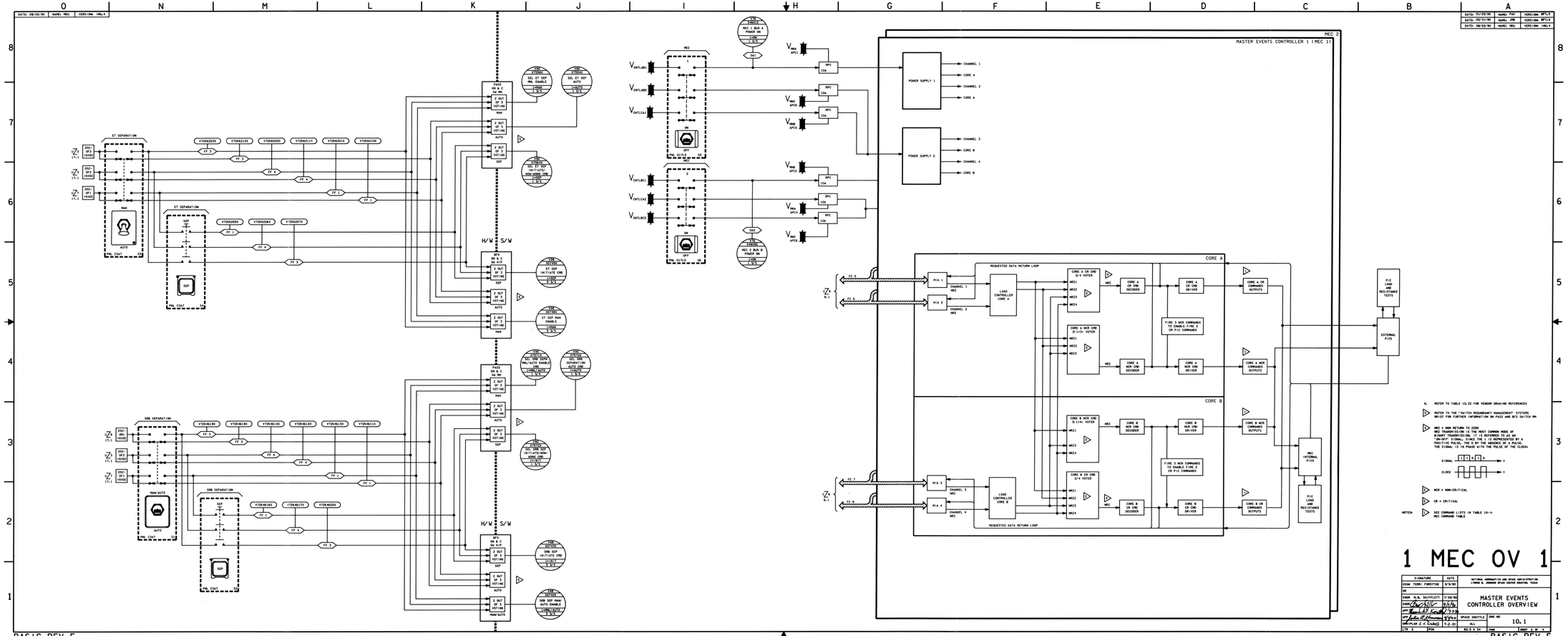
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS

MEC COMMAND TABLE
TABLE 10. I

SPACE SHUTTLE | DWG NO 10.1
ALL | REV
SCALE NONE | SHEET 1 OF 1

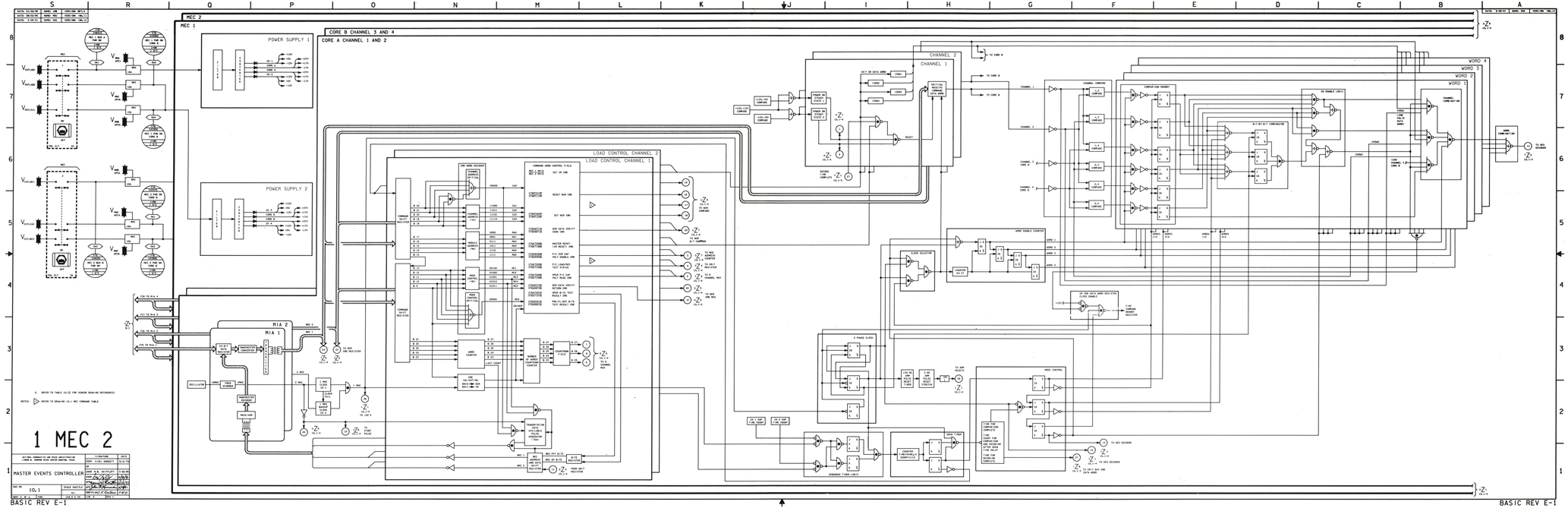
BASIC REV E

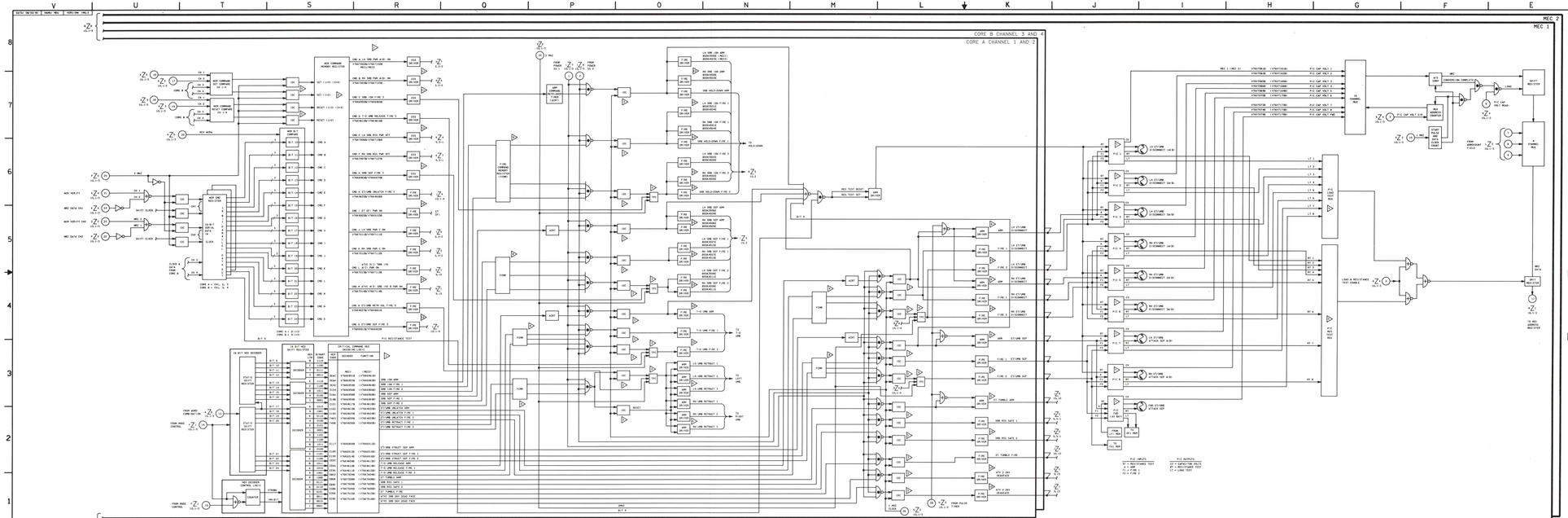
BASIC REV E

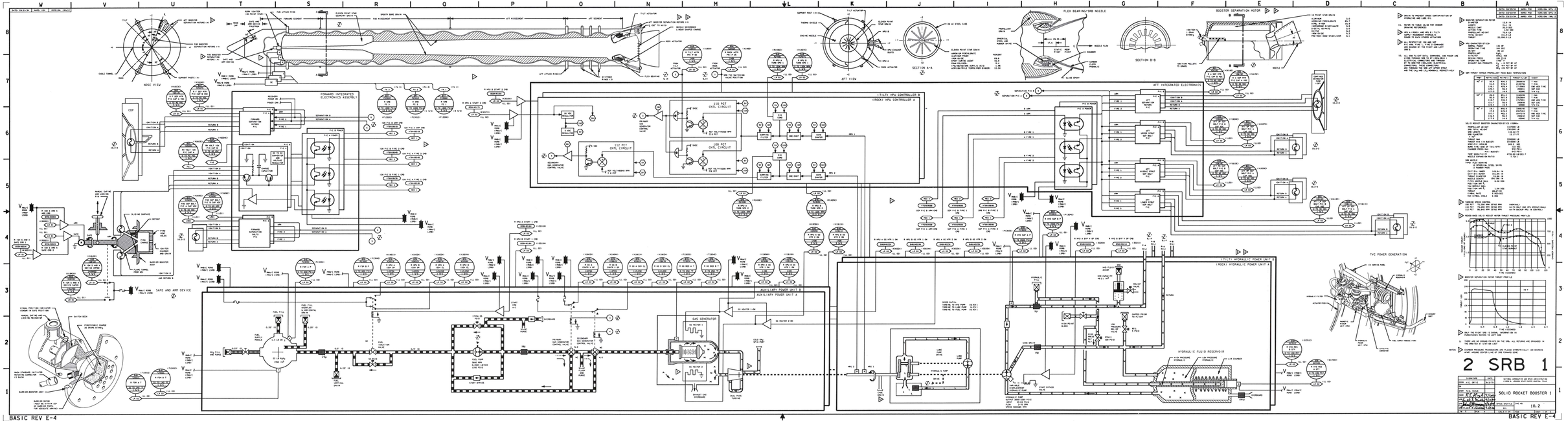


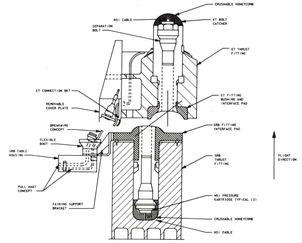
BASIC REV E

BASIC REV E

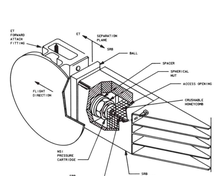

MEC 2
MEC 1
CORE B CHANNEL 3 AND 4
CORE A CHANNEL 1 AND 2
POWER SUPPLY 1
POWER SUPPLY 2
CHANNEL 2
CHANNEL 1
LOAD CONTROL CHANNEL 2
LOAD CONTROL CHANNEL 1
MIA 2
MIA 1
WORD 4
WORD 3
WORD 2
WORD 1
1 MEC 2
MASTER EVENTS CONTROLLER
BASIC REV E-1
BASIC REV E-1


MEC 2
MEC 1
CORE B CHANNEL 3 AND 4
CORE A CHANNEL 1 AND 2
MCR COMMAND MEMORY REGISTER
MCR COMMAND SET COMPARE REGISTER
MCR COMMAND RESET COMPARE REGISTER
MCR MCPA
MCR DMS REGISTER
MCR DMS REGISTER DATA
MCR XOR-FF1
MCR XOR-FF2
MEC DATA ONE
MEC DATA TWO
SHIFT CLOCK
CLOCK A DATA CORE A
CLOCK B DATA CORE B
CORE A = DCL 0, 2
CORE B = DCL 1, 3
16 BIT MCR SHIFT REGISTER
STATUS SHIFT REGISTER
16 BIT MCR DECODER
MCR COMMAND DECODE
FUNCTION
PCU RESISTANCE TEST
CRITICAL COMMAND MCR DECODE/DELAYS
FROM MCPA CONTROL
FROM MODE CONTROL
FROM CORE/MCR
FROM MODE CONTROL
MCR MCPA
MCR COMMAND MEMORY REGISTER
MCR DMS REGISTER
MCR COMMAND SET COMPARE
MCR COMMAND RESET COMPARE
MCR DMS REGISTER
MCR DMS REGISTER DATA
MCR COMMAND MEMORY REGISTER
MCR COMMAND SET COMPARE
MCR COMMAND RESET COMPARE
MCR MCPA

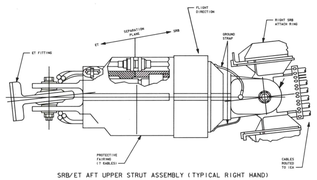

2 SRB 1
SOLID ROCKET BOOSTER 1
10.2
BASIC REV E-4
NOSE VIEW
FORWARD INTEGRATED ELECTRONICS ASSEMBLY
AFT INTEGRATED ELECTRONICS
(TILT) HPU CONTROLLER B
(ROCK) HPU CONTROLLER A
(TILT) HYDRAULIC POWER UNIT B
(ROCK) HYDRAULIC POWER UNIT A
AUXILIARY POWER UNIT B
AUXILIARY POWER UNIT A
SAFE AND ARM DEVICE
FLEX BEARING/SRB NOZZLE
BOOSTER SEPARATION MOTOR
TVC POWER GENERATION
HYDRAULIC FLUID RESERVOIR
GAS GENERATOR
SECTION A-A
SECTION B-B
AFT VIEW



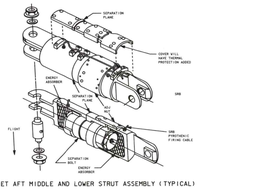
SRB/ET FWD ATTACH AND SEPARATION INTERFACES



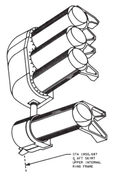
SRB/ET FWD ATTACH FITTING



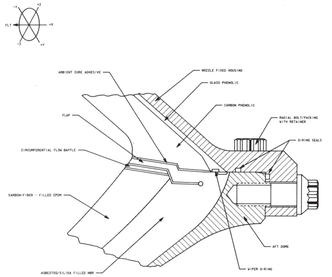
SRB/ET AFT UPPER STRUT ASSEMBLY (TYPICAL RIGHT HAND)



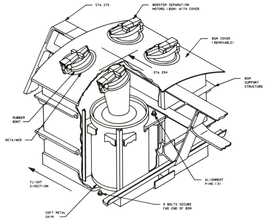
SRB/ET AFT MIDDLE AND LOWER STRUT ASSEMBLY (TYPICAL)



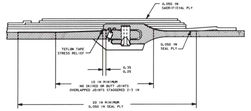
SRB AFT BOOSTER SEPARATION MOTORS (4)



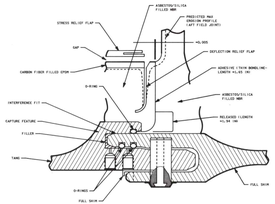
ASSEMBLED RSRM CASE TO NOZZLE JOINT -Z



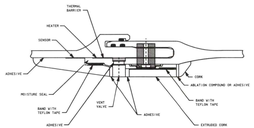
SRB FORWARD BOOSTER SEPARATION MOTORS (4)



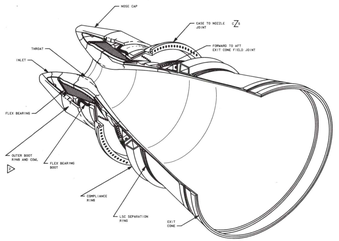
FACTORY JOINT (2)



FIELD JOINT (1)



FIELD JOINT PROTECTION SYSTEM (1)



NOZZLE

▷ ALL DATA/POWER/COMMANDS GO THROUGH THE AFT UMBILICAL ONLY

▷ THE CONAL IS VENTED TO ALLOW CONAL PRESSURE ACROSS THE FLEX/BLE BOOT

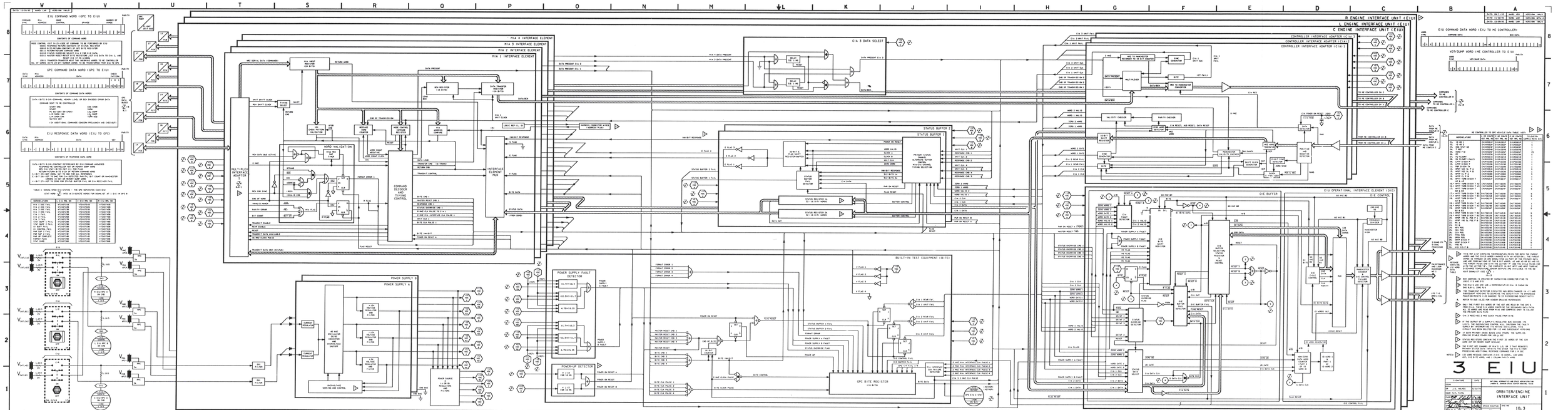
NOTES: ALL REFER TO TABLE 10-22 FOR VENDOR DRAWING REFERENCES

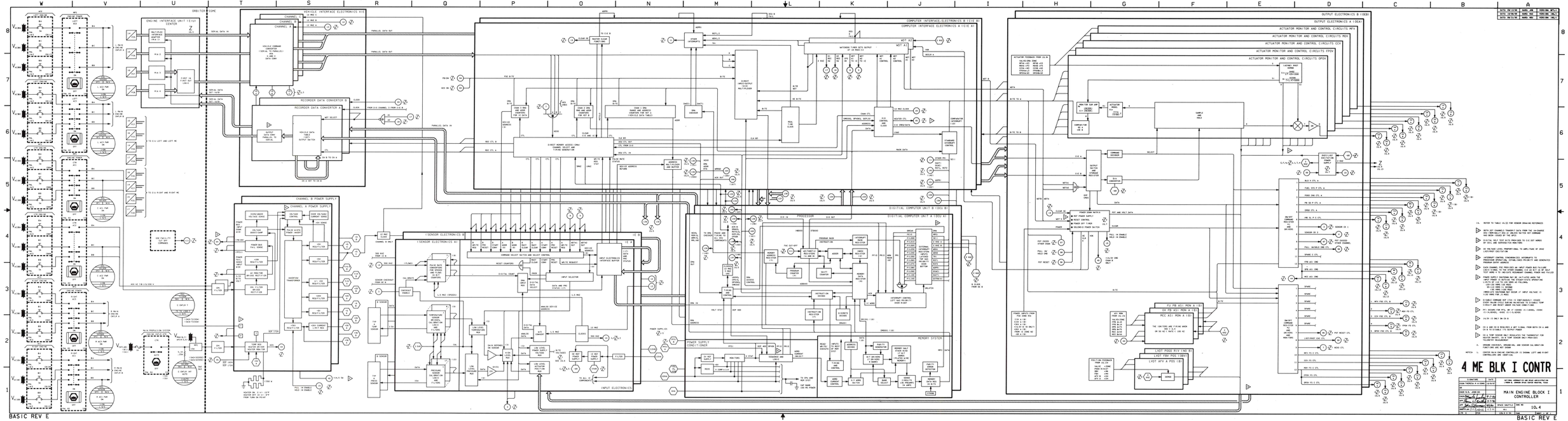
2 SRB 2

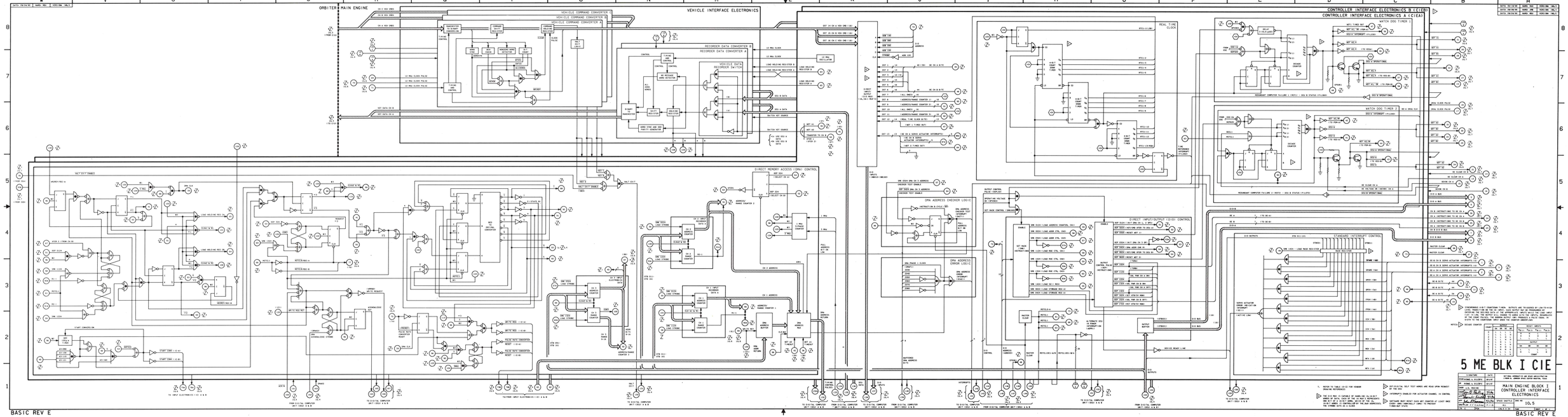
SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION MARSHALL SPACE FLIGHT CENTER, MARSHALL SPACE FLIGHT CENTER, ALABAMA
ORIG: G. A. RUSSELL	9/1/87	
APP: G. A. RUSSELL	9/1/87	
CHKD BY: HOLT		SOLID ROCKET BOOSTER 2
APP: [illegible]	9/10/87	
APP: [illegible]	10/6/87	
APP: [illegible]	10/6/87	SPACE SHUTTLE
APP: [illegible]	9/1	DWG NO 10.2
CM - 1	STSM	10A.5.1.14

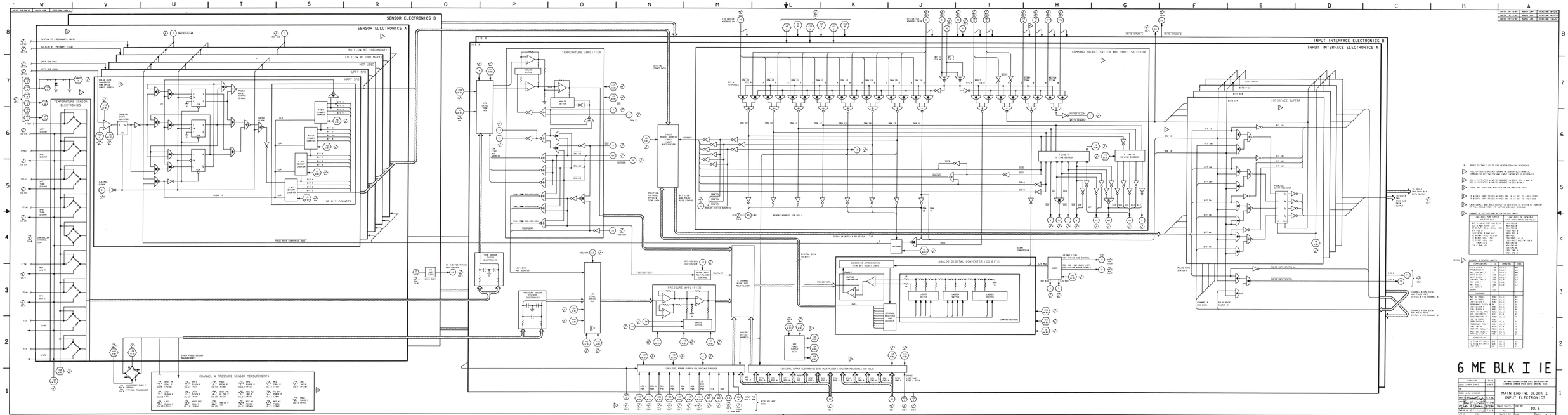
SHEET 1 OF 1

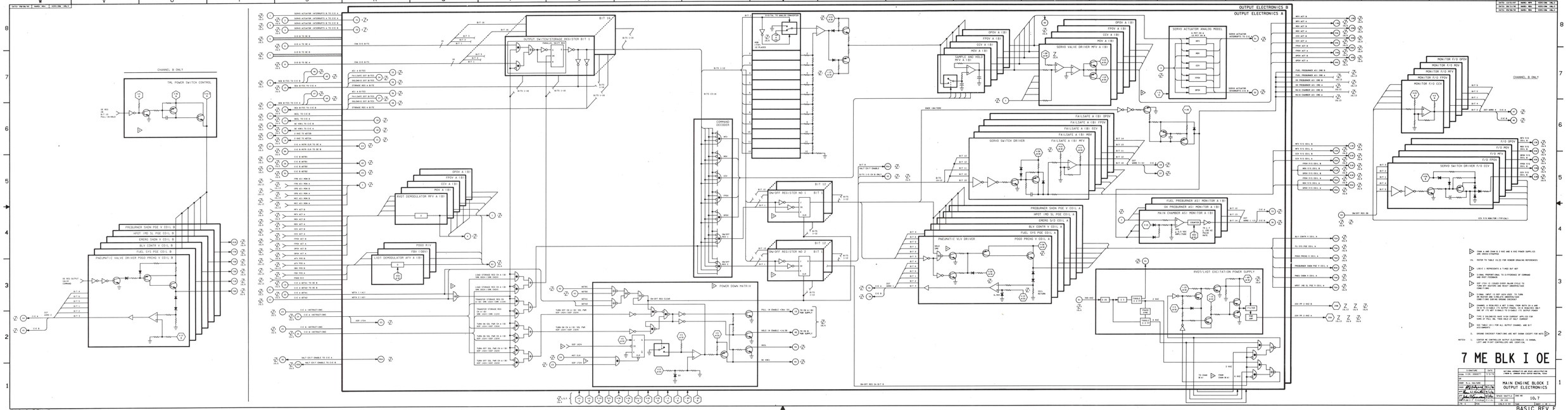
BASIC REV E

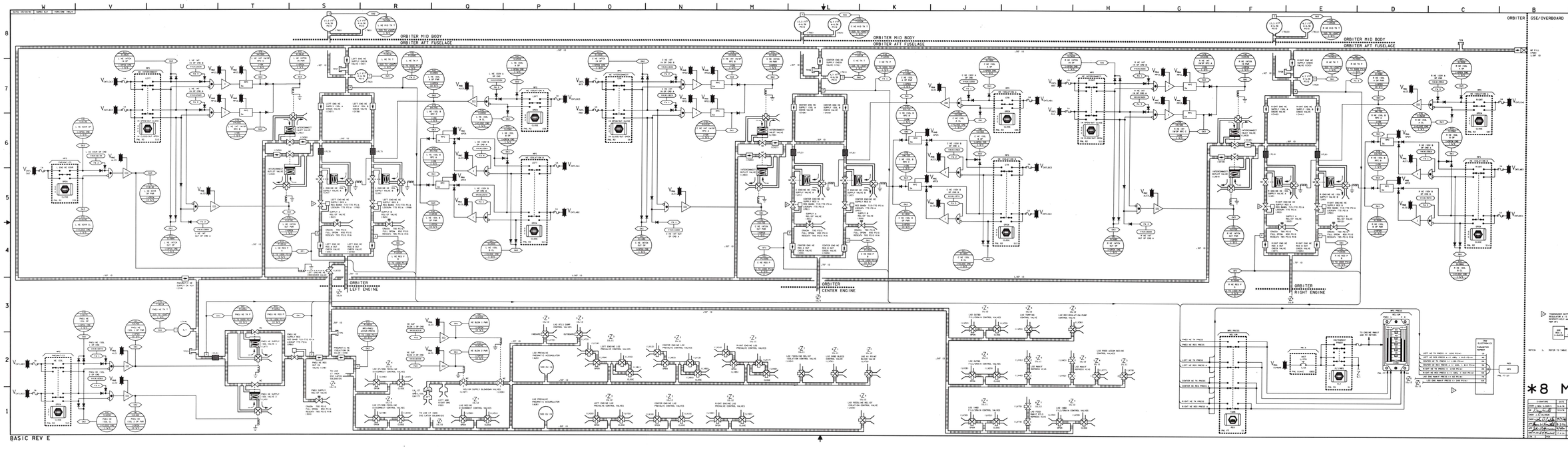

R ENGINE INTERFACE UNIT (EIU)
L ENGINE INTERFACE UNIT (EIU)
C ENGINE INTERFACE UNIT (EIU)
3 EIU
ORBITER/ENGINE INTERFACE UNIT
BASIC REV E-6
BASIC REV E-6

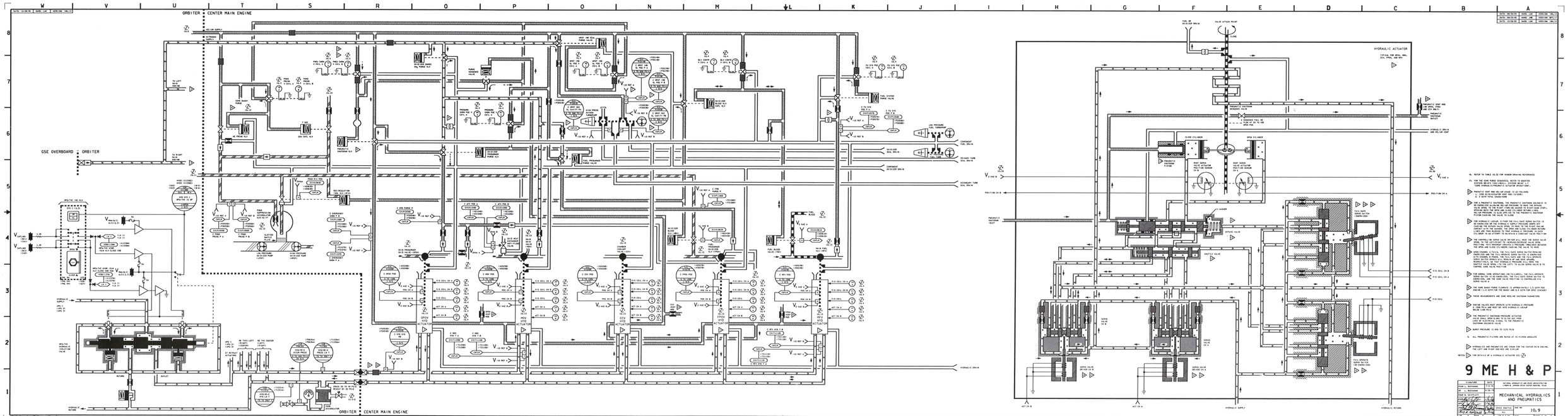

ORBITER SSME
ENGINE INTERFACE UNIT (EIU) CENTER
VEHICLE INTERFACE ELECTRONICS B15
CHANNEL A
CHANNEL B
RECORDER DATA CONVERTER A
RECORDER DATA CONVERTER B
COMPUTER INTERFACE ELECTRONICS B (CIEU B)
COMPUTER INTERFACE ELECTRONICS A (CIEU A)
DIGITAL COMPUTER UNIT B (DCU B)
DIGITAL COMPUTER UNIT A (DCU A)
PROCESSOR
MEMORY SYSTEM
I SENSOR ELECTRONICS B
I SENSOR ELECTRONICS A
INPUT ELECTRONICS
CHANNEL A POWER SUPPLY
POWER SUPPLY CIRCUITRY
OUTPUT ELECTRONICS B (OEB)
OUTPUT ELECTRONICS A (OEA)
ACTUATOR MONITOR AND CONTROL CIRCUITS MFV
ACTUATOR MONITOR AND CONTROL CIRCUITS MOV
ACTUATOR MONITOR AND CONTROL CIRCUITS OPOV
ACTUATOR MONITOR AND CONTROL CIRCUITS FPOV
MAIN ENGINE BLOCK I CONTROLLER
4 ME BLK I CONTR
BASIC REV E
BASIC REV E

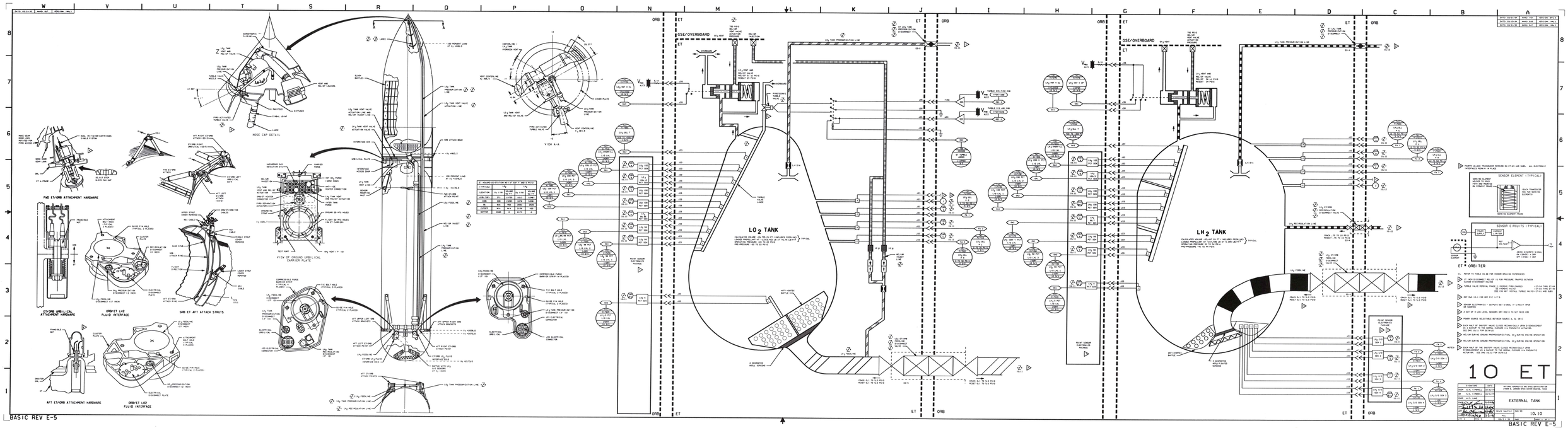

ORBITER MAIN ENGINE
VEHICLE INTERFACE ELECTRONICS
CONTROLLER INTERFACE ELECTRONICS B (CIEB)
CONTROLLER INTERFACE ELECTRONICS A (CIEA)
VEHICLE COMMAND CONVERTER C
VEHICLE COMMAND CONVERTER B
VEHICLE COMMAND CONVERTER A
RECORDER DATA CONVERTER B
RECORDER DATA CONVERTER A
VEHICLE DATA RECORDER (WITCH)
REAL TIME CLOCK
WATCH DOG TIMER 1
WATCH DOG TIMER 2
DIRECT MEMORY ACCESS (DMA) CONTROL
DMA ADDRESS CHECKER LOGIC
DMA ADDRESS ERROR LOGIC
DIRECT INPUT/OUTPUT (DIO) CONTROL
STANDARD INTERRUPT CONTROL
DIO INPUTS
DIO OUTPUTS
5 ME BLK I CIE
MAIN ENGINE BLOCK I CONTROLLER INTERFACE ELECTRONICS
BASIC REV E
BASIC REV E

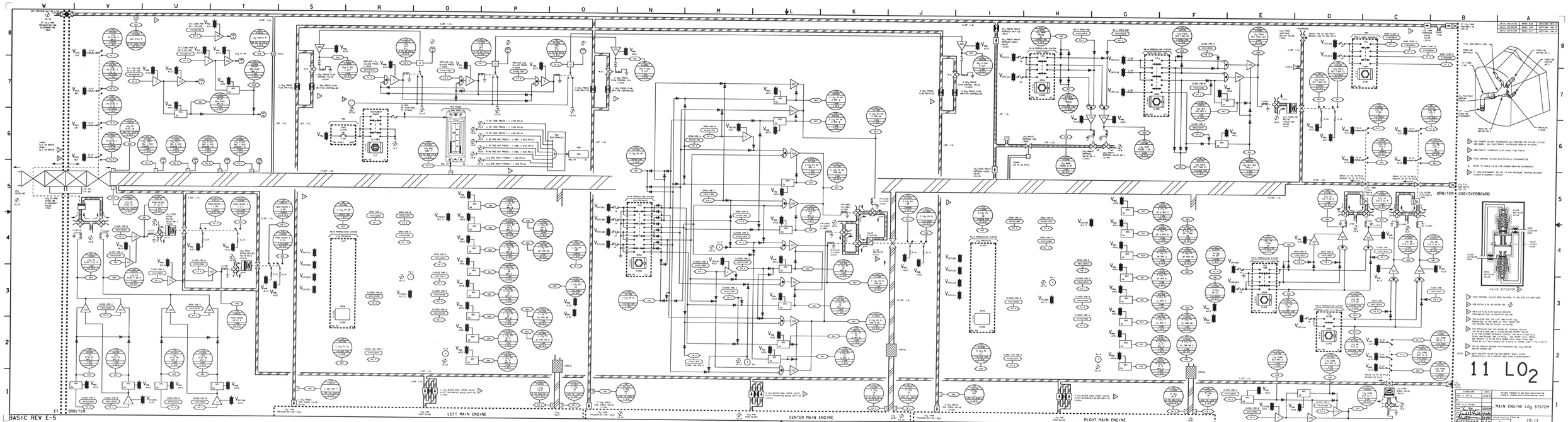

SENSOR ELECTRONICS B
SENSOR ELECTRONICS A
INPUT INTERFACE ELECTRONICS B
INPUT INTERFACE ELECTRONICS A
TEMPERATURE SENSOR ELECTRONICS
TEMPERATURE AMPLIFIER
PRESSURE AMPLIFIER
PRESSURE SENSOR ELECTRONICS
TEMP SENSOR FLOW ELECTRONICS
COMMAND SELECT SWITCH AND INPUT SELECTOR
INTERFACE BUFFER
ANALOG DIGITAL CONVERTER (10 BITS)
16 BIT COUNTER
PULSE RATE CONVERTER
CHANNEL A PRESSURE SENSOR MEASUREMENTS
6 ME BLK I IE
MAIN ENGINE BLOCK I
INPUT ELECTRONICS
BASIC REV E

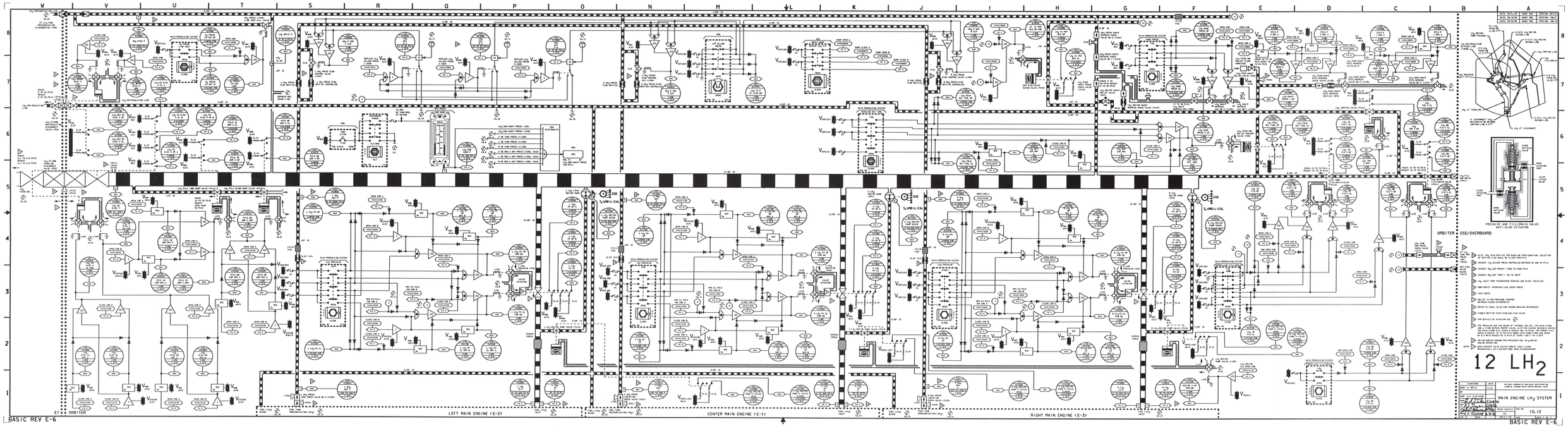

OUTPUT ELECTRONICS B
OUTPUT ELECTRONICS A
CHANNEL B ONLY
TML POWER SWITCH CONTROL
PREBURNER SHDN PDE V COIL B
MPOT (MD SL PDE COIL B
CMDRU SHDN V COIL B
BLK CONTR V COIL B
FUEL SYS PDE COIL B
PNEUMATIC VALVE DRIVER PODD PROHB V COIL B
PODD RLY
FBV LOOKY
LVDT DEMODULATOR MFV A (B)
PIVOT DEMODULATOR MFV A (B)
SAMPLE AND HOLD
SERVO VALVE DRIVER MFV A (B)
SERVO ACTUATOR ANALOG MODEL
SERVO SWITCH DRIVER
FAILSAFE A (B) MFV
FAILSAFE A (B) CCV
FAILSAFE A (B) FPOV
FAILSAFE A (B) OPOV
PNEUMATIC VLV DRIVER
FUEL PREBURNER ASI MONITOR A (B)
OX PREBURNER ASI MONITOR A (B)
MAIN CHAMBER ASI MONITOR A (B)
RVDT/LVDT EXCITATION POWER SUPPLY
COMMAND DECODER
POWER DOWN MATRIX
ON/OFF REGISTER NO 1
ON/OFF REGISTER NO 2
OUTPUT SWITCH/STORAGE REGISTER BIT 1
DIGITAL TO ANALOG CONVERTER
MONITOR F/O OPOV
MONITOR F/O MFV
MONITOR F/O FPOV
MONITOR F/O CCV
F/O OPOV
F/O MFV
F/O FPOV
F/O CCV
SERVO SWITCH DRIVER F/O CCV
7 ME BLK I OE
MAIN ENGINE BLOCK I
OUTPUT ELECTRONICS
BASIC REV E
BASIC REV E

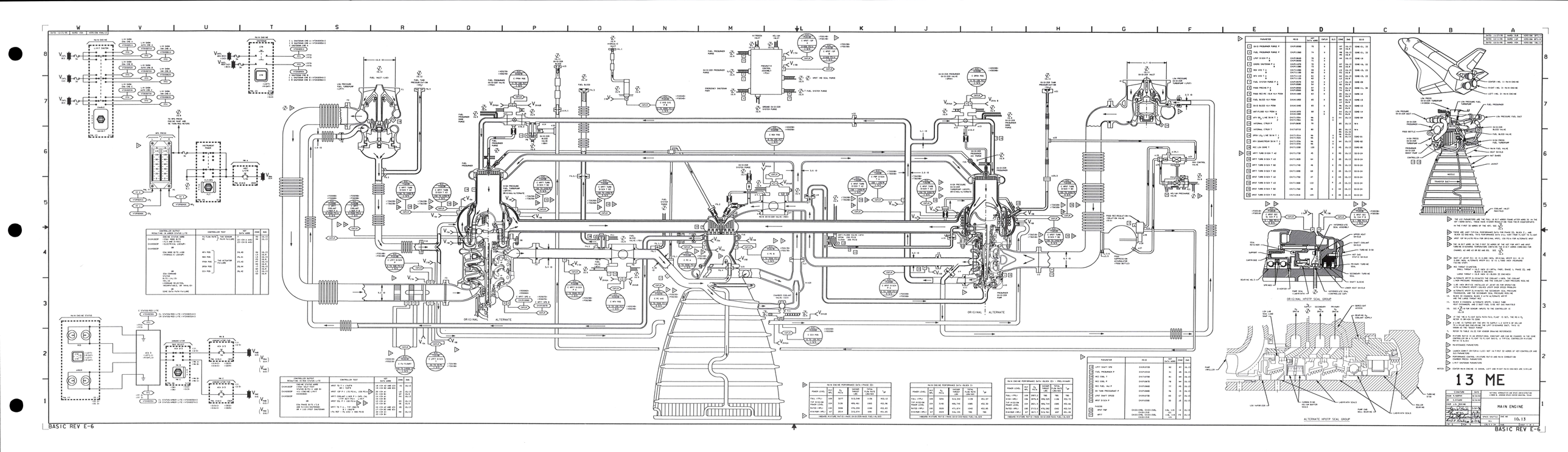

ORBITER MID BODY
ORBITER AFT FUSELAGE
ORBITER LEFT ENGINE
ORBITER CENTER ENGINE
ORBITER RIGHT ENGINE
ORBITER GSE/OVERBOARD
*8 MPS HE
MPS HELIUM SUPPLY
10.8
BASIC REV E


ORBITER
CENTER MAIN ENGINE
GSE OVERBOARD
ORBITER
CENTER MAIN ENGINE
HYDRAULIC ACTUATOR
TYPICAL FOR SPOOL VALVE, COIL DRAIN, AND MLV
9 ME H & P
MECHANICAL HYDRAULICS AND PNEUMATICS
SPACE SHUTTLE
10.9
BASIC REV E-6
BASIC REV E-6

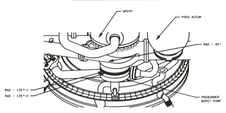

NOSE CAP DETAIL
VIEW A-A
VIEW OF GROUND UMBILICAL CARRIER PLATE
FWD ET/ORB ATTACHMENT HARDWARE
ET/ORB UMBILICAL ATTACHMENT HARDWARE
ORB/ET LH2 FLUID INTERFACE
SRB ET AFT ATTACH STRUTS
AFT ET/ORB ATTACHMENT HARDWARE
ORB/ET LO2 FLUID INTERFACE
LO2 TANK
LH2 TANK
GSE/OVERBOARD
ET ORBITER
10 ET
EXTERNAL TANK
BASIC REV E-5

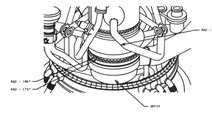

11 LO2
MAIN ENGINE LO2 SYSTEM
ORBITER
GSE/OVERBOARD
LEFT MAIN ENGINE
CENTER MAIN ENGINE
RIGHT MAIN ENGINE
VALVE ACTUATOR
BASIC REV E-5
10.11


12 LH2
MAIN ENGINE LH2 SYSTEM
ORBITER
GSE/OVERBOARD
LEFT MAIN ENGINE (E-2)
CENTER MAIN ENGINE (E-1)
RIGHT MAIN ENGINE (E-3)
PRESAVE AND FILL/DRAIN VALVE ANTI-SLAM ACTUATOR
BASIC REV E-6


MAIN ENGINE
13 ME
BASIC REV E-6
ORIGINAL
ALTERNATE
ORIGINAL HPOTP SEAL GROUP
ALTERNATE HPOTP SEAL GROUP
LEFT MAIN ENGINE
RIGHT MAIN ENGINE
MAIN ENGINE STATUS
MAIN ENGINE PERFORMANCE DATA (PHASE III)
MAIN ENGINE PERFORMANCE DATA (BLOCK II)
MAIN ENGINE PERFORMANCE DATA (BLOCK II) - PRELIMINARY
MAIN ENGINE PERFORMANCE DATA (BLOCK II) (DEEP THROTTLE)
CONTROLLER OUTPUT INSTALLATION 14 RSS STATUS LITE
CONTROLLER TEST
CONTROLLER OUTPUT INSTALLATION LITE
CONTROLLER TEST
ENGINE STATUS WORD
ENGINE STATUS BITS 17 AND 30
ENGINE SHUTDOWN LIMIT EXCEEDED
ETM PHASE BITS 17,18
AND 31=ECO SWITCHING
OR = ESS CPOST SWITCHING
MPS PRESS
FUEL INLET (LH2)
FUEL TURBOPUMP
LOW PRESSURE FUEL TURBOPUMP (LPFTP)
HIGH PRESSURE FUEL TURBOPUMP (HPFTP)
HIGH PRESSURE OXIDIZER TURBOPUMP (HPOTP)
LOW PRESSURE OXIDIZER TURBOPUMP (LPOTP)
FUEL PREBURNER
OXIDIZER PREBURNER
MAIN COMBUSTION CHAMBER
NOZZLE
FUEL PUMP INTERMEDIATE SEAL DRAIN
OXIDIZER PUMP INTERMEDIATE SEAL DRAIN
FUEL PUMP SECONDARY SEAL PURGE
OXIDIZER PUMP SECONDARY SEAL PURGE
FUEL PUMP SECONDARY SEAL PRESSURE
OXIDIZER PUMP SECONDARY SEAL PRESSURE
FUEL PUMP INTERNAL CAVITY PURGE
OXIDIZER PUMP INTERNAL CAVITY PURGE
FUEL PUMP SECONDARY GASEOUS HELIUM PURGE
OXIDIZER PUMP SECONDARY GASEOUS HELIUM PURGE
FUEL PUMP SECONDARY GASEOUS NITROGEN PURGE
OXIDIZER PUMP SECONDARY GASEOUS NITROGEN PURGE
FUEL PUMP INTERNAL CAVITY GASEOUS HELIUM PURGE
OXIDIZER PUMP INTERNAL CAVITY GASEOUS HELIUM PURGE
FUEL PUMP INTERNAL CAVITY GASEOUS NITROGEN PURGE
OXIDIZER PUMP INTERNAL CAVITY GASEOUS NITROGEN PURGE
FUEL PUMP SECONDARY GASEOUS HELIUM PURGE
OXIDIZER PUMP SECONDARY GASEOUS HELIUM PURGE
FUEL PUMP SECONDARY GASEOUS NITROGEN PURGE
OXIDIZER PUMP SECONDARY GASEOUS NITROGEN PURGE
FUEL PUMP INTERNAL CAVITY GASEOUS HELIUM PURGE
OXIDIZER PUMP INTERNAL CAVITY GASEOUS HELIUM PURGE
FUEL PUMP INTERNAL CAVITY GASEOUS NITROGEN PURGE
OXIDIZER PUMP INTERNAL CAVITY GASEOUS NITROGEN PURGE
MAIN COMBUSTION CHAMBER
NOZZLE
FUEL PREBURNER
OXIDIZER PREBURNER
MAIN INJECTOR

FASCOS ACCELEROMETER LOCATIONS





ORBITER CENTER ME FASCOS

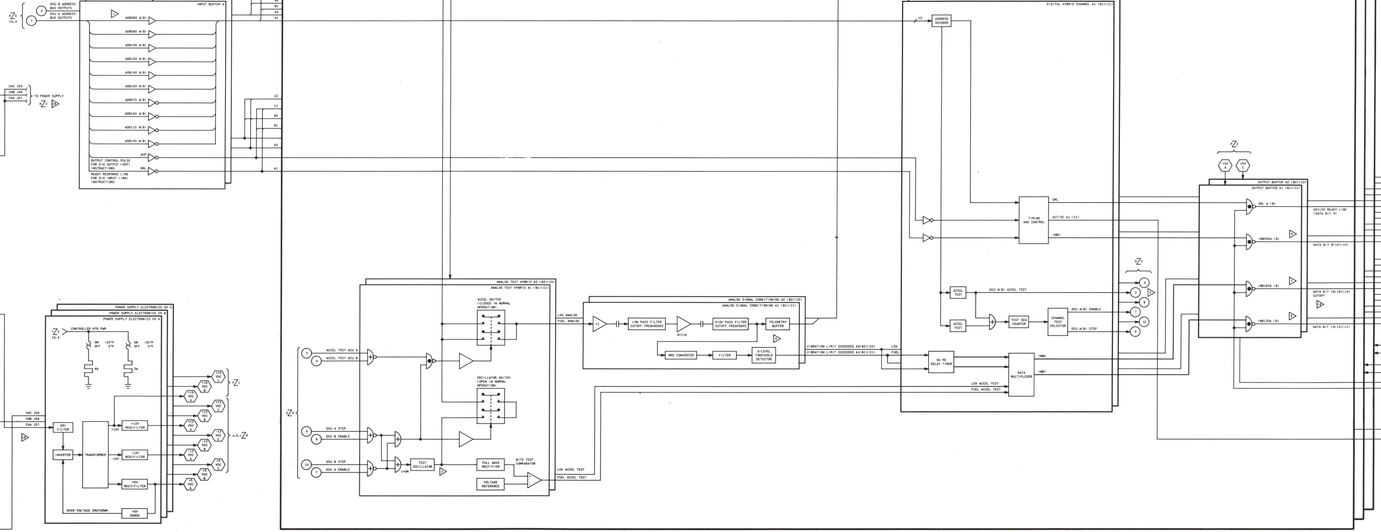
CENTER SSME (1,Y,R)

OV-102, OV-103

FASCOS POWER SUPPLY

NOTE: ONE OF EACH PAIR BECOMES AN ACTIVE REDS MC, AT LIFT-OFF IF OV-103, ALL BE INACTIVE TO THE OV-104, OV-105 CONFIGURATION

OV-104 , OV-105



INTERFACE CONTROL AND RESPONSE CODES																	
CARD NAME	DESCRIPTION	STATUS CODE (-HAB 2001)															DESCRIPTION
		D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	
1HA * 2001	READ CO, BI, AI STATUS	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	ACCEL STATUS CO, BO, AO
1HA * 2002	READ CO, BI, AI STATUS	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	ACCEL STATUS CO, BO, AO
2UP * 2001	CLEAR TEST SEQUENCE	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	CLEAR STATE
2UP * 2012	INITIATE BITE TEST	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	BITE TEST STEP 0 (ALL FAILS)
2UP * 2013	INCREMENT BITE TEST	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	BITE TEST STEP A, CH A2 TEST
2UP * 2013	INCREMENT BITE TEST	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	BITE TEST STEP B, CH B2 TEST
2UP * 2013	INCREMENT BITE TEST	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	BITE TEST STEP A, CH A1 TEST
2UP * 2013	INCREMENT BITE TEST	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	BITE TEST STEP B, CH B1 TEST
2UP * 2013	INCREMENT BITE TEST	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	BITE TEST STEP A, CH C1 TEST
2UP * 2013	INCREMENT BITE TEST	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	BITE TEST STEP B, CH C1 TEST
2UP * 2002	CLEAR TEST SEQUENCE	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	CLEAR STATE
2UP * 2045	INITIATE ACCEL TEST	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	ACCEL TEST STEP 0 (ALL FAILS)
2UP * 2046	INCREMENT ACCEL TEST	0	1	0	0	1	1	-	-	0	0	0	0	0	0	0	0	ACCEL TEST STEP A, ACCEL A2 TEST
2UP * 2046	INCREMENT ACCEL TEST	0	1	0	1	0	1	-	-	0	0	0	0	0	0	0	0	ACCEL TEST STEP B, ACCEL B2 TEST
2UP * 2046	INCREMENT ACCEL TEST	0	1	0	1	1	1	-	-	0	0	0	0	0	0	0	0	ACCEL TEST STEP A, ACCEL A1 TEST
2UP * 2046	INCREMENT ACCEL TEST	1	0	0	1	0	1	-	-	0	0	0	0	0	0	0	0	ACCEL TEST STEP B, ACCEL B1 TEST
2UP * 2046	INCREMENT ACCEL TEST	1	0	0	1	1	1	-	-	0	0	0	0	0	0	0	0	ACCEL TEST STEP A, ACCEL C1 TEST
2UP * 2046	INCREMENT ACCEL TEST	1	0	1	1	0	1	-	-	0	0	0	0	0	0	0	0	ACCEL TEST STEP B, ACCEL C1 TEST

- FASCOS CABLES TO CONTROLLER ARE NOT CONNECTED IN FLIGHT
- TWO POWER SUPPLY CONFIGURATIONS, 2 FOR OV-104, FOR OV-102 AND OV-105, SEE "C" & "A"
- REFER TO TABLE III.II FOR VENDOR DRAWING REFERENCES
- POWER FAILURE COMPARATOR TRIP LEVEL SET TO 4.6V TO ENSURE STABLE/NO OUTPUT BUFFERS
- ACCEL LOCATION, PACS TO MCO (-Y, +Z, +Y)

AFT (A1)		FWD (A2)	
AFT (A1)		FWD (A2)	
1		1	
AFT (A1)		FWD (A2)	
2		2	
AFT (A1)		FWD (A2)	
3		3	

- ACCEL STATUS (HA =ACCEL OR CAL) EQUAL TO 1 =BI/ACCEL TO P (+Z) ACCEL TEST STEP A, =BO/ACCEL TO P (+Z) ACCEL TEST STEP B, =CO/ACCEL TO P (+Z) ACCEL TEST STEP C, =AI/ACCEL TO M (-Y) ACCEL TEST STEP D
- CMD BITS 2001 AND 2002 ARE 1,0 FOR OV-1 ECO MODE (-HA 1200) AND 0,1 FOR OV-2 ECO MODE (-HA 1201) FOLLOWING MAY STOPS (-HAP 1001) OR ABT (2001)
- CMD BITS 2001 AND 2002 ARE 1,1 FOR OV-3 ECO MODE (-HA 1202) AND 0,0 FOR OV-4 ECO MODE (-HA 1203) FOLLOWING MAY STOPS (-2001)
- A SOFTWARE DELAY OF 20 MSEC IS ALLOWED FOLLOWING BOP (-HA) BEFORE READING THE DIO INPUT BUS STATUS
- A SOFTWARE DELAY OF 200 MSEC IS ALLOWED FOLLOWING BOP (-2011) BEFORE READING THE DIO INPUT BUS STATUS
- CHANNEL CODE FORMS TWO BIT CODE IN -HA (MSB/LSB FOR RESULTS INDICATED (0 = OFF, 1 = ON)
  - 0,0 STATUS
  - 0,1 STATUS
  - 1,0 STATUS
  - 1,1 STATUS
- STATE STATUS (DATA BITS 13,14 AND 15) IS A 3 BIT CODE FOR-MED TO TELL STEP NUMBER
  - ACCEL TEST STEP NUMBER
  - NORMAL OPERATION = ALL 0'S
- OUTPUT DATA (-102)
  - BITS 102 (0), 48 (1) =
  - ACCEL TEST (A) = BR 14.0
  - =INDICTOR (-IN) = MAINTAIN ON 0 OR ON 2
- CENTER ME FASCOS (1) SHOWN; LEFT AND RIGHT FASCOS ARE IDENTICAL
- ACCEL SELECT OUTPUTS TURN ON ACCEL SWITCH AND ENABLE BITE TESTS FOR INDIVIDUAL CONTROL AND MONITORING CIRCUITS
- COMPARATOR REFERENCE VOLTAGE SET FOR TRIP LEVEL IN SPMS FOR APTP AND 1% MRG FOR MPTP
- OSCILLATOR OUTPUT SYNC'S/ISOLATES F/BIRATTAN FOR FREQ/ANCH SIGNAL CONDITIONING SELF TEST
- 305-0703
- NOTES: D/O ADDRESS BUS OUTPUTS DESIGNATED PER HONEYWELL DIAGRAM NO. PART 1

14 M BLK I FASCOS

SIGNATURE	DATE
DSNE R.A. TUCKER JR.	10-14-83
DM	
CHIEF R.A. SNIDER	
CHIEF Randy Bye	10-19-83
CHIEF Richard Bennett	10-19-83
CHIEF Richard Bennett	10-19-83
DM	

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

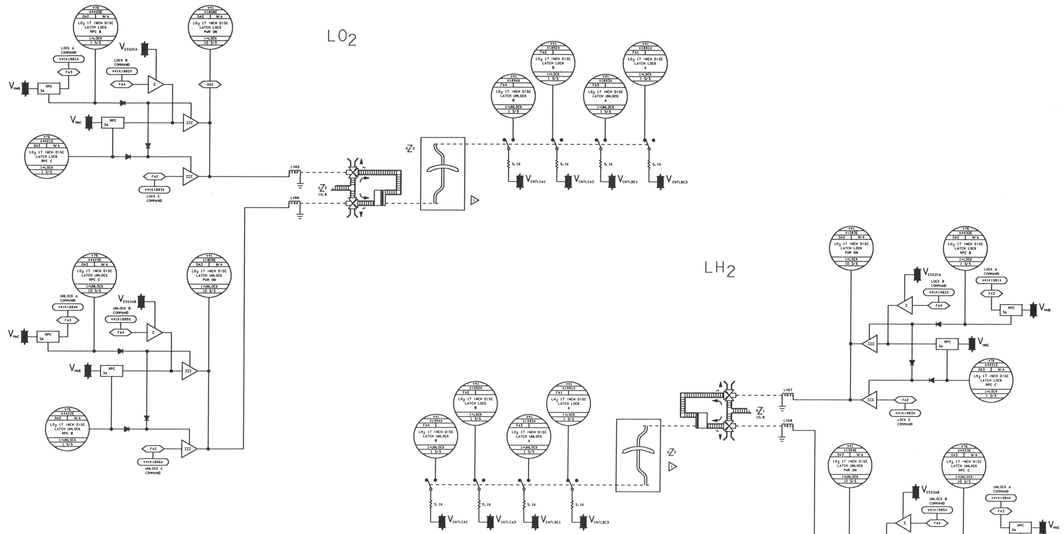
MAIN ENGINE BLOCK I
FLIGHT ACCELEROMETER
SAFETY CUTOFF SYSTEM

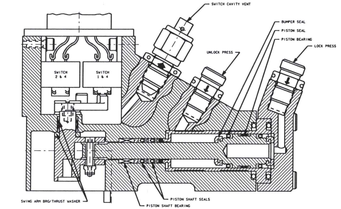
SPACE SHUTTLE DWG NO. 10,14

SIZE	CODE IDENT NO.	REV
D	1	

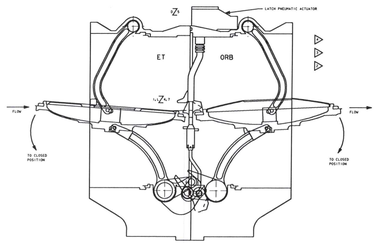
SCALE NONE SHEET 1 OF 1

BASIC REV E-1





17-INCH DISCONNECT LATCH ACTUATOR ASSEMBLY ▷



DISCONNECT LATCH

1. REFER TO TABLE 15.2.2 FOR VENDOR DRAWING REFERENCES

▷ LO2 ET DISCONNECT VALVE SHOWN, LH2 ET DISCONNECT VALVE HAS AN ELECTRICAL SHIM SIMILAR TO THE LO2 MBS/ISR DISCONNECT VALVE

▷ TYPICAL FOR LO2 AND LH2 17 INCH DISCONNECT LATCH

▷ PRELAUNCH OPERATION
- LATCH MICRO-NO IN THE UNLATCHED/UNLOCKED POSITION AND THE LOCKED MICRO-NC IN THE UNLOCKED POSITION FOR ALL LATCHES AND LOCKS. THE ONLY TIME THE 17" DISCONNECT IS UNLOCKED AND THE LATCH LOCKED IS ON AN AS NEEDED BASIS FOR TESTING AND JUST PRIOR TO LOADING (T&P SPC-41198).

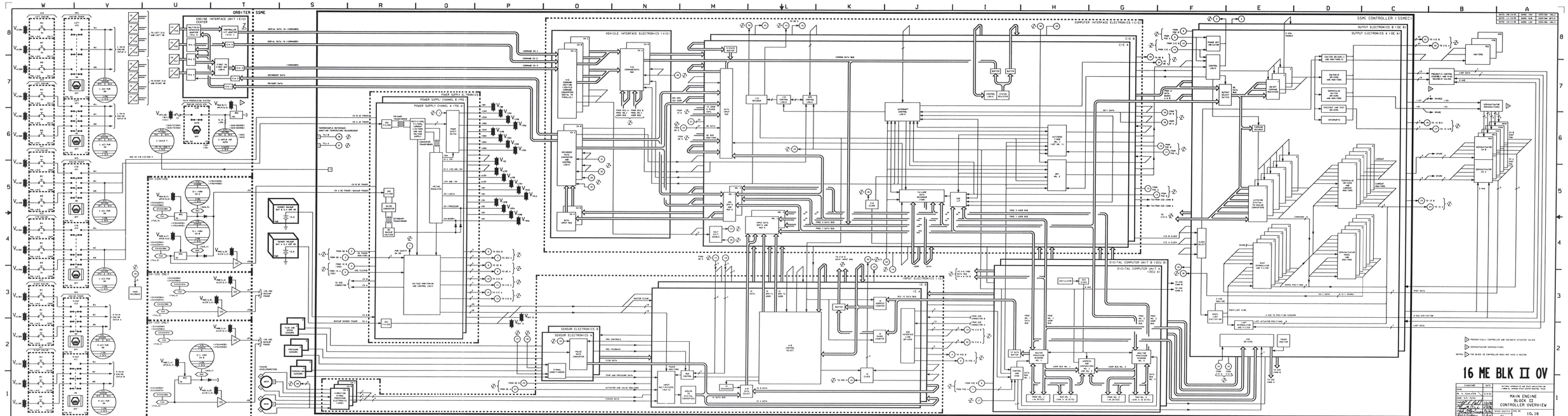
▷ ASCENT OPERATION
- LATCH MICRO-NO IN LATCHED POSITION FROM T-0 TO ET SEPARATION

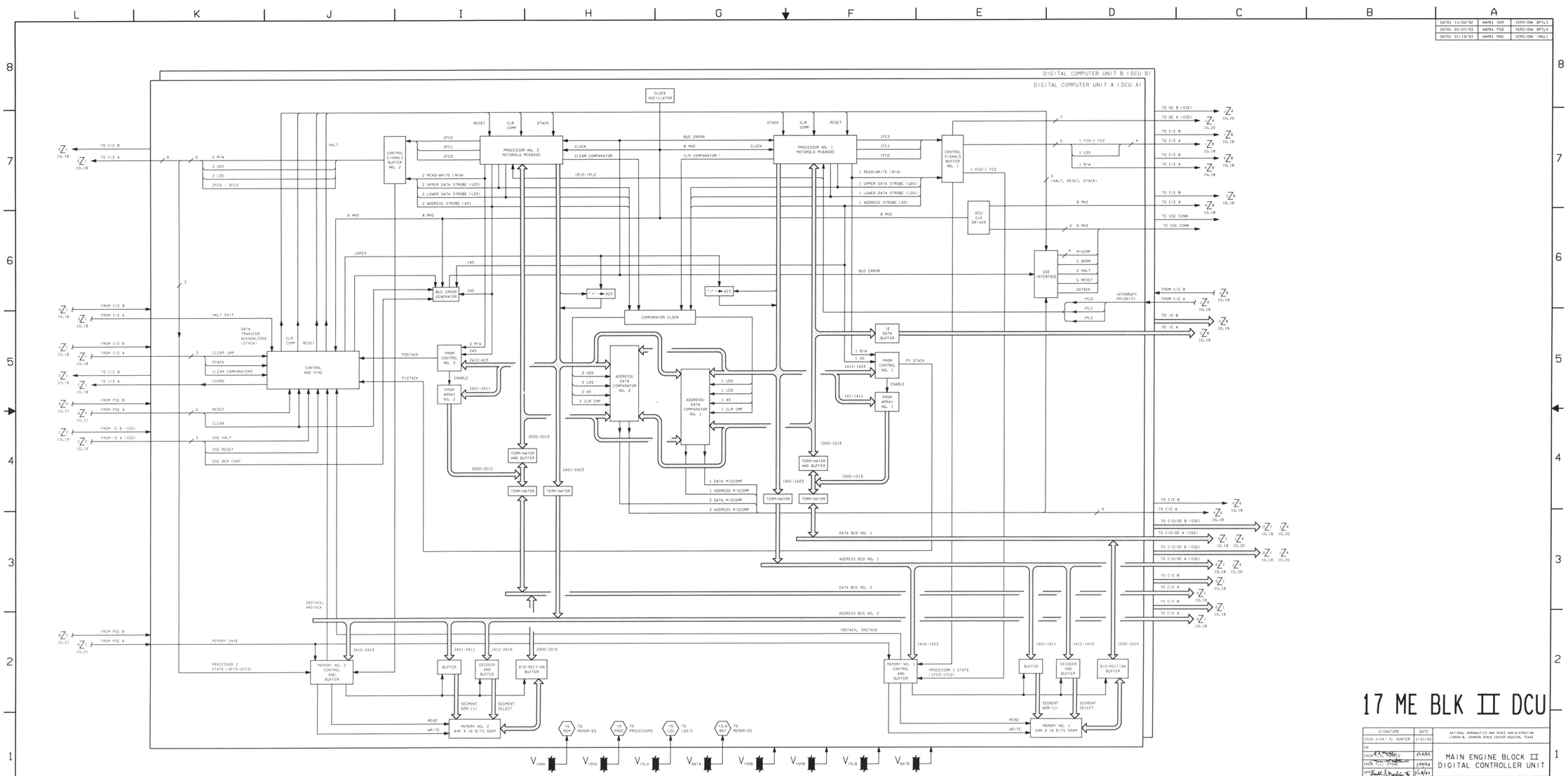
REFER ▷ LATCH TO HELIUM 17 INCH DISCONNECT VALVE BODY, FOR DETAILS, SEE 10.0-15-01 DRAWING AT BOTTOM OF SHEET

15 DISC LAT

SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR		
CHKR N.K. PATHELA		LO2 AND LH2 17-INCH DISCONNECT LATCH
CHKR		
CHKR		
APPR		
APPR		
CHF E		SPACE SHUTTLE DWG NO 10.15
MGR		REV
		SCALE NONE SHEET 1 OF 1

BASIC REV E-6


ORBITER SSME
ENGINE INTERFACE UNIT (EIU) CENTER
VEHICLE INTERFACE ELECTRONICS (VIE)
COMPUTER INTERFACE ELECTRONICS (CIE)
SSME CONTROLLER (SSMEC)
POWER SUPPLY CHANNEL A (PSC A)
POWER SUPPLY CHANNEL B (PSC B)
SENSOR ELECTRONICS A
SENSOR ELECTRONICS B
DIGITAL COMPUTER UNIT A (DCU A)
DIGITAL COMPUTER UNIT B (DCU B)
OUTPUT ELECTRONICS A (OE A)
OUTPUT ELECTRONICS B (OE B)
MAIN ENGINE CONTROLLER OVERVIEW
16 ME BLK II OV
BASIC REV E-6
BASIC REV E-6

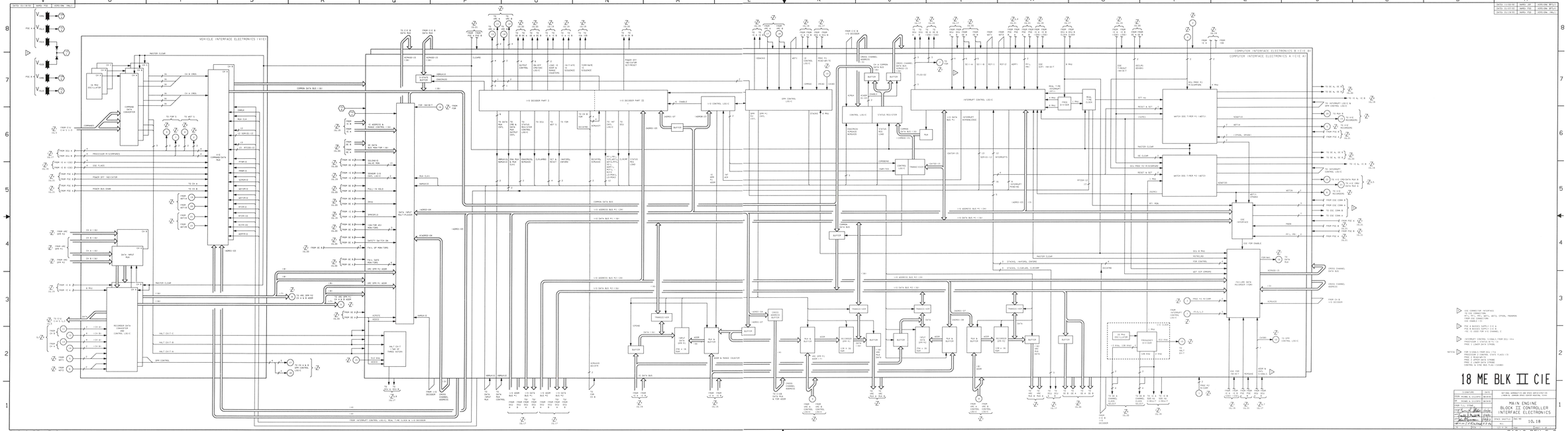


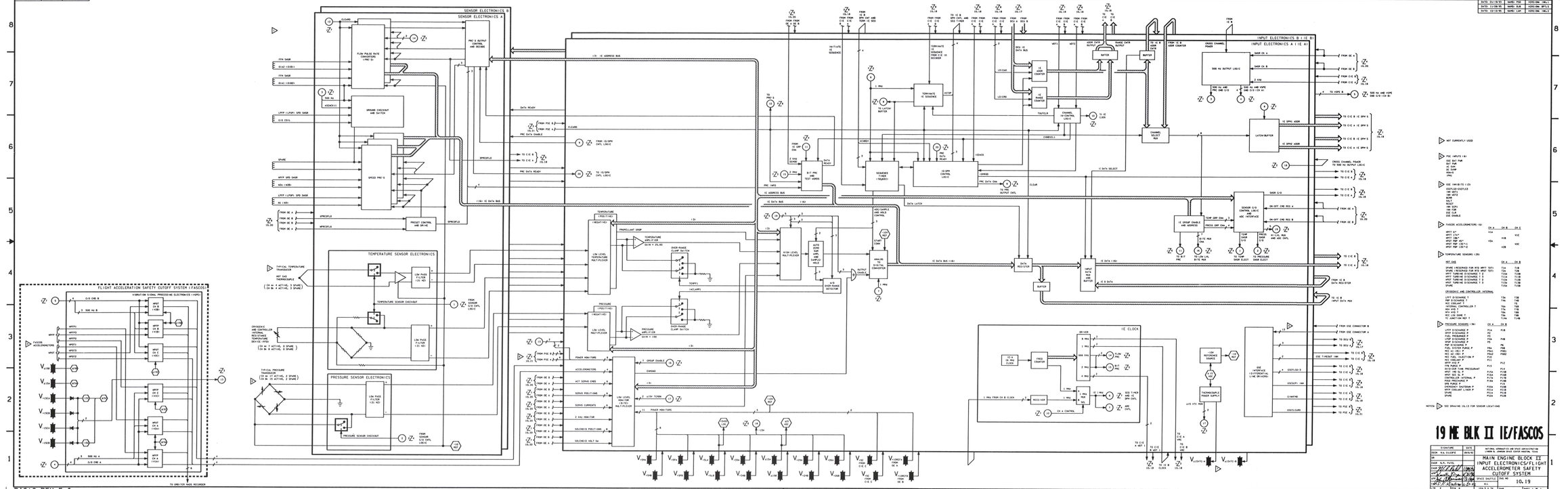
DATE= 11/02/92	NAME= VEM	VERSION= BPT=3
DATE= 01/07/93	NAME= PSD	VERSION= BPT=4
DATE= 01/19/93	NAME= MAG	VERSION= INA=1

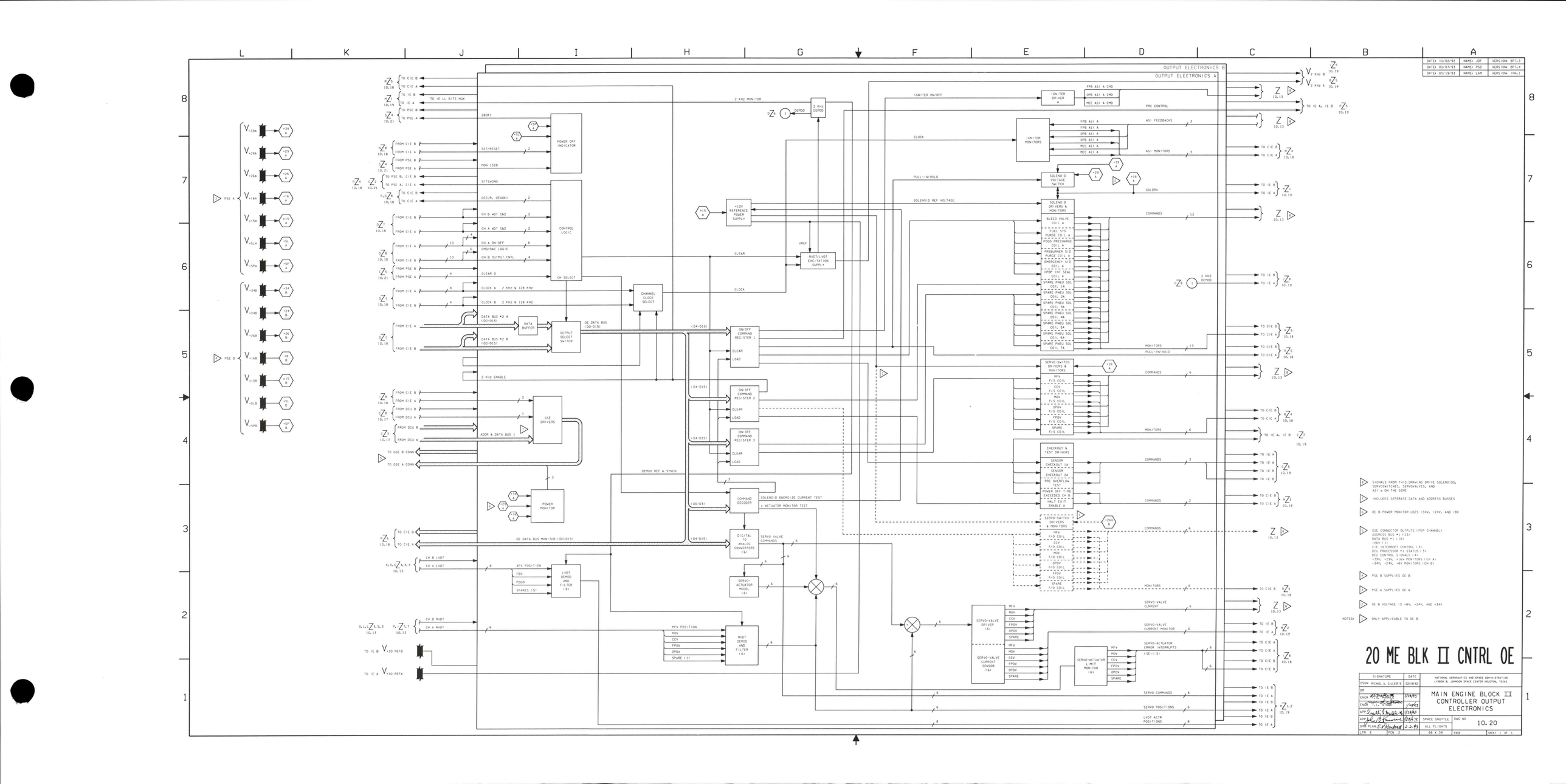
17 ME BLK II DCU

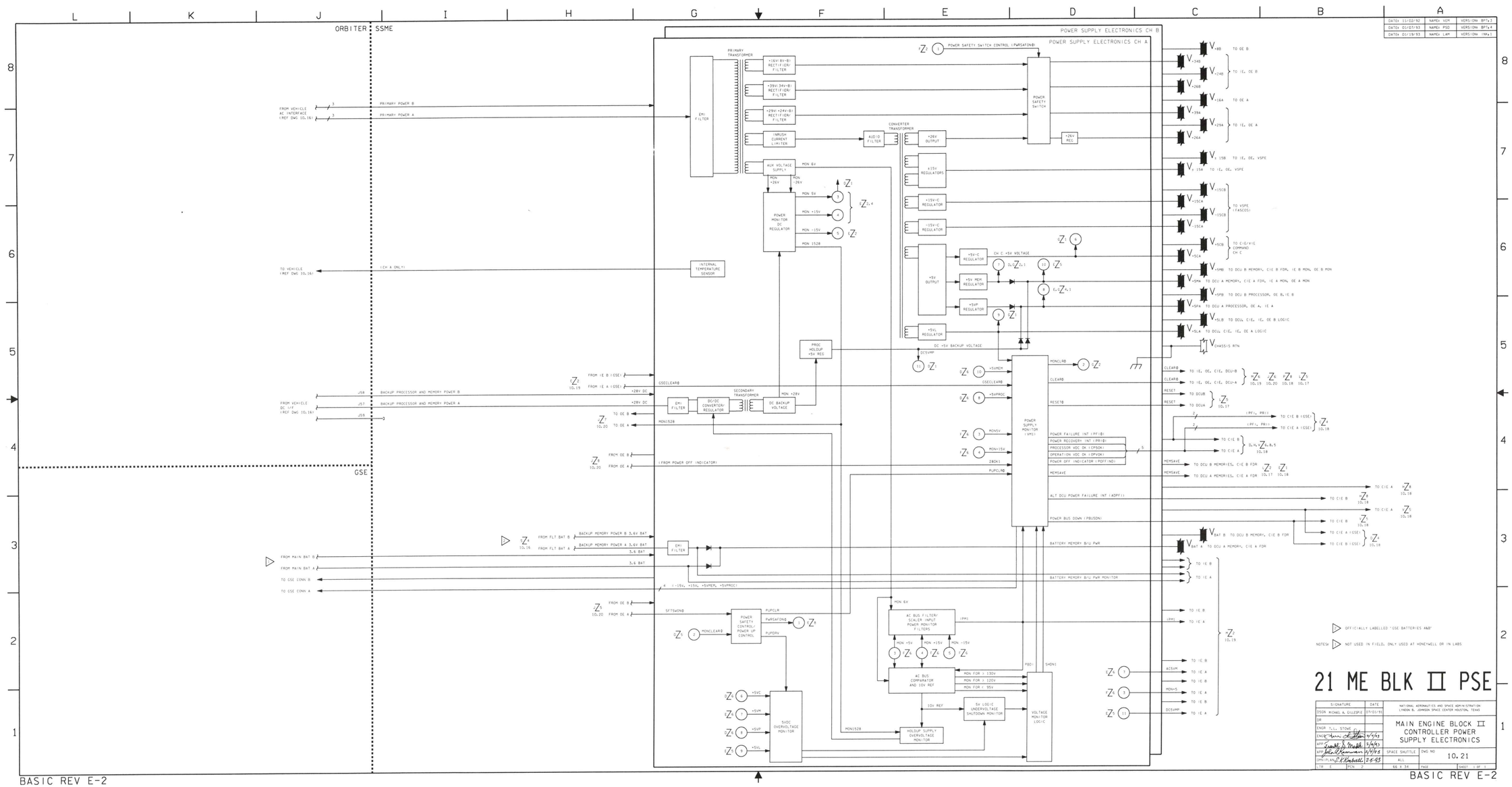
SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DSGN V+CK: S. HUNTER	1/31/92	LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR		
CHK	2/4/93	MAIN ENGINE BLOCK II
ENGR	2/9/93	DIGITAL CONTROLLER UNIT
APP	2/9/93	
APP	2/10/93	SPACE SHUTTLE / DWG NO 10.17
QA	02-05	ALL
LTR E	PCN 2	66 X 34 / PAGE / SHEET 1 OF 1

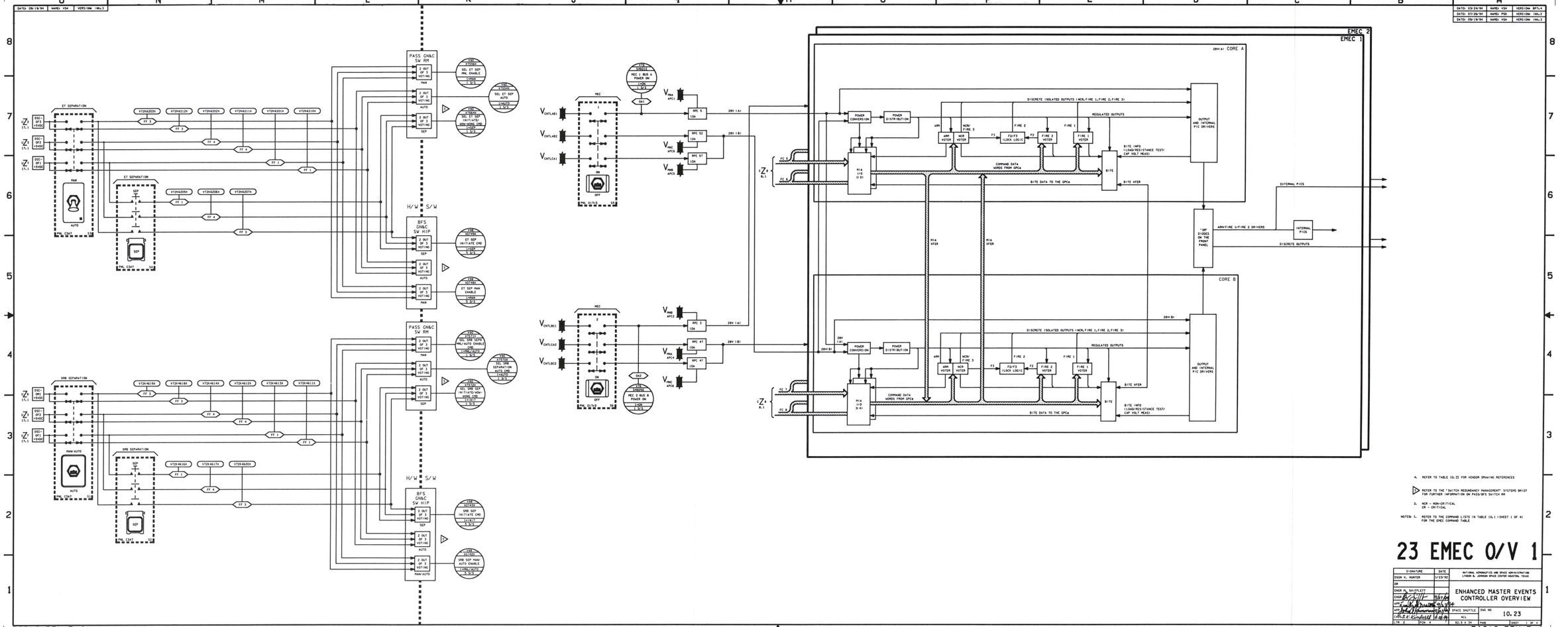
BASIC REV E-2


VEHICLE INTERFACE ELECTRONICS (VIE)
COMPUTER INTERFACE ELECTRONICS & CIE-82
MAIN ENGINE
BLOCK II CONTROLLER
INTERFACE ELECTRONICS
18 ME BLK II CIE
10.18
BASIC REV E-2


SENSOR ELECTRONICS B
SENSOR ELECTRONICS A
FLIGHT ACCELERATION SAFETY CUTOFF SYSTEM (FASCOS)
VIBRATION SIGNAL PROCESSING ELECTRONICS (VSPE)
TEMPERATURE SENSOR ELECTRONICS
PRESSURE SENSOR ELECTRONICS
INPUT ELECTRONICS B (IE B)
INPUT ELECTRONICS A (IE A)
IE CLOCK
19 ME BLK II IE/FASCOS
MAIN ENGINE BLOCK II
INPUT ELECTRONICS/FLIGHT
ACCELEROMETER SAFETY
CUTOFF SYSTEM
BASIC REV E-6


DATE= 11/02/92 NAME= JDF VERSION= BPT.3
DATE= 01/07/93 NAME= PSD VERSION= BPT.4
DATE= 03/18/93 NAME= LAM VERSION= INV.1
OUTPUT ELECTRONICS B
OUTPUT ELECTRONICS A
PSE A
PSE B
+39 A
+29 A
+26 A
+16 A
+15 A
+5L A
+5P A
+34 B
+24 B
+26 B
+16 B
+15 B
+5L B
+5P B
POWER OFF INDICATOR
CONTROL LOGIC
CH SELECT
CHANNEL CLOCK SELECT
DATA BUFFER
OUTPUT SELECT SWITCH
GSE DRIVERS
POWER MONITOR
+10V REFERENCE POWER SUPPLY
2 KHz DEMOD
RVDT/LVDT EXCITATION SUPPLY
ON/OFF COMMAND REGISTER 1
ON/OFF COMMAND REGISTER 2
ON/OFF COMMAND REGISTER 3
COMMAND DECODER
DIGITAL TO ANALOG CONVERTERS (6)
SERVO-ACTUATOR MODEL (6)
LVDT DEMOD AND FILTER (8)
RVDT DEMOD AND FILTER (6)
IGNITER DRIVER A
IGNITER MONITORS
SOLENOID VOLTAGE SWITCH
SOLENOID DRIVERS & MONITORS
SERVO-SWITCH DRIVERS & MONITORS
CHECKOUT & TEST DRIVERS
SERVO-VALVE DRIVER (6)
SERVO-VALVE CURRENT SENSOR (6)
SERVO-ACTUATOR LIMIT MONITOR (6)
20 ME BLK II CNTRL OE
MAIN ENGINE BLOCK II CONTROLLER OUTPUT ELECTRONICS
SPACE SHUTTLE
ALL FLIGHTS
DWG NO 10.20
66 X 34
SHEET 1 OF 1


ORBITER : SSME
GSE
POWER SUPPLY ELECTRONICS CH B
POWER SUPPLY ELECTRONICS CH A
PRIMARY TRANSFORMER
EMI FILTER
+16V/-8V/-8/ RECTIFIER/ FILTER
+39V/-34V/-8/ RECTIFIER/ FILTER
+29V/-+24V/-8/ RECTIFIER/ FILTER
INRUSH CURRENT LIMITER
AUX VOLTAGE SUPPLY
CONVERTER TRANSFORMER
AUDIO FILTER
+26V OUTPUT
±15V REGULATORS
+15V-C REGULATOR
-15V-C REGULATOR
+5V-C REGULATOR
+5V OUTPUT
+5V MEM REGULATOR
+5VP REGULATOR
+5VL REGULATOR
POWER SAFETY SWITCH
+26V REG
POWER MONITOR DC REGULATOR
INTERNAL TEMPERATURE SENSOR
PROC VOLDUP +5V REG
DC +5V BACKUP VOLTAGE
POWER SUPPLY MONITOR (PSM)
EMI FILTER
DC/DC CONVERTER REGULATOR
SECONDARY TRANSFORMER
DC BACKUP VOLTAGE
POWER SAFETY CONTROL/ POWER UP CONTROL
AC BUS FILTER/ SCALER INPUT POWER MONITOR FILTERS
AC BUS COMPARATOR AND ION REF
5V LOGIC UNDERVOLTAGE SHUTDOWN MONITOR
5VDC OVERVOLTAGE MONITOR
VOLTAGE MONITOR LOGIC
HOLDUP SUPPLY OVERVOLTAGE MONITOR
FROM VEHICLE AC INTERFACE (REF DWG 10.16)
PRIMARY POWER B
PRIMARY POWER A
TO VEHICLE (REF DWG 10.16)
(CH A ONLY)
FROM VEHICLE DC I/F (REF DWG 10.16)
BACKUP PROCESSOR AND MEMORY POWER B
BACKUP PROCESSOR AND MEMORY POWER A
FROM MAIN BAT B
FROM MAIN BAT A
TO GSE CONN B
TO GSE CONN A
FROM FLT BAT B
FROM FLT BAT A
BACKUP MEMORY POWER B 3.6V BAT
BACKUP MEMORY POWER A 3.6V BAT
3.6 BAT
3.6 BAT
(-15V, +15V, +5VMEM, +5VPROC)
FROM IE B (GSE)
FROM IE A (GSE)
GSECLEAR0
+28V DC
TO OE B
TO OE A
MON1528
FROM OE B
FROM OE A
(FROM POWER OFF INDICATOR)
SFTSWON0
MONCLEAR0
PWRSAFON0
PUPDRV
PUPCLR
POWER SAFETY SWITCH CONTROL (PWRSAFON0)
MON 6V
MON +26V
MON -26V
MON 5V
MON +15V
MON -15V
CH C +5V VOLTAGE
DC +5V BACKUP VOLTAGE
DCSVMP
MONCLR0
CLEAR0
GSECLEAR0
+5VPROC
+5VMEM
MON5V
MON+15V
ZBOK1
PUPCLR0
RESET0
POWER FAILURE INT (PFI0):
POWER RECOVERY INT (PRI0)
PROCESSOR VDC OK (CPSOK)
OPERATION VDC OK (OPVOK)
POWER OFF INDICATOR (POFFIND)
MEMSAVE
ALT DCU POWER FAILURE INT (ADFI):
POWER BUS DOWN (PBUSDN)
BATTERY MEMORY B/U PWR
BATTERY MEMORY B/U PWR MONITOR
(PFI)
PBDI
SHDNI
MON FOR > 130V
MON FOR > 120V
MON FOR < 95V
ION REF
TO OE B
TO OE A
TO VSPE (FASCOS)
TO C/E/eVIC COMMAND CH C
TO DCU B MEMORY, C/E B FDR, IE B MON, OE B MON
TO DCU A MEMORY, C/E A FDR, IE A MON, OE A MON
TO DCU B PROCESSOR, OE B, IE B
TO DCU A PROCESSOR, OE A, IE A
TO DCU C/E, IE, OE B LOGIC
TO DCU C/E, IE, OE A LOGIC
CHASSIS RTN
TO IE, OE, C/E, DCU-B
TO IE, OE, C/E, DCU-A
TO DCUB
TO DCUA
TO C/E B (GSE)
TO C/E A (GSE)
TO C/E B
TO C/E A
TO DCU B MEMORIES, C/E B FDR
TO DCU A MEMORIES, C/E A FDR
TO C/E A
TO C/E B
TO C/E A
TO C/E B
TO C/E A (GSE)
TO C/E B (GSE)
TO IE B
TO IE A
ACSVM
MON+5
DCSVMP
OFFICIALLY LABELLED "GSE BATTERIES A&B"
NOTES: NOT USED IN FIELD, ONLY USED AT HONEYWELL OR IN LABS
21 ME BLK II PSE
MAIN ENGINE BLOCK II CONTROLLER POWER SUPPLY ELECTRONICS
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
SPACE SHUTTLE
DWG NO 10.21
ALL
66 X 34
SHEET 1 OF 1
DATE: 11/02/92 NAME: VEM VERSION: BFT-3
DATE: 01/07/93 NAME: PSD VERSION: BFT-4
DATE: 01/19/93 NAME: LAM VERSION: (NAS)
BASIC REV E-2
BASIC REV E-2



4. REFER TO TABLE 10.II FOR VENDOR DRAWING REFERENCES

▷ REFER TO THE SWITCH REDUNDANCY MANAGEMENT SYSTEMS BRIEF FOR FURTHER INFORMATION ON PASS/BFS SWITCH MM

2. NCR = NON-CRITICAL
CR = CRITICAL

NOTES: 1. REFER TO THE COMMAND LISTS IN TABLE 10.I (SHEET 1 OF 4) FOR THE EMEC COMMAND TABLE

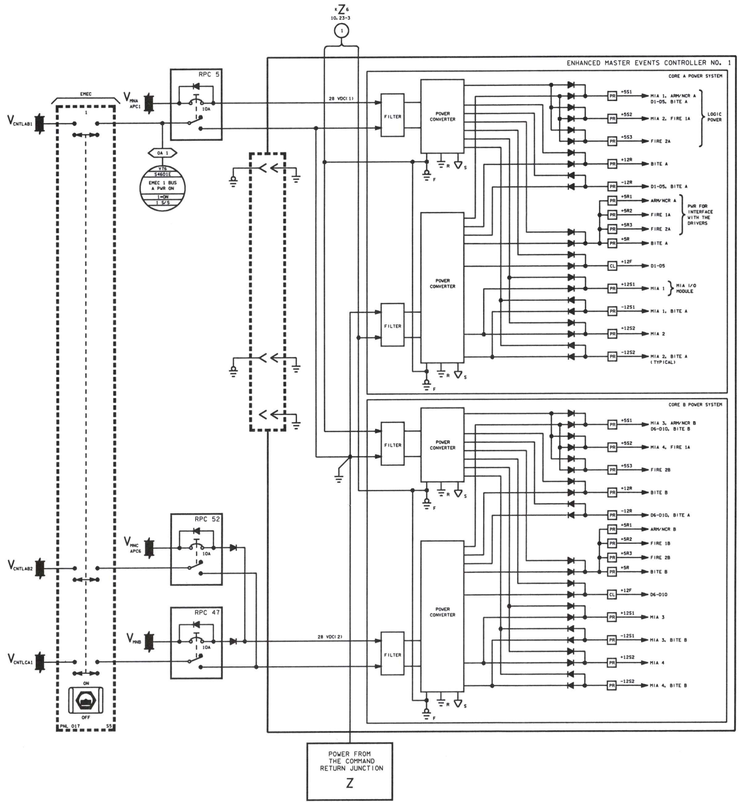
23 EMEC O/V 1

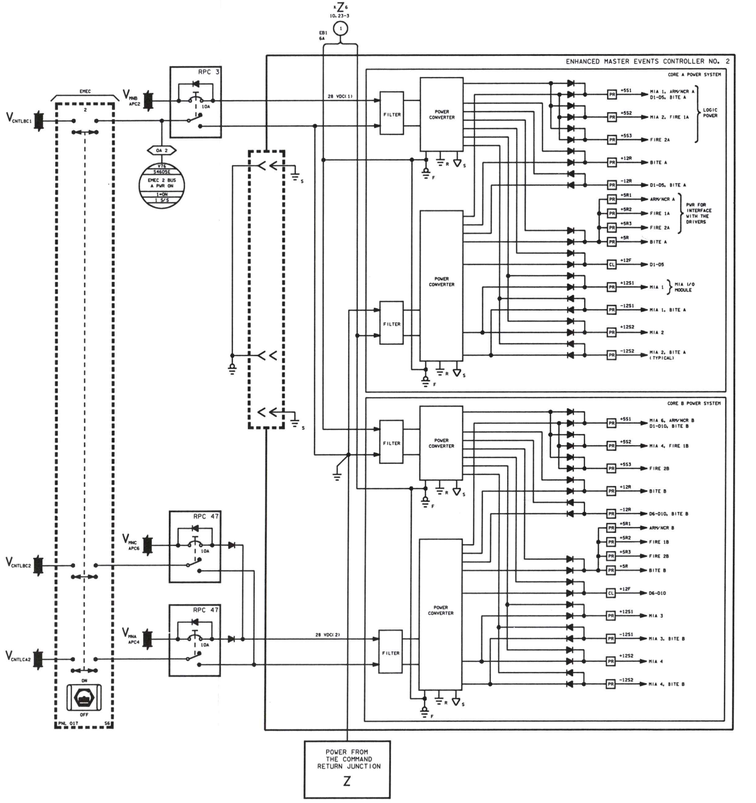
SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DOUG W. HUNTER	1/23/92	LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
QA		
CHIEF, SHUTTLE GNC		ENHANCED MASTER EVENTS CONTROLLER OVERVIEW
APP'D		
APP'D		SPACE SHUTTLE
APP'D		DWG NO 10.23
SYS E	SYS A	REV SHEET 1 OF 4

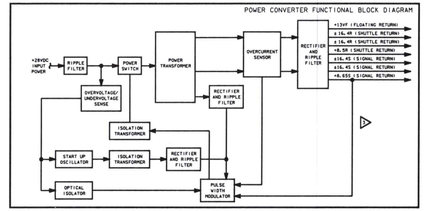
BASIC REV E-4

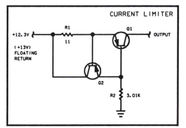
DATE: 05/15/94	NAMED: VSH	VERSION: 19Rev2

DATE: 2/6/92	NAMED: VSH	VERSION: BFTv2
DATE: 3/25/92	NAMED: MTB	VERSION: 19Rev1
DATE: 05/15/94	NAMED: VSH	VERSION: 19Rev2









▷ SHUTTLE RETURN AND SIGNAL RETURN ARE USED TO ISOLATE LOGIC CIRCUITS FROM THE DRIVER CIRCUITS

2. PR - POWER REGULATOR AND CURRENT LIMITER
CL - CURRENT LIMITER

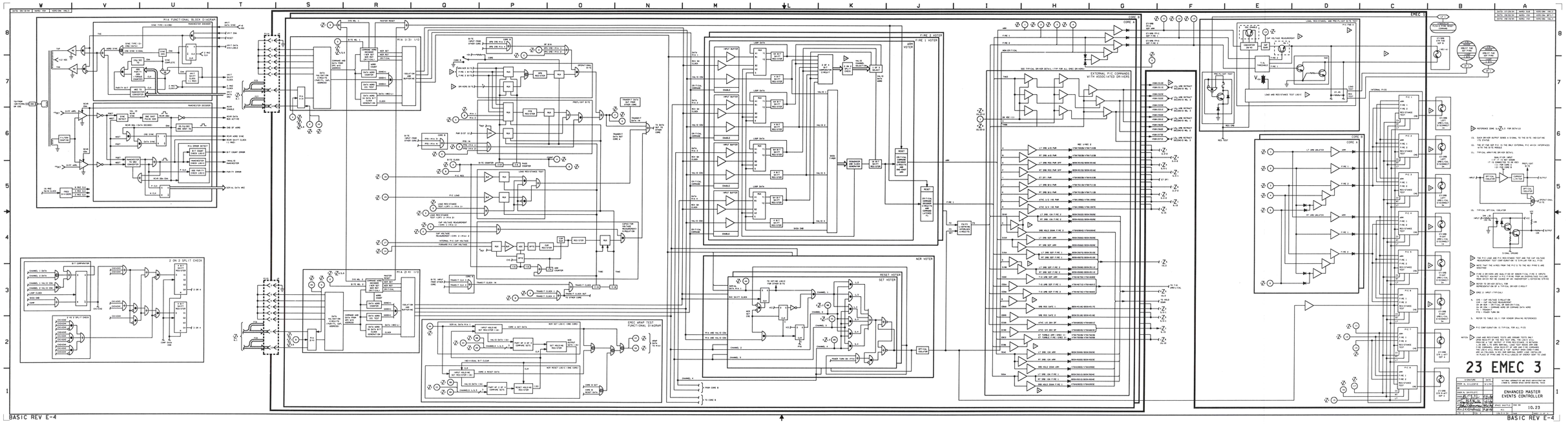
NOTES: 1. LETTER AT THE RETURN SYMBOL REPRESENTS THE FOLLOWING
F FOR FLOATING RETURN
R FOR THE 28V RETURN
S FOR SIGNAL RETURN
AND AT POWER SYSTEM

23 EMEC 1 & 2 PWR ON 2

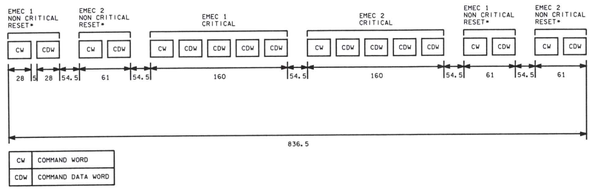
SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DSGN N. HUNTER	1/22/92	
QA		
CHCK N. SHUTTLEY		EMEC 1 AND 2 POWER ON
CHCK		
APVL		
APVL		SPACE SHUTTLE PROG
APVL		DWG NO 10.23
TTL E	DCN A	SIZE A/L SCALE 3/4 PAGE SHEET 1 OF 9

BASIC REV E-4

BASIC REV E-4


M1A FUNCTIONAL BLOCK DIAGRAM
TRANSMITTER DECODER
RECEIVER DECODER
M1A (1/3) 1/12
M1A (2/3) 1/12
M1A (3/3) 1/12
CORE A
CORE B
CORE C
CORE D
FIRE 2 VOTER
FIRE 1 VOTER
VOTER
NOR VOTER
RESET VOTER
SET VOTER
EXEC WRAP TEST FUNCTIONAL DIAGRAM
EXTERNAL P/C COMPANDS WITH ASSOCIATED DRIVERS
LOAD, RESISTANCE, AND PRECYLIGHT BITE TEST
2 OF 2 SPLIT CHECK
8-BIT COMPARATOR
EMEC 3
23 EMEC 3
ENHANCED MASTER EVENTS CONTROLLER
10.23
BASIC REV E-4

DATE= 08/05/94 NAME= BJT VERSION= INH.1
DATE= 09/09/94 NAME= SEH VERSION= INH.2
DATE= 09/19/94 NAME= VSH VERSION= INH.3

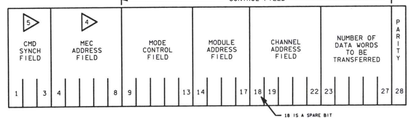


CW	COMMAND WORD
CDW	COMMAND DATA WORD

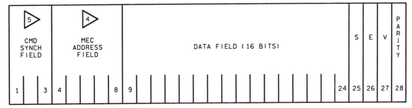
NOTE: ALL VALUES IN MICROSECONDS
* SET CDW AND RESET CDW ARE COMPLEMENTS OF EACH OTHER

PASS COMMAND STRUCTURE

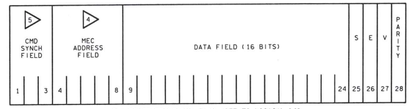
COMMAND WORD FROM GPC TO MEC



COMMAND DATA WORD FROM GPC TO MEC



RESPONSE DATA WORD FROM MEC TO GPC



S = POWER TRANSIENT FLAG, SET TO LOGICAL "1"
E = ERROR FLAG, SET TO LOGICAL "0"
V = VALIDITY FLAG, SET TO LOGICAL "1"

MEC 1 NON-CRITICAL COMMAND DATA WORDS

HEX DECODING LOGIC

HEX CODE	COMMAND DATA WORD 9 10 11 12	13 14 15 16	17 18 19 20	21 22 23 24	COMMAND LETTER	MSID	COMMAND DESCRIPTION
8000	1 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	RES TEST	V76K7001B	PIC RESISTANCE TEST
4000	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	A	V76K7002B	L SRB POWER A
2000	0 0 1 0	0 0 0 0	0 0 0 0	0 0 0 0	B	V76K7003B	R SRB POWER A
1000	0 0 0 1	0 0 0 0	0 0 0 0	0 0 0 0	C	V76K6955B	SRB IGN FIRE 3
0800	0 0 0 0	1 0 0 0	0 0 0 0	0 0 0 0	D	V76K4612B	L T-0 UMB REL FIRE 3
0400	0 0 0 0	0 1 0 0	0 0 0 0	0 0 0 0	E	V76K7006B	L SRB RSS POWER OFF
0200	0 0 0 0	0 0 1 0	0 0 0 0	0 0 0 0	F	V76K7007B	R SRB RSS POWER OFF
0100	0 0 0 0	0 0 0 1	0 0 0 0	0 0 0 0	G	V76K6960B	SRB SEP FIRE 3
0080	0 0 0 0	0 0 0 0	1 0 0 0	0 0 0 0	H	V76K4625B	ET/UMB UNLATCH FIRE 3
0040	0 0 0 0	0 0 0 0	0 1 0 0	0 0 0 0	I	V76K9003B	ET DFI POWER ON ▷
0020	0 0 0 0	0 0 0 0	0 0 1 0	0 0 0 0	J	V76K7011B	L SRB POWER C
0010	0 0 0 0	0 0 0 0	0 0 0 1	0 0 0 0	K	V76K7012B	R SRB POWER C
0008	0 0 0 0	0 0 0 0	0 0 0 0	1 0 0 0	L	V76K7013B	ATVC 2 SRB IVD A PWR ON
0004	0 0 0 0	0 0 0 0	0 0 0 0	0 1 0 0	M	V76K7014B	ATVC 4 SRB IVD B PWR ON
0002	0 0 0 0	0 0 0 0	0 0 0 0	0 0 1 0	N	V76K4657B	ET/UMB RETR FIRE 3
0001	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 1	O	V76K6921B	ET/ORB STRUCT SEP FIRE 3

MEC 2 NON-CRITICAL COMMAND DATA WORDS

HEX DECODING LOGIC

HEX CODE	COMMAND DATA WORD 9 10 11 12	13 14 15 16	17 18 19 20	21 22 23 24	COMMAND LETTER	MSID	COMMAND DESCRIPTION
8000	1 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	RES TEST	V76K7101B	PIC RESISTANCE TEST
4000	0 1 0 0	0 0 0 0	0 0 0 0	0 0 0 0	A	V76K7102B	L SRB POWER B
2000	0 0 1 0	0 0 0 0	0 0 0 0	0 0 0 0	B	V76K7103B	R SRB POWER B
1000	0 0 0 1	0 0 0 0	0 0 0 0	0 0 0 0	C	V76K6965B	SRB IGN FIRE 3
0800	0 0 0 0	1 0 0 0	0 0 0 0	0 0 0 0	D	V76K4616B	L T-0 UMB REL FIRE 3
0400	0 0 0 0	0 1 0 0	0 0 0 0	0 0 0 0	E	V76K7106B	L SRB RSS POWER OFF
0200	0 0 0 0	0 0 1 0	0 0 0 0	0 0 0 0	F	V76K7107B	R SRB RSS POWER OFF
0100	0 0 0 0	0 0 0 1	0 0 0 0	0 0 0 0	G	V76K6970B	SRB SEP FIRE 3
0080	0 0 0 0	0 0 0 0	1 0 0 0	0 0 0 0	H	V76K4626B	ET/UMB UNLATCH FIRE 3
0040	0 0 0 0	0 0 0 0	0 1 0 0	0 0 0 0	I	V76K9103B	ET DFI POWER ON ▷
0020	0 0 0 0	0 0 0 0	0 0 1 0	0 0 0 0	J	V76K7111B	L SRB POWER C
0010	0 0 0 0	0 0 0 0	0 0 0 1	0 0 0 0	K	V76K7112B	R SRB POWER C
0008	0 0 0 0	0 0 0 0	0 0 0 0	1 0 0 0	L	V76K7113B	ATVC 1 SRB IVD A PWR ON
0004	0 0 0 0	0 0 0 0	0 0 0 0	0 1 0 0	M	V76K7114B	ATVC 3 SRB IVD B PWR ON
0002	0 0 0 0	0 0 0 0	0 0 0 0	0 0 1 0	N	V76K4661B	ET/UMB RETR FIRE 3
0001	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 1	O	V76K6922B	ET/ORB STRUCT SEP FIRE 3

MEC 1 AND MEC 2 COMMAND WORDS

COMMAND WORD CONTROL FIELD: MODE CONTROL FIELD 9 10 11 12 13	MODULE ADDRESS FIELD 14 15 16 17	CHANNEL ADDRESS FIELD 18 19 20 21 22	NUMBER OF WORDS FIELD 23 24 25 26 27	MEC 1 MSID	MEC 2 MSID	COMMAND DESCRIPTION
0 1 0 1 0	0 0 0 0	X 1 1 0 1	1 0 0 0 1	V76K8351B	V76K8851B	PRE-FLIGHT BITE TEST RESULT CMD
0 1 0 0 0	0 0 0 0	X 0 0 0 0	0 0 0 0 0	V76K8371B	V76K8871B	NON-CRIT DATA VERIF SEND CMD
0 1 0 1 0	0 0 0 0	X 1 1 1 0	0 0 0 0 0	V76K8372B	V76K8872B	NON-CRIT DATA VERIF RETURN CMD
0 0 1 0 0	0 0 0 1	X 0 0 0 0	0 0 0 0 0	V76K8400B	V76K8900B	PIC SIM CAP VOLT ENABLE CMD
0 1 0 0 1	1 1 1 0	X 0 0 0 0	0 0 1 0 1	V76K7099B	V76K7199B	OPER PIC CAPACITOR VOLT READ CMD
0 1 0 1 1	1 1 1 1	X 1 0 0 0	0 0 0 0 1	V76K7059B	V76K7159B	PIC LOAD/RESISTANCE TEST STATUS
0 1 0 1 0	0 0 0 0	X 1 0 1 1	0 0 0 0 0	V76K7097B	V76K7197B	OPER BITE TEST RESULT CMD
0 1 0 0 0	1 0 1 1	X 0 0 0 0	0 0 0 0 0	V76M7000P	V76M7100P	SET NON-CRITICAL CMD
0 1 0 0 0	0 1 1 1	X 0 0 0 0	0 0 0 0 0	V76M7019P	V76M7119P	RESET NON-CRITICAL CMD
1 1 0 0 0	0 0 0 0	X 0 0 0 0	0 0 0 Y Y	N/A	N/A	SET CRITICAL CMD
0 1 0 1 1	0 0 0 0	X 0 0 0 0	0 0 0 0 0	V76K7098B	V76K7198B	MASTER RESET (RESET CRIT) CMD

(SPARE)

X = EITHER 1 OR 0
Y = FUNCTION OF THE NUMBER OF WORDS

MEC 1 CRITICAL COMMAND DATA WORDS

HEX DECODING LOGIC

HEX CODE	COMMAND DATA WORD 9 10 11 12	13 14 15 16	17 18 19 20	21 22 23 24	MSID	COMMAND DESCRIPTION
3EAC	0 0 1 1	1 1 1 0	1 0 1 0	1 1 0 0	V76K6951B	SRB IGNITION ARM
3E6A	0 0 1 1	1 1 1 0	0 1 1 0	1 0 1 0	V76K6953B	SRB IGNITION FIRE 1
3E42	0 0 1 1	1 1 1 0	0 1 0 0	0 0 1 0	V76K6954B	SRB IGNITION FIRE 2
3154	0 0 1 1	0 0 0 1	0 1 0 1	0 1 0 0	V76K6956B	SRB SEPARATION ARM
316A	0 0 1 1	0 0 0 1	0 1 1 0	1 0 1 0	V76K6958B	SRB SEPARATION FIRE 1
3198	0 0 1 1	0 0 0 1	1 0 0 1	1 0 1 1	V76K6959B	SRB SEPARATION FIRE 2
C121	1 1 0 0	0 0 0 1	0 0 1 0	0 0 0 1	V76K4617B	ET/UMB UNLATCH ARM
C162	1 1 0 0	0 0 0 1	0 1 1 0	0 0 1 0	V76K4619B	ET/UMB UNLATCH FIRE 1
C193	1 1 0 0	0 0 0 1	1 0 0 1	0 0 1 1	V76K4623B	ET/UMB UNLATCH FIRE 2
7463	0 1 1 1	0 1 0 0	0 1 1 0	0 0 1 1	V76K4655B	ET/UMB RETRACT FIRE 1
7498	0 1 1 1	0 1 0 0	1 0 0 1	1 0 0 0	V76K4656B	ET/UMB RETRACT FIRE 2
E117	1 1 1 0	0 0 0 1	0 0 0 1	0 1 1 1	V76K6909B	ET/ORB STRUCT SEP ARM
E168	1 1 1 0	0 0 0 1	0 1 1 0	1 0 0 0	V76K6913B	ET/ORB STRUCT SEP FIRE 1
E199	1 1 1 0	0 0 0 1	1 0 0 1	1 0 0 1	V76K6914B	ET/ORB STRUCT SEP FIRE 2
CEDC	1 1 0 0	1 1 1 0	1 1 0 1	1 1 0 0	V76K4609B	L T-0 UMB RELEASE ARM
CE6A	1 1 0 0	1 1 1 0	0 1 1 0	1 0 1 0	V76K4610B	L T-0 UMB RELEASE FIRE 1
CE9A	1 1 0 0	1 1 1 0	1 0 0 1	1 0 1 0	V76K4611B	L T-0 UMB RELEASE FIRE 2
EBC2	1 1 1 0	1 0 1 1	1 1 0 0	0 0 1 0	V76K7504B	ET TUMBLE ARM
E868	1 1 1 0	1 0 1 1	0 1 1 0	1 0 0 0	V76K7508B	L SRB RSS SAFE 1
E895	1 1 1 0	1 0 1 1	1 0 0 1	0 1 0 1	V76K7509B	R SRB RSS SAFE 2
EC86	1 1 1 0	1 1 0 0	1 0 1 1	0 1 1 0	V76K7505B	ET TUMBLE FIRE
EC68	1 1 1 0	1 1 0 0	0 1 1 0	1 0 0 0	V76K7515B	ATVC 2 SRB 26V DEAD FACE
EC9D	1 1 1 0	1 1 0 0	1 0 0 1	1 1 0 1	V76K7516B	ATVC 4 SRB 26V DEAD FACE

MEC 2 CRITICAL COMMAND DATA WORDS

HEX DECODING LOGIC

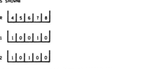
HEX CODE	COMMAND DATA WORD 9 10 11 12	13 14 15 16	17 18 19 20	21 22 23 24	MSID	COMMAND DESCRIPTION
3EAC	0 0 1 1	1 1 1 0	1 0 1 0	1 1 0 0	V76K6961B	SRB IGNITION ARM
3E6A	0 0 1 1	1 1 1 0	0 1 1 0	1 0 1 0	V76K6963B	SRB IGNITION FIRE 1
3E42	0 0 1 1	1 1 1 0	0 1 0 0	0 0 1 0	V76K6964B	SRB IGNITION FIRE 2
3154	0 0 1 1	0 0 0 1	0 1 0 1	0 1 0 0	V76K6966B	SRB SEPARATION ARM
316A	0 0 1 1	0 0 0 1	0 1 1 0	1 0 1 0	V76K6968B	SRB SEPARATION FIRE 1 & RECOVERY ON
3198	0 0 1 1	0 0 0 1	1 0 0 1	1 0 1 1	V76K6969B	SRB SEPARATION FIRE 2 & RECOVERY ARM
C121	1 1 0 0	0 0 0 1	0 0 1 0	0 0 0 1	V76K4618B	ET/UMB UNLATCH ARM
C162	1 1 0 0	0 0 0 1	0 1 1 0	0 0 1 0	V76K4620B	ET/UMB UNLATCH FIRE 1
C193	1 1 0 0	0 0 0 1	1 0 0 1	0 0 1 1	V76K4624B	ET/UMB UNLATCH FIRE 2
7463	0 1 1 1	0 1 0 0	0 1 1 0	0 0 1 1	V76K4659B	ET/UMB RETRACT FIRE 1
7498	0 1 1 1	0 1 0 0	1 0 0 1	1 0 0 0	V76K4660B	ET/UMB RETRACT FIRE 2
E117	1 1 1 0	0 0 0 1	0 0 0 1	0 1 1 1	V76K6911B	ET/ORB STRUCT SEP ARM
E168	1 1 1 0	0 0 0 1	0 1 1 0	1 0 0 0	V76K6915B	ET/ORB STRUCT SEP FIRE 1
E199	1 1 1 0	0 0 0 1	1 0 0 1	1 0 0 1	V76K6916B	ET/ORB STRUCT SEP FIRE 2
CEDC	1 1 0 0	1 1 1 0	1 1 0 1	1 1 0 0	V76K4613B	R T-0 UMB RELEASE ARM
CE6A	1 1 0 0	1 1 1 0	0 1 1 0	1 0 1 0	V76K4614B	R T-0 UMB RELEASE FIRE 1
CE9A	1 1 0 0	1 1 1 0	1 0 0 1	1 0 1 0	V76K4615B	R T-0 UMB RELEASE FIRE 2
EBC2	1 1 1 0	1 0 1 1	1 1 0 0	0 0 1 0	V76K7604B	ET TUMBLE ARM
E868	1 1 1 0	1 0 1 1	0 1 1 0	1 0 0 0	V76K7608B	R SRB RSS SAFE 1
E895	1 1 1 0	1 0 1 1	1 0 0 1	0 1 0 1	V76K7609B	L SRB RSS SAFE 2
EC86	1 1 1 0	1 1 0 0	1 0 1 1	0 1 1 0	V76K7605B	ET TUMBLE FIRE
EC68	1 1 1 0	1 1 0 0	0 1 1 0	1 0 0 0	V76K7615B	ATVC 1 SRB 26V DEAD FACE
EC9D	1 1 1 0	1 1 0 0	1 0 0 1	1 1 0 1	V76K7616B	ATVC 3 SRB 26V DEAD FACE

▷ THE COMMAND SYNCHRONIZATION FIELD IS A THREE BIT TIME NON-VALID MANCHESTER SYNCHRONIZATION CODE. THUS, EACH WORD HAS A 3 MICROSECOND CODE, WITH THE FIRST 1 1/2 MICROSECONDS IN THE "1" OR "ON" POSITION AND THE NEXT 1 1/2 MICROSECONDS IN THE "0" OR "OFF" POSITION

THE DATA SYNCH MANCHESTER WAVE FORM IS THE COMPLIMENT OF THE COMMAND SYNCH WAVE

I.E.,

▷ THE MEC ADDRESS FIELD IS DEFINED BY TWO POSSIBLE COMBINATIONS, WHEN A COMMAND WORD OR DATA WORD RETURNS FROM OR IS SENT TO EITHER MEC 1 OR MEC 2, THEN THE MEC ADDRESS FIELD BIT COUNT WILL BE AS SHOWN.



3. REFER TO TABLE 10.II FOR VENDOR DRAWING REFERENCES

2. NOT EVERY COMMAND STRING WILL HAVE A RESPONSE DATA WORD, ALL RESPONSE DATA WORDS ARE USED ONLY FOR PRE-FLIGHT CHECKS & NO RESPONSE DATA WORDS ARE TRANSFERRED DURING ACTUAL FLIGHT

NOTES ▷ THE "ET DFI POWER ON" COMMANDS ARE NON-EXISTANT IN THE CURRENT MEC SOP, THEY MAY BE RE-ISTATED AT A LATER DATE

23 EMEC CMD TBL 4

SIGNATURE	DATE
DSGN M. GILLESPIE	9/29/97
QR M. GILLESPIE	9/29/97
CHCK A.B. SHUTTLEY	
CHCK	
APPD	
APPD	
APPD	

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EMEC COMMAND TABLE

SPACE SHUTTLE | DWG NO 10.23 | ALL | LTR E | SHT 4 | 83.5.9.34 | PAGE SHEET 4 OF 4

BASIC REV E-4

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
10.1 (SHEETS 1 – 4)	MEC	AUTONETICS	10607–41		C	5/2/76	POWER SUPPLY
			15175–507			12/3/82	MEC
			15177–507			1/18/82	MODULE VII B
			15181–507			10/12/82	MODULE I
			15182–507			10/12/82	MODULE II, COMPARATOR
			15183–507			9/12/82	MODULE III, HEX DECODER
			15184–507			9/28/82	PIC
			15185–507			8/31/82	MODULE V
			15186–507			10/15/82	MODULE VI
			15187–507			11/5/82	MODULE VII A
		ROCKWELL	VS70–760502		L	7/17/87	EVCON SUBSYSTEM
			VS70–976099		A	12/7/87	INT. SYSTEM SCHEM. – ORBITER EPDC
		MSFC	MC450–0016				MEC SPECIFICATIONS
10.2 (SHEETS 1–2)	SRB	ROCKWELL	VS72–948095		A	1/18/84	SRB
			VS72–948099		A	10/29/87	SRB
			VS72–948102		D	4/17/89	SRB
		MSFC	10A95509C				SRB TVC
			13A10130		D	5/30/80	SRB TVC SUBSYSTEM DESCRIPTION
			MSFC–DOC–1633F	41 AND 42		4/5/90	SRB MEASUREMENT LOCATION DOCUMENT
10.3	EIU	ROCKWELL	VO70–730397		A	12/12/80	D&C, 017
			VO70–773755			6/17/80	WIRE HARNESS ASSY, D&C
			VS70–720302		F	7/13/90	EIU DPS SUBSYSTEM
			SSME–ECP	1259	I	7/24/95	SSME THERMOCOUPLES
		CONRAC	7906744	1/1	A	6/19/81	EIU FAMILY TREE
			7906745	1/1	A	6/18/81	BLOCK DIAGRAM EIU (–011)
			7906743	1/1	A	6/17/81	INTERCONNECTION DIAGRAM GPC I/F
			7906734	1/1	A	5/20/81	LOGIC DIAGRAM, GPC I/F (A1)
			7906742	1/2	C	9/8/81	LOGIC DIAGRAM, GPC I/F (A2)
			7906742	2/2	C	5/1/81	LOGIC DIAGRAM, GPC I/F (A2)
			7906748	1/2	A	5/1/81	BUILT IN TEST EQUIPMENT (A5)

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
10.3 (CONT'D)			7906748	2/2	A	5/1/81	BUILT IN TEST EQUIPMENT (A5)
			7906746	1/2	A	5/1/81	OI BUFFER (A6)
			7906746	2/2	A	5/1/81	OI BUFFER (A6)
			7906747	1/2	B	3/17/82	OI CONTROLLER (A7)
			7906747	2/2	B	3/17/82	OI CONTROLLER (A7)
			7906749	1/2	C	4/22/82	CONTROLLER I/F (A8, A9, A10)
			7906749	2/2	C	4/22/82	CONTROLLER I/F (A8, A9, A10)
			7906750	1/2	C	3/25/83	STATUS BUFFER (A11, A12)
			7906750	2/2	C	3/25/83	STATUS BUFFER (A11, A12)
			7906751	1/1	D	4/23/82	POWER SUPPLY
10.4	ME BLK I CONTR	ROCKWELL	VS70–410142		G	4/25/84	MPS, SSME I/F SUBSYSTEM
		ROCKETDYNE	RSS–8502–1			1971	DESIGN DEFINITION REPORT
			RSS–8502–2			1971	DESIGN DEFINITION REPORT
			RSS–8628				
			D525401–04	PART I	H		
				PART II	AD		
			KD BM15000		T		
		HONEYWELL	ES25624–01		L	7/19/82	ACCEPTANCE TEST FOR POWER SUPPLY
			ES24693–04		R	10/12/73	INPUT ELECTRONICS PRESSURE CARD ASSY
			ES25603–01		C	1/12/82	IE BOARDS 1A, 1B
			ES25603–02		C	12/12/82	IE BOARDS, 2A, 2B
			ES25603–07		C	11/23/81	IE BOARDS 7A, 7B
			ES25604–01		C	1/12/82	CIE BOARD 1
			ES25604–02		A	1/12/82	CIE BOARD 2
			ES25604–03		A	1/12/82	CIE BOARD 3
			ES25604–04		E	1/26/83	CIE BOARD 4
			ES25604–05		A	1/12/82	CIE BOARD 5
			ES25604–06		A	1/12/82	CIE BOARD 6
			ES25604–07		A	1/12/82	CIE BOARD 7A, 7C
			ES25604–17		A	1/12/82	CIE BOARD 7B

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
10.4 (CONT'D)			ES25605–01		D	1/12/82	OE BOARD 1A
			ES25605–02		C	9/19/78	OE BOARD 2A
			ES25605–03		D	1/12/82	OE BOARD 3A
			ES25605–04		N	12/14/82	OE BOARD 4A, 4B, 5A, 5B
			ES25605–06		C	9/7/78	OE CIRCUIT CARD ASSY NO. 6
			ES25605–07		P	12/12/82	OE BOARDS 7A, 7B
			ES25605–11		D	1/12/82	OE BOARD 1B
			ES25605–12		C	9/19/78	OE BOARD 2B
			ES25605–13		D	1/12/82	OE BOARD 3B
			ES25605–14			3/22/78	OE BOARD 4A, 4B, 5A, 5B
			ES25605–17			3/22/78	OE BOARD 7A, 7B7
		HONEYWELL	C13747AF31	38	D	4/25/78	INPUT ELECTRONICS
			C13747AF41	48	F	10/29/78	INPUT ELECTRONICS
			C13747AF51		D	2/23/78	COMPUTER I/F ELECTRONICS
			C13747AF57		A	1/20/78	COMPUTER I/F ELECTRONICS
			C13747AF67		A	1/20/78	COMPUTER I/F ELECTRONICS
			C13747AF01		E	5/23/78	POWER SUPPLY ASSEMBLY
			C13747AF02		C	11/17/77	POWER SUPPLY ASSEMBLY
			C13747AF51	70, 71, 73, 74 76, 77, 80, 81 83, 8			OUTPUT ELECTRONICS BOARDS
		HONEYWELL	C13759AF01	32	E	8/23/78	CONTROLLER ASSEMBLY
			10056061		A		FILTER & CONNECTOR ASSEMBLY
			10056063		B	10/12/78	FILTER SUBASSEMBLY
			10060061	66	B	1/26/78	INPUT ELECTRONICS
			34027816			3/10/77	CONTROLLER BOARDS
			34027819			3/4/77	CONTROLLER BOARDS
			34027822			3/10/77	CONTROLLER BOARDS
			34027825		A	6/6/78	CONTROLLER BOARDS
			34027828			3/10/77	CONTROLLER BOARDS
			34027831		A	6/7/78	CONTROLLER BOARDS
			34027834			3/4/77	INTERRUPT BOARD

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
10.4	ENGR J. D. REDING			ENGR	
	ENGR			ENGR	
	ENGR			ENGR	
	ENGR			ENGR	
	ENGR			APP	
	ENGR			APP	
	ENGR			APP	
	ENGR			LTR E PCN 6	

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VENDOR DRAWING REFERENCES

SPACE SHUTTLE	TBL NO. 10–II	
ALL	PAGE 10.II–3	SHEET 3 OF 7

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
10.4 (CONT'D)			34027813				POWER SUPPLY BOARDS
			34027804		C	8/14/78	WORD ELECTRONICS
			34027837		A	6/2/77	SENSE DIGIT ELECTRONICS
			34022712		E	11/18/78	SENSE DIGIT ELECTRONICS
			34027807		A	7/15/77	PARITY BOARD
			34027810		F	11/14/78	MEMORY TIMING
10.5	ME BLK I CIE	ROCKWELL	VS70–720302		F	7/13/90	EIU DPS SUBSYSTEM
		HONEYWELL	C13759AF01	1	L	6/13/83	COVER SHEET
				2	K	7/16/82	POWER GENERATION – CHANNEL A
				3	K	7/16/82	POWER GENERATION – CHANNEL B
				4	K	7/16/82	POWER GENERATION – CHANNEL A
				5	K	7/16/82	POWER GENERATION – CHANNEL B
				16	K	7/16/82	I/F BUFFERS
				17	K	7/16/82	VEEI COMMAND INPUT CHANNEL
				18	K	7/16/82	VEEI RECORDER DATA CHANNEL
				19	K	7/16/82	IE OUTPUT BUFFERS
				20	K	7/16/82	DIO MUX – OE INPUTS – CHANNEL
				21	K	7/16/82	DIO MUX – OE INPUTS – CHANNEL B
				22	K	7/16/82	DIO MUX – CIE INPUTS – CHANNEL A
				23	K	7/16/82	DIO MUX – CIE INPUT – CHANNEL B
				24	K	7/16/82	OUTPUT SWITCH, REGISTERS – CHANNEL A
				25	K	7/16/82	OUTPUT SWITCH, REGISTERS – CHANNEL B
			C13747AF51		D	2/23/78	CIE 1
			C13747AF52		B	6/14/77	CIE 2
			C13747AF53		C	4/12/77	CIE 3
			C13747AF54	1	C	10/25/77	CIE 4
				2	B	4/25/77	CIE 4
			C13747AF55			2/5/77	CIE 5
			C13747AF56		A	9/20/77	CIE 6
			C13747AF57		A	1/20/78	CIE 7A, 7C
			C13747AF67		A	1/20/78	CIE 7B

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
10.4	ENGR J. D. REDING			ENGR	
	ENGR			ENGR	
10.5	ENGR J. D. REDING			ENGR	
	ENGR			ENGR	
	ENGR			APP	
	ENGR			APP	
	ENGR			APP	
	ENGR			LTR E PCN 6	

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VENDOR DRAWING REFERENCES

SPACE SHUTTLE	TBL NO.	
ALL	10–II	
	PAGE 10.II–4	SHEET 4 OF 7

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
10.5 (CONT'D)		HONEYWELL	10060062		B	1/26/78	SSME CONTROLLER ASSY – CIE
			10060064		B	1/26/78	SSME CONTROLLER ASSY – OE
10.6	ME BLK I IE	HONEYWELL	10060061	8–16			INPUT ELECTRONICS
10.7	ME BLK I OE	HONEYWELL	10060064	24–30			OUTPUT ELECTRONICS
10.8	MPS HE	ROCKWELL	VS70–410139	1–4	E	5/12/89	MPS HELIUM SUBSYSTEM
			VS70–410159	2	E	5/3/89	MPS PANEL I/F SUBSYSTEM
			VS70–415008	1		8/2/84	MPS HELIUM
			VS72–941099	24–29	A/B15	3/23/90	HELIUM VALVES
			VS70–415004	1			MPS SYS
			VO70–415771				HELIUM INSTALL
			VO70–415772				HELIUM INSTALL
		JSC	JSC–16983 51–L		B		OI MDM/DSC FAILURE IMPACTS 51–L MML
10.9	ME H&P	ROCKETDYNE				11/1/84	SSME COURSE NO. ME 110(A) RIR
10.10	ET	ROCKWELL	VS70–760502	8	L	7/17/87	EVCON SUBSYSTEM
			VS72–941102	24	J/11	3/23/90	LH_2/LO_2 MANIFOLD REPRESS
			VS72–941102	25	J	4/25/88	HELIUM BLOWDOWN & XOVER VALVES
			VS72–941102	26	J	4/25/88	RTLS LH_2 REPRESS
10.11	LO_2	ROCKWELL	VS70–410119	3–6	D	12/18/89	MPS FEED, RECIRC, & POGO
			VS70–410129	1–3	F	11/16/89	MPS FILL, RLF & ET DSC
			VS70–410139	4	E	5/12/89	MPS HELIUM
			VS70–410159	1	E	5/3/89	MPS PANEL I/F
			VS72–941099	10–12	A/B15	3/23/90	LO_2 PREVALVES
			VS72–941099	13	A/B15	3/23/90	LH_2 RECIRCULATION
			VS72–941099	14	A/B15	3/23/90	LO_2 OVERBOARD BLEED & POGO
			VS72–941099	17	A/B15	3/23/90	LO_2 INBOARD F/D
			VS72–941099	19	A/B15	3/23/90	LO_2 RLF SHUTOFF VALVE
			VS72–941099	21	A/B15	3/23/90	LO_2 TANK FEED DSC
			VS72–941099	30	A/B15	3/23/90	LH_2/LO_2 MANIFOLD REPRESS

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
10.5	ENGR J. D. REDING		10.10	ENGR W. F. LANE	
	ENGR			ENGR	
10.6, 10.7	ENGR J. D. REDING		10.11	ENGR E. GALLAGHER	
	ENGR			ENGR	
10.8	ENGR J. D. CALHOUN			APP	
	ENGR			APP	
10.9	ENGR M. B. SHIFFLETT			APP	
	ENGR			LTR E PCN 6	

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

VENDOR DRAWING REFERENCES

SPACE SHUTTLE	TBL NO. 10–II	
ALL	PAGE 10.II–5	SHEET 5 OF 7

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
10.11 (CONT'D)			VS72–941099	31	A/B15	3/23/90	HELIUM BLOWDOWN & XOVER
			VS72–941099	34	A/B15	3/23/90	ECO SENSOR ELECTRONICS
			VS72–941099	42	A/B15	3/23/90	PANEL I/F: LH_2/LO_2 MANIFOLD
		JSC–RDCS	STS–46			8/27/92	STS–46 RDCS DATABASE
10.12	LH_2	ROCKWELL	VS70–410112		F	11/16/84	MPS FEED, RECIRC & POGO
			VS70–410122		H	4/23/87	MPS FILL, RLF & ET DSC
			VS70–410132		G	8/16/84	MPS HELIUM
10.13	ME	ROCKWELL	VS70–410159	1–5	G	7/26/91	MPS PANEL I/F
			VS72–941099	55, 74, 90	8–18	8/27/91	ME SHUTDOWN & STATUS LIGHTS
			SSME–ECP	1259	I	7/24/95	SSME THERMOCOUPLES
		MSFC	ICD–13M15000		Y	7/16/91	VEHICLE/ME ICD
10.14	ME BLK I FASCOS	AUTONETICS	10059–401				POWER SUPPLY
			10090–516				DIGITAL BITE
			10091–516				ANALOG BITE
			10092–516				SIGNAL CONDITIONER #1
			10093–516				SIGNAL CONDITIONER #2
			10192–401				POWER SUPPLY
			13667–507				CONTROLLER, FASCOS
			13671–507				DIGITAL/ANALOG BITE CONTROL
			13696–507				NETWORK, SIGNAL CONDITIONER
			13697–507				SIGNAL CONDITIONER/LOGIC CONTROL
			14051–507				CONTROLLER, FASCOS
			14178–507				CONTROLLER, FASCOS
			14179–507				SIGNAL CONDITIONER/LOGIC CONTROL
		ROCKWELL	VS72–941099	69.1, 85.1, & 101.1	A/B15	3/23/90	FASCO
		JSC	51–L				51–L MML
10.15	LATCH	ROCKWELL	VS70–410129	1–5	F	11/16/89	MPS FILL, RLF, & ET DSC
10.16	ME BLK II CONTR	HONEYWELL	34048827	1	—	6/15/87	SSME CONTROLLER ASSY – INPUT ELECTRONICS FUNCTIONAL SCHEMATIC
			34048828	1	—	6/15/87	SSME CONTROLLER ASSY – COMPUTER INTERFACE ELECTRONICS FUNCTIONAL SCHEMATIC

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
10.11	ENGR E. GALLAGHER		10.15	ENGR M. F. MACHULA	
	ENGR			ENGR	
10.12	ENGR G. A. DICKINSON		10.16	ENGR M. P. PATEL	
	ENGR			ENGR	
10.13	ENGR J. D. REDING			APP	
	ENGR			APP	
10.14	ENGR			APP	
	ENGR			LTR E PCN 6	

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

VENDOR DRAWING REFERENCES

SPACE SHUTTLE	TBL NO. 10–II	
ALL	PAGE 10.II–6	SHEET 6 OF 7

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
10.16 (CONT'D)			34048829	1	—	6/15/87	SSME CONTROLLER ASSY – OUTPUT ELECTRONICS FUNCTIONAL SCHEMATIC
			34048830	1	—	6/15/87	SSME CONTROLLER ASSY – DIGITAL COMPUTER UNIT FUNCTIONAL SCHEMATIC
			34048831	1	—	6/15/87	SSME CONTROLLER ASSY – POWER SUPPLY ELECTRONICS FUNCTIONAL SCHEMATIC
			34048832	1	—	6/15/87	SSME CONTROLLER ASSY – FUNCTIONAL SCHEMATIC
			34071161	1–52	B	10/19/89	SSME CONTROLLER ASSEMBLY SCHEMATIC DIAGRAM (PROTOTYPE/QUAL/FLIGHT)
		ROCKWELL	SSME–ECP	1259	I	7/24/95	SSME THERMOCOUPLES
10.17	ME BLK II DCU	HONEYWELL	340448830	1	—	6/15/87	SSME CONTROLLER ASSY – DIGITAL COMPUTER UNIT FUNCTIONAL SCHEMATIC
			34071161	1, 14–16, 41–43	B	10/19/89	SSME CONTROLLER ASSEMBLY SCHEMATIC DIAGRAM (PROTOTYPE/QUAL/FLIGHT)
10.18	ME BLK II CIE	HONEYWELL	34048828	1	—	6/15/87	SSME CONTROLLER ASSY – COMPUTER INTERFACE ELECTRONICS FUNCTIONAL SCHEMATIC
			34071161	1, 17–28, 44–52	B	10/19/89	SSME CONTROLLER ASSEMBLY SCHEMATIC DIAGRAM (PROTOTYPE/QUAL/FLIGHT)
10.19	ME BLK II IE/FASCOS	HONEYWELL	34048827	1	—	6/15/87	SSME CONTROLLER ASSY – INPUT ELECTRONICS FUNCTIONAL SCHEMATIC
			34071161	1, 3–8, 26–28, 31–35, 50–52	B	10/19/89	SSME CONTROLLER ASSEMBLY SCHEMATIC DIAGRAM (PROTOTYPE/QUAL/FLIGHT)
		ROCKWELL	SSME–ECP	1259	I	7/24/95	SSME THERMOCOUPLES
10.20	ME BLK II OE	HONEYWELL	34048829	1	—	6/15/87	SSME CONTROLLER ASSY – OUTPUT ELECTRONICS FUNCTIONAL SCHEMATIC
			34071161	1, 9–13, 26–28, 36–40, 50–52	B	10/19/89	SSME CONTROLLER ASSEMBLY SCHEMATIC DIAGRAM (PROTOTYPE/QUAL/FLIGHT)
10.21	ME BLK II PSE	HONEYWELL	34048831	1	—	6/15/87	SSME CONTROLLER ASSY – POWER SUPPLY ELECTRONICS FUNCTIONAL SCHEMATIC
			34071161	1,2,27,29,30,51	B	10/19/89	SSME CONTROLLER ASSEMBLY SCHEMATIC DIAGRAM (PROTOTYPE/QUAL/FLIGHT)
10.23 (SHEETS 1–3)	EMEC	ROCKWELL	VS70–976099	23/55.1	EO A18	10/16/90	EMEC 1 & 2 POWER ON
			VS70–976099	24/57.1	EO A18	9/13/90	EMEC 1 CORE A
			VS70–976099	25/57.2	EO A18	9/13/90	EMEC 1 CORE B
			VS70–976099	26/74.1	EO A18	9/13/90	EMEC SOLENOIDS AND EMEC 1 PICS
			VS70–976099	27/78.1	EO A18	9/13/90	EMEC 2 CORE A
			VS70–976099	28/78.2	EO A18	9/13/90	EMEC 2 CORE B
			VS70–976099	29/95.1	EO A18	9/13/90	EMEC PFB TABLE

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
10.16	ENGR M. P. PATEL		10.20	ENGR J. D. CALHOUN	
	ENGR			ENGR	
10.17	ENGR C. M. LOWE		10.21	ENGR W. F. LANE	
	ENGR			ENGR	
10.18	ENGR C. M. LOWE		10.23	ENGR M. B. SHIFFLETT	
	ENGR			APP	
10.19	ENGR M. P. PATEL			APP	
	ENGR			LTR E PCN 6	

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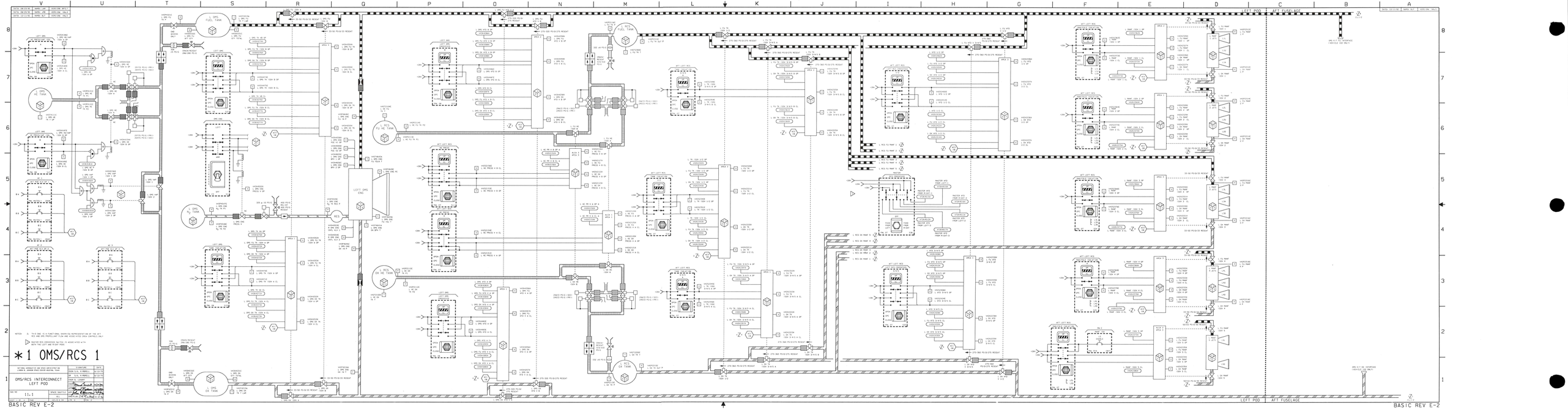
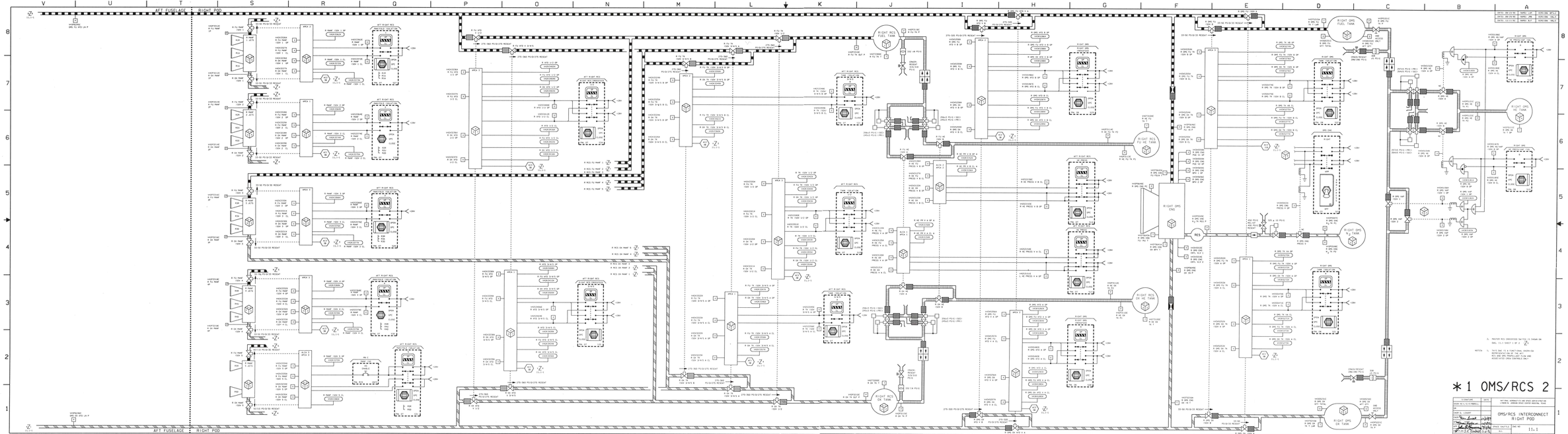
LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEXAS

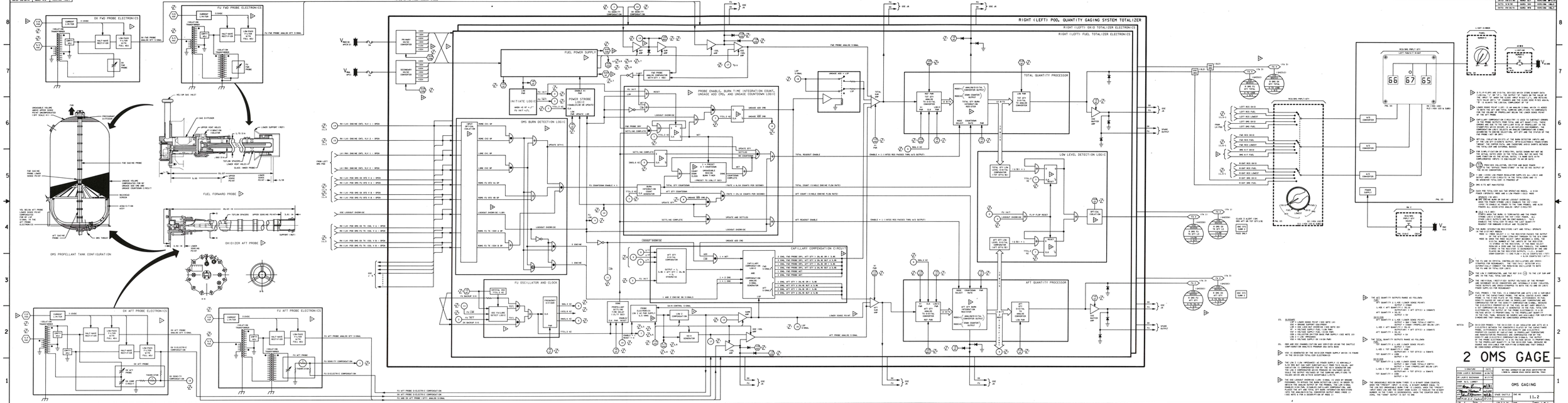
VENDOR DRAWING REFERENCES

SPACE SHUTTLE	TBL NO. 10–II	
ALL		
	PAGE 10.II–7	SHEET 7 OF 7

BASIC REV E–6


*1 OMS/RCS 1
OMS/RCS INTERCONNECT
LEFT POD
11.1
BASIC REV E-2
LEFT POD
AFT FUSELAGE
L OMS FUEL TANK
L OMS OX TANK
L OMS HE TANK
L RCS FU HE TANK
L RCS OX HE TANK
L RCS FUEL TANK
L RCS OX TANK
LEFT OMS ENG
LEFT OMS MANIFOLD
LEFT RCS MANIFOLD
AFT LEFT RCS
MASTER XFD FROM LEFT-1
MASTER XFD FROM LEFT-2
L OMS FUEL TANK VENT
L OMS OX TANK VENT
L OMS HE TANK
L RCS FU HE TANK
L RCS OX HE TANK
L RCS FUEL TANK
L RCS OX TANK
LEFT OMS ENG
L OMS FU TK
L OMS OX TK
L RCS FU TK
L RCS OX TK
L OMS HE TK
L RCS HE TK
L OMS HE REG
L RCS HE REG
L OMS HE PRESS
L RCS HE PRESS
L OMS FU TK VENT
L OMS OX TK VENT
L RCS FU TK VENT
L RCS OX TK VENT
L OMS FU TK PRESS
L OMS OX TK PRESS
L RCS FU TK PRESS
L RCS OX TK PRESS
L OMS HE PRESS
L RCS HE PRESS
L OMS FU TK ISOL
L OMS OX TK ISOL
L RCS FU TK ISOL
L RCS OX TK ISOL
L OMS HE ISOL
L RCS HE ISOL
L OMS FU TK FILL
L OMS OX TK FILL
L RCS FU TK FILL
L RCS OX TK FILL
L OMS HE FILL
L RCS HE FILL
L OMS FU TK DRAIN
L OMS OX TK DRAIN
L RCS FU TK DRAIN
L RCS OX TK DRAIN
L OMS HE DRAIN
L RCS HE DRAIN
L OMS FU TK SAMPLE
L OMS OX TK SAMPLE
L RCS FU TK SAMPLE
L RCS OX TK SAMPLE
L OMS HE SAMPLE
L RCS HE SAMPLE


AFT FUSELAGE : RIGHT POD
V U T S R Q P O N M L K J I H G F E D C B A
8 7 6 5 4 3 2 1
RIGHT RCS FUEL TANK
RIGHT RCS FU HE TANK
RIGHT RCS OX TANK
RIGHT OMS FUEL TANK
RIGHT OMS OX TANK
RIGHT OMS ENG
RIGHT OMS HE TANK
AFT RIGHT RCS
RCS
*1 OMS/RCS 2
OMS/RCS INTERCONNECT
RIGHT POD
11.1
BASIC REV E-2


RIGHT (LEFT) POD, QUANTITY GAGING SYSTEM TOTALIZER
RIGHT (LEFT) OX10 TOTALIZER ELECTRONICS
RIGHT (LEFT) FUEL TOTALIZER ELECTRONICS
OX FWD PROBE ELECTRONICS
FU FWD PROBE ELECTRONICS
OX AFT PROBE ELECTRONICS
FU AFT PROBE ELECTRONICS
FUEL POWER SUPPLY
FU OSCILLATOR AND CLOCK
OMS BURN DETECTION LOGIC
PROBE ENABLE, BURN TIME INTEGRATION COUNT, UNGAGE ADD CMD, AND UNGAGE COUNTDOWN LOGIC
CAPILLARY COMPENSATION CIRCUIT
TOTAL QUANTITY PROCESSOR
LOW LEVEL DETECTION LOGIC
AFT QUANTITY PROCESSOR
OMS PROPELLANT TANK CONFIGURATION
FUEL FORWARD PROBE
OX10IZER AFT PROBE
2 OMS GAGE
OMS GAGING
SPACE SHUTTLE
11.2
BASIC REV E-1

DATE= 11/21/86	NAME= MAG	VERSION= BPTL7
DATE= 12/2/86	NAME= MAG	VERSION= BPTL8
DATE= 08/27/90	NAME= JMB	VERSION= INHL3

	LEFT	RIGHT
OMS ARM CMD 1	V4354572X	V4355572X
OMS ARM CMD 2	V4354573X	V4355573X
OMS ARM/PRESS CMD 1	V43545710X	V43555710X
OMS ARM/PRESS CMD 2	V43545711X	V43555711X
OMS VLV PWR ENA 1	V43545715E	V43555715E
OMS V1C1	V43545483X	V43555583X
OMS V1C2	V43545484X	V43555584X
OMS V2C1	V43545485X	V43555585X
OMS V2C2	V43545486X	V43555586X
BFS ARM/PRESS	V98X07723X	V98X07724X
BFS ARM	V98X07726X	V98X07727X
ARM/PRESS SW DIS	V90X70431X	V90X70495X
ARM SW DIS	V90X70432X	V90X70644X

LCA'S NO 1 AND 2-LEFT OMS

LCA'S NO 1 AND 3-RIGHT OMS

AMC1

AMC2

AMC3

BOTH VALVES V1 AND V2 REQUIRED TO FIRE OMS ENGINE, COIL 1 OR COIL 2 WILL OPEN ENGINE VALVE

NOTES: THE SAMPLE RATE IS 1 S/S IN OPS 1

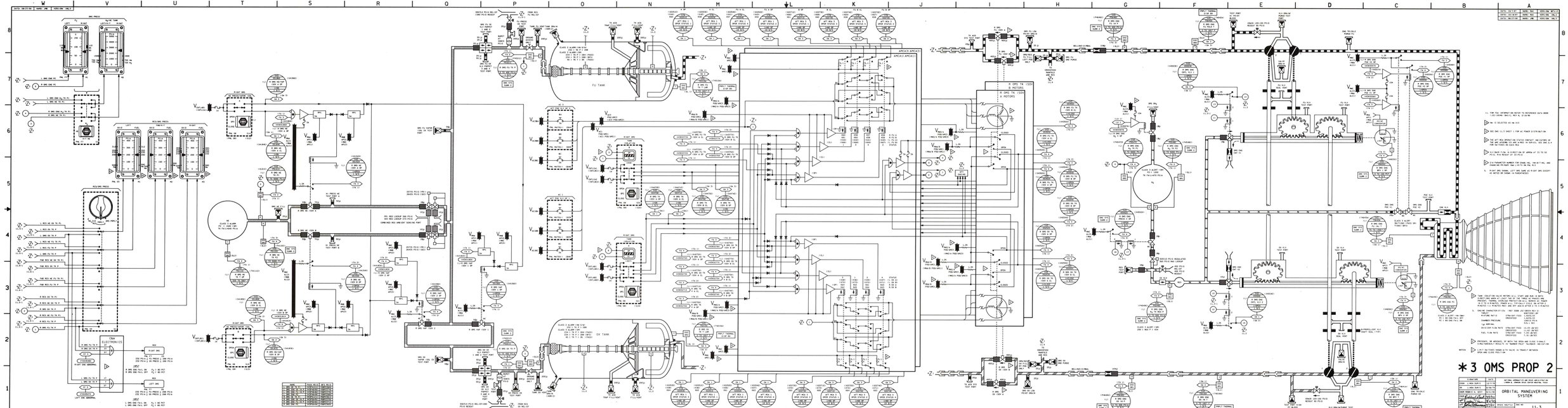
* 3 OMS 1

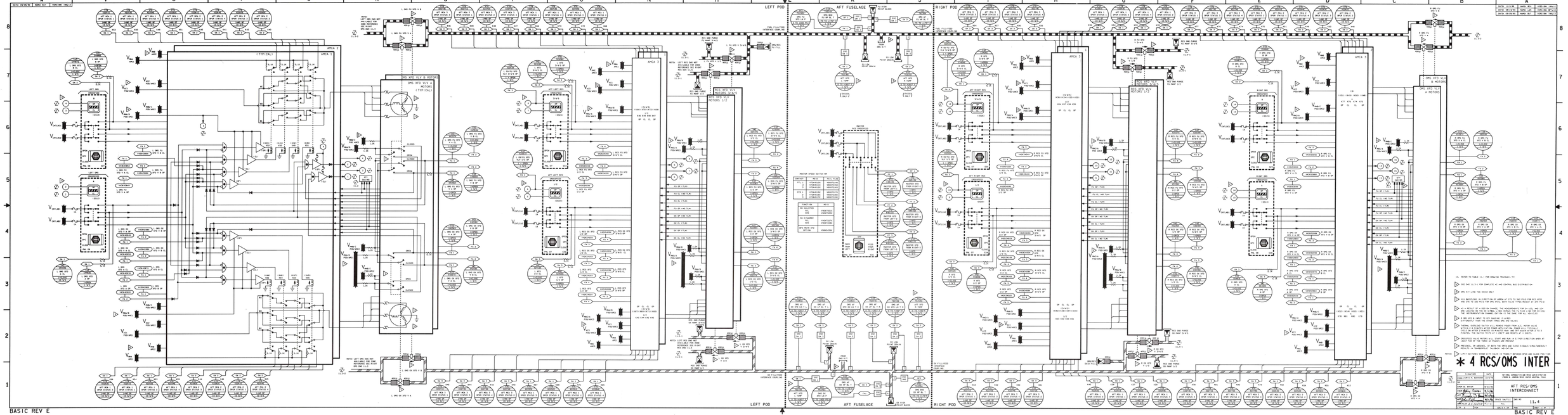
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS	SIGNATURE	DATE
	DSGN VICKI S. HUNTER	8/8/83
OMS/DRIVERS	DR VICKI S. HUNTER	8/8/83
	CHGR ROBBIE D. GEST	8/21/90
	CHGR	9/4/90
		9/4/90
	CHIEF PLAN'S	9/4/90

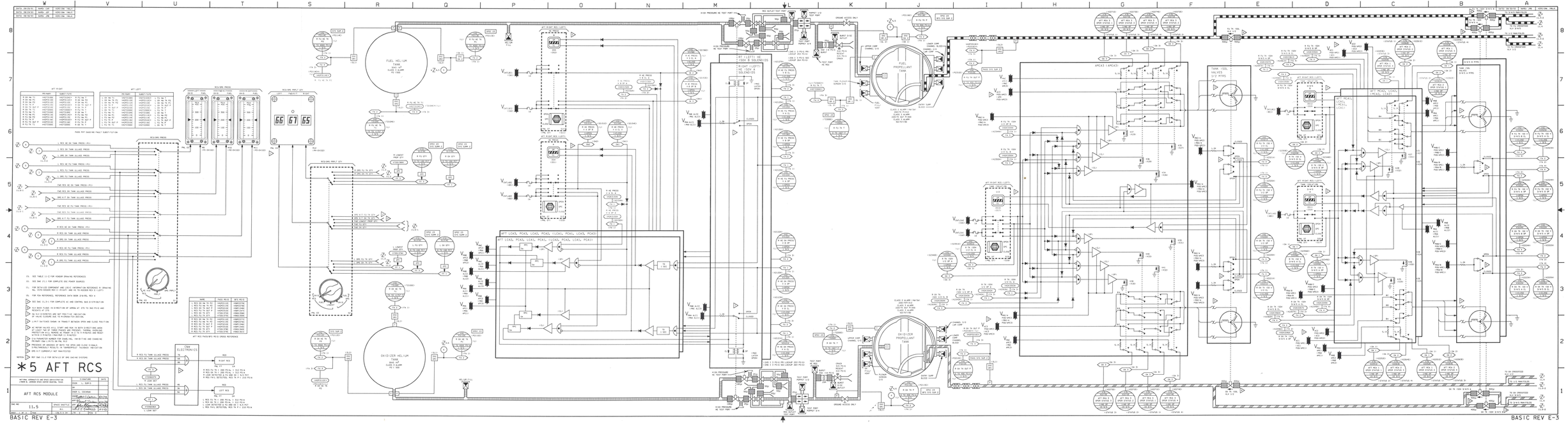
DWG NO	SPACE SHUTTLE
11.3	ALL
SHEET 1 OF 2	PAGE 66 V 34
VER E	FOR

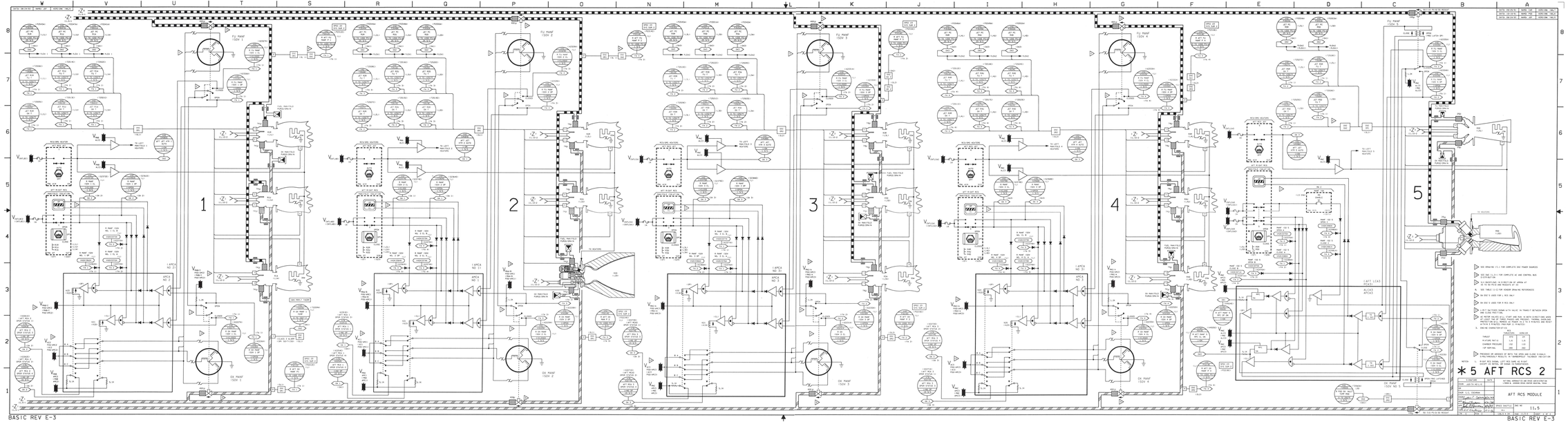
BASIC REV E

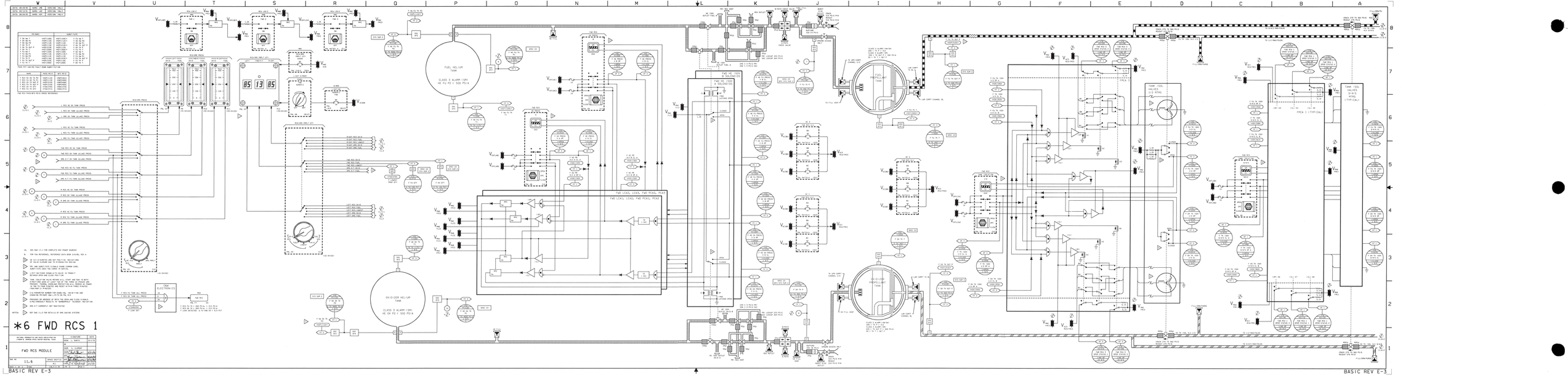
BASIC REV E

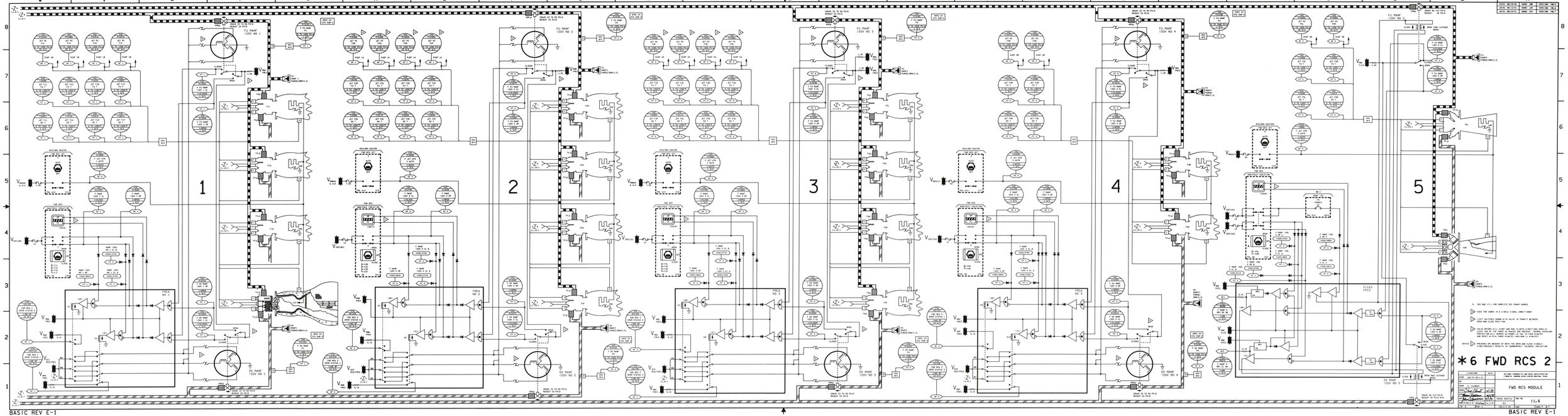

*3 OMS PROP 2
ORBITAL MANEUVERING SYSTEM
11.3
BASIC REV E

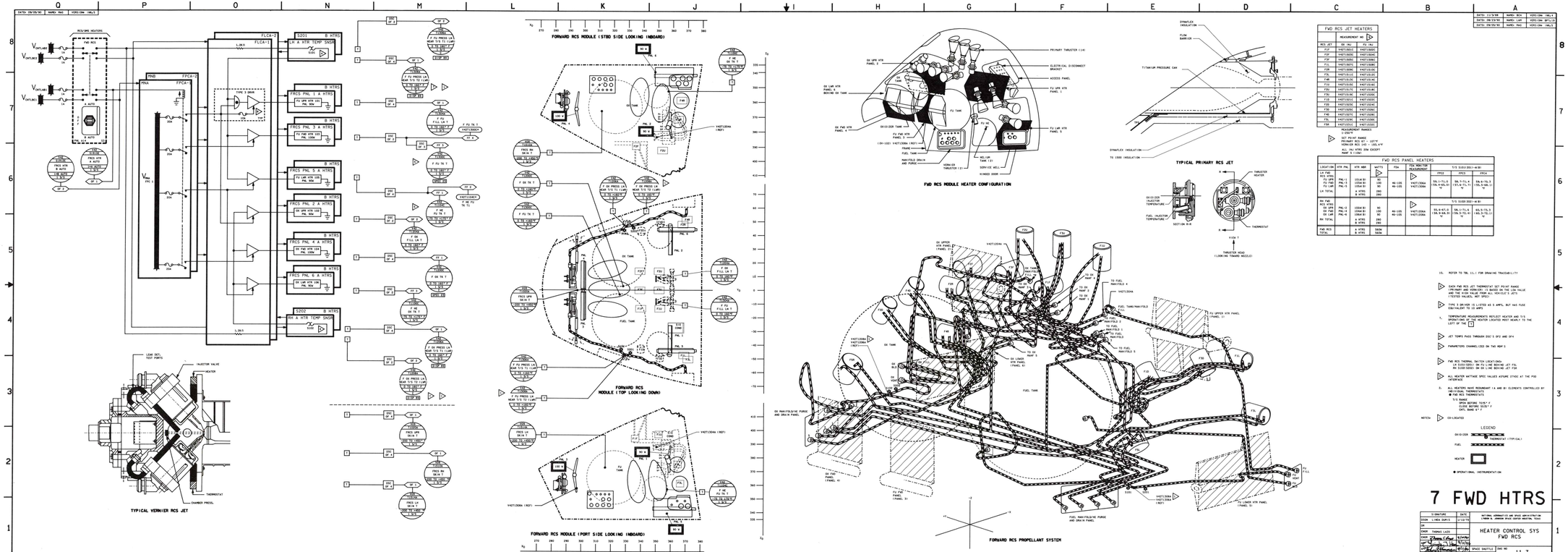

LEFT POD
AFT FUSELAGE
RIGHT POD
LEFT POD
AFT FUSELAGE
RIGHT POD
ARCA 2
ARCA 3
OMS XFD VLV B MOTORS
OMS XFD VLV A MOTORS
RCS XFD VLV MOTORS 1/2
OMS XFD VLV B MOTORS
OMS XFD VLV A MOTORS
* 4 RCS/OMS INTER
AFT RCS/OMS INTERCONNECT
11.4
BASIC REV E
BASIC REV E

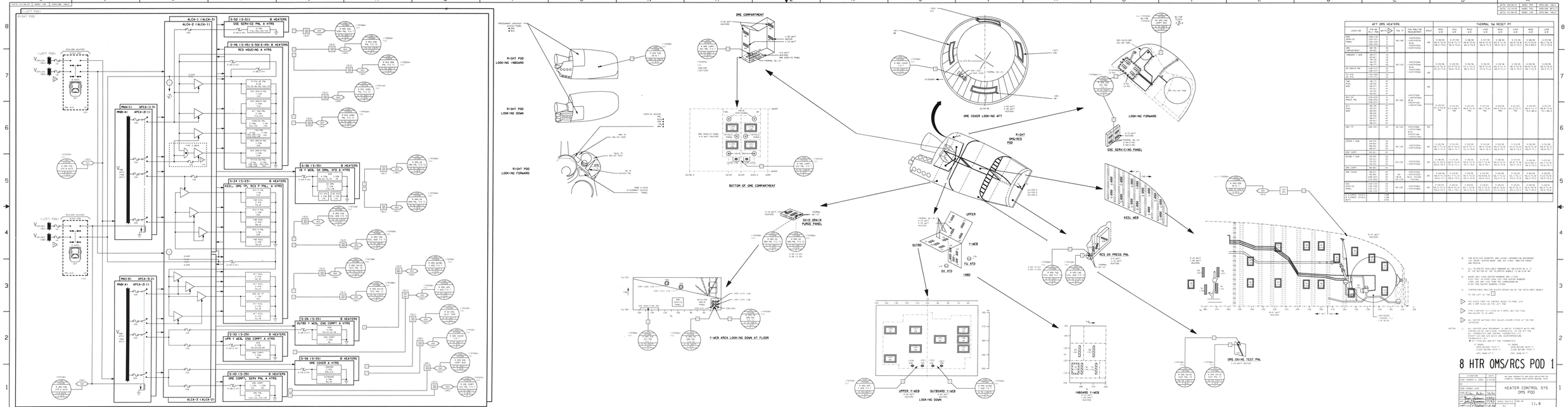

*5 AFT RCS
AFT RCS MODULE
11.5
BASIC REV E-3
BASIC REV E-3


* 5 AFT RCS 2
AFT RCS MODULE
11.5
BASIC REV E-3
BASIC REV E-3


*6 FWD RCS 1
FWD RCS MODULE
11.6
BASIC REV E-3
BASIC REV E-3


*6 FWD RCS 2
FWD RCS MODULE
1
2
3
4
5
FCA 1
FCA 2
FCA 3
FCA 4
FPC 1
FPC 2
FPC 3
FPC 4
FU MANF 150V NO 1
FU MANF 150V NO 2
FU MANF 150V NO 3
FU MANF 150V NO 4
FU MANF 150V NO 5
DX MANF 150V NO 1
DX MANF 150V NO 2
DX MANF 150V NO 3
DX MANF 150V NO 4
DX MANF 150V NO 5
FLOAT FPC3
BASIC REV E-1
BASIC REV E-1


RCS/OMS HEATERS
FWD RCS
FPCA-2
FLCA-2
FLCA-1
S201
LH A HTR TEMP SNSR
S202
RH A HTR TEMP SNSR
B HTRS
A HTRS
FRCS PNL 1 A HTRS
FRCS PNL 3 A HTRS
FRCS PNL 2 A HTRS
FRCS PNL 4 A HTRS
FRCS PNL 6 A HTRS
FRCS PNL 5 A HTRS
TYPICAL VERNIER RCS JET
FORWARD RCS MODULE (STBD SIDE LOOKING INBOUND)
FORWARD RCS MODULE (TOP LOOKING DOWN)
FORWARD RCS MODULE (PORT SIDE LOOKING INBOUND)
FWD RCS MODULE HEATER CONFIGURATION
TYPICAL PRIMARY RCS JET
FORWARD RCS PROPELLANT SYSTEM
FWD RCS JET HEATERS
FWD RCS PANEL HEATERS
7 FWD HTRS
HEATER CONTROL SYS
FWD RCS
BASIC REV E



AFT OMS HEATERS						THERMAL SW RESET PT					
LOCATION	QTY PER W/O PNL	QTY PER PNL	TYPE TH	FOR MEAN/OVR MEASUREMENT	SPDT#	MPRO A/B	LPRO A/B	MFAV A/B	LFAV A/B	MFAV A/B	LFAV A/B
OX SPPL PANEL	1	1	MI-1/8	1.5V/28.5V/4.5V/5TC/ 1.5V/5TC/28.5V	#5	5.19±.96 (66.7±12.3)	5.17±.96 (66.4±12.3)	5.18±.96 (66.5±12.3)	5.17±.96 (66.4±12.3)	5.18±.96 (66.5±12.3)	5.17±.96 (66.4±12.3)
OME COMPARTMENT	1	1									
HEADER A WEB	1	1									
OX SPPLY PNL	1	1									
TVC SPPLY OX PNL	1	1									
FWD WEB	1	1			#5						
RCS OX PRESS PNL	1	1	MI-1/8	1.5V/28.5V/4.5V/5TC/ 1.5V/5TC/28.5V		5.22±.96 (66.7±12.3)	5.21±.96 (66.7±12.3)	5.22±.96 (66.7±12.3)	5.21±.96 (66.7±12.3)	5.22±.96 (66.7±12.3)	5.21±.96 (66.7±12.3)
AFT WEB	1	1									
APU PNL	1	1	MI-1/8	1.5V/28.5V/4.5V/5TC/ 1.5V/5TC/28.5V	#5						
UPPER Y WEB	1	1	MI-1/8	1.5V/28.5V/4.5V/5TC/ 1.5V/5TC/28.5V	#5	5.22±.96 (66.7±12.3)	5.21±.96 (66.7±12.3)	5.22±.96 (66.7±12.3)	5.21±.96 (66.7±12.3)	5.22±.96 (66.7±12.3)	5.21±.96 (66.7±12.3)
OME COMPT	1	1									
OUTBD Y WEB	1	1	MI-1/8	1.5V/28.5V/4.5V/5TC/ 1.5V/5TC/28.5V	#5	5.19±.96 (66.7±12.3)	5.17±.96 (66.4±12.3)	5.19±.96 (66.7±12.3)	5.17±.96 (66.4±12.3)	5.19±.96 (66.7±12.3)	5.17±.96 (66.4±12.3)
INB COMPT	1	1									
OME COVER	1	1	MI-1/8	1.5V/28.5V/4.5V/5TC/ 1.5V/5TC/28.5V	#5	5.19±.96 (66.7±12.3)	5.17±.96 (66.4±12.3)	5.19±.96 (66.7±12.3)	5.17±.96 (66.4±12.3)	5.19±.96 (66.7±12.3)	5.17±.96 (66.4±12.3)
OUTBD Y WEB	1	1	MI-1/8	1.5V/28.5V/4.5V/5TC/ 1.5V/5TC/28.5V	#5	5.19±.96 (66.7±12.3)	5.17±.96 (66.4±12.3)	5.19±.96 (66.7±12.3)	5.17±.96 (66.4±12.3)	5.19±.96 (66.7±12.3)	5.17±.96 (66.4±12.3)
OME COMPT, SERV PNL	1	1	MI-1/8	1.5V/28.5V/4.5V/5TC/ 1.5V/5TC/28.5V	#5	5.19±.96 (66.7±12.3)	5.17±.96 (66.4±12.3)	5.19±.96 (66.7±12.3)	5.17±.96 (66.4±12.3)	5.19±.96 (66.7±12.3)	5.17±.96 (66.4±12.3)
# SYSTEM TOTALS & ELEMENTS WITH		19 PNL 23 HTR									

A. FOR DETAILED GEOMETRY AND LAYOUT INFORMATION REFERENCE OMS/RCS THRUSTER BANK AND OME/RCS TANK CONTOUR DRAWING AND PROCESS

B. ALL HEATER AVAILABLE POWER AT NOMINAL 28.5 V DC AT THE BOTTOM OF THE TELEMETRY BUNDLE IS ON STEP #8

C. WIRE RUNS SHOWN HEATER NUMBERS ARE LISTED. NOTE THAT IN EVERY CASE LEFT POD HEATER NUMBERS ARE ONE LESS THAN RIGHT POD HEATER NUMBERS EXCEPT FOR HEATER NUMBERS 23/24).

D. TEMPERATURES MONITOR HEATER OPERATION OF THE PATCH MEET NEARLY THE TIME LEFT OF THE

TWO FUSES FROM THE CONTROL BUSES TO PANEL A1A (THE C AND APCA-2) ON THE LEFT POD.

THREE 3 OR 5 AMP HI LITTLE NO. 5 AMPS, BUT HAS FUSE DESIGNATION TO 15 AMPS.

ALL HEATER WATTAGE SPEC VALUES ASSUME STUDY AT THE POD ELEMENTS.

F. ALL HEATERS HAVE REDUNDANT A AND B) ELEMENTS WITCH ARE CONTROLLED BY MULTIPLE THERMOSTATS, TO THE AFT POD ALL THERMOSTATS ARE CONTROL THERMOSTATS (TC) EXCEPT FOR THE TWO WHICH ARE OVERTEMPERATURE THERMOSTATS (OT).

● AFT FUSELAGE AND AFT POD THERMOSTATS

OPEN BEFORE 1015° F	OPEN BEFORE 1015° F
CLOSE BEFORE 1015° F	CLOSE BEFORE 1015° F
CNTL BAND 6° F	CNTL BAND 6° F

8 HTR OMS/RCS POD 1

DESIGNED	DATE
DON TARBERG W. ORES 7-13-83	
CHECKED	
CHAP THOMAS LAS	
APPROVED	
[signature] 7-26-84	
[signature] 7-26-84	
[signature] 7-26-84	
[signature] 7-26-84	

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

HEATER CONTROL SYS
OMS POD

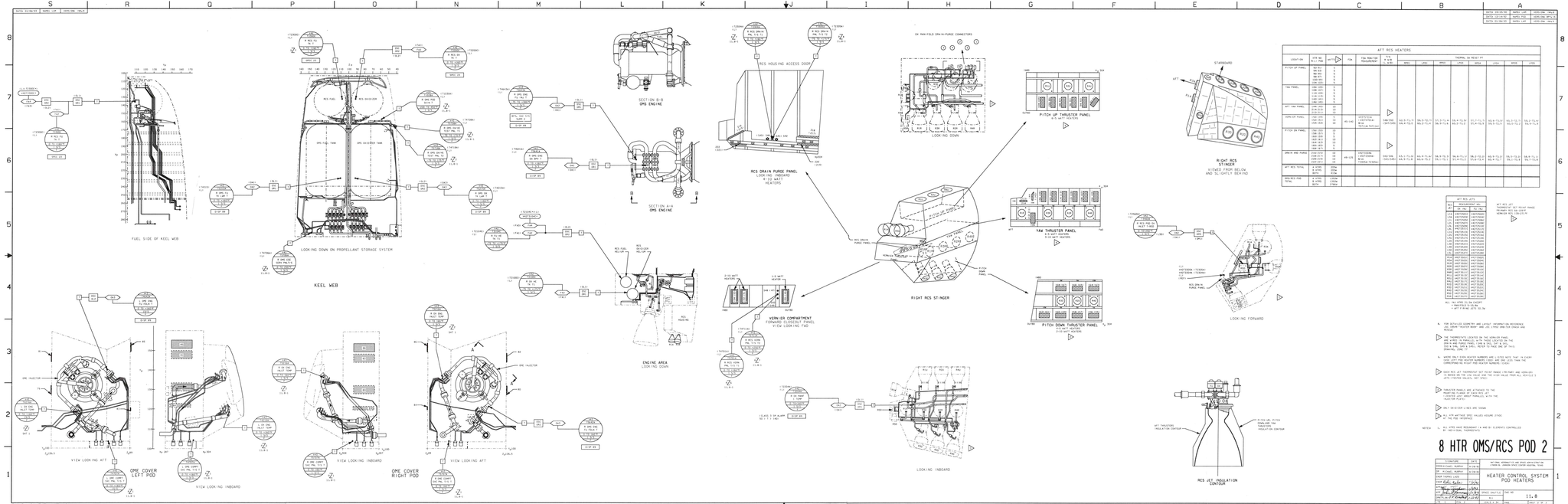
SPACE SHUTTLE | DWG NO. 11.8

SCALE NONE | SHEET 1 OF 1 | REV LTR

DATA ON DWG NO. | SUPSD NOS | SUPPLYING VEHICLE
DATA ON DWG NO. | SUPSD NOS | SUPPLYING VEHICLE
DATA ON DWG NO. | SUPSD NOS | SUPPLYING VEHICLE

BASIC REV E-2

BASIC REV E-2



AFT RCS HEATERS

LOCATION	HTR NO. W.U. NO.	WATTS	TSS	TSS TEMP FOR TEMPERATURE	W.U. & H.U. WATTS	THERMAL SW RESET PT.							
						SPARE	LPSU	SPARE	LPSU	SPARE	LPSU	SPARE	LPSU
PITCH UP PANEL	R2-R3 R4-R5 R6-R1 R7-R8	6 6 6 6											
YAW PANEL	L08-L09 L10-L11 L12-L13 L14-L15	105 105 105 105											
AFT YAW PANEL	L16-L17 L18-L19 L20-L21	105 105 105											
DOWN-LOT PANEL	L22-L23 L24-L25 L26-L27	105 105 105	#01-L60	HEATERS & SWITCHES ARE ON PANEL L26									
PITCH DN PANEL	L28-L29 L30-L31 L32-L33 L34-L35	105 105 105 105											
DRAIN AND PURGE	L36-L37 L38-L39 L40-L41 L42-L43	105 105 105 105	#R-L60	HEATERS & SWITCHES ARE ON PANEL L26	L42/L96 L96/L98	83.4-71.74 84.9-73.0	83.4-71.74 84.9-73.0	78.8-70.5 80.3-71.7	78.8-70.5 80.3-71.7	78.8-70.5 80.3-71.7	78.8-70.5 80.3-71.7	83.4-71.74 84.9-73.0	83.4-71.74 84.9-73.0
AFT RCS TOTAL		2,100											
NON-RCS FOR TOTAL	4 #105 BOTH	420W 210W											

AFT RCS JETS

NO.	REQUIREMENT NO.
L1A	V42T70250
L1B	V42T70260
L2A	V42T70270
L2B	V42T70280
L3A	V42T70290
L3B	V42T70300
L4A	V42T70310
L4B	V42T70320
L5A	V42T70330
L5B	V42T70340
L6A	V42T70350
L6B	V42T70360
R1A	V42T70370
R1B	V42T70380
R2A	V42T70390
R2B	V42T70400
R3A	V42T70410
R3B	V42T70420
R4A	V42T70430
R4B	V42T70440
R5A	V42T70450
R5B	V42T70460
R6A	V42T70470
R6B	V42T70480

ALL YAW JETS ON THE CENTER AFT PANEL (L07 & R7) ARE 4 AFT PANEL JETS (#'s 1&2 ON EACH SIDE)

AFT RCS JET THRUST PER REQUIREMENT NO. V42-070-01

NOTES:

A. FOR DETAILED GEOMETRY AND LAYOUT INFORMATION REFERENCE DRAWING "HEATER BANK" AND JSC 17902 DRB FOR STRAIN AND WELDS

B. ONE THERMOSTAT LOCATED IN THE VERNIER PANEL ARE WIRED IN PARALLEL WITH THOSE LOCATED ON THE OMS/RCS POD 2 PANEL AND ARE SET TO OPEN AT 105 ± 4°F, CLOSE AT 95 ± 4°F. (SEE DETAIL "D" ON 7415 DRAWING, SHEET 7)

C. WHERE ONLY EVEN HEATER NUMBERS ARE LISTED NOTE THAT IN EVERY CASE THE ODD NUMBERED HEATER IS LOCATED ON THE OPPOSITE SIDE OF THE CORRESPONDING PLOAT POD HEATER NUMBERS. (L2A/L2B)

D. EACH RCS JET THERMOSTAT SET POINT RANGE (TRIP/RAT AND LOW-LEG) IS BASED ON THE ON-VALVE AND THE PITOR VALVE FROM ALL VEHICLE 5 JETS (TESTED VALVES, NOT SPEC).

E. VERNIER PANELS ARE ATTACHED TO THE VERNIER CLOSEOUT PANEL BY 1/4-20 CAPTIVE FASTENERS AT THE CORNERS, AS IN THE INJECTOR PLATE.

F. RCS SWITCH LOCATIONS ARE SHOWN

G. ALL AFT HEATERS SPEC VALUES ASSUME STEEL AS THE POD MATERIAL

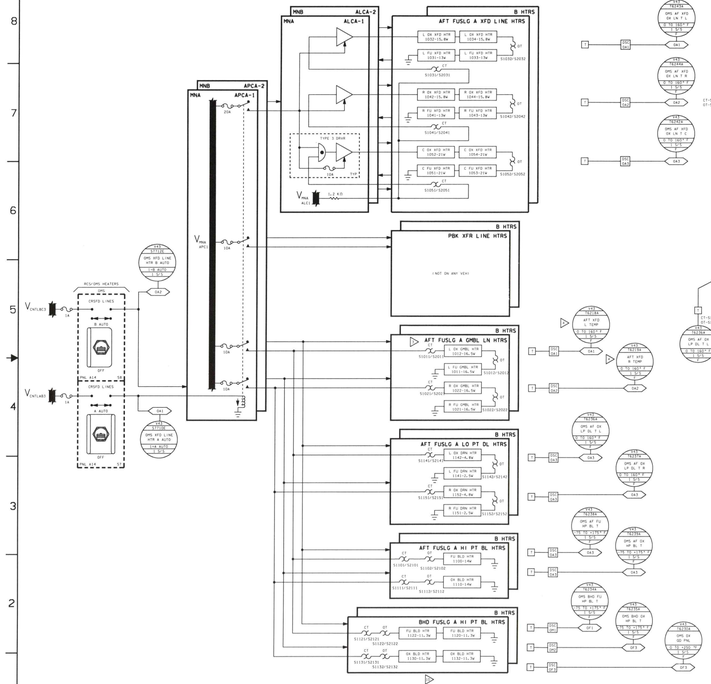
NOTES: 1. ALL ATPS ARE REDUNDANT 1 & AND BY ELEMENTS CONTROLLED BY TWO DUAL THERMOSTATS

8 HTR OMS/RCS POD 2

ENGINEERING		SCALE	
MECHANICAL WORKS	4-15-82	NOT ONEL INFORMATION ONE SPACE DATA FURNISHED ON CONTRACT NUMBER NAS9-15800	
QA	4-15-82		
SHOP FOREMAN		HEATER CONTROL SYSTEM POD HEATERS	
PROJECT ENGR.	4-15-82		
MANUFACTURING ENGR.	4-15-82		
DESIGN ENGR.	4-15-82	SPACE SHUTTLE	DWG NO. 11.8
CHECKED BY			
DRAWN BY	4-15-82	SHEET 1 OF 2	

BASIC REV E-2

BASIC REV E-2


MNB
ALCA-2
MNA
ALCA-1
APCA-2
APCA-1
B HTRS
AFT FUSLG A XFD LINE HTRS
PBK XFR LINE HTRS
AFT FUSLG A OMBL LN HTRS
AFT FUSLG A LO PT DL HTRS
AFT FUSLG A HI PT BL HTRS
BHD FUSLG A HI PT BL HTRS
RCS/OMS HEATERS
OMS CROSS 1 LINES
OMS CROSS 2 LINES
AFT FUSLG A OMBL LN
AFT FUSLG A LO PT DL
AFT FUSLG A HI PT BL
BHD FUSLG A HI PT BL
OMS AFT XFD
OMS AFT FU
OMS AFT FD
OMS BHD FU
OMS AFT PD
OMS AFT PU
OMS AFT XFD DL LN
OMS AFT FU DL
OMS AFT FD DL
OMS AFT PD DL
OMS AFT PU DL
OMS AFT XFD BL LN
OMS AFT FU BL
OMS AFT FD BL
OMS AFT PD BL
OMS AFT PU BL
OMS BHD FU BL
OMS BHD FD BL
OMS AFT XFD LN 1
OMS AFT XFD LN 2
OMS AFT FU
OMS AFT FD
OMS AFT PD
OMS AFT PU
OMS BHD FU
OMS BHD FD
OMS AFT XFD LN 7
OMS AFT XFD LN 8
OMS AFT FU
OMS AFT FD
OMS AFT PD
OMS AFT PU
OMS BHD FU
OMS BHD FD
OMS AFT XFD DL LN 7
OMS AFT XFD DL LN 8
OMS AFT FU DL
OMS AFT FD DL
OMS AFT PD DL
OMS AFT PU DL
OMS BHD FU DL
OMS BHD FD DL
OMS AFT XFD BL LN 7
OMS AFT XFD BL LN 8
OMS AFT FU BL
OMS AFT FD BL
OMS AFT PD BL
OMS AFT PU BL
OMS BHD FU BL
OMS BHD FD BL
OMS AFT XFD LN 1
OMS AFT XFD LN 2
OMS AFT FU
OMS AFT FD
OMS AFT PD
OMS AFT PU
OMS BHD FU
OMS BHD FD
OMS AFT XFD DL LN 1
OMS AFT XFD DL LN 2
OMS AFT FU DL
OMS AFT FD DL
OMS AFT PD DL
OMS AFT PU DL
OMS BHD FU DL
OMS BHD FD DL
OMS AFT XFD BL LN 1
OMS AFT XFD BL LN 2
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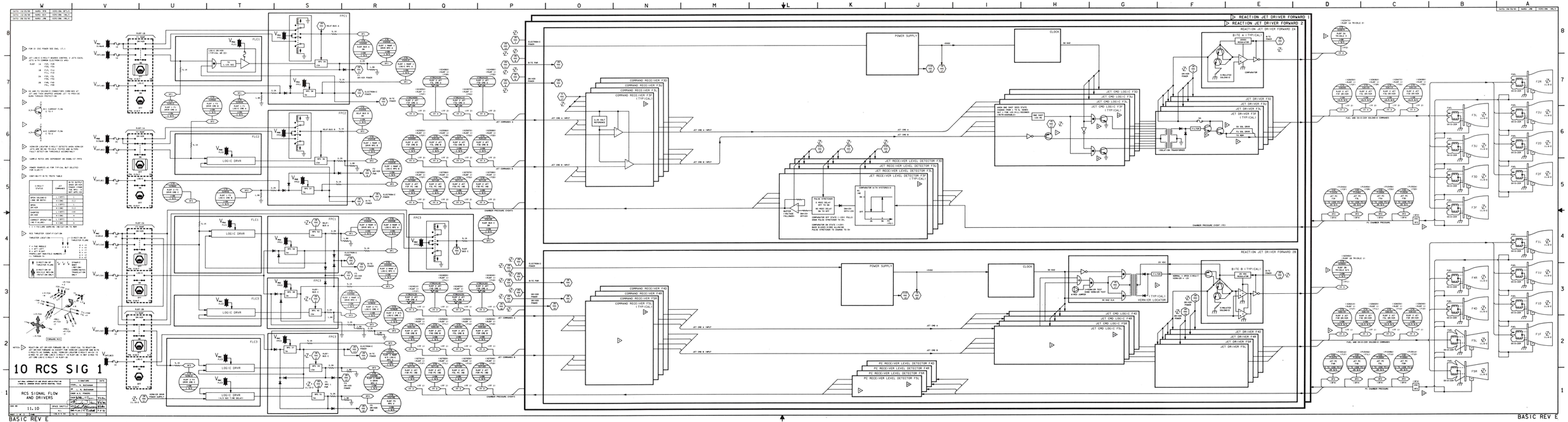
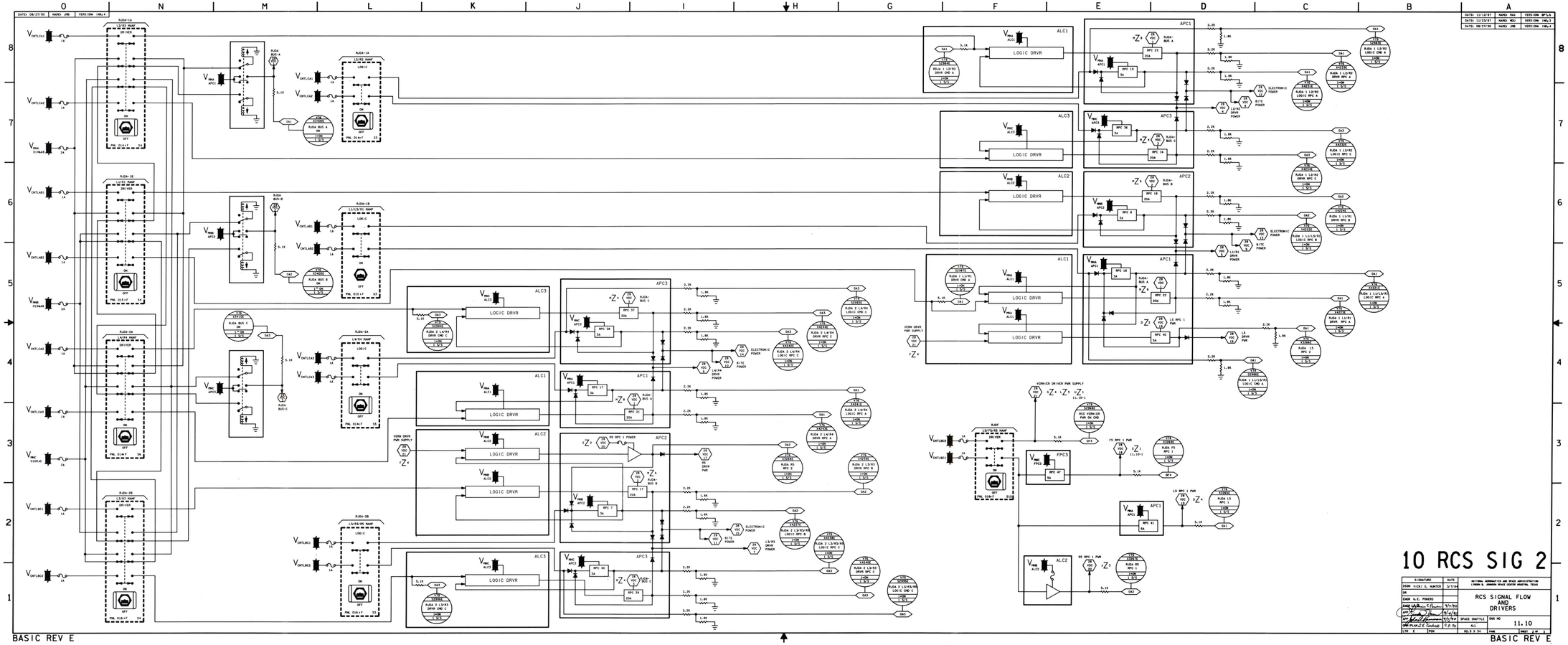
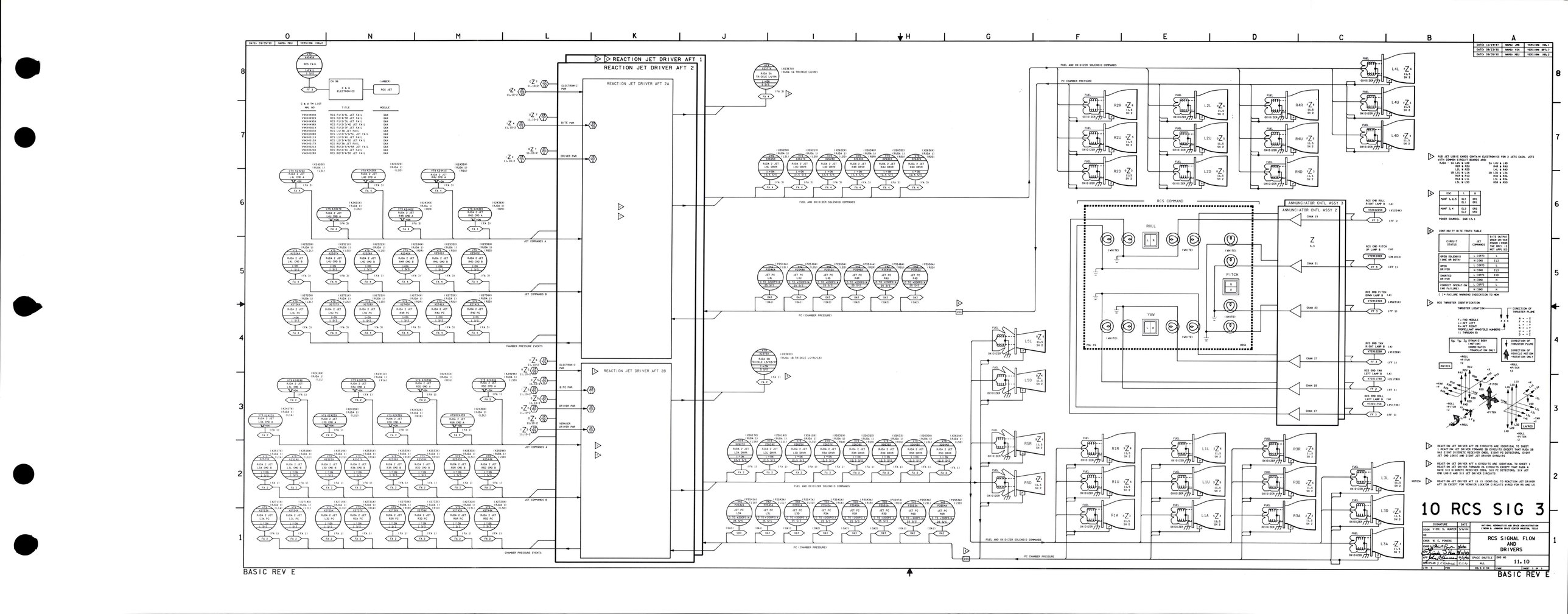
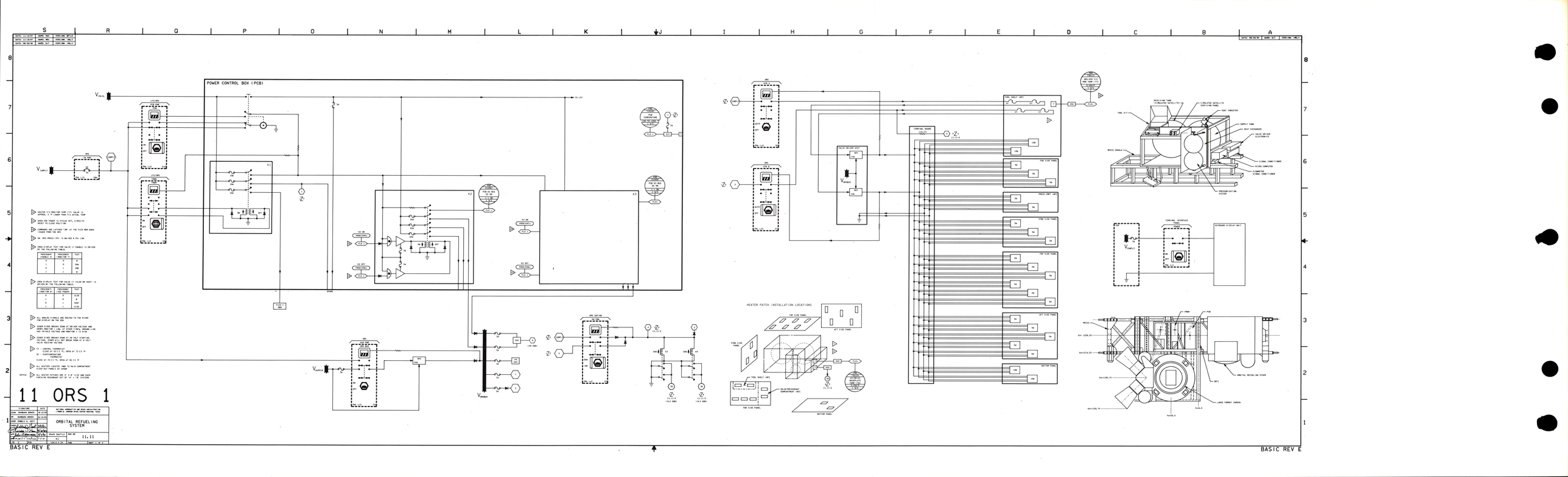
OMS BHD FU BL
OMS BHD FD BL


10 RCS SIG 1
RCS SIGNAL FLOW AND DRIVERS
11.10
REACTION JET DRIVER FORWARD 1
REACTION JET DRIVER FORWARD 2
REACTION JET DRIVER FORWARD 2A
REACTION JET DRIVER FORWARD 2B
POWER SUPPLY
CLOCK
COMMAND RECEIVER F3D
COMMAND RECEIVER F3S
COMMAND RECEIVER F4D
COMMAND RECEIVER F4S
JET CMD LOGIC F3D
JET CMD LOGIC F3S
JET CMD LOGIC F4D
JET CMD LOGIC F4S
JET DRIVER F3D
JET DRIVER F3S
JET DRIVER F4D
JET DRIVER F4S
JET RECEIVER LEVEL DETECTOR F3D
JET RECEIVER LEVEL DETECTOR F3S
PC RECEIVER LEVEL DETECTOR F4D
PC RECEIVER LEVEL DETECTOR F4S
PC RECEIVER LEVEL DETECTOR F3D
PC RECEIVER LEVEL DETECTOR F3S
BITE & TYP(CAL)
BITE B TYP(CAL)
VERNIER LOCATION
F2D
F2S
F3D
F3S
F4D
F4S
F1D
F1S
BASIC REV E


10 RCS SIG 2
RCS SIGNAL FLOW AND DRIVERS
SPACE SHUTTLE
11.10
BASIC REV E
BASIC REV E

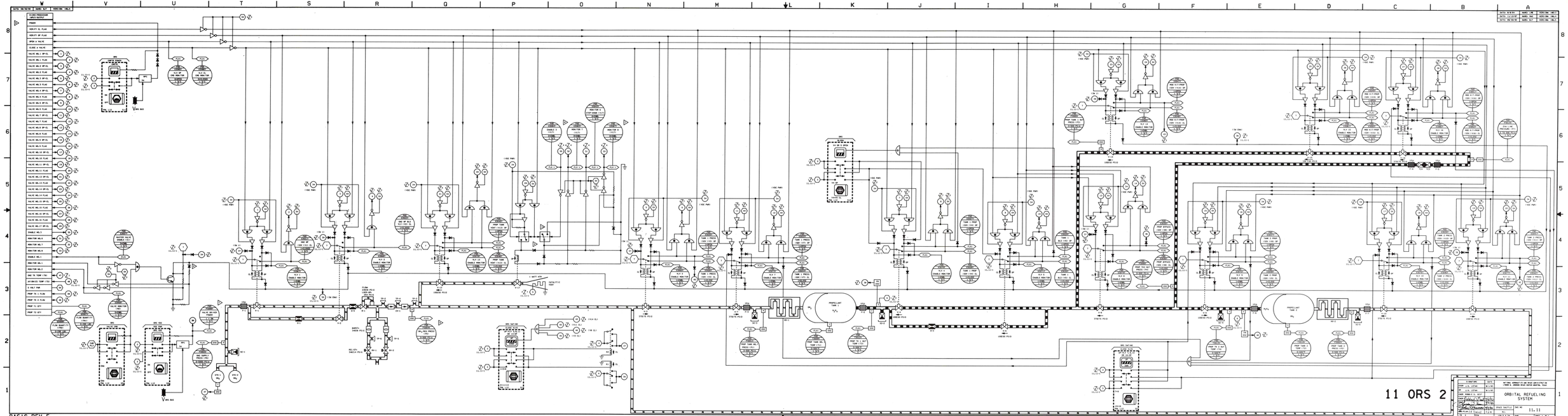

REACTION JET DRIVER AFT 1
REACTION JET DRIVER AFT 2
REACTION JET DRIVER AFT 2A
REACTION JET DRIVER AFT 2B
RCS FAIL
C & W ELECTRONICS
RCS JET
C & W TM LIST
JET COMMANDS A
JET COMMANDS B
CHAMBER PRESSURE EVENTS
FUEL AND OXIDIZER SOLENOID COMMANDS
PC CHAMBER PRESSURE
RCS COMMAND
ROLL
PITCH
YAW
ANNUNCIATOR CNTL ASSY 3
ANNUNCIATOR CNTL ASSY 2
10 RCS SIG 3
RCS SIGNAL FLOW AND DRIVERS
SPACE SHUTTLE
DWG NO
11.10
BASIC REV E



11 ORS 1

BASIC REV E

BASIC REV E


11 ORS 2
ORBITAL REFUELING SYSTEM
BASIC REV E
BASIC REV E

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
11.1 (SHEET 1)	OMS/RCS INTERCONNECT LEFT POD	R.I.	VS70-943099	1-61	A A/EOB17	8/18/88	INTEGRATED SYSTEM SCHEMATIC AFT, OMS/RCS
		R.I.	VS70-420309	1-14	D	6/19/84	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL LEFT POD
		R.I.	VS70-430302	1-14	F	5/20/91	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL LEFT POD
		R.I.	VS70-430309	1-14	F	5/29/91	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL LEFT POD
		R.I.	VS70-420302	1-13	G	8/8/88	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL LEFT POD
11.1 (SHEET 2)	OMS/RCS	R.I.	VS70-943099	1-61	A A/EOB17	8/18/88	INTEGRATED SYSTEM SCHEMATIC AFT, OMS/RCS
		R.I.	VS70-420202	1-11	F	7/28/88	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL RIGHT POD
		R.I.	VS70-420209	1-12	C	4/3/80	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL RIGHT POD
		R.I.	VS70-430202	1-12	E	8/1/84	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL RIGHT POD
		R.I.	VS70-430209	1-12	B	8/3/82	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL RIGHT POD

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
11.1-1,2	ENGR D. LENORT			ENGR	
	ENGR Dean Lenort	10/29/91		ENGR	
	ENGR			ENGR	
	ENGR			ENGR	
	ENGR			APP Anthony J. Bocacci	10/29/91
	ENGR			APP John P. Kennamer	12/2/91
	ENGR			OMNIPLAN	
	ENGR			LTR E PCN 1	

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

VENDOR DRAWING REFERENCES

SPACE SHUTTLE	TBL NO 11-I
ALL	PAGE II.I-1 SHEET 1 OF 6

BASIC REV E-1

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
11.2	OMS GAUGING	SIMMONDS PRECISION	1550420-002	1	B	3/27/85	SCHEM DIAG, OMS TOTALIZER VOLTAGE REGULATORS, FU
		SIMMONDS PRECISION	1550421-001	1,2	A	3/27/85	SCHEM DIAG, OMS TOTALIZER CONTROL LOGIC, FU
		SIMMONDS PRECISION	1550422-002	1,2	D	5/20/88	SCHEM DIAG, OMS TOTALIZER AFT SIGNAL CHANNEL, FU
		SIMMONDS PRECISION	1550423-002	1,2	D	3/27/85	SCHEM DIAG, OMS TOTALIZER TOTAL SIGNAL CHANNEL, FU
		SIMMONDS PRECISION	1550424-002	1	A	3/27/85	SCHEM DIAG, OMS TOTALIZER ANALOG PROCESSOR, FU
		SIMMONDS PRECISION	1550425	1	L	7/1/88	SCHEM DIAG, OMS AFT PROBE ELECTRONICS, FU
		SIMMONDS PRECISION	1550426	1	L	10/11/88	SCHEM DIAG, OMS FWD PROBE ELECTRONICS, FU
		SIMMONDS PRECISION	1550430-002	1	C	3/27/85	SCHEM DIAG, OMS TOTALIZER VOLTAGE REGULATORS, OX
		SIMMONDS PRECISION	1550431-001	1,2	A	4/4/85	SCHEM DIAG, OMS TOTALIZER CONTROL LOGIC, OX
		SIMMONDS PRECISION	1550432-002	1,2	D	5/20/88	SCHEM DIAG, OMS TOTALIZER AFT SIGNAL CHANNEL, OX
		SIMMONDS PRECISION	1550433-002	1,2	E	5/20/88	SCHEM DIAG, OMS TOTALIZER TOTAL SIGNAL CHANNEL, OX
		SIMMONDS PRECISION	1550434-002	1	A	3/27/85	SCHEM DIAG, OMS TOTALIZER ANALOG PROCESSOR, OX
		SIMMONDS PRECISION	1550435	1	K	7/5/88	SCHEM DIAG, OMS AFT PROBE ELECTRONICS, OX
		SIMMONDS PRECISION	1550436	1	K	7/5/88	SCHEM DIAG, OMS FWD PROBE ELECTRONICS, OX
		SIMMONDS PRECISION	1550440	1	D	8/23/78	SCHEM DIAG, OMS TOTALIZER POWER COMPONENTS
		SIMMONDS PRECISION	1550475	1	B	3/27/88	BLOCK DIAGRAM, OMS FUEL SYSTEM
		SIMMONDS PRECISION	1550448-001	1-35			OMS TOTALIZER WIRING LIST
		SIMMONDS PRECISION	1550476	1	B	3/27/88	BLOCK DIAGRAM, OMS OXIDIZER SYSTEM
		SIMMONDS PRECISION	1550478-001	1	BAS	5/14/79	INSTALLATION DIAGRAM, ELECTRICAL OMS GAUGING SYSTEM
		R.I.	VS70-973102	8,9	F-EO/ 6-03	6/21/90	INTEGRATED SCHEMATIC, DISP & CONT OV-102
		R.I.	VS70-973099	8,9	A-EO/ B03	4/25/90	INTEGRATED SCHEMATIC, DISP & CONT OV-099, OV-103, OV-104
		R.I.	VS70-976102	11,18,22, 25,41	F-EO/ G17	3/23/90	INTEGRATED SCHEMATIC, EPD & C OV-102
		R.I.	VS70-976099	11,18,22, 25,41	A EO/A15	3/14/90	INTEGRATED SCHEMATIC, EPD & C OV-099, OV-103, OV-104

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
11.2	ENGR B. C. LUNNEY			ENGR	
	ENGR Bryan Lunney	9/11/90		ENGR	
	ENGR			ENGR	
	ENGR			ENGR	
	ENGR			APP Linda J. Hom	9/11/90
	ENGR			APP John A. Kamman	9/11/90
	ENGR			OMNIPLAN	
	ENGR			LTR E PCN	

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VENDOR DRAWING REFERENCES

SPACE SHUTTLE	TBL NO 11-I
ALL	
	PAGE 11.I-2 SHEET 2 OF 6

BASIC REV E

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
11.3 (SHEET 1)	OMS/DRIVERS	ROCKWELL	VS70-430302	1-14	F	5/20/91	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL LEFT POD
		ROCKWELL	VS70-430202	1-12	E	7/13/84	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL RIGHT POD
		ROCKWELL	VS70-760709	1-11	E	11/15/90	SCHEMATIC DIAGRAM - MOTOR CONTROL ASSY POWER DISTRIBUTION
11.3 (SHEET 2)	ORBITAL MANEUVERING SYSTEM	ROCKWELL	VS70-430302	1-14	E	8/23/88	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL LEFT POD
		ROCKWELL	VS70-430202	1-12	E	8/1/84	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL RIGHT POD
		ROCKWELL	VS70-430209	1-12	B	8/3/82	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL RIGHT POD
		ROCKWELL	VS70-430309	1-14	F	5/29/91	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL LEFT POD
		ROCKWELL	VS70-943099	6-25	B	8/18/88	INTEGRATED SYSTEM SCHEMATIC AFT PROPULSION SYSTEM, OMS/RCS
		ROCKWELL	MC284-0430	ALL	F	1/20/88	PROCUREMENT SPECIFICATION - VALVE, AC MOTOR OPERATED
		ROCKWELL	MC284-0421	ALL	E	6/2/82	PROCUREMENT SPECIFICATION - VALVE, RELIEF, BURST DISC AND POPPET ASSY
		ROCKWELL	MC284-0481	ALL	B	7/18/84	PROCUREMENT SPECIFICATION - VALVE, QUAD CHECK
		MDAC	73P620001	ALL	B	3/82	PROCUREMENT SPECIFICATION - VALVE, DC SOLENOID OPERATED HIGH PRESSURE
		MDAC	73P620002	ALL	D	10/82	PROCUREMENT SPECIFICATION - REGULATOR, HELIUM PRESSURE SERIES REDUNDANT
		MDAC	73P620004	ALL	A	4/79	PROCUREMENT SPECIFICATION - VALVE, DC SOLENOID OPERATED LOW PRESSURE
		AEROJET	118 6745	ALL	J	2/13/84	PROCUREMENT SPECIFICATION - 3-WAY CONTROL VALVE
		AEROJET	118 6443	ALL	B	6/12/85	FILTER ASSEMBLY, PROPELLANT LINE
		AEROJET	118 6775	ALL	G	8/8/84	PURGE VALVE ASSEMBLY
		AEROJET	118 6813	ALL	F	3/14/84	2-WAY FILL AND VENT VALVE
		AEROJET	118 6110	ALL	AJ	8/2/88	ENGINE SUB-ASSEMBLY ORBITAL MANEUVER SYSTEM
		JSC	18546		BASIC, A	2/16/86	
		JSC	08934	VOLUME 1, SECTION 3.4-3, 4.3	E	7/15/88	SHUTTLE OPERATIONS DATA BOOK - SHUTTLE SYSTEMS PERFORMANCE AND CONSTRAINTS DATA
11.4	AFT RCS/OMS INTERCONNECT	ROCKWELL	VS70-430302	4,5	F	5/20/91	CROSSFEED VALVE A,B
		ROCKWELL	VS70-430302	8	F	5/20/91	THRUST VECTOR CONTROL
		ROCKWELL	VS70-430302	14	F	5/20/91	THERMAL SENSORS
		ROCKWELL	VS70-430209	4,5	B	8/3/82	CROSSFEED VALVE A,B
		ROCKWELL	VS70-420302	6,7	G	8/8/88	CROSSFEED VALVES 1/2, 3/4/5
		ROCKWELL	VS70-420203	6,7	D	7/28/88	CROSSFEED VALVES 1/2, 3/4/5

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
11.3-1,2	ENGR ROBBIE D. GEST			ENGR	
	ENGR Robbie D. Gest	10/29/91		ENGR	
11.4	ENGR R. BARBER			ENGR	
	ENGR Robin Barber	10/30/91		ENGR	
	ENGR			ACT Anthony Cocozzi	10/29/91
	ENGR			APP John Kamman	12/2/91
	ENGR			OMNIPLAN	
	ENGR			LTR E	PCN 1

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VENDOR DRAWING REFERENCES

SPACE SHUTTLE	TBL NO 11-I
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BASIC REV E-1

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
11.4 (CONT)		ROCKWELL	VS70-760709	9	E	11/15/90	AFT MCA-1, AFT MCA-2 OPERATIONAL STATUS, MDM INTERFACE
		ROCKWELL	VS70-760709	10	E	11/15/90	AFT MCA-3, OPERATIONAL STATUS, MDM INTERFACE
11.5	AFT RCS MODULE	R.I.	VS70-420203		D	7/8/88	SCHEMATIC DIAGRAM - AFT RCS SUBSYSTEM CONTROL RIGHT OMS POD
			VS70-420303		C	7/26/88	SCHEMATIC DIAGRAM - AFT RCS SUBSYSTEM CONTROL LEFT OMS POD
11.6 (SHEET 1)	FWD RCS MODULE	ROCKWELL	VS70-420109	1-11	B	6/24/82	SCHEMATIC DIAGRAM - RCS SUBSYSTEM CONTROL FWD MODULE
11.6 (SHEET 2)	FWD RCS MODULE	ROCKWELL	VS70-420109	1-11	B	6/24/82	SCHEMATIC DIAGRAM - RCS SUBSYSTEM CONTROL FWD MODULE (FOR MANIFOLD 1-4 COMPONENT AND LOGIC)
		ROCKWELL	VS70-420109	1-11	C	7/7/87	SCHEMATIC DIAGRAM - RCS SUBSYSTEM CONTROL FWD MODULE (FOR MANIFOLD 5 COMPONENT AND LOGIC INFORMATION)
11.7	FWD HTRS	R.I.	VS70-420102	ALL	H	9/11/87	SCHEMATIC DIAGRAM - RCS SUBSYSTEM FORWARD MODULE
		R.I.	VS70-420109	ALL	D	2/15/88	SCHEMATIC DIAGRAM - RCS SUBSYSTEM FORWARD MODULE
		R.I.	VS70-750092	ALL	B	6/5/91	SCHEMATIC DIAGRAM TPS/TCS OPERATIONAL INSTRUMENTATION (V09)
		R.I.	VS70-750099	ALL	C	4/23/84	SCHEMATIC DIAGRAM TPS/TCS OPERATIONAL INSTRUMENTATION (V09)
11.8	HTR OMS/RCS POD	R.I.	VS70-420202	ALL	D	7/28/88	SCHEMATIC DIAGRAM - AFT RCS SUBSYSTEM CONTROL RIGHT OMS POD
		R.I.	VS70-420209	ALL	C	6/20/84	SCHEMATIC DIAGRAM - AFT RCS SUBSYSTEM CONTROL RIGHT OMS POD
		R.I.	VS70-420302	ALL	G	8/8/88	SCHEMATIC DIAGRAM - AFT RCS SUBSYSTEM CONTROL LOMS POD
		R.I.	VS70-420309	ALL	D	6/4/84	SCHEMATIC DIAGRAM - AFT RCS SUBSYSTEM CONTROL LOMS POD
		R.I.	VS70-430202	ALL	E	8/1/84	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL RIGHT POD
		R.I.	VS70-430209	ALL	B	8/25/82	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL RIGHT POD
		R.I.	VS70-430302	ALL	F	5/20/91	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL LEFT POD
		R.I.	VS70-430309	ALL	F	5/29/91	SCHEMATIC DIAGRAM - OMS SUBSYSTEM CONTROL LEFT POD
11.9	HTR AFT OMS/RCS	R.I.	V070-435040	ALL	B	7/1/91	HEATER INSTL - OMS PROPELLANT CROSSFEED LINES
		R.I.	V070-435010	ALL	A	9/13/91	INSULATION INSTL - OMS PROPELLANT CROSSFEED

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
11.4	ENGR B. BAKER		11.8	ENGR T. LAZO	
	ENGR Robin Baker	10/30/91		ENGR Thomas C Lazo	10/29/91
11.5	ENGR C. COCHRAN		11.9	ENGR T. LAZO	
	ENGR Cynthia C. Cochran	10/30/91		ENGR Thomas C Lazo	10/29/91
11.6 - 1, 2	ENGR C. CLEMENT			APP Anthony Occaccio	10/29/91
	ENGR Chad Clement	10/29/91		APP John R Bowman	12/2/91
11.7	ENGR T. LAZO			OMNIPLAN	
	ENGR Thomas C Lazo	10/29/91		LTR E	PCN 1

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VENDOR DRAWING REFERENCES

SPACE SHUTTLE	TBL NO 11-I
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BASIC REV E-1

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
11.9 (CONT)		R.I.	V070-434221	ALL	B	4/28/88	HIGH POINT BLEED LINERS INSTL - OMS PROPELLANT (MID-BODY) INCREMENT
		R.I.	VK70-434111	ALL	B	3/13/87	HIGH POINT BLEED LINES INSTL - CENTAUR KIT
		R.I.	ECN 102-11003	-	-	8/14/91	ORBITER HEATER CIRCUIT REDESIGN
11.10 (SHEET 1)	RCS SIGNAL FLOW AND DRIVERS	R.I.	VS70-420102	ALL	H	8/26/87	RCS SUBSYSTEM CONTROL FORWARD MODULE
		R.I.	VS70-420109	ALL	D	2/8/86	RCS SUBSYSTEM CONTROL FORWARD MODULE
		R.I.	VS70-973099	8	A	6/19/87	ORBITER DISPLAY AND CONTROL PANEL CONFIGURATION
		R.I.	VS70-973102	8	F	11/30/87	ORBITER DISPLAY AND CONTROL PANEL CONFIGURATION
		HONEYWELL	340243230	2.0	E	6/13/77	ISOLATE/RECTIFIER
		HONEYWELL	340243240	2.0	J	8/5/76	RJD DC POWER SUPPLY
		HONEYWELL	34024428	1.0	A	4/17/80	COMPONENT BOARD ASSY - CLOCK & LOGIC
		HONEYWELL	34024426	2.0	B	2/11/81	JET LOGIC
		HONEYWELL	34024406	2.0	-	3/11/80	HEAT SINK ASSY - UPPER
		HONEYWELL	34024408	2.0	-	5/28/80	HEAT SINK ASSY - LOWER
		HONEYWELL	C12268	4	A	4/17/81	RJDF INTERCONNECT
		HONEYWELL	C11268	6	A	4/17/81	RJDP POWER AND GROUND
		HONEYWELL	C12268	7	A	4/21/81	RJDA/RJDF BLOCK DIAGRAM
11.10 (SHEET 2)	RCS SIGNAL FLOW AND DRIVERS	R.I.	VS70-420302	ALL	G	7/6/88	AFT RCS SUBSYSTEM CONTROL RIGHT OMS POD
		R.I.	VS70-420202	ALL	F	7/26/88	AFT RCS SUBSYSTEM CONTROL LEFT OMS POD
		R.I.	VS70-420209	ALL	C	6/4/84	AFT RCS SUBSYSTEM CONTROL RIGHT OMS POD
		R.I.	VS70-420309	ALL	E	8/23/88	AFT RCS SUBSYSTEM CONTROL LEFT OMS POD
11.10 (SHEET 3)	RCS SIGNAL FLOW AND DRIVERS	R.I.	VS70-420202	ALL	F	7/6/88	AFT RCS SUBSYSTEM CONTROL RIGHT OMS POD
		R.I.	VS70-420302	ALL	G	7/26/88	AFT RCS SUBSYSTEM CONTROL LEFT OMS POD
		R.I.	VS70-420209	ALL	C	6/4/84	AFT RCS SUBSYSTEM CONTROL RIGHT OMS POD
		R.I.	VS70-420309	ALL	E	8/23/88	AFT RCS SUBSYSTEM CONTROL LEFT OMS POD
		HONEYWELL	34024410	2.1	A	5/4/81	RJDA SOLENOID DRIVER
		HONEYWELL	C12268	3	A	4/17/81	RJDA INTERCONNECT
		HONEYWELL	C12268	5	A	4/17/81	RJDA POWER AND GROUNDS

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
11.9	ENGR R. BARBER			ENGR	
	ENGR Robin Barber	2/19/93		ENGR	
11.10-	ENGR W. POWERS			ENGR	
1,2,3	ENGR William E Powers	2/19/93		ENGR	
	ENGR			APP Karen Jackson	2/19/93
	ENGR			APP	
	ENGR			OMNIPLAN	
	ENGR			LTR E	PCN 2

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VENDOR DRAWING REFERENCES

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BASIC REV E-2

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
11.11	ORS	NASA/JSC	SED 39116942	①	N/A	6/26/84	ORS FLIGHT COMPUTER
		NASA/JSC	SID 36132449	①	N/A	3/9/84	ORS STANDARD SWITCH PANEL LOGIC BOX FUNCTIONAL DIAGRAM
		NASA/JSC	SED 39115875		N/A	7/12/84	ORS HEATER/FLUID SYSTEM
		NASA/JSC	SID 39116232	①	N/A	7/30/84	DRAWING TREE, ORS FOR ORS AUX PANEL, KDU, VLV DRIVER, CABLING AND HEATER WIRING
		NASA/JSC	SED 39115875			7/12/84	ORS MECHANICAL, FLUIDS, AND THERMAL
		R.I.	MC476-0147		D	3/28/84	ORS DEDICATED SIGNAL CONDITIONER
		R.I.	MC476-0134		B	9/17/87	ORS FLOWMETER SIGNAL CONDITIONER

① JSC DRAWINGS WERE RETIRED BY THE ORIGINATING ORGANIZATIONS IN 1987. JM2/ENGINEERING DRAWING CONTROL HAS SENT THEM TO FORT WORTH, TX FOR LONG TERM STORAGE.

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
11.11	ENGR ROBBIE D. GEST			ENGR	
	ENGR Robbie D Gest	9-11-90		ENGR	
	ENGR			ENGR	
	ENGR			ENGR	
	ENGR			APP Linda J. Hamm	9/11/90
	ENGR			APP John C. Hammar	9/11/90
	ENGR			OMNIPLAN	
	ENGR			LTR E	PCN

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VENDOR DRAWING REFERENCES

SPACE SHUTTLE | TBL NO 11-I
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BASIC REV E

12. APU/HYDRAULICS SYSTEMS

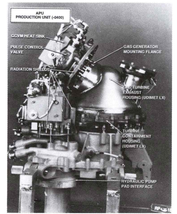
DATE	ITEM	APPROVAL
03-23-70	MANUAL UPD	KEEN/ENA HALL
07-24-70	MANUAL ADD	KEEN/ENA HALL
10-30-70	MANUAL REV.	KEEN/ENA HALL

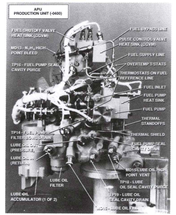
DATE	ITEM	APPROVAL
09-22-70	MANUAL REV.	KEEN/ENA HALL

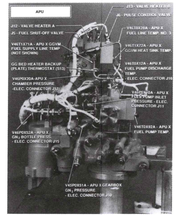
HEATER IDENTIFICATION TABLE

SYS	FUNCTION	THERMOSTAT NUMBERS	HEATER NUMBERS	ANALOG/BIN REQUIREMENT	ALTERNATE REQUIREMENT
1	FUEL TANK	5-1-A, B	1-TA-A 1-TA-B	1-MA7010-A 1-MA7010-B	1-MB7010-A 1-MB7010-B
	FUEL FEEDLINE	5-1-C, D 5-1-E, F 5-1-G, H	1-FA-A 1-FA-B	1-MA7020-A 1-MA7020-B	1-MB7020-A 1-MB7020-B
	ENGINE LINE	5-1-J, K	1-LA-A 1-LA-B	1-MA7030-A 1-MA7030-B	1-MB7030-A 1-MB7030-B
	LUBE OIL LINE	5-1-L, M	1-LA-A 1-LA-B	1-MA7030-A 1-MA7030-B	1-MB7030-A 1-MB7030-B
	GG BED	5-1-N, P, R	1-GA-A 1-GA-B	1-MA7040-A 1-MA7040-B	1-MB7040-A 1-MB7040-B
	SUMP/FUEL PUMP	5-1-S, T 5-1-U, V 5-1-W, X	1-SA-A 1-SA-B	1-MA7050-A 1-MA7050-B	1-MB7050-A 1-MB7050-B
2	FUEL TANK	5-2-A, B	2-TA-A 2-TA-B	2-MA7010-A 2-MA7010-B	2-MB7010-A 2-MB7010-B
	FUEL FEEDLINE	5-2-C, D 5-2-E, F 5-2-G, H	2-FA-A 2-FA-B	2-MA7020-A 2-MA7020-B	2-MB7020-A 2-MB7020-B
	ENGINE LINE	5-2-J, K	2-LA-A 2-LA-B	2-MA7030-A 2-MA7030-B	2-MB7030-A 2-MB7030-B
	LUBE OIL LINE	5-2-L, M	2-LA-A 2-LA-B	2-MA7030-A 2-MA7030-B	2-MB7030-A 2-MB7030-B
	GG BED	5-2-N, P, R	2-GA-A 2-GA-B	2-MA7040-A 2-MA7040-B	2-MB7040-A 2-MB7040-B
	SUMP/FUEL PUMP	5-2-S, T 5-2-U, V 5-2-W, X	2-SA-A 2-SA-B	2-MA7050-A 2-MA7050-B	2-MB7050-A 2-MB7050-B
	FUEL TANK	5-3-A, B	3-TA-A 3-TA-B	3-MA7010-A 3-MA7010-B	
	GG APPU FEEDLINE	5-3-C, D	3-FA-A 3-FA-B	3-MA7020-A 3-MA7020-B	
	GG APPU TO APU 1	5-3-E, F	3-FA-A 3-FA-B	3-MA7020-A 3-MA7020-B	
	GG APPU TO APU 2	5-3-G, H	3-FA-A 3-FA-B	3-MA7020-A 3-MA7020-B	
	APPU LINE	5-3-J, K	3-LA-A 3-LA-B	3-MA7030-A 3-MA7030-B	

CAU 5-3-A, B, C, D, E, F, G, H, J, K
& A BACKUP THERMOSTAT







NOTES:
1. FOR DRAWING REFERENCES, SEE TABLE CB-5
2. HEATER THERMOSTATS ADDED BY ECR 10003, 2000 FOR HEATER CIRCUIT PROTECTION. FOR SPECIFICS, SEE PS/T3 VALVE 1 AND 10 LINE VALVE AND FOR 2000 AND 3000.
3. FUSE TBL. 5-10, 5-11, 5-12, 5-13, 5-14, 5-15, 5-16, 5-17, 5-18, 5-19, 5-20, 5-21, 5-22, 5-23, 5-24, 5-25, 5-26, 5-27, 5-28, 5-29, 5-30, 5-31, 5-32, 5-33, 5-34, 5-35, 5-36, 5-37, 5-38, 5-39, 5-40, 5-41, 5-42, 5-43, 5-44, 5-45, 5-46, 5-47, 5-48, 5-49, 5-50, 5-51, 5-52, 5-53, 5-54, 5-55, 5-56, 5-57, 5-58, 5-59, 5-60, 5-61, 5-62, 5-63, 5-64, 5-65, 5-66, 5-67, 5-68, 5-69, 5-70, 5-71, 5-72, 5-73, 5-74, 5-75, 5-76, 5-77, 5-78, 5-79, 5-80, 5-81, 5-82, 5-83, 5-84, 5-85, 5-86, 5-87, 5-88, 5-89, 5-90, 5-91, 5-92, 5-93, 5-94, 5-95, 5-96, 5-97, 5-98, 5-99, 5-100, 5-101, 5-102, 5-103, 5-104, 5-105, 5-106, 5-107, 5-108, 5-109, 5-110, 5-111, 5-112, 5-113, 5-114, 5-115, 5-116, 5-117, 5-118, 5-119, 5-120, 5-121, 5-122, 5-123, 5-124, 5-125, 5-126, 5-127, 5-128, 5-129, 5-130, 5-131, 5-132, 5-133, 5-134, 5-135, 5-136, 5-137, 5-138, 5-139, 5-140, 5-141, 5-142, 5-143, 5-144, 5-145, 5-146, 5-147, 5-148, 5-149, 5-150, 5-151, 5-152, 5-153, 5-154, 5-155, 5-156, 5-157, 5-158, 5-159, 5-160, 5-161, 5-162, 5-163, 5-164, 5-165, 5-166, 5-167, 5-168, 5-169, 5-170, 5-171, 5-172, 5-173, 5-174, 5-175, 5-176, 5-177, 5-178, 5-179, 5-180, 5-181, 5-182, 5-183, 5-184, 5-185, 5-186, 5-187, 5-188, 5-189, 5-190, 5-191, 5-192, 5-193, 5-194, 5-195, 5-196, 5-197, 5-198, 5-199, 5-200, 5-201, 5-202, 5-203, 5-204, 5-205, 5-206, 5-207, 5-208, 5-209, 5-210, 5-211, 5-212, 5-213, 5-214, 5-215, 5-216, 5-217, 5-218, 5-219, 5-220, 5-221, 5-222, 5-223, 5-224, 5-225, 5-226, 5-227, 5-228, 5-229, 5-230, 5-231, 5-232, 5-233, 5-234, 5-235, 5-236, 5-237, 5-238, 5-239, 5-240, 5-241, 5-242, 5-243, 5-244, 5-245, 5-246, 5-247, 5-248, 5-249, 5-250, 5-251, 5-252, 5-253, 5-254, 5-255, 5-256, 5-257, 5-258, 5-259, 5-260, 5-261, 5-262, 5-263, 5-264, 5-265, 5-266, 5-267, 5-268, 5-269, 5-270, 5-271, 5-272, 5-273, 5-274, 5-275, 5-276, 5-277, 5-278, 5-279, 5-280, 5-281, 5-282, 5-283, 5-284, 5-285, 5-286, 5-287, 5-288, 5-289, 5-290, 5-291, 5-292, 5-293, 5-294, 5-295, 5-296, 5-297, 5-298, 5-299, 5-300, 5-301, 5-302, 5-303, 5-304, 5-305, 5-306, 5-307, 5-308, 5-309, 5-310, 5-311, 5-312, 5-313, 5-314, 5-315, 5-316, 5-317, 5-318, 5-319, 5-320, 5-321, 5-322, 5-323, 5-324, 5-325, 5-326, 5-327, 5-328, 5-329, 5-330, 5-331, 5-332, 5-333, 5-334, 5-335, 5-336, 5-337, 5-338, 5-339, 5-340, 5-341, 5-342, 5-343, 5-344, 5-345, 5-346, 5-347, 5-348, 5-349, 5-350, 5-351, 5-352, 5-353, 5-354, 5-355, 5-356, 5-357, 5-358, 5-359, 5-360, 5-361, 5-362, 5-363, 5-364, 5-365, 5-366, 5-367, 5-368, 5-369, 5-370, 5-371, 5-372, 5-373, 5-374, 5-375, 5-376, 5-377, 5-378, 5-379, 5-380, 5-381, 5-382, 5-383, 5-384, 5-385, 5-386, 5-387, 5-388, 5-389, 5-390, 5-391, 5-392, 5-393, 5-394, 5-395, 5-396, 5-397, 5-398, 5-399, 5-400, 5-401, 5-402, 5-403, 5-404, 5-405, 5-406, 5-407, 5-408, 5-409, 5-410, 5-411, 5-412, 5-413, 5-414, 5-415, 5-416, 5-417, 5-418, 5-419, 5-420, 5-421, 5-422, 5-423, 5-424, 5-425, 5-426, 5-427, 5-428, 5-429, 5-430, 5-431, 5-432, 5-433, 5-434, 5-435, 5-436, 5-437, 5-438, 5-439, 5-440, 5-441, 5-442, 5-443, 5-444, 5-445, 5-446, 5-447, 5-448, 5-449, 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5-593, 5-594, 5-595, 5-596, 5-597, 5-598, 5-599, 5-600, 5-601, 5-602, 5-603, 5-604, 5-605, 5-606, 5-607, 5-608, 5-609, 5-610, 5-611, 5-612, 5-613, 5-614, 5-615, 5-616, 5-617, 5-618, 5-619, 5-620, 5-621, 5-622, 5-623, 5-624, 5-625, 5-626, 5-627, 5-628, 5-629, 5-630, 5-631, 5-632, 5-633, 5-634, 5-635, 5-636, 5-637, 5-638, 5-639, 5-640, 5-641, 5-642, 5-643, 5-644, 5-645, 5-646, 5-647, 5-648, 5-649, 5-650, 5-651, 5-652, 5-653, 5-654, 5-655, 5-656, 5-657, 5-658, 5-659, 5-660, 5-661, 5-662, 5-663, 5-664, 5-665, 5-666, 5-667, 5-668, 5-669, 5-670, 5-671, 5-672, 5-673, 5-674, 5-675, 5-676, 5-677, 5-678, 5-679, 5-680, 5-681, 5-682, 5-683, 5-684, 5-685, 5-686, 5-687, 5-688, 5-689, 5-690, 5-691, 5-692, 5-693, 5-694, 5-695, 5-696, 5-697, 5-698, 5-699, 5-700, 5-701, 5-702, 5-703, 5-704, 5-705, 5-706, 5-707, 5-708, 5-709, 5-710, 5-711, 5-712, 5-713, 5-714, 5-715, 5-716, 5-717, 5-718, 5-719, 5-720, 5-721, 5-722, 5-723, 5-724, 5-725, 5-726, 5-727, 5-728, 5-729, 5-730, 5-731, 5-732, 5-733, 5-734, 5-735, 5-736, 5-737, 5-738, 5-739, 5-740, 5-741, 5-742, 5-743, 5-744, 5-745, 5-746, 5-747, 5-748, 5-749, 5-750, 5-751, 5-752, 5-753, 5-754, 5-755, 5-756, 5-757, 5-758, 5-759, 5-760, 5-761, 5-762, 5-763, 5-764, 5-765, 5-766, 5-767, 5-768, 5-769, 5-770, 5-771, 5-772, 5-773, 5-774, 5-775, 5-776, 5-777, 5-778, 5-779, 5-780, 5-781, 5-782, 5-783, 5-784, 5-785, 5-786, 5-787, 5-788, 5-789, 5-790, 5-791, 5-792, 5-793, 5-794, 5-795, 5-796, 5-797, 5-798, 5-799, 5-800, 5-801, 5-802, 5-803, 5-804, 5-805, 5-806, 5-807, 5-808, 5-809, 5-810, 5-811, 5-812, 5-813, 5-814, 5-815, 5-816, 5-817, 5-818, 5-819, 5-820, 5-821, 5-822, 5-823, 5-824, 5-825, 5-826, 5-827, 5-828, 5-829, 5-830, 5-831, 5-832, 5-833, 5-834, 5-835, 5-836, 5-837, 5-838, 5-839, 5-840, 5-841, 5-842, 5-843, 5-844, 5-845, 5-846, 5-847, 5-848, 5-849, 5-850, 5-851, 5-852, 5-853, 5-854, 5-855, 5-856, 5-857, 5-858, 5-859, 5-860, 5-861, 5-862, 5-863, 5-864, 5-865, 5-866, 5-867, 5-868, 5-869, 5-870, 5-871, 5-872, 5-873, 5-874, 5-875, 5-876, 5-877, 5-878, 5-879, 5-880, 5-881, 5-882, 5-883, 5-884, 5-885, 5-886, 5-887, 5-888, 5-889, 5-890, 5-891, 5-892, 5-893, 5-894, 5-895, 5-896, 5-897, 5-898, 5-899, 5-900, 5-901, 5-902, 5-903, 5-904, 5-905, 5-906, 5-907, 5-908, 5-909, 5-910, 5-911, 5-912, 5-913, 5-914, 5-915, 5-916, 5-917, 5-918, 5-919, 5-920, 5-921, 5-922, 5-923, 5-924, 5-925, 5-926, 5-927, 5-928, 5-929, 5-930, 5-931, 5-932, 5-933, 5-934, 5-935, 5-936, 5-937, 5-938, 5-939, 5-940, 5-941, 5-942, 5-943, 5-944, 5-945, 5-946, 5-947, 5-948, 5-949, 5-950, 5-951, 5-952, 5-953, 5-954, 5-955, 5-956, 5-957, 5-958, 5-959, 5-960, 5-961, 5-962, 5-963, 5-964, 5-965, 5-966, 5-967, 5-968, 5-969, 5-970, 5-971, 5-972, 5-973, 5-974, 5-975, 5-976, 5-977, 5-978, 5-979, 5-980, 5-981, 5-982, 5-983, 5-984, 5-985, 5-986, 5-987, 5-988, 5-989, 5-990, 5-991, 5-992, 5-993, 5-994, 5-995, 5-996, 5-997, 5-998, 5-999, 5-1000

1 APU 1

CONTRACTOR	SIGNATURE	DATE
HAMILTON STANDARD DIVISION OF UNITED AIRCRAFT CORPORATION	DESIGN ENGR'G. MANAGER	8/28/70
	CHIEF ENGINEER	
	PROJECT ENGINEER	
	CHIEF, ELECTRICAL SYSTEMS	

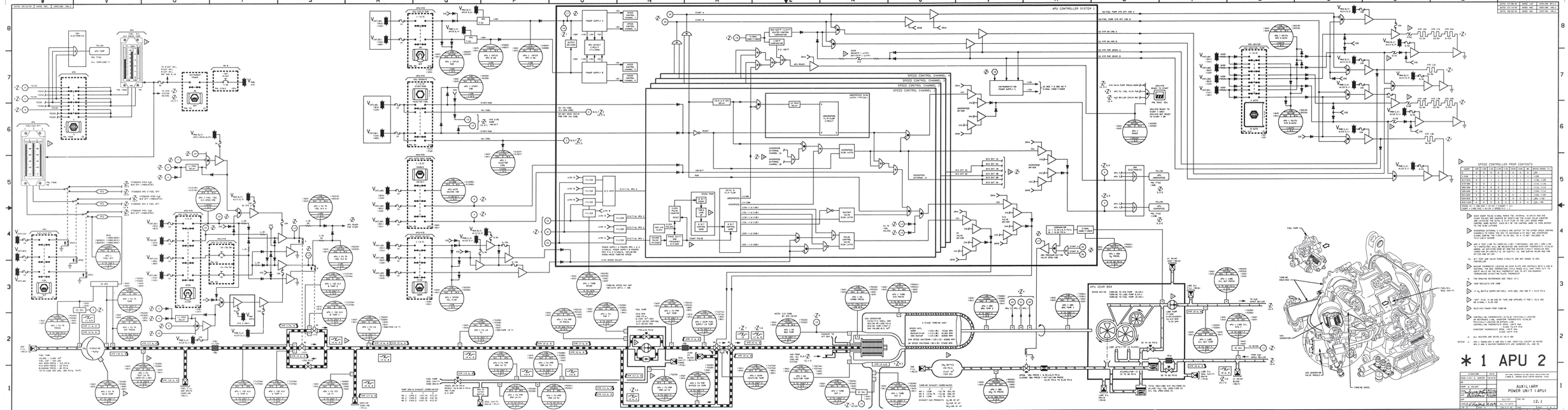
AUXILIARY POWER UNIT (APU)

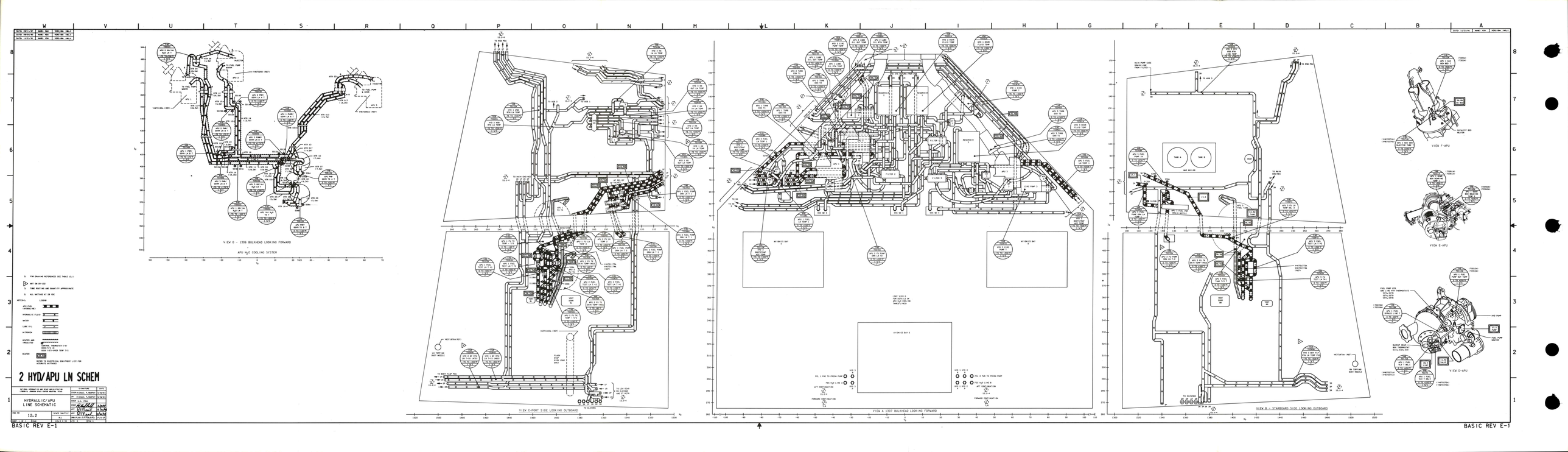
DWG NO.	SPACE SHUTTLE
12.1	

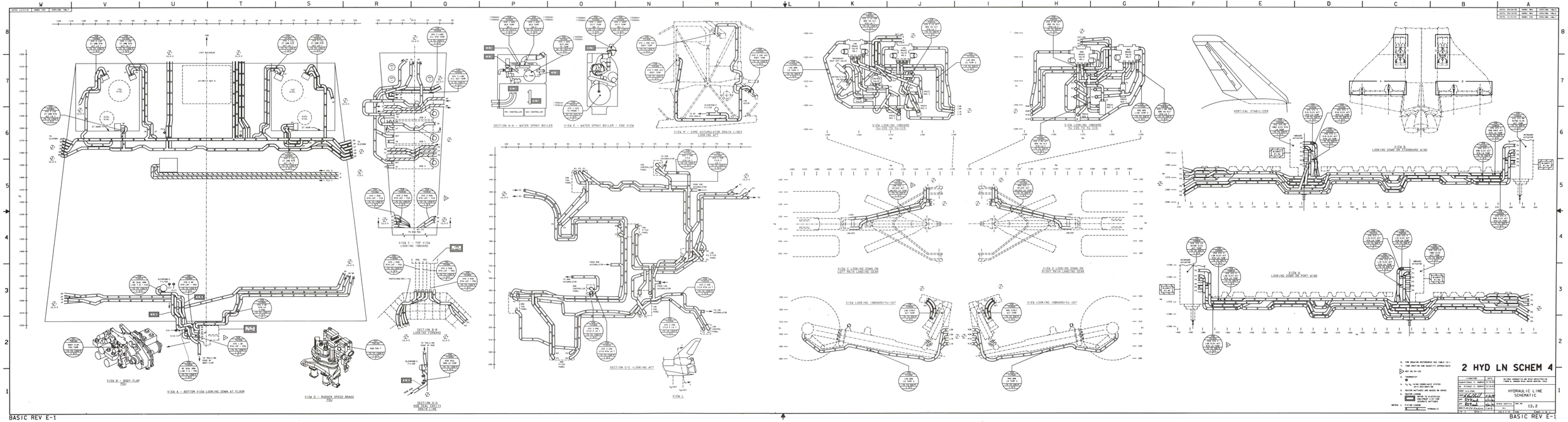
SHEET 1 OF 1 SHEETS
SCALE: NONE

BASIC REV E-4

BASIC REV E-4

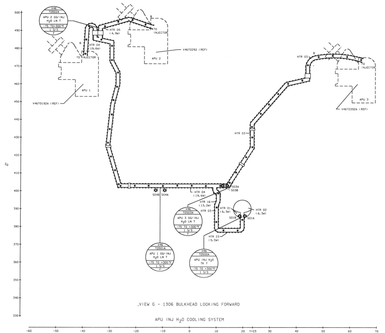

APU CONTROLLER SYSTEM 1
SPEED CONTROL CHANNEL 1
SPEED CONTROL CHANNEL 2
SPEED CONTROL CHANNEL 3
APU GEAR BOX
* 1 APU 2
AUXILIARY POWER UNIT (APU)
SPEED CONTROLLER FROM CONTENTS
BASIC REV E-4

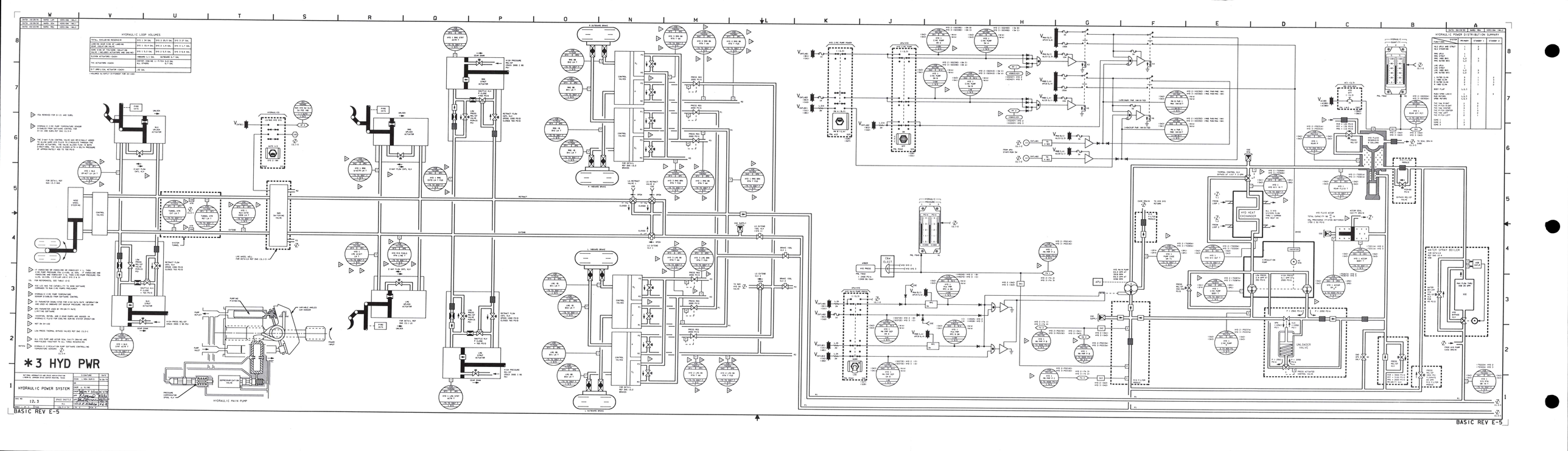

2 HYD/APU LN SCHEM
HYDRAULIC/APU LINE SCHEMATIC
12.2
SPACE SHUTTLE
BASIC REV E-1
VIEW G - 1306 BULKHEAD LOOKING FORWARD
APU H2O COOLING SYSTEM
VIEW C-PORT SIDE LOOKING OUTBOARD
VIEW A 1307 BULKHEAD LOOKING FORWARD
VIEW B - STARBOARD SIDE LOOKING OUTBOARD
VIEW F-APU
VIEW E-APU
VIEW D-APU
BASIC REV E-1

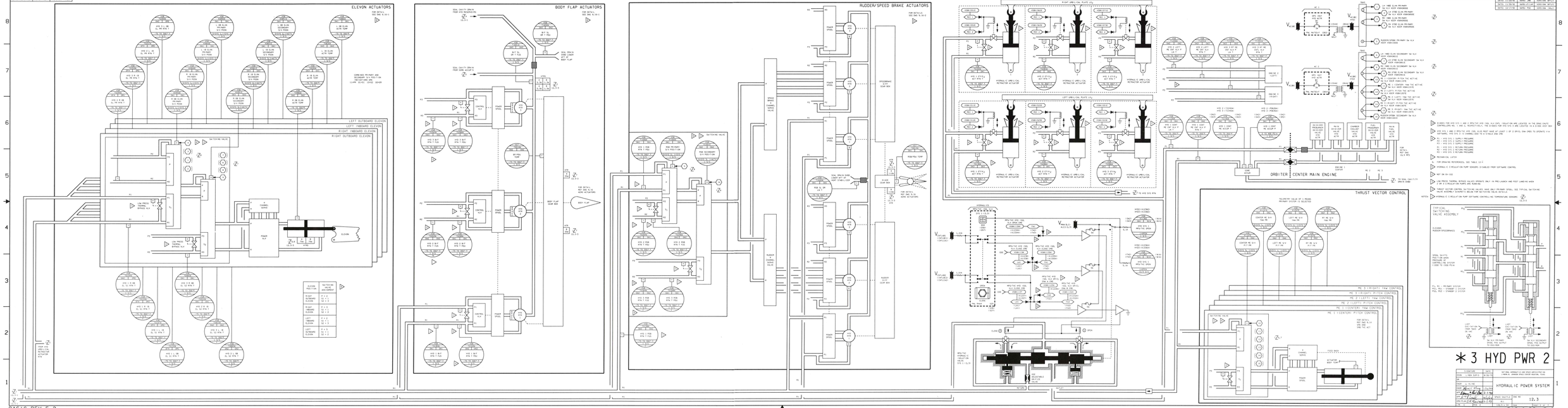

VIEW A – BOTTOM VIEW LOOKING DOWN AT FLOOR
VIEW B – BODY FLAP
VIEW C – TOP VIEW LOOKING INBOARD
SECTION A-A – WATER SPRAY BOILER
VIEW E – WATER SPRAY BOILER – END VIEW
VIEW M – SOME ACCUMULATOR DRAIN LINES LOOKING AFT
SECTION B-B LOOKING FORWARD
SECTION C-C LOOKING AFT
VIEW D – RUDDER SPEED BRAKE
SECTION D-D RUDDER SPEED BRAKE LINE
VIEW L
VIEW LOOKING INBOARD
VIEW LOOKING INBOARD
VIEW K LOOKING DOWN ON LEFT MAIN LANDING GEAR
VIEW LOOKING INBOARD
VIEW LOOKING INBOARD
VIEW K LOOKING DOWN ON RIGHT MAIN LANDING GEAR
VERTICAL STABILIZER
VIEW B LOOKING DOWN ON STARBOARD WING
VIEW A LOOKING DOWN ON PORT WING
2 HYD LN SCHEM 4
HYDRAULIC LINE SCHEMATIC
12.2

BASIC REV E-1

DATE: 08-09-93	MARK: 107	ADDED PM - APU 1
DATE: 09-24-93	MARK: 108	ADDED PM - PNL 1
DATE: 09-28-93	MARK: 109	ADDED PM - PNL 2


VIEW G - 1306 BULKHEAD LOOKING FORWARD
APU 1 H2O COOLING SYSTEM
APU 1 FUEL SUPPLY
APU 1 FUEL RETURN
APU 1 FUEL DRAIN
APU 1 FUEL PUMP
APU 1 FUEL FILTER
APU 1 FUEL HEATER
APU 1 FUEL SHUTOFF VALVE
APU 1 FUEL SHUTOFF VALVE CONTROL
APU 1 FUEL SHUTOFF VALVE INDICATION


*3 HYD PWR
HYDRAULIC POWER SYSTEM
HYDRAULIC MAIN PUMP
HYDRAULIC POWER DISTRIBUTION SUMMARY
HYDRAULIC LOOP VOLUMES
BASIC REV E-5
BASIC REV E-5


ELEVON ACTUATORS
BODY FLAP ACTUATORS
RUDDER/SPEED BRAKE ACTUATORS
LEFT OUTBOARD ELEVON
LEFT INBOARD ELEVON
RIGHT INBOARD ELEVON
RIGHT OUTBOARD ELEVON
ORBITER CENTER MAIN ENGINE
THRUST VECTOR CONTROL
* 3 HYD PWR 2
HYDRAULIC POWER SYSTEM
12.3
BASIC REV E-2

DATE= 11/20/92	NAME= JMB	VERSION= IMU-2
DATE= 05/03/96	NAME= MDU	VERSION= BPT-1
DATE= 05/11/96	NAME= BJB	VERSION= IMU-1

BODY FLAP HEATERS
HEATER WATTAGE AT 25VDC "A" AND "B"

ELEVON ACTUATOR HEATERS
HEATER WATTAGE AT 25VDC "A" AND "B"

RUDDER/SPEEDBRAKE HEATERS
HEATER WATTAGE AT 28VDC "A" AND "B"

AFT FUSELAGE HYDRAULIC HEATERS
HEATER WATTAGE AT 28.5VDC "A" AND "B"

BRAKE AND TUNNEL LINE HEATERS
HEATER WATTAGE AT 28VDC "A", "B", AND "C"

CIRC PUMP SOFTWARE CONSTANTS			
ACCUMULATOR PRESSURE MGMT SOFTWARE			
NAME	ID NUMBER	PRESET VALUE	UNITS
HYD SYS 1 GN2 ACCUM PRESS L/L	V12P1740C	1960	PSIA
HYD SYS 2 GN2 ACCUM PRESS L/L	V82P1834C	1960	PSIA
HYD SYS 3 GN2 ACCUM PRESS L/L	V92P1932C	1960	PSIA
HYS SYS ACCUM PRESS TIMER	V82V1747C	2	MINUTES
RESERVOIR PRESSURE MANAGEMENT SOFTWARE CONSTANTS			
NAME	ID NUMBER	PRESET VALUE	UNITS
HYD SYS 1 RSVR PRESS L/L	V82P0142C	32	PSIA
HYD SYS 2 RSVR PRESS L/L	V82P0143C	32	PSIA
HYD SYS 3 RSVR PRESS L/L	V82P0144C	32	PSIA
HYS SYS RSVR PRESS TIMER	V82V0141C	2	MINUTES
HYD THERMAL CONDITIONING SOFTWARE			
NAME	ID NUMBER	PRESET VALUE	UNITS
HYD 1 CIRC PUMP MINIMUM RUN TIME	V82V1744C	15	MINUTES
HYD 2 CIRC PUMP MINIMUM RUN TIME	V82V1745C	10	MINUTES
HYD 3 CIRC PUMP MINIMUM RUN TIME	V82V1746C	10	MINUTES
HYD CIRC PUMP START DELAY TIME	V82V1676C	1	MINUTES
HYD 1 CIRC PUMP PRESS L/L	V82P1742C	100	PSIA
HYD 2 CIRC PUMP PRESS L/L	V82P1842C	100	PSIA
HYD 3 CIRC PUMP PRESS L/L	V92P1942C	100	PSIA

HYDRAULIC CIRC PUMP TEMP SENSORS

SYSTEM	MSID	DESCRIPTION	↓LOW↓	S/W CONTROL LIMITS	↑HIGH↑
HYD SYSTEM 1	V58T0126A	HYD 1 WLG UPLK LN T		DISABLED	
	V58T1143A	HYD 1 WLG EXTD XIGOD LN T		DISABLED	
	V58T0127A	HYD 1 WLG EXTD XBOB LN T		DISABLED	
	V58T0129A	HYD 1 RMG BRK RTN T FUS		DISABLED	
	V58T0128A	HYD 1 RMG EXTD LN T FUS		DISABLED	
	V58T0464A	HYD 1 RMG BRK RTN T VW		DISABLED	
	V58T0128A	HYD 1 RMG UFACTR RTN T		DISABLED	
	V58T0125A	HYD 1 LMG UFACT RTN T		DISABLED	
	V58T1084A	HYD 1 B/F RTN T FUS	0°F		20°F
	V58T0169A	HYD 1 B/F RTN T POU		DISABLED	
	V58T0158A	HYD 1 RIB ELEVON T		DISABLED	
	V58T0133A	HYD 1 LOB ELEVON T	0°F		20°F
	V58T0134A	HYD 1 ROB ELEVON T	0°F		20°F
	V58T0157A	HYD 1 LIB ELEVON T		DISABLED	
	V58T0158A	HYD 1 RSB RTN T FUS	0°F		20°F
	V58T1008A	HYD 1 RSB RTN T POU	-10°F		20°F
HYD SYSTEM 2	V58T0296A	HYD 2 LMG BK RTN T FUS		DISABLED	
	V58T0292A	HYD 2 RMG BK RTN T FUS		DISABLED	
	V58T0293A	HYD 2 RMG RTN T VW		DISABLED	
	V58T0841A	HYD 2 LMG BK RTN VW		DISABLED	
	V58T0268A	HYD 2 B/F RTN T FUS		DISABLED	
	V58T0288A	HYD 2 B/F RTN T POU	-10°F		20°F
	V58T0294A	HYD 2 ROB ELEVON T	0°F		20°F
	V58T0933A	HYD 2 RIB ELEVON T		DISABLED	
	V58T0833A	HYD 2 LOB ELEVON T		DISABLED	
	V58T0257A	HYD 2 LIB ELEVON T	0°F		20°F
	V58T0284A	HYD 2 RSB RTN T FUS	0°F		20°F
	V58T0298A	HYD 2 RSB RTN T POU	-10°F		20°F
HYD SYSTEM 3	V58T0392A	HYD 3 RMG BK RTN T FUS		DISABLED	
	V58T0393A	HYD 3 LMG BK RTN T FUS		DISABLED	
	V58T0843A	HYD 3 LMG BK RTN T VW		DISABLED	
	V58T0842A	HYD 3 RMG BK RTN T VW		DISABLED	
	V58T0368A	HYD 3 B/F RTN T FUS		DISABLED	
	V58T0388A	HYD 3 B/F RTN T POU	-10°F		20°F
	V58T0983A	HYD 3 ROB ELEVON T	0°F	DISABLED	20°F
	V58T0359A	HYD 3 RIB ELEVON T	0°F		20°F
	V58T0334A	HYD 3 LOB ELEVON T	0°F		20°F
	V58T0833A	HYD 3 LIB ELEVON T		DISABLED	
	V58T0384A	HYD 3 RSB RTN T FUS		DISABLED	
	V58T0388A	HYD 3 RSB RTN T POU	-10°F		20°F

PASS CIRC-PUMP FDA PRE-CONDITIONING LOGIC					
MESSAGE	MSID	LS	LL	UL	PRECONDITION LOGIC
S87 CIRC PUMP P	V58P0137A HYD 1 CP P	1	100	OSH	HYD CIRC PMP A=ON OR HYD CIRC PMP B=ON OR PMP GPC CMD = ON (V58S0138E = 1) (V58K0142Y = 1)
		2	OSL	100	HYD CIRC PMP A=OFF AND HYD CIRC PMP B=OFF AND PMP GPC CMD = OFF (V58S0138E = 0) (V58K0142Y = 0)
	V58P0237A HYD 2 CP P	1	100	OSH	HYD CIRC PMP C=ON OR PMP GPC CMD = ON (V58S0239E = 1) (V58K0242Y = 1)
		1	100	OSH	HYD CIRC PMP B=OFF AND HYD CIRC PMP C=OFF AND PMP GPC CMD = OFF (V58S0238E = 0) (V58K0242Y = 0)
	V58P0337A HYD 3 CP P	1	100	OSH	HYD CIRC PMP A=ON OR HYD CIRC PMP C=ON OR PMP GPC CMD = ON (V58S0338E = 1) (V58K0242Y = 1)
		1	100	OSH	HYD CIRC PMP C=OFF AND HYD CIRC PMP A=OFF AND PMP GPC CMD = OFF (V58S0338E = 0) (V58S0339E = 0) (V58K0242Y = 0)
CIRC PUMP	THRML CNTLR CIRC PMP FLG ON	N/A	N/A	N/A	CIRC PUMP X THERMAL CNTLR SW FLAG SET "ON" AND CIRC PUMP PRESSURE ON SYS Y OR Z GREATER THAN THEIR CIRC PMP PRESSURE CONSTANTS (SYS 1=V92P1742C, SYS 2=V92P1842C, SYS 3=V92P1942C).

ACCUMULATOR/RESERVOIR PRESSURE MGMT SOFTWARE

ENTER → IF OPS TRANSITION THEN → TERMINATE CIRC PUMP SOFTWARE RUN COMMANDS (V58K0142Y, V58K0143Y, V58K0242Y, V58K0243Y, V58K0342Y, V58K0343Y); SET PRIORITIES FOR ALL THREE SYSTEMS = 0; SET CIRC PUMP ON/OFF INDICATIONS = "OFF"

ELSE → DO FOR N = 1, 2, 3

IF HYD SYS (N) CIRC PUMP SW IN GPC THEN → IF HYD SYS (N) ACCUM PRESS FLAG OR RSVR PRESS FLAG = "OFF" THEN → IF HYD SYS (N) ACCUM PRESS < LOW LIMIT AND > 32 PSIA THEN → SET ACCUM PRESS FLAG FOR HYD SYS (N) = "ON"; TERMINATE CIRC PUMP SOFTWARE RUN COMMANDS FOR ANY SYS WITH ACCUM PRESS AND RSVR PRESS FLAGS = "OFF"; RESET REMAINING HYD SYS PRIORITIES IN NUMERICAL ORDER; SET CIRC PUMP SOFTWARE RUN COMMAND FOR HYD SYS (N) = "ON"; START ACCUM PRESS TIMER

ELSE → IF HYD SYS (N) HAS ALREADY SCHEDULED FOR TURN ON BY SOFTWARE THEN → TERMINATE HYD SYS (N) CIRC PUMP SOFTWARE RUN COMMAND; RESET HYD SYS (N) ACCUM (RSVR) PRESS FLAGS = "OFF"; SET HYD SYS (N) THERMAL PRIORITY = 0; RESET REMAINING HYD SYS PRIORITIES IN NUMERICAL ORDER

IF NO HYD SYS ACCUM OR RSVR PRESS FLAGS = "ON" → RETURN

IF HYD SYS (N) ACCUM PRESS OR RSVR PRESS FLAG = "ON" THEN → IF HYD SYS (N) RSVR PRESS < LOW LIMIT AND > 2 PSIA THEN → SET RSVR PRESS FLAG FOR HYD SYS (N) "ON"; TERMINATE CIRC PUMP SOFTWARE RUN COMMANDS FOR ANY SYS WITH ACCUM PRESS AND RSVR PRESS FLAGS = "OFF"; RESET REMAINING HYD SYS PRIORITIES IN NUMERICAL ORDER; SET CIRC PUMP SOFTWARE RUN COMMAND FOR HYD SYS (N) = "ON"; START RSVR PRESS TIMER

ELSE → IF HYD SYS (N) ACCUM PRESS FLAG = "ON" THEN → IF HYD SYS (N) ACCUM PRESS > LOW LIMIT AND ACCUM PRESS TIMER HAS EXPIRED THEN → TERMINATE CIRC PUMP SOFTWARE RUN COMMAND FOR HYD SYS (N); RESET ACCUM PRESS FLAG = "OFF"

ELSE → IF HYD SYS (N) RSVR PRESS > LOW LIMIT AND RSVR PRESS TIMER HAS EXPIRED THEN → TERMINATE CIRC PUMP SOFTWARE RUN COMMAND FOR HYD SYS (N); RESET RSVR PRESS FLAG = "OFF"

HYD THERMAL CONDITIONING SOFTWARE

DO FOR N = 1, 2, 3 → IF HYD SYS (N) CIRC PUMP SW IN GPC THEN → IF HYD SYS (N) PRIORITY = 0 (PUMP NOT ASSIGNED TO COME ON) THEN → IF ONE OR MORE HYD SYS (N) TEMP SENSORS < LOW LIMIT THEN → PRIORITY ASSIGNMENT: INCREMENT TOTAL PRIORITY ASSIGNMENT BY 1; SET HYD SYS (N) PRIORITY EQUAL TO NEW TOTAL PRIORITY ASSIGNMENT → IF HYD SYS (N) PRIORITY = 1 THEN → START HYD CIRC PUMP START DELAY TIMER

ELSE → IF HYD SYS (N) IS SCHEDULED TO BE TURNED ON (PRIORITY > 0) THEN → CALL "PUMP TURN OFF" SEQUENCE

PUMP TURN ON SEQUENCE

IF PRIORITY NO. 1 HAS BEEN ASSIGNED TO A HYD SYS → IF PRIORITY NO. 1 CIRC PUMP IS NOT RUNNING (CIRC PUMP ON/OFF IND = "OFF") THEN → CALL "PUMP TURN ON" SEQUENCE → RETURN

ENTER → IF HYD CIRC PUMP START DELAY TIMER EXPIRED THEN → IF BOTH CIRC PUMP PRESS IN OTHER TWO HYD SYS < LOW LIMIT (NOT RUNNING) THEN → ISSUE PRIORITY NO. 1 HYD SYS SOFTWARE RUN COMMANDS; START TIMER FOR CIRC PUMP MINIMUM RUN TIME; SET CIRC PUMP ON/OFF INDICATION = "ON"

ELSE → SM ALERT: CLASS 3 FAULT MESSAGE "HYD CIRC PUMP" WILL BE ISSUED; PRIORITY NO. 1 PUMP WILL NOT BE COMMANDED ON

RETURN

IF ALL TEMP SENSORS IN PRIORITY NO. 1 SYSTEM > HIGH LIMIT OR PRIORITY NO. 1 CIRC PUMP RUN TIME > MINIMUM RUN TIME AND PRIORITY NO. 2 HAS BEEN ASSIGNED → CALL "PUMP TURN OFF" SEQUENCE

PUMP TURN OFF SEQUENCE

ENTER → FOR PRIORITY NO. 1 CIRC PUMP: TERMINATE HYD SYS SOFTWARE RUN COMMANDS; SET PRIORITY = 0; SET CIRC PUMP ON/OFF INDICATION = "OFF" → IF ANY OTHER HYD SYS PRIORITY > 0 (WAITING TO COME ON) THEN → RESET HYD SYS PRIORITIES AND MAINTAIN THE SAME ORDER FOR TURN ON; START HYD CIRC PUMP START DELAY TIMER FOR NEW PRIORITY NO. 1 HYD SYS

RETURN

6. FOR DRAWING REFERENCES, SEE TABLE 12-1

△ TUNNEL LINE HEATERS ARE ON SYSTEM A ONLY, AND ARE NOT ON OV-102

△ HYD TEMPERATURE LOW AND HIGH LIMITS, ACCUM PRESS LOW LIMIT ACCUM PRESS TIMER, START UP TIME DELAY, PUMP MINIMUM RUN TIME, CIRC PUMP PRESS LOW LIMIT ALL ARE CHANGEABLE BY THIS OR ONBOARD ITEM ENTRY - SEE TABLES FOR CONSTANT VALUES

△ LOW LIMIT MUST BE CHANGED BY ITEM ENTRY OR THRU TO ALLOW SIMULTANEOUS MANUAL/GPC OPERATIONS

△ PUMP WOULD BE SCHEDULED FOR TURN ON IF ACCUM PRESS FLAG = ON OR IF PUMP WERE PRIORITY NO. 1

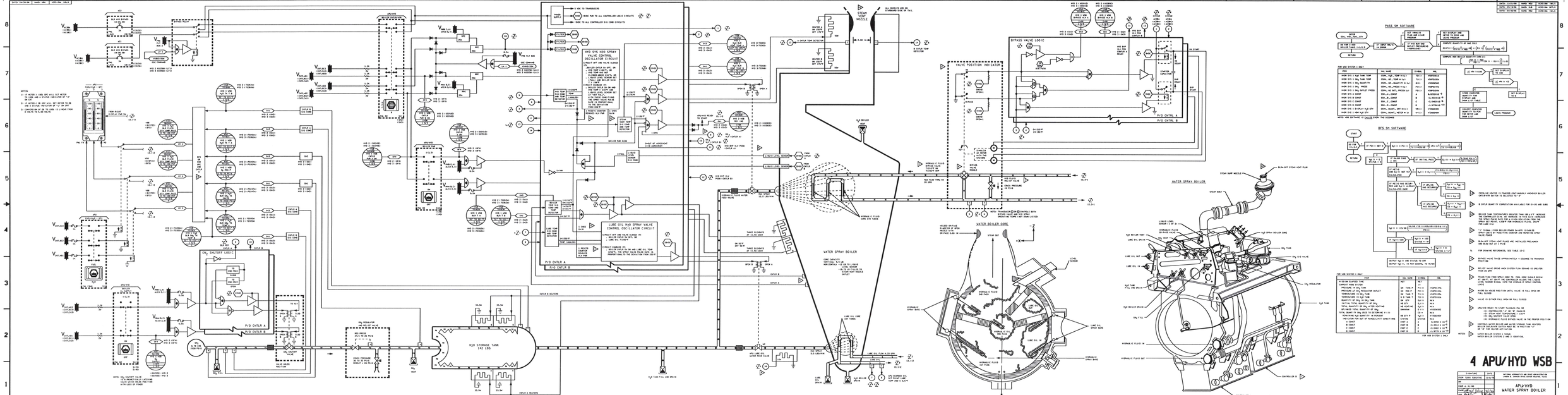
NOTES: △ RSC COMMANDS ARE USED TO RUN THE CIRC PUMPS PRELAUNCH AND REMAIN SET "ON" UNTIL CLEARED BY THE OPS 2 INITIALIZATION

3 HYD PWR 3

SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DSCH VICKI S. DOGETT	6/5/96	
DR MONYA D. URDIALES	7/23/87	
CHEF A. KLING		HYDRAULIC POWER SYSTEM
ENGR Jeffrey V. Kling	7/15/96	
APP B. Dynamus	7-24-96	
APP Paul Thurman	7-24-96	
CHIEF S.K. Ramsey	7-26-96	

SPACE SHUTTLE	DWG NO
ALL	12.3
66 X 34	PAGE SHEET 3 OF 3
LTR E	PCN 6

BASIC REV E-6


4 APU/HYD WSB
APU/HYD
WATER SPRAY BOILER
WATER SPRAY BOILER
WATER SPRAY BOILER CORE
PASS SM SOFTWARE
BFS SM SOFTWARE
FOR ONE SYSTEM 3 ONLY
FOR ONE SYSTEM 1 ONLY
FOR ONE SYSTEM 2 ONLY
H2O STORAGE TANK 142 LBS
P/O CNTLR A
P/O CNTLR B
BASIC REV E-6

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
12.1-1	AUXILIARY POWER UNIT (APU)	ROCKWELL	VS70-460109	ALL	L	1/90	SCHEMATIC DIAGRAM - AUXILIARY POWER UNIT SUBSYSTEM
			V070-465463	ALL	B	8/89	HEATER INSTALLATION - APU SYSTEM, FUEL, AND LUBE OIL
			V070-465523	ALL	D	9/88	COOLING SYSTEM INSTALLATION - APU INJECTOR AND FUEL PUMP
12.1-2	AUXILIARY POWER UNIT (APU)	ROCKWELL	VS70-460109	ALL	L	1/90	SCHEMATIC DIAGRAM - AUXILIARY POWER UNIT SUBSYSTEM
		SUNDSTRAND	754994	ALL	-	8/90	SCHEMATIC DIAGRAM - IMPROVED APU CONTROLLER
12.2-1	HYD/APU LINE SCHEMATIC	ROCKWELL	V070-585015	1 - 5	A	4/9/84	HYDRAULIC SUB-SYSTEMS INSTALLATION UPPER AFT FUSELAGE, STATION 1307
12.2-2	HYDRAULIC LINE SCHEMATIC	ROCKWELL	V070-586096	1 - 5	-	8/27/80	HYDRAULIC SUBSYSTEM INSTALLATION - RH WING & ELEVON ACTUATORS
			V070-587006	1	B	8/7/81	HYDRAULIC LINES INSTALLATION - MATING VERTICAL STABILIZER/AFT FUSELAGE
			V070-586095	1 - 4	-	10/1/80	HYDRAULIC SUBSYSTEM INSTALLATION - LH WING AND ELEVON ACTUATORS
			V070-586140	1 - 4	B	1/29/81	HYDRAULIC SUBSYSTEM INSTALLATION - LEFT HAND MLG WHEEL WELL
			V070-586145	1 - 4	B	11/19/85	HYDRAULIC SUBSYSTEM INSTALLATION - RIGHT HAND MLG WHEEL WELL
			VS70-580999	1 - 6	E	9/28/89	SCHEMATIC - HYDRAULIC SUBSYSTEM, ORBITER
			VS70-581000	1 - 6	B	9/21/89	SCHEMATIC - HYDRAULIC SUBSYSTEM ORBITER OV-105
12.2-3	HYD/IAPU LINE SCHEMATIC		VO70-585015	1-5	A	4/9/84	HYDRAULIC SUB-SYSTEMS INSTALLATION UPPER AFT FUSELAGE, STATION 1307
			VO70-465523	ALL	E	7/24/89	COOLING SYSTEM INSTALLATION - APU INJECTOR AND FUEL PUMP
12.3-1	HYDRAULIC POWER SYSTEM		VS70-581000	1 - 6	B	2/21/89	SCHEMATIC - HYDRAULIC SUBSYSTEM, OV-105
			VS70-580102	1 - 13	M	2/12/90	SCHEMATIC DIAGRAM - HYDRAULIC CONTROL SUBSYSTEM
			VS70-580109	1 - 17	H	1/30/90	SCHEMATIC DIAGRAM - HYDRAULIC CONTROL SUBSYSTEM
12.3-2	HYDRAULIC POWER SYSTEM	ROCKWELL	VS70-580999	1-6	E	9/29/89	SCHEMATIC - HYDRAULIC SYSTEM, ORBITER
		ROCKWELL	VS70-580102	4 - 12	M	2/12/90	SCHEMATIC DIAGRAM - HYDRAULIC CONTROL SUBSYSTEM
		ROCKWELL	VS70-750589	1-8	D	7/19/83	SCHEMATIC DIAGRAM - OI HYDRAULIC MEASUREMENTS
		JSC	SODB JSC 08934	4.2.4-1 & 2	E AMEND. 217	10/5/88	SHUTTLE OPERATIONAL DATA BOOK, VOLUME I (LOOP VOLUMES)
		ROCKWELL	VS70-958099	43	A		INTEGRATED SYSTEM SCHEMATIC, HYDRAULICS - ORBITER VEHICLES 099, 103, 104, AND SUBS

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
12.1-1	ENGR N. KNIGHT		12.3-1	ENGR J. KLING	
	ENGR [signature]	9/27/94		ENGR [signature]	9-22-94
12.1-2	ENGR N. KNIGHT		12.3-2	ENGR J. KLING	
	ENGR [signature]	9/27/94		ENGR [signature]	9-22-94
12.2-1,2	ENGR K. POHL			APP	
	ENGR [signature]			APP [signature]	9-27-94
12.2-3	ENGR N. KNIGHT			APP	
	ENGR [signature]	9/27/94		LTR E	PCN 4

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

VENDOR DRAWING REFERENCES

SPACE SHUTTLE
ALL

TBL NO 12-I

PAGE 12.I-1

SHEET 1 OF 2

BASIC REV E-4

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
12.3-3	HYDRAULIC POWER POWER SYSTEM	JSC	SS-P-0002-580H	6-94 - 6-122 HYDRAULIC CIRCULATION PUMP AUTO-MATIC CONTROL	H	2/28/89	NATION SPACE TRANSPORTATION SYSTEM COMPUTER PROGRAM DEVELOPMENT SPECIFICATIONS (CPDS). FUNCTIONAL LEVEL REQUIREMENTS, SYSTEM MANAGEMENT
		ROCKWELL	STS81-0027/V12	6.10 HYDRAULIC CIRC PUMP AUTOMATIC CONTROL SEQUENCE	2Q	9/28/83	ROCKWELL FLIGHT SYSTEM SOFTWARE REQUIREMENTS DOCUMENT
		IBM	NAS-9-16920	SECTION 3.2.1.19 HYDRAULIC CIRCULATION PUMP AUTO-MATIC CONTROL SEQUENCE SST_HYD_ FLD_TEMP	DI20	6/18/90	SPACE SHUTTLE ORBITER AVIONICS SOFTWARE - SOFTWARE DESIGN SPECIFICATION. PART II OPS DETAIL DESIGN SPECIFICATIONS, VOLUME III - APPLICATION. PART 2 - SYSTEMS MANAGEMENT
		ROCKWELL	VS70-580102	8.9,10,12,13	M	2/12/90	SCHEMATIC DIAGRAM - HYDRAULIC CONTROL SUBSYSTEM
			VS70 580109	12,13	H	8/4/86	SCHEMATIC DIAGRAM - HYDRAULIC CONTROL SUBSYSTEM
			EEL	238 - 240	OPERA-TIONAL	4/21/87	ELECTRICAL EQUIPMENT LIST (BRAKE HEATER WATTAGE)
12.4	APU/HYD WATER SPRAY BOILER	HAMILTON STANDARD	SVSK 91674	1-3	P	10/19/87	ELECTRICAL SCHEMATIC, ITEM 642, WSB CONTROLLER
		JSC	SS-P-0002-580G	6-79 - 6-83 HYDRAULIC WATER BOILER QUANTITY	g	11/17/86	SPACE SHUTTLE PROGRAM ORBITER ROJECT COMPUTER DEVELOPMENT SPECIFICATION, VOLUME 1, BOOK 4 NAS-9-14000
		IBM	MGO38119	42 - 49 HYDRAULIC WATER BOILER QUANTITY	E	5/30/90	BACKUP FLIGHT SYSTEM (BFS) SYSTEM MANAGEMENT/SPECIAL PROCESSES AND PAYLOAD PROGRAM REQUIREMENTS DOCUMENT
		ROCKWELL	VS70-580112	1-4	G	4/11/83	SCHEMATIC DIAGRAM - WATER SPRAY BOILER NO. 1, 2, 3
		HAMILTON STANDARD		ALL		9/16/76	SHUTTLE WATER SPRAY BOILER PRELIMINARY DESIGN REVIEW DOCUMENT
		ROCKWELL	VS70-580999	2	E	9/29/89	SCHEMATIC - HYDRAULIC SUBSYSTEM, ORBITER, OV103 ONLY

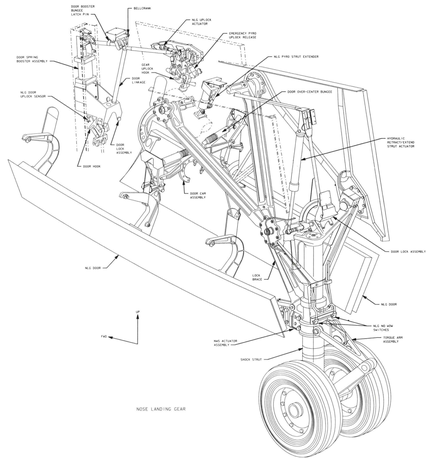
DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
12.3-3	ENGR J. KREYKES			ENGR	
	ENGR			ENGR	
12.4	ENGR K. POHL			ENGR	
	ENGR	9/27/94		ENGR	
	ENGR			APP	
	ENGR			APP	9/27/94
	ENGR			APP	
	ENGR			LTR E PCN 4	

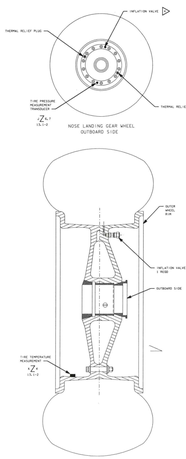
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS

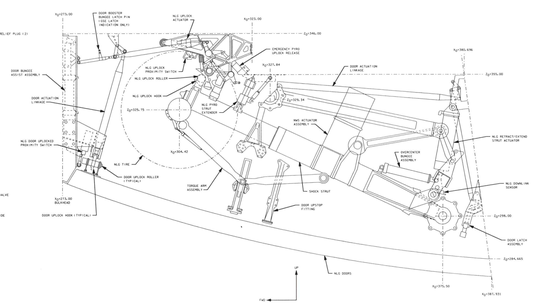
VENDOR DRAWING REFERENCES

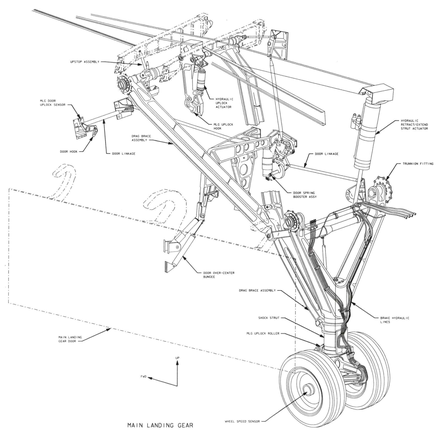
SPACE SHUTTLE | TBL NO 12-I

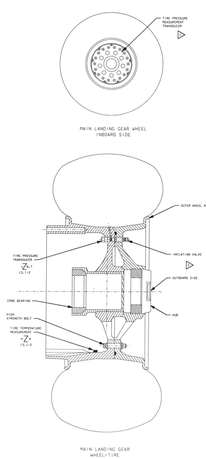
ALL

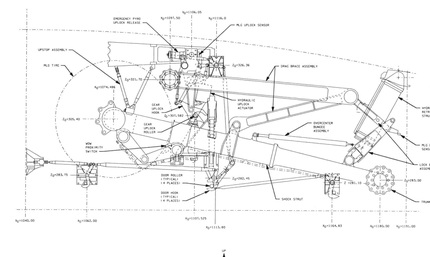












△ NOSE GEAR TIRES ARE INITIALLY INFLATED TO 350 PSI AT 70°F ± 5°F & MAINTAIN NORMAL GEAR TYPE PRESSURE OF 350 PSI AT 70°F (3900 KILO-PASCAL)

△ MLG GEAR TIRES ARE INITIALLY INFLATED TO 370 PSI AT 70°F ± 5°F & MAINTAIN NORMAL GEAR TYPE PRESSURE OF 370 PSI AT 70°F (2550 KILO-PASCAL)

△ FACE PATH LANDING GEAR TIRE AND 3 TAXIING REV OFF PLUGS WITH A 937 PAINT OR 350 TO ABUTT (NOT SHOWN)

NOTES: 1. FOR DRAWING REFERENCES SEE TABLE 13-1

1 LG 1

SIGNATURES	DATE
EDITH L. BUTTERMAN	1-1-85
CHIEF ENGINEER	
CHIEF DESIGNER	
CHIEF PROJECT ENGINEER	
APPROVED	

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

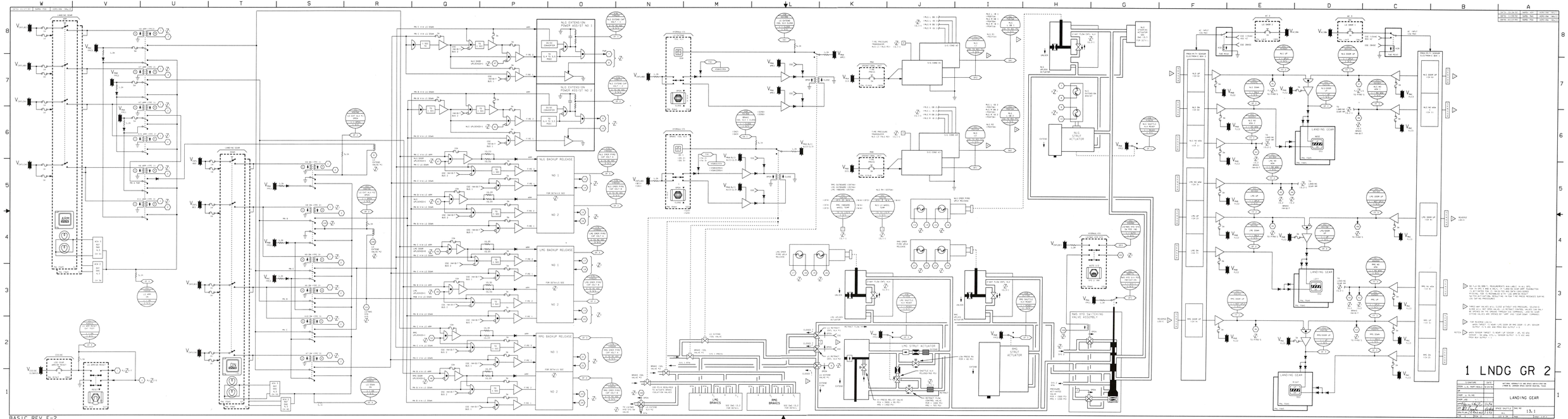
LANDING GEAR

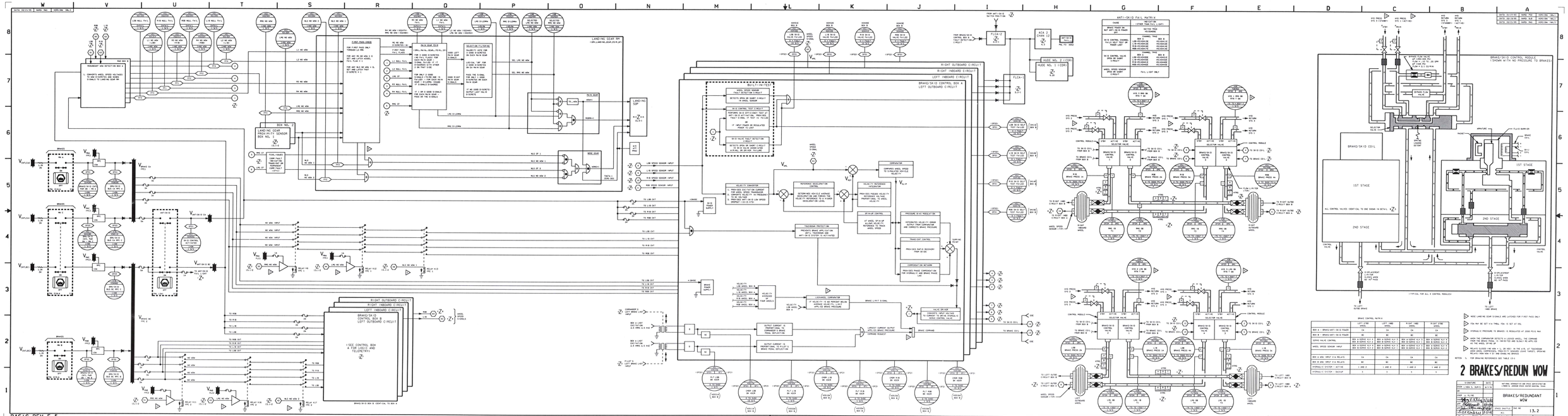
SPACE SHUTTLE DWG NO

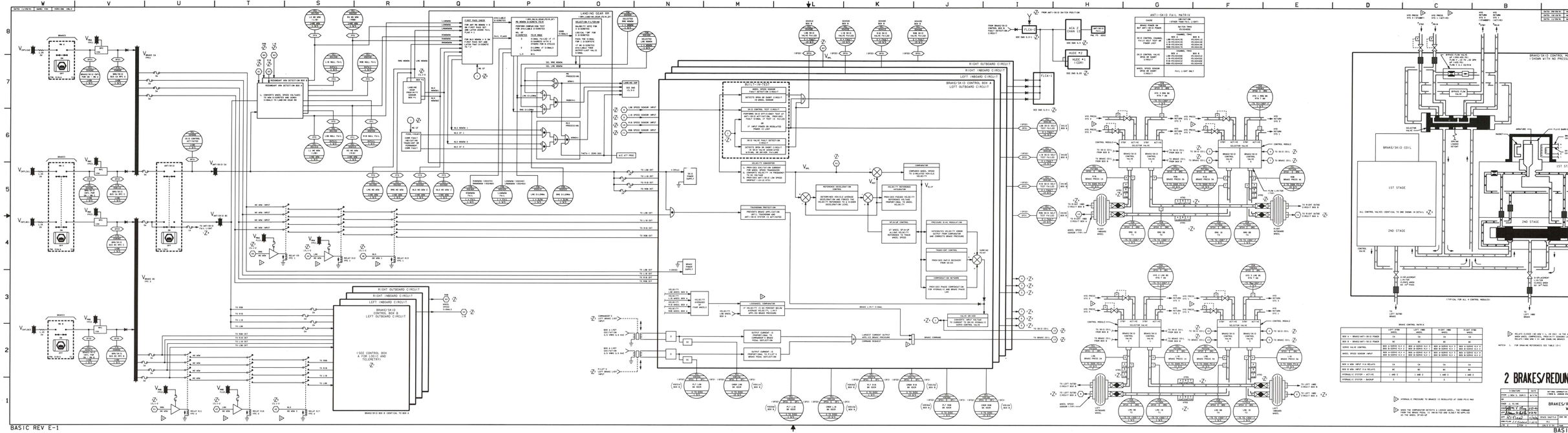
13.1

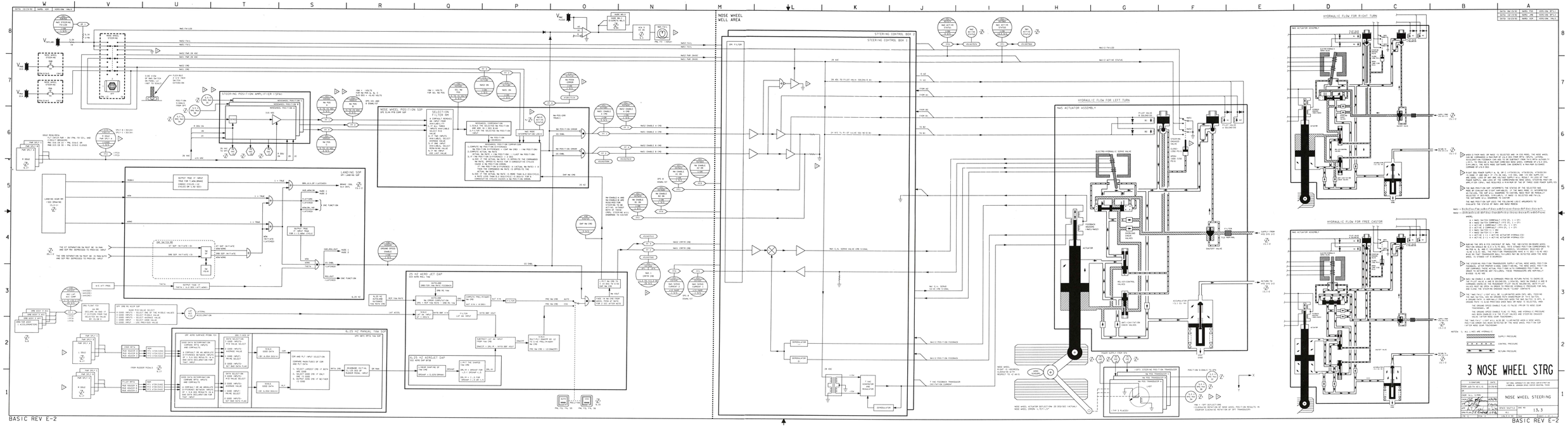
SCALE NONE SHEET 1 OF 1

BASIC REV E-2

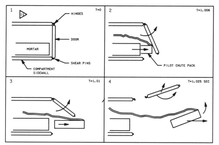

1 LNDG GR 2
LANDING GEAR
13.1
BASIC REV E-2


BRAKE/SKID CONTROL MODULE (SHOWN WITH NO PRESSURE TO BRAKES)
BRAKE/SKID COIL
1ST STAGE
2ND STAGE
ANTI-SKID FAIL MATRIX
BRAKE/SKID CONTROL MATRIX
2 BRAKES/REDUN WOW
BRAKE/REDUNDANT WOW
BRAKE/SKID CONTROL BOX A
LEFT INBOARD CIRCUIT
RIGHT INBOARD CIRCUIT
LEFT OUTBOARD CIRCUIT
RIGHT OUTBOARD CIRCUIT
LANDING GEAR SHOCK STRUT SENSOR BOX NO. 1
LANDING GEAR SHOCK STRUT SENSOR BOX NO. 2
BRAKE/SKID CONTROL BOX B
BASIC REV E-5

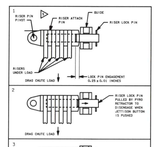

BRAKE/SKID CONTROL BOX A
LEFT OUTBOARD CIRCUIT
RIGHT OUTBOARD CIRCUIT
BRAKE/SKID CONTROL BOX B
LEFT INBOARD CIRCUIT
RIGHT INBOARD CIRCUIT
(SEE CONTROL BOX A FOR LOGIC AND TELEMETRY)
BRAKE/SKID BOX B IDENTICAL TO BOX A
REDUNDANT WOW DETECTION BOX
LANDING GEAR SYS
SELECTOR
CURET PASS ORDER
ANTI-SKID FAIL MATRIX
BRAKE CONTROL MATRIX
2 BRAKES/REDUN WOW 2
BRAKES/REDUNDANT WOW
BASIC REV E-1


NOSE WHEEL WELL AREA
STEERING CONTROL BOX 1
STEERING CONTROL BOX 2
STEERING POSITION AMPLIFIER 1 (SPA1)
NOSE WHEEL POSITION SOP
SELECTION FILTER SW
LANDING SOP
25 HZ AERO JET DAP
6.25 HZ AEROJET DAP
6.25 HZ MANUAL TAX SOP
HYDRAULIC FLOW FOR RIGHT TURN
HYDRAULIC FLOW FOR LEFT TURN
HYDRAULIC FLOW FOR FREE CASTOR
NWS ACTUATOR ASSEMBLY
3 NOSE WHEEL STRG
NOSE WHEEL STEERING
BASIC REV E-2

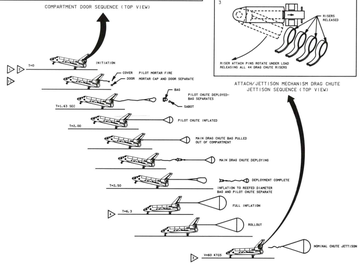
DATE	CR/ECN	AUTH	VERS/IMP. APPLY
04/08/82	16699-2026	HARRY LAM	VERS/IMP. APPLY
04/08/82	16699-2028	HARRY LAM	VERS/IMP. APPLY
04/07/83	16699-2061	HARRY LAM	VERS/IMP. APPLY



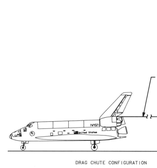
COMPARTMENT DOOR SEQUENCE (TOP VIEW)



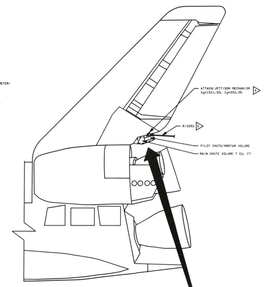
ATTACH/JETTISON MECHANISM DRAG CHUTE JETTISON SEQUENCE (TOP VIEW)



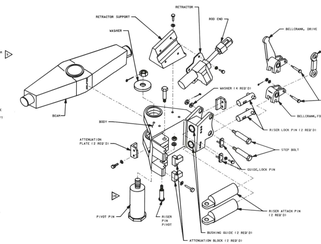
NOMINAL SEQUENCE OF DRAG CHUTE DEPLOYMENT, INFLATION, AND JETTISON



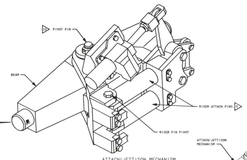
DRAG CHUTE CONFIGURATION



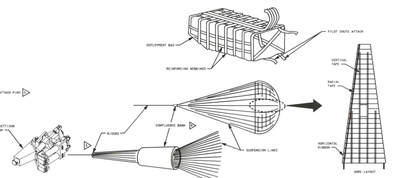
DRAG CHUTE SYSTEM



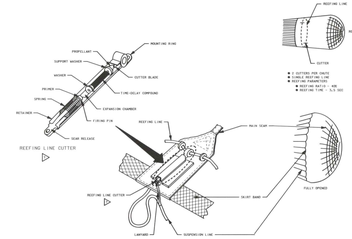
ATTACH/JETTISON MECHANISM EXPLODED VIEW



ATTACH/JETTISON MECHANISM



PARACHUTE ASSEMBLY COMPONENTS



MAIN DRAG CHUTE REEFING

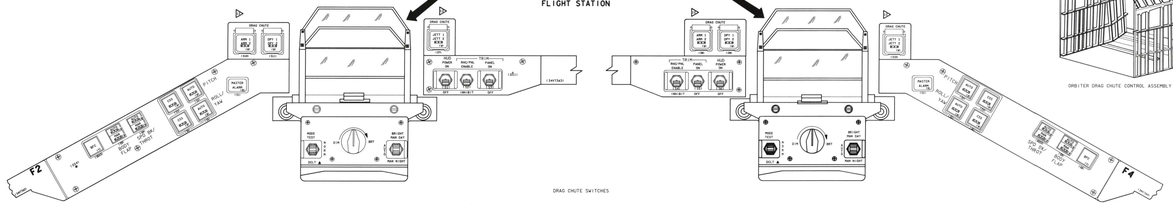
1. ALL PBI'S ARE GUARDED, WHEN V.LIFTED THE GUARDS REMAIN UP
2. THERE IS A ONE SECOND CAPACITOR DELAY BETWEEN PUSHING THE CHUTE DEPLOY PBI AND FIRE INITIATION INCLUDED IN THIS TIMELINE
3. THE P-DEP P/B FAILS WHEN A LOAD BETWEEN 1000LBS LBF AND 1950LBS LBF IS APPLIED RESULTING IN CHUTE SEPARATION
4. ALL DRAG CHUTE LOADS ARE TAKEN IN THE ATTACH/JETTISON MECHANISM BEAM AT THIS POINT AND DISTRIBUTED IN THE INBOARD TAIL STRUCTURE
5. THE COMPLIANCE BAND REMOVED AT A FIXED DISTANCE FROM THE ATTACH/JETTISON MECHANISM (+4.0, -0.0")
6. DRY CHUTE SET EXPLODED TO 1000 LBS AT 10 SECONDS
7. THE RESETTING RATIO IS DEFINED AS THE RATIO OF DRAG FORCE USED TO TOTAL DRAG FORCE AVAILABLE WITH FULL INFLATION
8. THE 9.938 INCH RED TAPE BAND WRAPS 20 M-BOOMS INCLUDING ONE 40 WITH A LENGTH OF 41.5 FT EACH. THERE ARE FOUR "PAIRS/SET" OF M-BOOMS WITH ONE SET EACH PIN, EACH BUNDLE HAS A MAXIMUM OF 10.0 M-BOOMS
9. THE MAXIMUM STRUCTURAL LOAD THAT THE ORBITER TAIL SECTION CAN WITHSTAND IS 60,000 LBS. THE ORBITER TAIL LOCATION FOR THE CHUTE ATTACHMENT IS EXPECTED TO BE LESS THAN 80000 LBS
10. NOMINAL JETTISON OF THE DRAG CHUTE IS 60 KNOTS GROUND SPEED
11. THE MAXIMUM DEPLOYMENT VELOCITY FOR THE DRAG CHUTE IS 230 KNOTS EAS, THE MINIMUM USEFUL DEPLOYMENT VELOCITY IS 150 KNOTS EAS AT SEA LEVEL
12. NOMINAL DEPLOYMENT OF THE DRAG CHUTE IS DEFINITIONAL FOR MAXIMUM DECELERATION, DEPLOY THE CHUTE AT MAIN GEAR TOUCHDOWN (7 MAIN WHEELS ALIGN)

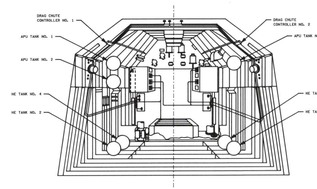
NOTES

4 D CHUTE MECH 1

NOTING CORRECTION AND ERROR DESCRIPTION (TRACK NO. DRAWING STAGE NUMBER MATERIAL TRACK)	SIGNATURE	DATE
	DESIGN VICINITY: L. HUNTER	3/11/83
	QA	
	CHIEF D. Dent Edwards	3/7/83
	CHIEF CLASS E ENGINEER	
	PROGRAM MANAGER	

DRAG CHUTE MECHANICAL		
DWG NO 13.4	SPACE SHUTTLE	SIZE B
		SCALE NONE
		WT.
		SHEET 1 OF 1


F2
F4
DRAG CHUTE
ARM
DISARM
MAIN BUS TIE
MAIN BUS A
MAIN BUS B
MAIN BUS TIE
MAIN BUS A
MAIN BUS B
MAIN BUS TIE
MAIN BUS A
MAIN BUS B



AFT COMPARTMENT, LOOKING FORWARD

DRAG CHUTE BUS FAILURE MATRIX	COMP 3 DRAG CHUTE ARM	PLT 3 DRAG CHUTE ARM	COMP 3 DPY/JETT FINE 1	COMP 3 DPY/JETT FINE 2	PLT 3 DPY/JETT FINE 1	PLT 3 DPY/JETT FINE 2
MNB D15		X				
MNC D16	X					
CNTL BC1				X		
CNTL BC2			X			
CNTL CA1					X	
CNTL CA2						X

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
13.1-1	LANDING GEAR	ROCKWELL	V070-756015	1	C	12/25/87	MAIN LANDING GEAR WHEEL - INSTRUMENTED, TIRE PRESSURE, ASSEMBLY
			V070-752015	1	A	6/30/87	NLG WHEEL - INSTRUMENTED, TIRE PRESSURE, ASSY OF
13.1-2	LANDING GEAR	ROCKWELL	VS70-510109	ALL	H	3/17/89	SCHEMATIC DIAGRAM - LANDING GEAR CONTROLS SUBSYSTEM
			VS70-510102	ALL	N	2/7/90	SCHEMATIC DIAGRAM - LANDING GEAR CONTROLS SUBSYSTEM
			VS70-581000	ALL	B	9/21/89	SCHEMATIC DIAGRAM-HYDRAULIC SUBSYSTEM
			VS70-958099	2-11	B	3/19/90	INTEGRATED SYSTEM SCHEMATIC HYDRAULICS
			SPECIFICATION MC476-0134	ALL	A	1/17/75	SPECIFICATION SIGNAL CONDITIONER, STRAIN GAGE
13.2-1	BRAKES/REDUNDANT WOW	ROCKWELL	VS70-520109	1, 2, 3	K	5/29/90	SCHEMATIC DIAGRAM - BRAKE SKID CONTROL SUBSYSTEM
			VS70-958099	2-11	B	3/19/90	INTEGRATED SYSTEMS SCHEMATIC - HYDRAULICS
			VS70-581000	ALL	B	9/21/89	SCHEMATIC - HYDRAULIC SUBSYSTEM - ORBITERS OV-103, OV-104, OV-105

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
13.1-1	ENGR J. KREYKES			ENGR	
	ENGR Jennifer Kreykes	2-17-93		ENGR	
13.1-2	ENGR J. KLING			ENGR	
	ENGR Jeffrey V. Kling	2-17-93		ENGR	
13.2-1	ENGR J. KLING			APP Paul F Uke	2-17-93
	ENGR Jeffrey V. Kling	2-17-93		APP K. Thomas	2/17/93
	ENGR			OMNIPLAN	
	ENGR			LTR E	PCN 2

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

VENDOR DRAWING REFERENCES

SPACE SHUTTLE ALL

TBL NO 13-I

PAGE 13.I-1 SHEET 1 OF 2

BASIC REV E-2

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
13.3-1	NOSE WHEEL STEERING	ROCKWELL	VS70-510203	1&2	A	2/12/90	SCHEMATIC DIAGRAM - NOSE WHEEL STEERING SUBSYSTEM
		ROCKWELL	CR89889	PAGES: 1A - 87	H	5/31/89	IMPROVED NOSE WHEEL STEERING CHANGE REQUEST
		ROCKWELL	CR89890	PAGES: 1A - 77	E	5/30/89	IMPROVED NOSE WHEEL STEERING VU CHECKOUT SOFTWARE CHANGE REQUEST
		STERER	CDR-70628	PAGES 6 - 8	-	-	INWS CRITICAL DESIGN REVIEW SCHEMATICS
		STERER	-	2	-	8/14/90	NWS FUNCTIONAL DIAGRAM (FAX) (EDMOND ISSAKHANIAN)
		ROCKWELL	VS70-958099	52	A	-	NOSE WHEEL STEERING, NLG UPLOCK & STRUT ACTR FLUIDS/CONTROL
13.4-1	DRAG CHUTE MECHANICAL	ROCKWELL	VO70-524001	1 & 2	A	11/14/91	ASSY - DRAG CHUTE
		ROCKWELL	CDR-NAS9-17800	ALL	A	1/8/90	ORBITTER DRAG CHUTE PROJECT
13.4-2	DRAG CHUTE ELECTRICAL	ROCKWELL	VS70-520203	SHEETS 1-3	E-1	11-14-91	SCHEMATIC DIAGRAM - DRAG CHUTE SUBSYSTEM

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
13.3-1	ENGR A. SIMON			ENGR	
	ENGR Alan H. Simon	2/16/93		ENGR	
13.4-1	ENGR C. DAVID PATERNOSTRO			ENGR	
	ENGR C. David Paternostro	2/18/93		ENGR	
13.4-2	ENGR C. DAVID PATERNOSTRO			APP Dale A. Hi	2-17-93
	ENGR C. David Paternostro	2/18/93		APP R. L. Ward	2/17/93
	ENGR			OMNIPLAN	
	ENGR			LTR E	PCN 2

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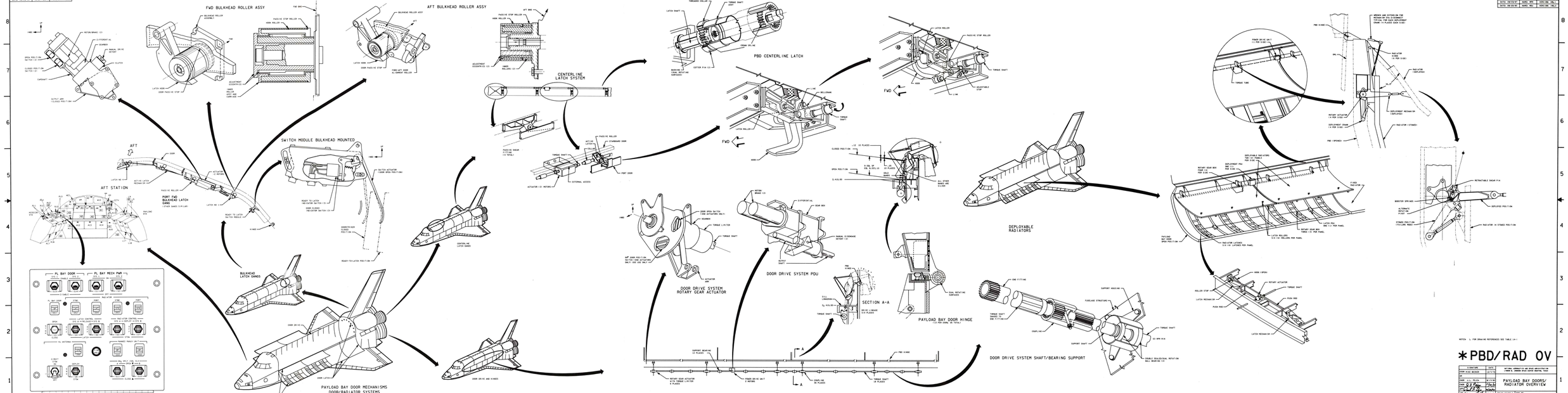
VENDOR DRAWING REFERENCES

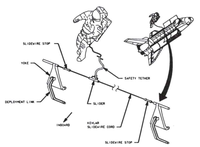
SPACE SHUTTLE ALL

TBL NO 13-I

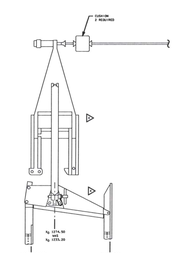
PAGE 13.I-2 SHEET 2 OF 2

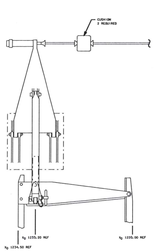
BASIC REV E-2


FWD BULKHEAD ROLLER ASSY
AFT BULKHEAD ROLLER ASSY
CENTERLINE LATCH SYSTEM
PBD CENTERLINE LATCH
AFT
AFT STATION
PORT FWD BULKHEAD LATCH GANG
SWITCH MODULE BULKHEAD MOUNTED
BULKHEAD LATCH GANGS
PAYLOAD BAY DOOR MECHANISMS DOOR/RADIATOR SYSTEMS
DOOR DRIVE SYSTEM ROTARY GEAR ACTUATOR
DOOR DRIVE SYSTEM PDU
SECTION A-A
PAYLOAD BAY DOOR HINGE
DEPLOYABLE RADIATORS
DOOR DRIVE SYSTEM SHAFT/BEARING SUPPORT
FWD
PBD
PBD/RAD OV
PAYLOAD BAY DOORS/ RADIATOR OVERVIEW
14.1
BASIC REV E

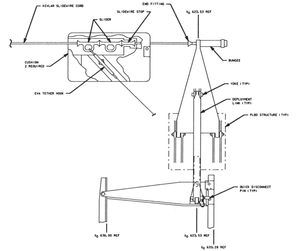


P/P PIN RETENTION DETAILS

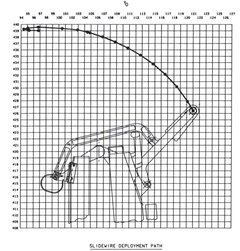


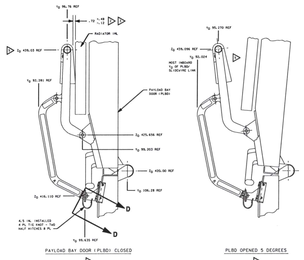


RELOCATED SLIDEWIRE TO ACCOMMODATE MIR SPACELAB
WIT INSTALLATION ONLY PART ON SN-1002

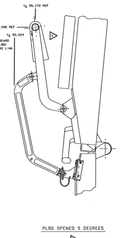


BASELINE
VIEW LOOKING TO PORT FROM PAYLOAD BAY
1 STAR INSTALLATION NOT SHOWN

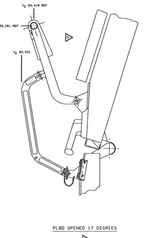




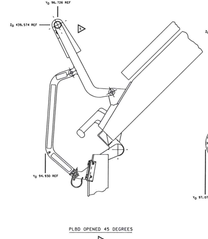
PAYLOAD BAY DOOR / PLBD CLOSED



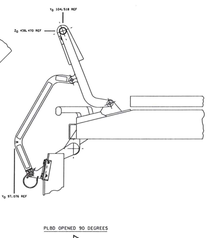
PLBD OPENED 5 DEGREES



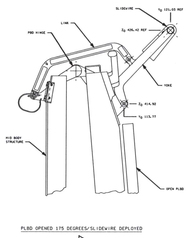
PLBD OPENED 17 DEGREES



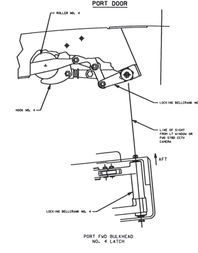
PLBD OPENED 45 DEGREES



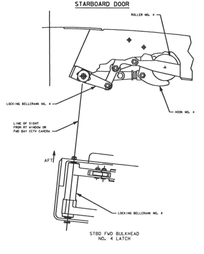
PLBD OPENED 90 DEGREES



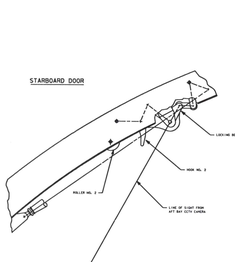
PLBD OPENED 175 DEGREES/SLIDEWIRE DEPLOYED



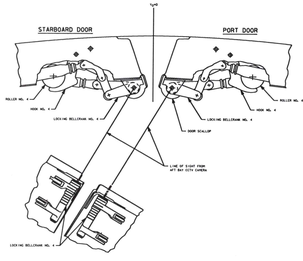
PORT FWD BULKHEAD NO. 4 LATCH



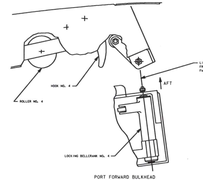
STBD FWD BULKHEAD NO. 4 LATCH



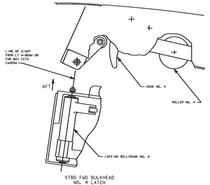
STBD AFT BULKHEAD NO. 2 LATCH



STBD AND PORT AFT BULKHEAD NO. 4 LATCH



PORT FORWARD BULKHEAD NO. 4 LATCH



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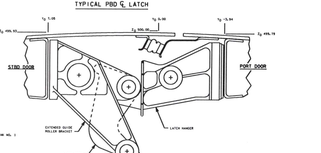
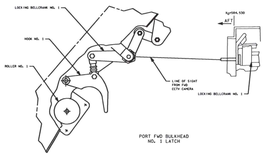
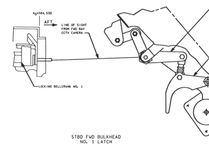
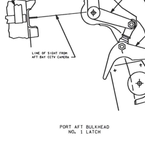




PORT FWD BULKHEAD NO. 1 LATCH



STBD FWD BULKHEAD NO. 1 LATCH



PORT AFT BULKHEAD NO. 1 LATCH

DIMENSIONS IN THESE DRAWINGS GENERATED THROUGH C.A.D.D. OPTIMIZATION WITH AN ACCURACY OF APPROXIMATELY ±0.100 INCH.

● DENOTES ONE PAIR HINGLINE TRAVEL POINT OF SLIDEWIRE CENTERLINE (SEE NOTE 3).

BOOM ANGLE	SLIDEWIRE LOCATION	
	Yp	Zp
0°	96.78	478.50
5°	95.27	478.58
17°	92.37	478.69
45°	86.72	478.97
67°	109.5	479.76
80°	133.50	478.13
90°	154.16	476.78
95°	174.94	474.59
110°	194.83	471.16
130°	216.72	472.26
150°	113.76	476.31
170°	114.76	476.16
180°	114.72	472.72
190°	114.64	469.27
210°	114.54	465.83
230°	114.43	462.39
250°	114.31	458.95
270°	114.18	455.51
290°	114.04	452.07
310°	113.90	448.63
330°	113.75	445.19
350°	113.59	441.75
370°	113.42	438.31
390°	113.24	434.87
410°	113.06	431.43
430°	112.87	427.99
450°	112.67	424.55
470°	112.46	421.11
490°	112.24	417.67
510°	112.01	414.23
530°	111.78	410.79
550°	111.54	407.35
570°	111.29	403.91
590°	111.03	400.47
610°	110.76	397.03
630°	110.49	393.59
650°	110.21	390.15
670°	109.92	386.71
690°	109.62	383.27
710°	109.31	379.83
730°	109.00	376.39
750°	108.68	372.95
770°	108.35	369.51
790°	108.01	366.07
810°	107.67	362.63
830°	107.32	359.19
850°	106.96	355.75
870°	106.60	352.31
890°	106.23	348.87
910°	105.85	345.43
930°	105.47	341.99
950°	105.08	338.55
970°	104.68	335.11
990°	104.28	331.67
1010°	103.87	328.23
1030°	103.45	324.79
1050°	103.03	321.35
1070°	102.60	317.91
1090°	102.16	314.47
1110°	101.72	311.03
1130°	101.27	307.59
1150°	100.81	304.15
1170°	100.35	300.71
1190°	99.88	297.27
1210°	99.40	293.83
1230°	98.92	290.39
1250°	98.43	286.95
1270°	97.94	283.51
1290°	97.44	280.07
1310°	96.93	276.63
1330°	96.42	273.19
1350°	95.90	269.75
1370°	95.38	266.31
1390°	94.85	262.87
1410°	94.31	259.43
1430°	93.77	255.99
1450°	93.22	252.55
1470°	92.67	249.11
1490°	92.11	245.67
1510°	91.54	242.23
1530°	90.97	238.79
1550°	90.39	235.35
1570°	89.81	231.91
1590°	89.22	228.47
1610°	88.63	225.03
1630°	88.03	221.59
1650°	87.42	218.15
1670°	86.81	214.71
1690°	86.19	211.27
1710°	85.57	207.83
1730°	84.94	204.39
1750°	84.31	200.95
1770°	83.67	197.51
1790°	83.03	194.07
1810°	82.38	190.63
1830°	81.73	187.19
1850°	81.07	183.75
1870°	80.41	180.31
1890°	79.74	176.87
1910°	79.07	173.43
1930°	78.39	169.99
1950°	77.71	166.55
1970°	77.02	163.11
1990°	76.33	159.67
2010°	75.63	156.23
2030°	74.93	152.79
2050°	74.22	149.35
2070°	73.51	145.91
2090°	72.79	142.47
2110°	72.07	139.03
2130°	71.34	135.59
2150°	70.61	132.15
2170°	69.87	128.71
2190°	69.13	125.27
2210°	68.38	121.83
2230°	67.63	118.39
2250°	66.88	114.95
2270°	66.12	111.51
2290°	65.36	108.07
2310°	64.59	104.63
2330°	63.82	101.19
2350°	63.05	97.75
2370°	62.27	94.31
2390°	61.48	90.87
2410°	60.69	87.43
2430°	59.90	83.99
2450°	59.10	80.55
2470°	58.30	77.11
2490°	57.49	73.67
2510°	56.68	70.23
2530°	55.86	66.79
2550°	55.04	63.35
2570°	54.21	59.91
2590°	53.38	56.47
2610°	52.54	53.03
2630°	51.70	49.59
2650°	50.85	46.15
2670°	50.00	42.71
2690°	49.15	39.27
2710°	48.29	35.83
2730°	47.43	32.39
2750°	46.56	28.95
2770°	45.69	25.51
2790°	44.82	22.07
2810°	43.94	18.63
2830°	43.06	15.19
2850°	42.17	11.75
2870°	41.28	8.31
2890°	40.39	4.87
2910°	39.49	1.43
2930°	38.58	-2.01
2950°	37.68	-5.45
2970°	36.76	-8.89
2990°	35.85	-12.33
3010°	34.93	-15.77
3030°	34.00	-19.21
3050°	33.08	-22.65
3070°	32.15	-26.09
3090°	31.21	-29.53
3110°	30.28	-32.97
3130°	29.34	-36.41
3150°	28.40	-39.85
3170°	27.45	-43.29
3190°	26.51	-46.73
3210°	25.56	-50.17
3230°	24.61	-53.61
3250°	23.66	-57.05
3270°	22.70	-60.49
3290°	21.75	-63.93
3310°	20.79	-67.37
3330°	19.83	-70.81
3350°	18.87	-74.25
3370°	17.91	-77.69
3390°	16.94	-81.13
3410°	15.98	-84.57
3430°	15.01	-88.01
3450°	14.04	-91.45
3470°	13.07	-94.89
3490°	12.10	-98.33
3510°	11.13	-101.77
3530°	10.16	-105.21
3550°	9.19	-108.65
3570°	8.22	-112.09
3590°	7.25	-115.53
3610°	6.28	-118.97
3630°	5.31	-122.41
3650°	4.34	-125.85
3670°	3.37	-129.29
3690°	2.40	-132.73
3710°	1.43	-136.17
3730°	0.46	-139.61
3750°	-0.51	-143.05
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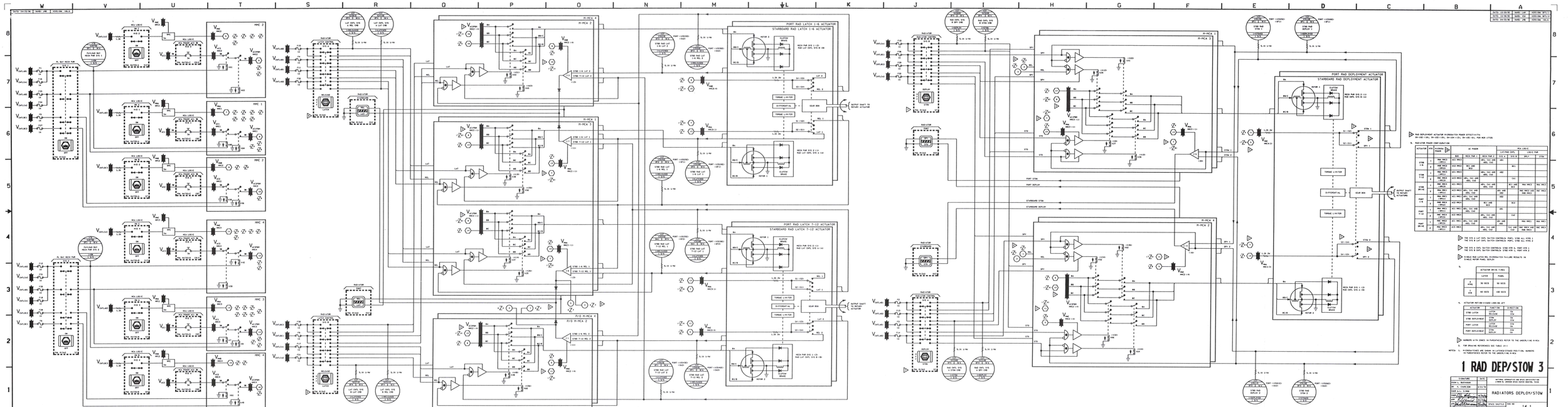
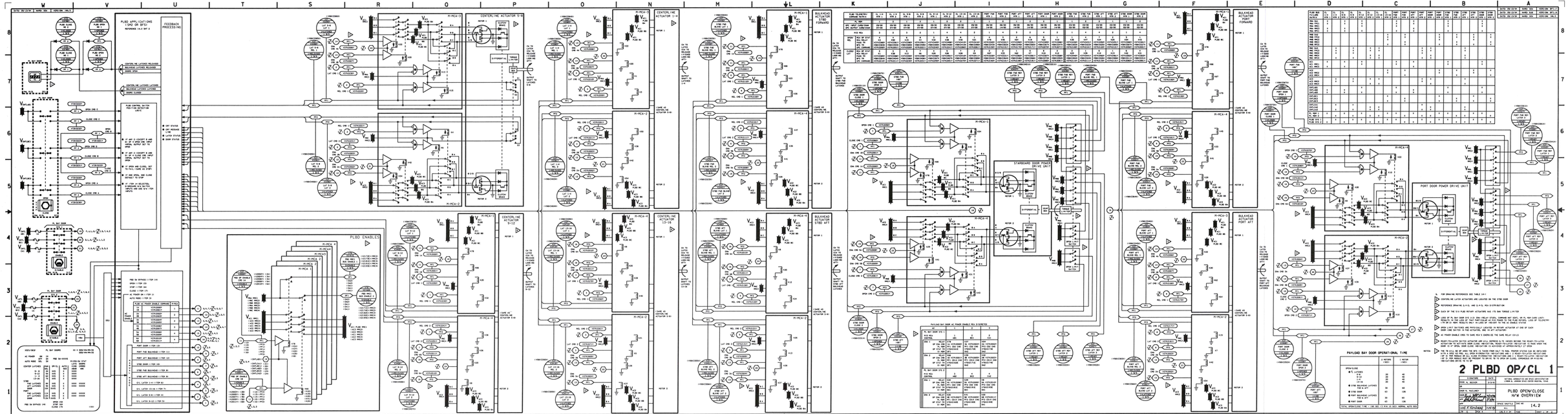
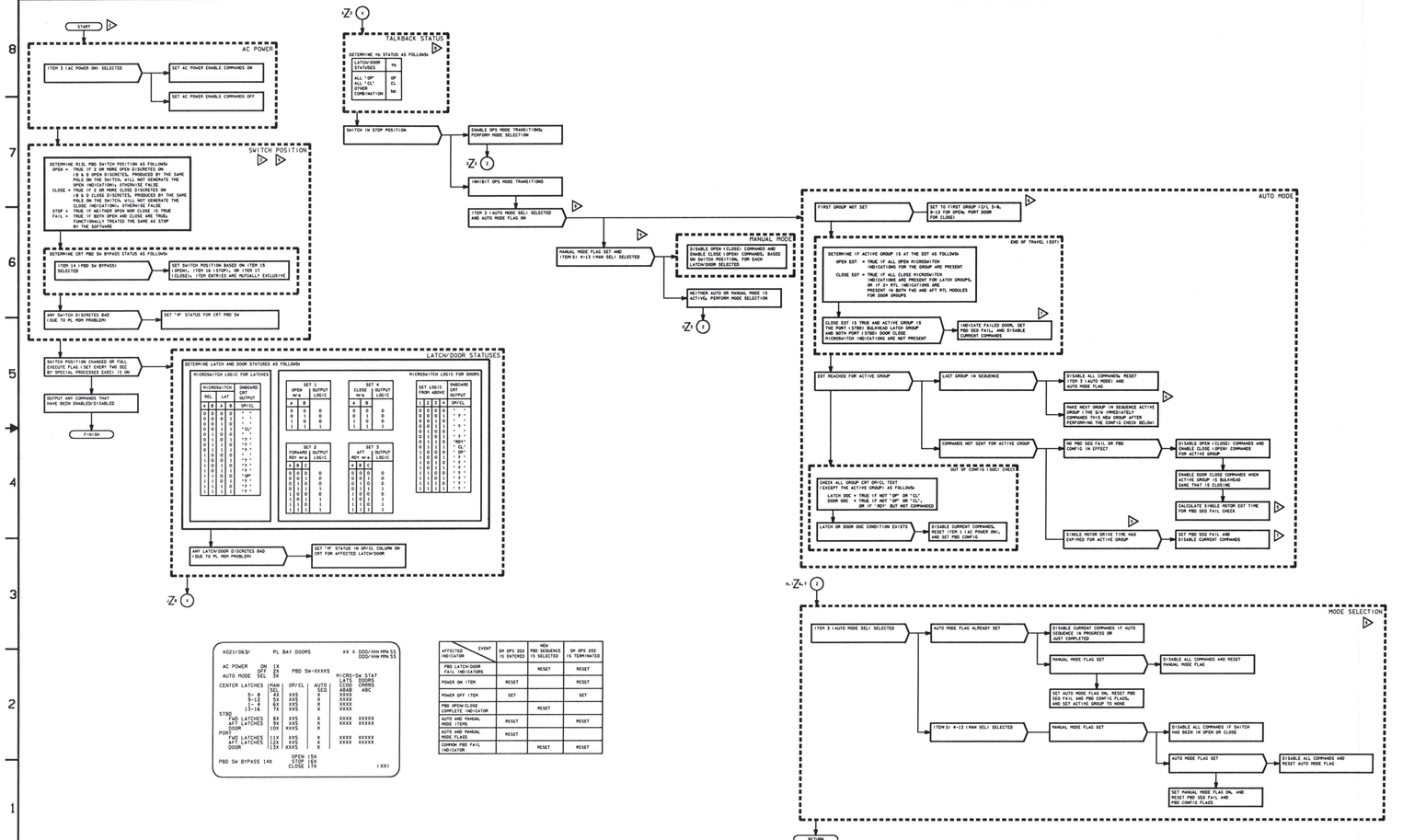
3810°	-3.42	-153.37
3830°	-4.39


1 RAD DEP/STOW 3
RADIATORS DEPLOY/STOW
PORT RAD LATCH 1-6 ACTUATOR
STARBOARD RAD LATCH 1-6 ACTUATOR
PORT RAD LATCH 7-12 ACTUATOR
STARBOARD RAD LATCH 7-12 ACTUATOR
PORT RAD DEPLOYMENT ACTUATOR
STARBOARD RAD DEPLOYMENT ACTUATOR
P/O P-MCA 1
P/O P-MCA 2
P/O P-MCA 3
P/O P-MCA 4
P-MCA 1
P-MCA 2
P-MCA 3
P-MCA 4
PPRC 1
PPRC 2
PPRC 3
PPRC 4
BASIC REV E-6


2 PLBD OP/CL 1
PLBD OPEN/CLOSE
H/W OVERVIEW
SPACE SHUTTLE
14.2
PAYLOAD BAY DOOR OPERATIONAL TIME
PLBD ENABLES
CENTERLINE ACTUATOR 1-4
CENTERLINE ACTUATOR 5-8
CENTERLINE ACTUATOR 9-12
CENTERLINE ACTUATOR 13-16
BULKHEAD ACTUATOR PORT FORWARD
BULKHEAD ACTUATOR PORT AFT
BULKHEAD ACTUATOR STBD FORWARD
BULKHEAD ACTUATOR STBD AFT
STARBOARD DOOR POWER DRIVE UNIT
PORT DOOR POWER DRIVE UNIT
BASIC REV E-4

DATED 03/24/94	NAMED JMB	VERSION BPS1.0
DATED 03/30/94	NAMED BJB	VERSION BPS1.1
DATED 06/15/94	NAMED BJB	VERSION IMAL3



XO21/063/ PL BAY DOORS XX X DDD/HHH MMM SS DDD/HHH MMM SS

PBD SW-XXXXS

			MICRO-SW STAT LATS	DOORS
AC POWER ON	1X		CLOD	CLOSD
OFF	2X		AUTO	ABC
AUTO MODE SEL	3X		X	
CENTER LATCHES MAN	4X	OP/CL	X	XXXX
5- 8	XX5		X	XXXX
9-12	6X		X	XXXX
13-16	7X		X	XXXX
STBD	8X	XX5	X	XXXX XXXXX
FWD LATCHES	9X	XX5	X	XXXX XXXXX
AFT LATCHES	AX	XX5	X	
DOOR	10X	XXX5	X	
PORT				
FWD LATCHES	11X	XX5	X	XXXX XXXXX
AFT LATCHES	12X	XX5	X	XXXX XXXXX
DOOR	13X	XXX5	X	
OPEN 15X				
STOP 16X				
CLOSE 17X				

PBD SW BYPASS 14X

(XX)

EVENT / AFFECTED INDICATOR	SM OPS 202 IS ENTERED	MDM PBD SEQUENCE IS SELECTED	SM OPS 202 IS TERMINATED
PBD LATCH/DOOR FAIL INDICATORS		RESET	RESET
POWER ON ITEM	RESET		RESET
POWER OFF ITEM	SET		SET
PBD OPEN/CLOSE COMPLETE INDICATOR		RESET	
AUTO AND MANUAL MODE ITEMS			RESET
AUTO AND MANUAL MODE FLAGS	RESET		
COMMON PBD FAIL INDICATOR		RESET	RESET

ITEMS 3-13 MAY NOT BE ENABLED UNLESS THE SWITCH POSITION IS IN STOP, ITEMS 15-17 MAY NOT BE ENABLED/DISABLED UNLESS ITEM 14 IS SELECTED

TALKBACK IS DRIVEN ONLY WHILE PLBD SOFTWARE IS ACTIVE (PASS OPS 202 OR OPS SPEC 83)

ALTHOUGH AUTO MODE IS TERMINATED, THE ITEM 3 ASTERISK REMAINS ON TO RESELECT AUTO MODE, ITEM 3 MUST BE TOGGLED TWICE (ASTERISK OFF, THEN BACK ON)

LATCH/DOOR GROUPS (AUTO MODE SEQUENCE)=

GROUP NO.	ACTUATORS IN GROUP	OPEN	CLOSE
1	GPL 9-8, GPL 9-12	↓	↑
2	GPL 1-8, GPL 13-16	↓	↑
3	STBD DOOR, STBD AFT	↓	↑
4	STBD DOOR	↓	↑
5	PORT FWD, PORT AFT	↓	↑
6	PORT DOOR	↓	↑

ACTUATOR DRIVE TIMES (SEC)=

ACTUATOR	2 MOTOR (NORMAL)	1 MOTOR
CENTER/ME LATCH	30	60
BULKHEAD LATCH	30	60
DOOR DRIVE	63	126

TOTAL OF 4 OPEN AND 4 CLOSE INDICATIONS PRODUCED FROM 3 SWITCH PACES

THE CRT PBD SW TEXT ALWAYS REFLECTS THE HARDWARE SWITCH POSITION, EVEN WHEN BYPASSED. FAILURE OF A PL MDM WHILE THE M/W SWITCH IS IN OPEN OR CLOSE WILL REQUIRE USE OF THE S/W BYPASS TO EXIT OPS 202

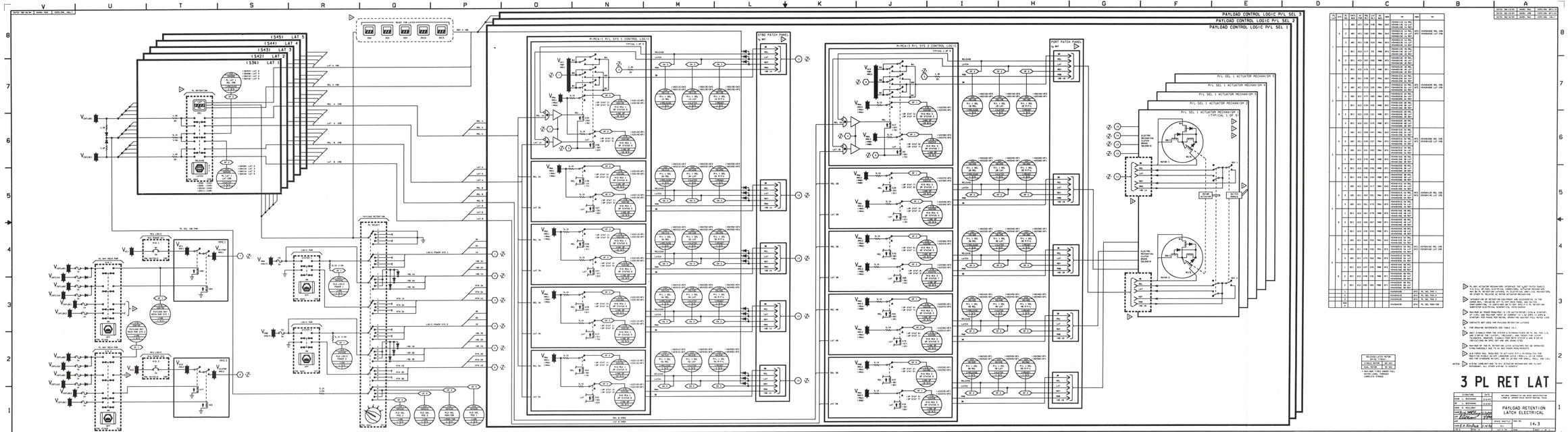
PLBD SOFTWARE IS CYCLED THROUGH EVERY 5 SECONDS. FULL EXECUTE FLAG IS SET EVERY 3 SECONDS

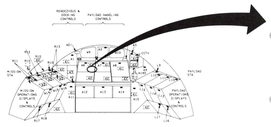
NOTES= 1. FOR DRAWING REFERENCES SEE TABLE 14-1

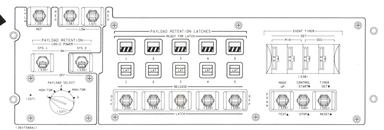
2 PLBD SW OV 2

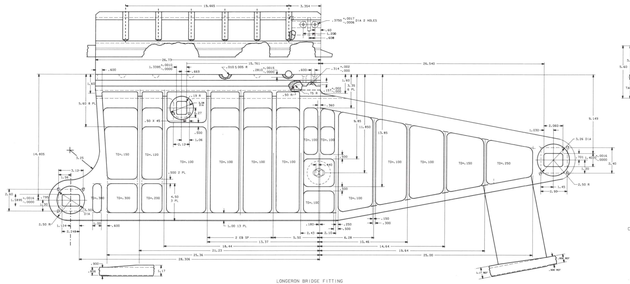
SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DSGN M. GILLESPIE	3/23/94	
DR		
CHCR R. McCLINEY		PLBD SOFTWARE OVERVIEW (PASS)
CHCR		
APP		
APP		SPACE SHUTTLE
CARD S.F. Simbeni	3-15-94	DWG NO 14.2
LTR E DTCN *		ALL SIZE B SCALE NONE SHEET 2 OF 2

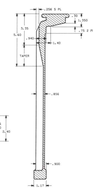
BASIC REV E-4

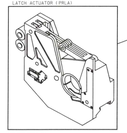

PAYLOAD CONTROL LOGIC P/L SEL 3
PAYLOAD CONTROL LOGIC P/L SEL 2
PAYLOAD CONTROL LOGIC P/L SEL 1
(S45) LAT 5
(S44) LAT 4
(S43) LAT 3
(S42) LAT 2
(S36) LAT 1
P/L SEL 1 ACTUATOR MECHANISM 1
P/L SEL 1 ACTUATOR MECHANISM 2
P/L SEL 1 ACTUATOR MECHANISM 3
P/L SEL 1 ACTUATOR MECHANISM 4
P/L SEL 1 ACTUATOR MECHANISM 5
M-MCA-1 P/L SYS 1 CONTROL LOGIC
M-MCA-3 P/L SYS 2 CONTROL LOGIC
STBD PATCH PANEL
PORT PATCH PANEL
P/L RET ACTUATOR
LATCH ACTUATOR
MOTOR 1
MOTOR 2
3 PL RET LAT
PAYLOAD RETENTION LATCH ELECTRICAL
BASIC REV E-4

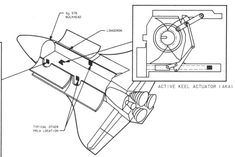


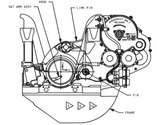


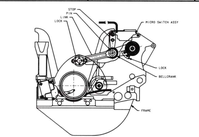


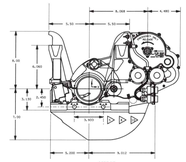


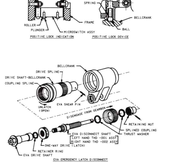


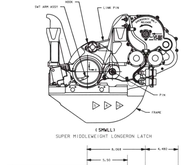


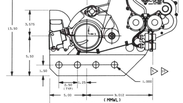


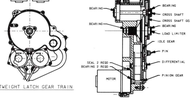


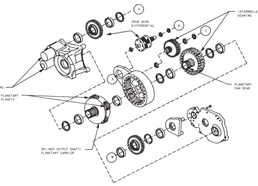


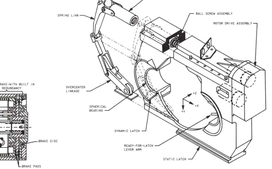


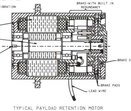


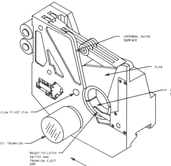


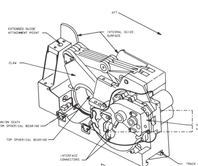


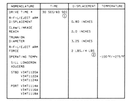








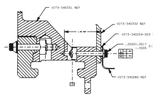


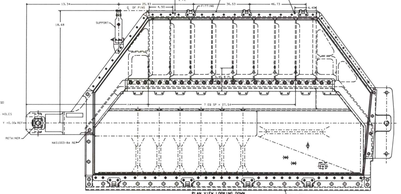


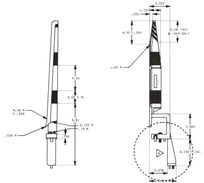
ABBREVIATIONS	I.M.	I.D.entification	Tolerancing
DP-HD T-PNL P-HD	SEE DESIGN REQ		
# = x-y LAST ARM PEACH		X.XX - INCHES	
CLPNL = MAKE PEACH		X.X - INCHES	
TRUNN-ON TRUNN-ON		S.DS - INCHES	
# = x-y LAST ARM FURLE		X - DEG / # - DEG	
FWD = FWD, TOPPA = PAYLOAD HOLDERS			+.030/+0/-0.75.00
STBD = STARBOARD STAT.LINE STAT.LINE STAT.LINE STAT.LINE			
PORT = PORT STAT.LINE STAT.LINE STAT.LINE			

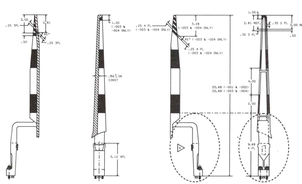
(1) DUAL MOTOR AND S-WALE MOTOR DRIVE TYPE REPRESENTATIVELY.

(2) # = x, ACT-HAT-ON FORCE/TRAUN-ON EJECT FORCE









THE LONGHEAVY, MIDDLEWEIGHT, MODIFIED MIDDLEWEIGHT, SUPER MIDDLEWEIGHT, AND STANDARD WEIGHT LONGERON LATCHES ARE ALL SIGNAL BY LEFT-HANDED VERTICAL TRAVERSE/LEFT OF MOTOR ENGAGE/ONE MOTOR DRIVE TYPE. THE LIGHTWEIGHT LONGERON LATCH IS DRIVEN BOTH WAYS WITH BOTH MOTORS. MODES OF LOCK-STATUS AND OPERATIONALITY IDENTICAL.

MOTOR FORWARD WILL ROTATE ON SIGNAL, MOTOR LEFT SIGNALING TO ROTATE CLOCKWISE (LOOKING AFT) TO OPEN LATCH (SIGNAL AND WIRE OPPOSITE SIGNALS, LOOKING AFT).

THE LIGHTWEIGHT, MIDDLEWEIGHT, AND SUPER MIDDLEWEIGHT LONGERON LATCHES HAVE IDENTICAL PHYSICAL ENVELOPES AS SHOWN FOR THE LWLL.

1. FOR SPECIFIC REFERENCES SEE TABLE 14-1.

THE MAIN DIFFERENCE IN A STANDARD EXTENDED GUIDE AND A STANDARD GUIDE IS THE LENGTH OF THE V-GUIDE. THE MAIN DIFFERENCE IN A DEEP GUIDE AND A STANDARD EXTENDED GUIDE IS THE LENGTH OF THE V-GUIDE. THE LONGHEAVY LATCH IS A DEEP GUIDE.

THE LIGHTWEIGHT AND THE HIGH-ENERGY/MODIFIED HIGH-ENERGY LONGERON LATCHES ARE MADE OF ALUMINUM AND TITANIUM RESPECTIVELY. THE SUPER HIGH-ENERGY/ENT LONGERON LATCHES ARE ALSO PRIMARILY TITANIUM CONSTRUCTION.

THE LIGHTWEIGHT/MIDDLEWEIGHT LONGERON LATCHES ARE THE ONLY LONGERON LATCHES WITH ENERGY/ENT LATCHES ALL HAVE THE EVA ENERGY/ENT FEATURE.

BR-ECE FITTING AND LATCH LOCATIONS ARE FLIGHT DEPENDENT

LATCH SPEEDS TO SECONDS FOR TWO MOTORS.
ONE MOTOR = 60 SECONDS FOR ONE MOTOR.
LONGER FULL-CYCL, THROUGH COMPLETE STROKE FOR EITHER DIRECTION

NOTES: PORT AND STARBOARD BR-ECE FITTINGS AS WELL AS LATCHES ARE MIRROR IMAGES OF EACH OTHER.
ON BOTH SIDES OF THE PAYLOAD BAY.

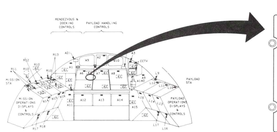
PL RET LAT-MECH

SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DESIGN ENGR	10/26/82	LYNDON B. JOHNSON SPACE CENTER
DRAFTING		PAYLOAD RETENTION LATCH-MECH
CHIEF, S & M MECH		
CHIEF, PROJECTS OFFICE		
CHIEF, ENGINEERING DIV		
CHIEF, SYSTEMS ENGINEERING & INTEGRATION OFFICE		SPACE SHUTTLE PRR NO. 14.3
CHIEF, SPACE SHUTTLE PROGRAM OFFICE		

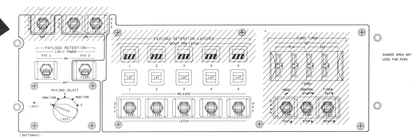
SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	74	14.3	

SCALE: NONE | SHEET 1 OF 1

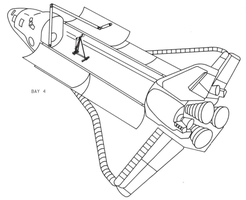
BASIC REV E

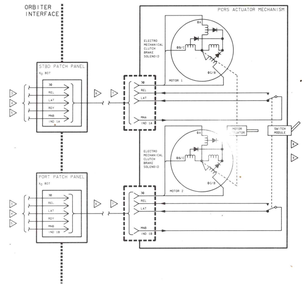


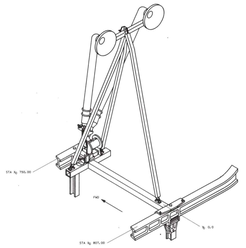
AFT FLIGHT DECK CONFIGURATION
VEHICLE LOCATION AFT



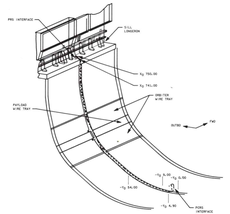
PAYLOAD RETENTION SYSTEM CONTROLS



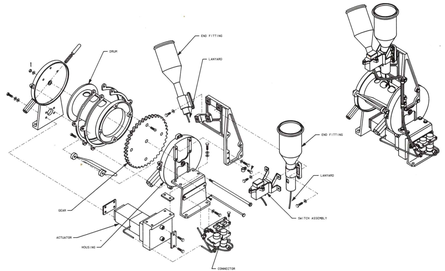




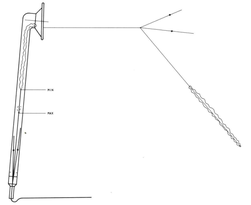
PCRS SUPPORT STRUCTURE
TYPICAL BAY 4 INSTALLATION



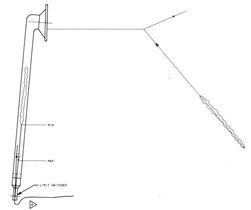
PCRS UNIQUE EXTENDER CABLES



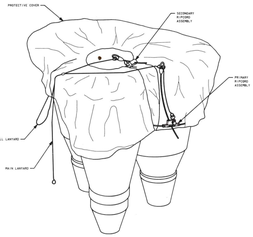
PCRS ACTUATOR MECHANISM



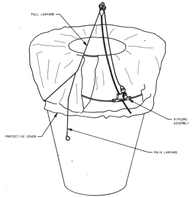
COVER STOWAGE IN SECONDARY PCRS FUNNEL



COVER STOWAGE IN PRIMARY PCRS FUNNEL



TYPICAL PROTECTIVE COVER ASSEMBLY
MULTIPLE LENS/SUNSHADE CONFIGURATION



TYPICAL PROTECTIVE COVER ASSEMBLY
SINGLE LENS/SUNSHADE CONFIGURATION

1. R-DRIVE/TENSC ACTUATED TO "RELEASE" UPON COVER REMOVAL/STOWAGE, (NH-B-T-140 FURTHER TRAVEL IN RELEASE DIRECTION, TRAVEL IN LATCH DIRECT ON (NH-B-T02 FURTHER TRAVEL IN RELEASE DIRECTION.
2. R-DRIVE/TENSC ARE DUAL CONTACT AND EITHER/BOTH CLOSED TO "LATCH" AND ARE LOCATED AT THE BASE OF THE PRIMARY FUNNEL. 2LB FORCE MAX REQUIRED TO ACTUATE MICROSWITCHES TO FAILURE
3. PCRS ACTUATOR MECHANISM INTERFACE THE 14 BOT PATCH PANELS P/O B (LL, LR, RL, RR, LT, RT, LOS, ROS, LOT, ROT) AND ARE USED TO CONNECT THE ASSY. MEANS P/O PCRS TO THE S.V. INTERFACE
4. R/R ONE COMPARTMENT TO PCRS ACTUATOR MECHANISMS ARE R/I DAY DEPENDENT
5. THE R-P/I, INDICATORS AND TALKBACKS ARE NOT USED WITH THE PCRS
6. ONLY 3 SIGNALS FROM THE SYSTEM A R-DRIVE/TENSC ON P1, S2, PINS 1, 2, AND 3 ARE USED FOR PCRS. THE REMAINING SIGNALS ARE USED FOR THE PAYLOAD RETENTION SYSTEM A AND B (R-P/I, INDICATORS ON SPEC 51 AND ARE DUAL/DUAL)
7. PCRS IS POWERED THROUGH PAYLOAD RETENTION SYSTEM ELECTRICAL CONNECTORS, SEE PAYLOAD ELECTRICAL POWER PANEL INTERFACES AND DETAILED PAYLOAD RETENTION SYSTEM ELECTRICAL SCHEMATIC
8. PCRS OPERATING TEMPERATURE: (-)4.7°C (+)37.5°C

NOTES: 1. PCRS DEVICE TYPES (LANYARD/COVER TRAVEL, ETC/ACCESS) ARE FLIGHT DEPENDENT, LANYARD PULL RATES SHALL BE:
DUAL MOTOR: 5.0 (N.=50)
SINGLE MOTOR: 10.0 (N.=100)

3 PCRS 3

SIGNATURE	DATE
DSM: N. EGAN-WYER	7/14/93
QA: N. EGAN-WYER	7/14/93
CHAR: J.R. ELWOOD	
Design: [illegible]	[illegible]
Lead Engr: [illegible]	[illegible]
APP: [illegible]	7/14/93
PRELIM/M.P.P. [illegible]	[illegible]
TM: E. BAUM	

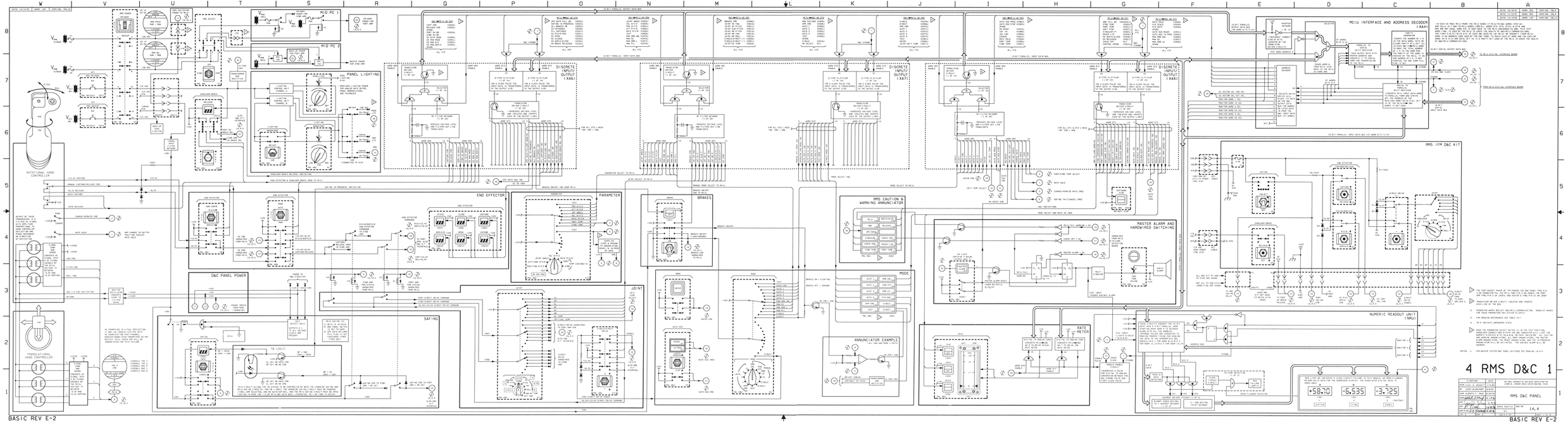
NOTICE: PROPRIETARY DATA
CONTAINS INFORMATION OF RESTRICTED DISTRIBUTION

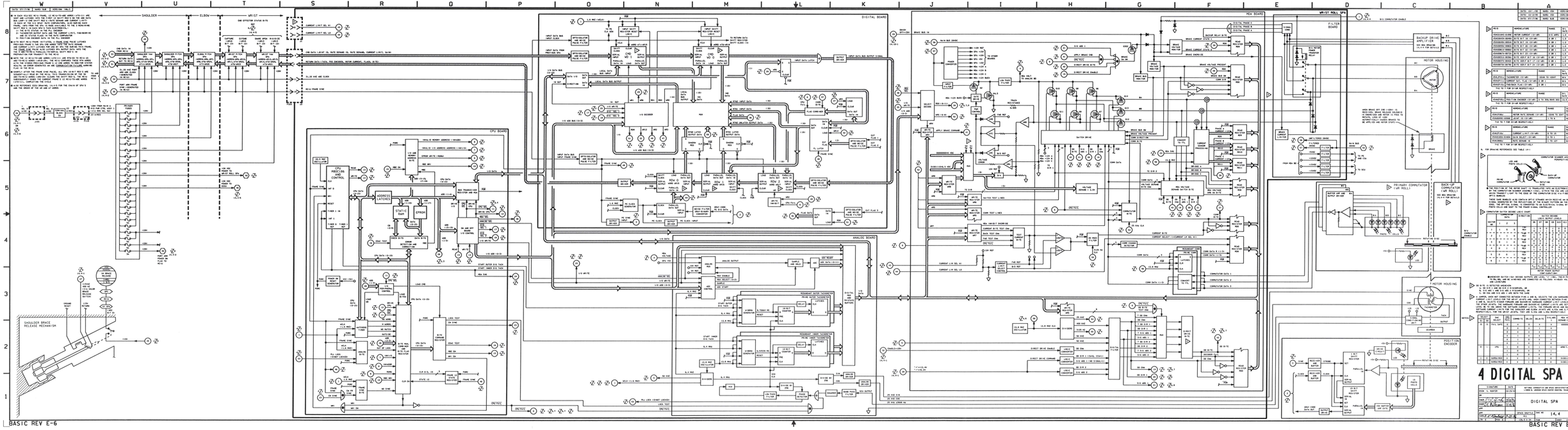
PROTECTIVE COVER REMOVAL SYSTEM

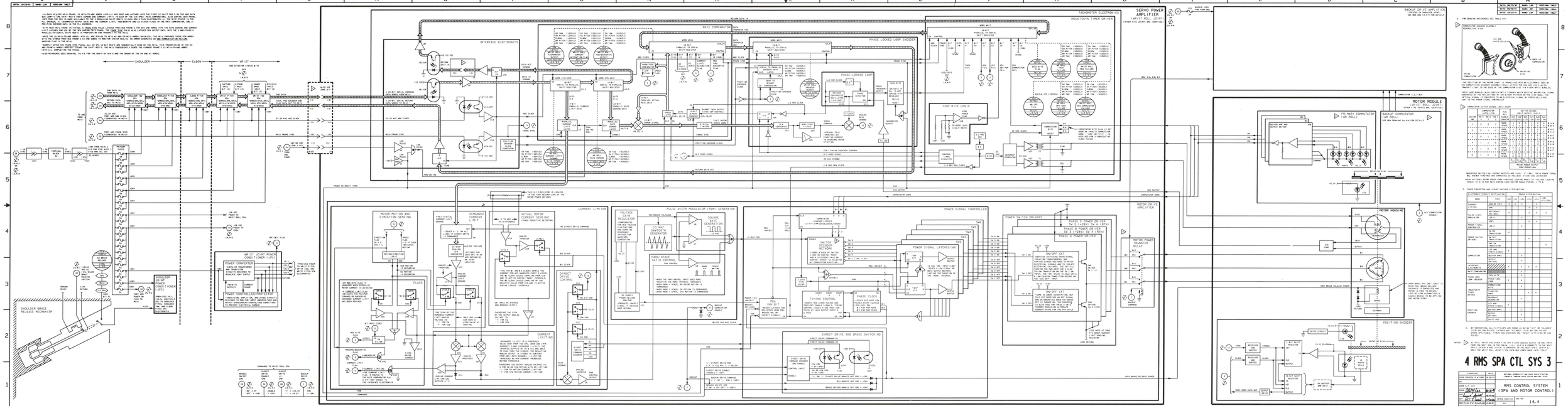
SPACE SHUTTLE | DWG NO. 14,3

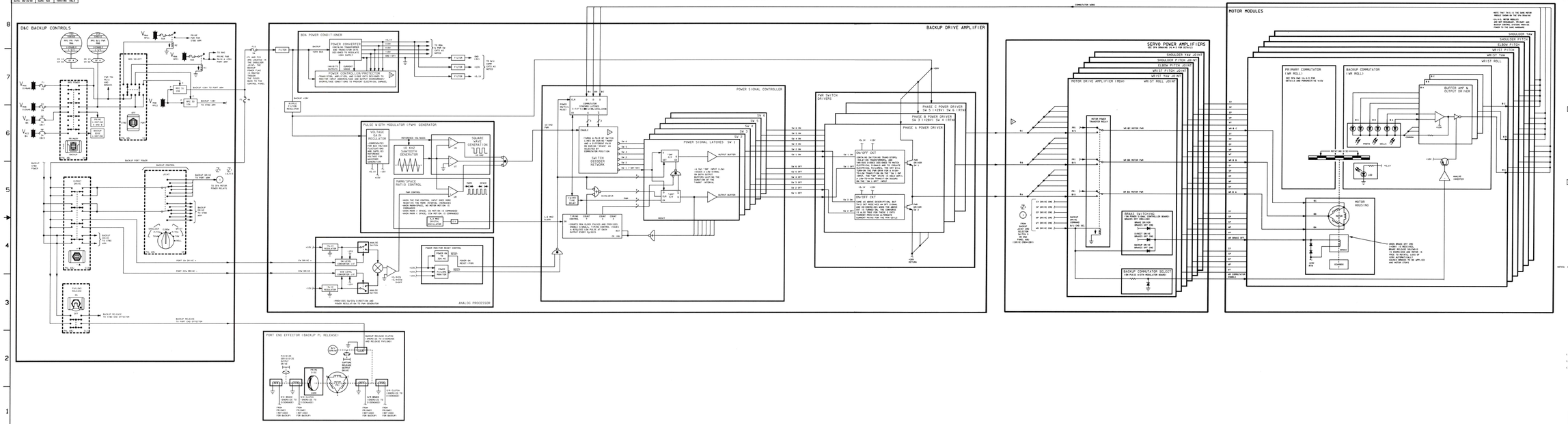
SCALE: NONE | SHEET NO. 1 OF 1

BASIC REV E


4 RMS D&C 1
RMS D&C PANEL
MC1U INTERFACE AND ADDRESS DECODER (XA4)
RMS IFM D&C KIT
RMS CAUTION & WARNING ANNUNCIATOR
MASTER ALARM AND HARDWIRED SWITCHING
NUMERIC READOUT UNIT (NRU)
RATE METER
ANNUNCIATOR EXAMPLE
MODE
BRAKES
PARAMETER
END EFFECTOR
SAFING
JOINT
D&C PANEL POWER
PANEL LIGHTING
ROTATIONAL HAND CONTROLLER
TRANSLATIONAL HAND CONTROLLER
MID PC 1
MID PC 2
BASIC REV E-2


4 DIGITAL SPA 2
DIGITAL SPA
14.4
SHOULDER
ELBOW
WRIST
WRIST ROLL SPA
DIGITAL BOARD
CPU BOARD
ANALOG BOARD
MCA BOARD
FILTER BOARD
PRIMARY COMPUTATOR
BACK-UP COMPUTATOR
MOTOR HOUSING
POSITION ENCODER
SHOULDER BRACE RELEASE MECHANISM
BASIC REV E-6


SERVO POWER AMPLIFIER
TACHOMETER ELECTRONICS
INDUCTOSYN TIMER DRIVER
INTERFACE ELECTRONICS
RATE COMPARATOR
PHASE LOCKED LOOP ENCODER
PHASE-LOCKED LOOP
+28V BITE LOGIC
BACKUP DRIVE AMPLIFIER
MOTOR MODULE
PRIMARY COMMUTATOR (+WR ROLL)
BACKUP COMMUTATOR (-WR ROLL)
MOTOR HOUSING
POSITION ENCODER
SHOULDER ELBOW WRIST
SHOULDER BRAKE RELEASE MECHANISM
WRIST JOINT POWER CONDITIONER (JPC)
POWER CONVERTER
POWER CONTROLLER/ISOLATOR
MOTOR MOTION AND DIRECTION SENSING
DEMANDED CURRENT LIMIT
ACTUAL MOTOR CURRENT SENSING
CURRENT LIMITER
VOLTAGE REGULATOR
PULSE WIDTH MODULATOR (PWM) GENERATOR
SQUARE WAVE OSCILLATION
SAWTOOTH GENERATOR
MARK/SPACE RATIO CONTROL
POWER SIGNAL CONTROLLER
POWER SIGNAL LATCHES-SW2
SKEW DECODER NETWORK
TIMING CONTROL
PHASE CLOCK
DIRECT DRIVE AND BRAKE SWITCHING
POWER SWITCH DRIVERS
PHASE C POWER DRIVER
PHASE B POWER DRIVER
PHASE A POWER DRIVER
ON/OFF CKT
MOTOR POWER RELAY
BRAKE RELEASE PHASE
POSITION ENCODER
4 RMS SPA CTL SYS 3
RMS CONTROL SYSTEM
(SPA AND MOTOR CONTROL)
BASIC REV E-1



NOTES:

A. FOR DRAWING REFERENCES SEE TABLE 14-1.

INPUT UNDERVOLTAGE PROTECTION
SHUTS OFF ALL MOTOR POWER IF ANY VOLTAGE DROPS BELOW +15V, +5V OR -15V. THIS CIRCUIT HAS APPROX. 1 VOLT HYSTERESIS, SO IF A VOLTAGE DROPS BELOW THE SHUTOFF LEVEL, IT WILL AUTOMATICALLY RESUME NORMAL OPS WITHIN 200 MSEC.

OUTPUT OVERVOLTAGE/OVERCURRENT PROTECTION
SHUNTS PWR TO C, WHICH TRIPS CIRCUIT BREAKER IF ANY VOLTAGE OR CURRENT LIMIT IS EXCEEDED. THE CIRCUIT BREAKER MUST BE MANUALLY RESET.

SUPPLY	+15V	+5V	-15V
MAX LIMIT	+16.5V	+5.5V	-16.5V
MIN LIMIT	+13.5V	+4.5V	-13.5V

SUPPLY	+15V	+5V	-15V
CURRENT LIMIT	1.5A	3A	1.5A

THE TP TABLE THAT SHOWS UP ON BDA PWR TRIP LEVELS.

COMPUTATION SWITCH DECODE LOGIC CHART

COMPUTATION SWITCH NO.	0	1	2	3	4	5	6	7
0	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0
5	1	0	1	0	0	0	0	0
6	0	1	1	0	0	0	0	0
7	1	1	1	0	0	0	0	0

PWR SWITCH DRIVERS	MOTOR DECODE							
		0	1	2	3	4	5	6
1	ANALOG	0	1	0	1	0	1	0
2	ANALOG	0	0	1	1	0	0	1
3	ANALOG	0	0	0	0	1	1	1
4	MAIN	0	1	1	0	1	0	0
5	MAIN	0	0	0	1	1	1	0
6	MAIN	0	1	0	1	0	1	1
7	MAIN	0	0	1	1	0	0	1
		Pri Pitch	Pri Yaw	Pri Roll	Sec Pitch	Sec Yaw	Sec Roll	Elbow Pitch

MOTOR POWER DECODE

WASHDOWN SWITCH (3A1 DECODE OUTPUT) HAS +15V, -15V, +5V PWR TO BE ON, AND BE W/MOTOR AND CONNECTED AS FOLLOWS W/DISC AND CB/RETURN

WASHDOWN SWITCH (3A1 DECODE OUTPUT) HAS +15V, -15V, +5V PWR TO BE ON, AND BE W/MOTOR AND CONNECTED AS FOLLOWS W/DISC AND CB/RETURN

WHEN BRAKE SET (NO MOTOR PWR) OR BRAKES RELEASED (W/DISCS) THE BRAKE SHUNTING CIRCUIT IS FREE TO RESPOND, LOCK UP (SHUNT MOTOR) OR UNLOCK (RELEASE) TO BE APPL-ED AND MOTOR STOPS

NOTES: 1. POWER CONVERTER AND +28VDC VOLTAGE DISTRIBUTION

ELECTRONICS CIRCUIT DESTINATION		POWER DISTRIBUTION			
		+5.1V	+15V	-15V	+28VDC (1)
NAME	DES				
ANALOG PROCESSOR	ANALOG 5V 1	X	X	X	
	APP				X
POWER MONITOR RESET CONTROL	MONITOR	X	X	X	
	RESET				X
PULSE WIDTH MODULATOR	REFERENCE	X	X	X	
	SQUARE WAVE	X	X	X	
	PWM				X
POWER SIGNAL CONTROLLER	LOGIC	X			
POWER SWITCH DRIVERS	5V ON DISTRIBUTION	X			
	15V ON DISTRIBUTION		X	X	
	PWR TO MOTOR				X (2)
BACKUP COMPUTER	LOGIC AND POWER SUPPLY SUPPLY TO BACKUP SWITCH	X			
	PWR				X

(1) POWER CONVERTER OUTPUT VOLTAGES ARE TURNED ON WHENEVER THE +28VDC BACKUP POWER RELAY IS ENERGIZED, AND TURNED OFF WHEN IT DROPS OUT.

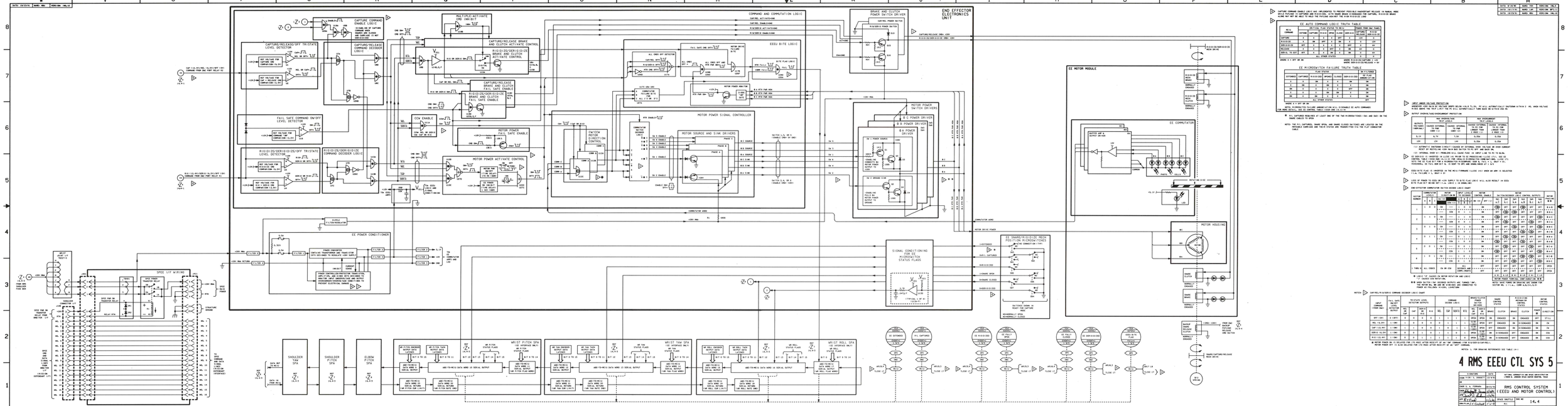
(2) MOTOR POWER OUTPUT ENABLED WHEN BACKUP DRIVE JOINT COMMAND IS SELECTED ON PWC PANEL.

(3) +15V TO COMPUTATION OUTPUT DRIVERS IS ENABLE ONLY WHEN JOINT IS SELECTED.

4 RMS BDA CTL SYS 4

STRUCTURE	DATE	NOTICE: INFORMATION ON THESE DRAWINGS IS SUBJECT TO RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT
DESIGN — H. BUCHANAN	12-84-82	
CHK — H. BUCHANAN	12-84-82	RMS CONTROL SYSTEM (BDA)
PGMR — H. LEE	04-15-83	
CHK —	04-15-83	
APP —	04-15-83	
APP —	04-15-83	SPACE SHUTTLE — PAY NO.
APP —	04-15-83	14.4
DRAWING NO. —		SHEET 1 OF 1

BASIC REV E



BASIC REV E

BASIC REV E-1

DATE: 04/20/99	NAME: MSL	SIZE: D	DRAWING: HALT
DATE: 04/20/99	NAME: MSL	SIZE: D	DRAWING: HALT
DATE: 04/20/99	NAME: MSL	SIZE: D	DRAWING: HALT

SHOULDER

ELBOW

WRIST

END EFFECTOR

SYSTEM A

SYSTEM B

THERM-STOR VOLTAGE OUTPUTS (-22)

TEMP SENSE BUS 3

TEMP SENSE BUS 2

TEMP SENSE BUS 1

ELECTRONICS TRAY

ETR 123 15.7W

YAW MOTOR MODULE

ETR 120 15.7W

ETR 135 6.2W

BUTER YAW HOUSING

CENTER TORQUE

PITCH MOTOR MODULE

SHOULDER PITCH OUTER TORQUE

MOTOR MODULE 11.0Ω

ETR 129 4.7W

ETR 127 4.7W

ETR 133 4.7W

POSITION ENCODER 11.0Ω

BASE PEDESTAL

ETR 125 15.7W

SPL-112 BLOCK 43

END EFFECTOR 7 FIXED W-MC

SPL-112 BLOCK 44

END EFFECTOR 8 FIXED W-MC

SPL-112 BLOCK 45

END EFFECTOR 9 FIXED W-MC

SPL-112 BLOCK 46

END EFFECTOR 10 FIXED W-MC

PIN-MAST FIXED

SYS A RETURN

SYS B RETURN

SYS A +28V

SYS B +28V

SYS A +28V

SYS B +28V

ELBOW MOTOR MODULE

ELBOW OUTER TORQUE

ETR 202 15.7W

ETR 203 4.7W

ETR 204 4.7W

ETR 205 4.7W

ETR 206 4.7W

ETR 207 4.7W

ETR 208 4.7W

ETR 209 4.7W

ETR 210 4.7W

ETR 211 4.7W

ETR 212 15.7W

POSITION ENCODER 11.0Ω

CENTER TORQUE

ROLL EXTERIOR

ETR 301 15.7W

ETR 302 15.7W

FWD ELECTRONICS TRAY

ETR 303 15.7W

ETR 304 15.7W

ROLL ELECTRONICS COMP

ETR 305 15.7W

ETR 306 15.7W

PITCH MOTOR MODULE

ROLL MOTOR MODULE

YAW MOTOR MODULE

PITCH OUTER TORQUE

MOTOR MODULE 11.0Ω

ETR 307 4.7W

ETR 308 4.7W

ETR 309 4.7W

ETR 310 4.7W

POSITION ENCODER 11.0Ω

CENTER TORQUE

ETR 311 15.7W

YAW OUTER TORQUE

ETR 312 4.7W

ETR 313 4.7W

ETR 314 4.7W

ETR 315 4.7W

ETR 316 4.7W

ETR 317 4.7W

ETR 318 4.7W

ETR 319 4.7W

ETR 320 4.7W

ETR 321 4.7W

ETR 322 15.7W

ETR 323 15.7W

ETR 324 15.7W

ETR 325 15.7W

ETR 326 15.7W

ETR 327 15.7W

ETR 328 15.7W

ETR 329 15.7W

ETR 330 15.7W

ETR 331 15.7W

ETR 332 15.7W

ETR 333 15.7W

ETR 334 15.7W

ETR

4 MECH OV 7

SOME COMPONENTS

TYPICAL MOTOR MODULE CONFIGURATION

RMS CUTS WRIST CAMERA AND 1-LIGHT SUBASSEMBLY DESIGN CONFIGURATION

ARM BOOM/MRL STRIKER CROSS SECTION

SHOULDER PITCH JOINT

SHOULDER YAW JOINT

ELBOW PITCH JOINT

ELBOW JOINT

WRIST PITCH JOINT

WRIST YAW JOINT

WRIST ROLL JOINT

WRIST JOINT

STANDARD END EFFECTOR (-7 CONFIGURATION)

END EFFECTOR DRIVE TRAIN (-7 CONFIGURATION)

STANDARD END EFFECTOR CAPTURE AND RIGIDIZE SEQUENCE

TYPICAL JOINT GEAR SCHEMATIC

PRECAPTURE MISALIGNMENT ENVELOPE OF GRAPPLE FIXTURE AND END EFFECTOR

JOINT TRAVEL LIMIT LOCATIONS

JOINT	DC SPEC TRAVEL	REACH LIMIT LOCATION	SOFT STOP LOCATION	SOFTWARE STOPPING ACCURACY	MECHANICAL STOP LOCATION
SHOULDER YAW	+180°	+175.9°	+173.4°	0.6°	+180°
	-180°	-175.9°	-173.4°		-180°
SHOULDER PITCH	+104°	+103.1°	+102.6°	0.6°	+104°
	-15°	-13.9°	-13.4°		-15°
ELBOW PITCH	+150°	+149.1°	+148.6°	0.6°	+150°
	-150°	-149.1°	-148.6°		-150°
WRIST PITCH	+120°	+119.1°	+118.6°	0.7°	+120°
	-120°	-119.1°	-118.6°		-120°
WRIST YAW	+120°	+119.1°	+118.6°	0.7°	+120°
	-120°	-119.1°	-118.6°		-120°
WRIST ROLL	+360°	+359.1°	+358.6°	0.9°	+360°
	-360°	-359.1°	-358.6°		-360°

NOTES: 1. ALL DIMENSIONS ARE IN INCHES

SIGNATURE	DATE
DESN: L.A.REED	8/13/90
DR: L.A.REED	8/13/90
CHKD: L.N. NARRO	
APP: [illegible]	
APP: [illegible]	
APP: [illegible]	

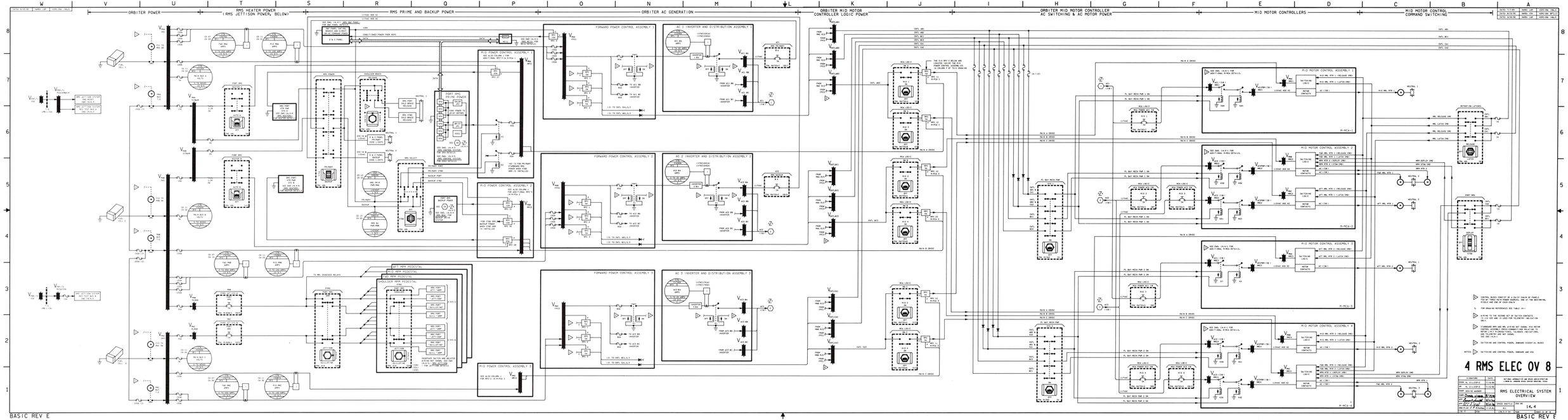
MECHANICAL ARRANGEMENT AND ENVELOPE DEFINITION FOR THE S. JOHNSON SPACE CENTER HOUSTON, TEXAS

RMS MECHANICAL SYSTEM OVERVIEW

SPACE SHUTTLE — DWG NO 14.4

SCALE: NONE — SHEET 1 OF 1

BASIC REV E


ORBITER POWER
RMS HEATER POWER (RMS JETTISON POWER, BELOW)
RMS PRIME AND BACKUP POWER
ORBITER AC GENERATION
ORBITER MID MOTOR CONTROLLER LOGIC POWER
ORBITER MID MOTOR CONTROLLER AC SWITCHING & AC MOTOR POWER
MID MOTOR CONTROLLERS
MID MOTOR CONTROL COMMAND SWITCHING
FORWARD POWER CONTROL ASSEMBLY 1
FORWARD POWER CONTROL ASSEMBLY 2
FORWARD POWER CONTROL ASSEMBLY 3
AC 1 INVERTER AND DISTRIBUTION ASSEMBLY 1
AC 2 INVERTER AND DISTRIBUTION ASSEMBLY 2
AC 3 INVERTER AND DISTRIBUTION ASSEMBLY 3
MID POWER CONTROL ASSEMBLY 1
MID POWER CONTROL ASSEMBLY 2
MID POWER CONTROL ASSEMBLY 3
MID MOTOR CONTROL ASSEMBLY 1
MID MOTOR CONTROL ASSEMBLY 2
MID MOTOR CONTROL ASSEMBLY 3
MID MOTOR CONTROL ASSEMBLY 4
AFT MPM PEDESTAL
MID MPM PEDESTAL
SHOULDER MPM PEDESTAL
4 RMS ELEC OV 8
RMS ELECTRICAL SYSTEM OVERVIEW
14.4
BASIC REV E

DATE: 09/01/81	NAME: ALR	USE/ON: BFTL10
DATE: 09/30/81	NAME: VDA	USE/ON: BFTL10
DATE: 07/13/82	NAME: VDA	USE/ON: FACT

WHEN DIGITAL SPK RD/WR (ATI,CSS), THIS DATA IS HAVAL(0) BUT IS STILL PROCESSED BY THE SPE

THE SPK SAT RD REGISTER IS ARE DISPLAYED. THE STACK AAT REGS ARE DISPLAYED, IN THIS ORDER: SSPC, ELR, AMR, APC, ARR

THERE ARE NINE MRE COMMANDS, FIVE COMMANDS ARE SHOWN ON DRAWING-16.3A. (MR,MCL, CMS,APC, CMC,CDS,CMA,TS, CMA,CLC,CMA,CLA) CMA,CLC = MCU/CMA DEPENDANT MRE DATA CMA,CLC = CONTROL CONSTANT TABLE CMA,CLA = CONTROL CONSTANT ACCUMULATOR CMC,CDS = DISCONTINUITY DATA

PROCEDURES ARE ONLY INVOKED BY CALLING THE PROCEDURE NAME FROM THE MCU. NESTED OR THROUGH PROCEDURES CANNOT BE USED IN SUPERSCRIBED

PROGRAMS ARE SCHEDULED AT A PRESCRIBED PHASE, FREQUENCY AND PRIORITY, AND ARE PLACED IN A QUEUE BY THE SYSTEM SOFTWARE AND EXECUTED INDEPENDENTLY OF ANY OTHER PROGRAM. THEY ARE NOT INTERRUPTED ONLY BY PROGRAMS OF A HIGHER PRIORITY

FLAG TRANSACTION ERROR FLAG IS SET ON EVERY PASS THAT ANY OF THE FOLLOWING ERRORS OCCURRED: • MRE OPTIMIZATION ERROR (SEE MRE DESCRIPTION) • CHECKSUM WORD COUNT • MCU TO SPE TRANSFER IN MCU3 NOT EQUAL (01) • PARITY BIT FAILURE • CHECKSUM TRANSMISSION ERROR • SPE TO MCU TRANSFER WORD WORDS • SUCCESS-IN TIME FOR COMPLETE 48 WORD MESSAGE

NUMBERS REFER TO DETAILED DESIGN SPEC (DDS) FUNCTIONS

DISPATCHER TABLE

THE SCHEDULER MAKES CALLS ONLY THOSE FUNCTIONS LISTED FOR THE CURRENT MODE AND CYCLE. FOR EXAMPLE, IF THE SOFTWARE ENTERED THE TERMINATE MONITORING MODE, AS DETERMINED BY THE MODE SWITCH, THE MRE AND MRC WOULD BE CALLED BEFORE THE NEXT CYCLE.

MODE	ENTRY REQUIREMENTS	FUNCTIONS CALLED	RATE
SLEEPING	1. MCU-SPE: V/B 10 OFF V/D 10 ON FOR ALL OTHER MODES	SOFTWARE DOES NOT EXECUTE AS FAR AS THE DISPATCHER IS CONCERNED	NA
TEMPERATURE MONITOR	1. MCU-APE SELECTED WITH RMS TEMPERATURE MONITOR APE-1 SELECTED FOR REMAINING MODES	TEMPERATURE MONITOR (ATI) MRE (CMA,TS) ENGINEER FUNCTION (ATI)	12.5 12.5
IDLE	1. SOFTWARE STOP ON, OR 2. MANUAL MODE, OR 3. MANUAL ON, AMR FAILS ON 1-2 ON, AMR FAILS ON 3. IF APE SELECTED THIS PASS & LAST PASS, SOFTWARE STOP ON & MODE SWITCH HAS FAILED & MODE SWITCH DIDN'T LAST FAILS, OR 4. MODE SWITCH FAILS 5. ENGINEERING FUNCTION = ENABLE 6. MCU-SPE TRANSFER ERROR IN MODE AND HAND CONTROLLER FAILS, (3-5)	4 MONITOR DATA GENERATOR (MGD) MONITOR VALVES (APE) SINGLE JOINT CONTROL (MGD) MRE (CMA,TS) TEMPERATURE MONITOR (ATI) ENGINEER FUNCTION (ATI) DEDICATED DISPLAY (MGD) ENGINEER FUNCTIONS (ATI)	12.5 12.5 12.5 12.5 12.5 12.5 12.5
SINGLE	1. THE ARM IS AT REST, AND THE SINGLE SPE-ATI SWITCH IS NOT IN THE PLUS (-) OR MINUS (-) POSITION	4 MONITOR DATA GENERATOR (MGD) POSITION VALVES (APE) SINGLE JOINT CONTROL (MGD) MRE (CMA,TS) TEMPERATURE MONITOR (ATI) ENGINEER FUNCTION (ATI) DEDICATED DISPLAY (MGD) ENGINEER FUNCTIONS (ATI)	12.5 12.5 12.5 12.5 12.5 12.5 12.5
MANUAL/TEST	1. THE ARM IS AT REST, AND THE SINGLE SPE-ATI SWITCH IS IN THE PLUS (-) OR MINUS (-) MANUAL MODE TO ANOTHER, AND 2. THE MANUAL HAND CONTROLLER THAT HAS BEEN SELECTED, AND 3. NO HAND CONTROLLER ERRORS EXIST AT TIME OF MODE SWITCH	4 MONITOR DATA GENERATOR (MGD) MANUAL/TEST CONTROL (MGD) MCU-SLAVE RATE ALGORITHM (MRC) POSITION VALVES (APE) MRE (CMA,TS) TEMPERATURE MONITOR (ATI) ENGINEER FUNCTION (ATI) DEDICATED DISPLAY (MGD) COORDINATE TRANSFORMATION (APM) MUTUALLY EXCLUSIVE MODULES	12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5
AUTO	1. THE ARM IS AT REST, AND THE SINGLE SPE-ATI SWITCH SWITCH IS IN ITS STATIONED AND COMMAND POSITION	4 MONITOR DATA GENERATOR (MGD) MCU-SLAVE RATE ALGORITHM (MRC) MESSAGE RATE ALGORITHM (MRC) POSITION VALVES (APE) MRE (CMA,TS) TEMPERATURE MONITOR (ATI) ENGINEER FUNCTION (ATI) DEDICATED DISPLAY (MGD) COORDINATE TRANSFORMATION (APM) MUTUALLY EXCLUSIVE MODULES	12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5 12.5

WHEN ANALOG SPK RD/WR (ATI,CSS), THIS DATA IS HAVAL(0), BUT IS STILL PROCESSED BY THE SPE

THE AMR MAY HAVE CHANGED COORDINATE SYSTEM FROM PRIOR DOWNLINK SPEC TO INDICATED IN PARENTHESIS

NOTES: 1. FOR DRAWING REFERENCED SEE TABLE 14-2

5 RMS/SW 1

SYSTEM	DATE
SSPE 5, 1280/1540	06/28/82
SSPE 5, 1620/2000	06/28/82
MCU BLOCK	
MCU-SPE I/F	07/13/82
SPE-ATI I/F	07/13/82
SPE-APE I/F	07/13/82

SYSTEMS ENGINEERING & SIM DEPT. 63-30 BOEING AEROSPACE CO. P.O.BOX 3999, SEATTLE, WASHINGTON 98124

RMS/SOFTWARE OVERVIEW

SPACE SHUTTLE | DWG NO: 14,5

SCALE: NONE | SHEET 1 OF 1

BASIC REV E-6

RMS HAND CONTROLLERS/D & C PANEL

ROTATIONAL HAND CONTROLLER

CAPTURE/RELEASE BUTTON

ROTATION/TRANSLATION DEFLECTIONS = -6.5 M

RATE HOLD COMMAND, HORIZON/CHANGE SELECT, CAPTURE/RELEASE COMMAND

MODE SELECT SWITCH (6 ONLY)

TRANSLATIONAL HAND CONTROLLER

ABU

MODE SELECT SWITCH

SAT ENG

BRAKES ENG

AUTO SEQ SYSTEM STOP

SINGLE DIRECT

SHOULDER BRACE SEL

ELBOW

WRIST PITCH

WRIST YAW

END EFFECTOR ROLL

END EFFECTOR PITCH

END EFFECTOR YAW

PARAMETER SEL SWITCH

JOINT ANGLE/ATTITUDE PLT/ROTATION CAM

TEST

SHOULDER PITCH

SHOULDER YAW

ELBOW PITCH

WRIST ROLL

END EFFECTOR

(1) APPLICABLE FOR D-24 AND SUBSEQUENT FLIGHT SOFTWARE RELEASES

SPK BIT(08) LOGIC FOR SPK B/TO VERIFICATION SPK B/TO, VALID FOR BOTH DIGITAL AND ANALOG SPK

B/T	B/T	B/T	SPK B/TO VERIFICATION DESCRIPTION
0	0	0	LOSS OF M/B
0	0	1	CONFIGURATION B/TO VERIFICATION
0	1	0	COMPLETION B/TO VERIFICATION
0	1	1	MRA CURRENT B/TO VERIFICATION
1	0	0	MRA B/TO VERIFICATION
1	0	1	CMA B/TO VERIFICATION
1	1	0	MRA/CMA B/TO VERIFICATION

SPK B/TO BIT(08) LOGIC FOR SPK B/TO VERIFICATION

B/T	B/T	B/T	B/T	SPK B/TO DESCRIPTION
14	13	12	11	HAVAL SPK B/TO DESCRIPTION
0	0	0	0	LOSS OF M/B
0	0	0	1	TACS TCU B/TO
0	0	1	0	RSA OVERCURRENT B/TO (RSA B/TO)
0	0	1	1	RSA SENSORS VOLTAGE B/TO
0	1	0	0	COMPUTATION B/TO, ITEM (ICOM B/TO)
0	1	0	1	MISCONFIGURATION B/TO
0	1	1	0	A/D CONVERTER B/TO
0	1	1	1	DIRECT INTERFACE B/TO
1	0	0	0	MULTIPLEXER B/TO
1	0	0	1	POSITION ENCODER B/TO
1	0	1	0	DIRECT B/TO (DIR B/TO)
1	0	1	1	CSPA (CMA B/TO)

(2) SPK B/TO VERIFICATION

B/T	B/T	B/T	B/T	SPK B/TO DESCRIPTION
14	13	12	11	HAVAL SPK B/TO DESCRIPTION
0	0	0	0	LOSS OF M/B
0	0	0	1	TACS TCU B/TO
0	0	1	0	RSA OVERCURRENT B/TO (RSA B/TO)
0	0	1	1	RSA SENSORS VOLTAGE B/TO
0	1	0	0	COMPUTATION B/TO, ITEM (ICOM B/TO)
0	1	0	1	MISCONFIGURATION B/TO
0	1	1	0	A/D CONVERTER B/TO
0	1	1	1	DIRECT INTERFACE B/TO
1	0	0	0	MULTIPLEXER B/TO
1	0	0	1	POSITION ENCODER B/TO
1	0	1	0	DIRECT B/TO (DIR B/TO)
1	0	1	1	CSPA (CMA B/TO)

ARM BASED ELECTRONICS (ABE)

THERMISTORS LOCATED ON ARM

ANALOG TO DIGITAL CONVERTER

ABE TO MCU DATA

MRE SELECT SWITCH

ABE

MANIPULATOR CONTROLLER INTERFACE UNIT (MCIU)

MCIU TO SPE DATA

MCIU TO MCU DATA

MCIU FAILURE DETECTION LOGIC

PROCESSES AND/OR GENERATES BITE FLAGS

ABE/DEU

KEYBOARD ENTRIES

USER INTERFACE

PORS CONTROL SPEC 0184 ITEM ENTRIES

PORS OVERRIDE SPEC 185 ITEM ENTRIES

SM 201 OR 202

RMS SOFTWARE

SCHEDULES

RMC SPEC-1 RMC(1) MANUAL CONTROL SEQUENCER

RMC SPEC-2 RMC(2) MANUAL CONTROL SEQUENCER

RMD SPEC-1 RMD(1) RMS DIAGNOSTIC SPECIALIST FUNCTION CONTROL SEQUENCER

RMD SPEC-2 RMD(2) RMS DIAGNOSTIC SPECIALIST FUNCTION CONTROL SEQUENCER

GPS TRANSITION SAVE DATA COMPOOL (CRC_GPT)

RMS CONSTANTS COMPOOL (CRC_CST)

RMS CONSTANTS COMPOOL (CRA_TE

NOTE:
SEQUENCE OF CONTROL MODULE EXECUTION IS ALPHABETICAL ORDER ALONG THIS LINE

CALLED BY MEA

1A/5-1

RKC_KINDEX (RKC)
KINEMATIC DATA GENERATOR

- COMPUTES ARM GEOMETRY PARAMETERS: JOINT ANGLE SINES AND COSINES AND DISTANCE COMPUTATIONS FOR USE BY OTHER MODULES
- DETERMINES ARM TRANSFORMATION MATRICES FOR TO UNDER STRUCTURAL, FOR TO ARM REFERENCE AND UNDER STRUCTURAL TO ARM REFERENCE FOR USE BY RJG, RAS AND RTV.
- COMPUTES POR POSITION IN UNDER STRUCTURAL, FOR ARM REFERENCE AND TOOL TIP FOR USE BY RJG. ALSO COMPUTES POR POSITION IN UNDER STRUCTURAL AXIS FOR DISPLAY BY MDU.
- COMPUTES POR ATTITUDE EULER ANGLES IN UNDER STRUCTURAL SYSTEM FOR DISPLAY BY MDU.
- DETERMINES WHICH ONE ARM GEOMETRY IS WITHIN EACH OF THE THREE SINGULARITY TOLERANCES AND SETS OR RESETS THE RESPECTIVE SINGULARITY FLAG FOR USE BY RJG. ALSO SETS THE SINGULARITY FLAG OFF IN SUPPORT AND TEMP MODES.
- PERFORMS JOINT ANGLE DISPLAY PROCESSING ON REQUEST.
- ACTUAL PATH PROCESSING ONLY 3/5 ACTUAL JOINT RATES COMPUTED IN RAE AND DISTANCE COMPUTATIONS. ALSO COMPUTES THE ACTUAL TOOL TIP VELOCITY TRANSFORMATION MATRICES FOR RAE AND COMPUTES THE ACTUAL POR VELOCITY COMPONENTS IN EITHER TOOL OR UNDER STRUCTURAL SYSTEM AS SELECTED. THE RESULTANT ACTUAL POR TRANS RATE IS ALSO DETERMINED.
- PERFORMS ACTUAL PATH PROCESSING.

5.5.4.4

MANUAL_TEST OR AUTO ONLY

NOTE:
RKP IS CALLED IN MANUAL, AUTO & TEST MODES AS PLACE OF RPP ONLY WHEN COMMANDING IN TOOL OR POSITION HOLD SUBMODES.

RFP_POS_HOLD (RFP)
POSITION HOLD

- COMMANDS JOINT RATES NECESSARY TO DRIVE THE ARM TO ITS SUBPOINT POSITION DURING POSITION HOLD SUBMODES.
- AT ENCODER CHECK FLAG = ON FOR ANY JOINT, COMMANDS THAT JOINT AS IF ALL COMMANDED.
- SYNCHRONIZE JOINTS ARE DRIVEN AT A RATE PROPORTIONAL TO THE DIFFERENCE BETWEEN THE POSITION OF THE SLAVE AND THE ACTUAL JOINT ANGLE.
- IF ANY OF THE COMPUTED JOINT ANGLE RATES EXCEEDS THE LIMIT FOR THAT JOINT, THAT RATE IS REDUCED TO ITS MAXIMUM LIMIT.
- THERE IS NO SPEC INITIALIZATION OR CLEANUP PROCESSING

5.5.4.13

SINGLE ONLY

RPP_INRATE (RRP)
INCREMENTAL RATE PROCESSOR

- RATES TO TRANS RATE AND ROT RATE ARE SET BY RATE TABLE FROM RAS SUBPOR MODE/MODES AND FROM RJG DURING MANUAL AND TEST MODES. ALSO SETS RATES FOR SYNCHRONIZE JOINT JOINT ANGLE SINES AND COSINES FROM RKG AND COMPUTES SIX JOINT RATE CMDS FOR USE BY RJG. ALSO COMPUTES THE ACCELERATION FOR USE BY THE JOINT DYNAMICS.
- TWO TERMS SINGULARITIES REQUIRE SPECIAL HANDLING:
  - WHEN NEAR THE 2ND SINGULARITY, THE SHY JOINT RATE CMD IS SET TO THE MAX RATE FOR THAT JOINT WITH THE SIGN OF THE COMPUTED VALUE OF J-COMPONENT OF THE WRIST TRAN JOINT, THE REMAINING JOINT RATE CMDS ARE COMPUTED NORMALLY.
  - FOR THE ARM SINGULARITY, THE SHY JOINT RATE CMD IS SET TO ZERO AND THE OTHER FIVE COMPUTED NORMALLY.
  - FOR THE SLP SINGULARITY, THE SHP JOINT RATE CMD IS SET TO THE MAXIMUM RATE FOR THAT JOINT OR ZERO, WHICHEVER IS LESS THAN THE COMPUTED VALUE. THE LINEAR VELOCITY CMDS ARE THEN SCALED SO THAT THE COMPUTED VELOCITY VECTOR IS ZERO. THE REMAINING FIVE JOINTS ARE COMPUTED NORMALLY.
- THE SIX COMPUTED JOINT RATE CMDS ARE THEN SCALED SO THAT NO COMMAND EXCEEDS ITS LIMIT IF COMPROMISING MAX ENDPOINT RATE.

5.5.4.11

RTV_TOTVEL (RTV)
TOTAL VELOCITY

- PERFORMS THE MATHEMATICAL AS WELL AS THE RESULTANT COMMANDED POR TRANS RATE AND ACTUAL POR TRANS RATE FOR USE BY THE TEST METER AND TO DISPLAY (RAS).
- COMMANDED RATE PROCESSING PROCEEDS ZERO POR RATE COMMAND IF POSITION HOLD IS ACTIVE OR IF NOT IN MANUAL, AUTO OR TEST MODES. OTHERWISE, THE POR COMMAND FROM ACTIVATED RATE TABLE IS CONVERTED TO EITHER SRAD, PLUS OR ESOS UNITS AND THE RESULTANT COMPARED POR TRANS RATE TO LIMITING.
- THERE IS NO SPEC INITIALIZATION OR CLEANUP PROCESSING

5.5.4.12

RMM_HLTH_MON (RMM)
HEALTH MONITOR

CALLS

- CALLS RVM.
- IF RAM FIRST PASS FLAG IS ON (SET ON IN SUBPOR MODE), SETS ALL ERROR FLAGS OFF AND CLEARS FROM TEMP MONITOR MODES. PERFORMS FIRST PASS INITIALIZATIONS.
- PERFORMS ERROR RELEASE AND SUMMARIZATION CHECKS AND INITIALIZES.
- ALL ARE RELATED FAULT COUNTERS, FAULT BITS AND ERROR FLAGS ARE INITIALIZED.
- PERFORMS AS SERVICE AND GENERATES RAM ALARM FLAG FOR MASTER ALARM GENERATION, FAULT BIT AND FAULT COUNTER FOR EACH OF THE FOLLOWING FAILURES IF THE DEVIATION IS MORE THAN 1 RAD/SEC FOR ONE PASS, ELSE:
  - IF ENCODER CHECK FLAG IS ON AND GENERATES RAM ALARM FLAG FOR FAULT ISOLATION AND RE-RELEASE SERVO.
  - IF ENCODER CHECK FLAG IS OFF, PERFORMS REACH-LIMIT CHECKS AND GENERATES RAM ALARM FLAG, FAULT BIT AND FAULT COUNTER FOR EACH OF THE FOLLOWING FAILURES IF THE DEVIATION IS MORE THAN 1 RAD/SEC FOR 3 PASSES:
- IF SOFT STOP LIMITS ENABLED/HARDSET FLAG IS ON, PERFORMS SOFT STOP CHECK FOR EACH JOINT. IF A JOINT IS OUTSIDE ITS REACH LIMIT ENVELOPE AND IS MOVING FURTHER OUTSIDE, THAT JOINT'S SOFT STOP FLAG IS TURNED ON AND ERROR RELEASED.
- ON FAILURES SINGULARITY CONDITIONS AND GENERATES RAM ALARM FLAG, FAULT ERROR FLAGS, SINGULARITY ERROR FLAG AND SINGULARITY CAUTION FLAG.
- ON FAILURES TOOL TIP CAUTION CONDITIONS AND GENERATES RAM ALARM FLAG AND CHECKS CRT WARNING FLAG.
- SETS MASTER ALARM FLAG AND CHECKS CRT FLAG WHEN A SERVO DRIVE BIT FLAG IS SET ON ANY OF THE SERVO DRIVE BIT WORDS.
- CALLS RMM TO ZM FILTER AND RELATED HARDWARE FAILURES (HARDWARE BIT FLAGS IN CSS).

5.5.4.14

RVM_CONEN (RVM)
CONSISTENCY AND ENCODER CHECKS

- AT ENCODER ENABLE/HARDSET FLAG IS ON (ENABLED) THEN THE ENCODER CHECKS ARE PERFORMED.
- IF ANY ENCODER CHECK FLAG IS ON, THE ENCODER CHECK AND UNVERIFIED FAULT FAIL, THE ENCODER CHECK PARAMETERS ARE INITIALIZED.
- IF NO ENCODER CHECK, THE ENCODER CHECK FLAG FAILURES DO ALL THE ENCODER CHECK 2 N ENCODER CHECK FLAGS ARE PERFORMED. IF A FAILURE IS DETECTED THE ENCODER CHECK FLAG IS SET ON AND THE FOLLOWING ARE PERFORMED:
  - PERFORMS AS SERVICE AND COMPARES THE ANGLE THRESHOLD VALUE OF THE ENCODER TO A 5.25 SECOND. IF THE ENCODER ANGLE IS GREATER THAN THE ANGLE FAILURE OF THE DEVIATION IS MORE THAN 1 RAD/SEC FOR SPEC OPERATIONS & LEVEL 2 (WITH-LEVEL).
  - IF ENCODER CHECK FLAG IS ON, THE FOLLOWING ANNUNCIATORS FLAG FOR WHICH THE ENCODER VALUE DOES NOT CHANGE WHEN MOTOR RATE COMMAND EXCEED 1 RAD/S.
  - IF ENCODER CHECK FLAG IS ON, THE FOLLOWING ANNUNCIATORS FOR SPEC OPERATIONS & LEVEL 2 (WITH-LEVEL).
- IF ENCODER CHECK FLAG IS ON, THE FOLLOWING ANNUNCIATORS FLAG FOR WHICH THE ENCODER VALUE DOES NOT CHANGE WHEN MOTOR RATE COMMAND EXCEED 1 RAD/S.
- THE CONSISTENCY CHECK PARAMETERS ARE RESET IF RAM FIRST PASS FLAG IS ON (SET ON IN SUBPOR MODE). PERFORMS ON TOP OF LOOSED RATE LIMIT AND CHANGES ESOS TO SRAD OTHERWISE IF THE ERROR IS GREATER THAN THE ERROR LIMIT ENVELOPE FOR THAT JOINT, THE CONSISTENCY CHECK ALGORITHMS ARE PERFORMED.
- FOR EACH JOINT, IF THE TACH FAIL FLAG IS OFF, THE TACH FAIL CONSISTENCY CHECK ALGORITHMS ARE PERFORMED.
- FORWARD/BACKWARD FAILS OR OFF (TACH DRIVE) OR THE FORWARD/BACKWARD FAILS ARE ON (TACH DRIVE) THE CONSISTENCY CHECKS IS PERFORMED.
- IF THE CONSISTENCY CHECK ERROR > LIMIT, TACH ERROR FLAG IS SET ON AND ALL OTHER CHECKS ARE BYPASSED FOR THAT JOINT. ALL BRAKES RED FLAG IS TURNED ON AND THE CONSISTENCY CHECK FLAG IS TURNED ON.
- CONSISTENCY CHECK ERROR < LIMIT, TACH ERROR FLAG IS ON, THE TACH FAIL FLAG IS TURNED ON AND ALL BRAKES RED FLAG IS TURNED ON.
- IF CONSISTENCY CHECK DETECTS JOINT MOVEMENT WHILE ALL BRAKES ARE ON, THE DIRECT MODE IS NOT SELECTED, AND THE ENCODERS FOR THE MONITORED JOINTS HAVE CHANGED.
- POSITION ENCODER CHECK, TACH DATA CONSISTENCY CHECK, AND RATE ENCODER/CONSISTENCY CHECK, USE THE TACH FAIL FLAG AND THE OVERVISION BIT ARE SHARE A BIT ON SPEC MA.
- IF FOUND IS ACTIVED, WHEN THE COMPUTED POSITION AND/OR RATE ENCODER/CONSISTENCY CHECK FLAG OR ANNUNCIATION IS SIDED TO THE JOINT, AUTO BRAKES, IF ENABLED ON SPEC MA, WILL BE APPLIED WHENEVER AN OVERSHOOT IS DETECTED.

5.5.4.21

RMC_ENCODE (RMC)
MCU ENCODER

- JOINT COMMAND LIMITS ARE DETERMINED FOR EACH JOINT FOR THE SELECTED ARM+DEFAULT PORTS. IF ANY JOINT IS OUTSIDE THE APPROPRIATE LIMIT (+10 OR -10) IS USED.
- THE SIX JOINT RATE CMDS ARE CONVERTED TO MOTOR RATE CMDS BY MULTIPLYING THE SIX JOINT RATES AND THE SIX JOINT ACCELERATIONS BY THE APPROPRIATE ROW OF EACH ARE SAVED IN A FOUR-LEVEL STACK.
- THE HOST MOTORS' SET OF MOTOR RATE CMDS ARE THEN CONVERTED TO EIGHTS X16 A TWO-POLE LINEAR INTERPOLATION BETWEEN THE TWO ENTRIES IN THE MOTOR TABLE WHICH THE COMMAND LIES. THE MOTOR ANGLE IS CONVERTED TO A RANGE OF 12288 TO 20481 AND THE ENTRIES ONES 1 THRU 5 IS INDICATED FOR CORRECT PHASING.
- THE RATE OBTAINED IS 15 HEXADECIMAL DIGITS (28 AND THE LATEST FOUR VALUES ARE SAVED IN A FOUR-LEVEL STACK.
- THE SIX MOTOR RATE CMDS AND JOINT CURRENT LIMITS ARE MODIFIED WITH SHY BEING A AND APR BEING 1 FOR CORRECT PHASING AND SCALING OF THE MOTORS.
- THE ACTUAL POR RESULTANT VELOCITY AND THE RESULTANT VELOCITY ARE CONVERTED TO SMD/SMDS INTEGERS (+ 255 TO DRIVE THE RATE METERS.
- FOUR DECIMAL INTEGER DIGITS FOR EACH OF THE SIX JOINT RATE CMDS ARE PACKED INTO A SINGLE DOUBLE INTEGER FROM THE INPUT DATA FIELD AND THE INPUT DECIMAL FIELD WORD.
- THE SIX JOINT RATE CMDS, THE ACTUAL TOOL TIP VELOCITY, THE SIX ENCODER CHECK FLAGS, THE SIX SERVO ON/OFF FLAGS, THE SIX RELEASE WARNING ARE PACKED INTO 4 SINGLE WORDS.
- THE SIX TACH DATA CHECK FAIL AND THE SIX RATE ENVELOPE CHECK FAIL FLAGS ARE PACKED INTO 4 SINGLE BIT WORDS.

5.5.4.15

RJR_HANDCTL (RJR)
HAND CONTROLLER

- RATE MODE REQUEST FLAG IS SET ON WHEN OPPOSITE STATE WHEN RATE MODE SELECTION SWITCH IS PUSHED AND THE SUPPORT FLAG CHANGES STATE.
- IF AUTO MODE IS REQUESTED, VERIFIES THE SUPPORT FLAG, MAX PV, TRANS RATE, MAX PV, ROT RATE, AND ROT ACCEL ARE WITHIN LIMITS.
- IN MANUAL, AUTO AND TEST MODES, THE ENCODER CHECKS AND UNVERIFIED FAULT FAIL, THE ENCODER CHECKS PARAMETERS ARE INITIALIZED.
- IN MANUAL, AUTO AND TEST MODES, THE ENCODER CHECK FLAG FAILURES DO ALL THE ENCODER CHECK 2 N ENCODER CHECK FLAGS ARE PERFORMED. IF A FAILURE IS DETECTED THE ENCODER CHECK FLAG IS SET ON AND THE FOLLOWING ARE PERFORMED:
  - PERFORMS AS SERVICE AND COMPARES THE ANGLE THRESHOLD VALUE OF THE ENCODER TO A 5.25 SECOND. IF THE ENCODER ANGLE IS GREATER THAN THE ANGLE FAILURE OF THE DEVIATION IS MORE THAN 1 RAD/S FOR SPEC OPERATIONS & LEVEL 2 (WITH-LEVEL).
  - IF ENCODER CHECK FLAG IS ON, THE FOLLOWING ANNUNCIATORS FLAG FOR WHICH THE ENCODER VALUE DOES NOT CHANGE WHEN MOTOR RATE COMMAND EXCEED 1 RAD/S.
  - IF ENCODER CHECK FLAG IS OFF, PERFORMS REACH-LIMIT CHECKS AND GENERATES RAM ALARM FLAG, FAULT BIT AND FAULT COUNTER FOR EACH OF THE FOLLOWING FAILURES IF THE DEVIATION IS MORE THAN 1 RAD/S FOR 3 PASSES:
- THE CONSISTENCY CHECK PARAMETERS ARE RESET IF RAM FIRST PASS FLAG IS ON (SET ON IN SUBPOR MODE). PERFORMS ON TOP OF LOOSED RATE LIMIT AND CHANGES ESOS TO SRAD OTHERWISE IF THE ERROR IS GREATER THAN THE ERROR LIMIT ENVELOPE FOR THAT JOINT, THE CONSISTENCY CHECK ALGORITHMS ARE PERFORMED.
- FOR EACH JOINT, IF THE TACH FAIL FLAG IS OFF, THE TACH FAIL CONSISTENCY CHECK ALGORITHMS ARE PERFORMED.
- FORWARD/BACKWARD FAILS OR OFF (TACH DRIVE) OR THE FORWARD/BACKWARD FAILS ARE ON (TACH DRIVE) THE CONSISTENCY CHECKS IS PERFORMED.
- IF THE CONSISTENCY CHECK ERROR > LIMIT, TACH ERROR FLAG IS ON AND ALL OTHER CHECKS ARE BYPASSED FOR THAT JOINT. ALL BRAKES RED FLAG IS TURNED ON AND THE CONSISTENCY CHECK FLAG IS TURNED ON.
- CONSISTENCY CHECK ERROR < LIMIT, TACH ERROR FLAG IS ON, THE TACH FAIL FLAG IS TURNED ON AND ALL BRAKES RED FLAG IS TURNED ON.
- IF CONSISTENCY CHECK DETECTS JOINT MOVEMENT WHILE ALL BRAKES ARE ON, THE DIRECT MODE IS NOT SELECTED, AND THE ENCODERS FOR THE MONITORED JOINTS HAVE CHANGED.
- POSITION ENCODER CHECK, TACH DATA CONSISTENCY CHECK, AND RATE ENCODER/CONSISTENCY CHECK, USE THE TACH FAIL FLAG AND THE OVERVISION BIT ARE SHARE A BIT ON SPEC MA.
- IF FOUND IS ACTIVED, WHEN THE COMPUTED POSITION AND/OR RATE ENCODER/CONSISTENCY CHECK FLAG OR ANNUNCIATION IS SIDED TO THE JOINT, AUTO BRAKES, IF ENABLED ON SPEC MA, WILL BE APPLIED WHENEVER AN OVERSHOOT IS DETECTED.

5.5.4.21

RPM_CTF (RPM)
COORDINATE TRANSFORMATION FUNCTION

- IF PMOC IS ENABLED AND NOT IN AUTO MODE, COMPUTES THE PMOC TOOL TIP POR AND ATTITUDE EULER ANGLES, OR THE ED IS IN TRANSITION, THE PMOC REFERENCE STATE IS RESET.
- IF PMOC IS ENABLED, THE ATTITUDE OF THE WRIST TOOL FROM RAE IS SET TO MFA AND TRANSFORMED TO THE UNDERSTRUCTURAL FRAME.
- IN MANUAL, AUTO AND TEST MODES, THE ENCODER CHECKS AND UNVERIFIED FAULT FAIL, THE ENCODER CHECKS PARAMETERS ARE INITIALIZED.
- IN MANUAL, AUTO AND TEST MODES, THE ENCODER CHECK FLAG FAILURES DO ALL THE ENCODER CHECK 2 N ENCODER CHECK FLAGS ARE PERFORMED. IF A FAILURE IS DETECTED THE ENCODER CHECK FLAG IS SET ON AND THE FOLLOWING ARE PERFORMED:
  - PERFORMS AS SERVICE AND COMPARES THE ANGLE THRESHOLD VALUE OF THE ENCODER TO A 5.25 SECOND. IF THE ENCODER ANGLE IS GREATER THAN THE ANGLE FAILURE OF THE DEVIATION IS MORE THAN 1 RAD/S FOR SPEC OPERATIONS & LEVEL 2 (WITH-LEVEL).
  - IF ENCODER CHECK FLAG IS ON, THE FOLLOWING ANNUNCIATORS FLAG FOR WHICH THE ENCODER VALUE DOES NOT CHANGE WHEN MOTOR RATE COMMAND EXCEED 1 RAD/S.
  - IF ENCODER CHECK FLAG IS OFF, PERFORMS REACH-LIMIT CHECKS AND GENERATES RAM ALARM FLAG, FAULT BIT AND FAULT COUNTER FOR EACH OF THE FOLLOWING FAILURES IF THE DEVIATION IS MORE THAN 1 RAD/S FOR 3 PASSES:
- THE CONSISTENCY CHECK PARAMETERS ARE RESET IF RAM FIRST PASS FLAG IS ON (SET ON IN SUBPOR MODE). PERFORMS ON TOP OF LOOSED RATE LIMIT AND CHANGES ESOS TO SRAD OTHERWISE IF THE ERROR IS GREATER THAN THE ERROR LIMIT ENVELOPE FOR THAT JOINT, THE CONSISTENCY CHECK ALGORITHMS ARE PERFORMED.
- FOR EACH JOINT, IF THE TACH FAIL FLAG IS OFF, THE TACH FAIL CONSISTENCY CHECK ALGORITHMS ARE PERFORMED.
- FORWARD/BACKWARD FAILS OR OFF (TACH DRIVE) OR THE FORWARD/BACKWARD FAILS ARE ON (TACH DRIVE) THE CONSISTENCY CHECKS IS PERFORMED.
- IF THE CONSISTENCY CHECK ERROR > LIMIT, TACH ERROR FLAG IS ON AND ALL OTHER CHECKS ARE BYPASSED FOR THAT JOINT. ALL BRAKES RED FLAG IS TURNED ON AND THE CONSISTENCY CHECK FLAG IS TURNED ON.
- CONSISTENCY CHECK ERROR < LIMIT, TACH ERROR FLAG IS ON, THE TACH FAIL FLAG IS TURNED ON AND ALL BRAKES RED FLAG IS TURNED ON.
- IF CONSISTENCY CHECK DETECTS JOINT MOVEMENT WHILE ALL BRAKES ARE ON, THE DIRECT MODE IS NOT SELECTED, AND THE ENCODERS FOR THE MONITORED JOINTS HAVE CHANGED.
- POSITION ENCODER CHECK, TACH DATA CONSISTENCY CHECK, AND RATE ENCODER/CONSISTENCY CHECK, USE THE TACH FAIL FLAG AND THE OVERVISION BIT ARE SHARE A BIT ON SPEC MA.
- IF FOUND IS ACTIVED, WHEN THE COMPUTED POSITION AND/OR RATE ENCODER/CONSISTENCY CHECK FLAG OR ANNUNCIATION IS SIDED TO THE JOINT, AUTO BRAKES, IF ENABLED ON SPEC MA, WILL BE APPLIED WHENEVER AN OVERSHOOT IS DETECTED.

5.5.4.21

RAS_AUTOSEQ (RAS)
AUTOMATIC SEQUENCE PROCESSOR

- ENG/ONTO CONDITIONS ARE MET FOR AUTO SEQUENCE READY INDICATION, AUTO SEQUENCE VALIDATION CONSISTS OF VERIFYING THAT THE ARM IS WITHIN THE SPECIFIED TOLERANCE OF THE SEQUENCE'S FIRST POINT. IF THE SEQUENCE IS RECORDED FOR AN UNLOADED ARM, THE PAYLOAD IS NOT CHANGED BETWEEN RECORDING AND PLAYBACK. IF LOADED ARM, IT MATCHES THE SELECTED PAYLOAD, AND (3) THE CURRENT POR MEETS THE SEQUENCE'S INITIAL CONDITIONS OF THE SEQUENCE START POINT.
- INTERRUPTS AUTO SEQUENCE PROCESS AND SETS ERROR FLAG IF ANY OF THESE FAIL.
- GENERATES ED RATE COMMANDS FOR USE BY ARM REQUIRED TO DRIVE THE POR FROM POINT TO POINT ALONG THE PATH AT THE SPECIFIED STRAIGHT LINE RATE AT MAXIMUM SCALED PV, VIEW OR COARSE RATE AS APPROPRIATE.
- PERFORMS ACCEL AND DECEL RAMPING AT THE BEGINNING AND END OF EACH SEGMENT TO BRING THE ARM TO REST WITHIN REQUIRED TOLERANCE.
- UPDATES LAST PT ON SPEC MA WHEN A POINT HAS BEEN ACHIEVED.

5.5.4.7

AUTO MODES ONLY

RSC_SYNCTL (RSC)
SINGLE JOINT CONTROL

- PERFORMS SINGLE MODE JOINT RATE PROCESSING FOR THE SELECTED JOINT (JOINT SELECT SWITCH).
- IF THE SELECTED JOINT SWITCH POSITION IS A VALID JOINT, THEN ITS HOLD ANGLE IS SET TO THE CURRENT JOINT ANGLE. IF IT IS SET TO ONE, OF THE SINGLE/DIRECT DRIVE SWITCH IS IN THE NULL POSITION, THEN THE SELECTED JOINT RATE CMD IS SIMULATED IF THE JOINT IS IN POSITION HOLD, IT HOLD, A ZERO JOINT RATE IS COMMANDED FOR THE SELECTED JOINT.
- COMMANDS THE SELECTED JOINT TO RAMP UP TO THE SELECTED VERNIER OR COARSE RATE AND RAMP DOWN TO ZERO AS IT CYCLES ON ITS CYCLES, REPEATEDLY.

5.5.4.7

SINGLE MODE ONLY

RJG_IDLE (RJG)
MANUAL, AUTO, SINGLE & TEST MODES

RMS SOFTWARE

MANUAL & TEST MODES ONLY

RJG_HANDCTL (RJG)
HAND CONTROLLER

- RATE MODE REQUEST FLAG IS SET ON WHEN OPPOSITE STATE WHEN RATE MODE SELECTION SWITCH IS PUSHED AND THE SUPPORT FLAG CHANGES STATE.
- IF AUTO MODE IS REQUESTED, VERIFIES THE SUPPORT FLAG, MAX PV, TRANS RATE, MAX PV, ROT RATE, AND ROT ACCEL ARE WITHIN LIMITS.
- IN MANUAL, AUTO AND TEST MODES, THE ENCODER CHECKS AND UNVERIFIED FAULT FAIL, THE ENCODER CHECKS PARAMETERS ARE INITIALIZED.
- IN MANUAL, AUTO AND TEST MODES, THE ENCODER CHECK FLAG FAILURES DO ALL THE ENCODER CHECK 2 N ENCODER CHECK FLAGS ARE PERFORMED. IF A FAILURE IS DETECTED THE ENCODER CHECK FLAG IS SET ON AND THE FOLLOWING ARE PERFORMED:
  - PERFORMS AS SERVICE AND COMPARES THE ANGLE THRESHOLD VALUE OF THE ENCODER TO A 5.25 SECOND. IF THE ENCODER ANGLE IS GREATER THAN THE ANGLE FAILURE OF THE DEVIATION IS MORE THAN 1 RAD/S FOR SPEC OPERATIONS & LEVEL 2 (WITH-LEVEL).
  - IF ENCODER CHECK FLAG IS ON, THE FOLLOWING ANNUNCIATORS FLAG FOR WHICH THE ENCODER VALUE DOES NOT CHANGE WHEN MOTOR RATE COMMAND EXCEED 1 RAD/S.
  - IF ENCODER CHECK FLAG IS OFF, PERFORMS REACH-LIMIT CHECKS AND GENERATES RAM ALARM FLAG, FAULT BIT AND FAULT COUNTER FOR EACH OF THE FOLLOWING FAILURES IF THE DEVIATION IS MORE THAN 1 RAD/S FOR 3 PASSES:
- THE CONSISTENCY CHECK PARAMETERS ARE RESET IF RAM FIRST PASS FLAG IS ON (SET ON IN SUBPOR MODE). PERFORMS ON TOP OF LOOSED RATE LIMIT AND CHANGES ESOS TO SRAD OTHERWISE IF THE ERROR IS GREATER THAN THE ERROR LIMIT ENVELOPE FOR THAT JOINT, THE CONSISTENCY CHECK ALGORITHMS ARE PERFORMED.
- FOR EACH JOINT, IF THE TACH FAIL FLAG IS OFF, THE TACH FAIL CONSISTENCY CHECK ALGORITHMS ARE PERFORMED.
- FORWARD/BACKWARD FAILS OR OFF (TACH DRIVE) OR THE FORWARD/BACKWARD FAILS ARE ON (TACH DRIVE) THE CONSISTENCY CHECKS IS PERFORMED.
- IF THE CONSISTENCY CHECK ERROR > LIMIT, TACH ERROR FLAG IS ON AND ALL OTHER CHECKS ARE BYPASSED FOR THAT JOINT. ALL BRAKES RED FLAG IS TURNED ON AND THE CONSISTENCY CHECK FLAG IS TURNED ON.
- CONSISTENCY CHECK ERROR < LIMIT, TACH ERROR FLAG IS ON, THE TACH FAIL FLAG IS TURNED ON AND ALL BRAKES RED FLAG IS TURNED ON.
- IF CONSISTENCY CHECK DETECTS JOINT MOVEMENT WHILE ALL BRAKES ARE ON, THE DIRECT MODE IS NOT SELECTED, AND THE ENCODERS FOR THE MONITORED JOINTS HAVE CHANGED.
- POSITION ENCODER CHECK, TACH DATA CONSISTENCY CHECK, AND RATE ENCODER/CONSISTENCY CHECK, USE THE TACH FAIL FLAG AND THE OVERVISION BIT ARE SHARE A BIT ON SPEC MA.
- IF FOUND IS ACTIVED, WHEN THE COMPUTED POSITION AND/OR RATE ENCODER/CONSISTENCY CHECK FLAG OR ANNUNCIATION IS SIDED TO THE JOINT, AUTO BRAKES, IF ENABLED ON SPEC MA, WILL BE APPLIED WHENEVER AN OVERSHOOT IS DETECTED.

5.5.4.21

RJG_TOTVEL (RJG)
TOTAL VELOCITY

- PERFORMS THE MATHEMATICAL AS WELL AS THE RESULTANT COMMANDED POR TRANS RATE AND ACTUAL POR TRANS RATE FOR USE BY THE TEST METER AND TO DISPLAY (RAS).
- COMMANDED RATE PROCESSING PROCEEDS ZERO POR RATE COMMAND IF POSITION HOLD IS ACTIVE OR IF NOT IN MANUAL, AUTO OR TEST MODES. OTHERWISE, THE POR COMMAND FROM ACTIVATED RATE TABLE IS CONVERTED TO EITHER SRAD, PLUS OR ESOS UNITS AND THE RESULTANT COMPARED POR TRANS RATE TO LIMITING.
- THERE IS NO SPEC INITIALIZATION OR CLEANUP PROCESSING

5.5.4.12

RPM_CTF (RPM)
COORDINATE TRANSFORMATION FUNCTION

- IF PMOC IS ENABLED AND NOT IN AUTO MODE, COMPUTES THE PMOC TOOL TIP POR AND ATTITUDE EULER ANGLES, OR THE ED IS IN TRANSITION, THE PMOC REFERENCE STATE IS RESET.
- IF PMOC IS ENABLED, THE ATTITUDE OF THE WRIST TOOL FROM RAE IS SET TO MFA AND TRANSFORMED TO THE UNDERSTRUCTURAL FRAME.
- IN MANUAL, AUTO AND TEST MODES, THE ENCODER CHECKS AND UNVERIFIED FAULT FAIL, THE ENCODER CHECKS PARAMETERS ARE INITIALIZED.
- IN MANUAL, AUTO AND TEST MODES, THE ENCODER CHECK FLAG FAILURES DO ALL THE ENCODER CHECK 2 N ENCODER CHECK FLAGS ARE PERFORMED. IF A FAILURE IS DETECTED THE ENCODER CHECK FLAG IS SET ON AND THE FOLLOWING ARE PERFORMED:
  - PERFORMS AS SERVICE AND COMPARES THE ANGLE THRESHOLD VALUE OF THE ENCODER TO A 5.25 SECOND. IF THE ENCODER ANGLE IS GREATER THAN THE ANGLE FAILURE OF THE DEVIATION IS MORE THAN 1 RAD/S FOR SPEC OPERATIONS & LEVEL 2 (WITH-LEVEL).
  - IF ENCODER CHECK FLAG IS ON, THE FOLLOWING ANNUNCIATORS FLAG FOR WHICH THE ENCODER VALUE DOES NOT CHANGE WHEN MOTOR RATE COMMAND EXCEED 1 RAD/S.
  - IF ENCODER CHECK FLAG IS OFF, PERFORMS REACH-LIMIT CHECKS AND GENERATES RAM ALARM FLAG, FAULT BIT AND FAULT COUNTER FOR EACH OF THE FOLLOWING FAILURES IF THE DEVIATION IS MORE THAN 1 RAD/S FOR 3 PASSES:
- THE CONSISTENCY CHECK PARAMETERS ARE RESET IF RAM FIRST PASS FLAG IS ON (SET ON IN SUBPOR MODE). PERFORMS ON TOP OF LOOSED RATE LIMIT AND CHANGES ESOS TO SRAD OTHERWISE IF THE ERROR IS GREATER THAN THE ERROR LIMIT ENVELOPE FOR THAT JOINT, THE CONSISTENCY CHECK ALGORITHMS ARE PERFORMED.
- FOR EACH JOINT, IF THE TACH FAIL FLAG IS OFF, THE TACH FAIL CONSISTENCY CHECK ALGORITHMS ARE PERFORMED.
- FORWARD/BACKWARD FAILS OR OFF (TACH DRIVE) OR THE FORWARD/BACKWARD FAILS ARE ON (TACH DRIVE) THE CONSISTENCY CHECKS IS PERFORMED.
- IF THE CONSISTENCY CHECK ERROR > LIMIT, TACH ERROR FLAG IS ON AND ALL OTHER CHECKS ARE BYPASSED FOR THAT JOINT. ALL BRAKES RED FLAG IS TURNED ON AND THE CONSISTENCY CHECK FLAG IS TURNED ON.
- CONSISTENCY CHECK ERROR < LIMIT, TACH ERROR FLAG IS ON, THE TACH FAIL FLAG IS TURNED ON AND ALL BRAKES RED FLAG IS TURNED ON.
- IF CONSISTENCY CHECK DETECTS JOINT MOVEMENT WHILE ALL BRAKES ARE ON, THE DIRECT MODE IS NOT SELECTED, AND THE ENCODERS FOR THE MONITORED JOINTS HAVE CHANGED.
- POSITION ENCODER CHECK, TACH DATA CONSISTENCY CHECK, AND RATE ENCODER/CONSISTENCY CHECK, USE THE TACH FAIL FLAG AND THE OVERVISION BIT ARE SHARE A BIT ON SPEC MA.
- IF FOUND IS ACTIVED, WHEN THE COMPUTED POSITION AND/OR RATE ENCODER/CONSISTENCY CHECK FLAG OR ANNUNCIATION IS SIDED TO THE JOINT, AUTO BRAKES, IF ENABLED ON SPEC MA, WILL BE APPLIED WHENEVER AN OVERSHOOT IS DETECTED.

5.5.4.21

RSC_SYNCTL (RSC)
SINGLE JOINT CONTROL

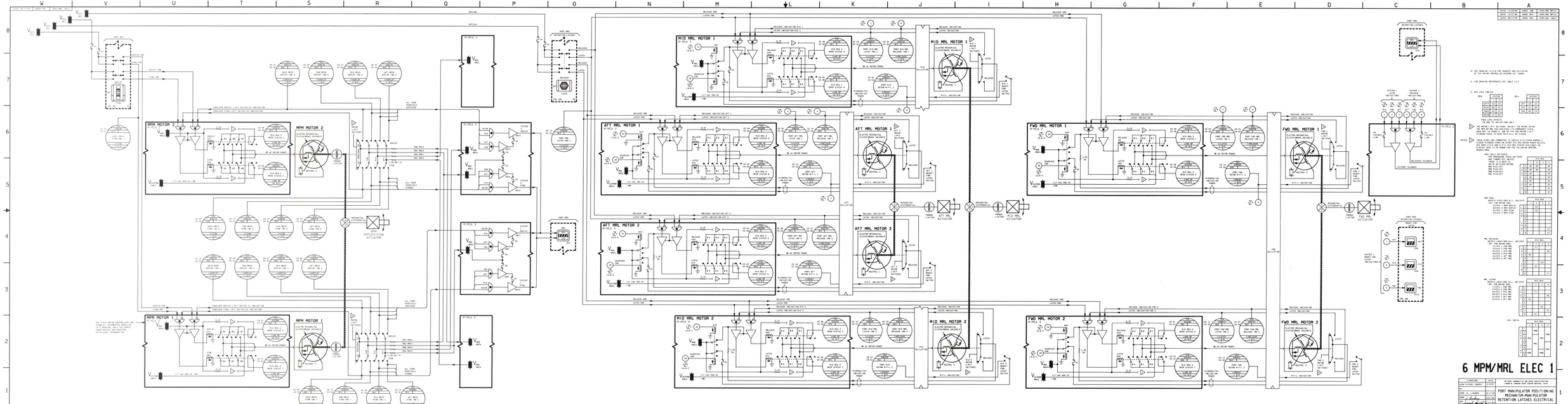
- PERFORMS SINGLE MODE JOINT RATE PROCESSING FOR THE SELECTED JOINT (JOINT SELECT SWITCH).
- IF THE SELECTED JOINT SWITCH POSITION IS A VALID JOINT, THEN ITS HOLD ANGLE IS SET TO THE CURRENT JOINT ANGLE. IF IT IS SET TO ONE, OF THE SINGLE/DIRECT DRIVE SWITCH IS IN THE NULL POSITION, THEN THE SELECTED JOINT RATE CMD IS SIMULATED IF THE JOINT IS IN POSITION HOLD, IT HOLD, A ZERO JOINT RATE IS COMMANDED FOR THE SELECTED JOINT.
- COMMANDS THE SELECTED JOINT TO RAMP UP TO THE SELECTED VERNIER OR COARSE RATE AND RAMP DOWN TO ZERO AS IT CYCLES ON ITS CYCLES, REPEATEDLY.

5.5.4.7

RJG_IDLE (RJG)
MANUAL, AUTO AND TEST MODES ONLY

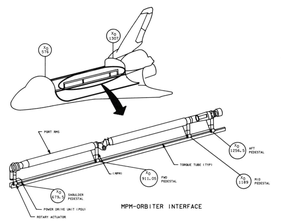
RPM_CTF (RPM)
COORDINATE TRANSFORMATION FUNCTION

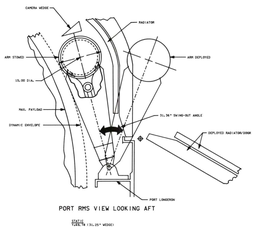
- IF PMOC IS ENABLED AND NOT IN AUTO MODE, COMPUTES THE PMOC TOOL TIP POR AND ATTITUDE EULER ANGLES, OR THE ED IS IN TRANSITION, THE PMOC REFERENCE STATE IS RESET.
- IF PMOC IS ENABLED, THE ATTITUDE OF THE WRIST TOOL FROM RAE IS SET TO MFA AND TRANSFORMED TO THE UNDERSTRUCTURAL FRAME.
- IN MANUAL, AUTO AND TEST MODES, THE ENCODER CHECKS AND UNVERIFIED FAULT FAIL, THE ENCODER CHECKS PARAMETERS ARE INITIALIZED.
- IN MANUAL, AUTO AND TEST MODES, THE ENCODER CHECK FLAG FAILURES DO ALL THE ENCODER CHEC

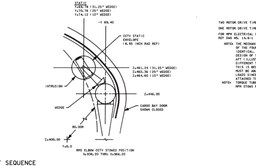

6 MPM/MRL ELEC 1
PORT MANIPULATOR POSITIONING MECHANISM-MANIPULATOR RETENTION LATCHES ELECTRICAL
BASIC REV E
MPM MOTOR 1
MPM MOTOR 2
MID MRL MOTOR 1
MID MRL MOTOR 2
AFT MRL MOTOR 1
AFT MRL MOTOR 2
FWD MRL MOTOR 1
FWD MRL MOTOR 2
PORT MNL RETENTION LATCHES
FWD MNL RETENTION LATCHES
PORT MNL RELEASE
FWD MNL RELEASE
PORT MRL RELEASE
FWD MRL RELEASE
PORT MRL RETENTION LATCHES
FWD MRL RETENTION LATCHES
MPM DPCA
MRL RELEASED
MRL LATCH
BUS TABLE
BASIC REV E

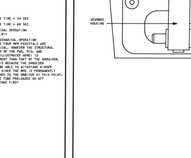
NOTES: 1. REFER TO SHEET 1 FOR GENERAL NOTES
DATES: 08/15/83 NAMES: MPM SIZES/DIM: ONLY
DATES: 08/15/83 NAMES: MRL SIZES/DIM: ONLY
DATES: 07/28/83 NAMES: LAT SIZES/DIM: ONLY

GENERAL MPM OPERATION

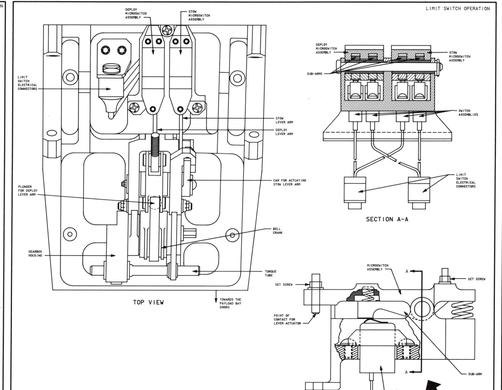




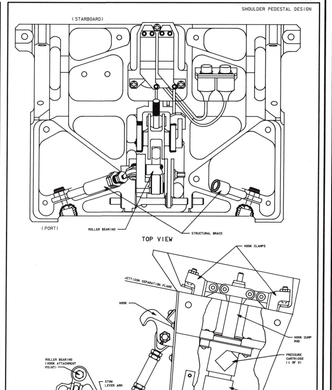




LIMIT SWITCH OPERATION

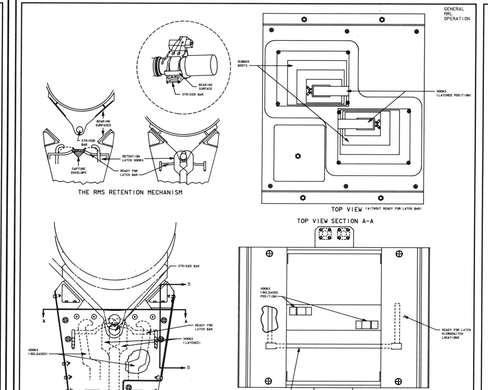


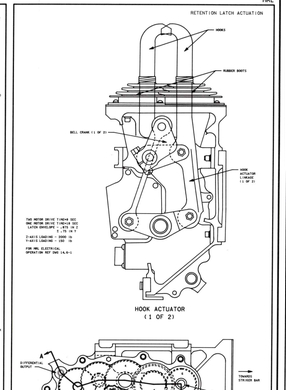
SHOULDER PEDESTAL DESIGN

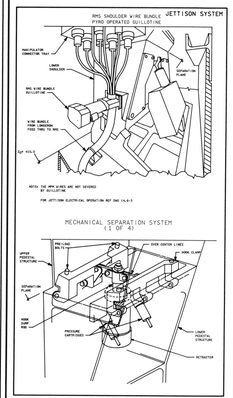


NOTES:
14.6-1
REF DWG BOE NO 19F2
TORQUE LIMITER IS SET AT 1.5 TIMES THE MAXIMUM TORQUE EXPERIENCED AND DISENGAGES AS TEMPERATURE RISES TO 60 DEG CA

GENERAL MRL OPERATION





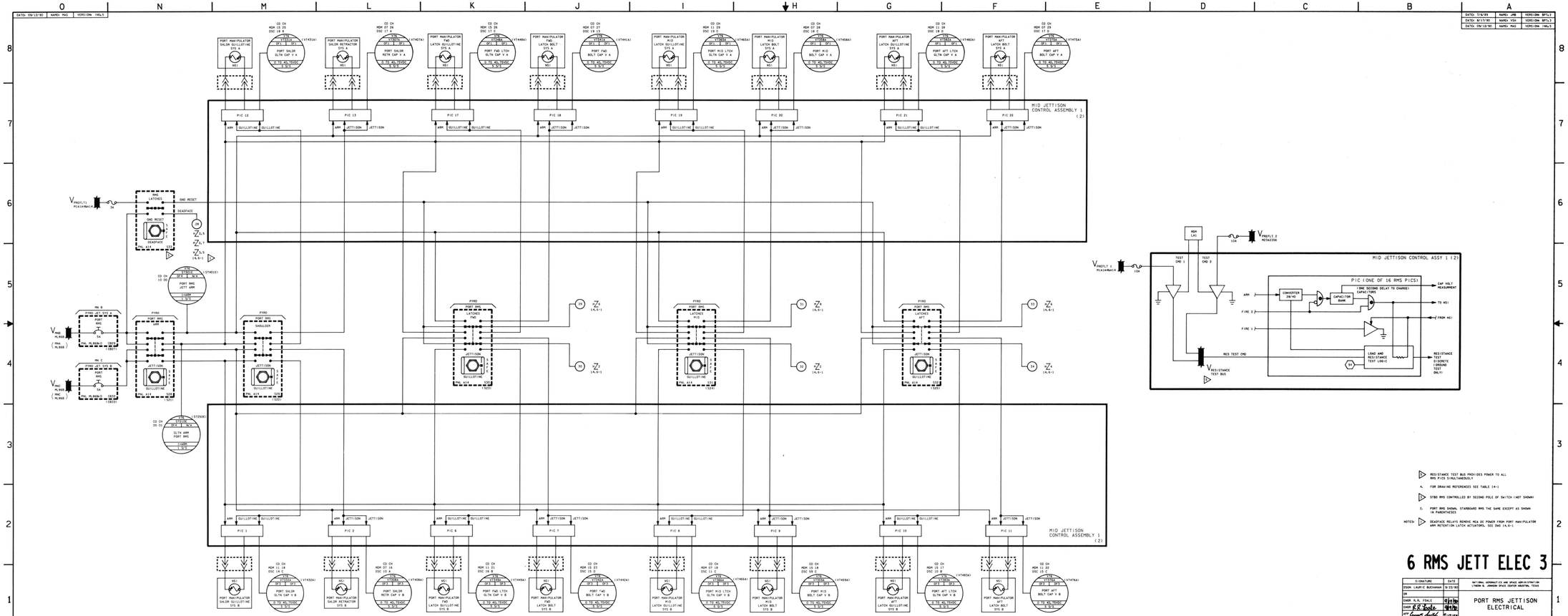


NOTES: 1. REFER TO TABLE 14-1 FOR Material REFERENCES

6 MPM/MRL MECH 2

CONTRACT NO.	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DESIGN DATA APPROVAL		LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEXAS
DRAWN		
CHKD		
DRAWING APPROVAL		PORT MANIPULATOR POSITIONING MECHANISM-MANIPULATOR RETENTION LATCHES MECHANICAL
DRAWING APPROVAL		
DRAWING APPROVAL		SPACE SHUTTLE DWG NO. 14.6
DRAWING APPROVAL		SCALE
SHEET 1 OF 2		

BASIC REV E



6 RMS JETT ELEC 3

SIGNATURE	DATE	
DSGN LAURIE BUCHANAN	9/22/80	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR		
CHKR R.N. FOALE	9/22/80	PORT RMS JETTISON ELECTRICAL
CHKR R.B. Boyle	9/22/80	
APP Grant Hale	9-22-80	
APP Bill Reed	9-22-80	SPACE SHUTTLE DWG NO 14.6
DRFTSMN J. Graham	9-22-80	ALL
SIZE E SCAL		SCALE 34 SHEET 3 of 3

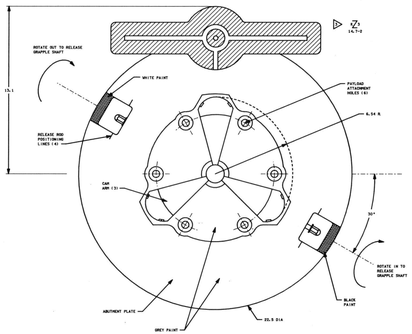
BASIC REV E

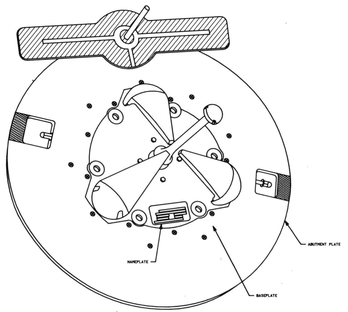
BASIC REV E

DATE: 11/21/91	NAME: JSF	VERSION# ORB_1

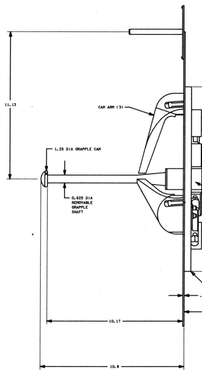
DATE: 07/28/93	NAME: PAS	VERSION# ORB_1
DATE: 08/18/93	NAME: PAS	VERSION# ORB_1
DATE: 11/21/91	NAME: JSF	VERSION# ORB_1

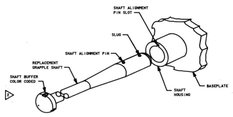
FLIGHT RELEASABLE GRAPPLE FIXTURE (FRGF)



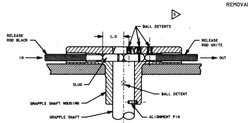


SIDE VIEW (FRGF)

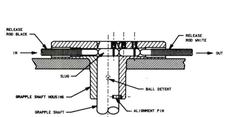




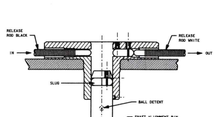
REMOVABLE GRAPPLE SHAFT



b. SHAFT IN POSITIONAL UNDER RIGIDIZATION FORCE

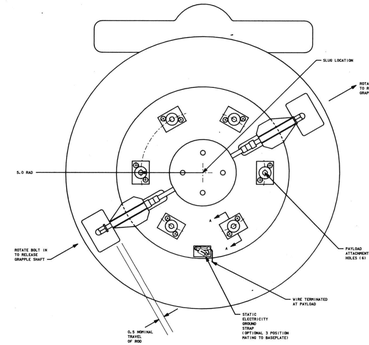


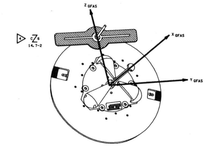
DETAIL OF SLUG OPERATION



c. SHAFT IS REMOVED

BACK VIEW (FRGF)



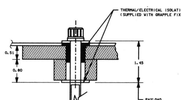


GRAPPLE FIXTURE AXIS SYSTEM (GFAS)

ALL GRAPPLE FIXTURES USE THE SAME AXIS SYSTEM

ORIGIN AT THE BASE OF THE GRAPPLE SHAFT, ON THE SHAFT CENTERLINE AT THE BASEPLATE

POSITIVE X IS NOT THE CENTERLINE OF GRAPPLE PIN
POSITIVE Z IS UP THROUGH THE CENTER OF GRAPPLE TARGET
POSITIVE Y COMPLETES RIGHT HANDED COORDINATE SYSTEM



DETAIL A-A

OPERATION OF FRGF EVA RELEASE

1. a. U.P. RATCHET WRENCH IS USED
   b. a) ROTATE WHITE RELEASE ROD COUNTERCLOCKWISE (OUT), IT WILL MECHANICAL HARD STOP (APPROX 0.5") ▷
      b) RELEASE RODS HAVE POSITIONING LINES TO INDICATE FULL LIMIT OF TRAVEL
      c) TO RETRACT, COMPLETE 0.5" OF TRAVEL
   c. a) ROTATE WHITE RELEASE ROD IN (CLOCKWISE)
      b) TWO POSITIONING THE SLUGS TO ENGAGE THE GRAPPLE SHAFT
   d. SHAFT IS RELEASED FROM FIXTURE

2. FOR VENDOR REFERENCES, SEE TABLE 14-1

3. REPLACEMENT SHAFT IS INSTALLED IN REVERSE ORDER FROM RELEASE SEQUENCE

4. DURING THE SAME EVA TO RELEASE THE GRAPPLE SHAFT, A CREWMEMBER PUTS A REPLACEMENT GRAPPLE SHAFT BACK INTO THE FIXTURE FOR THE NEXT USE. THE REPLACEMENT GRAPPLE SHAFT HAS A RED COLOR CODED CAP TO INDICATE IT HAS BEEN REPLACED

5. THE GRAPPLE SHAFT BOLTING SHARED ON THE EVA EFFECTOR (EE) AND A COVER IS PLACED OVER THE EE TO CONTAIN THE SHAFT IN THE EE SHOULD IT AN LOOSE OF THE SHARES DURING RELEASE

▷ BALL DETENT PREVENTS THE SLUG FROM MOVING WHEN IN THE GRAPPLE SHAFT

▷ SEE "GFAS" DWG 14.7-2

▷ SEE "TARGET ASSEMBLY" (DWG 14.7-2)

▷ REPLACEMENT SHAFTS HAVE A RED COLOR CODED CAP ON THE SHAFT, RELEASE SHAFTS HAVE A WHITE CAP

NOTES: 1. DIMENSIONS ARE IN INCHES

7 FRGF 1

	SIGNATURE	DATE
DSGN	L.A. MARTINEAU	1/20/93
CK	L.A. MARTINEAU	1/20/93
CHIEF DES(S)	DOOSHTA	8/17/93
DSGN	David Cooper	11/20/91
CK	[illegible]	11/20/91
APP	[illegible]	11/20/91
SPECIALIST	[illegible]	11/21/91

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

FLIGHT RELEASABLE GRAPPLE FIXTURE

SPACE SHUTTLE | DWG NO: 14.7

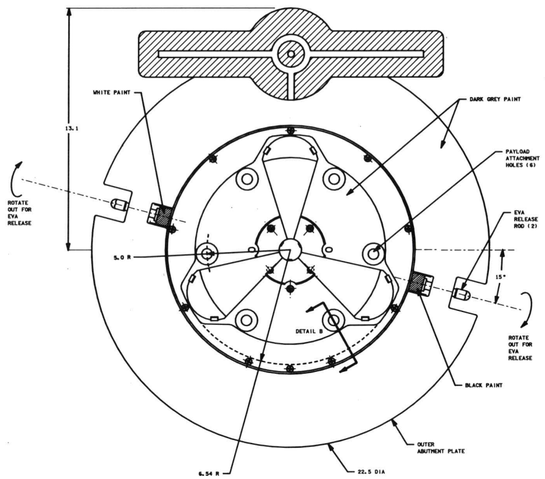
SCALE: | SHEET 1 OF 1

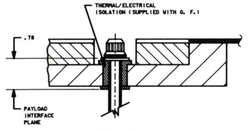
BASIC REV E-1

BASIC REV E-1

DATE: 07/20/89	NAME: SEV	VERSION: INK 3
DATE: 08/16/90	NAME: MAG	VERSION: INK 4
DATE: 11/21/91	NAME: JDF	VERSION: INK 5

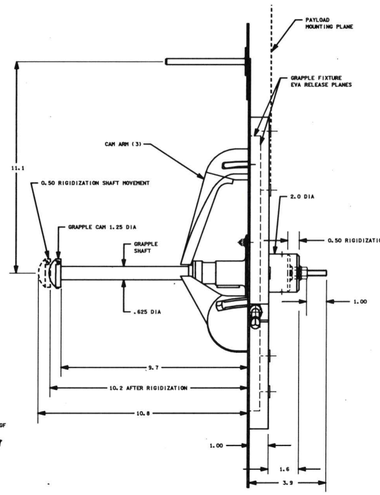
RIGIDIZE SENSING GRAPPLE FIXTURE (RSGF)

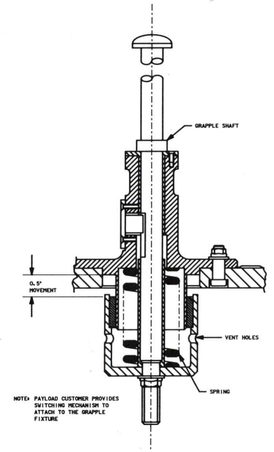




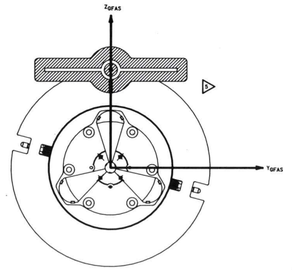
DETAIL B

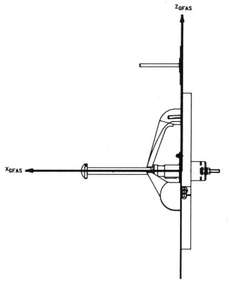
EVA RELEASE ROD
(SAME ON OPPOSITE SIDE)





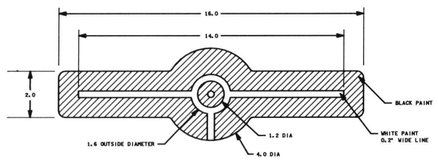
RSGF SPRING MECHANISM

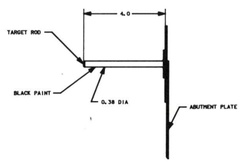


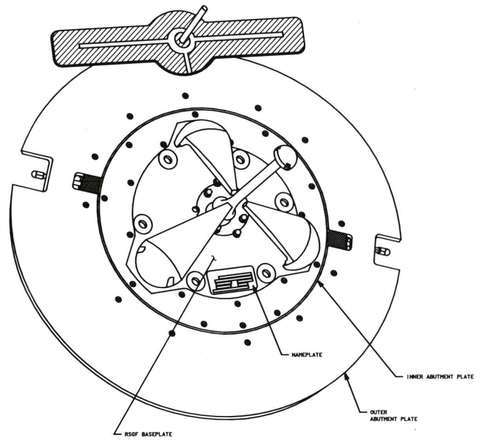


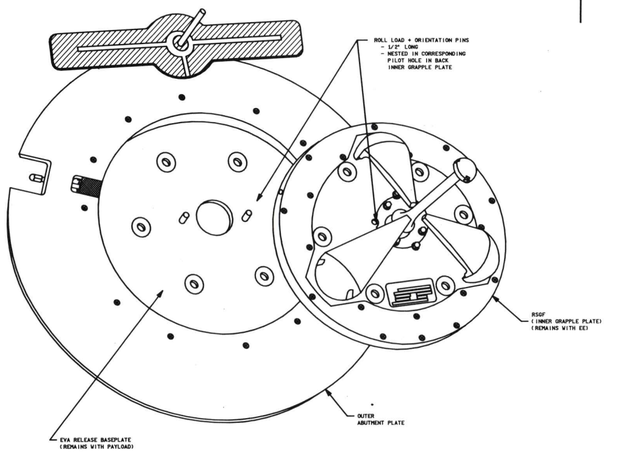
GRAPPLE FIXTURE AXIS SYSTEM (GFAS)
(ALL GRAPPLE FIXTURES USE THE SAME AXIS SYSTEM)
ORIGIN AT THE BASE OF THE GRAPPLE SHAFT, ON THE ABUTMENT PLATE PLANE
POSITIVE X IS OUT THE CENTERLINE OF GRAPPLE PIN
POSITIVE Z IS UP THROUGH CENTER OF GRAPPLE TARGET
POSITIVE Y COMPLETES RIGHT HANDED COORDINATE SYSTEM

TARGET ASSEMBLY
(RSGF, RSGF, AND EFGF ARE THE SAME)









OPERATION OF RSGF EVA RELEASE

1. 1/2" RATCHET WRENCH IS USED
2. ROTATE RELEASE RODS
   WHITE - ROTATE OUT (COUNTERCLOCKWISE)
   BLACK - ROTATE OUT (COUNTERCLOCKWISE)
   THIS CAUSES THE RELEASE RODS TO BACK OUT OF THE INNER GRAPPLE PLATE
3. THE INNER GRAPPLE PLATE WILL BE RELEASED FROM OUTER ABUTMENT PLATE AND REMAINS SHARED IN THE EE

6. FOR VENDOR REFERENCES, SEE TABLE 14-1

▷ SEE ALSO 'GFAS' DWG 14.7-1

4. DURING THE RIGIDIZATION PROCESS, THE GRAPPLE SHAFT DOES NOT BEGIN THE 0.5° OF MOVEMENT UNTIL THERE IS A RIGIDIZATION FORCE OF 300 LBF. A PRE-LOADED SPRING PREVENTS MOVEMENT OF THE SHAFT WITH LESS THAN 300 LBF

3. WHEN THE RSGF IS EVA RELEASED THE INNER GRAPPLE PLATE REMAINS WITH THE EE. THE INNER GRAPPLE PLATE BECOMES AN ADDITIONAL PROTRUSION FROM THE END EFFECTOR, AND CAN HIT CAMERA B

2. THE BLACK AND WHITE COLOR CODE FOR THE RSGF IS DIFFERENT FROM THE FRGF. BOTH RODS ARE ROTATED OUT

NOTES: 1. DIMENSIONS ARE IN INCHES

7 RSGF 2

SIGNATURE		DATE
DSGN	L.A. MARTINDALE	2/1/89
DR	L.A. MARTINDALE	2/1/89
ENGR	DANIEL GOODWIN	8/17/90
ENGR	Daniel Goodwin	11/21/91
APP	RTYlead	11/26/91
APP	RTYlead	11/26/91
DRAFTSMAN	J.K.Gordon	11-22-91

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

RIGIDIZE SENSING GRAPPLE FIXTURE

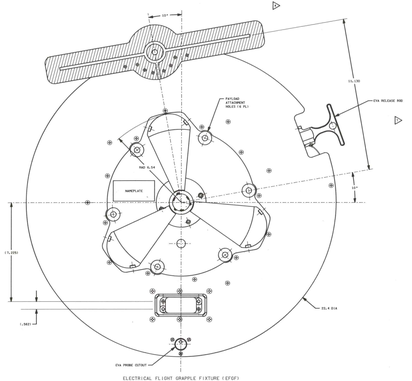
SSSH	DWG NO	14.7
ALL		
68 X 34	PAGE	SHEET 2 OF 3

LTR E PCN 1

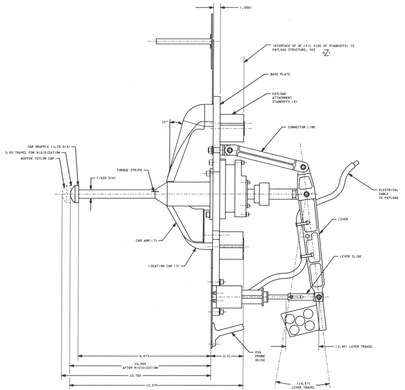
BASIC REV E-1

DATA 14/06/91 NAME REU 1553/ENG (ALL)

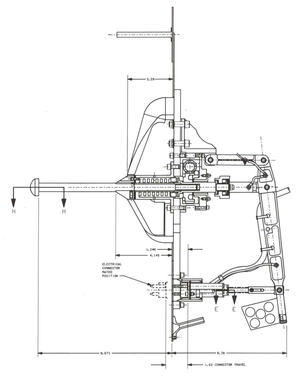
DATA 19/03/91 NAME JEF 1553/ENG (ATLS)
DATA 19/10/91 NAME EDA 1553/ENG (ATLS)
DATA 15/06/92 NAME REU 1553/ENG (ALL)



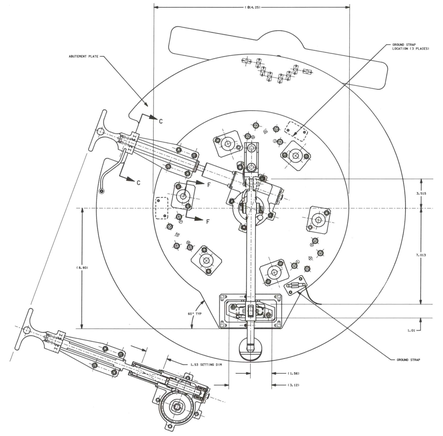
ELECTRICAL FLIGHT GRAPPLE FIXTURE (EFGF)



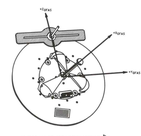
SIDE VIEW (EFGF)



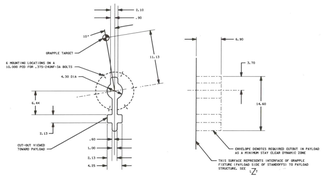
SIDE VIEW (-EFGF)



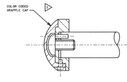
BACK VIEW (-EFGF)



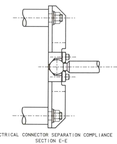
GRAPPLE FIXTURE AXIS SYSTEM



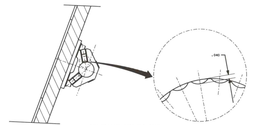
PAYLOAD/EFGF CLEARANCE ZONE



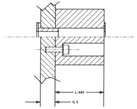
GRAPPLE CAP DETAIL SECTION H-H



ELECTRICAL CONNECTOR SEPARATION COMPLIANCE SECTION E-E



EVA RELEASE ROD RESTRAINT SECTION C-C



PAYLOAD ATTACHMENT STANDOFF DETAIL SECTION F-F

EFGF EVA RELEASE

EVA RELEASE OF ELECTRICAL FLIGHT GRAPPLE FIXTURE

TOOLS NEEDED:
- 1. EVA RELEASE TOOL (STOWAGE BAG, SPARE GRAPPLE SHAFT, GRAPPLE SHAFT BAG TOOL REV - 4.5" DIA, REU RESTRAINT, INFO, EVA PROBE)
- 2. 3/8" DRIVE RATCHET WRENCH (10-15 FT-LBS) TO MARK STOP (APPROX. 90 STROKES OF 90 DEGREES)
- 3. VOLT/OHM ELECTRICAL CONNECTOR DISCONNECTED
- 4. ELECTRICAL CONNECTOR MATED TO DISCONNECTED - INSERT PROBE INTO EVA CONNECTOR RELEASE PORT
- 5. CLEAR APPROACH TO FOR MMU BOOSTING
- 6. STOWAGE BAG WITH SETTLING STRAPS AND TO RESTRAIN GRAPPLE SHAFT

SPARE SHAFT REPLACEMENT

- 1. ROTATE EVA RELEASE ROD CW TO HARDSTOP THEN ROTATE CCW 5 STROKES
- 2. REMOVE 4 SCREWS AND REMOVE SHAFT RETAINER PLATE
- 3. INSERT SPARE SHAFT (-APPROX. 5 LBS TO OVERCOME BALL DETENT)
- 4. ROTATE RELEASE ROD CCW TO HARDSTOP (-APPROX 90 STROKES OF APPROX 90 DEGREES) TO ENGAGE SHAFT (-APPROX 10 FT-LBS) TO MARK STOP (INITIAL RESTRAINTS, THICK TO REQUIRED TO AID IN ENGAGEMENT OF HOME SHAFT)
  - IF GRAPPLE SHAFT NOT ENGAGED AFTER 4 REVS OF EVA RELEASE ROD REPEAT STEPS 3 THROUGH 5
- 5. VERIFY 90 GAP BETWEEN GRAPPLE SHAFT SHOULDER AND GRAPPLE FIXTURE FACE

4. FOR VENDOR REFERENCES, SEE TABLE 14-1

5. WEIGHT OF EFGF IS 55 LBS

SEE "TARGET ASSEMBLY" DRAWING NO. 14.7-2

SEE "EFGF" DRAWING NO. 14.7-3

REPLACEMENT SHAFTS HAVE RED COLOR CAP ON SHAFT, REGULAR SHAFTS ARE WHITE

NOTES: 1. DIMENSIONS ARE IN INCHES

7 EFGF 3

SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DESIGN S. OSAN-KHOR	8/4/91	
DRAFTING		
ENGINEERING SUPERVISOR		ELECTRICAL FLIGHT GRAPPLE FIXTURE
PROGRAM OFFICE		
PROGRAM MANAGER		
CONFIGURATION MANAGEMENT		

SPACE SHUTTLE	DWG NO. 14.7
SIZE B	SCALE NONE
DATE 8/4/91	SHEET 1 OF 1

BASIC REV E-1

INTRODUCTION

THE MCIU FIRMWARE IS A MACHINE-LANGUAGE PROGRAM WHICH IS PERMANENTLY STORED IN PROGRAMMABLE READ-ONLY MEMORY (PROM). THE PROM IS LOCATED ON THE MCIU MICROCOMPUTER MEMORY BOARD.

THE FIRMWARE IS DESIGNED TO PERFORM CYCLIC PROCESSING WITHIN THE 40 MILLISECOND MCIU CYCLE. TEST PATTERNS ARE PERIODICALLY INTRODUCED WITHIN THE SPS GPC INTERFACE BOARD TO EXERCISE MCIU FEEDBACKS.

CYCLIC DATA SETS ARE ALSO USED BY A DEDICATED SUBSYSTEM OF THE MCIU FIRMWARE TO PERFORM A BUILT-IN TEST (BIT) OF THE MCIU. THE BIT SUBSYSTEM IS DESCRIBED IN DETAIL IN THE MCIU FIRMWARE BIT SUBSYSTEM SOFTWARE SPECIFICATION. THE MCIU BIT CAN BE INITIATED BY PUSHBUTTON, BY PERIODIC FIRMWARE CONFIGURABLE TEST TIME OR FROM PROGRAM INTERRUPTS.

RMS POWERUP SEQUENCE OF EVENTS

- ON 115 VAC RMS BUS ACTIVE
  - LAUNCH DATA BUS 1 (1280) ASSIGNED TO SM GPC
  - MCIU POWERUP TEST IS RUN IF SM GPC SOFTWARE IS ACTIVE
- MCIU POWER POWER TO RELAYS ENERGIZED
- MCIU I/O POWER TO MCIU, SM PANEL
- MCIU BUILT-IN TEST (BIT) PERFORMS TIMING BETWEEN MCIU AND SM PANEL
  - TIMING ELEMENTS ARE POWERED BEFORE SWITCH-REG ON / OFF BETWEEN THE MCIU AND THE SMC ADJUSTS TO NOMINAL NO FAULT STATE
  - MCIU BIT
  - THE MCIU IS CLOCKED IN "LOW" STATE ON THE SM HARDWIRE CAUSES THE "CLEAR" TO BE SET
  - MCIU BUILT-IN POWERON INITIALIZATION MODE (POWERON) AFTER POWERUP UP TO 10 SECS
- SM + MCIU CONTROL IS ENABLED
  - SM GPC SOFTWARE ENABLES MCIU CYCLE PROCESSING IN SM GPC IF SM "A" THEN MCIU START PROCESSING RMS COMMANDS AND DATA TO SM GPC
  - MCIU SOFTWARE ENABLES MCIU CYCLE PROCESSING IF SM GPC IS ENABLED (TOTAL FAIL) AND IS TEMPORARILY BUSY WHEN THE MCIU IS BYPASSED BY THE SM GPC
  - IN RESPONSE TO THE GPC POLL-OUT, THE MCIU SENDS TO THE GPC A BLOCK OF 40 RESPONSE DATA WORDS FROM SU, A TRANSMISSION IN PROGRESS
  - THE MCIU SENDS A BLOCK OF 40 RESPONSE DATA WORDS TO THE GPC
  - BEFORE SUCCESSFUL TRANSMISSION OF THE BLOCK OF DATA, SM FAILS OF MCIU RESPONSE DATA WORDS ARE SENT TO THE GPC AND THE MCIU ENTERS BYPASS MODE
  - THE MCIU INTERRUPT CAUSES THE I/O MANAGER TO RUN + ISSUE A MCIU DISCRETE WORD
  - WHEN POLR = 1 (ACTIVE), THE "GPC WATCHDOG TIMER" BEGINS TO COUNT UP FROM ZERO
    - THE WATCHDOG TIMER IS RESET TO 0 EVERY MCIU CYCLE WHEN IN POLR, WHEN SAFTAK OR CHANNELS_OK FOLLOWING A RECEPTION OF THE GPC OUTPUT DATA WORDS
    - THE WATCHDOG TIMER IS NOT RESET IF THE MCIU IS BYPASSED, FOLLOWING THE FIRST TRANSMISSION OF DATA TO THE GPC STATE, NO DATA BLOCKS ARE TRANSMITTED TO THE GPC
    - THE TIMER REACHES 0.480 + TWICE BUT THE MCIU ENTERS SAFTAK MODE
    - THE MCIU ENTERS SAFTAK MODE IF THE WATCHDOG TIMER REACHES 0.12 + THE GPC DOES NOT RESET THE MCIU TO POR ON THE SPECIAL COMMAND
- IF CHANNEL_OKAY = TRUE, SPEC MM
  - THE SAFTAK COMMAND CAN BE ENTERED FROM THE GPC AND THE MCIU IS NOTIFIED OF THE SAFTAK COMMAND BY THE CHANNEL_OKAY DISCRETE WHICH CAUSES THE WATCHDOG TIMER TO BE RESET TO ZERO
- AUTO MCIU MANUAL CANCELLED FROM THE SM PANEL
  - THE MCIU ENTERS AUTO MODE WHEN THE SM PANEL MANUAL/AUTO SWITCH IS SET TO AUTO
  - THE SM GPC SOFTWARE "ALLOWS" THE MCIU TO ENTER AUTO MODE BY SETTING THE SAFTAK DISCRETE TO "NOT SAFTAK"
- SM GPC LOAD TIME 15 SECONDS TYPICAL
- SM GPC I/O SELECTED
  - MCIU ENTERS I/O FROM THE SMC IS CHANGED FOR 5.135 SECONDS BY SOFTWARE
  - MASTER ALARM AND FAULT MESSAGES CLEARED
  - THE MCIU ENTERS I/O FROM THE SMC
    - I/O MODE = 1
    - FLOW 3 THRU #9???

RMS POWER CYCLE SEQUENCE OF EVENTS

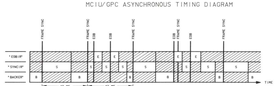
- ON 115 VAC GPC ACTIVE
  - WHEN THE MCIU LOSES POWER (RMS PRIMARY POWER IS LOST/DEFECTIVE), THE MCIU ENTERS POWERDOWN MODE AND THE MCIU SOFTWARE INITIATES THE MCIU BYPASS FAULT AND ALL I/O GOES ON THE OPENING
  - THE SM GPC SOFTWARE RECOGNIZES THE MCIU BYPASS FAULT AND ENTERS THE SM GPC I/O SELECTED MODE
  - MASTER ALARM AND FAULT MESSAGES TO NONCONFIGURABLE MCIU/SM I/O TIMING
  - THE MCIU ENTERS POWERDOWN
- ON SM + MCIU CONTROL + SM ENABLED
  - THE SM GPC SOFTWARE ENABLES MCIU PROCESSING, AND SINCE THE PREVIOUS MCIU CYCLE WAS BYPASSED, THE MCIU ENTERS POWERUP MODE
  - MCIU RUNNING IN POR = NOT(POLR)
  - THE MCIU ENTERS POWERUP MODE AND THE WATCHDOG TIMER DOES NOT TIME OUT/MCIU RESET WILL BE PRESENT
- SM GPC SOFTWARE REPEATS IN SUSPEND MODE
- SM GPC I/O SELECTED
- SM + MCIU CONTROL + SM ENABLED
  - MCIU ENTERS I/O FROM THE SMC + CHANGED FOR 5.135 SECONDS BY SOFTWARE
  - THE "I-DON'T-BLOCK-UP" DATA SENT BY THE MCIU IS CHANGED SINCE THE MCIU ENTERS I/O FROM THE SMC
  - THE MCIU ENTERS THE SM GPC I/O SELECTED MODE
  - MASTER ALARM AND FAULT MESSAGES CLEARED
  - THE MCIU ENTERS I/O FROM THE SMC IS CHANGED FOR 5.135 SECONDS

SYNCHRONOUS DATA PROCESSING OPERATING MODES

MODE	OPERATION / REQUIREMENTS	FUNCTIONS
NORMAL	■ MCIU POWERUP COMPLETED ■ MCIU SOFTWARE IN NORMAL POWER SELECTED ■ SM GPC SOFTWARE COMMUNICATION WITH MCIU ACTIVE AND MCIU EXTERNAL/DIRECT SPEC	■ MCIU PERFORMS COMMUNICATION WITH SM GPC ■ MCIU PERFORMS BUILT-IN TEST PLAS 1** (TRMF) / (SEE SAFTAK DISCRETE) ■ MCIU SETS BIT STATUS REGISTER (BSR) / PLAS_BSR** ■ MCIU SETS BIT PATTERN WORD (BPW) / PLAS_BPW** ■ MCIU SETS FAILURE WORDS ■ MCIU INITIATES TIMING TO 40 MSEC ■ MCIU SETS POWER STATUS TO "NORMAL" / PLAS_PST** ■ MCIU SETS POWER FAILURE WARNING BITS "1"/MAINPL/PTSPWF1 ■ MCIU SETS POWER FAILURE WARNING BITS "1"/MAINPL/PTSPWF1
SAFTAK	■ MCIU INITIATED WHEN ■ SM GPC SOFTWARE SET ON ■ MCIU SOFTWARE INITIATED FROM ■ SM GPC ■ SM GPC SOFTWARE TIMES OUT ■ MCIU CYCLES ■ TRANSMISSION FROM SM GPC CANCELLED FROM SM PANEL	■ MCIU SETS POWER COMMAND BITS "1" IN PLAS_BSR**/SAFTAK ■ MCIU SETS SAFTAK BIT IN PLAS_BPW** ■ MCIU SETS SAFTAK STATUS BIT "1" TO "SAFTAK"
SELF-TEST/ POWER-TEST	■ EXECUTED AT POR AND ■ THE MCIU BUILT-IN TEST ■ SM GPC SOFTWARE ■ TERMINATED 5.05 SECONDS AFTER SM GPC I/O SELECTED	■ MAIN BITE AND MEMORY BITE ■ MCIU SETS BIT STATUS REGISTER AND BIT PATTERN WORD ■ MCIU SETS POWER STATUS TO "SELF-TEST"
MCIU FAILURE	■ INITIATED AT ANY ONE OF THE MCIU FAILURES TO SET FAIL_SYSTEM	■ MCIU SETS BIT STATUS REGISTER AND BIT PATTERN WORD ■ MCIU SETS POWER STATUS TO "FAILURE" ■ MCIU SETS FAILURE WARNING BITS "1"/MAINPL/PTSPWF1
SMC FAILURE	■ INITIATED AT ANY ONE OF THE SMC FAIL BITS IS SET ■ SM GPC ■ SM COMMUNICATION FAIL ■ SM GPC POWER FAIL ■ SM FAIL ■ SM GPC COMM FAIL ■ SM TACH FAIL ■ SM GPC I/O UNSELECTED WHEN SM FAILURE WARNING RESET (FAIL_SM = 0) SET	■ MCIU SETS BIT STATUS REGISTER AND BIT PATTERN WORD ■ MCIU SETS POWER STATUS TO "FAILURE" ■ MCIU SETS FAILURE WARNING BITS AND SETS TO ENABLE 3
NORMAL	■ WHEN NONE OF THE ABOVE MODES ARE IN EFFECT	■ SENDS SMC FAILURE WARNING TO SM / "STOP" 1 ■ SENDS SMC FAILURE WARNING TO GPC / "FAILS" 1

NOTES:
1. EXCEPT FOR NORMAL MODE, MULTIPLE MODES CAN BE ACTIVE SIMULTANEOUSLY
2. MCIU "SLEEP MODE" IS NOT RELATED TO RMS GPC SOFTWARE "SLEEP MODE"

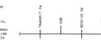
MCIU/GPC ASYNCHRONOUS TIMING DIAGRAM



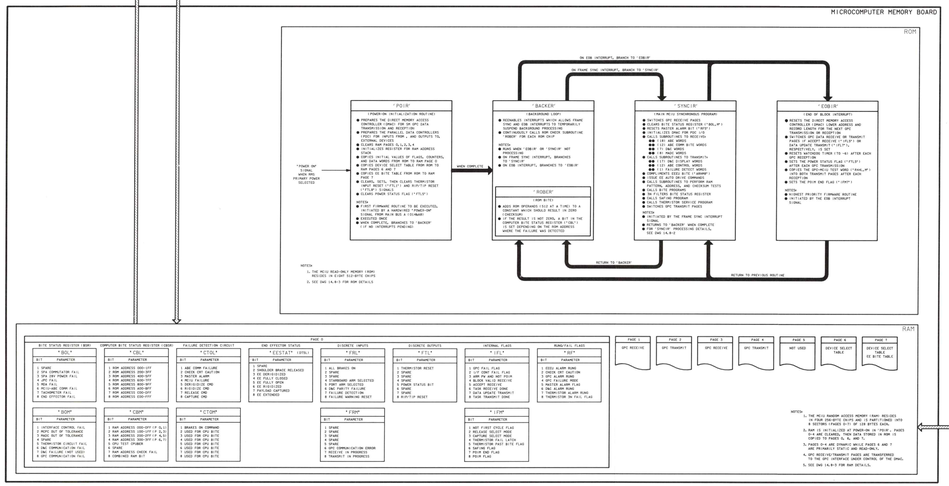
FRAME SYNC INTERRUPT - GENERATED EVERY 40 MILLISECONDS BY THE MCIU SYSTEM CLOCK IN THE GPC INTERFACE BOARD, CAUSES "SYNC-UP" TO START PROCESSING ALL CLOSE ALL "ERR-OR" NOT PROCESSING.

END OF BLOCK (EOB) INTERRUPT - GENERATED IMMEDIATELY FOLLOWING THE SUCCESSFUL EXCHANGE OF DATA BETWEEN THE GPC AND THE MCIU.

GPC/MCIU DATA TRANSFER - THE GPC LOADS A TRANSMIT COMMAND WORD (TCW) TO THE MCIU TO TRANSMIT THE 40 RESPONSE DATA WORDS FROM TO THE GPC, DURING THIS PROCESS, THE TRANSMIT IN PROGRESS (TIP) FLAG IS SET, FOLLOWING TRANSMISSION OF THE 40 DATA WORDS, THE MCIU SETS THE TIP FLAG TO 0 AND GENERATES AN EOB INTERRUPT. IF A SUBSEQUENT ERROR* THAT PREVENTS THE MCIU FROM TRANSMITTING THE 40 RESPONSE DATA WORDS, THE TIP FLAG IS SET WHILE THE MCIU IS RECEIVING AND RECOMMAND DATA WORDS FROM THE GPC.



MICROCOMPUTER MEMORY BOARD


ROM
"POLR"
(POWERON INITIALIZATION ROUTINE)
■ PREPARES THE CURRENT MEMORY ADDRESS
■ PREPARES THE CURRENT FRAME DATA
TRANSMISSION AND RECEPTION
■ PREPARES THE PARALLEL DATA CONTROLLERS
■ SETS THE INTERFACE DISCRETE OUTPUTS TO
EXTERNAL DEVICES
■ SETS THE INTERFACE DISCRETE OUTPUTS TO
SWITCH-CLOSE REGISTER FOR RAM ADDRESS
■ SETS OUTPUT INITIAL VALUES OF PLASS, PLASS, CONTROL
AND DATA WORDS FROM ROM TO RAM PAGE 0
■ SETS THE INTERFACE DISCRETE TABLE FROM ROM TO
RAM PAGE 0 AND 1
■ COPIES BIT PATTERN TABLE FROM ROM TO RAM
PAGE 0 AND 1
■ SETS THE INTERFACE DISCRETE OUTPUTS
■ SETS "POLR" = 1 / "SYNCUP" = 1 / "SYNCUP" RESET
"PLAS" = 0 / "PLAS" = 0 / "PLAS" = 0 / "

DATE: 09/09/93	NAME: MDU	VERSION: SWL1

'SYNCIR' ROUTINE CALL SEQUENCE

ROUTINE	MCIU	RAM	ABE	ABE	ONC	ONC	MADC
			XMIT	RCV	XMIT	RCV	RCV
SYNCIR	1						
MRCI	2						
USER	3						
ABERR		0					
CPUBOK	0		1				
ABE		1					
RETBER		2					
RETXOK		3					
ABEXMIT			2				
FICHEK	0						
ABEXMIT		4	3				
ABER		5					
ABERCT		6	4				
ABERCT		7					
ABERCT		8	5				
ABERCT		9					
ABER		A	6				
ABERCT		B					
ABERCT		C	7				
ABERCT		D					
ABERCT		E	8				
ABERCT		F					
ABERCT	1	0	9				
ABERCT		1					
ABERCT		2	A				
ABERCT		3					
ABERCT		4	B				
ABERCT		5					
ABERCT		6	C				
ABERCT		7					
ABERCT		8	D				
ABERCT		9					
ABERCT		A	E				
ABERCT		B					
ABERCT		C	F				
ABERCT		D					
ABERCT		E	10				
ABERCT		F					
ABERCT	2	0	11				
ABERCT		1					
ABERCT		2	12				
ABERCT		3					
ABERCT		4	13				
ABERCT		5					
ABERCT		6	14				
ABERCT		7					
ABERCT		8	15				
ABERCT		9					
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ABERCT		F					
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ABERCT		F					
ABERCT	4	0					
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INMSC	0						

GPC TRANSMIT/RECEIVE

- DATA TRANSMISSION TO / RECEPTION FROM THE GPC IS CONTROLLED BY THE SMAD, INDEPENDENT OF THE MCIU FRAME SYNC CYCLE
- THE 'GPCXMIT' SYNCHRONIZE SYNCHRONIZE IS IMPLEMENTED WHICH ALLOWS SMAD MESSAGE TO BE ACTIVE WITH THE GPC WHILE THE OTHER PAGE IS BEING ACCESSED BY THE MCIU
- GPC TRANSMIT PAGE SELECTION SWITCHING IS PERFORMED IN BOTH 'GPCXMIT' AND 'GPCRCV'
- GPC TRANSMIT PAGE 13 AND 41 SWITCHING IS PERFORMED IN 'GPCXMIT' ONLY (NOT 'GPCRCV')
- 'GPCXMIT' AND 'GPCRCV' ARE FIXED EACH TIMY AN ESB INTERRUPT WILL OCCURE BEFORE THE SUBROUTINE IS COMPLETED IF THE RUNTIME RESET BIT IS SET

'GPCER'
(GPC RECEIVE)

- CALLED ONCE PER MCIU FRAME AT BEGINNING OF TIMYNC
- CHECKS FOR 3 CONSECUTIVE WORD / FRAME ERRORS
- SWITCHES GPC RECEIVE PAGES (A RAM 1) AND 2B) AND SENDS RECEIVE PAGE ADDRESS THE GPC RECEIVE PAGE SELECTED
  - THEY WERE NOT SWITCHED DURING THE LAST EXECUTION OF 'GPCER' ('GPCRCV' = 0)
  - THE GPC RECEIVE IS PROGRESS (ELP)
  - 'GPCRCV' = 1 AND 'GPCXMIT' = 0)
- IF GPC RECEIVE ('GPCRCV' = 1)
  - SETS 'ACCEPT RECEIVE' = 'FLT'=.
  - SETS 'ACCEPT RECEIVE' = 'FLT'=. TO BE SWITCHED WHEN 'GPCRCV' IS CHECKED NEXT
  - SETS 'TASK RECEIVE DONE' ='FLT'=)

'GTER'
(GPC TRANSMIT)

- CALLED ONCE PER MCIU FRAME (LATE IN TIMYNC)
- INPUTS 8-BIT DISCRETE WORD ('FBM')
- CHECKS FOR 3 CONSECUTIVE WORD / FRAME IDENTICATION (AND 2 CONSECUTIVE STORES 'FR EQUENT' IN GPC TRANSMIT WORD 44
- IF GPC TRANSMIT PAGE SELECTION (WORD 44 AND SENDS THE 'CURRENT' TRANSMIT PAGE ADDRESS TO THE TRANSMIT DATA CONTROLLER (FI
- IF 'GPCXMIT' = 1 AND 'GPCRCV' = 0 (GPC RECEIVE IS PROCESSING) THE 'CURRENT' TRANSMIT PAGES TO BE SWITCHED WHEN 'GTER' IS EXECUTED NEXT
- IF PAGES ARE SWITCHED 'GPC FAIL FLAG' (='FLF') IS CLEARED

'BTSTER'
(BSE BITE PROCESSING)

- IF MATCHING TIMES IS POSITIVE OR ZERO
  - SETS GPC FAIL FLAG ('FBM')
  - SETS SAFING FAIL ('FBM')
  - SETS 'GPC FAIL' ('FBM') AND GPC ALARM FLAG ('FBM') IF THE 'GPC ALARM' RUNS FLAG NOT PREVIOUSLY SET
- IF MATCHING TIMES IS NEGATIVE (IS SETH
  - SETS 'GPC FAILURE WARNING' ('LMP')
  - SAFING IN PROGRESS (TALKBACK)
  - ALL BRAKES TALKBACK

'BTSER'
(BSE BITE PROCESSING)

- COPIES 'FAIL' TO 'TSLM', 'TTLL/M', 'TTDL/M', AND 'TTAN/M' IN GPC TRANSMIT PAGE

ABE TRANSMIT/RECEIVE

- DATA TRANSMISSION TO / RECEPTION FROM THE ABE IS PERFORMED BY SEVEN 4-WORD BIBUFFERS
- 32 16-BIT COMMAND WORDS FROM THE GPC ARE TRANSMITTED TO THE ABEC
  - WORD 1 WORD CONTAINS RATE DEMAND AND CURRENT LIMIT DATA FOR EACH OF THE SIX ACUATS
- SIX 16-BIT RESPONSE WORDS ARE RETURNED FROM THE ABEC
  - WORD 1 CONTAINS ACTUATOR POSITION DATA FOR EACH FROM EACH OF THE SIX ACUATS, AND ERR DTECTION / CORRECTION AND EEDC BITE INDICATIONS
  - WORDS 2 THROUGH 6 CONTAIN ADDITIONAL STATUS FROM THE CONSISTENCY CHECKS IS RETURNED TO THE GPC
- ABE FAILURE INDICATIONS ARE 3M-FILTERED PRIOR TO INITIATION

'ATER'
(ABE TRANSMIT)

- CALLED 12 TIMES PER MCIU FRAME
- CHECKS FOR ABE BITE INDICATIONS
- ABE (ABEC) FAIL AND SENDS 'FS' ABE (ABEC) INTERFACE
- SENDS ABE TRANSMIT WORD IN RAM 1 PAGE 01 FOR LATER COMPARISON BY 'ACBER' TO VERIFY MCIU-ABE COMMUNICATION

'ABER'
(ABE RECEIVE)

- CALLED 12 TIMES PER MCIU FRAME
- CHECKS ABE BITE ACT AND RETURN DATA WORD AND STORES IN THE GPC TRANSMIT PAGE
- SENDS ABE BITE ACT AND RETURN DATA WORD FROM EACH ACUAT TO GPC
- DOES NOT MODIFY RETURN DATA

'ABERT'
(ABE RECEIVE BITE)

- CALLED 4 TIMES PER MCIU FRAME
- CHECKS ABE 3-WORD BIBUFFER DATA WORD AND STORES IN THE GPC TRANSMIT PAGE
- SENDS ABE BITE ACT AND RETURN DATA WORD FROM EACH ACUAT TO GPC
- DOES NOT MODIFY RETURN DATA
- SETS 'ABE FAIL' AND 'ABE FAILURE' FLAGS AND STORES IN BITE STATUS REGISTER ('BSLF')

'ACSER'
(ABE COMM BITE RECEIVE)

- CALLED 12 TIMES PER MCIU FRAME (11 TIMES BY 'ITSYNCH', ONCE BY 'ACSERT')
- CHECKS FOR ABE BITE RETURNING TWELVE ABE TRANSMIT WORDS
- COMPARES THESE WORDS TO ORIGINAL VALUE FROM 'ACBER' TO VERIFY MCIU-ABE COMMUNICATION
- SETS 'MCIU-ABE COMM FAIL' IN THE BITE STATUS REGISTER ('BSLF') IF THERE IS A MISCOMPARE

'BITER'
(MCIU BITE RECEIVE)

- CLEARS ABE BITE BITS ('FBL') IF ABE NOT SELECTED ('FFLM' AND 'FFLS'=0) OR FOR 25 FRAMES AFTER AN ABM IS SELECTED
- TRANSFERS ABM SELECTED BITS FROM 'FFLS.S' TO 'FAINM.S' OF IN PROM ('.IMP'=0) OR IF AN ABM IS SELECTED ('FFLM' OR 'FFLS'=1)

'BTZER'
(ABE BITE PROCESSING)

- 3M-FILTERS BITE STATUS REGISTER LSB ('BSL') AND SETS 'ABE FAILURE' FLAG ('FBM') IF ANY ABE FAILURE BITS SET IN THE BITE STATUS REGISTER ('BSLF=')
- SETS 'ABE FAILURE WARNING' ('LMP') IF ANY ABE FAIL BITS ('BSLF=') AND SET FOR THREE CONSECUTIVE CYCLES EACH SEE 'STCOM')
- SETS 'ABE ALARM' FLAG ('FBM') IF ANY BITS IS SET FOR THREE CONSECUTIVE CYCLES, WHICH RESULTS IN AUTO SAFING
- SETS 'ABE ALARM' FLAG ('FBM') IF NOT PREVIOUSLY ANNUNCIATED
- NOTES: ANNUNCIATION OF ABE FAILURES IS BASED ON THE STATE OF THE ABE BITE STATUS REGISTER ON ALL CHECK ARE FAILURE OCCURS, THE ABE BIT REMAINS SET UNLESS THE FAILURE DOES AWAY, THEREFORE, IF MULTIPLE FAILURES OF THE SAME TYPE OR A DIFFERENT JOINT WILL NOT BE ANNUNCIATED FOR.
  - SETS 'ABE FAIL' ('BSLF'),
  - 3M SPA DTR ('.BSL'),
  - GPC FAIL ('.BSLM'),
  - 'ABE FAILURE' ('FBM'), OR
  - 3M TACH FAIL ('.BSL7')

END EFFECTOR PROCESSING

- EE INCORPORATION INDICATIONS ARE EXTRACTED FROM ABE RECEIVE WORDS AND COPIED TO GPC TRANSMIT PAGE
- THE EE IS CONTROLLED BY SEQUENCES OF INDIVIDUAL (SIGNIFICAL, RUDDER/BRAKE) AND GENERATED VIA LOGIC BASED UPON THE CURRENT EE INCORPORATION STATUS
- THE EE BITE STATUS IS RECEIVED FROM THE SIGNALS FROM THE ABE (DIFCES) INTO THE GPC'S DISCRETE SIGNALS WITHIN ABE SIGNAL BACK TO THE GPC
- EE INCORPORATION AND SHUTDOWN BRACE RELEASE INDICATIONS IN 'EESTAT' ('.EESL') ARE CLEARED WHEN AN EE IS NOT SELECTED
- THE EE RETURNING COMMAND WORDS ARE COMPARED TO THE ORIGINAL COMMAND WORDS TO VERIFY GPC-EE COMMUNICATION AND DATA RECEIVED BY THE SPA IS A MISCOMPARE BETWEEN THESE RESULTS IN AN MCIU-ABE ERROR ('FS'), AND AUTO SAFING IS INITIATED IF THE ERROR PERSISTS FOR THREE CYCLES (IF NOT THE CONSISTENCY CHECK) IS RETURNED TO THE GPC
- ABE FAILURE INDICATIONS ARE 3M-FILTERED PRIOR TO INITIATION

'EER'
(EE RECEIVE)

- CALLED ONCE PER MCIU FRAME
- CHECKS FOR 3 CONSECUTIVE WORD / ANDS, / ANDS, / ANDS ERRORS ('FBM' 'FBS' 'FBA')
- EXTRACTS EE MSW INDICATIONS (TWO PER WORD) AND STORES THEM IN PAGE 0 WORD 1 ('EEFSL')
- INVERTS DEBIDED MSW (AS IT'ESTATS')
- SETS 'EE FAIL' ('.BSLF') IF ANY EE MSW (SHOULDER BRACE BKL) ERR (IF ANY ARM IS NOT SELECTED ('FFLM'=0 OR '.FBL'=0)
- SETS 'EE FAILURE WARNING' ('.LMP') IF ANY EE ('.EESL') IF 'FFLM' = 'FFLS' = 1 IS SET, SYNCHRONIZE SETS ('.IFL') IF AN ARM IS SELECTED
- COPIES THE CONTENTS OF 'EESTAT' ('.ETSL') INTO GPC TRANSMIT PAGE WORD 45 ('.FEBL')

'EBER'
(EE BITE)

- NOT A FORMAL FUNCTIONAL SUBROUTINE
- PERFORMED ONLY WHEN 'SYNCIR' INVOCATIALLY AFTER READING ABE RECEIVE WORD ('ABR')
- CHECKS FOR 3 CONSECUTIVE EE BITE ERRORS
- INVERTS EESTAT TO BIT-1 FORMAT
- SETS 'EE FAIL' ('.BSLF') IF 'ABRMB' IS NOT SELECTED ('FFLM'=0 OR '.FBL'=0)
- CLEARS ('.EESL') IN 'BTSER' IF AN ARM IS NOT SELECTED

'ETBER'
(EE DATA TRANSFER & BITE)

- CALLED ONCE PER MCIU FRAME
- CLEARS 'RELEASE SELECT MODE' ('.FSMC') AND ('CAPTURE SELECT MODE' ('.FSMC') IF ONC 'ETSTAT' = 0 (NO EE SELECTED)
- SETS 'CAPTURE SELECT MODE' ('.FSMC') IF ('.FSMC' = 0 AND 'ETSTAT' = 1 (EE SELECTED FOR THREE CONSECUTIVE CYCLES (EE AUTO MODE ONLY)
- SETS 'RELEASE SELECT MODE' ('.FSMC') IF THE RELEASE BUTTON ('.FBMB' = 1) SELECTED FOR THREE CONSECUTIVE CYCLES (EE AUTO MODE ONLY)
- LOADS THE 'ETSAT' WORD FROM THE EE STATUS TABLE CORRESPONDING TO THE CURRENT EE SELECTED ('.FSMC' = 'CAPTURE' OR 'RELEASE')
  - SETS 'EE FAIL' ('.BSLF') IF THE BITE BIT ('.FSTBAT') IS SET (INDICATING AN EE BITE ERROR) FOR THREE CONSECUTIVE CYCLES WHEN 'ETSAT' IS SET, EE AUTO COMMANDS ARE INHIBITED
  - CLEARS 'RELEASE SELECT MODE' ('.FSMC') IF ('.FSMC' = 'RELEASE' MODE' BIT ('.FSTSAT') IS SET (AT END OF NOMINAL CAPTURE SEQUENCE)
  - CLEARS 'RELEASE SELECT MODE' ('.FSMC') IF ('.ELEAN RELEASE MODE' BIT ('.FSTSAT') IS SET (AT END OF NOMINAL RELEASE SEQUENCE)
  - IN THE EE AUTO MODE, COPIES DRIVE COMMANDS FROM THE EE STATUS TABLE TRANSFER TO THE FAILURE DETECTION BOARD OPTO-ISOLATORS AND TO GPC TRANSMIT PAGE WORD 45 ('.FEBL')
  - IN THE EE MANUAL MODE, COPIES CAP/REL AND R-U/D/DRIVE COMMANDS FROM THE EMC DIGITAL INTERFACE AND TRANSFERS TO GPC TRANSMIT PAGE WORD 45 ('.FEBL')

'BTSTER'
(TILE MODE BITE PROCESSING)

- CLEARS EE FAIL BITS ('.FBL') IF ('.FSMC' = 0 AND NOT SELECTED ('.FFLM' AND '.FBL'=0) OR FOR 25 FRAMES AFTER AN ARM IS SELECTED (APPROX 1 SEC)

'BTZER'
(EE BITE PROCESSING)

- 3M-FILTERS BITE STATUS REGISTER LSB ('.BSL')

'BTSER'
(EE BITE PROCESSING)

- 3M-FILTERS BITE STATUS REGISTER ('.BSLF')
- WHEN 'EE FAIL' FLAG SET FOR THREE CONSECUTIVE CYCLES ('.BSLM'=1)
  - SETS 'EE FAILURE' FLAG ('.FBM')
  - SETS 'MASTER ALARM' FLAG ('.FBM') (IF NOT PREVIOUSLY ANNUNCIATED
  - SETS 'EE ALARM' FLAG ('.FBM') (IF NOT PREVIOUSLY ANNUNCIATED
- SYNCHRONIZE RESETS '.BSL'

C&O TRANSMIT/RECEIVE

- DATA TRANSMISSION TO / RECEPTION FROM THE ONC PANEL (ARU) IS PERFORMED BY SEVEN 4-WORDBIBUFFERS, ALL CALLED BY 'SYNCIR' WITHIN A SINGLE MCIU FRAME
- 28 16-BIT COMMAND WORDS ARE TRANSMITTED VIA THE DIGITAL INTERFACE TO THE ONCs. THESE WORDS CONTAIN DATA TO BE DISPLAYED BY LAMP INDICATORS, TALKBACKS, DIGITAL READOUT (DRDR) AND CRTs
- 7 16-BIT DATA WORDS ARE RECEIVED FROM THE ONC DIGITAL INTERFACE AND TRANSMITTED TO THE GPC. THESE WORDS CONTAIN ONC DISCRETE AND ONC KEYBOARD ENTRY DATA
- MCIU TO ONC COMMUNICATION IS VERIFIED VIA COMPARISON OF TEST WORD 6 AND PARITY CHECK OF EACH WORD FROM ONC TO MCIU

'OTER'
(ONC TRANSMIT)

- CALLED 13 TIMES PER MCIU FRAME
- CHECKS FOR ONC DATA INPUT WORD FROM THE GPC RECEIVE PAGE (RAM 2)
- VERIFIES ONC WORD ADDRESS IN 0 (1C MOST SIGNIFICANT BITS) AND TRANSFERS ONC DATA WORD TO ONC DIGITAL INTERFACE
- INCREMENTS ONC WORD ADDRESS
- COMPUTES ONC PARITY BIT (CALLED BY 'ITSYNCH', 'OTSYNC', 'OTSYNP', AND 'OTRDRP'

'OTOCER'
(ONC TRANSMIT ERROR)

- CALLED ONCE PER MCIU FRAME
- CHECKS FOR ONC DATA INPUT WORD FROM THE GPC RECEIVE PAGE (RAM 2)
- SETS 'INTERNAL MASTER ALARM FLAG ('MFB')' IF 'ONCXMIT' = 1 AND 'ONCRCV' = 0 AND ('.FBL' OR '.FBS' = 1 IS SET
- BRANCHES 'ONTS' 'OTSYP' TO PERFORM DATA WORD TRANSMIT

'OTIER'
(ONC TRANSMIT WORD 1)

- CALLED ONCE PER MCIU FRAME
- READS ONC INPUT WORD 1 (SECOND WORD) FROM THE GPC RECEIVE PAGE
- SETS ABE FAILURE WARNING ('.LMP') IF ANY ABE FAIL INDICATIONS ARE SET IN THE 3M-FILTERED ABE BITE STATUS REGISTER ('.BSLF')
- BRANCHES INTO 'OTSYP' TO PERFORM DATA WORD TRANSMIT

'OTSER'
(ONC TRANSMIT WORD 3)

- CALLED ONCE PER MCIU FRAME
- READS ONC INPUT WORD 3 (THIRD WORD) FROM THE GPC RECEIVE PAGE
- SETS 'ONC FAILURE WARNING' ('.LMP') IF ANY ONC FAIL INDICATIONS ARE SET IN THE 3M-FILTERED ONC BITE STATUS REGISTER ('.BSLF')
- SETS ALL BRAKES ON BIT ('.BTSTAT') IF ARM SELECTED ('FFLM' AND '.FBL'=0) OR FOR 25 FRAMES AND ALL BRAKES ON ('.FBL'=' + 1

'OTOCER'
(ONC TRANSMIT WORD 4)

- CALLED ONCE PER MCIU FRAME
- CHECKS FOR ONC DATA INPUT WORD FROM THE GPC RECEIVE PAGE (RAM 2)
- CHECKS ONC COMMUNICATION FAIL FLAG FROM THE ONC DIGITAL INTERFACE
- SETS 'ONC FAILURE' FLAG ('.FBM') IF 'ONCXMIT' = 1 AND 'ONCRCV' = 0 AND ('.FBL' OR '.FBS' = 1 IS SET
- BRANCHES INTO 'OTSYP' TO PERFORM DATA WORD TRANSMIT

'OTDER'
(ONC TRANSMIT WORD 5)

- CALLED ONCE PER MCIU FRAME
- CHECKS FOR ONC DATA INPUT WORD FROM THE GPC RECEIVE PAGE (RAM 2)
- CHECKS ONC COMMUNICATION FAIL FLAG FROM THE ONC DIGITAL INTERFACE
- SETS 'ONC FAILURE' FLAG ('.FBM') IF 'ONCXMIT' = 1 AND 'ONCRCV' = 0 AND ('.FBL' OR '.FBS' = 1 IS SET
- BRANCHES INTO 'OTSYP' TO PERFORM DATA WORD TRANSMIT

'OTSYP'
(ONC TRANSMIT)

- CALLED ONCE PER MCIU FRAME
- CHECKS FOR ONC DATA INPUT WORD FROM THE GPC RECEIVE PAGE (RAM 2)
- VERIFIES ONC WORD ADDRESS IN 0 (1C MOST SIGNIFICANT BITS) AND TRANSFERS ONC DATA WORD TO ONC DIGITAL INTERFACE
- INCREMENTS ONC WORD ADDRESS
- COMPUTES ONC PARITY BIT (CALLED BY 'ITSYNCH', 'OTSYNC', 'OTSYNP', AND 'OTRDRP'

'OTRDRER'
(ONC TRANSMIT ERROR)

- CALLED ONCE PER MCIU FRAME
- CHECKS FOR ONC DATA INPUT WORD FROM THE GPC RECEIVE PAGE (RAM 2)
- CHECKS ONC COMMUNICATION FAIL FLAG FROM THE ONC DIGITAL INTERFACE
- SETS 'ONC FAILURE' FLAG ('.FBM') IF 'ONCXMIT' = 1 AND 'ONCRCV' = 0 AND ('.FBL' OR '.FBS' = 1 IS SET
- BRANCHES INTO 'OTSYP' TO PERFORM DATA WORD TRANSMIT

'OTRDRP'
(ONC TRANSMIT)

- SETS ONC PARITY BIT ('.FBM') = 1 IF ONC PARITY FAIL FLAG ('.FBL') = 1
- SETS 3M-FILTERS BITE STATUS REGISTER MSB ('.BSM')
- SETS 'ONC FAILURE' FLAG ('.FBM') IF ONC SYSTEM FAILURE BIT ('.BSM') IS SET FOR 3 CONSECUTIVE CYCLES
  - SETS 'MASTER ALARM' ('.FBM') (IF NOT PREVIOUSLY ANNUNCIATED
  - SETS 'ONC ALARM RUNS FLAG ('.FBM') = 1 ('.FBM')=1)
- SYNCHRONIZE RESETS '.BSM'

MADC RECEIVE

- DATA RECEPTION FROM THE MADC (MAIN/PULSATOR ANALOG TO DIGITAL CONVERTER) IS PERFORMED BY FOUR 4-WORDBIBUFFERS, ALL CALLED BY 'SYNCIR' WITHIN A SINGLE MCIU FRAME
- 16 16-BIT MADC DISCRETE DATA WORDS ARE TRANSMITTED VIA THE DIGITAL INTERFACE TO THE GPC. THESE WORDS CONTAIN DATA TO BE DISPLAYED BY LAMP INDICATORS, TALKBACKS, DIGITAL READOUT (DRDR) AND CRTs
- 7 16-BIT DATA WORDS ARE RECEIVED FROM THE DIGITAL INTERFACE AND TRANSMITTED TO THE GPC. THESE WORDS CONTAIN MADC DISCRETE AND KEYBOARD ENTRY DATA
- MCIU TO MADC COMMUNICATION IS VERIFIED VIA COMPARISON OF TEST WORD 6 AND PARITY CHECK OF EACH WORD FROM MADC TO MCIU

'MRER'
(MADC RECEIVE)

- CALLED 8 TIMES PER MCIU FRAME
- READS ONE 8-BIT HAND CONTROLLER SIGNAL
- SETS 'MADC FAIL' FLAG ('.FBM') IF 'MADC' FAILURE BIT ('.FBM') IS SET
- DOES NOT MODIFY DATA

'MRBER'
(MADC RECEIVE BITE)

- CALLED 3 TIMES PER MCIU FRAME
- CHECKS FOR ONE 16-BIT MADC POWER SUPPLY, CONVERTER TIMING, AND ANALOG INTERNAL REFERENCE VOLTAGE
- CHECKS FOR ONE 16-BIT MADC CONVERTER DIFFERENCE EXCESS FAILURE
- SETS 'MADC FAIL' FLAG ('.FBM') IF
  - 'MADC OUT OF TOLERANCE' ('.FBMB') =
  - PART OF THIS INDICATION IS CALLED BY 'TBER'

'TRER'
(THERMISTOR RECEIVE)

- CALLED ONCE PER MCIU FRAME
- READS ONE 8-BIT THERMISTOR VALUE FROM THE THERMISTOR TABLE
- COMPARES THE THERMISTOR VALUE TO THE 'TEMP-1' LO 'FUSED' LIM BY ONE AND THE NEW THERMISTOR VALUE IS STORED IN THE TABLE
- THE THERMISTOR IDENTIFIER ('TRMP') IS INCREMENTED TO POINT TO THE NEW THERMISTOR VALUE
- SETS 'THERMISTOR FAILURE' ('.FBM') = 1 WHEN THE LAST 3 (SAME) THERMISTOR CHANNEL ('TRMP') HAVE BEEN FAILED ('.FBM' = 1 OR '.FBT') (IS SET, SYNCHRONIZE THEN RESETS THE THREE THERMISTOR ADDRESS TO CHANNEL 0
- THE THERMISTOR VALUE IS ALSO READ INTO THE NEXT MCIU FRAME, 'TRER' IS CALLED AFTER EACH THERMISTOR VALUE IS STORED IN THE TABLE, AND THE 'TRMP' IS INCRED TO THE 3RD THERMISTOR CHANNEL
- 'TBER' IS CALLED FOR THE FIRST TWO THERMISTOR CHANNELS

'TBER'
(THERMISTOR BITE PROCESSING)

- CALLED TWICE IN 30 MCIU FRAMES BY 'TRER'
- PREPARES ONE OF THE 7 FIRST TWO THERMISTOR CHANNELS ('TRMP') FOR LIMIT AND TREND CHECK FOR COMPARISON
- BRANCHES INTO 'TRBSP' TO PERFORM COMPARISON
- SETS 'THERMISTOR 2 MCIU-1' FAIL' ('.FBMP=') IF COMPARISON DIFFERENCE IS GREATER THAN ALLOWABLE TOLERANCE

'BTZER'
(THERMISTOR BITE PROCESSING)

- WHEN 'THERMISTOR' +/- THERMISTOR 1 MCIU-1 (ONLY) VOLTAGE='
  - SETS 'THERMISTOR FAIL' BITS ('.FBM=')
  - SETS 'THERMISTOR 1 MCIU-1 CIRCUIT FAIL NOT SET ('.FBMP=0)
  - SETS 'THERMISTOR AND THERMISTOR SELECT MODE' ('.FBMP' = 0'.FBMP=')
- WHEN 'THERMISTOR' +/- THERMISTOR CALIBRATION VOLTAGE='
  - RESETS '.FBMP' AND THERMISTOR ALARM RUNS ('.FBM') TO ZEROS, AND THERMISTOR FAIL ('.FBM') AND ('.FBMP' = 0') IF '.FBMP' AND '.FBMP=0')
  - SYNCHRONIZE SETS THERMISTOR 'TRACK', AND IF THERMISTOR SEL RESETS '.FBMP'

'BTSTER'
(THERMIST

ROM MEMORY MAP

HEX ADDRESS	MNEMONIC	DESCRIPTION
000	PWRL	POWER-ON INITIALIZATION
053	PSET	POWER-ON INITIALIZATION
0DF	SYNCHR	SYNCHRONOUS INTERRUPT
0E8	SYNCHR	SYNCHRONOUS INITIALIZATION MODE
1AA	PWRSTR	POWER-ON STORE
1DD	1RDR	DIGNITAL FLAG RECEIVE
1F8	1RDR	DIGNITAL FLAG RECEIVE
445	SWTCH	SWITCHING ENABLE (MCIU SWTHD)
45A	2RDR	DNC RECEIVE
47F	2RDR	DNC RECEIVE WORD 1 TRANSMIT
487	OTDER	DNC TRANSMIT WORD 0
492	OTDER	DNC TRANSMIT WORD 1
4A2	OTDER	DNC TRANSMIT WORD 2
4C2	OTDER	DNC TRANSMIT
4D2	OTDER	DNC TRANSMIT WORD 3
4E2	3RDER	DNC RECEIVE WORD 0 RITE
500	4RDER	ABC RECEIVE
510	4RDER	ABC RECEIVE BITE
537	ATDER	ABC TRANSMIT
550	ACDER	ABC COMMUNICATIONS BITE
560	ACDER	ABC COMMUNICATIONS WORD 19
5A4	CLLDR	FAILURE DETECTION CIRCUIT TRANSMIT
5B0	MRDR	MADC RECEIVE
5C0	MRDER	MADC RECEIVE BITE
5E4	TRDR	THERMISTOR BITE
5A6	TRDR	THERMISTOR RECEIVE
5F0	BTDER	BITE TRANSMIT BITE
5B3	BTDER	BITE
613	BTDER	BITE
623	BTDER	BITE
651	DTDR	DPC TRANSMIT
851	INRABER	INITIALIZE RAM BITE
8A3	INRABER	INITIALIZE
8E3	INRTBER	INITIALIZE RAM A & T BITE
900	RNTBER	RAM A & T BITE
920	INTDER	INITIALIZE TRANSMIT BITE
940	SYNCHR	SYNCHRONOUS INTERRUPT (CONT'D)
95D	SYNCHR	SYNCHRONOUS INTERRUPT (CONT'D FRAME)
9A2	INRAG	INITIALIZE RAM CHECK
9B0	RAMCR	RAM ADDRESS CHECK
9C0	RAMCR	RAM BITE
9D0	RAMDES	RAM ADDRESS CHECK (FINAL)
9B0	RABERS	RAM BITE
F00	DSTR	DEVICE SELECT TABLE (PAGE 6)
F80	DSTT	DEVICE SELECT TABLE (PAGE 7)
FC0	ESTAB	END EFFECTOR STATUS TABLE
FFF		LAST STATEMENT

RAM MEMORY MAP

DECIMAL BYTES	PAGE 0	PAGE 1	PAGE 2	PAGE 3	PAGE 4	PAGE 5	PAGE 6	PAGE 7
	FLAGS, COUNTERS, ADDRESSES	DPC RECEIVE	DPC TRANSMIT	DPC RECEIVE	DPC TRANSMIT	NOT USED	DEVICE SELECT TABLE	DEVICE SELECT TABLE (SEE STATUS TABLE)
	(TEMPORARY STORAGE)	(45 16-BIT WORDS)	(45 16-BIT WORDS)	(45 16-BIT WORDS)	(45 16-BIT WORDS)			
HEX ADDRESS	0 80	100 180	200 280	300 380	400 480	500 580	600 680	700 780
DECIMAL BYTES	0 128	256 384	512 640	768 896	1024			

PAGE 0

HEX ADDRESS	BIT/BYTE	DESCRIPTION
00	0400	SPARE
01	0401	SPARE
02	0402	DNC WORD ADDRESS
03	0403	DNC TRANSMIT POINTER
04	SPT	PROGRAM TRANSMIT PAGE POINTER
05	RASSUB	RAM BITE SUBCOMPUTATION COUNTER
06	SPR	SPARE
07	RPR	PROGRAM RECEIVE PAGE POINTER
08	GDR	GPA RECEIVE PAGE POINTER
09	GPTDRD	GPA TRANSMIT PAGE
10	MRDF	MF RF RAM FAILURES COUNTER
11	MRATDN	MF RT RAM FAILURES COUNTER
12	RTF	RAM TEST FAILURE
13	APT	RAM TEST PAGE POINTER
14	ABT	RAM TEST BLOCK POINTER
15	ABT	ABC TRANSMIT WORD 3
16	PRAT	PAGE N OR T RAM TEST PAGE POINTER
17	RADMS	RAM CHECKSUM
18	RADMS	RAM CHECKSUM ADDRESS POINTER
19	RADMES	RAM CHECKSUM
20	EEDA	END EFFECTOR DA FILTER
21	LLDA	L REGISTER DA BYTE
22	LLDB	L REGISTER LAMDA BYTE
23	LAIDA	L REGISTER APPROX BYTE
24	LAIDB	L REGISTER LAMDA COUNTER
25	THCI	THERMISTOR FAIL COUNT
26	THCT	NOT USED
27	ADDENT	ADDRESS FRAME IDENTIFIER
28	CSA	USER SUPPLY AND HOLD COUNTER
29	CTDL	FAILURE DETECTION WORD LSB
30	CTDL	FAILURE DETECTION WORD MSB
31	DTDL	ESTAT (-12) MSW, SSI, MF RCLI
32	DTDR	DPC DATA FAIL, SATINL BRAKES ON
33	DTDR	DNC TEST WORD LSB
34	DTDR	DNC TEST WORD MSB
35	CBL	MICROCOMPUTER BITE STATUS REGISTER (BSR) LSB
36	CBM	MICROCOMPUTER BITE STATUS REGISTER (BSR) MSB
37	FTL	DIGINETTE FLAG TRANSMIT/ MSC SVFL
38	FRL	DIGINETTE FLAG RECEIVE LSB (FSDC LVF)
39	FRM	DIGINETTE FLAG RECEIVE MSB (FSDC LVF)
40	RF	RUNGFAIL FLAGS
41	ARF	ABC RUNGFAILS FLAGS
42	ARF	ABC FLAGS
43	ATA	INTERNAL FLAGS LSB
44	ATA	INTERNAL FLAGS MSB
45	DPC	R/T STATUS REGISTER LSB
46	BDR	MSB
47	R11	- - - - - - I/M FILTERED LSB
48	R12	- - - - - - I/M FILTERED MSB
49	R21	- - - - - - I/M FILTERED LSB
50	R22	- - - - - - I/M FILTERED MSB
51	R31	- - - - - - I/M FILTERED LSB
52	R32	- - - - - - I/M FILTERED MSB
53	TRDL	THERMISTOR - - - - 12 FRAMES OLDEST LSB
54	TRDL	- - - - - - IDENTIFIER 12 FRAMES OLD
55	TRDR	- - - - - - VALUE 12 FRAMES OLDER MSB
56	TRDR	- - - - - - IDENTIFIER 12 FRAMES OLDER LSB
57	TRDL	- - - - - - VALUE 12 FRAMES OLDEST MSB
58	TRDL	- - - - - - IDENTIFIER 12 FRAMES OLDEST LSB
59	TRDL	- - - - - - IDENTIFIER LSB (THIDENT)
60	DPT	COPY BITE
61	DPT	32 ABC TRANSMIT WORDS
76	SPR	SPARE
77	SPR	
78	SPR	STATUS PAD
79	SPR	
7A	ABRF	AUTO BRAKES RUNG FLAGS

NOTES:
1. LSB = LEAST SIGNIFICANT BITE
   MSB = MOST SIGNIFICANT BITE
2. THE POWER-ON TABLE
   (PBTAB) IS TRANSFERRED OR LOADED INTO PAGE 0 DURING "PSTR"

PAGES 1 & 3 (DPC TO MCIU)

CDH	DEST	DESCRIPTION	FW ADDRESS (H)	MSID
1		SPARE	RSL,#	
2		SPARE	RSL,#	
3		SPARE	RSL,#	
4		SPARE	RSL,#	
5		WRR RATE DEMAND	RSL,#	A770,N
6	ABC	WRR CURRENT LIMIT + RATE DMD ID	RSL,#	A771,N
7	ABC	WRR CURRENT LIMIT	RTL,#	A772,N
8	ABC	WRT CURRENT LIMIT	RTL,#	A773,N
9	ABC	SPR RATE DEMAND	RRL,#	A746,N
10	ABC	SPR CURRENT LIMIT	RRL,#	A747,N
11 (-10)	ABC	ELP RATE DEMAND	R10L,#	A742,N
12	ABC	ELP CURRENT LIMIT	R11L,#	A743,N
13	ABC	EWP RATE DEMAND	R12L,#	A744,N
14	ABC	EWP CURRENT LIMIT	R13L,#	A745,N
15	ABC	SHT RATE DEMAND	R14L,#	A748,N
16	ABC	SHT CURRENT LIMIT	R15L,#	A749,N
17		SPARE	R16L,#	
18		SPARE	R17L,#	
19		SPARE	R18L,#	
20		SPARE	R19L,#	
21		SPARE	R20L,#	
22		SPARE	R21L,#	
23		SPARE	R22L,#	
24		SPARE	R23L,#	
25		SPARE	R24L,#	
26		SPARE	R25L,#	
27		SPARE	R26L,#	
28	DNC	ADDRESS FIELD, DATA FIELD	R28L,#	ST2L,N
29	DNC	ADDRESS FIELD, DATA FIELD	R29L,#	ST3L,N
30	DNC	ADDRESS FIELD, DATA FIELD	R30L,#	ST4L,N
31	DNC	ADDRESS FIELD, DATA FIELD	R31L,#	ST5L,N
32	DNC	ADDRESS FIELD, DATA FIELD	R32L,#	ST6L,N
33	DNC	ADDRESS FIELD, DATA FIELD	R33L,#	ST7L,N
34 (-33)	DNC	ADDRESS FIELD, MSW WORD # 0, SEL DNC	R34L,#	ST8L,N
35	DNC	ADDRESS FIELD, ES TEST WORD	R35L,#	ST9L,N
36 (-35)	DNC	ADDRESS FIELD, MSW WORD # 1	R36L,#	ST10L,N
37	DNC	ADDRESS FIELD, MSW WORD # 2	R37L,#	ST11L,N
38	DNC	ADDRESS FIELD, MSW WORD # 3A	R38L,#	ST12L,N
39	DNC	ADDRESS FIELD, MSW WORD # 3B	R39L,#	ST13L,N
40	DNC	ADDRESS FIELD, MSW WORD # 4	R40L,#	ST14L,N
41	DNC	ADDRESS FIELD, MSW WORD # 4	R41L,#	ST15L,N
42	DNC	ADDRESS FIELD, MSW WORD # 4A	R42L,#	ST16L,N
43		SPARE	R43L,#	
44		SPARE	R44L,#	
45	DPC	DPC/MCIU TEST WORD	T43L,#	

NOTES:
1. DNC ADDRESS FIELD (BITS 4-8 OF MSB) INSERTED BY F/FIRMWARE
2. 17 WORDS TRANSMITTED TO DNC WITH WORDS "DTF" AND "DTH" READ FROM PAGE 0

PAGES 2 & 4 (MCIU TO DPC)

ROW	SOURCE	DESCRIPTION	FW ADDRESS (H)	MSID
1	MCIU	MCIU BITE STATUS (BLD)	T0L,#	BSL,BDM
2	MCIU	BITE STATUS REGISTER	T1L,#	BSL,BDM
3	MCIU	BITE STATUS REGISTER	T2L,#	BSL,BDM
4		SPARE ANALOG CHANNEL 3	T3L,#	A95L,N
5	ABC	SHT SWITCH OUTPUTS, FLAGS	T4L,#	AF1L,N
6	ABC	SHT SWITCH OUTPUTS, BP REL	T5L,#	AF2L,N
7	ABC	SHT CURRENT OUTPUT	T6L,#	AF3L,N
8	ABC	SWP SWITCH OUTPUTS, FLAGS	T7L,#	AF4L,N
9	ABC	SWP CURRENT OUTPUT	T8L,#	AF5L,N
10 (-9)	ABC	ELP ENCODER OUTPUT	T9L,#	AF6L,N
11	ABC	ELP SWITCH OUTPUTS, FLAGS	T10L,#	AF7L,N
12	ABC	ELP CURRENT OUTPUT	T11L,#	AF8L,N
13	ABC	WPP ENCODER OUTPUT	T12L,#	AF9L,N
14	ABC	WPP SWITCH OUTPUTS, FLAGS	T13L,#	AF10L,N
15	ABC	WPP CURRENT OUTPUT	T14L,#	AF11L,N
16		SPARE	T15L,#	
17		SPARE	T16L,#	
18		SPARE	T17L,#	
19		SPARE	T18L,#	
20	ABC	WPR ENCODER OUTPUT	T19L,#	AF12L,N
21	ABC	WPR SWITCH OUTPUTS, FLAGS	T20L,#	AF13L,N
22	ABC	WPR CURRENT OUTPUT	T21L,#	AF14L,N
23		SPARE ANALOG CHANNEL 4	T22L,#	A96L,N
24	RADC	THC A, THC T	T23L,#	MAAL,MBBL
25	RADC	RHC PITCH, PITCH	T24L,#	MBAL,MBBL
26	RADC	RHC YAW, ROLL	T25L,#	MBCL,MBFL
27	RADC	THERMISTOR TEMP, IDENT	T26L,#	AM3L,N
28	RADC	THERMISTOR TEMP, IDENT	T27L,#	AM4L,N
29	RADC	THERMISTOR TEMP, IDENT	T28L,#	AM5L,N
30	RADC	THERMISTOR TEMP, IDENT	T29L,#	AM6L,N
31	ABC	ADDRESS FIELD, DATA FIELD	T30L,#	DM1L,N
32	ABC	ADDRESS FIELD, DATA FIELD	T31L,#	DM2L,N
33	ABC	ADDRESS FIELD, DATA FIELD	T32L,#	DM3L,N
34	ABC	ADDRESS FIELD, DATA FIELD	T33L,#	DM4L,N
35	ABC	ADDRESS FIELD, MSW WORD # 0	T34L,#	DM5L,N
36	ABC	ADDRESS FIELD, ES TEST WORD	T35L,#	DM6L,N
37	MCIU	MICROCOMPUTER BITE	T36L,#	CBL,CBM
38		SPARE	T37L,#	
39		SPARE	T38L,#	
40		SPARE	T39L,#	
41		SPARE	T40L,#	
42	MCIU	FLAGS, ID MSW (HI)	T40L,#	
43	MCIU	FLAGS, ID LSW (LO)	T41L,#	
44	DPC/MCIU	RATE DMD (L, MCIU FRAME ID	T42L,#	
45	DPC	DPC/MCIU TEST WORD	T43L,#	

ABC RECEIVE WORDS

T4L*/*AR1L

BIT	PARAMETER
1	SHT FWD/BACK DRIVE FLAG
2	SHT CURRENT LIMIT
3	SPARE
4	SPARE
5	SH YAW
6	TACH OUTPUT

T5L*/*AR2L

BIT	PARAMETER
1	SPARE
2	SHT SPA COMM FAIL
3	SHT SPA 28V FAIL
4	SPARE
5	SHT MEA FAIL
6	SPARE
7	SHT TACH FAIL

T6L*/*AR3L

BIT	PARAMETER
1	SPARE
2	SWP SPA COMM FAIL
3	SWP SPA 28V FAIL
4	SPARE
5	SWP MEA FAIL
6	SPARE
7	SWP TACH FAIL

T11L*/*AR8L

BIT	PARAMETER
1	SPARE
2	ELP SPA COMM FAIL
3	ELP SPA 28V FAIL
4	SPARE
5	ELP MEA FAIL
6	SPARE
7	ELP TACH FAIL

T13L*/*AR9L

BIT	PARAMETER
1	WPP FWD/BACK DRIVE FLAG
2	WPP CURRENT LIMIT
3	PAYLOAD CAPTURED
4	ES EXTENDED
5	
6	WR PITCH
7	TACH OUTPUT

T4M*/*AR1M

BIT	PARAMETER
1	
2	
3	
4	
5	SH YAW
6	TACH OUTPUT
7	

SAME FORMAT FOR "T5M"/"AR2M" THRU "T13M"/"AR9M"

T5M*/*AR2M

BIT	PARAMETER
1	
2	
3	
4	SPARES
5	
6	
7	SH EXTERNAL FLAG (SPARE)

T6M*/*AR5M

BIT	PARAMETER
1	
2	
3	
4	SPARES
5	
6	
7	EXTERNAL FLAG (SPARE)

T11M*/*AR8M

BIT	PARAMETER
1	
2	
3	
4	SPARES
5	
6	
7	EXTERNAL FLAG (SPARE)

T13M*/*AR9M

BIT	PARAMETER
1	
2	
3	
4	WR PITCH
5	TACH OUTPUT
6	(12-BIT 2'S COMP)
7	

ABC RECEIVE WORDS

T14L*/*AR0L

BIT	PARAMETER
1	WPT FWD/BACK DRIVE FLAG
2	WPT CURRENT LIMIT
3	WPT CAPTURED
4	ES CLOSED
5	
6	WR YAW
7	TACH OUTPUT

T15L*/*AR6L

BIT	PARAMETER
1	WRR FWD/BACK DRIVE FLAG
2	WRR CURRENT LIMIT
3	WRR SPA COMM FAIL
4	WRR SPA 28V FAIL
5	SPARE
6	WRR MEA FAIL
7	WRR TACH FAIL

T20L*/*AR4L

BIT	PARAMETER
1	WRR SPA COMM FAIL
2	WRR SPA 28V FAIL
3	SPARE
4	WPR MEA FAIL
5	SPARE
6	WPR TACH FAIL
7	SPARE

T30L*/*DR1L

BIT	PARAMETER
1	PARITY FIELD
2	MODE SEL - MANUAL PR
3	MODE SEL - MANUAL YAW
4	MODE SEL - MANUAL ROLL
5	MODE SEL - MANUAL DRB SNL
6	MODE SEL - AUTO P
7	PARAM SEL - RATE P/Y/R
8	PARAM SEL - ATT P/Y/R

T16M*/*AR0M

BIT	PARAMETER
1	
2	
3	
4	WR YAW
5	TACH OUTPUT
6	(12-BIT 2'S COMP)
7	

T19M*/*AR5M

BIT	PARAMETER
1	
2	
3	
4	WR ROLL
5	TACH OUTPUT
6	(12-BIT 2'S COMP)
7	

T20M*/*AR6M

BIT	PARAMETER
1	
2	
3	
4	SPARES
5	
6	
7	EEDU RATE (-INVERTED)

T30M*/*DR1M

BIT	PARAMETER
1	
2	
3	
4	PARAM SEL - MAN P/Y/R
5	PARAM SEL - ATT P/Y/R
6	PARAM SEL - JET/ATT ANGLE
7	
8	SPARE

T31L*/*DR2L

BIT	PARAMETER
1	JET/ATT SEL - DEFT PWM
2	JET/ATT SEL - DEFT TEMP
3	MODE SEL - AUTO 4
4	MODE SEL - AUTO 5
5	MODE SEL - AUTO 6
6	MODE SEL - AUTO 7
7	MODE SEL - AUTO 8

T32L*/*DR3L

BIT	PARAMETER
1	PARITY FIELD
2	PARAM SEL - STBD TEMP
3	PARAM SEL - PORT TEMP
4	RATE HOLD SEL
5	COARSE RATE SEL
6	FINE RATE SEL
7	SAT/ANT SEL
8	PASTER ALARM RESET

T33L*/*DR4L

BIT	PARAMETER
1	SPARE
2	RELEASE SEL
3	CAPTURE SEL
4	ES
5	ES DEN/DIS/DE ENC
6	ES ENA MODE SEL
7	ES DIS MODE SEL
8	ES ENA/DIS SEL
9	PORT SAW SEL

T40L*/ROW 42

BIT	PARAMETER
1	SPARE
2	ANT FAILURE WARNING
3	SPARE
4	ES DEPLOYED
5	ES OPEN
6	ES CLOSED
7	PAYLOAD CAPTURED
8	ES EXTENDED

T41L*/ROW 43

BIT	PARAMETER
1	
2	
3	
4	
5	
6	
7	SPARES

T30P*/DR2M

BIT	PARAMETER
1	
2	
3	
4	MODE SEL - DPR DMD
5	MODE SEL - DIRECT
6	MODE SEL - SINGLE
7	
8	SPARE
9	ENC
A	ADDRESS
B	FIELD

T32M*/DR3M

BIT	PARAMETER
1	
2	
3	
4	AUTO SEQ STOP
5	AUTO SEQ PROCESS
6	
7	
8	SPARE
9	ENC
A	ADDRESS
B	FIELD

T33M*/DR4M

BIT	PARAMETER
1	
2	PORT TEMP CAUTION
3	STBD TEMP CAUTION
4	ANT FAILURE WARNING
5	
6	SPARE
7	ENC
8	ADDRESS
9	FIELD

T40M*/ROW 42

BIT	PARAMETER
1	
2	ES RELEASED SW
3	ES SPA FAILURE WARNING
4	ES SPA PROCESS
5	PORT SAW SELECTED
6	SPARE
7	ES DEPLOYED
8	MCIU FAILURE WARNING

T41M*/ROW 43

BIT	PARAMETER
1	
2	
3	
4	ES DEN/DIS/DE ENC
5	ES DISABLE ENC
6	ES ENABLE ENC
7	ES CAPTURE ENC

PAGE 7

END EFFECTOR MICROMOTION STATUS

END EFFECTOR STATUS TABLE "ESTAB"

INPUT FROM "ESSTAT"

BIT	SPARE	SPARE	PAYLOAD CAPTURED	ES EXTENDED	ES CLOSED	ES OPEN	PARITY FIELD	ES DEPLOYED
8								
7								
6								
5								
4								
3								
2								
1								

OUTPUT TO EE AND TO BITE

BIT	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE
8								
7								
6								
5								
4								
3								
2								
1								

SEQUENCES IN HEX

BIT	SHT COMMAND	SHT RELEASE	SHT CAPTURE	SHT PROCESS	SHT SEQ STOP
8					
7					
6					
5					
4					
3					
2					
1					

HEX	BIT
00	00
01	01
02	02
03	03
04	04
05	05
06	06
07	07
08	08
09	09
0A	10
0B	11
0C	12
0D	13
0E	14
0F	15
10	16
11	17
12	18
13	19
14	20
15	21
16	22
17	23
18	24
19	25
1A	26
1B	27
1C	28
1D	29
1E	30
1F	31
20	32
21	33
22	34
23	35
24	36
25	37
26	38
27	39
28	40
29	41
2A	42
2B	43
2C	44
2D	45
2E	46
2F	47
30	48
31	49
32	50
33	51
34	52
35	53
36	54
37	55
38	56
39	57
3A	58
3B	59
3C	60
3D	61
3E	62
3F	63
40	64
41	65
42	66
43	67
44	68
45	69
46	70
47	71
48	72
49	73
4A	74
4B	75
4C	76
4D	77
4E	78
4F	79
50	80
51	81
52	82
53	83
54	84
55	85

NOTES:
1. THE "ESTAT" ADDRESS IS COMPOSED OF THE 5/6 END EFFECTOR MICROMOTION STATUS INDICATIONS. THE 5/6 BITS ARE SHIFTED TWO PLACES TO THE RIGHT TO CLEAR BITS 7 AND 8 (SEE "ESTAB/1).
   THE BITS FOR PARITY AND SPARE ARE ZEROED.
2. THE END EFFECTOR BITE AND AUTO CAPTURE/RELEASE LOGIC ARE ZERO-FED FROM THE PAGE 0 ES STATUS TABLE ("ESTAB") BASED UPON THE "ESSTAT" ADDRESS, ESTAB IS LOADED INTO PAGE 7 DURING "PSTR".
3. A "1" IN THE 8 BITS COLUMN ("ESTAB#") INDICATES AN UNSOLICITED MSG COMMUNICATION. THIS WILL CAUSE A "1" IN THE 13 (+) ANNUNCIATOR AND WILL TERMINATE AN ES AUTO SEQUENCE.
4. A "1" IN THE 7 BITS COLUMN ("ESTAB#") CAUSES TERMINATION OF A NORMAL AUTO CAPTURE SEQUENCE.
5. A "1" IN THE CLEAR RELEASE MODE" COLUMN ("ESTAB#") CAUSES TERMINATION OF A NORMAL AUTO RELEASE SEQUENCE.
6. A "1" IN THE COMMAND COLUMN ("ESTAB#-5") CAUSES THE LISTED COMMAND TO BE ISSUED (4 ES AUTO MODE, 1 SHT AUTO MODE). THE COMMAND IS ISSUED ONCE WHEN THE BIT GOES FROM "0" TO "1" AND IS NOT REISSUED UNTIL THE BIT HAS CHANGED AGAIN IN ES MANUAL MODE. THE COMMAND COLUMN ARE NOT USED WHEN IN ES MANUAL MODE.
7. THE DEV/DC SELECT TABLE (NOT DETAILED HERE) IS LOADED INTO PAGES 6 AND 7 DURING "PSTR".

DATA WORD BIT CORRESPONDENCE

	SYNC	MCIU ADDRESS		MSB								LSB								SEV BITS	PARITY
DPC	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MCIU	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ENG, ABC, MADC		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	(B17 IN MADC STATUS WORD)	B17 (=FTSL#-1)

MCIU WORD NOMENCLATUREX

1ST LETTER	2ND LETTER	3RD LETTER	4TH LETTER	5TH LETTER
D = DPC	R = RECEIVE	380 = 1ST WORD IN THE 380-ES	A = 1.5 BITS	STBL, FTSL# - DPC TRANSMIT WORD WORD SL (LEAST SIGNIFICANT BITE
T = TRANSMIT (WITH RESPECT TO THE MCIU)			B = MS BITE	DRSAM-FTLAM# - DPC RECEIVE WORD (#, MOST SIGNIFICANT BITE

EXAMPLES:
STBL, FTSL# - DPC TRANSMIT WORD WORD SL (LEAST SIGNIFICANT BITE
DRSAM-FTLAM# - DPC RECEIVE WORD (#, MOST SIGNIFICANT BITE

GPC WORD NOMENCLATUREX

1ST LETTER	2ND LETTER	3RD LETTER	4TH LETTER	EXAMPLES
D = DPC (OPT/DUAL)	R = RECEIVE T = TRANSMIT (WITH RESPECT TO THE MCIU)	380 = 1ST WORD IN THE 380-ES MS = MS BITE	A = 1.5 BITS B = MS BITE	ATAL - ATTITUDE ACCELEROMETER WORD 1 (+N)

ATAL - ATTITUDE ACCELEROMETER WORD 1 (+N), LEAST SIGNIFICANT BITE

NOTES: 1. FOR DRAWING REFERENCES SEE TABLE (+1)

8 FW MEMORY 3

SIGNATURE	DATE
DSGN: Darrell G. Hunter	
pp: Mike Ellsperger	12/26/87
CHKR: Donald L. Kunz	
DSGN Manager: [signature]	12/26/87
Lead Engr: [signature]	12/26/87
Lead Engr: [signature]	12/26/87
DPM/Mgr/Engr: [signature]	12/26/87

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

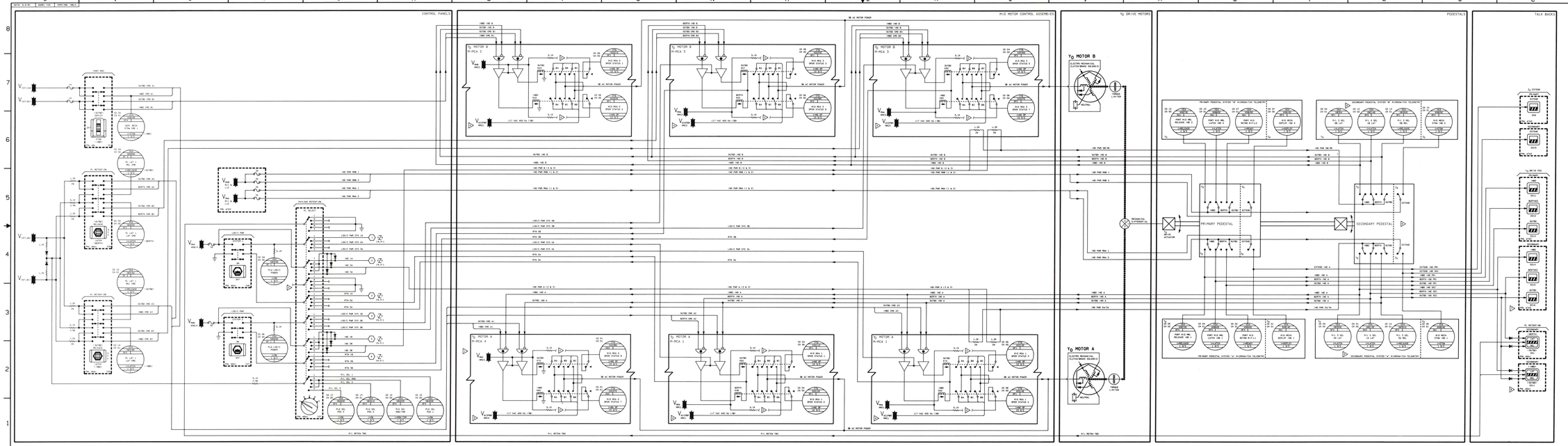
MCIU FIRMWARE MEMORY MAP

SIZE	CODE IDENT NO	REV
D	SPACE SHUTTLE	14.8

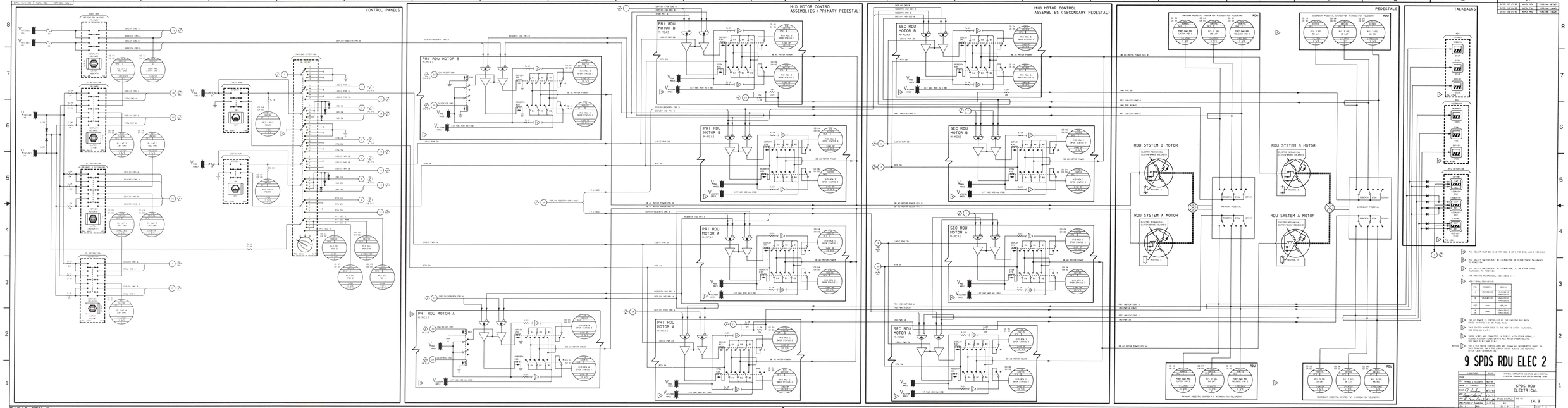
SCALE: NONE | SHEET 1 OF 1

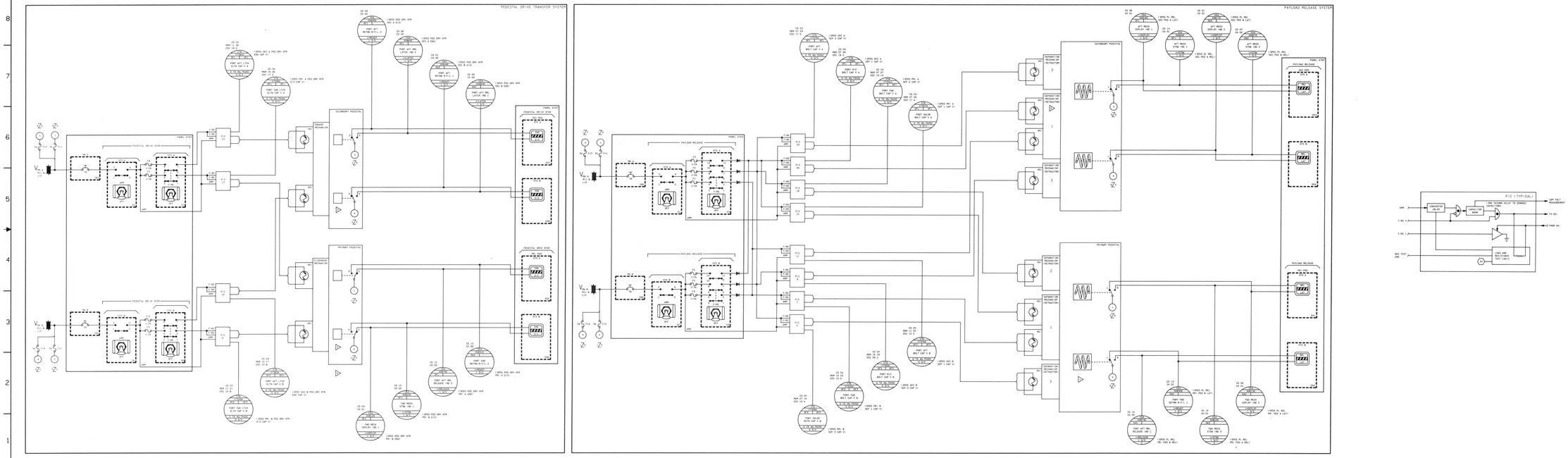
BASIC REV E

DATE: 01/05/88	NUMO: BOT	VERS:SMA SMP1.5
DATE: 01/12/88	NUMO: JMB	VERS:SMA SMA1.5
DATE: 04/08/91	NUMO: MCU	VERS:SMA SMA1.5


CONTROL PANEL
MID MOTOR CONTROL ASSEMBLIES
Y0 DRIVE MOTORS
PEDESTALS
TALK BACK
Y0 MOTOR B
Y0 MOTOR A
PRIMARY PEDESTAL
SECONDARY PEDESTAL
9 SPDS Y0 ELECTRICAL 1
SPDS Y0 ELECTRICAL
14.9

BASIC REV E


CONTROL PANELS
MID MOTOR CONTROL ASSEMBLIES (PRIMARY PEDESTAL)
MID MOTOR CONTROL ASSEMBLIES (SECONDARY PEDESTAL)
PEDESTALS
TALKBACKS
PRI RDU MOTOR B M-MCA3
PRI RDU MOTOR A M-MCA4
SEC RDU MOTOR B M-MCA5
SEC RDU MOTOR A M-MCA6
RDU SYSTEM B MOTOR
RDU SYSTEM A MOTOR
PRIMARY PEDESTAL
SECONDARY PEDESTAL
PRIMARY PEDESTAL SYSTEM "B" MICROSYNCTRA TELEMETRY
SECONDARY PEDESTAL SYSTEM "A" MICROSYNCTRA TELEMETRY
9 SPDS RDU ELEC 2
SPDS RDU ELECTRICAL
14.9
BASIC REV E



NOTES:

1. REFER TO THE SPDS MECHANICAL DRAWING 14.9-4.
2. NORMALLY THE PRIMARY PEDESTAL DR-IC IS ENGAGED AND SECONDARY PEDESTAL DR-IC IS DISENGAGED. DURING DR-IC TRANSFER, THE SECONDARY PEDESTAL DR-IC IS ENGAGED AND THE PRIMARY PEDESTAL DR-IC IS DISENGAGED SIMULTANEOUSLY.
3. WHEN PRIMARY PEDESTAL DR-IC IS DISENGAGED, SHAFT PRESSURE CLOSES THE N-CROSS-TONES.
4. WHEN SECONDARY PEDESTAL DR-IC IS ENGAGED, SHAFT PRESSURE CLOSES THE N-CROSS-TONES.

NOTES: 5. A SPRING CONNECTED TO THE ELECTRI-PIN PULLING THE N-CROSS-TONES TO THE RELEASE POSITION. REFER TO THE SPDS MECHANICAL DRAWING.

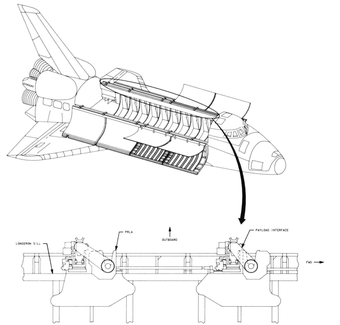
9 SPDS PYL REL SYS PED DR TRANS SYS 3

CONTRACT NO.		SHEET NO.
NOTHING APPROVED ON THIS SHEET SUPERSEDES THE CONTRACT SPECIFICATIONS.		
ROCKWELL INTERNATIONAL		
SPACE SHUTTLE		SPDS PAYLOAD RELEASE SYSTEM AND PEDESTAL DRIVE TRANSFER SYSTEM
SPACE SHUTTLE		DWG NO. 14,9
SIZE	CODE ID NO.	

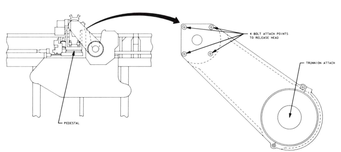
BASIC REV E

DATA ON FILE NAMED MSO VERSION ONLY

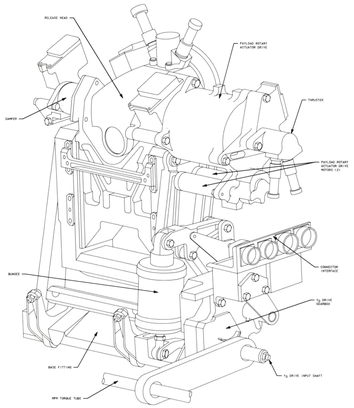
PEDESTAL CONFIGURATION



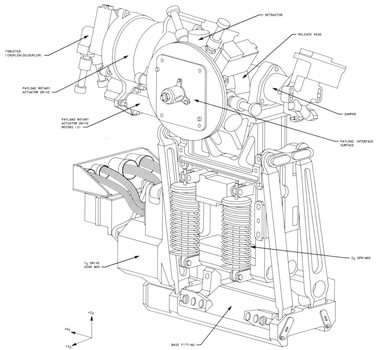
SPDS ORBITER INTERFACE - PORT SIDE



PAYLOAD INTERFACE PLATE

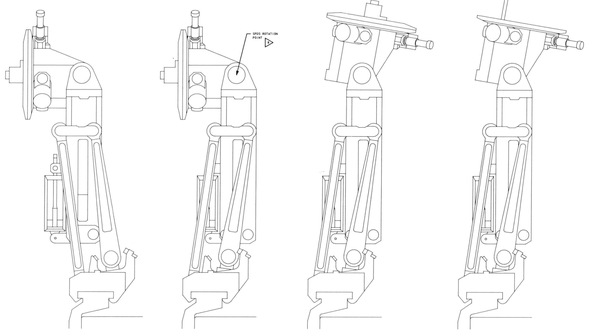


OUTBOARD FACE

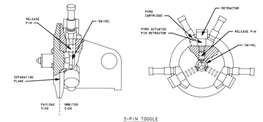


INBOARD FACE

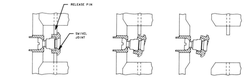
SPDS OPERATION



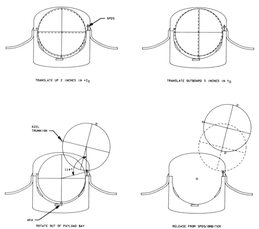
SPDS PAYLOAD DEPLOYMENT AND RELEASE MOTION



3-PIN TOGGLE
PAYLOAD RELEASE MECHANISM



PAYLOAD RELEASE SEQUENCE



PAYLOAD DEPLOYMENT SEQUENCE

NOTES:

1. FOR ORBITER REFERENCES, SEE TABLE 14-1

2. THE SPDS ROTATION PIVOT IS ALWAYS the SY DIR

3. UNLOADED SPDS MOTOR RUN TIMES

FROM STOWED TO 114° 180 RPM 60 SECS (2 MOTORS)
300 RPM 30 SECS (2 MOTORS)

Y_{PL} DRIVE FROM TO 3" 48 RPM 60 SECS (2 MOTORS)
FROM 3" TO 5" 48 RPM 30 SECS (2 MOTORS)
FROM REPLAY TO ROTATE 80 RPM 60 SECS (2 MOTORS)
FROM ROTATE TO STOW 160 RPM 60 SECS (2 MOTORS)
44 RPM 60 SECS (2 MOTORS)

4. THE SECONDARY PEDESTAL +Z FACE TO MOVE ON THE Y_{PL} TRACKS TO COMPENSATE FOR THERMAL EXPANSION/CONTRACTION

5. THE SPDS PEDESTALS CAN BE POSITIONED IN ANY OF THE 5 BAYS OF THE PAYLOAD BAY TO ACCOMMODATE PAYLOAD CONFIGURATION

6. RELEASE 3 CAPTIVE PINS (MUST HAVE ATLEAST 2 PINS ENGAGED) AT ONE END, PULL 2 PINS SIMULTANEOUSLY, ONLY ONE PIN NEED BE RETRACTED TO RELEASE PAYLOAD. THE PAYLOAD IS LIFTED BY THE PAYLOAD/ORBITER ATTACHMENTS AT FULL "UP" ELECTRO-PISTON TRAVEL (~11.4 INCHES) BEFORE THE PAYLOAD RELEASE PINS ARE RETRACTED. THIS ENSURES THAT THE INTERFACE PLATES TO PERMANENTLY ATTACHED TO THE PAYLOAD.

7. THE PAYLOAD ROTARY DRIVE ACTUATOR ROTATES THE RELEASE HEAD/PAYLOAD ASSEMBLY 180 DEGREES FROM THE LAUNCH TRUNNION DOWNWARD TO ZENITH, AND FROM THE STOWED POSITION BY 114 DEGREES TO REPLAY.

8. THE PAYLOAD ROTATION PROVIDES 3 INCH OUTBOARD MOTION OF PAYLOAD, AS WELL AS PERMITS RADIATORS, +Y LATCH THE MPM ACTUATOR AND DRIVE SHAFT AS SHOWN, THE Z AXIS TO BE PARALLEL TO THE SPDS ROTATION PLANE.

NOTES 9. THE CENTER OF GRAVITY OF Y_{PL} AND MPM TRUNNION IS 2 INCHES BETWEEN ASSEMBLY OF RELEASE OF THE ASSEMBLY BETWEEN THE LATCHES

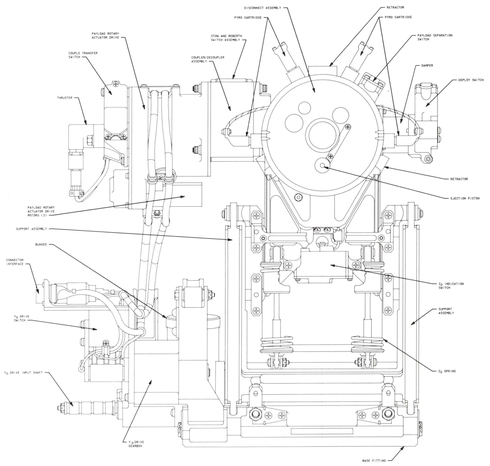
9 SPDS MECH O/V 4

SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION GEORGE C. MARSHALL SPACE FLIGHT CENTER
DRAW N.A.TOOLEY JR.	5/11/77	
CHECK N.A. TOOLEY	5/11/77	
CHECK K.E.Brady	5/11/77	STABILIZED PAYLOAD DEPLOYMENT SYSTEM MECHANICAL OVERVIEW
APP. J.C. Stokes	5/11/77	
APP. [illegible]	5/11/77	SIZE CODE IDENT NO. 14.9
APP. [illegible]	5/11/77	SCALE NONE SHEET 9 OF 9
TM	DATE	5/11/77

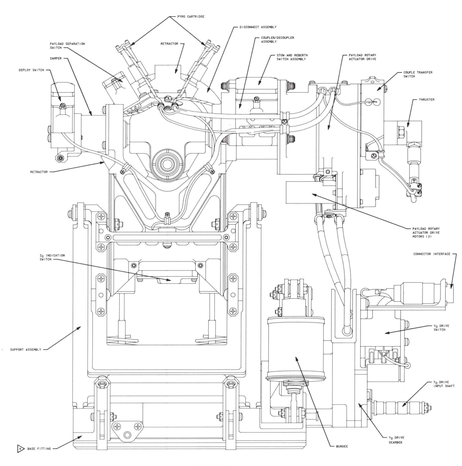
DATA ON FILE NAMED MSO VERSION ONLY
DATA 5/11/77 NAMED ATP VERSION ONLY
DATA ON FILE NAMED MSO VERSION ONLY

DATE: 06/17/92	NAME: MEL	SIZE/DWG: SMALL

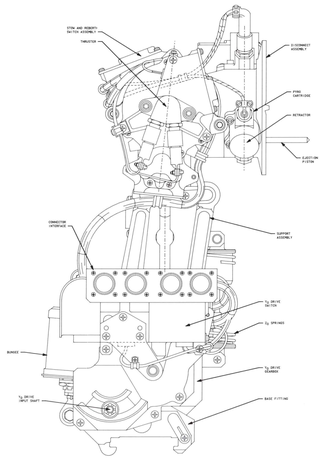
PEDESTAL DESIGN



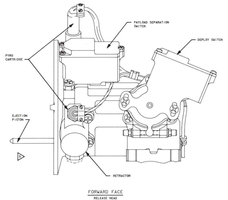
INBOARD FACE



OUTBOARD FACE

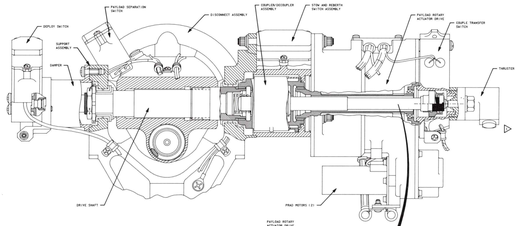


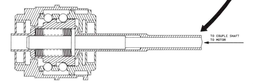
AFT FACE



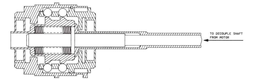
FORWARD FACE
RELEASE MODE

ROTARY DRIVE TRANSFER SYSTEM





COUPLER ASSEMBLY
SECONDARY PEDESTAL



DECOUPLER ASSEMBLY
PRIMARY PEDESTAL

NOTES:

1. FOR DRAWING REFERENCES, SEE TABLE 14.1

2. RELEASE IS ATTEMPTED ONCE WITH A MAIN STANDARD INITIATOR FIRE AND FAIL 2 FIRE SIMULTANEOUSLY ONLY ONE FIRE PER INITIATOR. IF THE PAYLOAD IS NOT RELEASED, IT MUST BE RETRACTED BY THE PAYLOAD EJECTION SPRING/EJECTION PISTON. THE EJECTION PISTON MUST BE FULLY EXTENDED BEFORE THE PAYLOAD RELEASE MECHANISM IS RESET. THE EJECTION PISTON MUST BE REPLACED IF IT PERMANENTLY EXTENDED TO THE TRAVEL.

3. THE BASE PLATE/HUB CLAMPS INTO THE DEPLOY BEAM IN THE SHUTTLE. THE PAYLOAD ROTARY ACTUATOR DRIVE AND TWO 2G LOCATOR TURNBUCKLES TIE THIS END OUT.

4. FOR THE SECONDARY PEDESTAL, THE COUPLER IS NORMALLY DRIVEN BY THE PRAD MOTORS. IF THE PRAD MOTORS FAIL, IT IS POSSIBLE IF THE TUMBLER IS FIXED, IT DISABLES THE PAYLOAD ROTARY ACTUATOR DRIVE MOTORS (2) AND THE 2G DRIVE SHAFT.

5. FOR THE PRIMARY PEDESTAL, THE DECOUPLER IS NORMALLY DRIVEN BY THE PAYLOAD ROTARY ACTUATOR DRIVE MOTORS (2). IF THE TUMBLER IS FIXED, IT DISABLES THE PAYLOAD ROTARY ACTUATOR DRIVE MOTORS (2).

NOTES: 6. THE TUMBLER IS A PASSIVE DEVICE THAT ACTIVATES DURING TRANSFER OF THE PAYLOAD ROTARY ACTUATOR DRIVE FROM THE COUPLER TO THE DECOUPLER. IF THE TUMBLER FAILS TO ACTIVATE PROPERLY, IT IS POSSIBLE ONLY IF THE PRIMARY PAYLOAD ROTARY ACTUATOR DRIVE FAILS. THIS IS A SWITCH/MECHANICAL OPERATION. IF THE TUMBLER FAILS, IT DISABLES AND THE SECONDARY IS COUPLED SIMULTANEOUSLY.

9 SPDS MECH O/V 5

SIGNATURE		DATE
DOM. S.L.TUSSEY JR.		06/16/92
CM		
CHIEF M.S. STAHLY		
DEPT. Ed Buckley		6/16/92
DEPT. Richard Lloyd		6/16/92
DEPUTY OF PROGRAM		

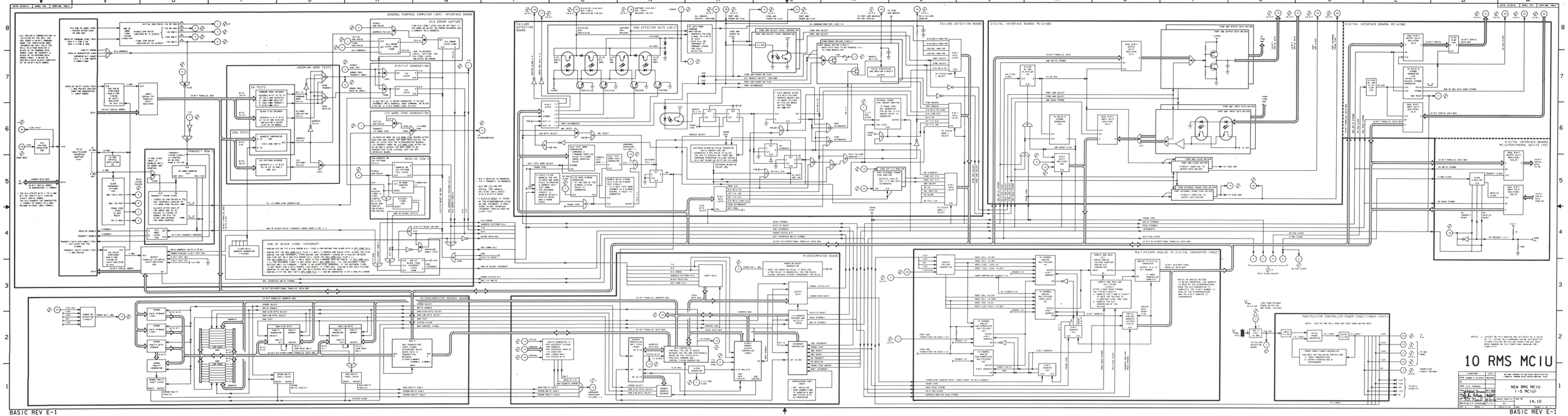
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER

STABILIZED PAYLOAD DEPLOYMENT SYSTEM MECHANICAL OVERVIEW

CODE	DWG NO	REV
10101	14.9	

SCALE: NONE | SHEET 1 OF 1

BASIC REV E


GENERAL PURPOSE COMPUTER (GPC) INTERFACE BOARD
MIA ERROR CAPTURE
INCOMING WORD TESTS
CW TESTS
RIV/TIP GENERATION
I/O WORD SYNC GENERATION
TRANSMIT REW
RECEIVE CW'S
END OF BLOCK (EOB) INTERRUPT
FAILURE DETECTION BOARD
END EFFECTOR AUTO LOGIC
DIGITAL INTERFACE BOARD MCIU/ABE
DIGITAL INTERFACE BOARD MCIU/D&C
DIGITAL INTERFACE BOARD MCIU/PERIPHERAL DEVICE (PDI)
MICROCOMPUTER BOARD
MICROCOMPUTER MEMORY BOARD
MULTIPLEXER ANALOG TO DIGITAL CONVERTER (MADC)
MANIPULATOR CONTROLLER POWER CONDITIONER (MCPC)
10 RMS MCIU
NEW RMS MCIU
(-5 MCIU)
14.10
BASIC REV E-1

DATA: R/D/S/T/U | NAME: PDV | VERSION: SPOLS

11 NEW MCIU F/W OV 1

BASIC REV E-1

INTRODUCTION

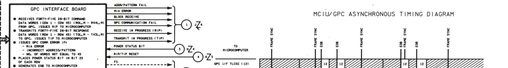
THE MCIU FLIGHT SOFTWARE IS PROGRAMMED IN THE HIGH-LEVEL LANGUAGE CORAL 66 AND RUNS UNDER THE CONTROL OF A REAL-TIME EXECUTIVE. THIS IS SUPPORTED BY HARDWARE TO EXPRESS EFFICIENCY. IN ALL THE MCIU FIRMWARE IS A MICROPROGRAM DEVICE IS PERMANENTLY STORED. IN ADDITION TO THE EXECUTIVE AND THE CORAL 66 RUN-TIME SYSTEM, THE INTERFACE BETWEEN PLANTS AND THE GPC SOFTWARE USES THE FOLLOWING:

- THE GPC INTERFACE BOARD (GIB) WHICH PROVIDES THE MCIU WITH A SERIAL DATA LINK TO/FROM EACH GPC
- THE MCIU'S BLANKCOM 'I/O' SYSTEM ON THE MA HARDWARE CAUSED THE MCIU TO BE SET
- THE MCIU'S INITIALISATION MODE (MIM) AFTER COMING UP TO PHASE

GPC INTERFACE BOARD

- 2 BIT SERIAL DATA BUS
- RECEIVES PARITY-FIVE OR 26-BIT COMMAND DATA WORDS (SDW = SDW-MSG/DATA + MSG_ID)
- TRANSMITS PARITY-FIVE 26-BIT RESPONSE DATA WORDS (SDW = SDW-MSG/DATA + MSG_ID)
- TRANSMITS PARITY-FIVE 26-BIT RESPONSE DATA WORDS (SDW = SDW-MSG/DATA + MSG_ID) TO GPC. CHOOSES 1 OF 3 TO INCORPORATE
- MCIU SOFTWARE ERROR (SWE)
- INCORRECT SEQUENCE/TIMING
- MCIU HARDWARE FAILURE (HWF)
- BLOCKS POWER STATUS BIT (PSB) TO BIT 25 OF EACH SDW RECEIVED FROM GPC
- GENERATES SDW TO MICROCOMPUTER
- GENERATES ITS TO MICROCOMPUTER

MCIU/GPC ASYNCHRONOUS TIMING DIAGRAM



FRAME SYNC INTERRUPT 1 GENERATED EVERY 40 MILLISECONDS BY THE MCIU SYSTEM CLOCK IN THE GPC SYNCHRONISES BOARD, CAUSES THE SYNCHRONOUS TLCSC TO START PROCESSING, AS LONG AS THE GPC I/P TLCSC IS NOT PROCESSING.

END OF BLOCK CODE INTERRUPT - GENERATED IMMEDIATELY FOLLOWING THE SUCCESSFUL EXCHANGE OF DATA BETWEEN THE GPC AND THE MCIU.

GPC/MCIU DATA TRANSFER - THE GPC LOADS A TRANSMIT COMMAND WORD (SDW) TO THE MCIU TO TRANSMIT THE 40 RESPONSE DATA WORDS (SDW = SDW-MSG/DATA + MSG_ID) TO THE GPC. THE MCIU RECEIVES THE SDW AND, AT THE END OF THE NEXT I/P TLCSC AFTER THE 40TH MSG, AN SDW INTERRUPT IS CAUSED BY THE MCIU'S GPC INTERFACE BOARD. THE RECEIVE PROCESS IS SIMILAR EXCEPT THAT THE RESPONSE IN PROCESS (R/P) FLAG IS SET WHILE THE MCIU IS RECEIVING 40 COMMAND DATA WORDS FROM THE GPC.

MICROCOMPUTER MEMORY BOARD

ROM

SYSTEMS TLCSC (11) ★ THE SYSTEMS TLCSC CONTROLS THE INTERFACE BETWEEN N/W AND S/W

POWER - ON INIT LLCSC (111)
- INITIATED BY POWER - ON RESET
- CLEARS MEMORY AND INITIALISES EQUIPMENT FOR THE OPERATIONAL M/W
- INITIALISES PROCESSOR MODULE
- INITIALISES RAM
- INITIATES NORMAL PROCESSING VIA MAIN/BACKGROUND LLCSC
- EXITS TO M/W MAINTENANCE LLCSC

MAIN/BACKGROUND LLCSC (112)
- LOOPS CONTINUALLY THROUGH A LIST OF SUBROUTINES CALLED TASKS, UNLESS NOT TOLD OTHERWISE BY AN INTERRUPT
- DOES WORK OF TASKS THERE ARE ACTIVE
- TASKS INCLUDE:
  - ★★ BACKGROUND TEST OF RAM
  - ★★ BACKGROUND TEST OF ROM
  - ★★ ANY INTERRUPT, TRANSFERS CONTROL TO INTERRUPT PROCESSING LLCSC

INTERRUPT PROCESSING LLCSC (113)
- ★★ THE MCIU SYS I/F OR INTERRUPT DRIVEN ROUTINE OF THE PROCESSOR MODULE
- ★★ THE MCIU SYS I/F OR INTERRUPT DRIVEN ROUTINE OF THE PERIPHERAL DEVICE I/F
- RETURNS TO THE APPROPRIATE INTERRUPT SERVICE ROUTINE IN THE MAIN/BACKGROUND LLCSC OR INTERRUPT CONTROLLER/EXECUTIVE TABLE WHEN ANY OF THE INTERRUPTS ARE CLEARED
- WHEN THE LIH IS COMPLETED, RETURNS TO MAIN/BACKGROUND LLCSC

NPI PROCESSING LLCSC (115)
- ★★ PROCESS THE NEW - INVALIDATE INTERRUPT (NIN) ★★ PROCESS THE NEW - DATA VALID INTERRUPT (NDI)
- IF SET AND NPI IS GENERATED RECIPTICALLY (SEE THE NPI I/F TLCSC)
- IF SET-INDICATORS BEFORE REAL AND TEST MAY BE

I/O PROCESSING LLCSC (114)
- PROVIDES FLCSC ACCESS TO THE I/O PORTS OF THE MCIU
- CALLED BY OTHER PROCESSING MODULES TO READ FROM OR WRITE TO BOARDS ON DEVICE(S)

COPROCESSOR I/F LLCSC (116)
- DETECTS PRESENCE OF A COPROCESSOR
- ★★ PROVIDES A COMMON SET OF INSTRUCTIONS FOR COPROCESSOR

UTILITY FUNCTION LLCSC (117)
- PROVIDES A COMMON SET OF ROUTINES TO PERFORM UTILITY FUNCTIONS, SUCH AS BIT MANIPULATION, ARITHMETIC, OTHER MISC FUNCTIONS

WATCHDOG TIMER/PROCESSOR FAILURE TLCSC (13)
- SERVICES AND MONITORS THE OPERATION OF THE WATCHDOG TIMER CIRCUIT
- MONITORS THE OPERATION OF THE PROCESSOR
  - ★★ CHECKS THE STATUS OF THE PROCESSOR SELF-TEST FAIL (SFTF) BIT
  - ★★ CHECKS THE STATUS OF THE MPU BIT MONITOR/DATA TEST
  - ★★ CHECKS THE STATUS OF THE FAULT OF PROCESSING (TO SYNCHRONOUS TLCSC)

SYNCHRONOUS PROCESSING TLCSC (13)
- PROCESSES THE FRAME SYNC INTERRUPT (FSI)
- ★★ PROCESSES THE PROCESSOR MODULE FAIL SIGNAL (★★ ENGAGING/DISENGAGE THE FS SIGNALS WITH ANY TRANSMISSIONS)
- ★★ ATTEMPTS ALARMS AND MODE SIGNAL

ABC/DBC I/F TLCSC (14)
- HANDLES TRANSFER OF DATA BETWEEN MCIU/ABC/DBC
- ★★ CONTROLS DATA FLOW PROCESSING BY OTHER TLCSC'S

CIRCUIT VERIFICATION TLCSC (18)
- ★★ WRITES DATA AND STATUS FOR THE OPERATION OF THE DRIVERS
- ★★ ★★ MCIU FAILURE WARNING CIRCUITRY
- ★★ FS FAILURE DETECTOR CIRCUIT

PERIPHERAL DEVICE I/F TLCSC (151)
- CALLED ONCE PER FS CYCLE
- ★★ ★★ PERIPHERAL PRESENT STATUS FROM THE PERIPHERAL DEVICE
- ★★ ★★ TRANSFER THE TRANSMIT REQUEST AND RECEIVE REQUEST STATUS FOR ★★ AND ENABLES STRUCTURAL REPLY ENABLED

END EFFECTOR I/F TLCSC (17)
- CONTROLS AND MONITORS THE AUTO CAPTURE/RELEASE AND DISCRETE/PROCESSOR SIGNAL LINES TO THE END EFFECTOR
- ★★ ★★ STATUS FOR THE ★★ CONTROL
- ★★ ★★ STATUS FOR ★★
- ★★ ★★ STATUS FOR ★★

ANALOG I/F TLCSC (16)
- ★★ PROCESSES THE DIGITAL INPUT PROVIDED BY THE MADE

PROCESSOR MODULE TESTING TLCSC (110)
- ★★ TESTS THE OPERATION OF THE CPU, MDP, AND RAM PRIORITY COMPONENTS OF THE PROCESSOR MODULE

GPC I/F TLCSC (12)
- ★★ ★★ GPC I/F TLCSC IS AN INTERRUPT SERVICE ROUTINE THAT SERVICES THE SDW OF BLOCK
- ★★ ★★ ★★

11 NEW MCIU DET F/W 2

NEW MCIU DETAILED FIRMWARE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS		
	DRAWN	
	CHECK	
	DATE	
SPACE SHUTTLE PROGRAM	APP	
ALL FLIGHTS	DRAW NO.	14.11
	SHEET	1 OF 1

BASIC REV E-1

BASIC REV E-1

SYSTEM TLCSC (11)

PROCESSOR EXECUTES THE POWER – ON INITIALIZATION ROUTINE LLCSC (1111)

MAIN/BACKGROUND PROCESSING LLCSC (1122)

MAIN/BACKGROUND PROCESSING LLCSC (1122)

INTERRUPT PROCESSING LLCSC (1123)

MPI PROCESSING LLCSC (1155)

INPUT/OUTPUT PROCESSING LLCSC (1141)

COPROCESSOR INTERFACE LLCSC (1156)

UTILITY FUNCTIONS LLCSC (1117)

CIRCUIT VERIFICATION TLCSC (18)

BRAKE CIRCUIT TEST FUNCTION LLCSC (1811)

BRAKE CIRCUIT TEST FUNCTION LLCSC (1801)

BRAKE CIRCUIT PULSE TEST FUNCTION LLCSC (1851)

FS ABSENT INTERRUPT SERVICE ROUTINE LLCSC (1841)

FS TEST ROUTINE LLCSC (1831)

FS TEST ROUTINE LLCSC (1821)

MCIU FAILURE WARNING TEST ROUTINE LLCSC (1802)

MCIU FAILURE WARNING TEST ROUTINE LLCSC (1822)

MCIU FAILURE WARNING PULSE FUNCTION (1861)

PERIPHERAL DEVICE ENABLE LLCSC (1151)

TRANSMIT REQUEST INTERRUPT SERVICE ROUTINE (1521)

RECEIVE REQUEST INTERRUPT SERVICE ROUTINE (1531)

GPC I/F TLCSC (123)

GPC I/F INTERRUPT SERVICE ROUTINE LLCSC (1231)

GPC I/F INTERRUPT SERVICE ROUTINE LLCSC (1251)

DMAC UPDATE UNIT (1251)

CDW BUFFER COPY/CHECKSUM UNIT (1221)

SYNCHRONOUS PROCESSING TLCSC (13)

FRAME SYNC INTERRUPT SERVICE ROUTINE LLCSC (1311)

GPC RESPONSE DATA UPDATE UNIT (1331)

GPC RESPONSE DATA UPDATE UNIT (1351)

GPC RCN BUFFER COPY UNIT (1341)

MODE PROCESSING UNIT (1351)

ALARM SIGNALS UPDATE ROUTINE (1361)

GPC COMMAND DATA ACCEPTANCE UNIT (1321)

ALARM SIGNALS UPDATE ROUTINE (1361)

ABE/D&C LLCSC 14

D&C READY INTERRUPT SERVICE ROUTINE LLCSC (1411)

ABE READY INTERRUPT SERVICE ROUTINE LLCSC (1431)

ABE READY INTERRUPT SERVICE ROUTINE LLCSC (1412)

D&C OUTPUT ROUTINE UNIT LLCSC (1431)

ABE BITE PROCESSING UNIT LLCSC (1421)

D&C READY INTERRUPT SERVICE ROUTINE LLCSC (1441)

DATE: 8/30/91 | NAME: TSH | VERSION: 1MA.5

DATE: 09/23/91 | NAME: LAM | VERSION: BPL1.0
DATE: 09/30/91 | NAME: PSD | VERSION: BPL1.4
DATE: 8/30/91 | NAME: TSH | VERSION: 1MA.5

14.11-0

END EFFECTOR INTERFACE TLCSC (17)

- CONTROLS AND MONITORS THE AUTO GRIPPER/RELEASE AND RIGID/COMPLIANCE SIGNAL LINES TO THE RMS PANEL
- THE FUNCTIONS OF THIS COMPONENT INCLUDE:
  - EE COMMAND INPUT
  - EE COMMAND OUTPUT MONITORING
  - EE STATUS FLAG BITS
  - EEIOU BITS

EE PROCESSING LLCSC (171)

- CHECKS EE AUTO FREE SWITCH STATUS (1MA BIT 10) EXTRACTED FROM 1MA INPUT DATA STREAM AND ASSIGNS VALUE TO EE_MODE FOR THE ONE READ (SR 1144)
- IF EE_MODE BIT 10 = 0 (IT NOT IN AUTO MODE), THEN
  - ---- EE CAPTURE STATUS = FALSE
  - ---- EE CAPTURE COUNTER RESET TO -3 (3m - FILTER RESET)
  - ---- EE RELEASE STATUS = FALSE
  - ---- EE RELEASE COUNTER RESET TO -3
- ELSE, AUTO MODE; CAPTURE OVERRIDDED RELEASE
  - ---- IF EE CAPTURE STATUS = TRUE, THEN INCREMENTS EE CAPTURE ONE COUNTER (EE_CAPT_CTR)
  - ELSE, RESETS THE EE CAPT CTR TO -3
  - ---- IF EE CAPT CTR = 0 (3 CYCLES OF 1 s), THEN INCREMENTS EE RELEASE ONE COUNTER
  - ELSE, RESETS THE EE RLSE_CTR TO -3
- DETERMINES EE RELEASE STATUS
  - ---- IF EE_CAPT_CTR = 0, THEN
  - ---- EE CAPTURE STATUS = TRUE
  - ---- EE RELEASE STATUS = FALSE
  - ELSE IF EE_RLSE_CTR = 0, THEN
  - ---- EE CAPTURE STATUS = FALSE
  - ---- EE RELEASE STATUS = TRUE
- ENDIF
- ENDIF EE CONTROL OUTPUT (LSC_CMD) ASSIGNED 9 th EE STATUS FLAG
- EE STATUS FLAGS ASSIGNED TABLE T.TABLE 14.11-91
- EE STATUS FLAGS BITS
  - CHECKS FOR 1MA(10) FLAG (SR 1144) ONCE / MAS, THEN
  - IF EE_MODE = 1 (EE IN AUTO MODE), THEN
  - ---- SETS EE FAIL FLAG (BOR BIT 11)
  - ---- INCREMENTS THE EE FAIL FLAG COUNTER (EE_FAIL_FLAG)
  - ---- SETS EE STATUS FLAG BIT 9
  - ---- SETS CHECK CNT = TRUE
  - ---- SETS MSN 45 BIT 05 = 1
  - ---- SETS MSN 45 BIT 15 = MASTER ALARM = TRUE
  - ELSE, RESETS THE EE_FAIL_FLAG COUNTER TO -3
- EEIOU BIT 10 (EEIOU_BIT)
  - IF EEIOU BIT 0 (WORDTOO IN CLOCK 141) AND NOT IN IDLE MODE AND ONE PHONEPED = 1, THEN
  - ---- SETS EEIOU BIT 17 = 1 AND INCREMENTS THE EEIOU_BITE_FAIL COUNTER
  - IF THE EEIOU_BITE_FAIL = 4 THEN
  - ---- CHECK CNT = TRUE
  - ---- SETS MSN 47 BIT 14 = 0, THEN SETS MASTER ALARM = TRUE
- ELSE, RESETS THE EEIOU_BITE_FAIL COUNTER TO -3
- EE CONTROL LOSS EE DATA TABLE T.A.13-CAPTURE
- IF CAPTURE MODE, BIT = 1, THEN CAPTURE MODE STATUS = FALSE
- IF RELEASE CHANEL BIT = 1, THEN RELEASE MODE STATUS = FALSE
- IF CAPTURE MODE STATUS = 1, THEN OUTPUTS CAPTURE MODE
- IF RELEASE MODE STATUS = 1, THEN OUTPUTS RELEASE MODE
- IF CAPTURE MODE STATUS = 0, THEN
- EE COMMAND OUTPUT FLAGS (SPC-81/EE-81/EE-91/EE-A1/EE-B1)
  - IN AUTO MODE, MSN 45 BITS 9-12 CONTAINS THE STATUS OF THE AUTO CAPTURE AND AUTO RELEASE CONTROL LOOPS (EE_CAPTURE, EE_RELEASE)
  - IN MANUAL MODE, MSN 45 BITS 9-12 CONTAIN THE EE INPUT COMMAND BITS FROM THE ONE / SEC 1BM BITS 5A,6A,15,17)
    - IF EE AUTO MODE SELECT (SPC 81 BIT 10) NOT EQUAL TO EE THEN
    - ---- SETS EE CAPTURE ONE OUTPUT STATUS (MSN 45 BIT 9)
    - ---- EE_EXPECTED VALUE OUTPUT TO BE READ FROM THE COMMAND OUTPUT MONITOR
    - ELSE IF EE RELEASE SELECT (SPC 81 BIT 9) = 0, THEN
    - ---- IF AUTO RELEASE OUTPUT STATUS (MSN 45 BIT 10) = 1 THEN SETS EXPECTED VALUE OUTPUT TO BE READ FROM THE EE COMMAND OUTPUT MONITOR
    - ---- SETS EE AUTO RELEASE OUTPUT = 1, THEN
    - ---- SETS EE AUTO RELEASE OUTPUT STATUS (MSN 45 BIT 10) = 1
    - ELSE, IF, AUTO RELEASE OUTPUT = 0, THEN
    - ---- SETS EE AUTO RELEASE OUTPUT STATUS (MSN 45 BIT 10) = 0
    - ELSE, EE MODE MANUAL OR OFF (SPC'S COMMAND INPUTS FROM 1MA (SR 1144) TO MSN 45 BITS 9-12
    - ---- EE_CMD_BIT = EE_CMD_BIT (EE_CMD_BIT BITS 5,6,15,17) RESP
    - CALLED MODULES
      - ● T.TABLE (TABLE)
      - ● I/O WRITE - WITH INVERSION

EE MONITOR BITE FUNCTION (172)

- CALLED ONCE PER CYCLE BY MAIN/BACKGROUND LLCSC TO READ EE MONITOR INPUT AND COMPARES IT WITH THE EXPECTED VALUE GENERATED BY THE EE PROCESSING LLCSC
- THE FUNCTIONS OF THIS COMPONENT INCLUDED
  - ONE (1TS, 1A,1MA)
- ONE (1) EE BITE INPUT (MSB/1TS0) BY MA WATCHDOG TIMER MCIU F/W LATCH
- ONE (1) EE BITE INPUT (LSB/1TS1) DIRECTLY FROM EE
- IF ONE EXPECTED 1S NOT EQUAL TO THE INPUT READ FROM THE EE ONE (1TS0, 1TS1)
  - SETS MSN 45 BIT 15 = 1 (EE ONE)
  - IF EE MON FAIL COUNTER = 4, THEN MASTER ALARM = TRUE
- ELSE, RESETS THE EE MON FAIL CTR TO -3

CALLED MODULES
- ● I/O READ - W/ INVERSION

ANALOG INTERFACE TLCSC (16)

- PROCESSES THE DIGITAL INPUT PROVIDED BY THE MADC
- MADC ACCEPTS ANALOG INPUTS FROM TWO (6) CHANNEL TIME DIVISION MULTIPLEXED (TDM) ANALOG-TO-DIGITAL CONVERTERS
  - SEQUENTIALLY SAMPLES AND CONVERTS THESE SIGNALS INTO BINARY CODED OUTPUT INCLUDING:
    - 4 ANALOG MULTIPLEXER CONTROLLER CHANNELS
    - 4 DAC-GENERATED MULTIPLEXER
    - 4 SUPPLY VOLTAGES
    - 2 THERMISTOR AND THERMISTOR INPUT CHANNELS
- THE FUNCTIONS OF THIS COMPONENT INCLUDED
  - ANALOG INPUT PROCESSING
  - MADC CONTROLLER CHANNELS BITS
  - MADC CONTROLLER CHANNELS BITS
  - MADC/MDPS BITS
  - THERMISTOR INPUT/COMMAND BITS
- AUTOMATED DATA TO TRANSMITTED TO THE GPC

ANALOG PROCESSING LLCSC (161)

- CALLED ONCE PER 80 CYCLE
- SAMPLES ALL ANALOG CHANNELS IN SEQUENCE FROM THE MADC U/F
- ALL ANALOG CHANNELS ARE CONVERTED FROM ANALOG TO DIGITAL
- 12-BIT CONVERSION FUNCTION TO CONVERT TO 8-BIT FORMAT
- IF 2 MUX ADDRESS FAILURE IS RETURNED, THEN MADC FAILURE = TRUE
- CHECKS FOR FAILURES IN EACH OF THE 4 MUX'S AS FOLLOWS
  - PROCESSES 8-BIT ANALOG CHANNELS
  - STORES SPARES 1 AND 2 IN GPC MSM P3 MSB,LSB
  - 1, 2, 3, 4, 5, 6, 7 CHANNEL MUX FAILURE
    - COMPARES MUX 8BIT DATA/STATE CHANNELS FOR SAME CONTROLLER MICROPROCESSOR FOR EACH MUX'S (1, 2, 3, 4, 5, 6)
    - IF ANY CHANNEL DATA/STATE DOES NOT MATCH, THEN SETS MUX BIT TO 1
    - THEN, INCREMENTS THAT SAME CONTROLLER'S MUX FAILURE COUNTER
    - IF MUX FAILURE COUNTER = 4, THEN
    - CONVERTS MUX 8BIT DATA/STATE CHANNELS FOR SAME CONTROLLER MICROPROCESSOR FOR EACH MUX'S (1, 2, 3, 4, 5, 6)
    - STORES CHANNEL VALUE IN GPC MSM P3,P4,P5,P6 (1, 2, 3, 4, 5, 6) MUX BIT 0 MSB - P 3 GPC MSM P3 LSB - P 4 GPC MSM P4 MSB - P 4 GPC MSM P4 LSB - P5 GPC MSM P5 MSB - P 5 GPC MSM P5 LSB - P6 GPC MSM P6 MSB - P 6 GPC MSM P6 LSB
    - 8, 9, 10, 11, 12, 13, 14, 15, 16 MUX FAILURE
    - IF THE ABSOLUTE VALUE OF (1553_TAS2 - 1553_TAS1) > TOLERANCE
    - IF (MADC/SYSTEMS OUT OF TOLERANCE) THEN
    - ---- MADC_FAILURE = TRUE
    - IF (MDPS/SYSTEMS OUT OF TOLERANCE) THEN
    - ---- MDPS_FAILURE = TRUE
  - 24 THERMISTOR CHANNEL PROCESSING
    - UPDATES THERMISTOR HISTORY BUFFER
    - CONVERTS THERMISTOR VALUE TO DEG F (TEMP)
    - STORES THERMISTOR VALUE IN GPC MSM P7 MSB
    - STORES THERMISTOR IDENTIFIER IN GPC MSM P7 LSB
    - IF THERMISTOR TEMP > HI LIMIT, THEN
    - ---- IF (THERMISTOR CONDITIONING VOLTAGE IS OUT OF TOLERANCE) THEN, SETS THERM_FAILURE = TRUE
    - ---- ELSE, RESETS THERM_FAILURE
    - UPDATES MADC ADDRESS FIELDS
- MADC FAILURE ANNUNCIATION
  - IF MADC_FAILURE = TRUE
  - THEN, SETS BOR BIT 12 = 1 AND INCREMENTS MADC FAIL COUNTER
    - IF MADC FAIL COUNTER = 2 THEN
    - ---- MADC FAILURE = TRUE
    - ---- SETS MADC FAIL WARN = TRUE
    - ELSE, MADC FAIL COUNTER = 0, THEN SETS MSTR ALARM
  - ELSE, RESET MADC FAIL COUNTER TO -1
- MDPS FAILURE ANNUNCIATION
  - IF MDPS_FAILURE = TRUE
  - THEN, SETS BOR BIT 13 = 1 AND INCREMENT MDPS FAIL COUNTER
    - IF MDPS FAIL COUNTER = 2 THEN
    - ---- SETS AUTOMANUAL = TRUE
    - ---- SETS MDPS FAIL WARN = TRUE
    - ELSE, RESET MDPS FAILURE COUNTER TO -1
- THERMISTOR FAILURE ANNUNCIATION
  - IF THERM_FAILURE = TRUE, THEN THERM_CONS_FAIL = TRUE
  - ELSE,
  - IF THERM_CONS_FAIL = TRUE
    - THEN, SETS BOR BIT 12 = 1 AND INCREMENTS THE THERM FAIL COUNTER
      - IF THERMISTOR FAIL COUNTER > = 6 THEN
      - ---- SETS CHECK CNT = TRUE
      - ---- THERM FAIL COUNTER = 0, THEN SETS MSTR ALARM
    - ELSE, RESET THERMISTOR FAIL COUNTER TO -1
- ● IF THERMISTOR = 0 (ALL SAILS THERMISTOR FUNCTION IN I/O PROCESSING LLCSC (160)
- ● UNDERGOES THERMISTOR OF

CALLED MODULES
- ● MADC - W/ INVERSION
- ● A/D FORMAT CONVERSION FUNCTION
- ● THERMISTOR RESET FUNCTION
- ● ABSOLUTE VALUE FUNCTION

ANALOG FORMAT CONVERSION FUNCTION (163)

- CONVERTS A 12-BIT BINARY DEFECT INPUT VALUE TO AN 8-BIT 2'S COMPLEMENT OUTPUT VALUE
- ● ELSE, RESETS THE FAIL CTR TO CONTROL THE PLACEMENT OF THE 8-BIT OUTPUT VALUE IN EITHER THE HIGH OR LOW BYTES OF THE FUNCTION RETURN VALUE

MADC INPUT FUNCTION (162)

- WAITS 100 MS FOR ANALOG DATA READY FLAG (INDICATING THAT THE MADC IS READY)
- SAMPLES A VALID MADC CHANNEL OR A PAIR OF MC CHANNELS (MAIN AND DUPLICATE SUMS)
- ● ELSE, RESETS TO READ THE MUX MULTIPLEXER ADDRESS/MD 15 VERIFIED
- RETURNS THE VALUE OF THE STATUS OF THIS VERIFICATION TO 161
- WHEN A PAIR OF CHANNELS ARE READ INTERRUPTS ARE DISABLED TO PREVENT THE TIME BETWEEN CONSECUTIVE MADC/DATA READ STORBES TO THE ANALOG I/F

H/W WATCHDOG TIMER/PROCESSOR FAILURE TLCSC (19)

- SERVICES AND VERIFIES THE OPERATION OF THE MCIU W/A WATCHDOG TIMER CIRCUIT AND VERIFIES THE OPERATION OF THE PROCESSOR FAILURE DETECTION CIRCUIT

H/W WATCHDOG TIMER PROCESSING LLCSC (191)

- CALLED AT A FUNCTION BY SYNCHRONOUS PROCESSING LLCSC
- ONE FAIL-FAST DISCRETE WITH THE 5 MS PERIOD FOLLOWING THE F5 INTERRUPT
- THE FUNCTIONS OF THIS COMPONENT INCLUDED
- ● ● ●

11 F/W MEMORY 4

NEW MC11U FIRMWARE MEMORY MAP

BASIC REV E-1

ROM MEMORY MAP

RAM MEMORY MAP

INPUT PORT BIT ASSIGNMENTS

OUTPUT PORT BIT ASSIGNMENTS

DATA TABLES

I/O PORT DESCRIPTION

DMAC PORT USAGE

DATA TABLE DESCRIPTION

GPC CDW BUFFER (GPC TO MC11U)

GPC RDW BUFFER (MC11U TO GPC)

END EFFECTOR CONTROL TABLE (=EE_CNTL_TABLE)

DATA WORD BIT CORRESPONDENCE

MC11U NOMENCLATURE=

GPC WORD NOMENCLATURE=

SAFING CANCEL/BITE OVERRIDE/CHECKSUM INIT

ARC TRANSFER WORDS

DMC TRANSFER WORDS

MMC TRANSFER WORDS

DMC RECEIVE WORDS

MMC RECEIVE WORDS

ARC RECEIVE WORDS

NOTES:

1. THE ENTRIES ARRAY IS CNTRL_TABLE CONTAINS THE EE CONTROL OUTPUTS. THE SPACE/BI PLAN COMBINATION OF THE EE STATUS PLANES.
2. THE OFFSETS ARRAY CONSISTS OF 64 VALUES AND IS USED TO SELECT THE NEXT EE CONTROL LINE OUTPUT
3. THE TABLE IS INDEXED BY THE EE ID SELECTED IN THE EE STATUS WORD IN THE OUTPUT VALUE
4. THE EE PROCESSING ALGORITHM FINDS THE EE ID FROM SWITCH OUTPUT AND THE EE END INPUT
   a. IF THE EE END INPUT IS NOT SET, THE ALGORITHM EXITS
   b. EACH BIT IN ONE WORD OF THE CNTRL_TABLE ARE USED TO OUTPUT THE ONE EE CONTROL LINE
   c. THE OFFSET VALUE IS USED TO INDEX TO THE NEXT WORD IN THE CNTRL_TABLE
   d. IF THE EE END FLAG IS SET, THE ALGORITHM EXITS. THIS WILL RESULT IN A CHECK SET TO FLAG UNMATCHING, BUT WILL NOT TERMINATE AN ENTRY SEQUENCE
   e. IF THE OFFSET VALUE IS ZERO, THE ALGORITHM CONTINUES TO INDEX TO THE NEXT WORD
5. CAPTURE MODE REMOVING RELEASE
6. THE ALGORITHM IS EXECUTED BEFORE AND AUTO RELEASE, THE REL SEQUENCE WILL
   THEN BE CAPTURE ENGAGED AFTER RELEASE

MC11U FIRMWARE MEMORY MAP

TYPE	FUNCTION	LISTING
0	01H-0F HEX	110
1	CONSOLE STEP	113
2	MC11U FAILURE / INTERRUPT	115
3	BREADCRUMB	119
4	SYNCHRON	120
5-15	NOT USED	
16	END OF BLOCK	121
17	DMA FAILURE WARNING	122
18	DMA DATA READY	123
19	TRANSMIT REQUEST	124
20	RECEIVE REQUEST	125
21	TRANS DONE CHANNEL	126
22	COMPRESSION ERROR	128
23-255	NOT USED	

INTERRUPT VECTOR TABLE

DATA (1/2/3) %%

ORBITER

PAYLOAD BAY REMOTELY OPERATED ELECTRICAL UMBILICAL UNIT

PAYLOAD CONTROL LOGIC P/L SEL 2

PAYLOAD RETENTION

PAYLOAD RETENTION LATCHES

LATCH/RELEASE (-543) LAT 3

MATE/DEMATE (-542) LAT 2

RELEASE (-541) LAT 1

PL RETENTION

PL LAT 3 LAT ONLY

PL LAT 2 MATE/DEMATE

PL LAT 1 RELEASE

PL SEL LNG PWR

PL SEL MECH PWR

PMCU

LOGIC PWR

PLB LOGIC PWR

PAYLOAD RETENTION

LOGIC POWER SYS 1

LOGIC POWER SYS 2

HI-MCA-1 P/L SYS 1 CONTROL LOGIC

HI-MCA-3 P/L SYS 2 CONTROL LOGIC (TYPICAL 1 OF 3)

STBD PATCH PANEL

PORT PATCH PANEL

ORBITER ARM DRIVE MOTORS

ODA LATCH/RELEASE MOTORS

AFT STATION

ODA LATCHES, MOTORS, GEAR AND GEARS

ARM DRIVE MOTORS GEAR AND GEARS

CONTACTS NOT USED

MOTOR DRIVE (1 AND 2 USED)		
	TERM 1	TERM 2
DEMATE TO MATE	M1	M2
ODA LATCH	M3	M4
RELEASE	M5	M6
ODA UNLATCH	M7	M8
RELEASE TO DEMATE	M9	M10

DEFINE THE MATING DEMATING, THE ARM DRIVE ACTUATOR DRIVES TOWARD THE MATE POSITION WHEN THE "MATE" LATCH POSITION IS SELECTED, AND THE "MATE" LATCH POSITION IS SELECTED, FROM FOR ANY ELECTRICAL POWER IS REMOVED FROM THE ACTUATOR, OR WHEN THE REMOTE TERMINATION SELECTION IS MADE. WHEN THE ACTUATOR IS ACTIVATED, DURING THE DEMATING SEQUENCE, THE ARM DRIVES TOWARD THE DEMATE POSITION WHEN THE "DEMATE" LATCH POSITION IS SELECTED WITH THE DRIVE CLOSE AND THE "DEMATE" LATCH SECTION IS ACTUATED.

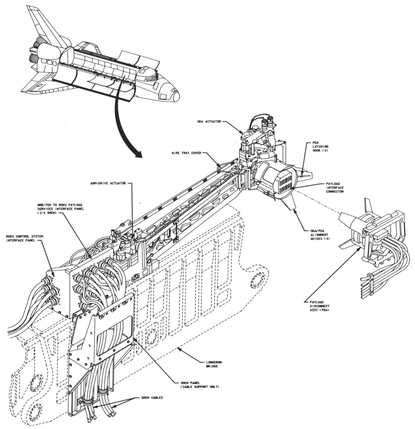
THE LATCH ACTUATOR CONTINUES TO DRIVE UNTIL DRIVE RELEASED AND THE ARM UNDERCOUNT AND "LATCHED" LIMIT SWITCHES ARE ACTUATED. THE RELEASE ACTUATOR CONTINUES TO RETRACT THE MARKET LIMIT, THE RELEASE ACTUATOR CONTINUES TO RETRACT THE UNLATCHED (RELEASE) LIMIT SWITCH IS ACTUATED.

NOTES: 1. HOLD DOWN 14 RATED, ARM RELEASED POSITION

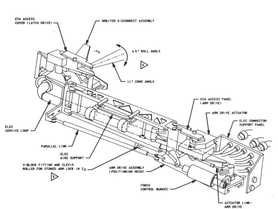
12 ROEU ELECT

ECO/MOD/ARC	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
ENGR: G. ESAU-KOCH	12/1/82	LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEXAS
DRFT: G. ESAU-KOCH	12/1/82	
CHK: G. ESAU-KOCH	12/1/82	ROEU ELECTRICAL
CHK: [illegible]	12/1/82	
CHK: [illegible]	12/1/82	
CHK: [illegible]	12/1/82

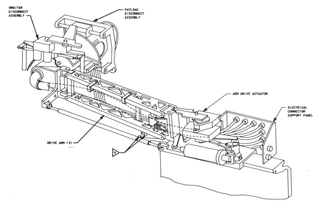
ROEU CONFIGURATION



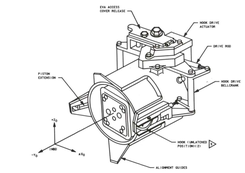
ROEU ORBITER INTERFACE - INBOARD FACE
DEPICTED POSITION



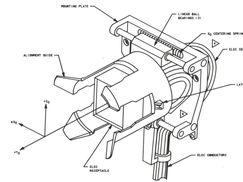
ORBITER ARM-DRIVE MECHANISM (-ODM) - OUTBOARD FACE
DEPICTED POSITION



ORBITER ARM-DRIVE MECHANISM (-ODM) - OUTBOARD FACE
MATED AND LATCHED POSITION

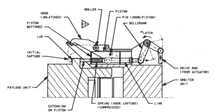


ORBITER DISCONNECT ASSEMBLY (-ODA)

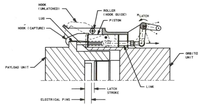


PAYLOAD DISCONNECT ASSEMBLY (-PDA)

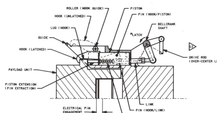
LATCHING OPERATIONS



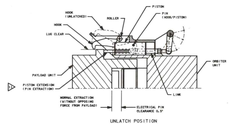
READY-TO-LATCH



HOOK CAPTURE

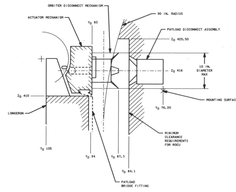


LATCHED POSITION

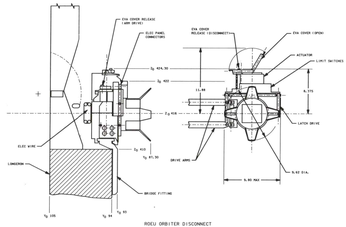


UNLATCH POSITION

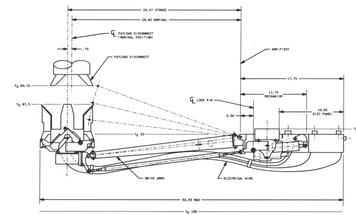
ROEU ENVELOPE



ROEU ENVELOPE



ROEU ORBITER DISCONNECT



ROEU DEPICTED (STOWED)
PLAN VIEW

▷ A ROLLER CONTROLS HOOK KINEMATICS. IF THE PISTON UPWARDS FAIL OR OPPOSITE FORCES ARE APPLIED FROM THE PAYLOAD SIDE OF THE SYSTEM

▷ IN THE FULLY LATCHED POSITION, THE BELLCRANKS ARE IN AN OVER-CENTER LOCK POSITION RELATIVE TO THE ACTUATOR BELLCRANK

▷ THE LATCHING PISTONS HAVE AN EXTENSION AT END AND THAT PISTON ASSIST THE PDA LUGS TO DETACH FROM THE PDA PINS FROM THE ORA HOLES DURING THE RELEASE OPERATION

PL	MASS (APPROX)
ORB	74.70 LBS
PDA	55.00 LBS (-ATD)

▷ THE LATCHING MECHANISM APPLIES +HOOKS OF PULL-IN/PUSH-OUT FORCE FOR THE FINAL ENGAGEMENT/EXTRACTION OF THE ORA AND PDA

▷ THE ORA PROVIDES THE DUAL LATCHING MECHANISM (-MOTOR) AND HOOKS) THAT PERFORMS THE P-BALL MATE AND INITIAL DONATE FUNCTIONS. THE PDA PROVIDES THE LATCHING LUGS

1. THE ORA PROVIDES THE HOLES FOR THE ELECTRICAL UMBILICAL. THE PDA PROVIDES THE PINS.

▷ THE ORA IS SUPPORTED BY A SPHERICAL BEARING WHICH ALLOWS FOR AN ANGULAR COMPLIANCE OF 0.1° MAXIMUM (ARM) DEFLECTION AND ±1.5° ROLL ABOUT THE X_0 DEPLOYING OF THE ORA.

▷ THE ARM IS RESTRAINED IN THE FULLY STOWED POSITION BY ARM-DRIVEN DRIVE LOCKS IN THE Z_0 DIRECTION AND 3 V-BLOCK FITTINGS AND CLOSING ROLLER FOR THE Z_0 DIRECTION

▷ THE PDA ALLOWS FOR A 2° DISPLACEMENT IN THE X_0 AXIS BY MEANS OF A CENTERING SPRING

▷ THE ORA ALLOWS FOR A MATING OVERLAP OF 0.70" TOWARD THE ORA AND 0.70" TOWARD THE PDA TO ALLOW FOR THE Z_0 DRIFT IN MATING TO INITIAL MATING POSITION

1. THE DRIVE MOTOR AND GEAR TRAIN MUST FOR THE ARM-DRIVE MECHANISM (AM) ATD CLOSED IN ORDER TO CONTACT A 28V PWR FOR ORA AND SPECIFICATION FOR THE ARM-DRIVE MECHANISM (AM) ATD CLOSED

NOTES: ▷ THE ROEU CAN BE MOUNTED ON A STANDARD ORBITER BRIDGE AND CAN BE INSTALLED FACING FORWARD OR AFT. PROTRUS IS THE LEFT-HANDED ROEU AND PROTRUS IS THE RIGHT-HANDED ROEU.

12 ROEU MECH O/V 2

SIGNATURE	DATE
CHAN H. TSAO-4928	10-14-91
M. A. CHAVEZ	10-14-91
CHIEF, Control Mechanisms Branch	10/28
CHIEF, Flight Support Systems Division	10/28
Chief, Mechanical Systems Division	10/28
Chief, Engineering Directorate	10/28

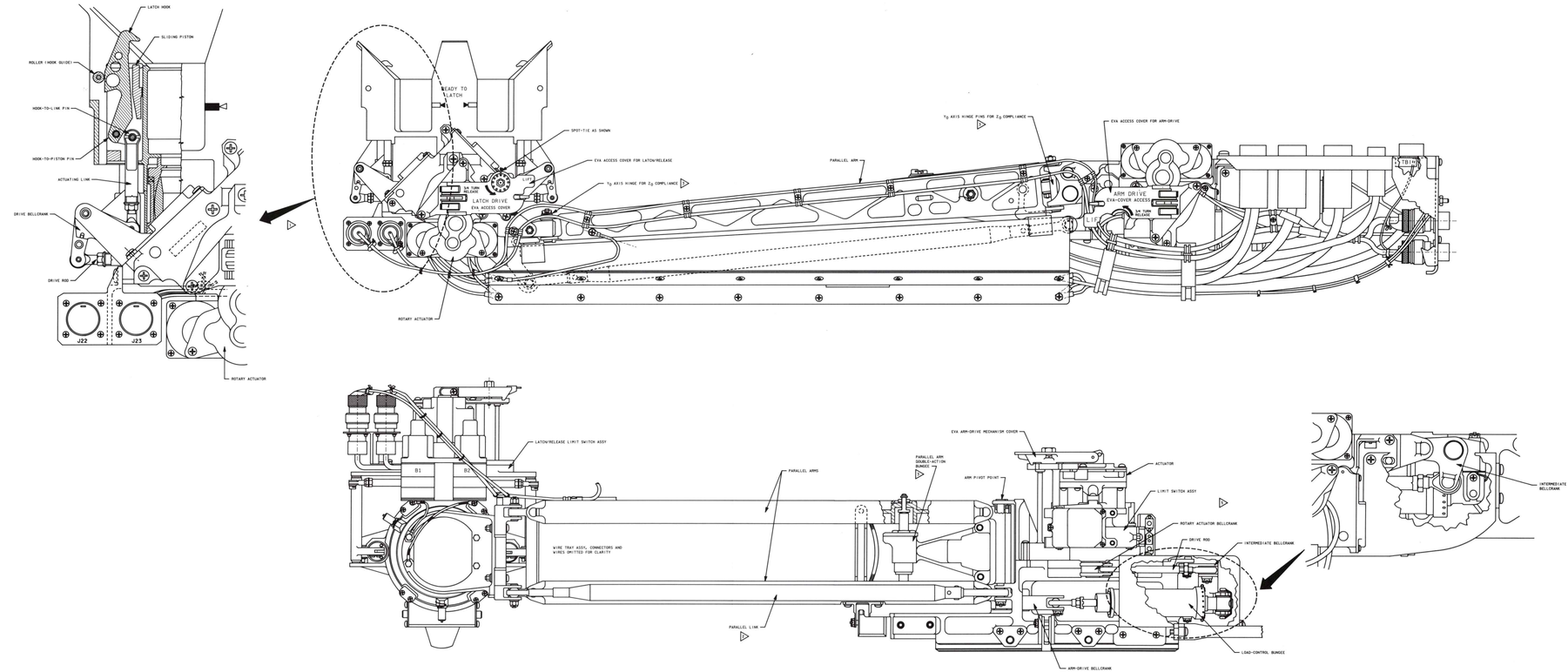
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEXAS

REMOTELY OPERATED ELECTRICAL UMBILICAL MECHANICAL OVERVIEW

SPACE SHUTTLE PAD NO. 14.12

SHEET 1 OF 3

BASIC REV E-1



6. THE ROEU HAS 2 SEPARATE EVA INTERFACES TO ALLOW FOR EVA MATE/DEMATE AND LATCH-RELEASE; BOTH EVA INTERFACES OPERATE THE SAME. AFTER THE 3/16" HEX BOLT IS BACKED OUT ~3-4 TURNS, THE COVER IS ROTATED ABOUT THE HINGE PIN TO ACCESS THE 3/16" HEX DRIVE BOLT. THE 3/16" HEX BOLT IS THE SHAFT THAT DISENGAGES THE MOTORS FROM THE GEAR BOXES TO ALLOW FOR EVA OPERATION OF THE MECHANISM. A RATCHET LEVER IS THEN ATTACHED TO THE 3/16" HEX DRIVE BOLT AND THE COVER IS CLOSED AND THE 3/16" HEX DRIVE BOLT IS ROTATED TO THE DESIRED POSITION. THE RATCHET LEVER IS RETURNED TO THE NEUTRAL POSITION AND THE COVER IS CLOSED AND SECURED.

7. RELAX OPERATION: AFTER THE LATCH HOOKS PULL THE OSA AND PDA TOGETHER, THE ARM-DRIVE MECHANISM IS DRIVEN TOWARD THE DEMATE DIRECTION. THE INTERMEDIATE BELLCRANK ROTATES UNTIL THE INTERMEDIATE LIMIT SWITCH IS ACTUATED. AFTER THE ARM HITS THE INTERMEDIATE LIMIT SWITCH WILL STOP THE ACTUATOR, THUS POSITION IS MIDTRAVEL OF THE BUNGEE PRELOAD AND WILL ENSURE THAT NO Y_D AXIS FORCE IS APPLIED TO THE PAYLOAD DUE TO SPRING FORCE

8. DEMATE-TO-MATE OPERATION: THE INITIAL ARM-DRIVE ACTUATOR ROTATION DRIVES THE ACTUATOR BELLCRANK AND THE DRIVE LINK ATTACHED TO THE INTERMEDIATE BELLCRANK. AS THE ACTUATOR ROTATES, THE ARM DOES NOT MOVE UNTIL THE PRELOAD IN THE BUNGEE IS TAKEN UP BY THE INTERMEDIATE BELLCRANK TRAVEL. THE BELLCRANK CONTINUES TO ROTATE UNTIL THE ARM HITS THE HARD STOP. AT THE END OF THE INTERMEDIATE BELLCRANK ACTION IS THE HARD LIMIT SWITCH

▷ ARM-DRIVE MECHANISM: THE ROTARY ACTUATOR IS ATTACHED TO A DRIVE ROD. THE DRIVE ROD IS ATTACHED TO AN INTERMEDIATE BELLCRANK WHICH ATTACHES TO A LOAD-CONTROL SPRING CARTRIDGE (BUNGEE). THE BUNGEE IS ATTACHED TO THE ARM-DRIVE BELLCRANK

4. IN THE STOWED POSITION, THE DRIVE ROD IS AT AN OVER-CENTER LOCK POSITION RELATIVE TO THE ACTUATOR BELLCRANK AND THE BUNGEE IS IN TENSION

▷ THE DOM ALLOWS FOR THERMAL AND STRUCTURAL DISTORTIONS WHILE MATED IN THE Z_D AXIS OF ± 1" BY MEANS OF Y_D HINGE PINS AT BOTH ENDS OF THE PARALLEL ARMS. A DOUBLE-ACTION SPRING CARTRIDGE (BUNGEE) IS USED TO MAINTAIN THE NORMAL CENTERING POSITION

▷ THE PARALLEL LINK ON THE DRIVE ARM MAINTAINS THE ORIENTATION OF THE PAYLOAD WITH RESPECT TO THE ORBITER PLANE AS THE POSITIONING ARM DRIVES TO THE MATE/DEMATE POSITION

NOTES▷ LATCHING MECHANISM: THE OSA HOOK MECHANISM CONSISTS OF A PAIR OF SPRING-LOADED HOOKS. THE HOOKS ARE CONNECTED TO SLIDING PISTONS WITH ATTACHMENT PINS. THE PISTONS ARE DRIVEN BY LINKS THAT APPLY A FORCE TO ANOTHER ATTACHMENT PIN THAT CONNECTS THE HOOK TO THE ACTUATING LINK. THIS CREATES A MOMENT ABOUT THE HOOK/LINK PIND WHICH CAUSES THE HOOKS TO CLOSE. THE LINKS ARE CONNECTED TO DRIVE BELLCRANKS WHICH ARE DRIVEN BY DRIVE RODS CONNECTED TO A COMMON ACTUATOR BELLCRANK

12 ROEU MECH 3

SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DSGN VICKI S. HUNTER	12/3/90	
DR		ROEU MECHANICAL
CHKR S. CARLISLE-MORGAN		
CHKR		
APP		CON. PSC. / DWG NO 14.12
APP		
APP		ALL
CM D	PCN	SIZE D SCALE / SHEET 3 of 3

BASIC REV E

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
14.1 (SHEET 1)	PAYLOAD BAY DOORS/ RADIATOR OVERVIEW	ROCKWELL	VO70-370002	ALL	H	9/17/87	PAYLOAD BAY DOORS ASSY-COMPLETE
			VO70-594125	ALL	D	3/5/80	ACTUATION MECHANISM INSTALLATION, PAYLOAD BAY DOOR
			VO70-594126	ALL	-	7/28/78	BELLCRANK - ACTUATING MECHANISM, PAYLOAD BAY DOOR, ASSY OF
			VO70-594145	ALL	-	12/26/83	UPPER ROD INSTL - ACTUATION MECHANISM, PAYLOAD BAY DOOR
			VO70-594160	ALL	C	8/20/82	FWD LATCHING MECHANISM INSTALLATION - PAYLOAD BAY DOOR
			VO70-594185	ALL	D	2/22/83	FWD LATCHING MECHANISM INSTALLATION - BULKHEAD, PAYLOAD BAY DOOR
			VO70-594222	ALL	A	8/5/82	SWITCH MODULE, PAYLOAD BAY DOOR, ASSY
			VO70-594260	ALL	D	8/31/82	AFT LATCHING MECHANISM INSTALLATION - PAYLOAD BAY DOOR
			VO70-594263	ALL	A	3/12/80	BELLCRANK - ACTUATING LATCH NO. 2, AFT LATCHING MECH, PAYLOAD BAY DOOR, ASSY OF
			VO70-594265	ALL	A	4/3/80	BELLCRANK, ACTUATING, LATCH NO. 3, AFT LATCHING MECH, PAYLOAD BAY DOOR, ASSY OF
			VO70-594276	ALL	A	3/6/80	BELLCRANK-LOCKING, LATCH NO. 1, AFT LATCHING MECH, PAYLOAD BAY DOOR, ASSY OF
			VO70-594281	ALL	A	1/17/80	BELLCRANK, LOCKING, LATCH 1 FWD LATCHING MECHANISM PAYLOAD BAY DOOR, ASSY OF
			VO70-594285	ALL	D	8/9/82	AFT LATCHING MECHANISM INSTL., BULKHEAD-PAYLOAD BAY DOOR
			VO70-594302	ALL	-	9/15/76	SHEAR FITTING ASSY - CENTERLINE LATCHING MECHANISM, PAYLOAD BAY DOOR
			VO70-594330	ALL	B	9/8/82	HANGER ASSY - LATCH, CENTERLINE LATCHING MECHANISM, PAYLOAD BAY DOOR
			VO70-594360	ALL	E	8/16/82	CENTERLINE LATCHING MECHANISM INSTALLATION - PAYLOAD BAY DOORS
			VO70-594400	ALL	A	4/28/80	DEPLOYMENT INSTALLATION, RADIATOR MECHANISM
			VO70-594401	ALL	-	3/23/84	LINK INSTALLATION - RADIATOR DEPLOYMENT
			VO70-594450	ALL	A	2/7/80	LATCH MECHANISM INSTALLATION - RADIATOR
14.1 (SHEET 2)	PL BAY DOOR LATCHES	ROCKWELL	VO70-362003	ALL	D	1/17/86	MARKING-PAYLOAD BAY INTERIOR, INSTALLATION

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
14.1-1,2	ENGR R. K. McCLUNEY			ENGR	
	ENGR Kevin McCluney	9/22/94		ENGR	
	ENGR			ENGR	
	ENGR			ENGR	
	ENGR			APP	
	ENGR			APP B Dismuke	9-27-94
	ENGR			APP	
	ENGR			LTR E PCN 4	

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

VENDOR DRAWING REFERENCES

SPACE SHUTTLE ALL

TBL NO 14-I

BASIC REV E-4

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
14.1 (SHEET 3)	RADIATORS DEPLOY/ STOW	ROCKWELL	VS70-590402	1 - 5	H	8/93	SCHEMATIC DIAGRAM - FREON RADIATOR DEPLOYMENT SUBSYSTEM (OV-102)
			VS70-590409	1 - 5	B	8/93	SCHEMATIC DIAGRAM - FREON RADIATOR DEPLOYMENT SUBSYSTEM (OV-103, -104, -105)
			VS70-760702	ALL	H	8/15/86	SCHEMATIC DIAGRAM - MOTOR CONTROL ASSY POWER DISTRIBUTION (OV-102)
			VS70-760709	ALL	D	8/15/86	SCHEMATIC DIAGRAM - MOTOR CONTROL ASSY POWER DISTRIBUTION (OV-103 & SUBS)
14.2 (SHEET 1)	PLBD OPEN/CLOSE H/W OVERVIEW	ROCKWELL	VS70-540302	ALL	J	6/25/86	SCHEMATIC DIAGRAM - PAYLOAD BAY DOOR CONTS SUBSYSTEM (OV-102)
			VS70-540309	ALL	E	6/20/86	SCHEMATIC DIAGRAM - PAYLOAD BAY DOOR CONTS SUBSYSTEM (OV-103 & SUBS)
			VS70-760702	ALL	H	8/15/86	SCHEMATIC DIAGRAM - MOTOR CONTROL ASSY POWER DISTRIBUTION (OV-102)
			VS70-760709	ALL	D	8/15/86	SCHEMATIC DIAGRAM - MOTOR CONTROL ASSY POWER DISTRIBUTION (OV-103 & SUBS)
14.2 (SHEET 2)	PLBD SOFTWARE OVERVIEW (PASS AND BFS	IBM	SS-P-0002-580G	PAYLOAD BAY DOOR SEQUENCE	G		SPACE SHUTTLE PROGRAM ORBITER PROJECT COMPUTER PROGRAM DEVELOPMENT SPECIFICATION, VOLUME V, BOOK 8: SYSTEMS MANAGEMENT LEVEL B SOFTWARE REQUIREMENTS
		ROCKWELL	MG038101	PAYLOAD BAY DOOR SEQUENCE	L	10/14/88	BFS PROGRAM REQUIREMENTS DOCUMENT
		IBM	OF350100. APPL. SSBPLBAY. LIT. T7314212	ALL		11/10/87	PAYLOAD BAY DOOR HAL CODE
		IBM	NAS 9-16920	PAYLOAD BAY DOOR SEQUENCE	1	9/9/87	SPACE SHUTTLE PROGRAMS ORBITER AVIONICS SOFTWARE OPERATIONAL DETAILED DESIGN SPECIFICATION VOL III PART 2 SM
14.3 (SHEET 1)	PAYLOAD RETENTION LATCH ELECTRICAL	ROCKWELL	VS70 764412	2,4,5,6	G	9/17/82	SCHEMATIC DIAGRAM - MID MOTOR CONT ASSY NO. 1 RIGHT FWD MID FUSELAGE
			VS70-760702	ALL	H	8/15/86	SCHEMATIC DIAGRAM MOTOR CONTROL ASSY POWER DISTRIBUTION
			VS70-733199	1 AND 2	C	9/30/86	SCHEMATIC DIAGRAM D&C PANEL R13A2 RIGHT HAND CONSOLE
			VS70-733709	4	D	5/10/84	SCHEMATIC DIAGRAM PANEL A6A1 AFT ON ORBIT STA
			VS70-733897	1 AND 2	B	5/8/85	SCHEMATIC DIAGRAM D&C PANEL MA73C MID DECK BAY 3B
			VS70-540229	1 - 4	C	4/1/85	SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYS (STS-23)
			VS70-540202	1 - 17	J	10/30/86	SCHEMATIC DIAGRAM PAYLOAD RETENTION SUBSYSTEM

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
14.1-3	ENGR A. SIMON			ENGR	
	ENGR [signature]	9/22/88		ENGR	
14.2-1, 2	ENGR R. K. McCLUNEY			ENGR	
	ENGR [signature]	9/22/88		ENGR	
14.3-1	ENGR R. K. McCLUNEY			APP	
	ENGR [signature]	9/22/88		APP [signature]	9/22/88
	ENGR			APP	
	ENGR			LTR E PCN 4	

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

VENDOR DRAWING REFERENCES

SPACE SHUTTLE | TBL NO 14-I
ALL

BASIC REV E-4

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
14.3 (SHEET 2)	PAYLOAD RETENTION LATCH - MECH	R. I.	V073-340101	1	A	6/29/82	FITTING - LONGERON BRIDGE, X0 636.00 TO X0 693.00, MID FUSELAGE, ASSY OF
			V073-544100	1	-	2/28/84	LATCH ASSY - LIGHTWEIGHT LONGERON ((COMPLETE)
			V073-544210	1	-	7/27/83	GEARBOX ASSEMBLY - MECHANISM DRIVE, LIGHTWEIGHT LONGERON LATCH
			V073-544230	1	-	4/18/84	LATCH ASSY - MIDDLEWEIGHT LONGERON COMPLETE
			V073-544300	1	A	12/14/84	LATCH ASSEMBLY - KEEL, LIGHTWEIGHT
			VO73-544100	1 - 4	-	4/20/83	DESIGN LAYOUT - LIGHT WT LONGERON RETENTION LATCH
			V073-340330	1 AND 2	-	9/15/82	BRIDGE FITTING - KEEL LT WT. BAY NO 2 ASSY OF
			V073-544110	1 - 3	-	8/12/83	FRAME SET - LIGHTWEIGHT LONGERON LATCH, ASSEMBLY
			V073-544221	1	-	3/1/83	GUIDE - EXTENDED LIGHTWEIGHT LONGERON LATCH
			V073-544227	1 - 3	A	12/7/84	FRAME - MIDDLEWEIGHT LONGERON LATCH ASSY
			V073-544302	1	A	1/23/85	GUIDE, SHORT END FINISHED
			V073-544552	1 AND 2	A	10/10/88	GUIDE ASSY - 18 INCH, SHORT END, PRLA
			V073-544301	1	-	2/5/81	GUIDE, LONG END FINISHED
			V073-544302	1	A	1/23/88	GUIDE, SHORT END FINISHED
			V073-544580	1	-	2/84	GUIDE ASSY - SHORT END, PRLA
			V776-544600	1	-	3/15/84	LATCH ASSEMBLY - MODIFIED MIDDLE WEIGHT (COMPLETE)
			V073-544240	1 AND 2	-	4/27/84	GUIDE ASSY - LIGHTWEIGHT LONGERON LATCH
14.3 (SHEET 3)	PROTECTIVE COVER REMOVAL SYSTEM	R.I.	V739-290001	1 AND 2	A	4/4/90	SCHEMATIC DIAGRAM MISSION KIT PROTECTIVE COVER REMOVAL SYSTEM
		R.I.	V739-544021	2,4	-	11/8/89	LANYARD DETAIL ASSEMBLY
		R.I.	V739-544002	1	-	7/24/89	PROTECTIVE COVER REMOVAL SYSTEM- MECHANICAL INSTL
		R.I.	V739-544001	1	-	3/15/89	ACTUATOR MECHANISM - ASSY OF, PROTECTIVE COVER REMOVAL MECHANISM
		SANDIA	R25746	1	A	5/11/90	AAOU SUNSHADES SOFT COVER / (INFLIGHT)
			R25747	1	A	5/11/90	ADVY SUNSHADES SOFT COVER / (INFLIGHT)

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
14.3-2,3	ENGR J. OLANSEN			ENGR	
	ENGR	10/23/90		ENGR	
	ENGR			ENGR	
	ENGR			ENGR	
	ENGR			APP	2 Nov 90
	ENGR			APP	11/15/90
	ENGR			OMNIPLAN	
	ENGR			LTR E PCN	

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

VENDOR DRAWING REFERENCES

SPACE SHUTTLE | TBL NO 14-I
ALL | PAGE 14.I-3 | SHEET 3 OF 11

BASIC REV E

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
14.4 (SHEET 1)	RMS D&C PANEL	CAE	ED85511.01. 1.300	1-3	E	1/79	POWER AND GROUNDING SRMS D&C SUBSYSTEM
		CAE	ED87300.01. 1.268	1-2	C	5/82	PRINTED WIRING ASSEMBLY DISCRETE INPUT/OUTPUT
		CAE	ED87305.01. 1.268	1-2	D	5/82	CIRCUIT CARD ASSEMBLY MCIU INTERFACE AND ADDRESS DECODER
		CAE	ED87310.01. 1.268	1	B	5/82	PRINTED WIRING ASSEMBLY NUMERIC READ OUT DRIVE
		CAE	ED87315.01. 1.268	1	A	10/78	CIRCUIT CARD ASSEMBLY D/A CONVERTER A1
		CAE	ED87325.51. 1.268	1	D	11/77	PRINTED WIRING BOARD HAND CONTROLLER DEMOD INTERFACE
		CAE	ED87775.01. 1.835	1	B	2/80	TRANSLATION HAND CONTROLLER (THC) A2A2
		CAE	ED87899.51. 1.840	1	B	6/77	CIRCUIT CARD ASSEMBLY R.H.C. & T.H.C. OSCILLATOR CIRCUIT
		CAE	ED92020.01. 1.834	1-7	C	5/82	SRMS D&C SUBSYSTEM
		CAE	ED94385.01. 1.268	1	C	5/82	CIRCUIT CARD ASSEMBLY MASTER ALARM & HARD WIRED SWITCHING CIRCUIT
		CAE	ED96400.01. 1.268	1	C	1/81	CIRCUIT CARD ASSEMBLY MONITOR A1A2A6
		CAE	ED96402.01. 1.268	1-3	C	8/79	CIRCUIT CARD ASSEMBLY INTERFACE A1A2A2
		CAE	ED96404.01. 1.268	1-2	A	6/81	CIRCUIT CARD ASSEMBLY D&C PROTECTION A1A2A8
		NASA	SIE33103307	1	-	3/84	WIRING DIAGRAM RMS D&C IFM

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
14.4-1	ENGR A. MAGH			ENGR	
	ENGR Alberto J. Magh	10-26-90		ENGR	
	ENGR			ENGR	
	ENGR			ENGR	
	ENGR			APP Ernest Smith	11-14-90
	ENGR			APP [illegible]	11/15/90
	ENGR			OMNIPLAN	
	ENGR			LTR E PCN	

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

VENDOR DRAWING REFERENCES

SPACE SHUTTLE | TBL NO 14-I

ALL

BASIC REV E

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
14.4 (SHEET 3)	RMS SPA	SPAR	2558977	1/1	2	7-81	GENERATOR, PULSE-WIDTH MODULATOR
			2563712	1/1	1	7-78	ELECTRONICS SUB-ASSY. PWR SWITCH
			2563717	1 AND 2/2	7B	11-82	CONTROLLER, PWR SIGNAL
			2563718	1/1	3	4-81	LIMITER, CURRENT
			2563719	1/1	5	6-81	DRIVER, INDUCTOSYN TIMER
			2563721	1/1	3A	11-82	COMPARATOR, RATE
			2563722	1/FIN	3A	11-82	INTERFACE ELECTRONICS
			2563723	1/1	5	3-82	ENCODER, PHASE LOCKED LOOP
			51140E2120	1/1	P	9-84	ENCODER, JOINT
			51140E2121	1/2	P	9-84	JOINT, COMMUTATOR SCANNER ASSY.
14.4 (SHEET 4)	RMS BDA	SPAR	2559029	1/FIN	2	4-81	PROCESSOR, ANALOG
		SPAR	2559039	1/1	0	10-82	GENERATOR, PULSE-WIDTH MODULATOR
		SPAR	2559044	1 AND 2/2	7	4-81	CONTROLLER, POWER CONDITIONER
		SPAR	2563712	1/1	1	7-78	ELECTRONICS SUB-ASSY. PWR SWITCH
		SPAR	2563735	1/1	OA	11-82	AMPLIFIER, BACKUP DRIVE
		SPAR	2563737	1/FIN	OB	10-82	CONTROLLER, PWR SIGNAL
		SPAR	2563739	1/1	7	8-78	CONVERTER, POWER
		SPAR	51140E2121	2/2	P	9-84	JOINT, COMMUTATOR SCANNER ASSY
		CAE	ED92020	1-3/7	B	6-80	SRMS D&C SUBSYSTEM
14.4 (SHEET 5)	RMS CONTROL SYSTEM (EEEU AND MOTOR CONTROL)	SPAR	2559082		2A	7/81	POWER CONDITIONER SUBASSEMBLY
			2563764		5B	12/81	EE ELECTRONIC UNIT SCHEMATIC DIAGRAM
			2563765		5B	12/81	COMMAND AND COMMUTATION LOGIC SCHEMATIC DIAGRAM
			2571253-			10/82	POWER CONDITIONER
			2571253-5502			10/82	EEEU FUNCTIONAL DIAGRAM
			2572811-			10/82	POWER CONDITIONER CONTROLLER
			2572811-5501			10/82	POWER CONDITIONER CONTROLLER
			2572980-5502			10/82	COMMAND AND COMMUTATION LOGIC, FUNCTIONAL DIAGRAM
			2578223			10/82	MCIU SOFTWARE DOCUMENTATION

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
14.4-3,4	ENGR A. LEE			ENGR	
	ENGR Alfred C. Lee	11/26/91		ENGR	
14.4-5	ENGR S. FERRARA			ENGR	
	ENGR La Verne Ann Ferrara	11/26/91		ENGR	
	ENGR			APP R T Neal	11/26/91
	ENGR			APP R T Neal	11/26/91
	ENGR			OMNIPLAN	
	ENGR			LTR E PCN 1	

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VENDOR DRAWING REFERENCES

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BASIC REV E-1

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
14.4 (SHEET 6)	RMS THERMOSTAT/ HEATER ELEMENTS	SPAR	SPAR-RMS-M-1140-1		2	5/2/83	INTERMEDIATE MAINTENANCE MANUAL, MANIPULATOR ARM
		SPAR	SPAR-RMS-M-1140-3		1	5/30/83	DEPOT, REPAIR, AND OVERHAUL MANUAL ELBOW JOINT SRU
		SPAR	SPAR-RMS-M-1140-4			2/28/83	DEPOT, REPAIR, AND OVERHAUL MANUAL, SHOULDER JOINT SRU
		SPAR	SPAR-RMS-M-1140-7			10/25/83	DEPOT, REPAIR, AND OVERHAUL MANUAL, END EFFECTOR LRU
		R.I.	VS72-956099 56NA		A	11/22/85	ELECTRICAL SCHEMATIC, REMOTE MANIPULATOR ARM
		R.I.	VS72-956102 56NA		E	6/9/86	ELECTRICAL SCHEMATIC, REMOTE MANIPULATOR ARM
14.4 (SHEET 7)	RMS MECHANICAL OVERVIEW	SPAR	RMS-M-1140-3-052	1		5/83	ELBOW JOINT MECHANICAL ASSEMBLY
		SPAR	RMS-M-1140-3-053	2		5/83	ELBOW JOINT MECHANICAL ASSEMBLY
		SPAR	RMS-M-1140-3-054	3		5/83	ELBOW JOINT MECHANICAL ASSEMBLY
		SPAR	RMS-M-1140-3-055			5/83	ELBOW JOINT G1 GEARBOX
		SPAR	RMS-M-1140-1-004			5/83	MANIPULATOR ARM OVERALL DIMENSIONS
		SPAR	RMS-M-1140-2-001			3/82	JOINT MOTOR MODULE FRONT/PIECE
		SPAR	RMS-M-1140-2-002			3/82	MAIN COMPONENTS OF TYPICAL JOINT MOTOR MODULE
		SPAR	RMS-M-1140-2-018			3/82	MOTOR MODULE ASSEMBLY
		SPAR	RMS-M-1140-3-003			5/83	ELBOW JOINT OVERALL DIMENSIONS
		SPAR	RMS-M-1140-3-004			5/83	ELBOW JOINT MAJOR COMPONENTS (PORT VIEW)
		SPAR	RMS-M-1140-3-005			5/83	ELBOW JOINT MAJOR COMPONENTS (STARBOARD VIEW)
		SPAR	RMS-M-1140-3-026			5/83	ASSEMBLY OF POSITION ENCODER
		SPAR	RMS-M-1140-3-050			5/83	ELBOW JOINT SRU
		SPAR	RMS-M-1140-4-014	2 OF 6		2/83	SHOULDER JOINT SRU

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
14.4-6	ENGR D. CULP			ENGR	
	ENGR D.R. Culp	11/26/91		ENGR	
14.4-7	ENGR J. HUGHES			ENGR	
	ENGR Jeff Hughes	11/26/91		ENGR	
	ENGR			APP R.J. Neal	11/26/91
	ENGR			APP R.J. Neal	11/26/91
	ENGR			OMNIPLAN	
	ENGR			LTR E PCN 1	

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BASIC REV E-1

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
14.4 (SHEET 7) (CONC'D)		SPAR	RMS-M-1140-4-041			2/83	SHOULDER JOINT OVERALL DIMENSIONS
		SPAR	RMS-M-1140-4-042			2/83	SHOULDER JOINT (PORT VIEW)
		SPAR	RMS-M-1140-4-049			2/83	SECTIONAL VIEW OF SHOULDER YAW ASSEMBLY
		SPAR	RMS-M-1140-5-002			5/84	WRIST JOINT (PORT VIEW)
		SPAR	RMS-M-1140-5-023	1		5/84	WRIST PITCH/YAW ASSEMBLY
		SPAR	RMS-M-1140-5-024	2		5/84	WRIST PITCH/YAW ASSEMBLY
		SPAR	RMS-M-1140-5-025	3		5/84	WRIST PITCH/YAW ASSEMBLY
		SPAR	RMS-M-1140-5-026	4		5/84	WRIST PITCH/YAW ASSEMBLY
		SPAR	RMS-M-1140-5-032	1		5/84	WRIST ROLL ASSEMBLY
		SPAR	RMS-M-1140-5-033	2		5/84	WRIST ROLL ASSEMBLY
		SPAR	RMS-M-1140-5-035			5/84	WRIST G1 DRIVE ASSEMBLY
		SPAR	RMS-M-1140-7-024			1/85	END EFFECTOR MAJOR COMPONENTS
		SPAR	RMS-M-1140-7-026			1/85	END EFFECTOR SNARE AND RIGIDIZE GEAR TRAIN
		SPAR	31140-D-456			7/78	PRECAPTURE MISALIGNMENT ENVELOPE
		SPAR	GRS-0046			7/87	ELBOW JOINT GEAR TRAIN
		SPAR	RMS ICD 17, F, FIG 3-3		F	6/82	CCTV AND LIGHT DESIGN CONFIGURATION
		NASA	FIG. 3.1.2.1.3-1	2 AND 3		1/88	ON-ORBIT DEPLOYMENT/RETRIEVAL CLEARANCES SHUTTLE ORBITER/CARGO STANDARD INTERFACES (ICD 2-19001, VOL XIV, ATT 1)
		NASA	FIG. 3.1.2.1.4-1	7 OF 8		1/88	PAYLOAD CLEARANCE ENVELOPE INTRUSIONS SHUTTLE ORBITER/CARGO STANDARD INTERFACES (ICD 2-19001, VOL XIV, ATT 1)
14.4 (SHEET 8)	RMS ELEC OV	ROCKWELL	VS70-540552	1-5	B	11/30/85	SCHEMATIC DIAGRAM - REMOTE MANIPULATOR ARM SUBSYSTEM
			VS70-540559	1-5	-	1/31/84	SCHEMATIC DIAGRAM - REMOTE MANIPULATOR ARM SUBSYSTEM
			VS72-956099	56NA	A	2/23/88	ELECTRICAL SCHEMATIC REMOTE MANIPULATOR ARM
			VS72-956102	56NA	E	8/15/87	ELECTRICAL SCHEMATIC REMOTE MANIPULATOR ARM
			VS70-764512	1-8	A	7/21/86	SCHEMATIC DIAGRAM - MID MCA #1 RIGHT FWD MID FUS
			VS70-764419	1-8	C	6/20/86	SCHEMATIC DIAGRAM - MID MCA #1 RIGHT FWD MID FUS
			VS70-764522	1-13	B	7/21/86	SCHEMATIC DIAGRAM - MID MCA #2 RIGHT FWD MID FUS

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
14.4-7	ENGR J. HUGHES			ENGR	
	ENGR David Linder for	4-5-95		ENGR	
14.4-8	ENGR D. WAGNER			ENGR	
	ENGR David Linder for	4-5-95		ENGR	
	ENGR			APP	
	ENGR			APP	
	ENGR			APP	
	ENGR			LTR E PCN 5	

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FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
14.4 (SHEET 8) (CONC'D)			VS70-764429	1-13	F	6/20/86	SCHEMATIC DIAGRAM - MID MCA #2 RIGHT FWD MID FUS
			VS70-764532	1-11	B	7/21/86	SCHEMATIC DIAGRAM - MID MCA #3 MID FUSELAGE
			VS70-764439	1-11	E	6/20/86	SCHEMATIC DIAGRAM - MID MCA #3 MID FUSELAGE
			VS70-764442	1-12	J	7/23/86	SCHEMATIC DIGRAM - MID MICA #4 RIGHT FWD MID FUS
			VS70-764449	1-12	F	6/20/86	SCHEMATIC DIAGRAM - MID MCA #4 RIGHT FWD MID FUS
			VS70-976099	76AS	A	3/23/89	PRE-FLT BUS 1 & 2 CONT, MONITOR, AND DISTRIBUTION
			VS70-976102	76AS	G	6/5/87	PRE-FLT BUS 1 & 2 CONT, MONITOR, AND DISTRIBUTION
14.5 (SHEET 1)	RMS SW OV	IBM	NAS9-16920		OI-23	7/15/93	OPERATIONAL DETAILED DESIGN SPECIFICATION
		IBM			OI-23		RMS SOFTWARE CODE LISTING
		IBM	STS87-00176			4/4/93	CPDS LEVEL C
14.5 (SHEET 2)	RMS SW OV	IBM	NAS9-16920		OI-23	7/15/93	OPERATIONAL DETAILED DESIGN SPECIFICATION
		IBM			OI-23		RMS SOFTWARE CODE LISTING
14.6 (SHEET 1)	RMS MPM/MRL ELEC	ROCKWELL	VS70-540512	1 & 2	B	6/5/84	SCHEMATIC DIAGRAM-PORT MANIPULATOR DEPLMT CONTROL SUBSYSTEM
		ROCKWELL	VS70-540519	1 & 2	A	5/11/84	SCHEMATIC DIAGRAM PORT MANIPULATOR DEPLMT CONTROL SUBSYSTEM
		ROCKWELL	VS72-956099	56 HA & 56 HB	A	2/23/88	PORT MANIPULATOR DEPLOYMENT SYSTEM 1
		ROCKWELL	VS72-956102	56 HA & 56 HB	E	4/22/85	PORT MANIPULATOR DEPLOYMENT SYSTEM 1
		ROCKWELL	VS70-540702	1-3	L	5/3/84	SCHEMATIC DIAGRAM PORT MANIP RETTN LATCH CONTROL SUBSYSTEM
		ROCKWELL	VS70-540709	1 -2	A	3/16/81	SCHEMATIC DIAGRAM PORT MANIP RETTN LATCH CONTROL SUBSYSTEM
		ROCKWELL	VS72-956099	56 KA & 56 KB	A	2/11/85	SCHEMATIC DIAGRAM PORT MANIP RETTN LATCH CONTROL SUBSYSTEM
		ROCKWELL	VS72-956102	56 KA & 56 KB	E	4/22/85	SCHEMATIC DIAGRAM PORT MANIP RETTN LATCH CONTROL SUBSYSTEM
14.6 (SHEET 2)	MPM/MRL MECH 2	ROCKWELL	V082-544600	1	A	5/1/79	MECHANISM ASSEMBLY - MPM SHOULDER
		ROCKWELL	V082-544601	1, 2	A	8/4/81	FITTING ASSEMBLY - LOWER SHOULDER, MPM
		ROCKWELL	V082-544650	2, 3	A	6/14/79	MECHANISM ASSEMBLY - RETENTION PEDESTAL
		ROCKWELL	V082-544651	1	A	8/25/81	FITTING ASSEMBLY - LOWER RETENTION, MPM
		ROCKWELL	V082-544835			10/23/79	MECHANISM ASSEMBLY - SWITCH MANIPULATOR LATCH MECHANISM

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
14.4-8	ENGR D. WAGNER			ENGR	
	ENGR David Lindner for	4-5-95		ENGR	
14.5-1,2	ENGR R. HAZLE			ENGR	
	ENGR R Hazle	4-5-95		ENGR	
14.6-1,2	ENGR D. LINDNER			APP	
	ENGR David Lindner	4-5-95		APP	
	ENGR			APP	
	ENGR			LTR E	PCN 5

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BASIC REV E-5

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
14.6 (SHEET 2) (CONC'D)		ROCKWELL	V082-544851	1		7/26/79	BASE ASSEMBLY - RETENTION, MPM
		ROCKWELL	V082-544800	1	A	2/16/81	MANIPULATOR POSITIONING MECHANISM ASSEMBLY - UPPER
		ROCKWELL	V082-544740	1	NC	2/19/80	SWITCH ASSEMBLY - MODULE, READY TO LATCH, MPM
		ROCKWELL	V082-544850	1	A	8/25/81	BASE ASSEMBLY - SHOULDER, MANIPULATOR POSITIONING MECHANISM
		ROCKWELL	M072-544501	3	B	7/5/84	MECHANICAL INSTALLATION - MPM TECH ORDER INSTALLATION
		ELLANEF	A1059A010	2 & 3	E	7/14/78	LATCH ASSEMBLY - MANIPULATOR RETENTION
		ELLANEF	A1059C010	1	D	7/20/78	MANIPULATOR RETENTION LATCH ASSEMBLY
14.6 (SHEET 3)	PORT RMS JETTISON ELECT	R.I.	VS70-540809	1-5	C	4/23/87	STARBD MANIP ARM SHLDR JTSN & RETTN* LATCH SUBSYSTEM
		R.I.	VS70-540822	1-5	A	3/24/83	STARBD MANIP ARM SHLDR JTSN & RETTN* LATCH SUBSYSTEM
		R.I.	VS72-	45-48	E/EOFO6		INTEGRATED SYSTEM SCHEMATIC-ORBITER OV-102 MECHANICAL & PAYLOAD SYSTEMS
		R.I.	VS70-540909	1-5	A	2/2/83	PORT MANIP ARM SHLDR JTSN & RETTN LCH JTSN SUBSYSTEM
		R.I.	VS70-540922	1-5	B	3/24/83	PORT MANIP ARM SHLDR JTSN & RETTN LCH JTSN SUBSYSTEM
		ROCKWELL	VS72-	54-57	A/EOB08		INTEGRATED SYSTEM SCHEMATIC-ORBITER OV-299
		ROCKWELL	VS70-764372	1, 2	C	6/28/79	SCHEMATIC DIAGRAM - MIDBODY JETTISON CONTROLLER ASSEMBLY
14.7 (SHEET 1)	FRGF	SPAR	51450F1	1 TO 2 OF 2	C	9/86	OUTLINE AND INSTALLATION FLIGHT RELEASABLE GRAPPLE FIXTURE
		SPAR	SPAR-RMS. R.950	PG 14.15	-	6/84	OPERATION ANALYSIS REPORT OPERATION OF A FRGF BY A SUITED CREWMEMBER
		SPAR	51450D114	1 OF1	-	11/83	TARGET PLATE (FRGF)
14.7 (SHEET 2)	RSGF	SPAR	51574E100	1 OF 2	A	9/85	OUTLINE AND INSTALLATION RIGIDIZE SENSING GRAPPLE FIXTURE
		SPAR	51574E101	1 OF 2	C	9/87	GRAPPLE FIXTURE/EVA RELEASE ASSY
		SPAR	SPAR-RMS-PA.1064 (A)	PG 7	-	9/86	HAZARD ANALYSIS FOR RSGF
14.7 (SHEET 3)	EFGF	SPAR	51597E100	1 - 4	D	8/90	ASSEMBLY - ELECTRICAL FLIGHT GRAPPLE FIXTURE
		SPAR	SPAR-RMS-SG-1198	5, 28, 29	B	3/90	CONTRACT END ITEM SPECIFICATION - PERFORMANCE/ DESIGN FOR AN EVA RELEASABLE ELECTRICAL FLIGHT GRAPPLE FIXTURE

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
14.6-2	ENGR D. LINDNER			ENGR	
	ENGR Dan Lindner	11/26/91		ENGR	
14.6-3	ENGR R. FOALE			ENGR	
	ENGR Rhonda Foale	11/26/91		ENGR	
14.7-1,2	ENGR D. GOODWIN			APP R J Neal	11/26/91
	ENGR Dan Goodwin	11/26/91		APP R J Neal	11/26/91
14.7-3	ENGR D. GOODWIN			OMNIPLAN	
	ENGR Dan Goodwin	11/26/91		LTR E PCN 1	

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BASIC REV E-1

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
14.9 (SHEET 1)	YO ELEC	ROCKWELL	V790-54001	1, 2, 6, 7, 11, 12	B	3/22/88	SCHEMATIC DIAGRAM SPDS DEPLOYMENT SUBSYSTEM
14.9 (SHEET 2)	RDU ELEC	ROCKWELL	V790-54001	1, 2, 3, 4, 5, 11, 12	B	3/22/88	SCHEMATIC DIAGRAM SPDS DEPLOYMENT SUBSYSTEM
14.9 (SHEET 3)	P.L RELEASE & DRIVE TRANSFER	ROCKWELL	V790-54001	8, 9, 10, 11, 12	B	3/22/88	SCHEMATIC DIAGRAM SPDS DEPLOYMENT SUBSYSTEM
14.9 (SHEET 4)	SPDS MECH 1	ROCKWELL	V790-544002	1		8/8/88	SCHEMATIC DIAGRAM SPDS PRIMARY AND SECONDARY PEDESTAL ASSY.
14.9 (SHEET 5)	SPDS MECH 2	ROCKWELL	V790-544002	1		8/8/88	SCHEMATIC DIAGRAM SPDS PRIMARY AND SECONDARY PEDESTAL ASSY
14.10 (SHEET 1)	NEW RMS MCIU	SPAR	812736	1		7/4/89	ANALOG INTERFACE BLOCK DIAGRAM
		SPAR	812735	1		7/7/89	DIGITAL INTERFACE FUNCTIONAL DIAGRAM
		SPAR	812738	1		7/4/89	FAILURE DETECTOR BOARD BLOCK DIAGRAM
		SPAR	812737	1		7/6/89	COMPUTER INTERFACE FUNCTIONAL DIAGRAM
		SPAR	812798	1		10/4/89	MANIPULATOR CONTROLLER POWER CONDITIONER SCHEMATIC DIAGRAM
		SPAR	812739	1		7/10/89	MCIU CPU BOARD SCHEMATIC
		SPAR	812740	1		7/10/89	EPROM, RAM, AND PARITY BOARDS BLOCK DIAGRAM
		SPAR	812742	1,2,3		11/16/88	ANALOG INTERFACE SCHEMATIC DIAGRAM
		SPAR	812796	1,2,3,4		11/16/88	DIGITAL INTERFACE SCHEMATIC DIAGRAM
		SPAR	812797	1,2,3,4,5		11/16/88	FAILURE DETECTOR BOARD SCHEMATIC DIAGRAM
		SPAR	812753	1,2,3		10/5/88	COMPUTER INTERFACE SCHEMATIC DIAGRAM
		SPAR	812802	1,2		8/10/88	POWER CONDITIONER CONTROLLER SCHEMATIC DIAGRAM
		SPAR	812806	1,2,3,4		11/16/88	MCIU CPU BOARD SCHEMATIC DIAGRAM
		SPAR	812804	1,2,3,4		11/30/88	MCIU RAM AND PARITY - PWB SCHEMATIC

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
14.9-1,2	ENGR D. LINDNER			ENGR	
	ENGR Don Lindner	11/26/91		ENGR	
14.9-3,4,5	ENGR R. FOALE			ENGR	
	ENGR Rhonda Foale	11/26/91		ENGR	
14.10-1	ENGR S. FERRARA			APP R.M. Neal	11/26/91
	ENGR Luke Scott Ferrara	11/26/91		APP R.M. Neal	11/26/91
	ENGR			OMNIPLAN	
	ENGR			LTR E	PCN 1

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FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
14.11 (SHEET 1)	NEW FIRMWARE OV	SPAR	RML-009-88-013		B	7/89	FLIGHT SOFTWARE TOP LEVEL DESIGN
			RML-009-88-032		C	7/89	FLIGHT SOFTWARE DETAILED DESIGN
			SG 1090		C	10/88	MANIPULATOR CONTROLLER INTERFACE UNIT SPECIFICATION
			812831		B	8/2/89	FLIGHT SOFTWARE REQUIREMENTS SPECIFICATIONS
			813362		-	11/89	MANIPULATOR CONTROLLER INTERFACE UNIT FLIGHT SOFTWARE PROGRAM
14.11 (SHEETS 2 & 3)	NEW MCIU DETAILED FIRMWARE	SPAR	RML-009-88-013		B	7/89	FLIGHT SOFTWARE TOP LEVEL DESIGN
			RML-009-88-032		C	7/89	FLIGHT SOFTWARE DETAILED DESIGN
			SG 1090		C	10/88	MANIPULATOR CONTROLLER INTERFACE UNIT SPECIFICATION
			812831		B	8/2/89	FLIGHT SOFTWARE REQUIREMENTS SPECIFICATIONS
			813362		-	11/89	MANIPULATOR CONTROLLER INTERFACE UNIT FLIGHT SOFTWARE PROGRAM
14.11 (SHEET 4)	NEW MCIU MEMORY FIRMWARE	SPAR	RML-009-88-013		B	7/89	FLIGHT SOFTWARE TOP LEVEL DESIGN
			RML-009-88-032		C	7/89	FLIGHT SOFTWARE DETAILED DESIGN
			SG 1090		C	10/88	MANIPULATOR CONTROLLER INTERFACE UNIT SPECIFICATION
			812831		B	8/2/89	FLIGHT SOFTWARE REQUIREMENTS SPECIFICATIONS
			813362		-	11/89	MANIPULATOR CONTROLLER INTERFACE UNIT FLIGHT SOFTWARE PROGRAM
14.12 (SHEET 1)	ROEU ELECTRICAL OVERVIEW	ROCKWELL	VS70-764412	2,4,5,6	G	9/17/82	SCHEMATIC DIAGRAM MID MOTOR CONT ASSY NO. 1 RIGHT FWD MID FUSELAGE
			VS70-760702	ALL	H	8/15/86	SCHEMATIC DIAGRAM MOTOR CONTROL ASSY POWER DISTRIBUTION
			VS70-733199	1 AND 2	C	9/30/86	SCHEMATIC DIAGRAM D&C PANEL R13A2 RIGHT-HAND CONSOLE
			VS70-733709	4	D	5/10/84	SCHEMATIC DIAGRAM PANEL A6A 1 AFT ON ORBIT STA
			VS70-733897	1 AND 2	B	5/8/85	SCHEMATIC DIAGRAM D&C PANEL MA7D3C MID DECK BAY 3B
			V751-544150	ALL		5/13/86	LIMIT SWITCH ASSY - LATCH DRIVE, ORBITER DISCONNECT MECH, ROEU
			V751-544250	ALL		7/10/86	LIMIT SWITCH ASSY - ORBITER DISCONNECT MECH, ROEU
14.12 (SHEET 2)	ROEU MECHANICAL OVERVIEW	ROCKWELL	JSC-23004	ALL		7/88	ROEU USER'S MANUAL
14.13 (SHEET 3)	ROEU MECHANICAL	ROCKWELL	V751-544100	ALL		3/9/87	ORBITER DISCONNECT MECHANISM, ASSY, ROEU
			V751-544110	ALL		9/26/86	MECHANISM ASSY - ORBITER ARM DRIVE, ROEU
			V751-544200	ALL		6/24/86	ORBITER DISCONNECT ASSY - ROEU

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
14.11,1-4	ENGR R. KERR			ENGR	
	ENGR Ronald L Kerr	11/26/91		ENGR	
14.12-1,2,3	ENGR K. CARLISLE-MORGAN			ENGR	
	ENGR A. Lewis for K Carlisle-Morgan	11/26/91		ENGR	
	ENGR			APP R T Neal	11/26/91
	ENGR			APP R T Neal	11/26/91
	ENGR			OMNIPLAN	
	ENGR			LTR E PCN 1	

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

VENDOR DRAWING REFERENCES

SPACE SHUTTLE	TBL NO 14-I
ALL	
	PAGE 14.1-11 SHEET 11 OF 11

BASIC REV E-1

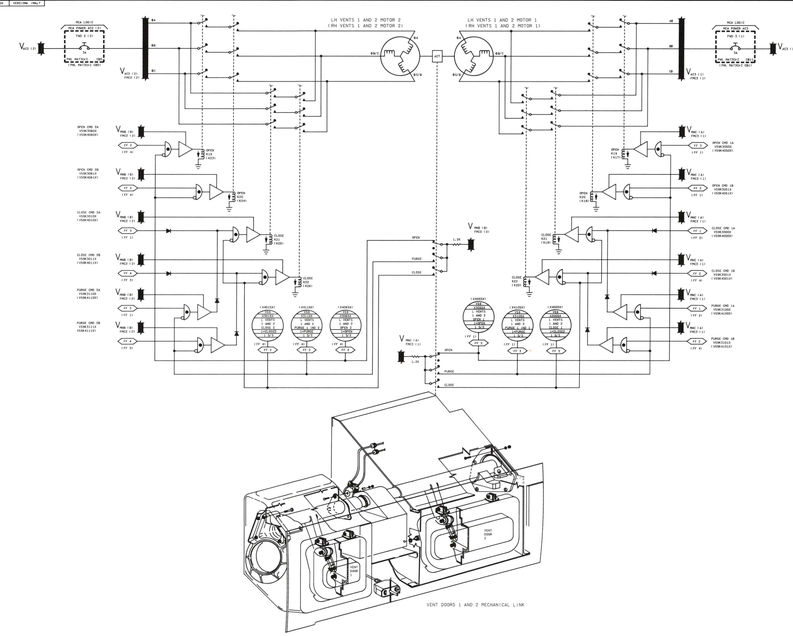

TABLE A
VENT DOOR MSI DF'S

MSI		DOOR	
P/O	BIT	VENT COMMANDS	FEEDBACK
4568/5552	4568077520	P OPEN VENT 1 RH SPDA 1	4568077521
4568/5552	4568077522	P CNC VENTS 1&2 RH SPDA 1	4568077523
4568/5552	4568077524	P CNC VENTS 1&2 RH SPDA 2	4568077525
4568/5552	4568077526	P CNC VENTS 1&2 RH SPDA 2I	4568077527
4568/5552	4568077800	P OPEN VENT 1 RH SPDA 2I	4568077801
4568/5552	4568077802	P OPEN VENTS 1&2 RH SPDA 2I	4568077803
4568/5552	4568077804	P OPEN VENTS 1&2 RH SPDA 1	4568077805
4568/5552	4568078060	P OPEN VENT 1 RH SPDA 1	4568078061
4568/5552	4568078062	P OPEN VENTS 1&2 RH SPDA 1	4568078063
4568/5552	4568078064	P OPEN VENTS 1&2 RH SPDA 2I	4568078065
4568/5552	4568078066	P OPEN VENT 1 RH SPDA 2I	4568078067
4568/5552	4568078068	P OPEN VENTS 1&2 RH SPDA 2I	4568078069
4568/5552	4568078070	P OPEN VENTS 1&2 RH SPDA 1	4568078071
4568/5552	4568078072	P OPEN VENT 1 RH SPDA 1	4568078073
4568/5552	4568078074	P OPEN VENTS 1&2 RH SPDA 1	4568078075
4568/5552	4568078076	P OPEN VENTS 1&2 RH SPDA 2I	4568078077
4568/5552	4568078078	P OPEN VENT 1 RH SPDA 2I	4568078079
4568/5552	4568078080	P OPEN VENTS 1&2 RH SPDA 2I	4568078081
4568/5552	4568078082	P OPEN VENTS 1&2 RH SPDA 1	4568078083
4568/5552	4568078084	P OPEN VENT 1 RH SPDA 1	4568078085
4568/5552	4568078086	P OPEN VENTS 1&2 RH SPDA 1	4568078087
4568/5552	4568078088	P OPEN VENTS 1&2 RH SPDA 2I	4568078089
4568/5552	4568078090	P OPEN VENT 1 RH SPDA 2I	4568078091
4568/5552	4568078092	P OPEN VENTS 1&2 RH SPDA 2I	4568078093
4568/5552	4568078094	P OPEN VENTS 1&2 RH SPDA 1	4568078095
4568/5552	4568078096	P OPEN VENT 1 RH SPDA 1	4568078097
4568/5552	4568078098	P OPEN VENTS 1&2 RH SPDA 1	4568078099
4568/5552	4568078100	P OPEN VENTS 1&2 RH SPDA 2I	4568078101
4568/5552	4568078102	P OPEN VENT 1 RH SPDA 2I	4568078103
4568/5552	4568078104	P OPEN VENTS 1&2 RH SPDA 2I	4568078105
4568/5552	4568078106	P OPEN VENTS 1&2 RH SPDA 1	4568078107
4568/5552	4568078108	P OPEN VENT 1 RH SPDA 1	4568078109
4568/5552	4568078110	P OPEN VENTS 1&2 RH SPDA 1	4568078111
4568/5552	4568078112	P OPEN VENTS 1&2 RH SPDA 2I	4568078113
4568/5552	4568078114	P OPEN VENT 1 RH SPDA 2I	4568078115
4568/5552	4568078116	P OPEN VENTS 1&2 RH SPDA 2I	4568078117
4568/5552	4568078118	P OPEN VENTS 1&2 RH SPDA 1	4568078119
4568/5552	4568078120	P OPEN VENT 1 RH SPDA 1	4568078121
4568/5552	4568078122	P OPEN VENTS 1&2 RH SPDA 1	4568078123
4568/5552	4568078124	P OPEN VENTS 1&2 RH SPDA 2I	4568078125
4568/5552	4568078126	P OPEN VENT 1 RH SPDA 2I	4568078127
4568/5552	4568078128	P OPEN VENTS 1&2 RH SPDA 2I	4568078129
4568/5552	4568078130	P OPEN VENTS 1&2 RH SPDA 1	4568078131
4568/5552	4568078132	P OPEN VENT 1 RH SPDA 1	4568078133
4568/5552	4568078134	P OPEN VENTS 1&2 RH SPDA 1	4568078135
4568/5552	4568078136	P OPEN VENTS 1&2 RH SPDA 2I	4568078137
4568/5552	4568078138	P OPEN VENT 1 RH SPDA 2I	4568078139
4568/5552	4568078140	P OPEN VENTS 1&2 RH SPDA 2I	4568078141
4568/5552	4568078142	P OPEN VENTS 1&2 RH SPDA 1	4568078143
4568/5552	4568078144	P OPEN VENT 1 RH SPDA 1	4568078145
4568/5552	4568078146	P OPEN VENTS 1&2 RH SPDA 1	4568078147
4568/5552	4568078148	P OPEN VENTS 1&2 RH SPDA 2I	4568078149
4568/5552	4568078150	P OPEN VENT 1 RH SPDA 2I	4568078151
4568/5552	4568078152	P OPEN VENTS 1&2 RH SPDA 2I	4568078153
4568/5552	4568078154	P OPEN VENTS 1&2 RH SPDA 1	4568078155
4568/5552	4568078156	P OPEN VENT 1 RH SPDA 1	4568078157
4568/5552	4568078158	P OPEN VENTS 1&2 RH SPDA 1	4568078159
4568/5552	4568078160	P OPEN VENTS 1&2 RH SPDA 2I	4568078161
4568/5552	4568078162	P OPEN VENT 1 RH SPDA 2I	4568078163
4568/5552	4568078164	P OPEN VENTS 1&2 RH SPDA 2I	4568078165
4568/5552	4568078166	P OPEN VENTS 1&2 RH SPDA 1	4568078167
4568/5552	4568078168	P OPEN VENT 1 RH SPDA 1	4568078169
4568/5552	4568078170	P OPEN VENTS 1&2 RH SPDA 1	4568078171
4568/5552	4568078172	P OPEN VENTS 1&2 RH SPDA 2I	4568078173
4568/5552	4568078174	P OPEN VENT 1 RH SPDA 2I	4568078175
4568/5552	4568078176	P OPEN VENTS 1&2 RH SPDA 2I	4568078177
4568/5552	4568078178	P OPEN VENTS 1&2 RH SPDA 1	4568078179
4568/5552	4568078180	P OPEN VENT 1 RH SPDA 1	4568078181
4568/5552	4568078182	P OPEN VENTS 1&2 RH SPDA 1	4568078183
4568/5552	4568078184	P OPEN VENTS 1&2 RH SPDA 2I	4568078185
4568/5552	4568078186	P OPEN VENT 1 RH SPDA 2I	4568078187
4568/5552	4568078188	P OPEN VENTS 1&2 RH SPDA 2I	4568078189
4568/5552	4568078190	P OPEN VENTS 1&2 RH SPDA 1	4568078191
4568/5552	4568078192	P OPEN VENT 1 RH SPDA 1	4568078193
4568/5552	4568078194	P OPEN VENTS 1&2 RH SPDA 1	4568078195
4568/5552	4568078196	P OPEN VENTS 1&2 RH SPDA 2I	4568078197
4568/5552	4568078198	P OPEN VENT 1 RH SPDA 2I	4568078199
4568/5552	4568078200	P OPEN VENTS 1&2 RH SPDA 2I	4568078201
4568/5552	4568078202	P OPEN VENTS 1&2 RH SPDA 1	4568078203
4568/5552	4568078204	P OPEN VENT 1 RH SPDA 1	4568078205
4568/5552	4568078206	P OPEN VENTS 1&2 RH SPDA 1	4568078207
4568/5552	4568078208	P OPEN VENTS 1&2 RH SPDA 2I	4568078209
4568/5552	4568078210	P OPEN VENT 1 RH SPDA 2I	4568078211
4568/5552	4568078212	P OPEN VENTS 1&2 RH SPDA 2I	4568078213
4568/5552	4568078214	P OPEN VENTS 1&2 RH SPDA 1	4568078215
4568/5552	4568078216	P OPEN VENT 1 RH SPDA 1	4568078217
4568/5552	4568078218	P OPEN VENTS 1&2 RH SPDA 1	4568078219
4568/5552	4568078220	P OPEN VENTS 1&2 RH SPDA 2I	4568078221
4568/5552	4568078222	P OPEN VENT 1 RH SPDA 2I	4568078223
4568/5552	4568078224	P OPEN VENTS 1&2 RH SPDA 2I	4568078225
4568/5552	4568078226	P OPEN VENTS 1&2 RH SPDA 1	4568078227
4568/5552	4568078228	P OPEN VENT 1 RH SPDA 1	4568078229
4568/5552	4568078230	P OPEN VENTS 1&2 RH SPDA 1	4568078231
4568/5552	4568078232	P OPEN VENTS 1&2 RH SPDA 2I	4568078233
4568/5552	4568078234	P OPEN VENT 1 RH SPDA 2I	4568078235
4568/5552	4568078236	P OPEN VENTS 1&2 RH SPDA 2I	4568078237
4568/5552	4568078238	P OPEN VENTS 1&2 RH SPDA 1	4568078239
4568/5552	4568078240	P OPEN VENT 1 RH SPDA 1	4568078241
4568/5552	4568078242	P OPEN VENTS 1&2 RH SPDA 1	4568078243
4568/5552	4568078244	P OPEN VENTS 1&2 RH SPDA 2I	4568078245
4568/5552	4568078246	P OPEN VENT 1 RH SPDA 2I	4568078247
4568/5552	4568078248	P OPEN VENTS 1&2 RH SPDA 2I	4568078249
4568/5552	4568078250	P OPEN VENTS 1&2 RH SPDA 1	4568078251
4568/5552	4568078252	P OPEN VENT 1 RH SPDA 1	4568078253
4568/5552	4568078254	P OPEN VENTS 1&2 RH SPDA 1	4568078255
4568/5552	4568078256	P OPEN VENTS 1&2 RH SPDA 2I	4568078257
4568/5552	4568078258	P OPEN VENT 1 RH SPDA 2I	4568078259
4568/5552	4568078260	P OPEN VENTS 1&2 RH SPDA 2I	4568078261
4568/5552	4568078262	P OPEN VENTS 1&2 RH SPDA 1	4568078263
4568/5552	4568078264	P OPEN VENT 1 RH SPDA 1	4568078265
4568/5552	4568078266	P OPEN VENTS 1&2 RH SPDA 1	4568078267
4568/5552	4568078268	P OPEN VENTS 1&2 RH SPDA 2I	4568078269
4568/5552	4568078270	P OPEN VENT 1 RH SPDA 2I	4568078271
4568/5552	4568078272	P OPEN VENTS 1&2 RH SPDA 2I	4568078273
4568/5552	4568078274	P OPEN VENTS 1&2 RH SPDA 1	4568078275
4568/5552	4568078276	P OPEN VENT 1 RH SPDA 1	4568078277
4568/5552	4568078278	P OPEN VENTS 1&2 RH SPDA 1	4568078279
4568/5552	4568078280	P OPEN VENTS 1&2 RH SPDA 2I	4568078281
4568/5552	4568078282	P OPEN VENT 1 RH SPDA 2I	4568078283
4568/5552	4568078284	P OPEN VENTS 1&2 RH SPDA 2I	4568078285
4568/5552	4568078286	P OPEN VENTS 1&2 RH SPDA 1	4568078287
4568/5552	4568078288	P OPEN VENT 1 RH SPDA 1	4568078289
4568/5552	4568078290	P OPEN VENTS 1&2 RH SPDA 1	4568078291
4568/5552	4568078292	P OPEN VENTS 1&2 RH SPDA 2I	4568078293
4568/5552	4568078294	P OPEN VENT 1 RH SPDA 2I	4568078295
4568/5552	4568078296	P OPEN VENTS 1&2 RH SPDA 2I	4568078297
4568/5552	4568078298	P OPEN VENTS 1&2 RH SPDA 1	4568078299
4568/5552	4568078300	P OPEN VENT 1 RH SPDA 1	4568078301
4568/5552	4568078302	P OPEN VENTS 1&2 RH SPDA 1	4568078303
4568/5552	4568078304	P OPEN VENTS 1&2 RH SPDA 2I	4568078305
4568/5552	4568078306	P OPEN VENT 1 RH SPDA 2I	4568078307
4568/5552	4568078308	P OPEN VENTS 1&2 RH SPDA 2I	4568078309
4568/5552	4568078310	P OPEN VENTS 1&2 RH SPDA 1	4568078311
4568/5552	4568078312	P OPEN VENT 1 RH SPDA 1	4568078313
4568/5552	4568078314	P OPEN VENTS 1&2 RH SPDA 1	4568078315
4568/5552	4568078316	P OPEN VENTS 1&2 RH SPDA 2I	4568078317
4568/5552	4568078318	P OPEN VENT 1 RH SPDA 2I	4568078319
4568/5552	4568078320	P OPEN VENTS 1&2 RH SPDA 2I	4568078321
4568/5552	4568078322	P OPEN VENTS 1&2 RH SPDA 1	4568078323
4568/5552	4568078324	P OPEN VENT 1 RH SPDA 1	4568078325
4568/5552	4568078326	P OPEN VENTS 1&2 RH SPDA 1	4568078327
4568/5552	4568078328	P OPEN VENTS 1&2 RH SPDA 2I	4568078329
4568/5552	4568078330	P OPEN VENT 1 RH SPDA 2I	4568078331
4568/5552	4568078332	P OPEN VENTS 1&2 RH SPDA 2I	4568078333
4568/5552	4568078334	P OPEN VENTS 1&2 RH SPDA 1	4568078335
4568/5552	4568078336	P OPEN VENT 1 RH SPDA 1	4568078337
4568/5552	4568078338	P OPEN VENTS 1&2 RH SPDA 1	4568078339
4568/5552	4568078340	P OPEN VENTS 1&2 RH SPDA 2I	4568078341
4568/5552	4568078342	P OPEN VENT 1 RH SPDA 2I	4568078343
4568/5552	4568078344	P OPEN VENTS 1&2 RH SPDA 2I	4568078345
4568/5552	4568078346	P OPEN VENTS 1&2 RH SPDA 1	4568078347
4568/5552	4568078348	P OPEN VENT 1 RH SPDA 1	4568078349
4568/5552	4568078350	P OPEN VENTS 1&2 RH SPDA 1	4568078351
4568/5552	4568078352	P OPEN VENTS 1&2 RH SPDA 2I	4568078353
4568/5552	4568078354	P OPEN VENT 1 RH SPDA 2I	4568078355
4568/5552	4568078356	P OPEN VENTS 1&2 RH SPDA 2I	4568078357
4568/5552	4568078358	P OPEN VENTS 1&2 RH SPDA 1	4568078359
4568/5552	4568078360	P OPEN VENT 1 RH SPDA 1	4568078361
4568/5552	4568078362	P OPEN VENTS 1&2 RH SPDA 1	4568078363
4568/5552	4568078364	P OPEN VENTS 1&2 RH SPDA 2I	4568078365
4568/5552	4568078366	P OPEN VENT 1 RH SPDA 2I	4568078367
4568/5552	4568078368	P OPEN VENTS 1&2 RH SPDA 2I	4568078369
4568/5552	4568078370	P OPEN VENTS 1&2 RH SPDA 1	4568078371
4568/5552	4568078372	P OPEN VENT 1 RH SPDA 1	4568078373
4568/5552	4568078374	P OPEN VENTS 1&2 RH SPDA 1	4568078375
4568/5552	4568078376	P OPEN VENTS 1&2 RH SPDA 2I	4568078377
4568/5552	4568078378	P OPEN VENT 1 RH SPDA 2I	4568078379
4568/5552	4568078380	P OPEN VENTS 1&2 RH SPDA 2I	4568078381
4568/5552	4568078382	P OPEN VENTS 1&2 RH SPDA 1	4568078383
4568/5552	4568078384	P OPEN VENT 1 RH SPDA 1	4568078385
4568/5552	4568078386	P OPEN VENTS 1&2 RH SPDA 1	4568078387
4568/5552	4568078388	P OPEN VENTS 1&2 RH SPDA 2I	4568078389
4568/5552	4568078390	P OPEN VENT 1 RH SPDA 2I	4568078391
4568/5552	4568078392	P OPEN VENTS 1&2 RH SPDA 2I	4568078393
4568/5552	4568078394	P OPEN VENTS 1&2 RH SPDA 1	4568078395
4568/5552	4568078396	P OPEN VENT 1 RH SPDA 1	4568078397
4568/5552	4568078398	P OPEN VENTS 1&2 RH SPDA 1	4568078399
4568/5552	4568078400	P OPEN VENTS 1&2 RH SPDA 2I	4568078401
4568/5552	4568078402	P OPEN VENT 1 RH SPDA 2I	4568078403
4568/5552	4568078404	P OPEN VENTS 1&2 RH SPDA 2I	4568078405
4568/5552	4568078406	P OPEN VENTS 1&2 RH SPDA 1	4568078407
4568/5552	4568078408	P OPEN VENT 1 RH SPDA 1	4568078409
4568/5552	4568078410	P OPEN VENTS 1&2 RH SPDA 1	4568078411
4568/5552	4568078412	P OPEN VENTS 1&2 RH SPDA 2I	4568078413
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4568/5552	4568078416	P OPEN VENTS 1&2 RH SPDA 2I	4568078417
4568/5552	4568078418	P OPEN VENTS 1&2 RH SPDA 1	4568078419
4568/5552	4568078420	P OPEN VENT 1 RH SPDA 1	4568078421
4568/5552	4568078422	P OPEN VENTS 1&2 RH SPDA 1	4568078423
4568/5552	4568078424	P OPEN VENTS 1&2 RH SPDA 2I	4568078425
4568/5552	4568078426	P OPEN VENT 1 RH SPDA 2I	4568078427
4568/5552	4568078428	P OPEN VENTS 1&2 RH SPDA 2I	4568078429
4568/5552	4568078430	P OPEN VENTS 1&2 RH SPDA 1	4568078431
4568/5552	4568078432	P OPEN VENT 1 RH SPDA 1	4568078433
4568/5552	4568078434	P OPEN VENTS 1&2 RH SPDA 1	4568078435
4568/5552	4568078436	P OPEN VENTS 1&2 RH SPDA 2I	4568078437
4568/5552	4568078438	P OPEN VENT 1 RH SPDA 2I	4568078439
4568/5552	4568078440	P OPEN VENTS 1&2 RH SPDA 2I	4568078441
4568/5552	4568078442	P OPEN VENTS 1&2 RH SPDA 1	4568078443
4568/5552	4568078444	P OPEN VENT 1 RH SPDA 1	4568078445
4568/5552	4568078446	P OPEN VENTS 1&2 RH SPDA 1	4568078447
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4568/5552	4568078454	P OPEN VENTS 1&2 RH SPDA 1	4568078455
4568/5552	4568078456	P OPEN VENT 1 RH SPDA 1	4568078457
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4568/5552	4568078460	P OPEN VENTS 1&2 RH SPDA 2I	4568078461
4568/5552	4568078462	P OPEN VENT 1 RH SPDA 2I	4568078463
4568/5552	4568078464	P OPEN VENTS 1&2 RH SPDA 2I	4568078465
4568/5552	4568078466	P OPEN VENTS 1&2 RH SPDA 1	4568078467
4568/5552	4568078468	P OPEN VENT 1 RH SPDA 1	4568078469
4568/5552	4568078470	P OPEN VENTS 1&2 RH SPDA 1	4568078471
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4568/5552	4568078480	P OPEN VENT 1 RH SPDA 1	4568078481
4568/5552	4568078482	P OPEN VENTS 1&2 RH SPDA 1	4568078483
4568/5552	4568078484	P OPEN VENTS 1&2 RH SPDA 2I	4568078485
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4568/5552	4568078492	P OPEN VENT 1 RH SPDA 1	4568078493
4568/5552	4568078494	P OPEN VENTS 1&2 RH SPDA 1	4568078495
4568/5552	4568078496	P OPEN VENTS 1&2 RH SPDA 2I	4568078497
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4568/5552	4568078504	P OPEN VENT 1 RH SPDA 1	4568078505
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4568/5552	4568078508	P OPEN VENTS 1&2 RH SPDA 2I	4568078509
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4568/5552	4568078530	P OPEN VENTS 1&2 RH SPDA 1	4568078531
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4568/5552	4568078552	P OPEN VENT 1 RH SPDA 1	4568078553
4568/5552	4568078554	P OPEN VENTS 1&2 RH SPDA 1	4568078555
4568/5552	4568078556	P OPEN VENTS 1&2 RH SPDA 2I	4568078557
4568/5552	4568078558	P OPEN VENT 1 RH SPDA 2I	4568078559
4568/5552	4568078560	P OPEN VENTS 1&2 RH SPDA 2I	4568078561
4568/5552	4568078562	P OPEN VENTS 1&2 RH SPDA 1	4568078563
4568/5552	4568078564	P OPEN VENT 1 RH SPDA 1	4568078565
4568/5552	4568078566	P OPEN VENTS 1&2 RH SPDA 1	4568078567
4568/5552	4568078568	P OPEN VENTS 1&2 RH SPDA 2I	4568078569
4568/5552	4568078570	P OPEN VENT 1 RH SPDA 2I	4568078571
4568/5552	4568078572	P OPEN VENTS 1&2 RH SPDA 2I	4568078573
4568/5552	4568078574	P OPEN VENTS 1&2 RH SPDA 1	4568078575
4568/5552	4568078576	P OPEN VENT 1 RH SPDA 1	4568078577
4568/5552	4568078578	P OPEN VENTS 1&2 RH SPDA 1	4568078579
4568/5552	4568078580	P OPEN VENTS 1&2 RH SPDA 2I	4568078581
4568/5552	4568078582	P OPEN VENT 1 RH SPDA 2I	4568078583
4568/5552	4568078584	P OPEN VENTS 1&2 RH SPDA 2I	4568078585
4568/5552	4568078586	P OPEN VENTS 1&2 RH SPDA 1	4568078587
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4568/5552	4568078596	P OPEN VENTS 1&2 RH SPDA 2I	4568078597
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4568/5552	4568078608	P OPEN VENTS 1&2 RH SPDA 2I	4568078609
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4568/5552	4568078626	P OPEN VENTS 1&2 RH SPDA 1	4568078627
4568/5552	4568078628	P OPEN VENTS 1&2 RH SPDA 2I	4568078629
4568/5552	4568078630	P OPEN VENT 1 RH SPDA 2I	4568078631
4568/5552	4568078632	P OPEN VENTS 1&2 RH SPDA 2I	4568078633
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4568/5552	4568078636	P OPEN VENT 1 RH SPDA 1	4568078637
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4568/5552	4568078640	P OPEN VENTS 1&2 RH SPDA 2I	4568078641
4568/5552	4568078642	P OPEN VENT 1 RH SPDA 2I	4568078643
4568/5552	4568078644	P OPEN VENTS 1&2 RH SPDA 2I	4568078645
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4568/5552	4568078648	P OPEN VENT 1 RH SPDA 1	4568078649
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4568/5552	4568078660	P OPEN VENT 1 RH SPDA 1	4568078661
4568/5552	4568078662	P OPEN VENTS 1&2 RH SPDA 1	4568078663
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4568/5552	4568078692	P OPEN VENTS 1&2 RH SPDA 2I	4568078693
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4568/5552	4568078696	P OPEN VENT 1 RH SPDA 1	4568078697
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4568/5552	4568078702	P OPEN VENT 1 RH SPDA 2I	4568078703
4568/5552	4568078704	P OPEN VENTS 1&2 RH SPDA 2I	4568078705
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4568/5552	4568078708	P OPEN VENT 1 RH SPDA 1	4568078709
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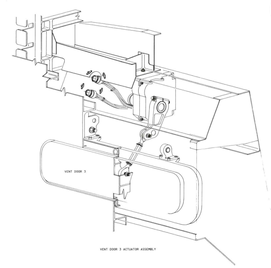
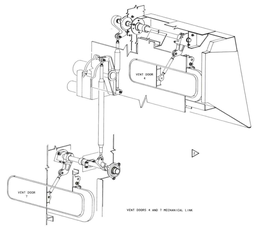
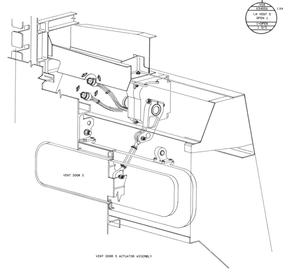
4568/5552	4568078712	P OPEN VENTS 1&2 RH SPDA 2I	4568078713



VENT DOOR 3 ACTUATOR ASSEMBLY



VENT DOORS 4 AND 7 MECHANICAL LINK



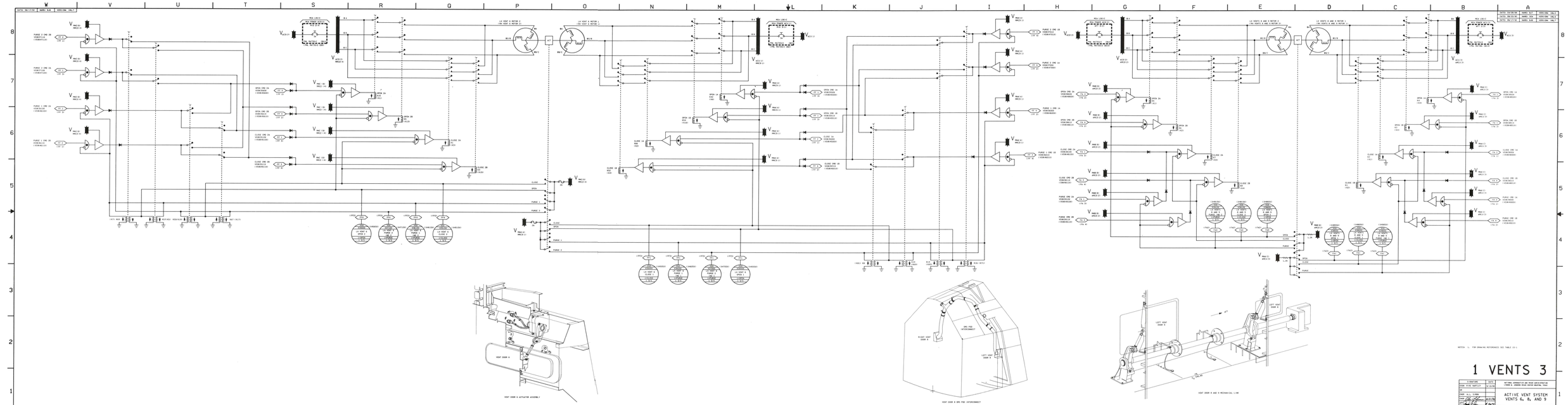
VENT DOOR 5 ACTUATOR ASSEMBLY

△ VENT DOORS 4 AND 7 ARE APU CABLE FOR OV-103 AND OV-104, RESPECTIVELY. VENT DOOR 4 IS NOT USED ON OV-105. VENT DOOR 7 IS FLIGHT/GROUND, FOR OV-103, OV-104, OV-105. (FLIGHT/GROUND MEANS VENT DOORS ARE MANUFLY/FLIGHT)

NOTES: 1. FOR DRAWING REFERENCES SEE TABLE 15-1

1 VENTS 2

SIGNATURE	DATE	NOTICE: INFORMATION ON THIS DRAWING IS PROPRIETARY TO THE BOEING COMPANY AND SHALL NOT BE REPRODUCED, COPIED, OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS OR EQUIPMENT WITHOUT WRITTEN PERMISSION.
DRAWN D.L. HARTLAUB	8/29/80	
CHECK		
ENGR		
ENGR		
ENGR



VENT DOOR 8 ACTUATOR ASSEMBLY

VENT DOOR 8 AND 9 MECHANICAL LINK

1 VENTS 3

ACTIVE VENT SYSTEM
VENTS 6, 8, AND 9

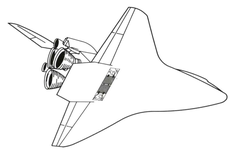
15.1

BASIC REV E-2

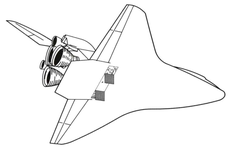
BASIC REV E-2

DATE	CO/ECN#	NAME	PSE	VERSION	ORIG'L
DATE	CO/ECN#	NAME	PSE	VERSION	ORIG'L
DATE	CO/ECN#	NAME	PSE	VERSION	ORIG'L
DATE	CO/ECN#	NAME	PSE	VERSION	ORIG'L

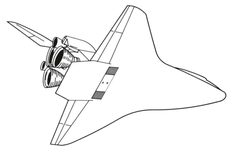
ORB/ET UMBILICAL CLOSEOUT DOOR OPERATIONAL SEQUENCE



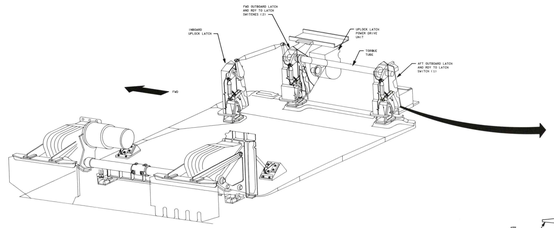
1. DOORS OPEN (CENTERLINE LATCHES LOCKED



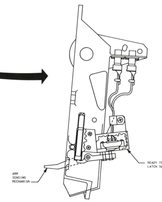
2. DOORS IN TRANSIT TO CLOSED POSITION AND CENTERLINE LATCHES STOWED



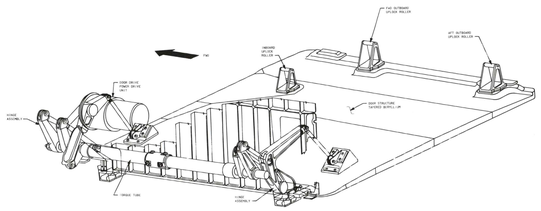
3. DOORS CLOSED, LATCHED AND CENTERLINE LATCHES STOWED



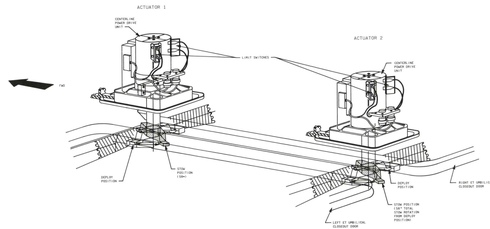
ET UMBILICAL UPLOCK LATCHING MECHANISMS



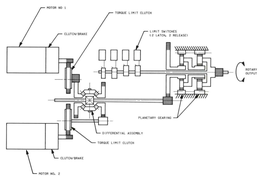
OUTBOARD UPLOCK LATCH MECHANISM WITH READY TO LATCH SWITCH (TYPICAL)



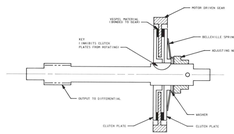
ET UMBILICAL CLOSEOUT DOOR DRIVE MECHANISM



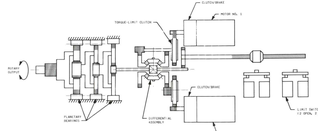
CENTERLINE LATCHES



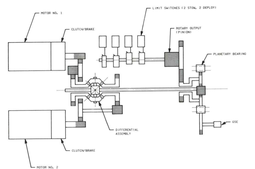
ET UMBILICAL UPLOCK LATCH POWER DRIVE UNIT



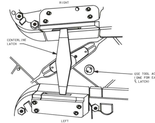
TORQUE LIMITER FOR DOOR DRIVE ACTUATOR AND UPLOCK LATCH ACTUATOR



DOOR DRIVE ACTUATOR POWER DRIVE UNIT



CENTERLINE LATCH ACTUATORS POWER DRIVE UNIT



CENTERLINE LATCH IN DEPLOY POSITION

MOTOR SPECIFICATIONS

ACTUATOR	PUR-POSE	MAX RUNNING TORQUE	MAX MOTOR POWER RQD	STALL TORQUE (1)	STALL POWER (1)
C/L LATCH	DEPLOY & STOW	9,100 IN-LBS	140 WATTS	17,500 IN-LBS	269 WATTS
UPLOCK LATCH	ALL MTR	9,100 IN-LBS	140 WATTS	17,500 IN-LBS	269 WATTS
DOOR ACTUATORS	CLOSE	50,000 IN-LBS	330 WATTS	100,000 IN-LBS	660 WATTS
	OPEN	50,000 IN-LBS	330 WATTS	100,000 IN-LBS	660 WATTS

ACTUATOR	OUTPUT TORQUE	MAX ACTUATOR RUNNING TYPE			MAX MOTOR STALL TYPE
				TBTDR (1)	
C/L LATCH	250 IN-LBS	1 MOTOR	17 SEC	23 SEC	17 SEC
UPLOCK LATCH	9800 IN-LBS	4 SEC	12 SEC	13 SEC	50 SEC
DOOR ACTUATOR	25,000 IN-LBS	24 SEC	44 SEC	48 SEC	50 SEC

(1) 1.8 (1.8 DYNASTIC) INC TO ACCOUNT FOR 80% EFFICIENCY & SET OF 3 MOTORS

L FOR DRAWING REFERENCED SEE TABLE 10-1

2 ORB/ET DOORS

ORIGINATOR	DATE
JOHN G. C. WILLIAMSON	6/15/72
CO	
DASH 5 REVISIONS	
Approved by: [illegible]	6/15/72
Checked [illegible]	6/15/72
Drafted [illegible]	6/15/72
Size A	Code Ident No. 81205

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

ORBITER/ET UMBILICAL CLOSEOUT DOORS

SPACE SHUTTLE PROGRAM

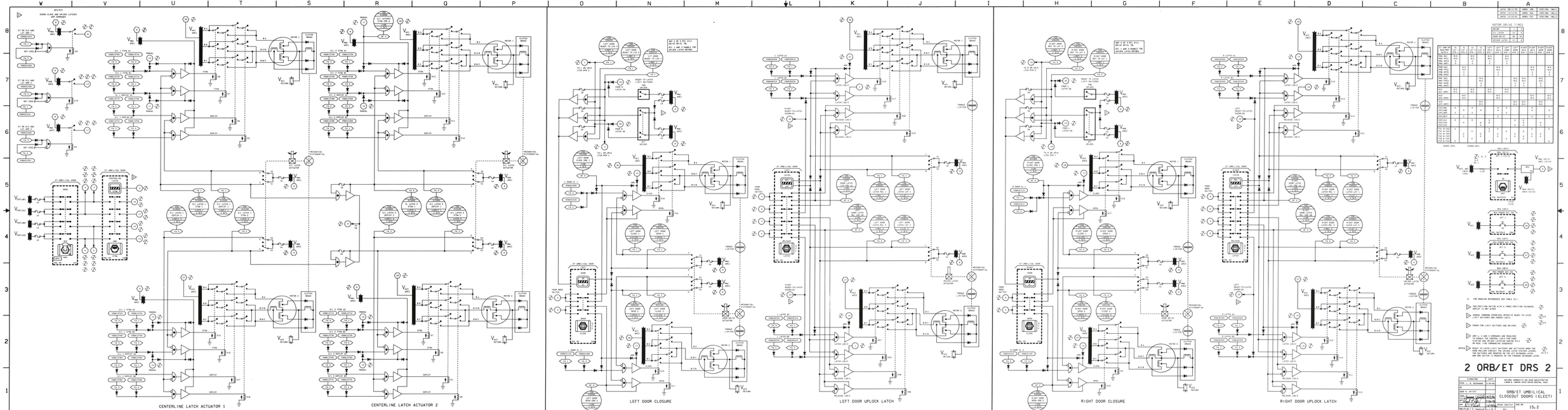
DWG NO. 15.2

REV

SCALE NONE SHEET 1 OF 2

BASIC REV E-2

BASIC REV E-2



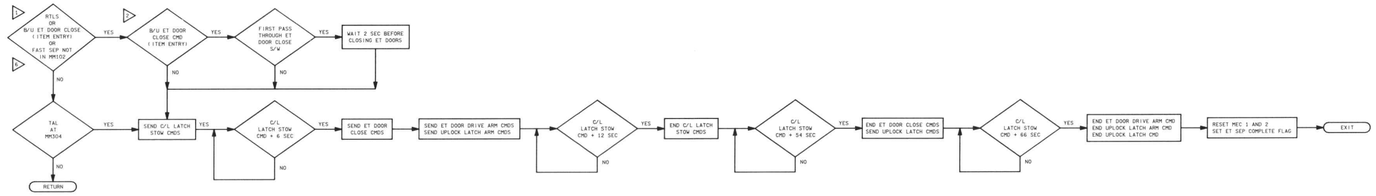
BASIC REV E-2

BASIC REV E-2

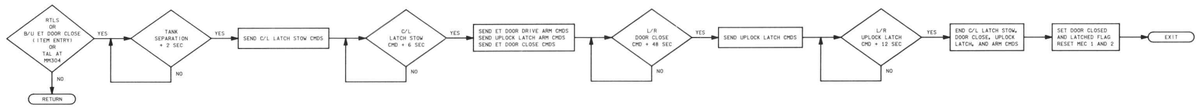
DATE= 12/11/92	NAME= SEW	VERSION= INW.1
DATE= 12/15/92	NAME= PSO	VERSION= INW.2

DOWNLIST TELEMETRY PARAMETERS

PASS	BFS	NOMENCLATURE	EVENT	MDM
V56X1205X	V98X4017X	ET LMB DR CL LCH 1 STOW IND 1	STO1	FA1
V56X1215X	V98X4036X	ET LMB DR CL LCH 1 STOW IND 2	STO2	FA2
V56X1255X	V98X4016X	ET LMB DR CL LCH 1 DEPLOY IND 1	DPY1	FA1
V56X1265X	V98X4035X	ET LMB DR CL LCH 1 DEPLOY IND 2	DPY2	FA2
V56X1305X	V98X4056X	ET LMB DR CL LCH 2 STOW IND 1	STO1	FA4
V56X1315X	V98X4076X	ET LMB DR CL LCH 2 STOW IND 2	STO2	FA3
V56X1355X	V98X4055X	ET LMB DR CL LCH 2 DEPLOY IND 1	DPY1	FA4
V56X1365X	V98X4075X	ET LMB DR CL LCH 2 DEPLOY IND 2	DPY2	FA3
V56X3010X	V98X4089X	ET L LMB DOOR OPEN IND 1	OPN 1	FA1
V56X3015X	V98X4149X	ET L LMB DOOR OPEN IND 2	OPN 2	FA3
V56X3110X	V98X4079X	ET L LMB DOOR CLOSED IND 1	CLS 1	FA1
V56X3115X	V98X4150X	ET L LMB DOOR CLOSED IND 2	CLS 2	FA3
V56X3541X	V98X4093X	ET L LMB DR RDY-TO-LCH IND 1	RDY 1	FA1
V56X3542X	V98X4094X	ET L LMB DR RDY-TO-LCH IND 2	RDY 2	FA1
V56X3543X	V98X4095X	ET L LMB DR RDY-TO-LCH IND 3	RDY 3	FA1
V56X3550X	V98X4091X	ET L LMB DR LATCHED IND 1	LCH 1	FA1
V56X3560X	V98X4131X	ET L LMB DR LATCHED IND 2	LCH 2	FA4
V56X3650X	V98X4092X	ET L LMB DR LATCH REL IND 1	REL 1	FA1
V56X3660X	V98X4132X	ET L LMB DR LATCH REL IND 2	REL 2	FA4
V56X4010X	V98X4129X	ET R LMB DOOR OPEN IND 1	OPN 1	FA4
V56X4015X	V98X4109X	ET R LMB DOOR OPEN IND 2	OPN 2	FA2
V56X4110X	V98X4130X	ET R LMB DOOR CLOSED IND 1	CLS 1	FA4
V56X4115X	V98X4110X	ET R LMB DOOR CLOSED IND 2	CLS 2	FA2
V56X4541X	V98X4153X	ET R LMB DR RDY-TO-LCH IND 1	RDY 1	FA3
V56X4542X	V98X4154X	ET R LMB DR RDY-TO-LCH IND 2	RDY 2	FA3
V56X4543X	V98X4155X	ET R LMB DR RDY-TO-LCH IND 3	RDY 3	FA3
V56X4550X	V98X4151X	ET R LMB DR LATCHED IND 1	LCH 1	FA3
V56X4560X	V98X4111X	ET R LMB DR LATCHED IND 2	LCH 2	FA2
V56X4650X	V98X4152X	ET R LMB DR LATCH REL IND 1	REL 1	FA3
V56X4660X	V98X4112X	ET R LMB DR LATCH REL IND 2	REL 2	FA2



PASS SOFTWARE



BFS SOFTWARE

FAST SEP FLAG IS SET BY=
1. MANUAL ET SEP CMD IN MM102 OR MM601
OR
2. MANUAL ET SEP CMD IN MM103 WITH TWO MAIN ENGINES DOWN

BFS G/L INDICATIONS NOT DEFINED ON DOWNLIST

4. FOR DRAWING REFERENCES SEE TABLE 15-I

3. MEC-MASTER EVENTS CONTROLLER

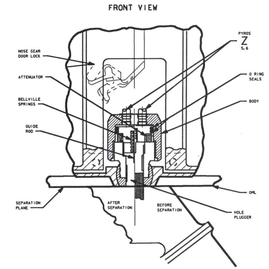
SPEC 51 OVERRIDE DISPLAY IS AVAILABLE IN OPS 1, 3, AND 6

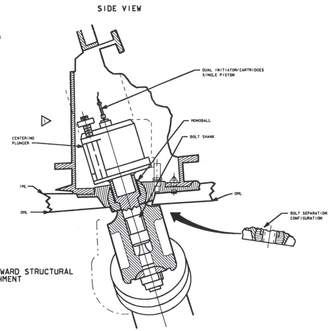
NOTES= SOFTWARE WILL AUTOMATICALLY CLOSE DOORS FOR AN RTLS DURING MM602

3 ET DOOR S/W 3

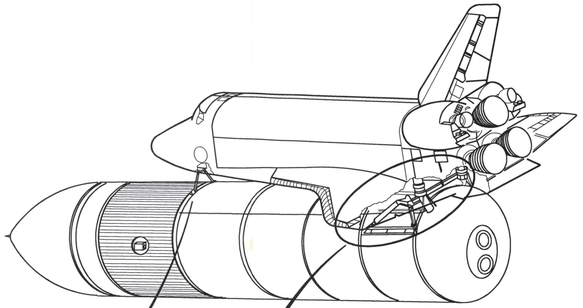
SIGNATURE	DATE	
DSGN B.J.TEDDER JR.	7/20/87	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR		
ENGR N. KNIGHT		ET DOOR SOFTWARE PASS AND BFS
CHKD	8/17/87	
APP	8/20/87	
APP	8/21/87	SPACE SHUTTLE / DWG NO 15.2
OMNIPLAN S.E. Gentsch	8/21/87	ALL / SHEET 3 OF 3
LTR E	PCN 2	66 X 34 / PAGE

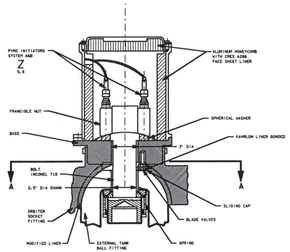
BASIC REV E-2



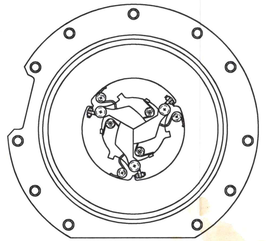


ORBITER / ET FORWARD STRUCTURAL ATTACHMENT

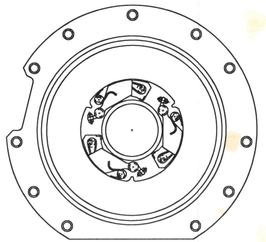




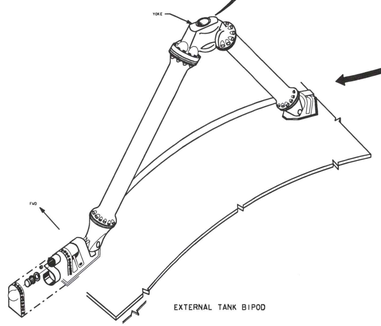
ORBITER / ET AFT STRUCTURAL ATTACHMENT



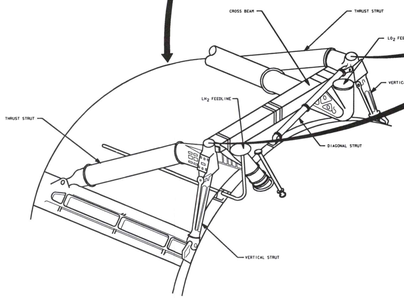
SECTION A-A CLOSED CONFIGURATION



SECTION A-A OPEN CONFIGURATION



EXTERNAL TANK BIPOD



EXTERNAL TANK AFT STRUTS

3. FOR DRAWING REFERENCES SEE TABLE 15-1

NOTES: ▷ FWD BOLT SHEARING WILL CAUSE ET BIPOD TO ROTATE +30° FORWARD

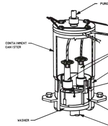
▷ FWD BOLT SHEARING WILL ACTIVATE CENTERING PLUNGER WHICH WILL RETRACT THE MINI MONOBALL EVEN WITH THE OUTER HOLES INC

3 ORB/ET SEP

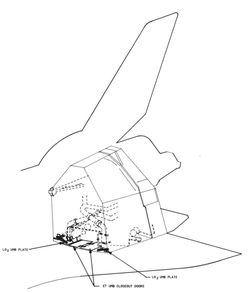
SIGNATURE	DATE	
DSGN A. NEELY	5/31/87	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
CK		
ENGR N. KNIGHT	8/13/90	ORBITER ET SEPARATION MECHANICAL
CHIEF [signature]	7/7/94	
APP [signature]	7/7/94	
APP		SPACE SHUTTLE DWG NO 15.3
CONFIGURATION [signature]	7-6-94	ALL
SIZE B FSCM 4		15.3-1-33 PAGE SHEET 1 OF 1

BASIC REV E-4

DATE	CHANGE	VOID/CAN
04/04/84	MARKS 2121	VOID/CAN ORB-1
04/04/84	MARKS 3127	VOID/CAN ORB-2
04/04/84	MARKS 3982	VOID/CAN ORB-3



UMBILICAL SEPARATION SYSTEM ASSEMBLY
ATTACH SIMILITUDE (TYPICAL)



ORBITER AFT FUSELAGE

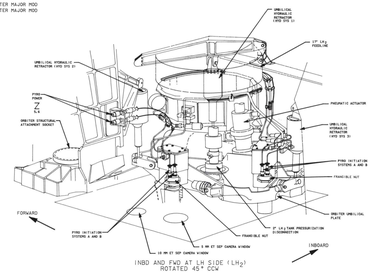
NOTE: THE UMBILICAL SEPARATION SYSTEM SHOWN ABOVE WILL NOT BE USED ON THE FOLLOWING AND SUBSEQUENT FLIGHTS

VEHICLE NUMBER	FLIGHT NUMBER
102	13 (STS-52)
103	15 (STS-53) 1ST FLIGHT AFTER MAJOR MOD
104	13 (STS-57) 1ST FLIGHT AFTER MAJOR MOD
105	1 (STS-49)

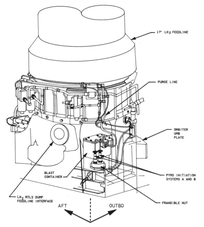
NOTES: 1. FOR DRAWING REFERENCES SEE TABLE 15-2

3 ORB/ET UMB SEP SYS MECH 2

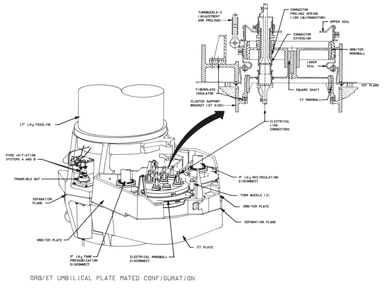
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEXAS		SIGNATURE	DATE
		DSMA 312-84112	3/8/84
ORBITER ET UMBILICAL SEPARATION SYSTEM MECHANICAL	DR		
	CHKR N. BRUNET		3/30/84
	CHKR		4/26/84
DWG NO 15.3	SPACE SHUTTLE		4/26/84
	PCL		5-4-84
SIZE D	CODE IDENT NO 73	SCALE NONE	SHEET 1



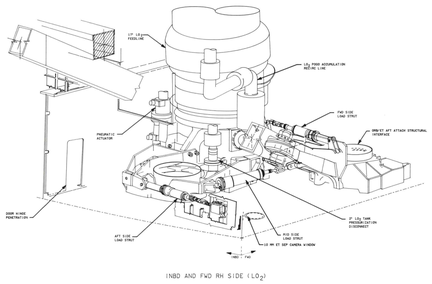
(INBD AND FWD AT LH SIDE (LH_2) ROTATED 45° CCW



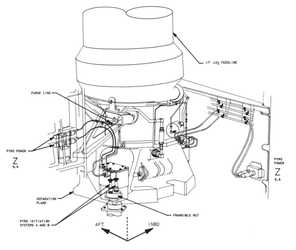
AFT AND OUTBD AT LH SIDE (LH_2) ROTATED 135° CCW



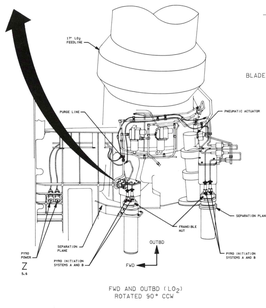
ORB/ET UMBILICAL PLATE MATED CONFIGURATION



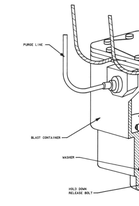
INBD AND FWD RH SIDE (LO_2)



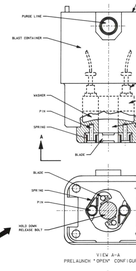
AFT AND INBD AT RH SIDE (LO_2) ROTATED 135° CCW



FWD AND OUTBD (LO_2) ROTATED 90° CCW

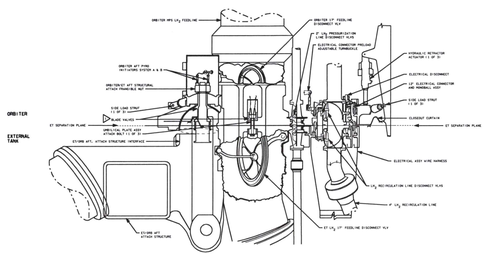


UMBILICAL SEPARATION SYSTEM ASSEMBLY
ATTACH SIMILITUDE (TYPICAL)



BLADE VALVE SYSTEM ASSEMBLY (TYPICAL)

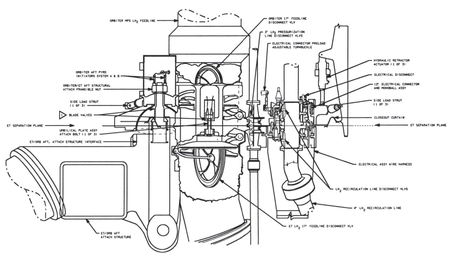
BASIC REV E-2



ORBITER/ET UMBILICAL PLATES MATED

SEPARATION SEQUENCE I

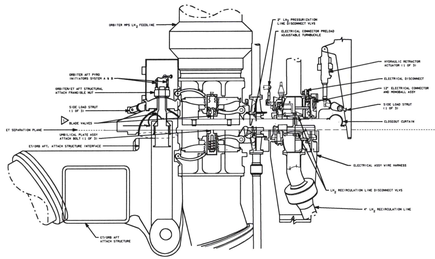
- MPS 17" FEEDLINE VALVES OPEN
- 4" LH_2 RECIRC ELECTRICAL DISCONNECT VALVE OPEN
- 4" LH_2 PRESSURIZATION DISCONNECT VALVE OPEN
- UMBILICAL HYDRAULIC RETRACTORS EXTENDED
- ELECTRICAL MANDRELL DISCONNECTS MATED



ORBITER/ET UMBILICAL PLATES MATED

SEPARATION SEQUENCE II

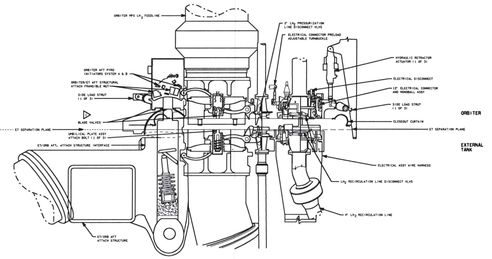
- MPS LH2 FEEDLINE VALVES CLOSED



ORBITER/ET UMBILICAL PLATES RETRACTED

SEPARATION SEQUENCE III

- UMBILICAL PLATES
  - FRANGIBLE NUTS FIRED
  - BOLTS DISPLACED
- UMBILICAL HYDRAULIC RETRACTORS (1, 2, 3) RETRACTED
- 4" LH_2 RECIRC ELECTRICAL DISCONNECT VALVE CLOSED
- 4" LH_2 PRESSURIZATION VALVE CLOSED
- ELECTRICAL MANDRELL DISCONNECTS REMATED



ORBITER/ET AFT STRUCTURAL SEPARATION

SEPARATION SEQUENCE IV

- BALL DETENT INTERFACE
- FRANGIBLE NUTS FIRED
- BOLTS DISPLACED

NOTES: ▷ BLADE VALVE FOR STRUCTURAL TEST ONLY. NOT USED FOR OV-102 FLIGHT (A, B-103 FLIGHT ON, C-104 FLIGHT ON, D-105 FLIGHT ON)
SR ALL REVISIONS - SEE DRAWING D, F, G OR H

3 ORB/ET SEP 3

SIGNATURE	DATE
FROM L. DEAN	10-13-94
SR L. DEAN	10-13-94
FROM A. PRUDY	10-13-94
DATA MANAGEMENT	10-13-94
QA	
CM/CONFIGURATION	
PM	

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

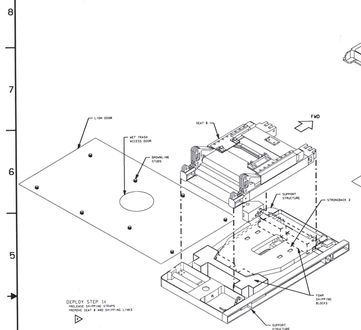
ORBITER ET SEPARATION MECHANICAL

SPACE SHUTTLE	DWG NO.
	15L3
SCALE	SHEET 1 OF 1

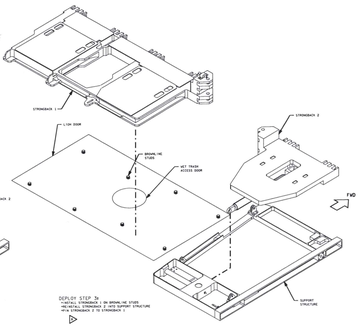
BASIC REV E-4

BASIC REV E-4

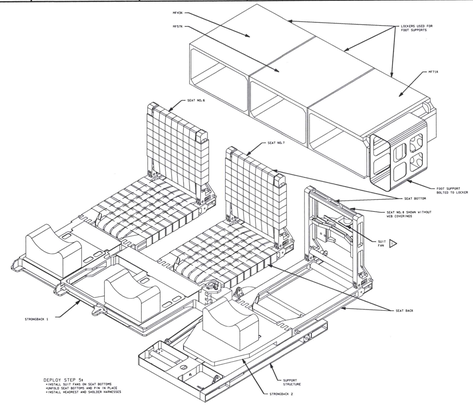
DATE	SHEET	DESCRIPTION
DATE: 02/15/93	SHEET: 2/8	DESCRIPTION: APPLY
DATE: 03/15/93	SHEET: 7/8	DESCRIPTION: APPLY
DATE: 03/19/93	SHEET: 2/8	DESCRIPTION: ONLY



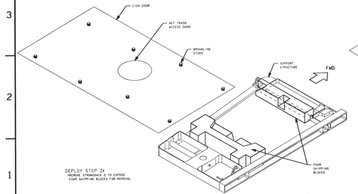
DEPLOY STEP 1a
•REMOVE SEAT 6 AND SUPPORT STRUCTURE
•REMOVE SEAT 6 AND SHIFT-NO. 1 LINES



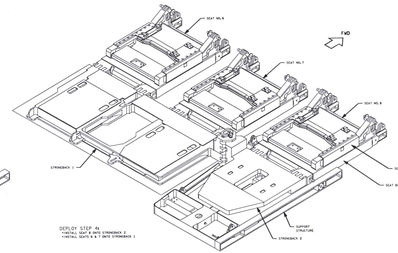
DEPLOY STEP 1b
•INSTALL STRONGBACK 1 ON BROWLINE STUDS
•INSTALL STRONGBACK 2 ON SUPPORT STRUCTURE
•MOVE STRONGBACK 2 TO STRONGBACK 1



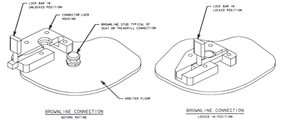
DEPLOY STEP 1c
•INSTALL SEAT 6 AND SEAT BOTTOMS
•INSTALL SEAT 7 AND SEAT 8 IN SEAT TRACKS
•INSTALL HEADREST AND SHOULDER HARNESSES



DEPLOY STEP 2a
•REMOVE STRONGBACK 2 TO EXPOSE FOOT SUPPORTING BLOCKS FOR REMOVAL

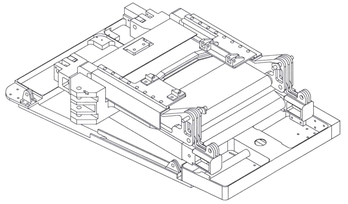


DEPLOY STEP 4a
•INSTALL SEAT 6 AND STRONGBACK 2
•INSTALL SEATS 8 & 7 ONTO STRONGBACK 1

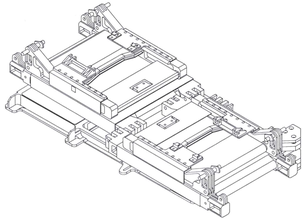


BROWLINE CONNECTION
BEFORE MATING

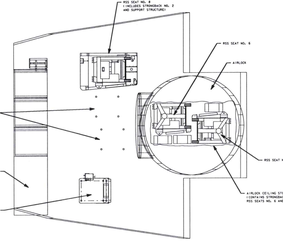
BROWLINE CONNECTION
LOCKED IN POSITION



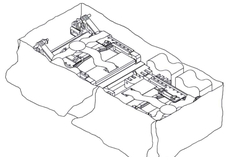
SUPPORT STRUCTURE, STRONGBACK 2 AND SEAT NO. 8



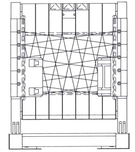
STRONGBACK 1 AND SEATS NO. 6 & 7 IN PRELAUNCH STOWAGE CONFIGURATION



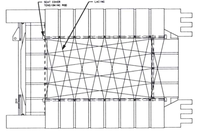
VIEW PERPENDICULAR TO MID DECK FLOOR
•RSS IN ASCENT CONFIGURATION

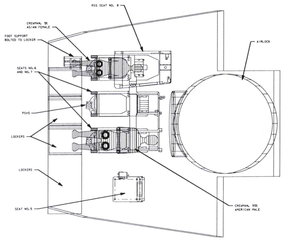


STRONGBACK 1 AND SEATS NOs. 6 & 7 STOWED IN SOFTSIDE BAG



SEAT BOTTOM COVER LACING





VIEW PERPENDICULAR TO MID DECK FLOOR
•RSS IN ASCENT CONFIGURATION

FOR PRELAUNCH STOWAGE AND FOR RSS CONFIGURATION, STRONGBACK NO. 2, SUPPORT STRUCTURE, AND SEAT NO. 8 ARE ATTACHED TO SAME DECK STUDS USED BY THE ESCAPE EQUIPMENT

1. STOWED BACK NO. 1 = 46.8 LBS
SEAT NO. 6 = 29.4 LBS
SEAT NO. 7 = 29.4 LBS
•AIRLOCK STOWAGE BAG = 96.3 LBS
•CONTAINS STRONGBACK NO. 1
TOTAL WEIGHT CAPACITY = 212.0 LBS
TOTAL WEIGHT = 202.9 LBS
•ALSO CALLED CARTRIDGE SECTION
SUPPORT STRUCTURE = 212.0 LBS
SEAT NO. 8 = 29.4 LBS
WITH TOTAL RSS WEIGHT DEPENDING ON THE NUMBER OF CRYOGENICALLY LOCKED RSS SEATS AND THE NUMBER OF RSS SEATS STOWED IN THE AIRLOCK (1 OR 2), THE COMPLIMENT OF RSS PACKS FOR FOOD/WATER (WETS, KITS), AND TOTAL RSS CONSUMABLES, THE TOTAL RSS WEIGHT MAY BE 1 WITHIN 1 OR 2% OF THE RSS WEIGHT CAPACITY MARGIN

RSS SETUP LISTED IN THE ORBIT OPS CHECKLIST

STRONGBACK NO.1 WILL ALWAYS BE USED REGARDLESS OF THE NUMBER OF RECUMBENT SEAT SYSTEMS. STRONGBACK NO. 2 WILL ONLY BE USED WITH RSS SEAT NO. 8 AND WILL ALWAYS BE STOWED IN THE MIDDEK. STRONGBACK NO. 2 WILL NOT BE USED IF ONLY ONE RECUMBENT CREW MEMBER INVOLVED

TWO FINAL SEAT NO. 6 AND 7 WILL BE STOWED IN AIRLOCK STOWAGE BAG DURING DESCENT PREP ACTIVITY

STOWED PRELAUNCH ON MIDDECK FLOOR

STOWED PRELAUNCH IN AIRLOCK CEILING BAG

NOTES: 1) FOUR FOOT OR TELCO CAN BE USED, REFER TO FLIGHT SPECIFIC CCD OR SEAT DATA BOOK FOR SPECIFIC FOOT AND STRAP CONFIGURATION

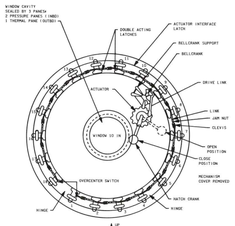
4 RECUMBENT SEAT SYS

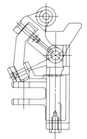
SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DSGN ⊥ FD/TS	02/27/93	LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR		
DSGN ⊥ ENG		RECUMBENT SEAT SYSTEM
CHK		
CHK		
APP		SIZE: D — DWG NO: 15.4
CI & I		SCALE: NONE — SHEET 1 OF 1

BASIC REV E-5

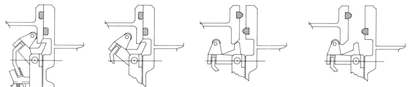
DATE: 08/23/91	MAPID: LAR	VERSION: OML1
DATE: 10/14/92	MAPID: VCR	VERSION: OML4
DATE: 11/29/92	MAPID: PAO	VERSION: OML5

HATCH MECHANISMS



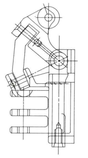


DOUBLE ACTING LATCH
- HAS KICKER CAM TO BREAK SEAL
- USED FOR LATCHES 11 AND 12

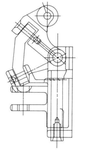


APPLYING LOAD TO BREAK SEALS
- ~0.2 PSID MAX

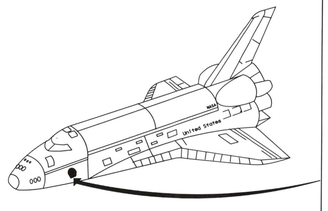
HOLDING HATCH IN VENT POSITION
- ALL LATCHES
- 0.3 PSID MAX



ACTUATOR INTERFACE LATCH
- USED FOR LATCH 10

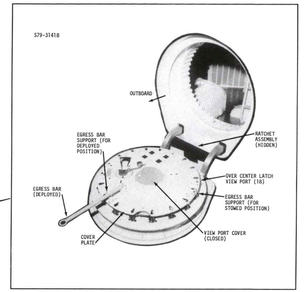


SINGLE ACTING LATCH
- USED FOR LATCHES 1-9 AND 13-18

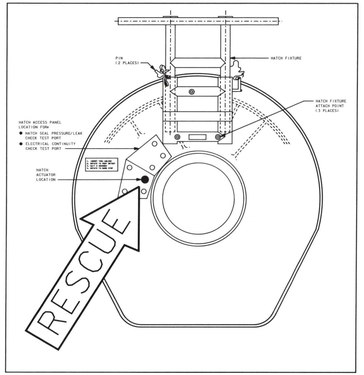


LATCH CLOSED INDICATION (-18)
- VIEWED FROM INSIDE THROUGH DOOR-CENTER LATCH VIEWPORT
- ARROW MUST POINT INTO MAGENTA (LATCHED) INDICATION

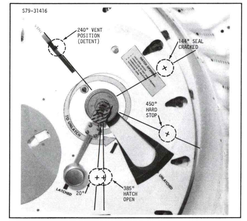
HATCH CONFIGURATION (INTERNAL)



HATCH CONFIGURATION (EXTERNAL)

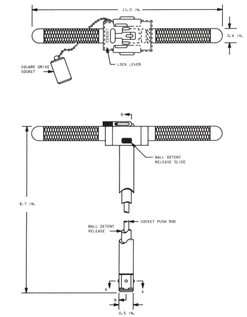


SIDE HATCH OPENING (INTERNAL)

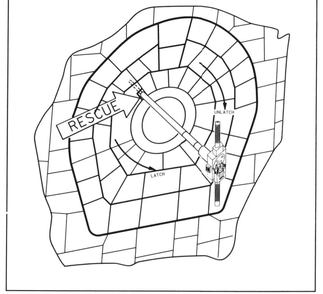


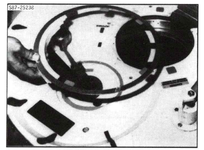
TO OPEN HATCH
- ACTUATOR HANDLE SHOWN IN LATCHED/LOCKED POSITION
- FLIP LOCK LEVER OVER 180° TO UNLOCK
- SNAP KNOB ON ACTUATOR HANDLE AND ROTATE CCW
  - ▽ 20° ROTATION - THE TWO LATCH KICKER CAMS START TO DISENGAGE THE SEALS
  - ▽ 140° ROTATION - THE SEAL IS UNSEALED
  - ▽ 240° ROTATION - VENT DETENT POSITION (EQUALIZES HATCH ΔP)
  - ▽ 400° ROTATION - END OF ACTUATOR TRAVEL AND HARD STOP, HATCH OPEN

GSE HATCH T-HANDLE

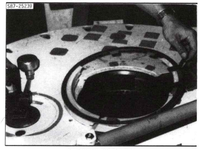


NORMAL SIDE HATCH OPENING/CLOSING (EXTERNAL)





SIDE HATCH UV FILTER INSTALLATION

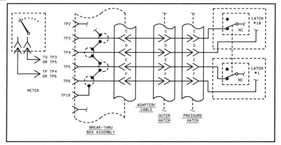


SIDE HATCH UV FILTER REMOVAL
- UV FILTER USED ONLY ON OV-103 AND OV-104
- INSTALLED POST-INSERTION, REMOVED BEFORE ENTRY
- MUST BE REMOVED BEFORE HATCH OPENING TO ALLOW FULL ROTATION OF LATCH ACTUATOR

NORMAL OPENING
- REMOVE TPS PLUG (6 FOR HATCH ACCESS PANEL, 3 FOR HATCH FIXTURE)
- REMOVE HATCH ACCESS PANEL (4 SCREWS)
- ATTACH HATCH FIXTURE
- INSERT T-HANDLE, LOCK IN PLACE
- UNLOCK/UNLATCH HATCH
- PULL ON HATCH FIXTURE TO OPEN

NORMAL CLOSING
- WITH HATCH OPEN, LATCH AND LOCK HATCH USING HATCH ACTUATOR HANDLE
- REMOVE TPS PLUGS AND ACCESS DOOR
- ATTACH HATCH FIXTURE
- INSERT HATCH T-HANDLE/LOCK IN PLACE
- WITH HATCH T-HANDLE UNLOCK/UNLATCH HATCH
- SEUND HATCH FIXTURE, CLOSE HATCH
- LATCH/LOCK HATCH
- VERIFY HATCH LOCKED AND LATCHED
- UNLOCK AND REMOVE T-HANDLE
- REMOVE HATCH FIXTURE
- REPLACE ACCESS DOOR AND TPS PLUGS

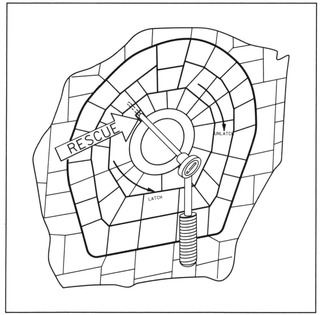
HATCH ELECTRICAL CONTINUITY CHECK (EXTERNAL)



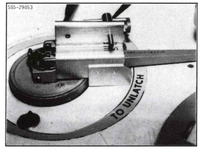
ELECTRICAL TEST SCHEMATIC

HATCH ELECTRICAL CONTINUITY CHECK OPERATIONS
- REMOVE ACCESS PANEL
- REMOVE DUST COVER FROM ELECTRICAL CONTINUITY TEST JACK
- CONNECT CABLE TO JACK (ASSUMES THE CABLE IS CONNECTED TO BREAK-TUBE BOX)
- CHECK RESISTANCE ACROSS TEST POINTS THREE AND FOUR (TP3, TP4) AND ACROSS TEST POINTS FIVE AND SIX (TP5, TP6) USING 1K MULTI-METER (5 USED FOR TPs 5+6)
- RESISTANCE FOR BOTH TESTS ≤ 1 OHMS - HATCH CLOSED, SYSTEM OK - HATCH OPEN
- DISCONNECT CABLE FROM ELECTRICAL CONTINUITY TEST JACK
- REINSTALL DUST COVER

EMERGENCY SIDE HATCH OPENING (EXTERNAL)



EMERGENCY OPENING
- IN A POST LANDING EMERGENCY, PUNCH THROUGH SMALL T-LC IN ACCESS DOOR USING T-HANDLE OR 3/1 IN. OR 5/8 IN. SQUARE DRIVE WITH 12 IN. EXTENSION
- INSERT DRIVE EXTENSION IN SIDE HATCH RELEASE SOCKET
- PUSH TO UNLOCK AND ROTATE 1 1/4 TURNS CCW TO UNLATCH
- PULL HATCH TO OPEN



LATCH ACTUATOR LOCK GUARD
- INSTALLED POST-INSERTION, REMOVED BEFORE ENTRY
- MUST BE REMOVED BEFORE HATCH OPENING TO ALLOW UNLOCKING OF LATCH ACTUATOR HANDLE

NOTES: 1. FOR DRAWING REFERENCES SEE TABLE 15-1

5 HATCH 1

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS	SIGNATURE	DATE
	DSOR V:CH.1 S. DOOLITT	9/15/89
	SA	
	CHAR -IC KRZYNSKI	
	CHAR -1 Kenyon	11/29/92
	APP Chief of Ofc	11/29/92
	APP R.Gilruth	11/29/92
	DRAWN PAD 2.0 Cowles	11/29/92
	CK -C	SPCN -1

HATCHES (SIDE)

DWG NO.	SPACE SHUTTLE
15.5	ALL
SHEET 1 OF 1	SCALE 0.04 IN

BASIC REV E-2

BASIC REV E-2

DATE: 10/26/90 NAME: CAR VERSION: ONLY

SINGLE ACTING LATCH
- USED FOR LATCHES 1,3 AND 5 (INNER) 1,3,4, AND 5 (OUTER)

DOUBLE ACTING LATCH
- HAS A CAM TO BREAK SEAL
- USED FOR LATCHES 2, 4 AND 6 (INNER) 2 AND 6 (OUTER)

HATCH ALIGNMENT GUIDE
- FIVE MOUNTED AROUND EDGE OF HATCHES ON PLATFORMS SIDE
- ENSURES PROPER HATCH POSITION PRIOR TO LATCHING

MANUFACTURING ACCESS PANEL
- ALLOWS MULTIPLE AIRLOCK/TUNNEL ADAPTER CRAFT-SURVEYING
- PANEL BOLTS TO AFT BULKHEAD (126 ATTACHMENTS)
- BEAM SPLICES (102 ATTACHMENTS)
- AIRLOCK BOLTS TO ACCESS PANEL (72 ATTACHMENTS)

AIRLOCK CREW MODULE CONFIGURATION

AIRLOCK PLB CONFIGURATION

AIRLOCK TUNNEL ADAPTER CONFIGURATION

HATCH SWING AND HOLD-OPEN MECHANISM (TYPE 1)

HATCH SWING AND HOLD-OPEN MECHANISM (TYPE 2)

AIRLOCK CONFIGURATION	HATCH LOCATION	TYPE	HINGE MECHANISM	NO. OF LATCHES
AIRLOCK INSIDE CREW MODULE	INNER HATCH	A	ROTATES (TYPE 2)	6
	OUTER HATCH	B	SWINGS DOWN (TYPE 1)	6
AIRLOCK INSIDE PLB	INNER HATCH	A	SWINGS DOWN (TYPE 1)	6
	OUTER HATCH	A	SWINGS DOWN (TYPE 1)	6
SPACELAB AIRLOCK TUNNEL ADAPTER INSIDE PLB	INNER AIRLOCK HATCH	A	ROTATES (TYPE 2)	6
	EVA HATCH	C	SWINGS DOWN (TYPE 1)	6
	SPACELAB TUNNEL ADAPTER HATCH	D	SWINGS DOWN (TYPE 1)	12

S80-28029

AIRLOCK HATCHES (PAYLOAD BAY SIDE)

S83-35399

TUNNEL ADAPTER HATCH

S80-28041

AIRLOCK OUTER/TUNNEL ADAPTER HATCH OPENING (FROM AIRLOCK/TUNNEL ADAPTER SIDE)
- PULL IN AND ROTATE DOWN ENGAGE LOCK-OPEN HOOK

S80-25152

ALL HATCHES UNLOCKING/UNLATCHING (FROM CREW MODULE/TUNNEL ADAPTER SIDE)
- ACTUATOR HANDLE DOWN IN LATCHED/LOCKED POSITION
- CLIP LOCK LEVER OVER 180° TO UNLOCKED POSITION
- SNAP RING ON HYDRAULIC ACTUATOR ROTATES IN
- 30° ROTATION - TO BREAK SEAL AND START TO DISENGAGE THE SEALS
- 144° ROTATION - THE SEAL IS CRACKED
- 450° ROTATION - END OF ACTUATOR TRAVEL AND HARD STOP, HATCH OPEN

S80-49152

AIRLOCK INNER HATCH OPENING (FROM CREW MODULE SIDE)

S79-38393

AIRLOCK INNER HATCH OPENING (FROM CREW MODULE SIDE)
- PULL OUT APPROX 6 INCHES
- PIVOT UPWARD 180° TO THE LEFT
- PUSH IN APPROX 6 INCHES
- SOME PIVOT MAY BE REQUIRED IF NECESSARY TO ENSURE PROPER ENGAGEMENT WHEN CLOSING HATCH

THE TUNNEL ADAPTER HATCH IS A TWO-WAY PRESSURE HATCH, DESIGNED TO WITHSTAND 14.7 PSID FROM THE AIRLOCK/TUNNEL ADAPTER SIDE AND 8.3 PSID FROM THE SPACELAB/TUNNEL ADAPTER SIDE. THE OTHER HATCHES (AIRLOCK AND EVA) WITHSTAND 14.7 PSID FROM EITHER SIDE. ALL HATCH LATCHES RELEASE THEY ARE DESIGNED TO HANDLE PRESSURE ONLY IN ONE DIRECTION

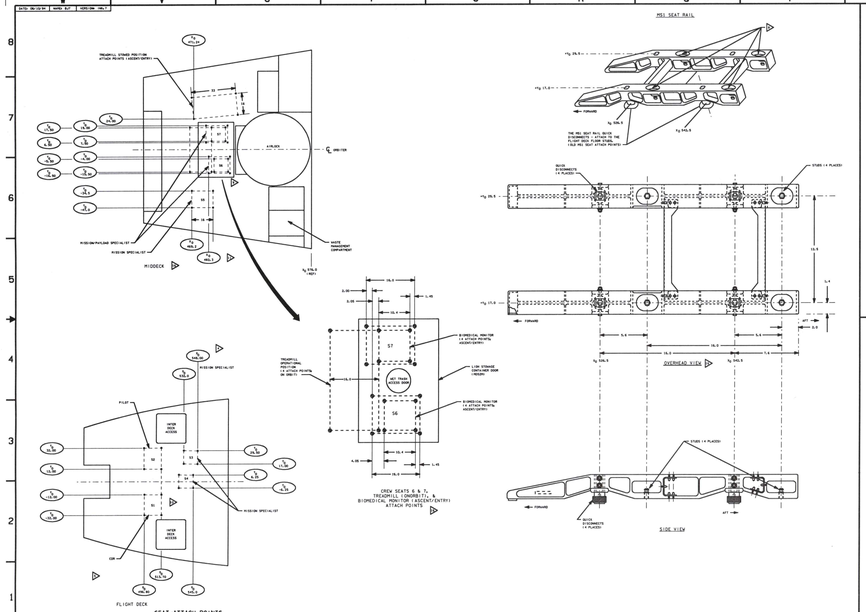
NUMBERING SCHEME FOR HATCH SWING AND HOLD MECHANISM IS ARBITRARY, USED FOR EASY REFERENCE IN HATCH CONFIGURATION TABLE

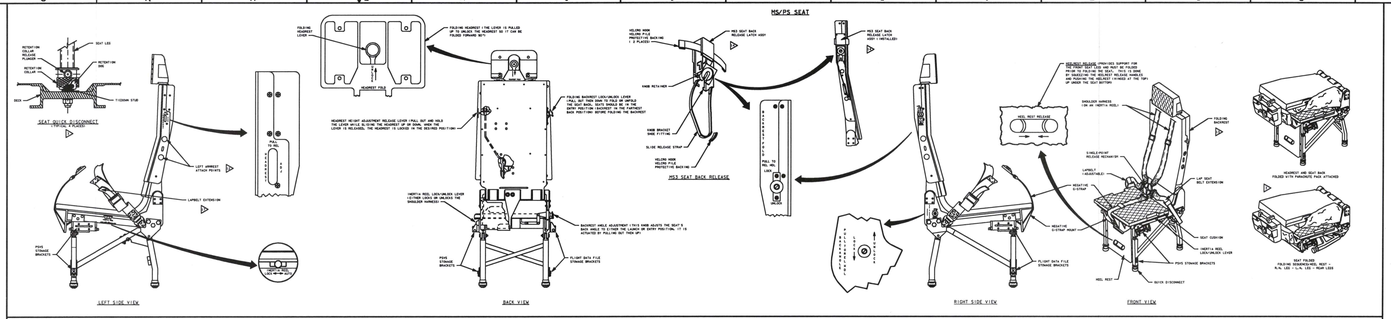
NOTES: 1. FOR DRAWING REFERENCES SEE TABLE (S-1)

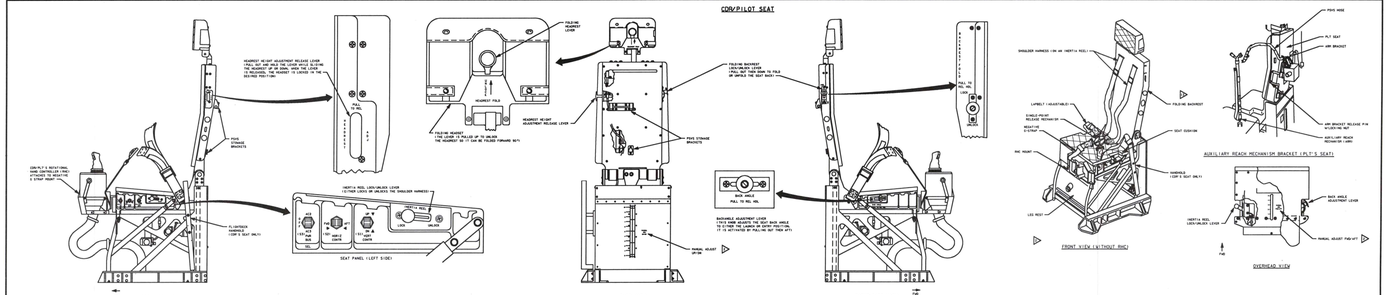
5 HATCH 2

SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DRAW V.(D) L. DENNETT	9/24/90	LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR V.(D) L. HUNTER	9/30/90	
CHKR J. MATHIES		HATCHES (AIRLOCK AND SPACELAB)
APPD	10-26-90	
APPD	10-25-90	
APPD	11-6-90	
SPACELAB E.F.CHANGE	11-7-90	SPACE SHUTTLE DWG NO. 15.5
SCALE NONE	SHEET 1 OF 2	REV

BASIC REV E







SEAT & LAP BELT HAS AN ADDITIONAL STRAP OR EXTENSION ATTACHED TO THE LAP BELT WHICH ALLOWS THE LAP BELT TO BE SNUGLY BROUGHT OVER THE PELVIS FOR ADDITIONAL CREW RACK STABILITY WHEN 17 IN HAND-FEEDING. THE EXTENSION IS LOCATED ON THE LEFT HAND SIDE.

ALL DIMENSIONS ARE IN INCHES, UNLESS INDICATED OTHERWISE

THE AUXILIARY REACH MECHANISM (ARM) AND ARM BRACKET ARE INSTALLED ONLY ON THE PILOT'S SEAT

INSTALLED ONLY ON MID SEAT

PURCHUTE PACK ATTACHES TO FOLDING BACKREST USING VELCRO

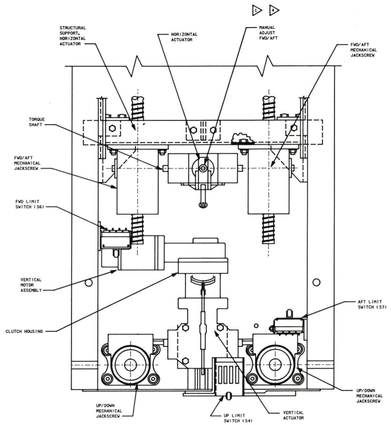
LEFT ARMREST IS FLUSH ONLY ON SEAT 4

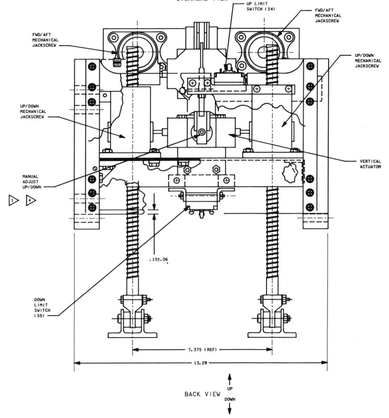
THE ORDER FOR THE MIDDECK CREW SEAT STUDS TO HAVE ALL COMPONENTS, INCLUDING THE SEAT ADJUSTER, SEAT SLIDE DISCONNECT, AND THE MIDDECK RAILS OF A SEAT ON A SEAT STUD AT ALL TIMES. THE COMPONENTS SHOWN ARE AN ALL PACKET. (FOR EXAMPLE, IN CREW CONFIGURATION 1 THE SEAT STUDS FOR SEAT 1 WILL BE ORDERED WITH THE $_{MS}$ PANELS AND ALL OF THE RAILS AND ALL OF THE $_{MS}$ PANELS AND ALL OF THE RAILS AND ALL OF THE $_{P

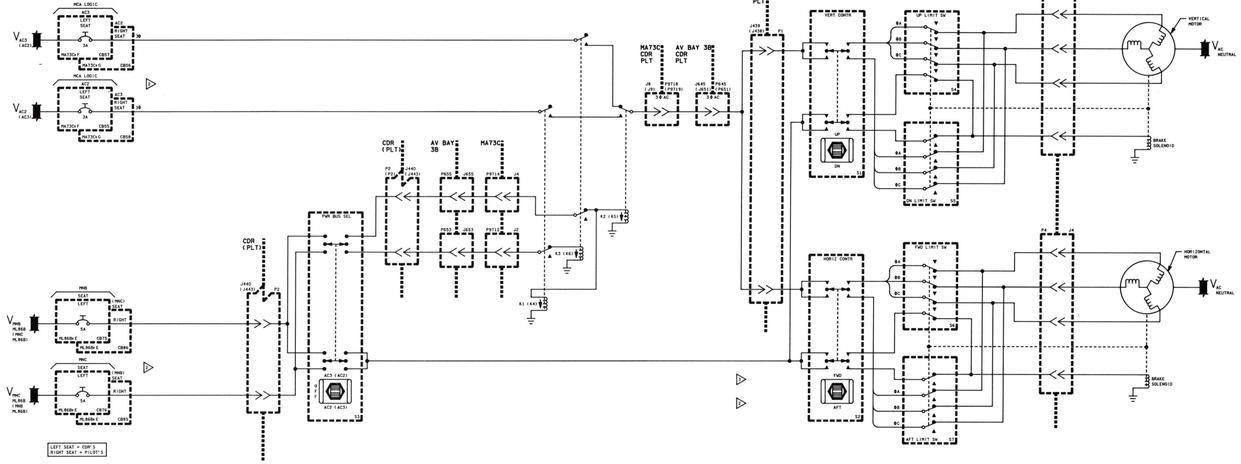
DATE: 10/24/90	NAMED: VSH	VERSION: 1RBL3

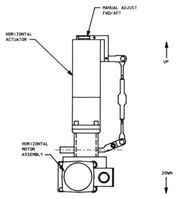
DATE: 10/06/90	NAMED: DEV	VERSION: BPLS
DATE: 10/22/90	NAMED: DEV	VERSION: BPLS
DATE: 10/24/90	NAMED: VSH	VERSION: 1RBL3

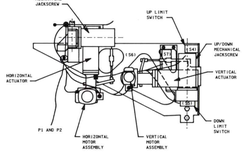
CDR/PILOT SEAT HORIZONTAL AND VERTICAL CONTROLS

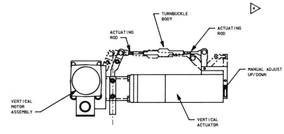


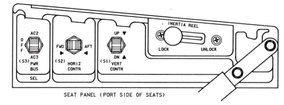












PLUGS CDR (PILOT)	PART # S	LOCATION
3095963SP3 (3095963SP3)	MB6GE12-10SNT2	FLIGHT DECK FLOOR: 10.79" AFT OF THE FORWARD SEAT TIE-DOWN POINTS ON THE SEAT CENTERLINE
3095963SP2 (3095963SP2)	MB6GE10-4SNT2	FLIGHT DECK FLOOR: 8.58" AFT OF THE FORWARD SEAT TIE-DOWN POINTS AND 4.19" TO THE LEFT OF THE SEAT CENTERLINE
3095963SP3 (3095963SP3)	MB6GE10-4SNT2	VERTICAL MOTOR
3095963SP4 (3095963SP4)	MB6GE10-4SNT2	HORIZONTAL MOTOR

SEAT DATA

1. VERTICAL TRAVEL RANGE = 10.00 ± .10"
2. HORIZONTAL TRAVEL RANGE = 5.00 ± .10"
3. SEAT SPEED: .75 ± .25"/SECOND FOR BOTH THE HORIZONTAL AND VERTICAL ADJUSTMENTS AT ANY POINT IN THE SPECIFIED TRAVEL RANGE

5. REFER TO TABLE 15-I FOR DRAWING TRACEABILITY

△ DURING MANUAL SEAT ADJUSTMENT - THE USE OF THE MANUAL SEAT ADJUSTMENT TOOL (MA073-0-0001) IS REQUIRED TO DISENGAGE THE VERTICAL (VERTICALLY DRIVE) MOTOR FROM THE VERTICAL (HORIZONTAL) ACTUATOR BY DISENGAGING THE VERTICAL (HORIZONTAL) CLUTCH

△ RELAYS K1, K2, K3 ARE IN THE CDR'S (LEFT) SEAT ASSEMBLY; RELAYS K4, K5, K6 ARE IN THE PILOT'S (RIGHT) SEAT ASSEMBLY

△ SWITCHES S1, S2, S3, S4, S5, S6, S7 ARE FOUND BOTH IN THE CDR'S AND PILOT SEAT ASSEMBLIES

NOTES: △ IN THE EVENT OF AN ELECTRICAL FAILURE, THE CREW SEATS MAY BE ADJUSTED UP/DOWN OR FWD/AFT USING A MANUAL SEAT ADJUSTMENT TOOL (A 3/16 - INCH HEX HEAD DRIVER) THAT IS NORMALLY STORED IN THE VFA TOOL LOCKER)

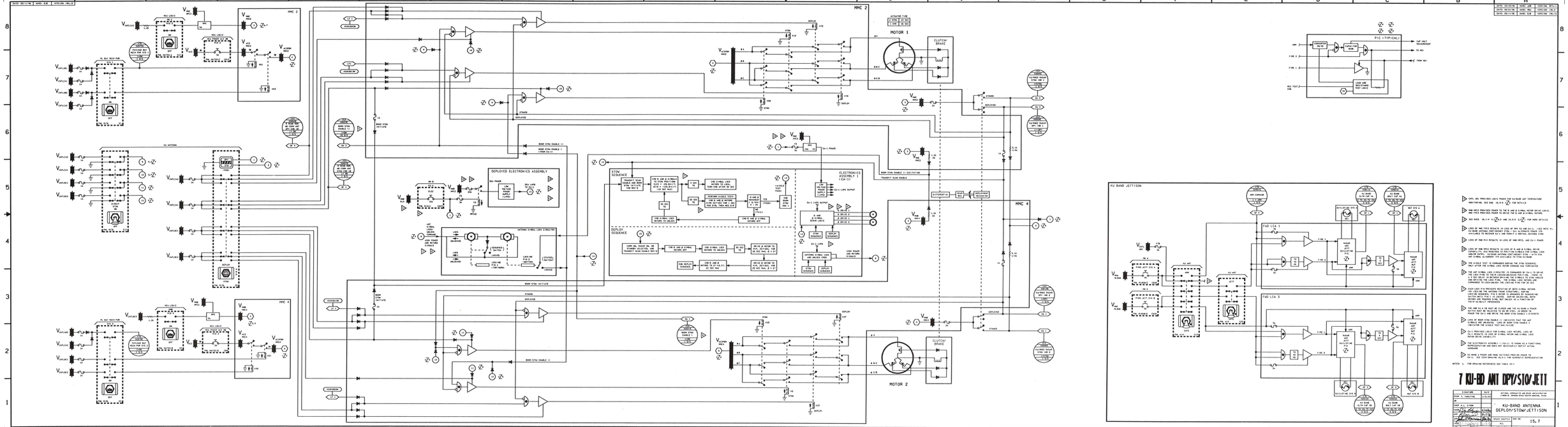
6 CREW SEATS 2

SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DSGN: L.A. MARTINDALE	9-2-88	
DR: L.A. MARTINDALE	9-2-88	CREW SEATS MECHANICAL/ELECTRICAL
ENGR: T. PALASAK		
ENGR: [illegible]	9-22-88	
APP: [illegible]		
APP: [illegible]	10-26-88	
OPNPLAN: [illegible]	10-5-88	

SPACE SHUTTLE	DWG NO: 15.6·
ALL	
REV: E	SHEET: 1 OF 2
10/24/90	

BASIC REV E

BASIC REV E



BASIC REV E-6

BASIC REV E-6

DATE: 09/27/96 NAME: MR HOUSING: SPT1.1

DATE: 09/01/96 NAME: RSJ HOUSING: SPL4

DATE: 05/17/96 NAME: RJB HOUSING: MA/ET1

DPU, MEC PROVIDES LOGIC POWER FOR KU-BAND ANT TEMPERATURE MONITORING. SEE PARA 15.9.5 FOR DETAILS

PWR MPCE PROVIDES POWER TO THE E-MOT & STOW, MOTOR DRIVE LOGIC, AND MPCE PROVIDES POWER TO DRIVE THE E-MOT & DUAL WINDING.

SEE DWGS 19L1-14 ✓Z1 AND 19L1-15 ✓Z2 FOR MORE DETAILS

LOSS OF PWR MPCE RESULTS IN LOSS OF MPC S1 AND S3-1, THIS MTR W/ S2 RAW MOTORS CONTINUOUSLY STOW. 1 S/C ALTERNATE POWER STS AVAILABLE TO RECOVER S3-1 AND PERMIT 3 MOTORS, INCLUDING STOW

LOSS OF PWR MCU RESULTS IN LOSS OF PWR MPCE, AND EA-1 POWER

LOSS OF PWR MPCE RESULTS IN LOSS OF S1 AND S3 OF A DUAL DRIVE CAPABILITY, THIS RESULTED TO POSITION SIGNALS FOR 3 DUAL LOCK MOTORS. 1 S/C ALTERNATE POWER STS AVAILABLE TO RECOVER S3-1 AND PERMIT 3 MOTORS, INCLUDING STOW. ANT DUMMY ALIGNMENT STS AVAILABLE TO STOW ELEMENT

THE 4 HINGE TEST IS COMMANDED DURING THE STOW SEQUENCE, ONLY AFTER THE SIGNAL LOCK MOTOR COMMAND HAS TERMINATED

THE ANT SIGNAL LOCK STRUCTURE IS COMMANDED BY EA-1 TO DRIVE THE LOCK PIN TO THE LOCKED/UNLOCKED POSITION. THERE IS A 90 SEC DELAY IN BETWEEN DRIVING THE SIGNAL TO STOW UNLOCK AND DRIVING THE SIGNAL TO DEPLOY UNLOCK. THE SIGNAL IS COMMANDED TO LOCK/UNLOCK THE LOCK PIN FOR 30 SEC

EACH LOCK PIN PROVIDES INDICATION OF BOTH SIGNAL MOTORS LOCKED ON THE ANTENNA FRAME STRUCTURE(S). BOTH ARE REQUIRED TO BE LOCKED TO ENABLE THE ANTENNA TO BE DEPLOYED. WITH PIN 3 IN LOCKED, DURING UNLOCKING, BOTH MOTORS MUST BE UNLOCKED BEFORE PIN 3 WILL BE IN MULTI IMPEDANCE

BOTH ONE MLA 2B MUST BE CLOSED AND THE KU BAND A POWER SWITCH MUST BE SELECTED TO ON OR BOTH TO ENABLE KU BAND TO POWER THE EA-1 AND DRIVE THE BOOM STOW ENABLE 2 SIGNALS

LOSS OF BOOM STOW ENABLE 2 INDICATES THAT THE ANT SIGNALS ARE UNLOCKED. LOSS OF BOOM STOW ENABLE 1 INDICATES THE HINGE TEST HAS FAILED

EA-1 PROVIDES LOGIC FOR SIGNAL LOCK MOTORS. LOSS OF EA-1 RESULTS IN LOSS OF SIGNAL MOTOR AND SIGNAL LOCK MOTOR DRIVE CAPABILITY

THE ELECTRONICS ASSEMBLY 1 (EA-1) IS SHOWN AS A FUNCTIONAL REPRESENTATION AND DOES NOT NECESSARILY DEPICT ACTUAL HARDWARE

KU BAND A POWER AND MCE SWITCHES PROVIDE POWER TO EA-1. SEE STOW DRAWING 19L1-1 FOR SCHEMATIC REPRESENTATION

NOTES: 1. FOR DRAWING REFERENCES SEE TABLE 15-1

7 KU-BD ANT DPY/STOW JETT

SIGNATURE	DATE	
JOHN A. FABISZEWSKI	11/26/96	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEXAS
DRAWN: A.L. SLYMAN		KU-BAND ANTENNA DEPLOY/STOW/JETTISON
CHECK:		
APPROVED:		
CM/CL:		
QA:		

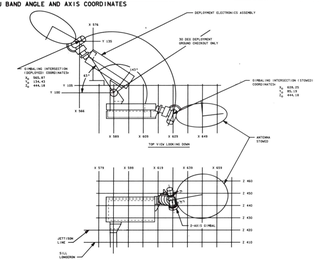
SHEET NUMBER: 15.7

SIZE: B SCALE: NONE

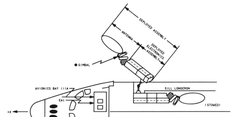
SHEET 15 OF 19

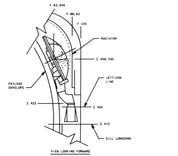
BASIC REV E-6

KU BAND ANGLE AND AXIS COORDINATES

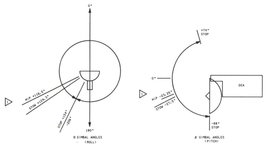


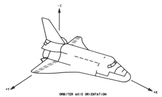
KU BAND LOCATION COORDINATES

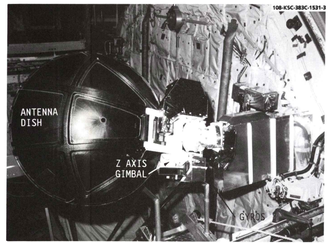




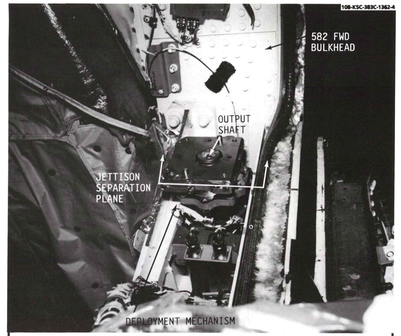
MOUNTED CONFIGURATION



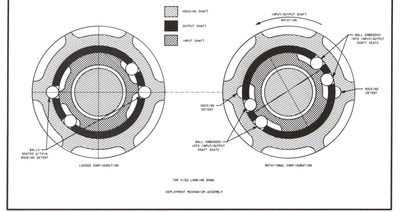




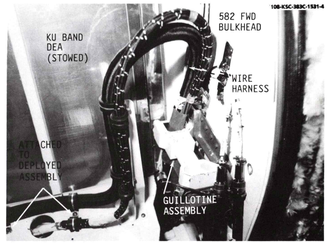
KU BAND ANTENNA-STOWED POSITION



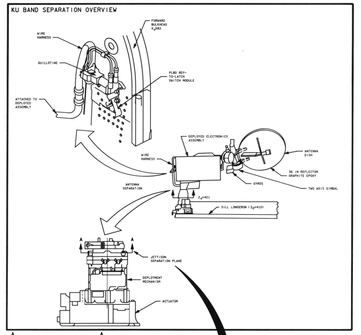
SIDE VIEW LOOKING OUTBOARD
DEPLOYMENT MECHANISM

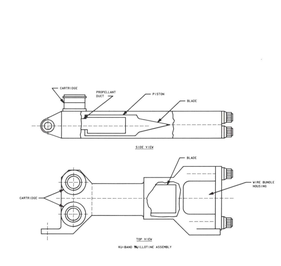


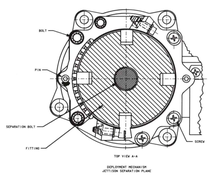
KU BAND JETTISON SYSTEM



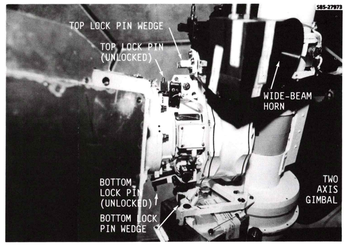
KU BAND GUILLOTINE



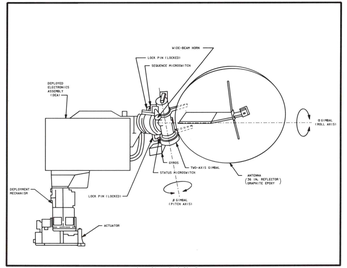




GIMBAL MECHANISM



GIMBAL LOCK MECHANISM



GIMBAL MECHANISM OVERVIEW

THE MASTER INDEX FILES (MIF) 15.2 PHOTO DIRECTORY CONTAINS ADDITIONAL PHOTOGRAPHS OF THE KU BAND ANTENNA SYSTEM. REFER TO ALL MIF'S INITIALIZED TO THE CURRENT ANTENNA SYSTEM.

NOTE: FOR DRAWING REFERENCES REFER TO TABLE 15-1

7 KU BAND MECH

CLEARANCE	DATE
DOOR RADIATOR BOARD	12/16/94
DA RADIATOR BOARD	12/16/94
OMRS D.A. SYSTEM	
OMRS D/A System	11/16/94
mid-life	11/16/94
orbiter D/A system	11/16/94
mechanical book	11/16/94

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS		
KU BAND MECHANICAL		
SPACE SHUTTLE PROG NO.	15.7	
ATL		
CR/S NO.	SHEET 1 OF 1	

BASIC REV E

BASIC REV E

DATE: 12/22/81	NAME: LAM	VERSION: OPS 1
DATE: 11/01/81	NAME: RDV	VERSION: OMS 3
DATE: 11/01/81	NAME: MAS	VERSION: OMS 3

PASS ONLY
MECHANICAL SOFTWARE

USER INTERFACE (UI)
● ROUTES INPUT COMMANDS FROM THE KEYBOARD(S)
● ROUTES DISPLAY INFORMATION TO CRTS
● PERFORMS INITIATION, SEQUENCING, AND TERMINATION OF APPLICATION AND SYSTEM SERVICES

KBD/DEU

ASCENT__SPS__CONTROL__SEGMENT (GO)
(GO)__ASCENT__SPS
5.5.1.1
● EXECUTES AFTER GRTLS (GO) IS SCHEDULED FOR OMS 2 THRU INSERTION BY A USER INTERFACE PROGRAM
● GO1 DIRECTS THE EXECUTION OF FUNCTIONS WITHIN THE GO1 TABLE (GO1__ASCENT__SPS__TABLE) IN THE FOLLOWING ORDER: FIRST STAGE (GO1), SECOND STAGE (GO2), OMS 2 INSERTION 1 (GO4), OMS 2 INSERTION 2 (GO5), AND MANEUVER TO ENTRY INTERFACE (GO6)
● GO1 RECOGNIZES EXECUTION OF PROCESSES BEFORE LAUNCH AND CONTINUES THROUGH THE ATTAINMENT OF SAFE ORBITAL CONDITIONS. GO1 ALSO RECOGNIZES WHEN AN ABORT ONCE (1) IS INITIATED DURING AN ABORT CONDITION OR ABTI. THE PRE-COAST SPS (1) ENTERED BEFORE (1)TIG+7
● GO1 IS SCHEDULED BY GRTLS (GO) AND GO1 ITSELF (1) IS SCHEDULED FOR STOLIC EXECUTION AT (1) BY AUTOMATIC INPUT
- CALL GUG__CG__COM__PROC
- CALL MNA__MA__INIT

CONTROL__SEGMENT__COMMON__PROCESSOR (GO)
(GO)__CG__COM__PROC
5.4.1.2
● THE CONTROL SEGMENT COMMON PROCESSOR (GO)1 IS INVOKED BY A CALL FROM AN SPS OR A SPEC CONTROL SEGMENT
● GO1 PERFORMS THE FOLLOWING CONTROL SEGMENT FUNCTIONS
- SPS (N) CLEANUP
- SPS (N) PROCESSING (ITEMS OR * EXCEPT COMMAND)
- MAJOR MODE INITIALIZATION
- SPEC (N) INITIATION
- SPEC CLEANUP

ENTRY__SPS__L__CONTROL__SEGMENT (GO)
(GO)__ENTRY__SPS
5.5.1.1
● THE ENTRY SPS 3 CONTROL SEGMENT (GO)1 IS SCHEDULED BY A USER INTERFACE PROGRAM OR BY THE ENTRY MAJOR MODE (GO)2 TO PERFORM THE RETROGRADE AND PREPARATION FOR RETURN FROM OMS-1
● GO1 DIRECTS THE EXECUTION OF THE ENTRY SPS CONTROL SEGMENTS, THE OMS-1 DEORBIT SPS CONTROL SEGMENTS, FROM IDLE SPS, OR IN THE EVENT OF ASA OR ATO, OR ABTI, FROM THE PRE-COAST SPS CONTROL SEGMENT
● THE ENTRY MTC (GO)1 IS SCHEDULED AT (T-35 HI GEING PREDEFINED RATES AND PRIORITIES
● GO1 ALSO PERFORMS THE TERMINATION OF THE OMS-1 SPS, IDLE SPS, OR THE PRECOAST SPS
- CALL GUG__CG__COM__PROC
- CALL GRC__RA__INIT
- CALL GEN__GEN__STTG__MTC

RM__DATA__BASE__INITIALIZATION (GO)
5.15.1.15
● RTLS RM INITIALIZATION MODULE IS CALLED ONCE BY GRTLS BEGINNING OF SPS 1, SPS 2 BY THE RESPECTIVE SPS CONTROL SEGMENTS (GO)1, GO3
● RM__DATA__BASE__INITIALIZATION COMMON RM PROCESSORS TO ASSESS REDUNDANT INPUT DATA

ASCENT__RTLS__VGL__FREQUENCY__EXECUTIVE (GO)
(GO)__RTLS__SPS1__SPS2
5.5.5.1
● GO1 IS A NON-UTILITY FUNCTION CALLED BY THE GO1__ASCENT__SPS__TABLE DURING RTLS ASCENT
● GO1 IS ACTIVE DURING SPS 1 AND SPS 2
● GO1 DIRECTS THE EXECUTION OF FUNCTIONS WITHIN THE GO1__ASCENT__SPS__TABLE IN THE FOLLOWING ORDER: FIRST STAGE (1ST), SECOND STAGE (2ST), OMS 2 INSERTION 1 (2A1), OMS 2 INSERTION 2 (2A2), AND MANEUVER TO ENTRY INTERFACE (2A3)
● GO1 RECOGNIZES EXECUTION OF PROCESSES BEFORE LAUNCH AND CONTINUES THROUGH THE ATTAINMENT OF SAFE ORBITAL CONDITIONS. GO1 ALSO RECOGNIZES WHEN AN ABORT ONCE (1) IS INITIATED DURING AN ABORT CONDITION OR ABTI. THE PRE-COAST SPS (1) ENTERED BEFORE (1)TIG+7
● GO1 IS SCHEDULED BY GRTLS (GO) AND GO1 ITSELF (1) IS SCHEDULED FOR STOLIC EXECUTION AT (T-35 HI GEING PREDEFINED RATES AND PRIORITIES
- CALL GUG__CG__COM__PROC
- CALL MNA__MA__INIT

CONTROL__SEGMENT__COMMON__PROCESSOR (GO)
(GO)__CG__COM__PROC
5.4.1.2
● THE CONTROL SEGMENT COMMON PROCESSOR (GO)1 IS INVOKED BY A CALL FROM AN SPS OR A SPEC CONTROL SEGMENT
● GO1 PERFORMS THE FOLLOWING CONTROL SEGMENT FUNCTIONS
- SPS (N) CLEANUP
- SPS (N) PROCESSING (ITEMS OR * EXCEPT COMMAND)
- MAJOR MODE INITIALIZATION
- SPEC (N) INITIATION
- SPEC CLEANUP

ENTRY__TERMINAL__PROCESSOR__EXECUTIVE (GO)
(GO)__ENTRY__SPS__TERMINAL
5.5.5.1
● GO1 WILL EXECUTE FOR THE DURATION OF SPS 3 AFTER CONTROL IS ESTABLISHED BY ALL MODULES DIRECTLY RELATED TO FLIGHT CONTROL OR OTHER HIGH RATE MODULES NOT DIRECTLY RELATED TO FLIGHT CONTROL
- CALL GPL__LANDING__SGP
- CALL GPL__LANDING__SSP
- CALL GPL__SPEC__THERMAL
- CALL GSC__VENT__SGNP
- CALL GSM__SPS__SGNP__GM__CNT
- CALL GPA__RTCL__SPS__SGP
- CALL GSL__AERO__RCL__TAC__PM__ITER
- CALL GSM__SPS__SGNP__GM__CNT
- CALL GSM__GEN__SAT__RTCL__RPT
- CALL GSM__GEN__SAT__PRE__
- CALL GSM__GEN__SAT__RTCL__RPT

ENTRY__SUPR__FREQUENCY__EXECUTIVE__ (GO)
(GO)__ENTRY__SPS__UPDATE
5.5.5.1
● GO1 IS CALLED BY GO3 UPON ENTRANCE TO SPS 3 FROM (GO)__SUPR__FREQ__EXEC
● GO1 IS ALSO CALLED BY GO1 UPON A DISPATCHER TABLE CHANGE REQUEST FROM GO1
● GO1 PERFORMS MAJOR MODE TRANSITION PROCESSING AND ADJUSTS ACTIVITY STATUS AND THE RATE OF EXECUTION OF ELEMENTS DISPATCHED FROM THE GO1 TABLE
● IF THE LANDING SSP (GP1) ENABLE BIT ACTIVATED DUE TO TACAN GUIDANCE FLAG, GP1 IS ACTIVATED IN THE DISPATCHER TABLE

EXTERNAL__TANK__SEPARATION__SEQUENCE (GO)
(GO)__EST__CG__SEP
5.5.5.3
● THE EXTERNAL TANK SEP SEQ (GO)1 MAY BE ACTIVE DURING SPS 1, SPS2, GO3, OMS 1/OMS 2, OMS 3/4, OR RTLS (NM GO)1
● MONITOR ET SEP ONE FIRE FLAG TO DETERMINE IF SEPARATION HAS OCCURRED
● TERMINATE UMBILICAL DOOR CONTROLLING LATCH LOCK COMMANDS TO ALLOW CLOSURE OF THE UMBILICAL CLOSE COMMANDS
● AFTER A SPECIFIC TIME DELAY, IF A FAST SEP (1) HAS NOT REQUESTED, THE LATCH POSITIONS ARE VOTED ON, IF SEPARATION HAS OCCURRED, THE FEEDLINE DISCONNECTS ARE COMMANDED, THEN THE FEEDLINE DISCONNECT VALVES ARE CLOSED
● IF A TIME TOLERANCE CHECKS AN ELAPSED TIME FOR THE FEEDLINE DISCONNECT VALVES TO ALLOW TIME TO FULLY CLOSE BEFORE CONTINUING
● AFTER A SPECIFIC TIME DELAY THE ET/OMS STRUCTURAL SEPARATION PINS ARE FIRED FOR A DELAY TIME TO ELAPSE SINCE THE UMBILICAL RETRACT FIRE COMMANDS WERE ISSUED
● THE MDC (GO)5 COMMANDS TO THE UMBILICAL PLATE HYDRAULIC RETRACT ACTUATORS AFTER SEPARATION HAS OCCURRED AND THE ET/OMS PINS ARE FIRED
● THE TIME DELAY ALLOWS TIME FOR THE LUG AND LVC UMBILICAL PLATES TO RETRACT AND LATCH
● THE RETRACT TIME DELAY CHECKS FOR LUG AND ANT PARAMETERS FAIL TO SATISFY THE LUG/T TEST RESULTS/MENTS, THE ERR(1) IS ALERTED AND THE SEQUENCE CONTINUES WITH THE NEXT COMMAND
● THE AUTO/MANUAL ET SEP SWITCH AND CURRENT MM AND MON MONITORED TO DETERMINE WHAT SEPARATION MODE IS TO BE PERFORMED
● WHEN RTLS ABORT OR TAL IS REQUESTED, THE UMBILICAL DOORS CONTROLLING LATCHES ARE STOWED, THE LVC UMBILICAL DOOR LATCHES ARE STOWED, THE DOORS ARE LATCHED ALL WITH PROPER TIMING CONSTRAINTS

ASCENT__ENTRY__VENT__DOOR__CONTROL__SEQUENCER (GO)
(GO)__ASCENT__ENTRY__VENT__DOOR__CONTROL__SEQUENCER
5.5.5.4
● GO5 IS ACTIVE DURING SPS 2 AND SPS 4
● AT T+28 SECS INITIATE ALL VENT OPEN COMMAND
● ALL VENT DOORS ARE NOT COMPLISHED FOR LAUNCH ROLL MANEUVER
● AT MET 1 000 SECS, AND IN MM 602+ INITIATE ALL VENT DOOR CLOSE COMMAND
● AT MET 1 100 SECS AND IN MM 104 OR LOA, IF TAL ABORT AND ET SEP ONE FLAGS ARE BOTH SET+ INITIATE ALL VENT DOOR OPEN COMMAND, OTHERWISE, GO TO ENTRY VENT DOOR CONTROL SEQUENCER
● IN MM 603+ AFTER ALL VENT CLOSE COMMAND), IF OPEN ON CLOSE ITEM ENTRY IS (1)SUCH+ INITIATE ALL VENT OPEN ON CLOSE COMMAND
● IN MM 602 OR MM 603, IF GROUND RELATIVE VELOCITY IS LESS THAN (1) KNOTS PTH+ INITIATE ALL VENT OPEN ON CLOSE COMMAND
● IN MM 603, IF OPEN ITEM ENTRY IS (1)SUCH+ INITIATE ALL VENT OPEN ON CLOSE COMMAND
● IN MM 602 OR MM 103 OR MM 104, IF TAL ABORT FLAG IS SET, OR IF ET SEP ONE FLAG IS SET, OR IF ET SEP TWO FLAG IS SET, OR IF ET SEP THREE FLAG IS SET, OR IF ET SEP FOUR FLAG IS SET+ INITIATE ALL VENT OPEN ON CLOSE COMMAND
● IN MM 602 PRIOR TO ROLLBACK, A CLOSE (1)OR IS CLOSING
● IN MM 103 AFTER ROLLBACK, IF OPEN OR CLOSE (1)OR ENTRY IS (1)SUCH+ INITIATE ALL VENT OPEN OR CLOSE COMMAND

RTLS__HYDRAULIC__SYSTEM__LANDING (GO)
(GO)__RTLS__HYDRAULIC__SYSTEM__LANDING
5.5.5.10
● THIS MODULE IS USED DURING AN RTLS ABORT TO PROVIDE AUTOMATIC CONTROL OF THE THREE HYDRAULIC SYSTEM BRAKE ISOLATION VALVES AND THE HYDRAULIC LANDING GEAR EXTENSION ISOLATION VALVE
● THIS MODULE IS ACTIVATED ON TRANSITION TO MM602
● IF MM602 IS ENTERED AND THE GROUND VEL IF ROLL 2 800 FPS+ OPEN HYD STS 1 LG EXT ISO VALVE CMD
● TERMINATE HYD STS 1 LG EXT ISO VALVE COMMAND AFTER A 5 SECOND INTERVAL
● AT MM603 IF THE BRAKE FLAG IS SET TO OPEN THE BRAKE ISOLATION VALVES
● TERMINATE BRAKES ISOLATION VALVE COMMAND AFTER A 5 SECOND INTERVAL

GRTLS__SAF__SPS_40__PITCH/ROLL/YAW/CHANNEL (GO)
(GO)__GRTLS__SAF__SPS_40__PITCH/ROLL/YAW/CHANNEL
5.15.1.4
● GRTLS__SAF__SPS_40 IS ACTIVATED AT INITIALIZATION BY MM 602 AND DEACTIVATED UPON TERMINATION OF MM 603
● IF THE SIGNAL FLAG IS ON, PERFORM THE FOLLOWING
- IF THE ROLL/YAW CONTROL MODE IS AUTO/BANK THEN FOR AUTO/BANK
- COMPUTE THE ROLL/YAW COMMAND IS (1)(1)_BANK, THEN COMPUTE THE PRED/IN-PLANE MISSILE COMMAND WITH THE BUFFERED TAR RATE COMMAND
- COMPUTE THE PRED/IN-PLANE MISSILE COMMAND WITH THE TAR RATE ERROR
- COMPUTE THE MISSILE/ACCEL COMMAND BY FACTORING THE PRED/IN-PLANE MISSILE COMMAND
- SCALE AND ROUTE THE MISSILE/ACCEL COMMAND FOR THE HARDWARE

FOR MANUAL/LAUNCH
- IF THE ROLL/YAW COMMAND IS (1)_BANK, THEN COMPUTE THE PRED/IN-PLANE MISSILE COMMAND WITH (1)ATSP__BIFF AND MISSILE (1)ATTB__BIAS FROM THE RUDDER PEDALS AND AXIS1

FOR AUTO/BANK
- COMPUTE THE YAW RATE ERROR BY COMBINING (1)ATSP__BIFF AND MISSILE (1)ATTB__BIAS WITH THE BUFFERED TAR RATE COMMAND
- COMPUTE THE PRED/IN-PLANE MISSILE COMMAND WITH THE YAW RATE ERROR
- COMPUTE THE MISSILE/ACCEL COMMAND BY FACTORING THE PRED/IN-PLANE MISSILE COMMAND
- SCALE AND ROUTE THE MISSILE/ACCEL COMMAND FOR THE HARDWARE

AUTOLAT__SAF__FDI__RCS__ROLL/YAW/CHANNEL (GO)
(GO)__AUTOLAT__SAF__FDI__RCS__ROLL/YAW/CHANNEL
5.15.1.4
● THIS MODULE COMPUTES THE COMMANDS TO AEROSURFACES AS A FUNCTION OF FLIGHT CONDITIONS AND ATTITUDE HYDRAULIC SYSTEMS
● THE FOLLOWING REDUCED HYDRAULIC SYSTEMS STATUS FROM THE FOR CONTROL SURFACE ACTUATORS, THE LANDING GEAR AND THE BRAKES
- IF ONLY HYDRAULIC SYSTEM 2 IS (1)SUPPLIES APU HORN
- IF ONLY HYDRAULIC SYSTEMS 1 AND 3 ARE IN THE PRIORITY RATE LIMITER (PRL) ARE AUTOMATICALLY ADJUSTED TO CORRESPOND
- IF ONLY HYDRAULIC SYSTEM 1 IS (1)SUPPLIES APU HORN AND THE PRL USES AN RPM HYDRAULIC FLOW (+)ASSUMES APU HORN
- IF ONLY HYDRAULIC SYSTEM 3 IS (1)SUPPLIES APU HORN AND THE PRL USES AN RPM HYDRAULIC FLOW (+)ASSUMES APU HORN
- IF NO HYDRAULIC SYSTEMS ARE (1)SUPPLIES APU HORN AND THE PRL USES AN RPM HYDRAULIC FLOW (+)ASSUMES APU HORN
● THE PRL USES AN RPM HYDRAULIC FLOW (+)ASSUMES APU HORN
● IF THE HYDRAULIC FLOW (+)ASSUMES APU HORN IS LESS THAN (1) GPM+ THE HYDRAULIC LANDING GEAR EXTENSION IS 6.54 GAL/PUN
● THE HYDRAULIC FLOW HYDRAULIC IS CLEARED FOLLOWING LOCKDOWN IS 5.65 GAL/PUN

HYDRAULIC__SYSTEM__LANDING__GEAR__CONTROL__SEQUENCER (GO)
(GO)__HYDRAULIC__SYSTEM__LANDING__GEAR__CONTROL__SEQUENCER
5.15.1.1
● THIS MODULE PROVIDES AUTOMATIC CONTROL OF THE THREE HYDRAULIC SYSTEM LANDING GEAR ISOLATION VALVES AND THE HYDRAULIC LANDING GEAR EXTENSION ISOLATION VALVE, AND THE THREE HYDRAULIC SYSTEM BRAKE ISOLATION VALVES
● THIS MODULE IS ACTIVATED AT T-81.91 MODE FPS
● AT T+ MODULE 1 SEC 2 2000 FPS, AND SURG RECEIVED+(1)ING IS ON, OPEN HYD STS 1 LG EXT ISO VALVE CMD AND OPEN HYD STS 3 LG EXT ISO VALVE CMD
● AT T+5 S FYE SECOND INTERVAL, AND IF THE SURG RECEIVED+(1)ING IS ON, OPEN HYD STS 2 LG EXT ISO VALVE CMD
● TERMINATE HYD STS 1 LG EXT ISO VALVE COMMAND AFTER A 5 SECOND INTERVAL
● IF THE GEAR FLAG IS SET TO OPEN THE BRAKE ISOLATION VALVES
● IF MM602 IS ENTERED AND THE GROUND VEL IF ROLL 2 800 FPS+ OPEN HYD STS 1 LG EXT ISO VALVE CMD
● TERMINATE HYD STS 1 LG EXT ISO VALVE COMMAND AFTER A 5 SECOND INTERVAL
● IF THE BRAKE ISO VALVE FLAG IS SET TO OPEN OPEN BRAKE ISOLATION VALVE
● TERMINATE BRAKES ISO VALVE COMMAND AFTER A 5 SECOND INTERVAL

HYDRAULIC__THERMAL__CONDITIONING (GP)
(GP)__HYDRAULIC__THERMAL__
5.15.1.1
● GP7 GENERATES SLOW PROTECTION TO THE ELEVONS, BODY FLAP, SPEEDBRAKE AND RUDDER
- CALL GP1__HYDR__ACT__ONE__SGP

AERO__ACTUATOR__COMMAND__SGP (GP)
(GP)__AERO__ACT__ONE__SGP
5.15.1.4
● THE AERO ACTUATOR COMMAND SGP (GP)1 PERFORMS THE FINAL PROCESSING OF ELEVONS, RUDDER AND SPEEDBRAKE COMMANDS IN PREPARATION TO THE CORRESPONDING HARDWARE
● GP1 IS CALLED BY GP7 DURING MAJOR MODES 301/303 TO OUTPUT APERSPH+ATTE COMMANDS REQUIRED TO CONTROL ATTITUDE WITH HYDRAULIC SYSTEMS

EXTERNAL TANK SEPARATION OPERATIONS

VENT DOOR OPERATIONS

ET SEPARATION
ET SEP 1(A)
ET SEP 2(B)
AUTO

SRB SEPARATION
MAN AUTO
SEP 1(C)
SEP 2(D)
RSO

ET 1 ELS MM ATM
ET 2 ELS MM ATM
ET 3 ELS MM ATM
ET 4 ELS MM ATM

BOX E
LG PRESS/RTLS SENSOR BOX 9

AERO SURFACE ACTUATORS

HYDRAULIC PUMPS SYSTEM

GEAR/DOOR UPLOCK DISCRETES

MODE WHEEL STEERING

STEERING CONTROL BOX

RWC ACTUATOR ASSEMBLY

Z_1 15.1-10
Z_1 15.1-1
Z_1 15.3-1
Z_1 15.3-1

NOTES:
1. SEE DRAWING 15.2-1
2. SEE DRAWING 15.1-1
3. SEE DRAWING 6.18-1
4. SEE DRAWING 13.3-1
5. FOR FURTHER INFORMATION ON A SPECIFIC MODULE, NOTE THE ASSOCIATED FLOW DIAGRAM NUMBER (E.G. 2.1-1) AND REFER TO BOOK VOLUME 2 (FLT. SOFTWARE), MAINTENANCE, AND CONTROL
6. THE ET SEPARATION ON MUST BE IN MAN AND SEP PB+ DEPRESSED TO PROVIDE INPUT TO THE LANDING SOP
7. THE SRB SEPARATION ON MUST BE IN MAN AND SEP PB+ DEPRESSED TO PROVIDE INPUT TO THE LANDING SOP
8. SPR (1) ALSO DISPATCHES AT 6.25 HI 1 IN SPR 1 (1)EA+ DURING MAJOR MODES 301/303 AND MM102
- (1)SPF DURING MM103, AND MM105
9. ACTIVATED ON TRANSITION TO MM 602 BY GEA
10. 1.64 HI RATE
11. 25 HZ RATE
12. 6.25 HZ RATE
13. PROCESSES ARE SCHEDULED AT A PRESCRIBED RATE, FREQUENTLY, OR BY EVENT. THEY ARE ACTIVATED BY THE CALLING ROUTINE (FLT. SOFTWARE AND EXECUTIVE, UMBILICAL), OR THE CONTROL ROUTINE AND ARE INTERRUPTED ONLY BY PROGRAMS OF HIGHER PRIORITY
NOTES:
1. PROCESSES ARE ONLY INVOKED BY CALLS BY THE CALLING ROUTINE AND CONTROL RETURNS BACK TO THE CALLER WHEN THROUGH. PROCESSES CANNOT BE USED AS EXPRESSIONS

8 MECH/SW OV 1

SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
JOHN VICKI S. HUNTER	2/16/82	LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
GM VICKI S. HUNTER	2/16/82	MECH/SW OV (PASS ONLY) OV-105 MAJOR MOD VEHICLES
CHIEF, G. BASS ROBINSON		
CHIEF, [illegible]	2/16/82	
MGR, [illegible]	2/16/82	
MGR, [illegible]	2/16/82	SPACE SHUTTLE DOC NO 15.8
DIR [illegible]	2/17/82	ALL SHEET 1 OF 1

BASIC REV E-1

PASS/SM
MECHANICAL SOFTWARE

CONSTANT VALUES TABLE — CDT
COMPOOL: CSS_CDT — 4.5.15.1

● CONTAINS THE TABLE MAINTENANCE UPDATEABLE CONSTANT VALUES USED BY THE SPECIAL PROCESSES. THEY ARE DIVIDED INTO SUBSECTIONS BY PARAMETER TYPE.

SCALAR SECTION:

DESCRIPTION	Public, L.D.
+ APU 1 TEMPERATURE CONSTANT	V$2721406C
+ APU 2 TEMPERATURE CONSTANT	V$2722406C
+ HYDRAULIC WSB 1 ONE QUANTITY	V$2083406C
+ HYDRAULIC WSB 1 ONE QUANTITY	V$2084406C
+ HYDRAULIC WSB 2 ONE QUANTITY	V$2085406C
+ HYDRAULIC WSB 2 ONE QUANTITY	V$2086406C
+ APU 1 NITROGEN PASS LOADED CONST	V$2053406C
+ APU 2 NITROGEN PASS LOADED CONST	V$2053806C
+ APU 3 NITROGEN PASS LOADED CONST	V$2054006C

	MSID	VALUE	UNITS
+ MPS 1 B/F RTN T PQS	V58701044	51 F	DEG F
+ MPS 1 LUB ELEVON T	V58701036	51 F	DEG F
+ MPS 1 RHR ELEVON T	V58701044	51 F	DEG F
+ MPS 1 RHR RTN T PQS	V58701052	51 F	DEG F
+ MPS 1 PGA RTN T PQS	V58702054	-157 F	DEG F
+ MPS 2 B/F RTN T PQS	V58702064	-157 F	DEG F
+ MPS 2 RHR ELEVON T	V58702044	51 F	DEG F
+ MPS 2 LUB ELEVON T	V58702036	51 F	DEG F
+ MPS 2 RHR ELEVON T	V58702044	51 F	DEG F
+ MPS 2 PGA RTN T PQS	V58702052	-157 F	DEG F
+ MPS 3 B/F RTN T PQS	V58703064	-157 F	DEG F
+ MPS 3 RHR ELEVON T	V58703044	51 F	DEG F
+ MPS 3 LUB ELEVON T	V58703044	51 F	DEG F
+ MPS 3 PGA RTN T PQS	V58703052	-157 F	DEG F

	MSID	VALUE	UNITS
+ HYDRAULIC SYSTEM 1 ACCUM PRESS LOW LIMIT	V53P1350C	1900	PSIA
+ HYDRAULIC SYSTEM 2 ACCUM PRESS LOW LIMIT	V53P1360C	1900	PSIA
+ HYDRAULIC SYSTEM 3 ACCUM PRESS LOW LIMIT	V53P1930C	1900	PSIA
+ HYDRAULIC SYSTEM ACCUM PRESS TIMER	V52W1747C	5	MINUTES
+ HYDRAULIC SYSTEM 1 CIRC PUMP PRESS LOW LIMIT	V53P1742C	100	PSIA
+ HYDRAULIC SYSTEM 2 CIRC PUMP PRESS LOW LIMIT	V53P1752C	100	PSIA
+ HYDRAULIC SYSTEM 3 CIRC PUMP PRESS LOW LIMIT	V53P1942C	100	PSIA
+ HYDRAULIC 1 CIRC PUMP RUN RUN TIME	V52W1744C	15	MINUTES
+ HYDRAULIC 2 CIRC PUMP RUN RUN TIME	V52W1754C	15	MINUTES
+ HYDRAULIC 3 CIRC PUMP RUN RUN TIME	V52W1746C	10	MINUTES

DISCRETE SECTION:

DESCRIPTION	MSID
+ APU 1 PRESSURE FLAG	V52U1350D
+ APU 2 PRESSURE FLAG	V52U1360D
+ APU 3 PRESSURE FLAG	V52U1930D
+ APU 1 PRESSURE OUT FLAG	V52U1529D
+ APU 2 PRESSURE OUT FLAG	V52U1539D
+ APU 3 PRESSURE OUT FLAG	V52U1929D
+ APU 1 TEMP OUT FLAG	V52U1650D
+ APU 2 TEMP OUT FLAG	V52U1660D
+ APU 3 TEMP OUT FLAG	V52U1960D

SP BASIC INITIALIZATION PROCESS — 4.5.1.30
I-SIS-SPI

● INITIALIZE PARAMETERS FOR BASIC SM PROCESSES AND SPECIAL PROCESSES
● SET HYDRAULIC INITIALIZATION FLAG TO ON FOR ON-ORBIT TEMPERATURE CONTROL

CALLS

SPS 2 INITIALIZATION/CLEANUP — 4.5.1.3
I-SIS-CLEANUP

● PROVIDES FOR CENTRAL/ISS ENTRY AND EXIT PROCESSING FOR SPS 2 SPECIAL PROCESSES
  ▪ CALL SIF__SPS PERFORMS THE INITIALIZATION OF PARAMETERS FOR SPS BASIC AND SPS SPECIAL PROCESSES
  ▪ CALL SIF__HYD PERFORMS THE INITIALIZATION OF PARAMETERS FOR SPS HYDRAULIC SPECIAL PROCESSES AND CYCLIC MISSION SELECTABLE PROCESSES, DATA CONSISTS OF A FREQUENCY, PHASE COUNT, AND CASE NUMBER. THE TABLE INITIALIZATION AND CONTENT IS HYDRAULIC DEPENDENT
● MODE 2002 INITIALIZATION INCLUDES SETTING OF FLAGS FOR PBD PROCESSOR AND THE HYBRID DISPATCHER TABLE TO ACTIVATE THE PBD PROCESSOR
● MODE 2003 INITIALIZATION INCLUDES RESETTING FLAGS FOR PBDS AND THE HYBRID DISPATCHER TABLE TO DEACTIVATE PBDS
● IF THE PBD SWITCH IS NOT IN "STOP" OR IF THE PBD POWER IS "ON" INDICATIONS ARE SET FOR THE PBD PROCESSOR AND THE PBD PROCESSOR IS CALLED TO CLEAN-UP

SPS 4 INITIALIZATION/CLEANUP — 4.5.1.4
I-SIS-CLEANUP

● PROVIDES FOR CENTRAL/ISS ENTRY AND EXIT PROCESSING FOR SPS 4 SPECIAL PROCESSES
  ▪ CALL SIF__SPS PERFORMS THE INITIALIZATION OF PARAMETERS FOR SPS BASIC AND SPS SPECIAL PROCESSES
  ▪ CALL SIF__HYD PERFORMS THE INITIALIZATION OF PARAMETERS FOR SPS 4 HYDRAULIC SPECIAL PROCESSES AND CYCLIC MISSION SELECTABLE PROCESSES, DATA CONSISTS OF A FREQUENCY, PHASE COUNT, AND CASE NUMBER. THE TABLE INITIALIZATION AND CONTENT IS HYDRAULIC DEPENDENT. UPDATES THE HYBRID DISPATCHER TABLE FOR SPS 4

CALLS

USER INTERFACE — 1.0.1
I-UIF

● ROUTES INPUT COMMANDS FROM THE KEYBOARDS, GROUND, AND OTHER COMPUTERS
● PERFORMS INITIATION, SEQUENCING, AND TERMINATION OF APPLICATION AND SYSTEM SERVICES

KBD/DEU

SCHEDULES

SPEC/PLMOD (SPS2) CONTROL SEGMENT — 4.5.1.1
I-SPS__SPS2

● ACTIVATES SPS 2 SYSTEMS MANAGEMENT PROCESSING AND PRESENTS THE PBD DISPLAY (MODE 2002)
  ▪ CALL SIF__CLEANUP
  ▪ CALL SBD__ITEM

SPEC/PLMOD (SPS3) CONTROL SEGMENT — 4.5.1.1
I-SPS__SPS3

● ACTIVATES SPS 2 SYSTEMS MANAGEMENT PROCESSING AND PRESENTS THE PBD DISPLAY (MODE 2003)
  ▪ CALL SIF__CLEANUP
  ▪ CALL SBD__ITEM

HYBRID DISPATCHER INITIALIZATION/CLEANUP TABLE — 4.5.27
COMPOOL: CSS__INIT/CLEANUP

● THIS TABLE IS USED BY THE SM HYBRID DISPATCHER INITIALIZATION/CLEANUP MODULE TO INITIALIZE THE HYBRID DISPATCHER TABLE

SM HYBRID DISPATCHER TABLE — 4.5.22
I-SIS-HYBRID

● PROVIDES INFORMATION TO THE SDP__EXEC__TO CYCLICALLY EXECUTE THE VARIOUS SPECIAL PROCESSES AND CYCLIC MISSION SELECTABLE PROCESSES. DATA CONSISTS OF A FREQUENCY, PHASE COUNT, AND CASE NUMBER. THE TABLE INITIALIZATION AND CONTENT IS HYDRAULIC DEPENDENT

SPECIAL PROCESSES EXECUTIVE — 4.5.1.5
I-SDP__EXEC

● SDP__EXEC IS GOVERNED BY THE HYBRID DISPATCHER, A TABLE DRIVEN SCHEDULER WHICH CONTROLS THE VARIOUS HARD/SOFT CYCLIC PROCESSES THROUGH USE OF THE HYBRID DISPATCHER TABLE
● WHEN THE HYBRID DISPATCHER DETERMINES THAT A PROCESS IS TO BE EXECUTED, THE CASE NUMBER FROM THE HYBRID TABLE ENTRY IS USED TO PERFORM THAT PROCESS

CALLS

APU FUEL QUANTITY — 5.5.1.14
I-SDA__APU_FUEL__QTY

● THIS MODULE EXECUTES CYCLICALLY TO DETERMINE THE QUANTITY OF FUEL IN EACH OF THE THREE APU FUEL TANKS
● COMPUTE DERIVATIVE FOR COMPUTATION # MOD 4
● IF DERIVATIVE# = 0 THEN SET APU FUEL TANK QTY = 0
● IF DERIVATIVE# NOT EQUAL 0 THEN COMPUTE APU FUEL TANK QTY
● IF APU FUEL TANK QTY < 0 THEN SET APU FUEL TANK QTY = 0
● IF APU FUEL TANK QTY > 100 THEN SET APU FUEL TANK QTY = 100
● CHECK INPUT PARAMETERS STATUS
● IF ANY INPUT PARAMETER STATUS IS INVALID, THEN SET OUTPUT PARAMETER STATUS TO INVALID

HYDRAULIC WATER BOILER QUANTITY — 5.5.1.14
I-SDA__HYD__WDB__QTY1

● THIS MODULE COMPUTES THE AMOUNT OF WATER REMAINING IN THE THREE STORAGE TANKS (SYSTEMS 1, 2, AND 3) OF THE HYDRAULIC WATER BOILER SYSTEM
● THEN COMPUTES HYD WDB QTY REMAINING
● IF HYD BLR GAS OUTLET PRESSURE < 0 THEN SET HYD WDB QTY = 0
● IF HYD WDB QTY > 0 THEN SET HYD WDB QTY = 0 - IF HYD WDB QTY > 100 THEN SET HYD WDB QTY = 100
● SEE SSSM DRAWING NO. 13.3-1 FOR ADDITIONAL WDB SOFTWARE LOGIC AND COMPUTATIONS

HYDRAULIC CIRC PUMP AUTO CONTROL SEQUENCE — 5.5.1.17
I-SDA__HYD__PCS__TEMP

● THIS MODULE TURNS THE THREE HYDRAULIC FLUID PUMPS ON AND OFF AUTOMATICALLY BASED ON THE ACCUMULATOR ASSISTPUMP PRESSURE AND FLUID TEMPERATURE SENSORS IN EACH OF THE THREE HYDRAULIC SYSTEMS
● THE MODULE ALSO CONTROLS THE HYDRAULIC FLUID TEMPERATURE LIMITS ON RUNNING CIRC PUMPS
● ACCUMULATOR PRESSURE MAINTENANCE HAS PRIORITY OVER THE HYDRAULIC FLUID TEMPERATURE MAINTENANCE
● CHECK CIRC PUMP FOR GPC CONTROL
● PERFORM HYD SYS ACCUMULATOR PRESSURE CHECK
  ▪ IF ACCUMULATOR PRESSURE IS LESS THAN 2950 PSIA
    a. IF CIRC PUMP RUNNING TIMER > 1860 AND/OR NUMBER OF CIRC PUMPS RUNNING FOR LOW ACCUMULATOR PRESSURE=1
    b. RESET RUNNING HYDRAULIC SYSTEM CIRC PUMP RUN TIME TO ZERO
    c. START ACCUMULATOR PRESSURE TIMER
    d. WHEN THE ACCUMULATOR PRESSURE > 1860 AND THE TIMER > 5 MINUTES AND HAS ELAPSED, TURN THE CIRC PUMP OFF
    e. SET ACCUMULATOR PRESSURE FLAG
● IF CIRC PUMP RUN TIME > 1860 SECONDS, TURN IT OFF
● IF ANY ACCUMULATOR PRESSURE FLAGS HAVE BEEN SET THEN BYPASS THE FLUID TEMPERATURE MONITORING PROCESS
● IF ACCUMULATOR PRESSURE IS NOMINAL, THE HYDRAULIC FLUID TEMPERATURE CONTROL MONITORING IS EXECUTED
  ▪ CHECK THAT THE TEMPERATURE SENSORS FOR AN OUT-OF-TEMP CONDITION
  ▪ SET HYD SYS PRIORITY ASSIGNMENTS BASED ON THE TEMP SENSORS
  ▪ CHECK HYD SYS WITH PRIORITY 1 FOR PUMP STATUS
    a. IF PUMP IS ON, THEN CHECK FOR OUT-OF-TEMP = THE HIGH LIMIT, OR MINIMUM ALLOWABLE CONTINUOUS PUMP RUN TIME IS EXCEEDED AND THE PUMP IS NOT ALREADY OFF, PERFORM CIRC PUMP TURN OFF FUNCTION
    b. IF THE PUMP FOR THIS SYSTEM HAS NOT BEEN TURNED OFF, PERFORM THE CIRC PUMP TURN ON PROCESS
● SEE SSSM DRAWING NO. 13.3-3 FOR ADDITIONAL CIRC PUMP SOFTWARE LOGIC

S-DISPLAY/DOWNLIST TABLE — 4.5.18
COMPOOL: CSS__DDT

● THE S-DISPLAY/DOWNLIST TABLE CONTAINS PARAMETERS THAT ARE TOO DISPLAY ONLY OR PARAMETERS THAT ARE TO BE DOWNLISTED
  ▪ APU FUEL QUANTITY VARIABLES
  ▪ HYDRAULIC H2O BOILER QUANTITY VARIABLES

SPECIAL PROCESSES OUTPUT BUFFER — 4.5.14
I-SDA__SPOB

● CONTAINS DISCRETE INDICATORS USED TO MERGE OUTPUT COMMANDS FROM THE FOUR SECTIONS
● THE SPOB CONSISTS OF FOUR SECTIONS:
  ▪ PAYLOAD BAY DOORS OUTPUT SECTION
  ▪ CYCLIC OUTPUT SECTION
  ▪ MRM OUTPUT SECTION
  ▪ ANNUNCIATION SECTION
● THE SPOB IS THE COLLECTION AND STORAGE AREA FOR ALL SPECIAL PROCESSES DATA THAT IS TO BE OUTPUT TO THE PAYLOAD MDM'S

SPECIAL PROCESSES DATA OUT — 5.5.1.11
I-SDA__SP__DATA__OUT

● THIS MODULE WRITES ALL SPECIAL PROCESSES OUTPUTS TO THE PAYLOAD MDM'S AND PERFORMS ALL SP ANNUNCIATION
● IF THE PAYLOAD BAY DOORS ARE CLOSED, THE PAYLOAD BAY DOORS ARE SET UP FOR FIDS FLIGHT COMPUTER OPERATING SYSTEM OUTPUT PROCESSING AND AN FIDS MAJFN IS ISSUED
● THE MODULE MERGES THE OUTPUT PARAMETERS IN THE SP OUTPUT BUFFER TABLE
● SYNCHRONIZE, RESET MAJOR FRAME AND SET UP FOR FIDS OUTPUT
● IF PAYLOAD BAY DOORS ARE OPEN, THE MODULE SETS UP THE MDM FIDS OF OUTPUT PARAMETERS IN THE SP OUTPUT BUFFER
● MERGE DISCRETE INDICATORS COMMON TO FIDS AND THE OTHER PROCESSES INTO ONE WORD FOR DOWNLIST
● PERFORM SP ANNUNCIATION OUTPUT PROCESSING
● THE MODULE MERGES THE DISCRETE INDICATORS THAT ARE SET BY THEIR SP MODULES
● ONCE ANNUNCIATION IS ENABLED FOR A PARTICULAR MODULE, THE ANNUNCIATION PROCESSING FOR THAT INDICATOR HAS BEEN MISSED AND PROCESSED BY SDA__SPL__DATA__OUT1 AND THEN SET ON AGAIN

PAYLOAD BAY DOORS — 5.5.1.20
I-SDB__PL__BAY__DOORS1

● THE PAYLOAD BAY DOORS MODULE EXECUTES CYCLICALLY TO OPEN AND CLOSE THE PAYLOAD BAY DOORS AND THEIR ASSOCIATED RADIATORS
● PERFORM SM/GPC PROCESSING
● CONTROL SWITCH DETERMINATION
● PERFORM CONTROLLING LATCH FEEDBACK
● PERFORM CONTROLLING LATCH FEEDBACK DISPLAY
● PERFORM STBD SM/GPC LATCH AND DOOR FEEDBACK DISPLAY
● PERFORM PORT SM/GPC LATCH AND DOOR FEEDBACK DISPLAY
● CALL PBD DOOR STATUS
● PERFORM PBD TALKBACK OPERATIONS
● MODE SELECTION: AUTO
● PERFORM AUTO MODE SELECT
  ▪ PERFORM OPEN COMMANDS
  ▪ DISABLE UNVERIFIED OPEN COMMANDS
  ▪ DISABLE UNVERIFIED CLOSE COMMANDS
  ▪ PERFORM CLOSE COMMANDS
● AUTO OPEN COMMANDS
  ▪ PERFORM OPEN FEEDBACK
  ▪ PERFORM CLOSE FEEDBACK
  ▪ PERFORM DOOR FEEDBACK
  ▪ PERFORM OPEN COMMANDS
  ▪ PERFORM PBD CONFIGURATION CHECK (FEEDBACK)
  ▪ ENABLE COMMANDS
  ▪ SET CLOSE FAIL INDICATORS
  ▪ SET CLOSE FAIL INDICATORS
● MODE SELECTION: MANUAL
● PERFORM MANUAL MODE SELECT
  ▪ PERFORM DISABLE COMMANDS
● MANUAL SEQUENCE
  ▪ PERFORM MANUAL OPEN
  ▪ PERFORM MANUAL CLOSE
● SEE SSSM DRAWING NO. 14.2-2 FOR ADDITIONAL PBD SOFTWARE LOGIC

PAYLOAD BAY DOORS COMMUNICATIONS TABLE — 4.5.15.5
COMPOOL: CSS__PBD__CDT

● THE PAYLOAD BAY DOORS COMMUNICATIONS TABLE CONTAINS DATA USED BY THE PAYLOAD BAY DOOR CYCLE PROCESSOR AND THE PAYLOAD BAY DOOR ITEM PROCESSOR
  ▪ AUTO MODE ITEM
  ▪ PBD OPEN COMMANDS
  ▪ POWER ON/OFF ITEM
  ▪ SWITCH BYPASS ITEM
  ▪ PBD OPEN ITEM
  ▪ PBD CLOSE ITEM
  ▪ PBD CLOSE ITEM
  ▪ PBD OPEN FAIL INDICATORS
  ▪ PBD CLOSE FAIL INDICATORS
  ▪ PBD SWITCH INDICATOR TEXT
  ▪ PBD SWITCH INDICATOR TEXT
  ▪ PBD SWITCH OUTPUT STATUS
  ▪ LATCH AND DOOR OUTPUT STATUS
  ▪ LATCH AND DOOR OUTPUT STATUS
  ▪ PBD OUTPUT INDICATOR
  ▪ PBD ITEM FLAG
  ▪ MANUAL MODE FLAG
  ▪ POWER ON/OFF FLAG
  ▪ PBD DISPLAY UPDATE INDICATOR

PAYLOAD BAY DOORS ITEM PROCESSOR — 5.5.1.1
I-SBD__ITEM1

● TAKES ITEM ENTRIES MADE ON THE PBD DISPLAYS, EDITS THEM FOR VALIDITY, AND PLACES THE ITEM DATA INTO APPROPRIATE ITEMS FOR LATER USE BY THE CYCLIC PBD MODULE OR ENABLES AN ERROR MESSAGE FOR DISPLAY
● IF A POWER ON/OFF ITEM ENTRY IS ENTERED, THE POWER ON/OFF ITEM IS SET TO THE ITEM ENTRY VALUE AND THAT POWER ON/OFF COMMAND NEED TO BE SET ON OR OFF
● THE AUTO MODE ITEM ENTRY IS ONLY VALID IF THE PBD SWITCH IS IN THE AUTO POSITION AND THE PBD ITEM 1726 IS IN THE "STOP" POSITION
● ALL MANUAL MODE ITEM ENTRIES ARE VALID IF EITHER THE PBD SWITCH IS IN THE MANUAL POSITION OR IF THE "STOP" POSITION OR ANY MANUAL MODE ITEMS ARE SET ON
● THE BYPASS SWITCH ITEM ENTRIES ARE VALID, WHEN THE PBD SWITCH BYPASS ITEM 1 IS ON
● IF AN INVALID ENTRY IS MADE, A BIT IS SET IN THE FAULT MESSAGE PARAMETER TABLE, THIS ALERTS THE CYCLIC USER INTERFACE PROGRAM THAT ANNUNCIATION IS TO BE PERFORMED

PAYLOAD BAY DOORS — 5.5.1.20
I-SDB__PL__BAY__DOORS1

● THE PAYLOAD BAY DOORS MODULE EXECUTES CYCLICALLY TO OPEN AND CLOSE THE PAYLOAD BAY DOORS AND THEIR ASSOCIATED RADIATORS
● PERFORM SM/GPC PROCESSING
● CONTROL SWITCH DETERMINATION
● PERFORM CONTROLLING LATCH FEEDBACK
● PERFORM CONTROLLING LATCH FEEDBACK DISPLAY
● PERFORM STBD SM/GPC LATCH AND DOOR FEEDBACK DISPLAY
● PERFORM PORT SM/GPC LATCH AND DOOR FEEDBACK DISPLAY
● CALL PBD DOOR STATUS
● PERFORM PBD TALKBACK OPERATIONS
● MODE SELECTION: AUTO
● PERFORM AUTO MODE SELECT
  ▪ PERFORM OPEN COMMANDS
  ▪ DISABLE UNVERIFIED OPEN COMMANDS
  ▪ DISABLE UNVERIFIED CLOSE COMMANDS
  ▪ PERFORM CLOSE COMMANDS
● AUTO OPEN COMMANDS
  ▪ PERFORM OPEN FEEDBACK
  ▪ PERFORM CLOSE FEEDBACK
  ▪ PERFORM DOOR FEEDBACK
  ▪ PERFORM OPEN COMMANDS
  ▪ PERFORM PBD CONFIGURATION CHECK (FEEDBACK)
  ▪ ENABLE COMMANDS
  ▪ SET CLOSE FAIL INDICATORS
  ▪ SET CLOSE FAIL INDICATORS
● MODE SELECTION: MANUAL
● PERFORM MANUAL MODE SELECT
  ▪ PERFORM DISABLE COMMANDS
● MANUAL SEQUENCE
  ▪ PERFORM MANUAL OPEN
  ▪ PERFORM MANUAL CLOSE
● SEE SSSM DRAWING NO. 14.2-2 FOR ADDITIONAL PBD SOFTWARE LOGIC

PF1
PF2

CALLED ONCE EVERY 400 MILLISECONDS WHILE IN OPS 202/402

SEE DRAWING 13.3-1 FOR HYDRAULIC CIRC PUMP OPERATIONS

THE PAYLOAD MDMS CHANNELIZE THE DATA FROM THE SPOB ONTO THE MDM FIDS. THE MDM FIDS ARE SET UP BY THE PAYLOAD MDMS (IMPLIED) AS A PORTION OF THE SM DOWNLIST, AND FOLLOWS THE SAME PATH TO THE GROUND AS THE ONE SPECIFIED FOR THE SM DOWNLIST. SEE SM DOWNLIST, AND SM DOWNLIST 2

SEE DRAWING 14.1-1 FOR PLBD OPERATIONS

FOR FURTHER UNDERSTANDING OF A SPECIFIC MODULE, NOTE THE REFERENCE NUMBER IN THE MODULE HEADER, AND GO TO THE OPS VOLUME (VOL. I, VOL. II, PART 2 - SYSTEMS MANAGEMENT)

CALLED WHEN AN ITEM ENTRY IS MADE TO THE PBD DISPLAY

CALLED BY THE PAYLOAD BAY DOORS PROCESS WHENEVER IT HAS COMMANDS TO OUTPUT

SCHEDULED 6.25 TIMES PER SECOND

CALLED EVERY 2 SECONDS

PROGRAMS ARE SCHEDULED AT A PRESET-RATE PHASE, FREQUENCY, AND CASE NUMBER. THEY ARE CALLED BY THE HYBRID SOFTWARE AND EXECUTE INDEPENDENTLY OF THE SCHEDULING ROUTINE AND ARE INTERRUPTED ONLY BY PROGRAMS OF HIGHER PRIORITY

NOTES: PROCEDURES ARE ONLY INVOKED AS CALLS BY THE CALLING ROUTINE AND CONTROL RETURNS BACK TO THE CALLING ROUTINE WHEN THROUGH. PROCEDURES CANNOT BE USED AS EXPRESSIONS

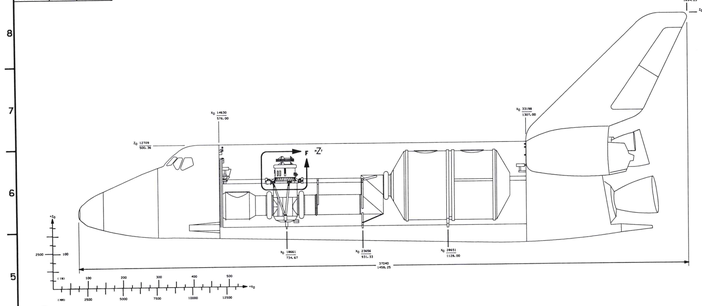
PL BAY DOOR — PL BAY MECH PWR
SYS 1 ENABLE / DISABLE — SYS 2 ON / OFF
DISABLE — OFF
RADIATOR CONTROL — RADIATOR CONTROL
PL BAY DOOR — STBD — PORT — STBD — PORT
OPEN — CLOSE
RADIATOR CONTROL SYS 1 → RELEASE / SYS 2 → DEPLOY — RADIATOR CONTROL SYS 1 → DEPLOY / SYS 2 → RELEASE
K2 ANTENNA — STOW — STOW — STOW — STOW
DIRECT STOW ON — DEPLOY — DEPLOY — STOW
DPLY 150, K2/A → OPEN / B → CLOSE
DIRECT STOW OFF

KBD/ ✓ PL BAY DOORS — XX X DDD:HH:MM:SS
AC POWER ON / OFF — PBD SW=XXXX — H/CRD=SW STAT LATS DOORS
AUTO MODE ON / OFF — RADS VRS
CENTER LATCHES (MAN) OP/CL (AUTO) TGT / ACT — STBD: LATCHES / DOORS — PORT: LATCHES / DOORS
PBD SW BYPASS 140 — OPEN 150 / CLOSE 170 — 1001

BASIC REV E-4

8 MECH/SW OV 2

SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
STEVEN K. HUNTER	4/2/85	LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DM		
DAVID C. PATTERSON		MECHANICAL/SOFTWARE OVERVIEW (PASS ONLY)
APP		
APP		SPACE SHUTTLE DOC NO 15.8
APP		ALL
APP		SHEET 2 OF 2
APP		
APP		
APP	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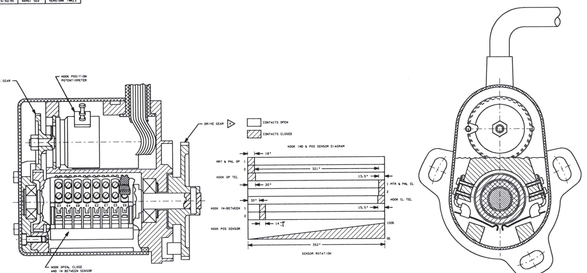
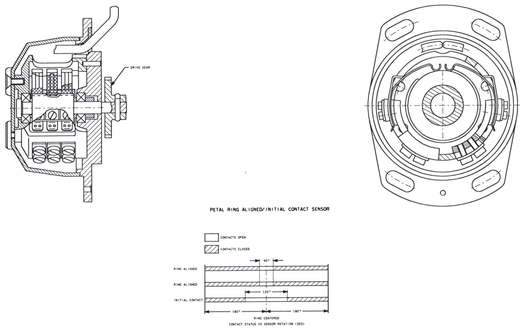
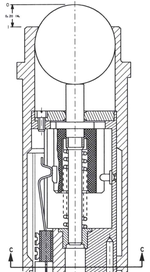
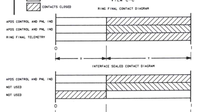


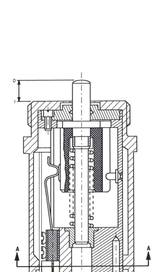
HOOK POSITION SENSOR

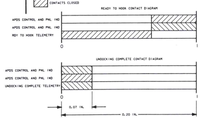


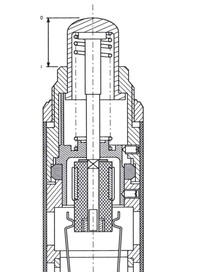
PETAL RING ALIGNED/INITIAL CONTACT SENSOR

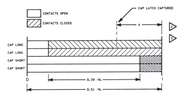


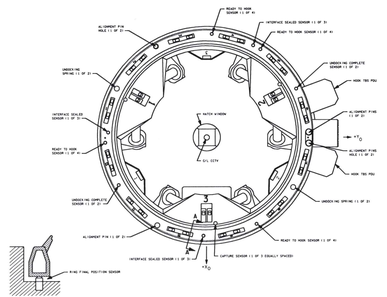






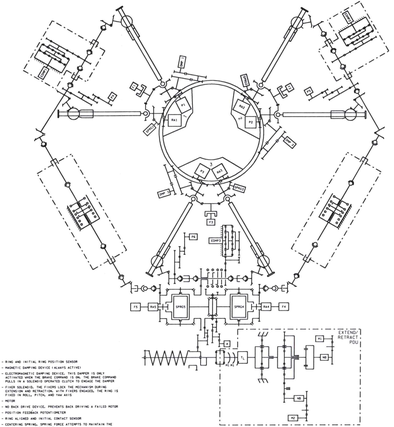


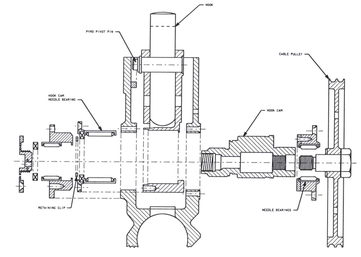




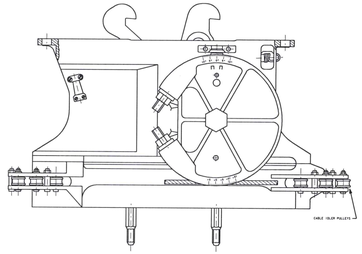
VIEW A-A
(3 PLACES EQUALLY SPACED)

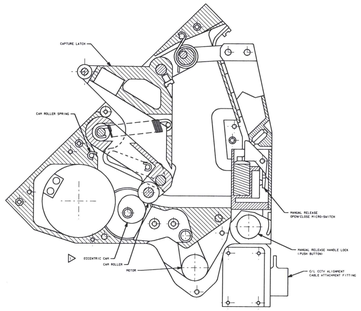
STRUCTURAL RING/DOCKING SENSOR LOCATIONS



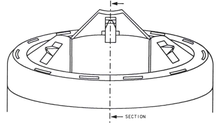


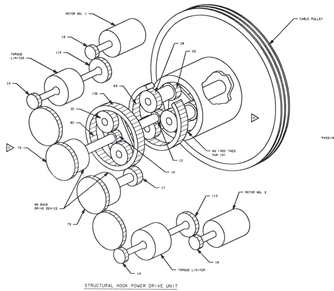
ACTIVE HOOK CROSS SECTION
(EXPLODED VIEW)





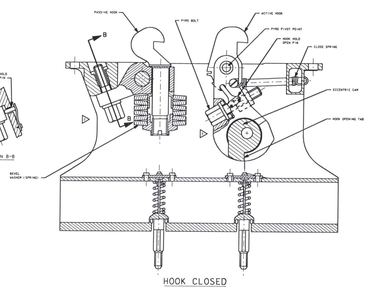
CAPTURE LATCH ASSEMBLY



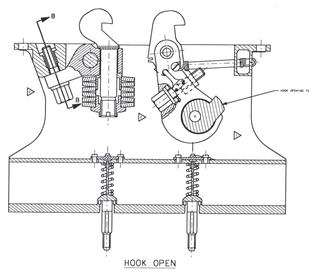


STRUCTURAL HOOK POWER DRIVE UNIT
(1 UNIT/ 4 HOOKS)

SECTION B-B

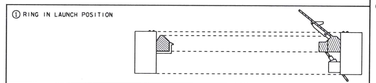


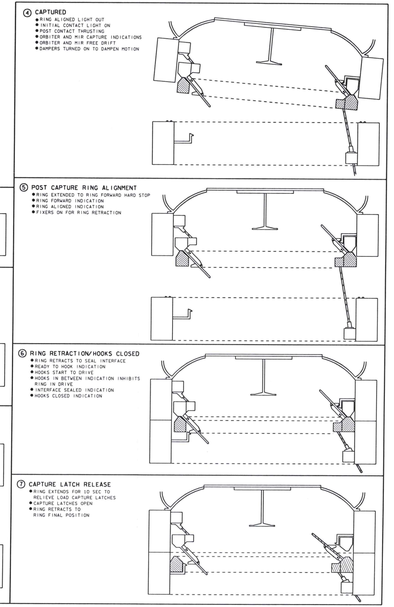
STRUCTURAL HOOK ASSEMBLY



HOOK CLOSED

HOOK OPEN





DOCKING SEQUENCE

HOOK OPEN, CLOSE, IN BETWEEN SENSOR (1 OF+OOA BY PDU PILOT)

NUMERIC REPRESENT SEAR TECH

NOT ONE (1) OF EITHER DETAILS ON HOOK PINS (INITIATION AND SUBSEQUENT HOOK RETRACTION

NOTES: LATCH SHOWN CLOSED, AT THE ECCENTRIC CAM ROTATES, THE CAM ROLLER WILL DROP ALLOWING THE CAPTURE LATCH TO ROTATE. THE CAM ROLLER PUSHES THE HOOK DIRECTLY TO OPEN AND CLOSE THE LATCH

9 ODS CAPT LAT/HKS/SEQ 3

SIGNATURE	DATE	NOTICE: CONTAINS U.S. GOVT. EXPORT CONTROLLED DATA PER DOD DIRECTIVE 5230.25, WITHHOLDING OF UNCLASSIFIED TECHNICAL DATA FROM PUBLIC DISCLOSURE, 6 NOV 1984. USE, DUPLICATION OR DISCLOSURE SUBJECT TO RESTRICTIONS AS STATED IN DOD DIRECTIVE 5230.25, WITHHOLDING OF UNCLASSIFIED TECHNICAL DATA FROM PUBLIC DISCLOSURE, 6 NOV 1984.
PREPARED BY		
M. A. TUDOSAL / C. FELTS	06/28/89	
CHIEF, D. DAHL		
APPROVED BY		

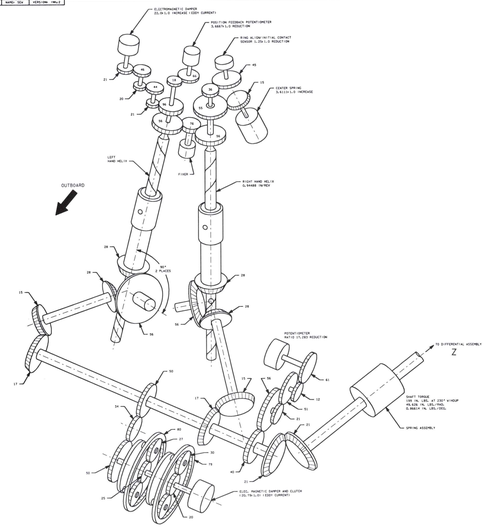
ORBITER DOCKING SYSTEM/CAPTURE LATCH, HOOKS, SEQUENCE

SPACE SHUTTLE | DWG NO. 15.9

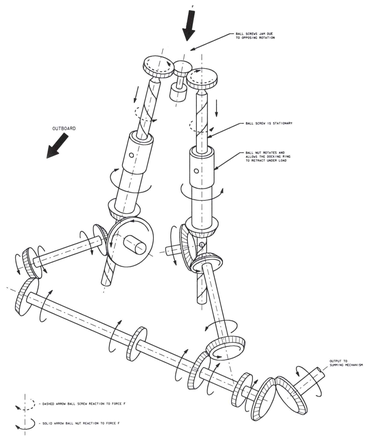
SIZE A | SCALE NONE | SHEET 1 OF 1

BASIC REV E-5

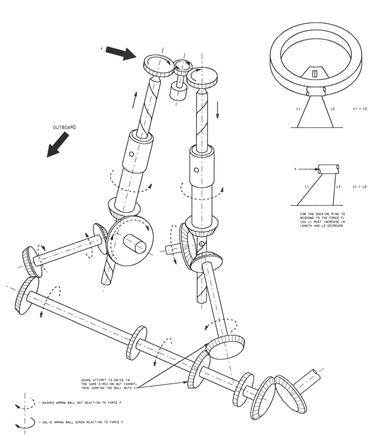
BASIC REV E-5



BALL SCREW PAIRS (3 PLACES) INTERCONNECTING DRIVE
(NUMBERS ARE TEETH/GEAR)

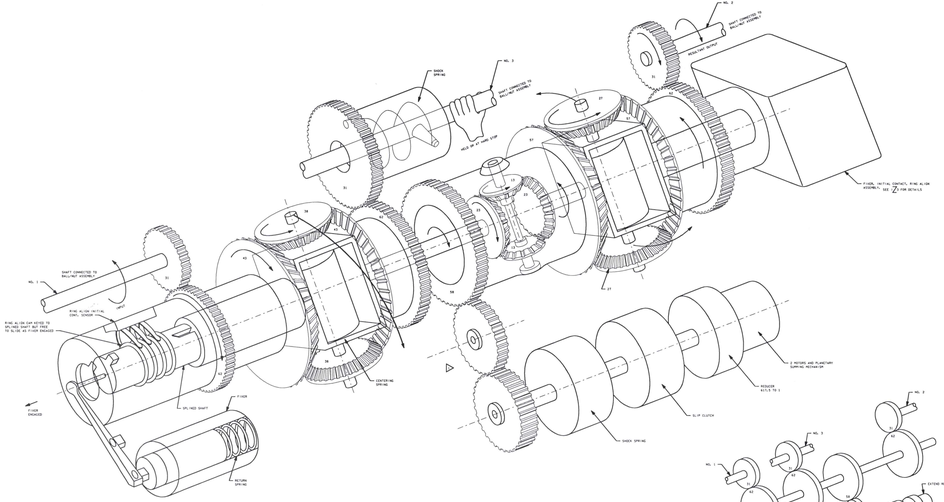


AXIAL LOAD (BOTH LEGS RETRACT/EXTEND)

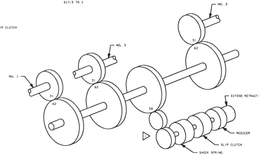


SHEAR LOAD (ONE LEG EXTENDS ONE RETRACTS)

BALL NUT ASSEMBLY



DIFFERENTIAL ASSEMBLY
(ARROWS SHOW MOTION FOR INPUT SHOWN)
PETAL 1 INPUT, PETAL 3 AT HARD STOP

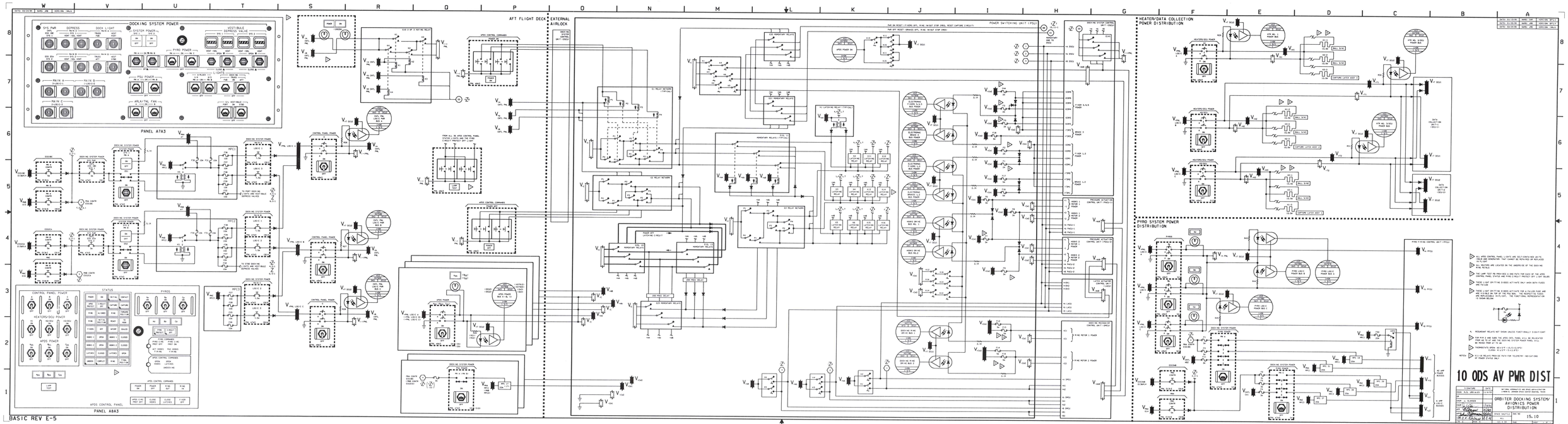


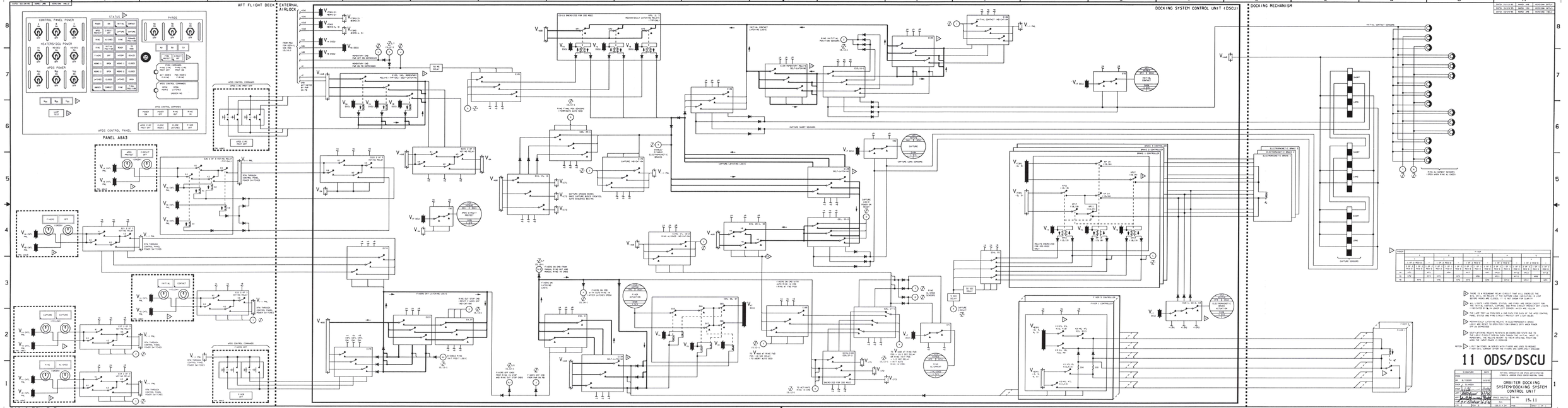
SIMPLIFIED MECHANISM WITH FIXERS ENGAGED
FOR EXTEND AND RETRACT OPERATIONS

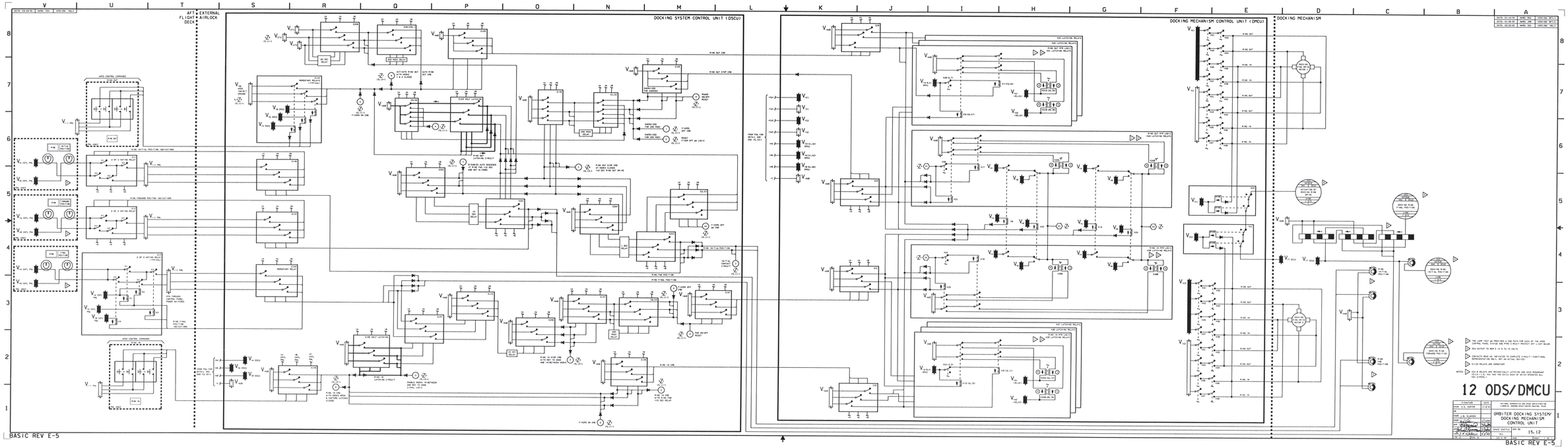
NOTES: 1. SIMPLIFIED REPRESENTATION OF ACTUAL MULTI-GEAR TRAIN

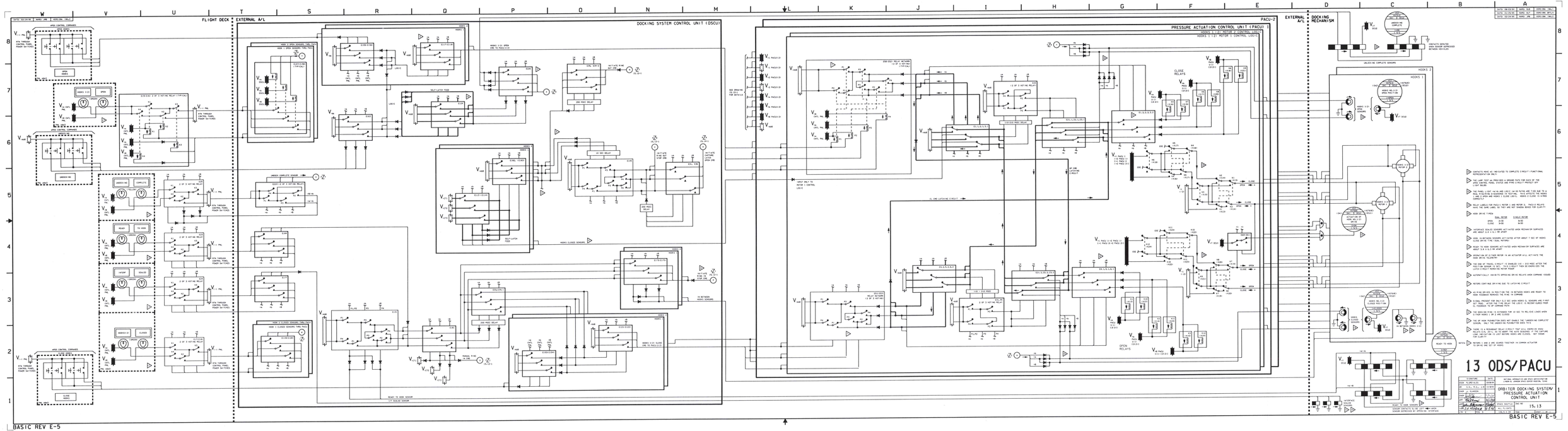
9 ODS CAPT LAT/HKS/MECH 1

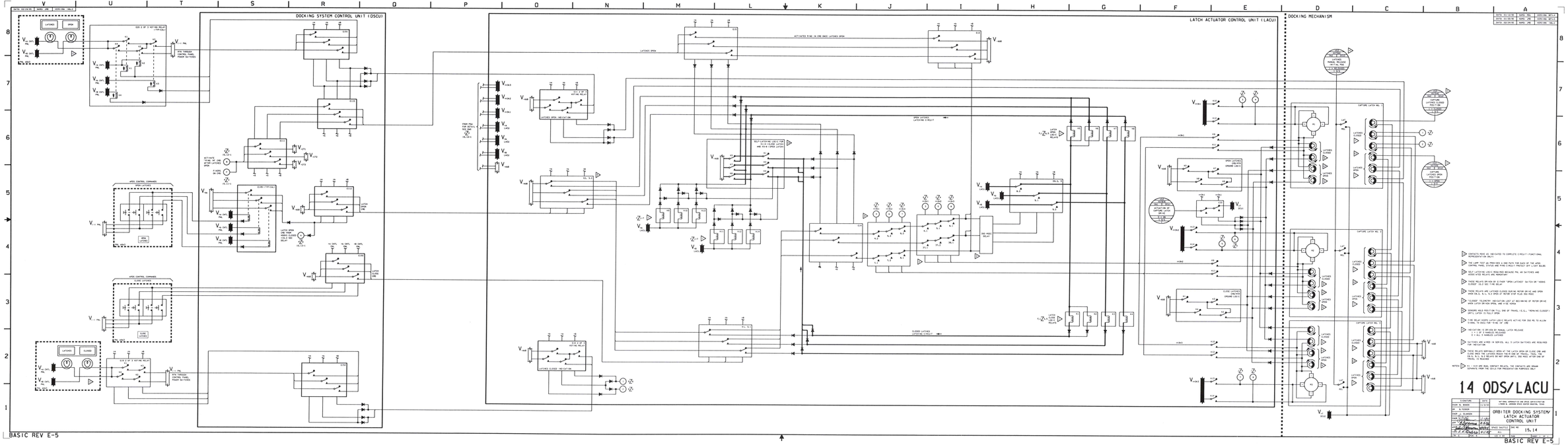
SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DRAWN		
DR. R. TOOMEY, J. CYLTY	10/18/91	ORBITER DOCKING SYSTEM CAPTURE LATCH, HOOKS, AND MECHANISM
TEAM LD. YOUR		
ENGINEER		
ENGINEER		
ENGINEER


AFT FLIGHT DECK
EXTERNAL AIRLOCK
DOCKING SYSTEM POWER
PANEL A7A3
APDS CONTROL PANEL
PANEL A8A3
HEATER/DATA COLLECTION POWER DISTRIBUTION
PYRO SYSTEM POWER DISTRIBUTION
10 ODS AV PWR DIST
ORBITER DOCKING SYSTEM/ AVIONICS POWER DISTRIBUTION
BASIC REV E-5


AFT FLIGHT DECK
EXTERNAL AIRLOCK
DOCKING SYSTEM CONTROL UNIT 1 (DSCU)
DOCKING MECHANISM
PANEL A8A3
APDS CONTROL PANEL
11 ODS/DSCU
ORBITER DOCKING SYSTEM/DOCKING SYSTEM CONTROL UNIT
15.11
BASIC REV E-5
BASTC REV E-5

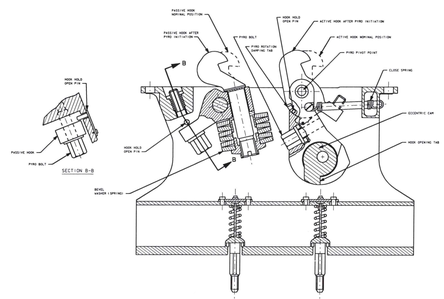

AFT EXTERNAL FLIGHT AIRLOCK DECK
DOCKING SYSTEM CONTROL UNIT (DSCU)
DOCKING MECHANISM CONTROL UNIT (DMCU)
DOCKING MECHANISM
12 ODS/DMCU
ORBITER DOCKING SYSTEM/ DOCKING MECHANISM CONTROL UNIT
BASIC REV E-5


FLIGHT DECK
EXTERNAL A/L
DOCKING SYSTEM CONTROL UNIT (DSCU)
PRESSURE ACTUATION CONTROL UNIT (PACU-1)
PACU-2
EXTERNAL A/L
DOCKING MECHANISM
13 ODS/PACU
ORBITER DOCKING SYSTEM/ PRESSURE ACTUATION CONTROL UNIT
BASIC REV E-5
BASIC REV E-5


DOCKING SYSTEM CONTROL UNIT (DSCU)
LATCH ACTUATOR CONTROL UNIT (LACU)
DOCKING MECHANISM
LATCHES
OPEN
CLOSED
OPEN CONTROL COMMANDS
CLOSE CONTROL COMMANDS
OPEN LATCHES
CLOSE LATCHES
ACTIVATED RING 14 ONE ONCE LATCHES OPEN
LATCHES OPEN
LATCHES CLOSED
OPEN LATCHES LATCHING CIRCUIT
CLOSED LATCHES LATCHING CIRCUIT
CAPTURE LATCH NO. 1
CAPTURE LATCH NO. 2
CAPTURE LATCH NO. 3
14 ODS/LACU
ORBITER DOCKING SYSTEM
LATCH ACTUATOR
CONTROL UNIT
15.14
BASIC REV E-5

CREW MODULE | PAYLOAD BAY | AIRLOCK | DOCKING MECHANISM

PYRO FIRING CONTROL UNIT
PASSIVE HOOK PYRO FIRING RELAYS
ACTIVE HOOK PYRO FIRING RELAYS (TYPICAL)
CIRCUIT PROTECTION CONTROL LOGIC - KO 2
CIRCUIT PROTECTION CONTROL LOGIC - KO 3
PASSIVE HOOKS
ACTIVE HOOKS



ORBITER STRUCTURAL HOOK ASSEMBLY AFTER PYRO INITIATION

NOTES:
1. PER ECO...2 RELAYS HAVE REDUNDANT COILS, EACH OF WHICH OPERATES ALL REDUNDANT CONTACTS.
2. EACH ORBITER SIDE HOOK HAS ONE PYRO BOLT WITH ONE CHARGE AND REDUNDANT INITIATORS.
3. EACH RELAY SET CAN ENERGIZE UP TO TWO PYRO INITIATORS, REDUNDANT AND/OR SEPARATE W/ONE TO NOT EXCEED 3 AMP CONTINUOUS.

TYPE	HOOK	BUS 1 RELAYS		BUS 2 RELAYS	
		K1	K2	K3	K4
ACTIVE	1	E1, E2	E3, E4	E81, E82	E83, E84
	2	E5, E6	E7, E8	E85, E86	E87, E88
	3	E9, E10	E11, E12	E89, E90	E91, E92
	4	E13, E14	E15, E16	E93, E94	E95, E96
	5	E17, E18	E19, E20	E97, E98	E99, E100
	6	E21, E22	E23, E24	E101, E102	E103, E104
	7	E25, E26	E27, E28	E105, E106	E107, E108
	8	E29, E30	E31, E32	E109, E110	E111, E112
PASSIVE	1	E33, E34	E35, E36	E113, E114	E115, E116
	2	E37, E38	E39, E40	E117, E118	E119, E120
	3	E41, E42	E43, E44	E121, E122	E123, E124
	4	E45, E46	E47, E48	E125, E126	E127, E128
	5	E49, E50	E51, E52	E129, E130	E131, E132
	6	E53, E54	E55, E56	E133, E134	E135, E136
	7	E57, E58	E59, E60	E137, E138	E139, E140
	8	E61, E62	E63, E64	E141, E142	E143, E144
	9	E65, E66	E67, E68	E145, E146	E147, E148
	10	E69, E70	E71, E72	E149, E150	E151, E152
	11	E73, E74	E75, E76	E153, E154	E155, E156
	12	E77, E78	E79, E80	E157, E158	E159, E160

15 ODS/PFCU

SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DOUG G. DAWSON	10/2/91	LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEXAS
CHIEF, ELECTRICAL POWER BRANCH		ORBITER DOCKING SYSTEM/PYRO FIRING CONTROL UNIT
CHIEF, ELECTRICAL POWER SECTION		
CHIEF, ELECTRICAL POWER SECTION		
CHIEF, ELECTRICAL POWER SECTION	

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
15.1-1	ACTIVE VENT SYSTEM VENTS 1 AND 2	NASA	08934	3.4.1	D	10/84	SHUTTLE OPERATIONS DATA BOOK
		NASA	DRL031 -0208			11/85	MASTER REQUIREMENTS LIST
		ROCKWELL	VS70-590509	1,2	C	1/29/85	SCHEMATIC DIAGRAM - ACTIVE VENT DOOR SUBSYSTEM
		ROCKWELL	VS70-590502	1,2	E	3/5/85	SCHEMATIC DIAGRAM - ACTIVE VENT DOOR SUBSYSTEM
		ROCKWELL	STS83-0026B	4.4.1	B	9/9/87	FUNCTIONAL SUBSYSTEM SOFTWARE REQUIREMENTS VENT DOORS (4.161)
15.1-2	ACTIVE VENT SYSTEM VENTS 1 AND 2	ROCKWELL	VS70-590509	2,3,4,5	C	1/29/85	SCHEMATIC DIAGRAM - ACTIVE VENT DOOR SUBSYSTEM
		ROCKWELL	VS70-590502	2,3,4,5	E	3/5/85	SCHEMATIC DIAGRAM - ACTIVE VENT DOOR SUBSYSTEM
		ROCKWELL	VO70-594571	1,2,3	B	12/5/85	MECHANICAL INSTALLATION - VENT DOOR MECHANISM, P/L BAY (3, 5, & 6)
		ROCKWELL	V070-594501	1,2,3	B	3/13/84	MECHANICAL INSTALLATION - VENT DOOR MECHANISM, P/L BAY AND WING (4 & 7)
15.1-3	ACTIVE VENT SYSTEM VENTS 6, 8, & 9	ROCKWELL	V070-595501	1	C	4/26/84	MECHANICAL INSTL - VENT DOOR MECHANISM, AFT FUSELAGE AND OMS.
		ROCKWELL	VS70-590509	6,7,8,9,10,11	C	1/29/85	SCHEMATIC DIAGRAM - ACTIVE VENT DOOR SUBSYSTEM
		ROCKWELL	VS70-590502	6,7,8,9,10,11	E	3/5/85	SCHEMATIC DIAGRAM - ACTIVE VENT DOOR SUBSYSTEM
		ROCKWELL	V070-594571	1,2,3	B	12/5/85	MECHANICAL INSTALLATION - VENT DOOR MECHANISM, P/L BAY (3, 5, & 6)
15.2-1	ORBITER/ET UMBILICAL CLOSEOUT DOOR	ROCKWELL	V070-565062		C	6/2/88	LATCH ASSY - CENTERLINE, ET SEPARATION SYSTEM CLOSEOUT DOOR
		ROCKWELL	V070-565103		A	12/6/78	LATCH ASSY- OUTBOARD FWD, CLOSED, ET UMBILICAL DOOR
		ROCKWELL	V070-565000		F	10/20/89	INSTALLATION - ET UMBILICAL DOOR MECHANISM
		ROCKWELL	V070-565001		B	6/17/81	MECHANISM ASSY - FWD ET / ORBITER UMBILICAL DOOR
		ROCKWELL	V070-565002		B	1/20/81	MECHANISM ASSY - AFT ET / ORBITER UMBILICAL DOOR
		NASA	08934	4.2.3.2.2	E	1/88	SHUTTLE OPERATIONS DATA BOOK
		NASA	WC-R-5439			1/7/80	SHUTTLE OPERATIONS DATA BOOK DATA REQUEST
15.2-2	ORBITER / ET UMBILICAL CLOSEOUT DOORS (ELECT)	ROCKWELL	V570-560112		C	11/12/86	SCHEMATIC DIAGRAM - EXTERNAL TANK DOORS CONTROL SUB-SYSTEM
		NASA	DRL031-0208			11/85	MASTER REQUIREMENTS LIST
		NASA	08934	4.2.3.2.2	E	1/88	SHUTTLE OPERATIONS DATA BOOK

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
15.1, 1-3	ENGR A. L. SIMON			ENGR	
	ENGR [signature]	2/16/93		ENGR	
15.2-1, 2	ENGR N. KNIGHT			ENGR	
	ENGR [signature]	2/17/93		ENGR	
	ENGR			APP [signature]	2-17-93
	ENGR			APP [signature]	2/17/93
	ENGR			OMNIPLAN	
	ENGR			LTR E	PCN 2

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

VENDOR DRAWING REFERENCES

SPACE SHUTTLE | ALL

TBL NO 15-1

PAGE 15. | SHEET 1 OF 5

BASIC REV E-2

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
15.2-3	ET DOOR SOFTWARE PASS AND BFS	NASA	81-0026	4.2.3		5/86	FLIGHT SYSTEMS SOFTWARE REQUIREMENTS
		IBM	NAS 9-16920	3.8.3.5	OI-20	6/87	DETAILED DESIGN SPECIFICATIONS
		NASA	MG0-38120	102 - 103	A		BACKUP FLIGHT SYSTEMS PROGRAM REQUIREMENTS DOCUMENT
15.3-1	ORBITER ET SEPARATION - MECHANICAL	ROCKWELL	V070-562001		C	5/20/85	EXTERNAL TANK / ORBITER FORWARD ATTACH INSTALLATION
		ROCKWELL	V070-565250		A	1/12/88	LINEAR INSTL - ORBITER / ET AFT ATTACH SEPARATION SYSTEM
15.3-2	ORBITER/ET UMBILICAL SEPARATION - SYSTEM MECHANICAL	ROCKWELL	V070-565301		E	11/20/89	SUPPORT BRACKET - ORBITER LH_2 / ELEC, UMBILICAL, ET / ORBITER SEPARATION SYSTEM, ASSY OF
		ROCKWELL	V070-565330		C	2/8/78	BRACKET ASSY - ORBITER LO_2 / ELEC, UMBILICAL, ET / ORBITER SEPARATION SYSTEM
		ROCKWELL	V070-565335		D	3/13/90	BRACKET ASSY - ORBITER LH_2 / ELEC, UMBILICAL, ET / ORBITER SEPARATION SYSTEM
		ROCKWELL	V070-565510	ALL	A	9/90	CONTAINER - BLAST, DEBRIS CONTAINMENT, UMBILICAL HOLDDOWN/RELEASE, ASS'Y OF
		ROCKWELL	V070-565510	ALL	A	8/90	CONTAINER - BLAST, DEBRIS CONTAINMENT, UMBILICAL HOLDDOWN/RELEASE, ASS'Y OF
		ROCKWELL	VO72-555369	ALL	G	11/91	WIRE HARNESS INSTL - ET/ORBITER, UMBILICAL HOLDDOWN/RELEASE
		ROCKWELL	V072-565370	ALL	F	6/91	MECHANICAL/PYROTECHNIC INSTALLATION ET/ORBITER UMBILICAL HOLDDOWN RELEASE
		ROCKWELL	V070-565371		B	12/4/84	CURTAIN - CLOSEOUT ET UMBILICAL PLATE, LH_2 ASSY
		ROCKWELL	V070-565410		B	12/20/84	CURTAIN - CLOSEOUT ET UMBILICAL PLATE, LH_2 & LO_2 INSTALLATION
15.3-3	ORBITER ET SEPARATION MECHANICAL	ROCKWELL	V070-565301		E	11/20/89	SUPPORT BRACKET - ORBITER LH_2 / ELEC UMBILICAL, ET / ORBITER SEPARATION SYSTEM, ASSY OF
		ROCKWELL	V070-565330		C	2/8/78	BRACKET ASSY - ORBITER LO_2 ELEC, UMBILICAL, ET / ORBITER SEPARATION SYSTEM
		ROCKWELL	V070-565335		D	3/13/90	BRACKET, ET ASSY - ORBITER LH_2 ELEC, UMBILICAL, ET / ORBITER SEPARATION SYSTEM
15.5-1	HATCHES (SIDE)	ROCKWELL	V070-332502	ALL		4/75	HATCH ASSY FUS-LH EGRESS
			PHOTO S87-25238 25239				
			S79-31418 31416 S85-29853				
			V070-338601	ALL		8/90	HATCH INSTL - FUSELAGE LH EGRESS

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
15.2-3	ENGR N. KNIGHT			ENGR	
	ENGR	2/17/93		ENGR	
15.3-1,2,3	ENGR N. KNIGHT			ENGR	
	ENGR	2/17/93		ENGR	
15.5-1	ENGR J. KREYKES			APP	2-17-93
	ENGR	2-17-93		APP	3/17/93
	ENGR			OMNIPLAN	
	ENGR			LTR E	PCN 2

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VENDOR DRAWING REFERENCES

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BASIC REV E-2

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
15.5-2	HATCHES (AIRLOCK AND SPACELAB)	ROCKWELL	V075-332603	ALL		4/75	HATCH ASSY - CREW MODULE AIRLOCK COMPLETE
			332604	ALL		8/90	HATCH - AIRLOCK ASSY
			593301	ALL		4/75	AIRLOCK MECH PROVISIONS
			000003	ALL		8/90	AIRLOCK GENERAL ASSY
			PHOTO NOS. S80-28029 28041 25152 S83-35399 S79-38393				
			M072-593301	ALL	C	4/77	AIRLOCK MECHANISM INSTALLATION

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
15.5-2	ENGR J. KREYKES			ENGR	
	ENGR Jennifer Kreykes	10-15-90		ENGR	
	ENGR			ENGR	
	ENGR			ENGR	
	ENGR			APP Ralph Hall	2 Nov 90
	ENGR			APP R T Neal	11/5/90
	ENGR			OMNIPLAN	
	ENGR			LTR E PCN	

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BASIC REV E

FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
15.6 Sheets 1 and 2	CREW SEATS	ROCKWELL	V208-651671	ALL		1/19/89	MOUNT - NEGATIVE G STRAP, PASSENGER SEAT, REWORK
		ROCKWELL	V070-332700	ALL		12/18/89	DOOR - LIOH, FLOOR MIDDECK, X_{CM} 289.00 TO X_{CM} 315.63, ASSY OF
		ROCKWELL	V070-334282	ALL		11/2/89	DOOR-LIOH, FLOOR MIDDECK, X_{CM} 289.060 TO X_{CM} 315.630, ASSEMBLY OF
		ROCKWELL	V070-332701	ALL	E	2/6/90	FLOOR INSTALLATION - MID DECK
		ROCKWELL	V070-334035	ALL	F	5/11/90	FLOOR INSTALLATION - MID DECK, Y_{CM} -50.50 TO Y_{CM} 50.50
		ROCKWELL	V070-773726	21,26	A	2/17/88	WIRE HARN D&C PANEL MA73C (85V73A129W1)
		ROCKWELL	V070-778302	3,81	B	1/24/90	WIRE HARN CREW MODULE MID DECK (80V77W2)
		ROCKWELL	V070-778909	2		1/10/80	WIRE HARN MID DECK MCA PWR (80V77W9)
		ROCKWELL	V570-760209	1	D	10/15/84	SCHEMATIC DIAGRAM - COAS SEAT SUIT CONTROLS CREW SYSTEMS
		ROCKWELL	VS70-760252	1	C	5/14/84	SCHEMATIC DIAGRAM - COAS SEAT/SUIT CONTROLS CREW SYSTEMS
		AMI	1172	ALL	Z/AA	2/16/89	FINAL ASSEMBLY CREW SEAT, SPACE SHUTTLE
		AMI	3172	ALL	AC	10/20/83	FINAL ASSEMBLY PASSENGER SEAT, SPACE SHUTTLE
		AMI	1172-2250	ALL	V	6/30/83	CARRIAGE ASSEMBLY, VERTICAL TRAVEL, SEAT BASE
		AMI	RT1172-2070	ALL	E	1/11/82	ACTIVATOR ASSY - CREW SEAT
		ROCKWELL	MC621-0069	ALL	C	8/15/83	SEATS - OPERATIONAL ORBITER CREW AND PASSENGER
		ROCKWELL	V610-333010	ALL		1/16/89	SEAT SUPPORT - MISSION SPECIALIST NO. 1 ASSY OF
		NASA	NSTS 08934 (VOL IV)	FIG. 4-9, 4-10		1/88	SHUTTLE OPERATIONAL DATA BOOK, VOLUME IV, ORBITER LANDING EMERGENCY RESCUE DATA - PART I
		ROCKWELL	ICD NO. 3-1314-01	24		11/21/90	ORBITER SEAT INTERFACES TO OCCUPANT, SUPPORTED EQUIPMENT, AND ORBITER FLOOR LOCATIONS
		NASA/GFE	SGD32101447	1,2		3/12/91	SEAT BACK RELEASE LATCH INSTALLATION
		NASA/GFE	SGD32101465	3		10/1/91	AUXILIARY REACH MECHANISM INSTL

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
15.6-1,2	ENGR T. MALKASIAN			ENGR	
	ENGR Todd J Malkasian	11/15/91		ENGR	
	ENGR			ENGR	
	ENGR			ENGR	
	ENGR			APP R Meal	12/2/91
	ENGR			APP R Meal	12/2/91
	ENGR			OMNIPLAN	
	ENGR			LTR E PCN 1	

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FOR DETAILED COMPONENT AND LOGIC INFORMATION REFER TO:

SSSH DWG NO.	SSSH DWG TITLE	VENDOR NAME	VENDOR DWG NO.	VENDOR SHEET NO.	REV	DATE	VENDOR DRAWING TITLE
15.7-1	KU BAND ANTENNA DEPLOY/STOW/ JETTISON	ROCKWELL	VS70-760709	1-11	D	8/29/86	SCHEMATIC DIAGRAM - MOTOR CONTROL ASSEMBLY POWER DISTRIBUTION
		ROCKWELL	VS70-760702	1-12	H	8/29/86	SCHEMATIC DIAGRAM - MOTOR CONTROL ASSY POWER DISTRIBUTION
		ROCKWELL	VS70-590119	1,2,3	B	12/3/85	SCHEMATIC DIAGRAM - KU BAND ANTENNA DEPLOYMENT
		ROCKWELL	VS70-590112	1,2,3	A	11/4/85	SCHEMATIC DIAGRAM - KU BAND ANTENNA DEPLOYMENT
		ROCKWELL	VS70-740102	1-9	H	9/16/88	SCHEMATIC DIAGRAM - KU BAND COMMUNICATIONS SUBSYSTEM
		ROCKWELL	VS70-740109	1-7	D	9/15/88	SCHEMATIC DIAGRAM - KU BAND COMMUNICATIONS SUBSYSTEM
15.7-2	KU BAND MECHANICAL	ROCKWELL	V070-544902	1,2,3	C	7/12/88	MECHANISM ASSEMBLY - KU BAND DEPLOYMENT
		ROCKWELL	V070-744008	1,2,3	A	12/5/85	INSTALLATION, COAXIAL CABLES - KU BAND COMM A RH AND B LH MID FUSELAGE
		ROCKWELL	V070-794041	1	B	3/22/89	INSTALLATION - MID-FUSELAGE UPPER WIRING X_O - 582.00 TO X_O 933.00 RH
15.8 SHEETS 1 AND 2	MECH SW OV	IBM	NAS9-14444		OI8D	5/22/89	OPERATIONAL DETAIL DESIGN SPECIFICATION
15.10 THROUGH 15.15	ODS/AV PWR DIST ODS/DOCK MECH CTRL U ODS/DOCK MECH CTRL U ODS/PRESS ACT CTRL U ODS/LATCH ACT CTRL U ODS/PYRO FIRING CTRL U	RI DOWNEY	VS70-953104	1-55	-	5/23/94	INTEGRATED SCHEMATIC - DOCKING SYSTEM, RUSSIAN MIR MISSION
		NPO-ENERGIA	SLIYu.468. 312.001-0	1-6	E3	6/93	ANDROGYNOUS PERIPHERAL DOCKING SYSTEM (APDS) CONTROL PANEL
		NPO-ENERGIA	TA082	1-15	E3	6/93	APDS DATA COLLECTION UNIT
15.10	ODS/AV PWR DIST	NPO-ENERGIA	33u.5114.007	1-3	E3	6/93	APDS POWER SWITCHING UNIT
15.11 THROUGH 15.14	ODS/DOCK MECH CTRL U ODS/DOCK MECH CTRL U ODS/PRESS ACT CTRL U ODS/LATCH ACT CTRL U	NPO-ENERGIA	33u.5212.005	1-12	E3	6/93	APDS DOCKING SYSTEM CONTROL UNIT
15.12	ODS/DOCK MECH CTRL U	NPO-ENERGIA	33u.5212.011	1-2	E3	6/93	APDS DOCKING MECHANISM CONTROL UNIT
15.13	ODS/PRESS ACT CTRL U	NPO-ENERGIA	33u.5212.006	1-3	E3	6/93	APDSPRESSURIZATION ACTUATORCONTROL UNIT
15.14	ODS/LATCH ACT CTRL U	NPO-ENERGIA	33u.5212.007	1-3	E3	6/93	APDS LATCH ACTUATOR CONTROL UNI
15.15	ODS/PYRO FIRING CTRL U	NPO-ENERGIA	17KS.10Yu 2601A-0	1-11	E3	6/93	APDS PYRO CONTROL UNIT

DWG	SIGNATURE	DATE	DWG	SIGNATURE	DATE
15.7-1,2	ENGR A. SIMON		15.15	ENGR W. ANDERSON	
	ENGR Alan Simon	9/22/94		ENGR	
15.8-1,2	ENGR C. D. PATERNOSTRO			ENGR	
	ENGR C. David Paternostro	9/22/94		ENGR	
15.9	ENGR H. KARL POHL			APP	
	ENGR H. Karl Pohl	9/22/94		APP B. Wayne Anderson	9/22/94
15.10-14	ENGR J. OLANSEN			APP	
	ENGR Jan B. Olansen	9/22/94		LTR E PCN 4	

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August 14, 1996

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