JSC-11174

Space Shuttle Systems Handbook

Volume II - Sections 12 through 20

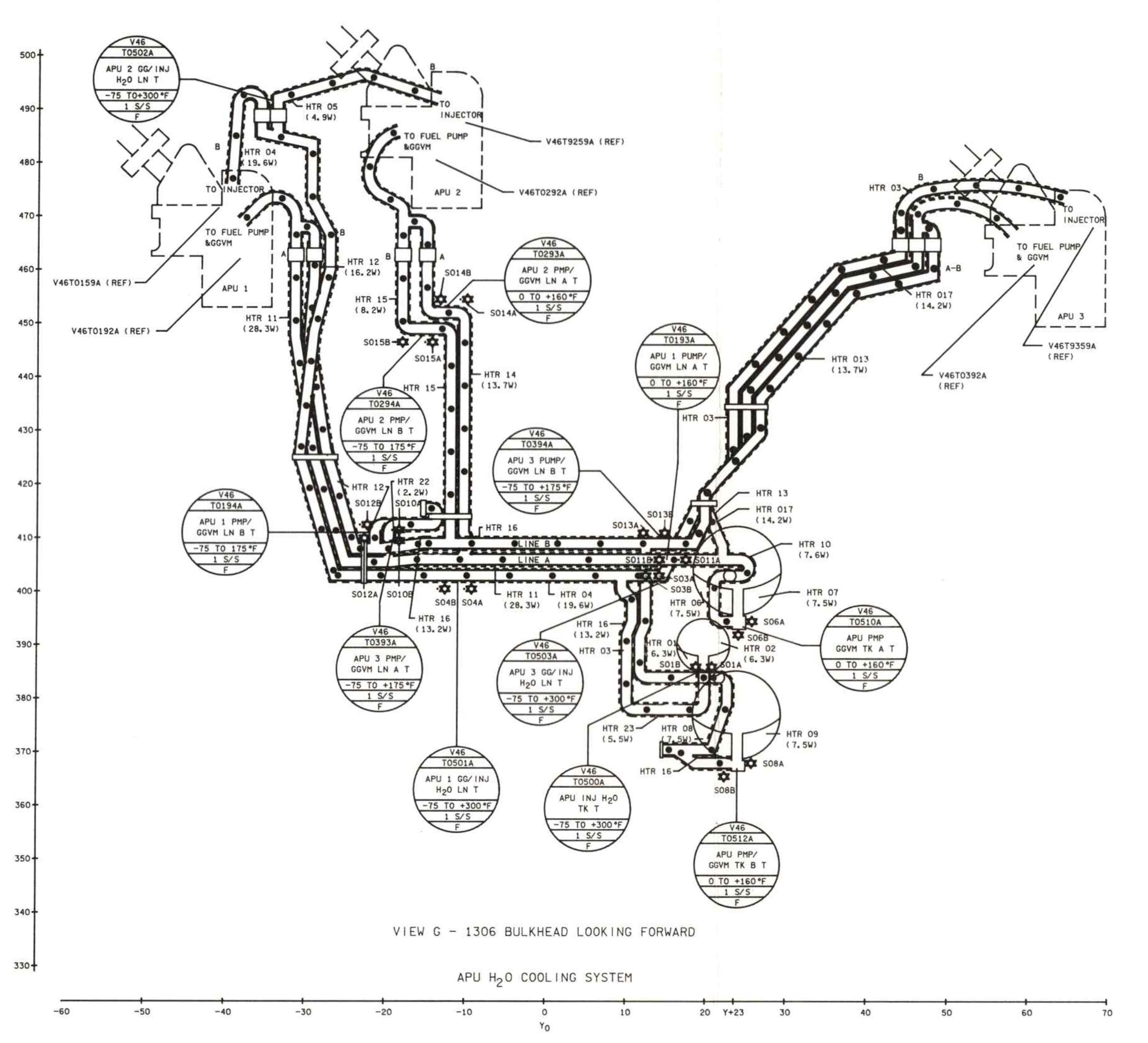
Mission Operations Directorate
Systems Division

Revision C, DCN-2
April 15, 1984

NASA
National Aeronautics and
Space Administration

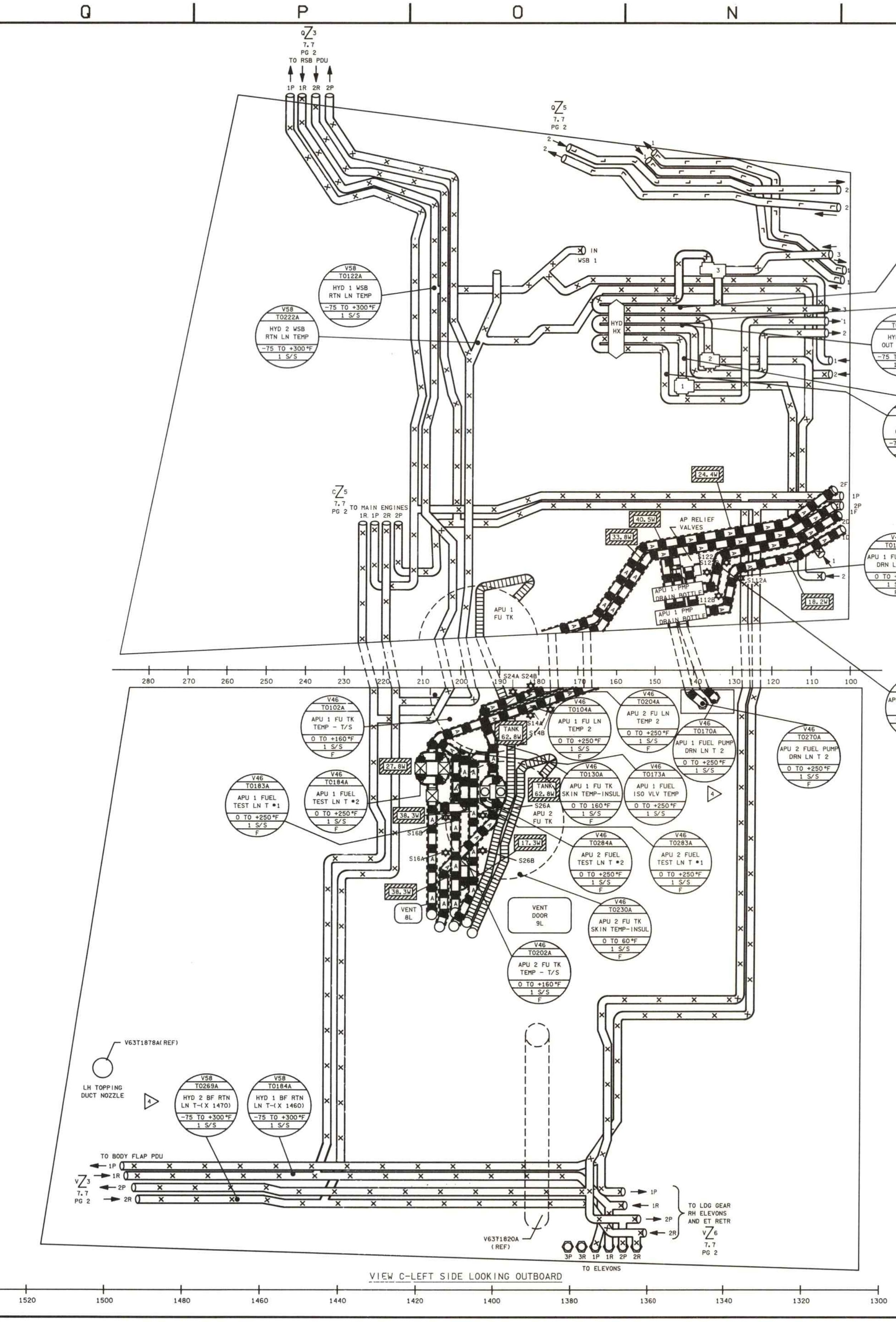
Lyndon B. Johnson Space Center
Houston, Texas

DATE: 5/27/83	NAME: TJL	VERSION: BPT,2
DATE: 3/7/84	NAME: LGH	VERSION: INK,1

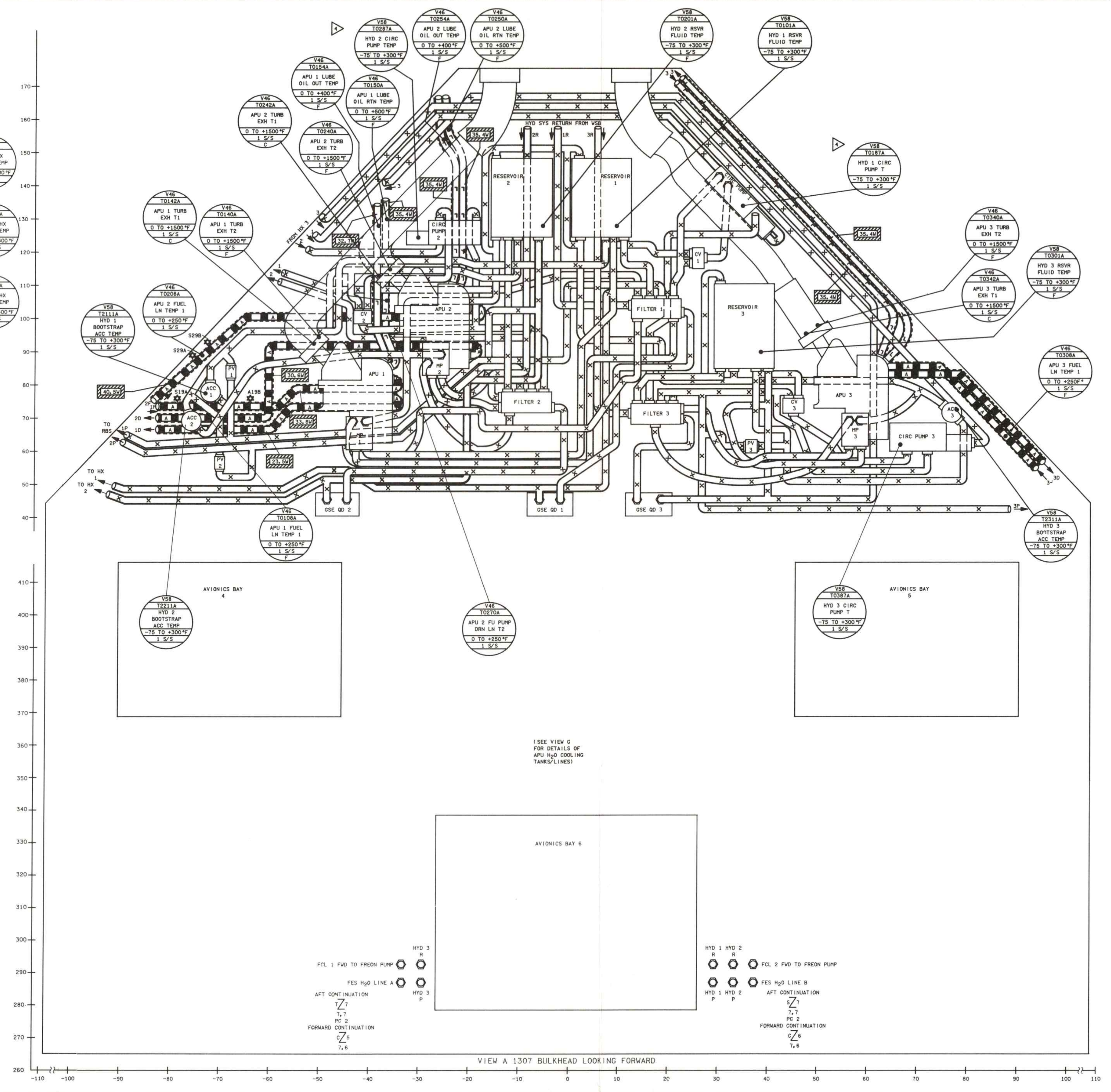

V46
T0512A
APU PMP/
GGVM TK B T
0 TO +160°F
1 S/S
F
-75 TO +300°F
TK T

VIEW G - 1306 BULKHEAD LOOKING FORWARD

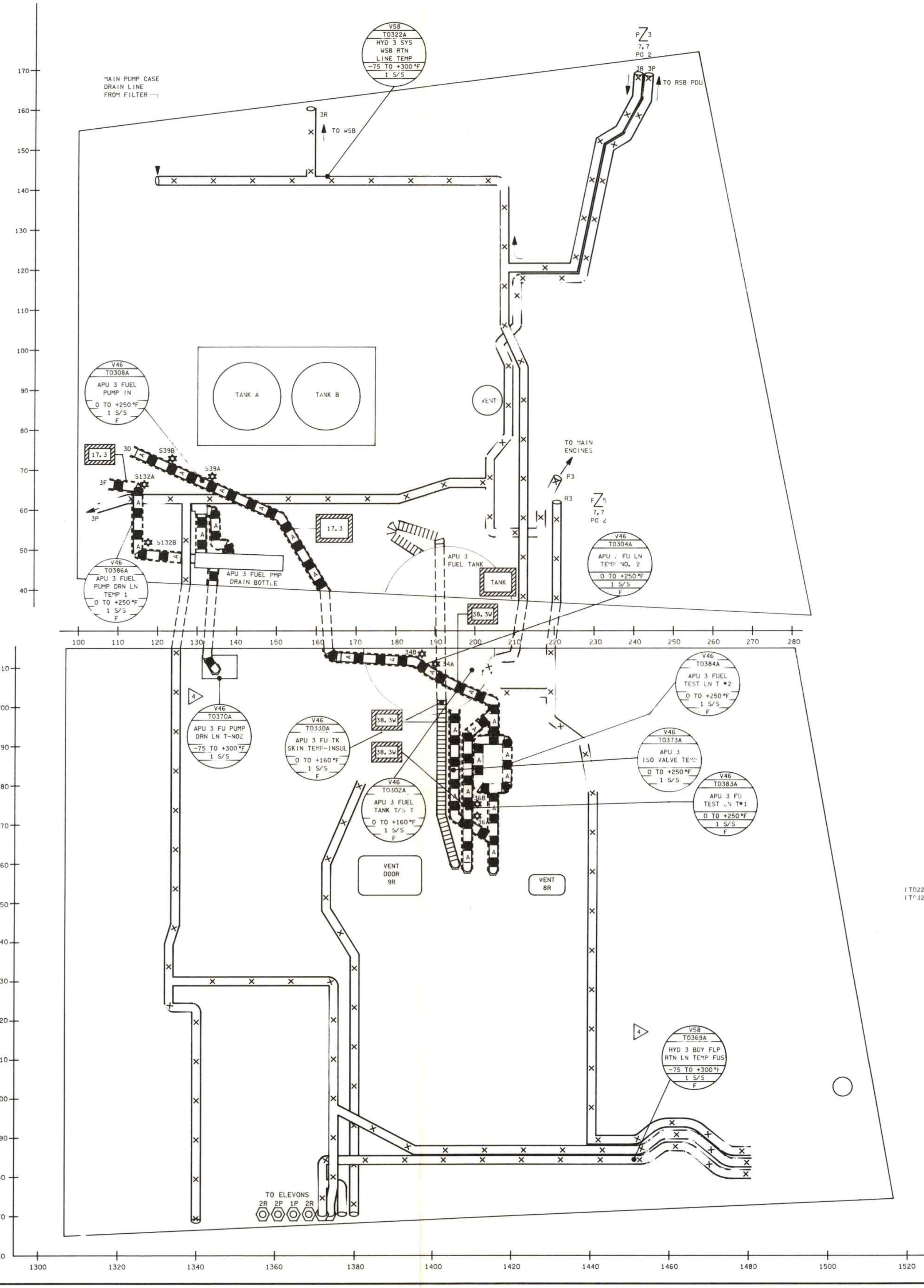
APU H_2O COOLING SYSTEM

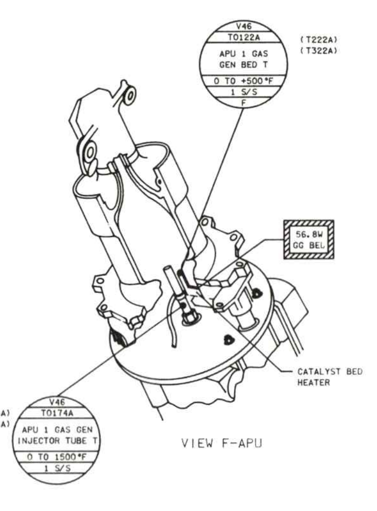

7.7
PG 2
2P
2R
1P
1R
TO LDG GEAR
RH ELEVONS
AND ET RETR
V63T1820A
(REF)
3P
3R
TO ELEVONS

VIEW C-LEFT SIDE LOOKING OUTBOARD

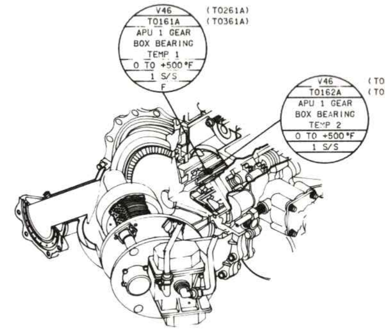

(SEE VIEW G
FOR DETAILS OF
APU H2O COOLING
TANKS/LINES)
AVIONICS BAY 6
HYD 3
R
FCL 1 FWD TO FREON PUMP
FES H2O LINE A
HYD 3
P
AFT CONTINUATION
7,7
PC 2
FORWARD CONTINUATION
7,6
HYD 1
R
HYD 2
R
FCL 2 FWD TO FREON PUMP
FES H2O LINE B
HYD 1
P
HYD 2
P

VIEW A 1307 BULKHEAD LOOKING FORWARD

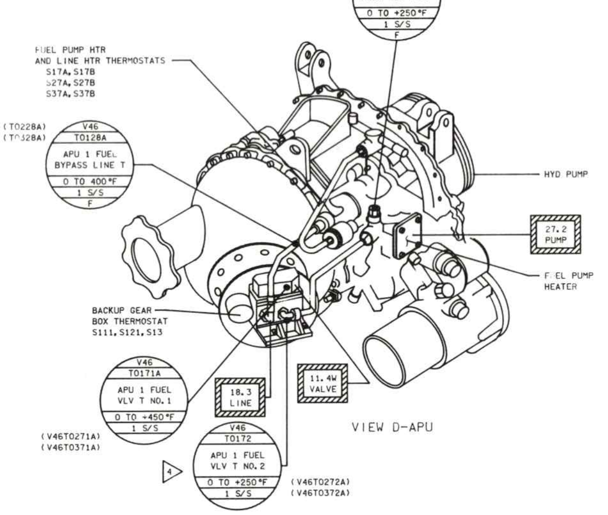

TO ELEVONS
2R
2P
1P
2R


V46
T0122A
APU 1 GAS
GEN BED T
0 TO +500°F
1 S/S
F
(T222A)
(T322A)
56.8W
GG BED
CATALYST BED
HEATER
(V46T0274A)
(V46T0374A)
V46
T0174A
APU 1 GAS GEN
INJECTOR TUBE T
0 TO 1500°F
1 S/S

VIEW F-APU


V46
T0161A
APU 1 GEAR
BOX BEARING
TEMP 1
0 TO +500°F
1 S/S
F
(T0261A)
(T0361A)
V46
T0162A
APU 1 GEAR
BOX BEARING
TEMP 2
0 TO +500°F
1 S/S
(T0262A)
(T0362A)

VIEW E-APU


V46
T0112A
APU 1 FUEL
PUMP OUT TEMP
0 TO +250°F
1 S/S
F
(T0212A)
(T0312A)
FUEL PUMP HTR
AND LINE HTR THERMOSTATS
S17A, S17B
S27A, S27B
S37A, S37B
(T0228A)
(T0328A)
V46
T0128A
APU 1 FUEL
BYPASS LINE T
0 TO 400°F
1 S/S
F
HYD PUMP
27.2
PUMP
FUEL PUMP
HEATER
BACKUP GEAR
BOX THERMOSTAT
S111, S121, S13
V46
T0171A
APU 1 FUEL
VLV T NO. 1
0 TO +450°F
1 S/S
(V46T0271A)
(V46T0371A)
18.3
LINE
11.4W
VALVE
V46
T0172
APU 1 FUEL
VLV T NO. 2
0 TO +250°F
1 S/S
(V46T0272A)
(V46T0372A)

VIEW D-APU

4 ONLY ON OV099

3. TUBE ROUTING AND QUANTITY APPROXIMATE

2. ALL WATTAGE AT 28 VDC

NOTES: 1. LEGEND

APU FUEL (HYDRALIZED)	
HYDRALIC FLUID	
WATER	
LUBE OIL	
HELIUM	
HEATED AND INSULATED	CONTROL THEMOSTAT(T/S) XXXX-T/S ID XXXX (QT)-OVER TEMP T/S
HEATER	23.5W

2 HYD/APU LINE SCHEM

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

HYDRAULIC/APU
LINE SCHEMATIC

	SIGNATURE	DATE
DSGN	MICHAEL P. MURPHY	3/26/83
DR	MICHAEL P. MURPHY	3/26/83
ENGR		
ENGR		4/4/84
APP		4/4/84
APP		
KENTRON	S.K. Kimmell	4-30-84

DWG NO 12.2
SPACE SHUTTLE
ALL
SHEET 3 OF 4
PAGE 12.2-3
126.5 X 34
LTR C
PCN 2

DATE: 10/26/83	NAME: LMB	VERSION: INK, 1
DATE: 3/1/84	NAME: MPM	VERSION: INK, 2
DATE: 3/7/84	NAME: LGH	VERSION: INK, 3

VIEW B - BODY FLAP PDU
VIEW A - BOTTOM VIEW LOOKING AT FLOOR
VIEW C - TOP VIEW LOOKING INBOARD
SECTION B-B LOOKING FORWARD
VIEW D - RUDDER SPEED BRAKE PDU
SECTION G-G RSB SEAL CAVITY DRAIN LINE
SECTION A-A - WATER SPRAY BOILER
VIEW E - WATER SPRAY BOILER - END VIEW
VIEW M - SSME ACCUMULATOR DRAIN LINES LOOKING AFT
SECTION C-C - LOOKING AFT
VIEW L
VIEW LOOKING INBOARD Yo-105 TO Yo-115
VIEW LOOKING INBOARD Yo 105 TO Yo 115
VIEW C LOOKING DOWN ON LEFT MAIN LANDING GEAR
VIEW D LOOKING DOWN ON RIGHT MAIN LANDING GEAR
VIEW LOOKING INBOARD=Yo-167
VIEW LOOKING INBOARD=Yo 167
VERTICAL STABILIZER
VIEW B LOOKING DOWN ON RIGHT WING
VIEW A LOOKING DOWN ON LEFT WING
V58 T1006A HYD 1 RSB RTN LNT - PDU -75 TO +300°F 1 S/S F
V58 T0298A HYD 2 RSB RTN LNT - PDU -75 TO +300°F 1 S/S F
V58 T0398A HYD 3 RSB RTN LNT - PDU -75 TO +300°F 1 S/S F
V57 T0014A RSB PDU T -75 TO +300°F 1 S/S F
V58 T1600A RSB SEAL DRN LN TEMP -75 TO +300°F 1 S/S
V58 T1650A BF SEAL DRN LINE T A - PDU -75 TO +300°F 1 S/S
V58 T0161A HYD 1 H20 TK PROBE T 32 TO +221°F 1 S/S F
V58 T0405A LMG STRUT ACT TEMP -75 TO 300°F 1 S/S
V58 T0406A RMG STRUT ACT TEMP -75 TO 300°F 1 S/S
V58 T0293A HYD 2 RH AFT BRK SW VLV RTN LN T -75 TO 300°F 1 S/S
V58 T1752A RMG BRK LINE TEMP C -75 TO 300°F 1 S/S
V58 T0846A HYD 1 RH FWD BRK SW VLV RTN LN T -75 TO 300°F 1 S/S F
V58 T0930A HYD SYS RH INBD ELEV RTN LN TEMP -75 TO 300°F 1 S/S F
V58 T0359A HYD SYS 3 RIB ELEV ACT RTN LN TEMP -75 TO 300°F 1 S/S
V58 T0933A HYD SYS 2 RIB ELEV ACT RTN LN TEMP -75 TO 300°F 1 S/S
138W BLANKET
BLANKET 87.9W
42.0W
8.4W
OLEOPHOBIC FILTER
TO TRAILING EDGE OF RSB
TO TRAILING EDGE OF BODY FLAP
TO BF PDU DRAIN
LME ACCUM
PRI CONTROLLER
SEC CONTROLLER
TO RSB PDU
INBOARD ACTUATOR

2 HYD LINE SCHEM

NOTES: 1. PIPING LEGEND

✕ ✕ HYDRAULIC

2. HEATER LEGEND

▨

3. HEATER WATTAGES ARE BASED ON 28VDC

4. Y_W X_W -WING COORDINATE SYSTEM AXIS DESIGNATION

5. THERMOSTAT

✡

6. ON OV099 ONLY

SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS	
DSGN MICHAEL P. MURPHY	3/10/83	HYDRAULIC LINE SCHEMATIC	
DR MICHAEL P. MURPHY	3/10/83		
ENGR			
ENGR	4/4/84		
APP	4/4/84		
APP		SPACE SHUTTLE	DWG NO 12.2
OMNIPLAN S.K. Kimbell	4-30-84	ALL	
LTR C / PCN 2		126.5 X 34	PAGE 12.2-4 / SHEET 4 OF 4

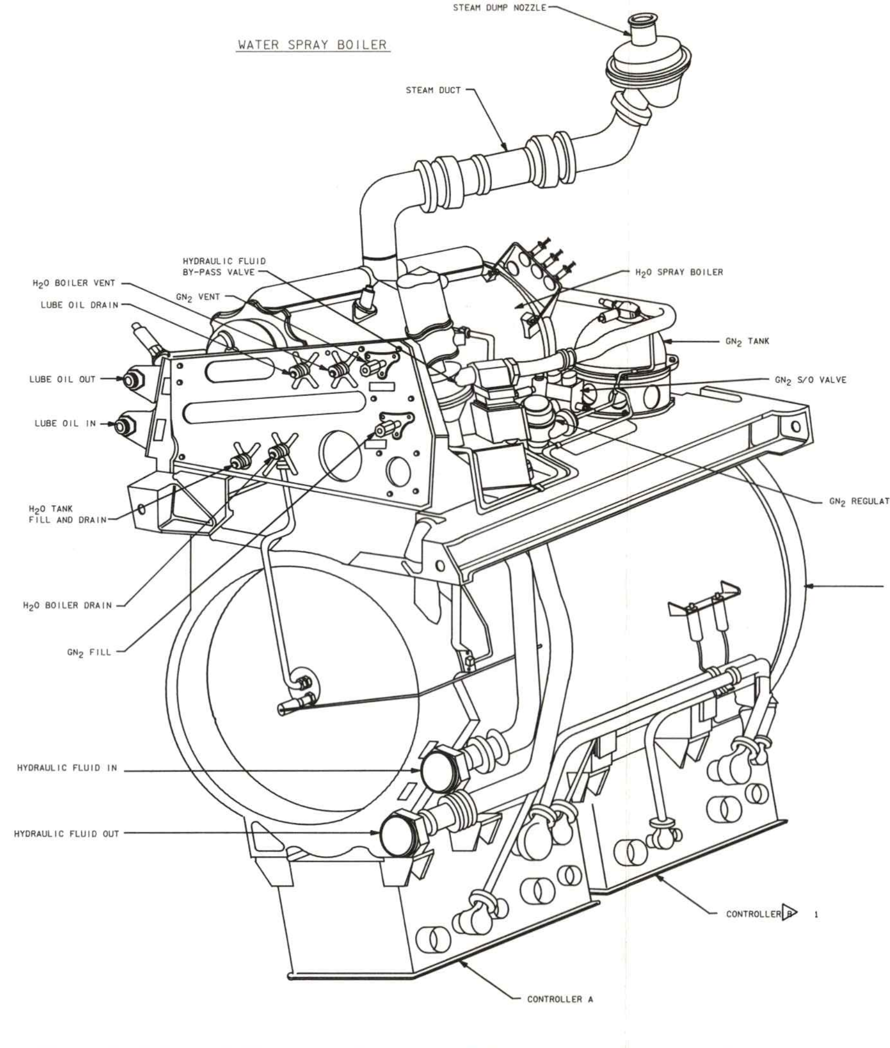
APU
FUEL/H2O - QTY
1 2 3
FROM RIGHT DISPLAY PWR SW
12.1-2
GN2 SHUTOFF LOGIC
P/O CNTLR A
P/O CNTLR B
HYD SYS H2O SPRAY VALVE CONTROL OSCILLATOR CIRCUIT
LUBE OIL H2O SPRAY VALVE CONTROL OSCILLATOR CIRCUIT
H2O STORAGE TANK 142 LBS
STEAM DUMP NOZZLE
WATER SPRAY BOILER
VALVE POSITION INDICATOR
BYPASS VALVE LOGIC
WATER BOILER CORE

NOTES:

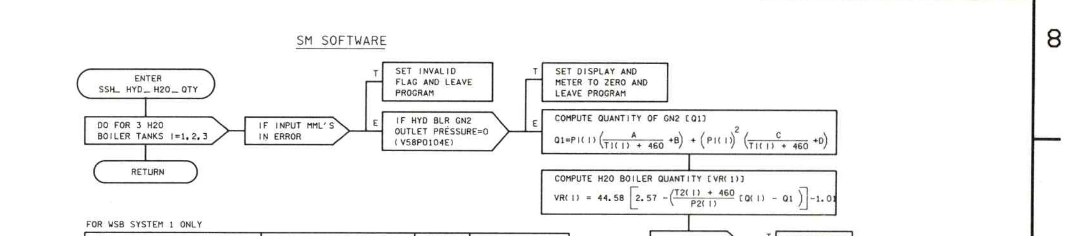
1) IF METER > 100% GPC WILL SET METER TO TO 100% AND A STATUS INDICATOR OF 'H' ON CRT
2) IF METER < 0% GPC WILL SET METER OF 0% AND A STATUS INDICATOR OF 'L' ON CRT
3) CONVERSION OF 0% TO 100% IS LINEAR FROM 0 VOLTS TO 5.00 VOLTS

WSB INSTRUMENTATION

ITEM \ MEASURAND	LIQUID LEVEL SENSOR	PRESSURE SENSOR (N_2 TANK	PRESSURE SENSOR (N_2 TANK	TEMP SENSOR (PROBE)	TEMP SENSOR
VENDOR	GULTON/SERVONICS COSTA MESA, CALIF	EDCLIFF INST MONROVIA, CLAIF	EDCLIFF INST MONROVIA, CLAIF	TAYCO ENGR LONG BEACH, CALIF	RDF CORP HUDSON, N.H.
PRINCIPLE OF OPERATION	ULTRASONIC SENSING ELEMENT (CRYSTAL) BONDED TO A DIAPHRAGM IS PART OF A TUNED RESONANT FREQUENCY OSCILLATOR CIRCUIT. WHEN THE DIAPHRAGM IS LOADED BY A LIQUID, THE OSCILLATIONS ARE DAMPED AND PRODUCE LOW LEVEL (0VDC) OUTTPUT SIGNAL. WHEN THE DIAPHRAGM IS NOT IN CONTACT WITH A LIQUID, THE UNIT PRODUCES A HIGH LEVEL (28VDC) OUTPUT	UTILIZES A PRESSURE CAPSULE WHOSE DEFLECTIONS PROPORTIONED TO THE APPLIED PRESSURE. A POTENTIOMETER IS CONNECTED BY A PUSHROD TO THE CAPSULE AND PRODUCES AN ELECTRICAL OUTPUT PROPORTIONAL TO THE APPLIED PRESSURE	UTILIZES A HELICAL BOURDON TUBE WHOSE ANGULAR ROTATION IS PROPORTIONAL TO THE PRESSURE BEING APPLIED. A POTENTIOMETER IS CONNECTED DIRECTLY TO THE END OF THE BOURDON TUBE AND PRODUCES AN ELECTRICAL OUTPUT PROPORTIONAL TO THE APLIED PRESSURE	PLATINUM ELEMENT WIRE WITH A VERY STABLE, WELL DEFINED POSITIVE COEFFICIENT OF RESISTANCE WITH TEMPERATURE	THERMISTOR WHICH HAS A HIGH RESISTANCE AND A HIGH NEGATIVE COEFFICIENT OF RESISTANCE WITH TEMPERATURE
POWER INPUT	0.3 WATTS MAX @ 28VDC	20 MW @ 10VDC	20 MW @ 10VDC	200 OHM ELEMENT IS PART OF SIGNAL CONDITIONING NETWORK	100 K OHM IS PART OF SIGNAL CONDITIONING NETWORK
SIGNAL OUTPUT	0VDC=FULL 28VDC=NOT FULL	0-5VDC (0-75 PSIA)	0-5VDC (0-3500 PSIA)	0-5VDC FROM CONTROLLER	0-5VDC FROM CONTROLLER
SIZE (BASIC)	1.90X0.65 DIA	1.75X1.0 DIA	2.50X1.10 DIA	3.36X0.12 DIA	2.15X0.70 DIA
CASE SEAL	HERMETIC	HERMETIC	HERMETIC	ENVIRONMENTAL	HERMETIC
WEIGHT	0.2 LBS	0.22 LBS	0.40 LBS	0.17 LBS	0.10 LBS


WATER SPRAY BOILER
STEAM DUMP NOZZLE
GN2 S/O VALVE
GN2 REGULATOR
CONTROLLER A
CONTROLLER B

SM SOFTWARE

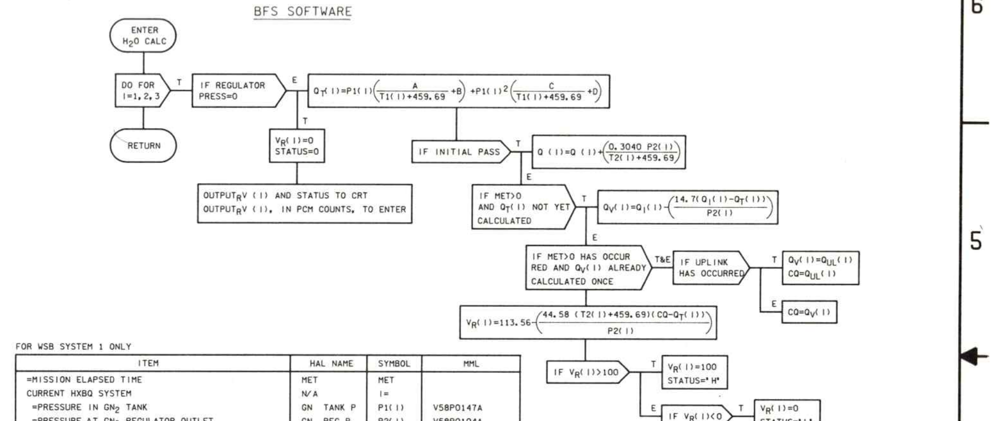

DO FOR 3 H2O BOILER TANKS I=1,2,3
RETURN
IF INPUT MML'S IN ERROR
E
IF HYD BLR GN2 OUTLET PRESSURE=0 (V58P0104E)
COMPUTE QUANTITY OF GN2 [Q1]
COMPUTE H2O BOILER QUANTITY [VR(I)]
IF VR(I)>100
STORE COMPUTED QUANTITY FOR DISPLAY AMD DOWN LIST TABLE
CONVERT COMPUTED QUANTITY TO PCM FOR METER AND DOWN LIST

FOR WSB SYSTEM 1 ONLY

ITEM	HAL NAME	SYMBOL	MML
HYDR SYS 1 H_2O TANK TEMP	CSHV_ H2O _TEMP $(1,)	T2(1)	V58T0161A
HYDR SYS 1 GN_2 TANK TEMP	CSHV_ N2 _TEMP $(1,)	T1(1)	V58T0105A
HYDR SYS 1 GN_2 QUANTITY	CSHV_ N2 _QUANTITY $(1,)	Q(1)	V92Q0650C
HYDR SYS 1 GN_2 PRESS	CSNV_ N2 _PRESS $(1,)	P1(1)	V58P0147A
HYDR SYS 1 GN_2 OUTLET PRESS	CSHV_ N2 OUT_ PRESS(1,)	P2(1)	V58P0104A
HYDR SYS A CONST	SSH _ A _ CONST	A	$8.0252X10^{-2}$
HYDR SYS B CONST	SSH _ B _ CONST	B	$-2.2014X10^{-5}$
HYDR SYS C CONST	SSH _ C _ CONST	C	$-2.0462X10^{-6}$
HYDR SYS D CONST	SSH _ D _ CONST	D	$-1.9779X10^{-10}$
HYDR SYS 1 DISPLAY H_2O QTY	CSHV_ QUANT_ CRT $(1,)	VR(1)	V72Q6040V
HYDR SYS 1 MDM H_2O QTY	CSHV_ QUANT_ METER $(1)	vr(1)	V72Q6040V

NOTE: WSB SOFTWARE IS CALLED EVERY TWO SECONDS

BFS SOFTWARE


ENTER H2O CALC
IF VR(I)>100
T
E
STATUS

FOR WSB SYSTEM 1 ONLY

ITEM	HAL NAME	SYMBOL	MML
=MISSION ELAPSED TIME	MET	MET	
CURRENT HXBQ SYSTEM	N/A	I=	
=PRESSURE IN GN_2 TANK	GN TANK P	P1(I)	V58P0147A
=PRESSURE ΔT GN_2 REGULATOR OUTLET	GN REG P	P2(I)	V58P0104A
=TEMPERATURE IN GN_2 TANK	GN TANK T	T1(I)	V58T0105A
=TEMPERATURE IN H_2O TANK	H O TANK T	T2(I)	V58T0161A
=QUANTITY OF GN_2 IN GN_2 TANK	GN QTY	$Q_T(I)$	?
=INITIAL TOTAL QUANTITY OF GN_2	WB QTY	$Q_I(I)$	V92Q0650C
=TOTAL QUANTITY OF GN_2 AFTER VENTING	WB VENTING	$Q_V(I)$	?
=UPLINKED TOTAL QUANTITY OF GN_2	UNKNOWN	Q (I)	?
TOTAL QUANTITY GN_2 USED TO DETERMINE V (I)		CQ=	?
=REMAINING H_2O QUANTITY IN PERCENT	WB QTY P	$V_R(I)$	V72Q6040V
=INDICATOR FOR OUT OF RANGE/LIMIT CONDITIONS	STATUS	STATUS	N/A
A CONST	CNST A	A	$8.0250 X 10^{-2}$
B CONST	CNST B	B	$2.2014 X 10^{-5}$
C CONST	CNST C	C	$2.0462 X 10^{-6}$
D CONST	CNST D	D	$1.9779 X 10^{-10}$

6. MICRO SW HOLDS POSITION UNTIL VALVE IS FULL OPEN OR FULL CLOSED

5. VALVE IS EITHER FULL OPEN OR FULL CLOSED

4. APU/HYD READY TO START TALKBACK PNL R2
   (1) CONTROLLERS 'A' OR 'B' ENABLED
   (2) STEAM VENT TEMPERATURE > 130°F
   (3) GN_2 SHUTOFF VALVE OPEN
   (4) HYDRAULIC FLUID BYPASS VALVE IN THE PROPER POSITION

3. CONTROLS WATER BOILER AND WATER STORAGE TANK HEATERS BOILER CONTROL PWR/HTR SWITCH MUST BE IN POSITION 'A' OR 'B' FOR HEATER ACTIVATION

2. WATER BOILER SYSTEM 1 SHOWN WATER BOILER SYSTEMS 2 AND 3 IDENTICAL

NOTES:

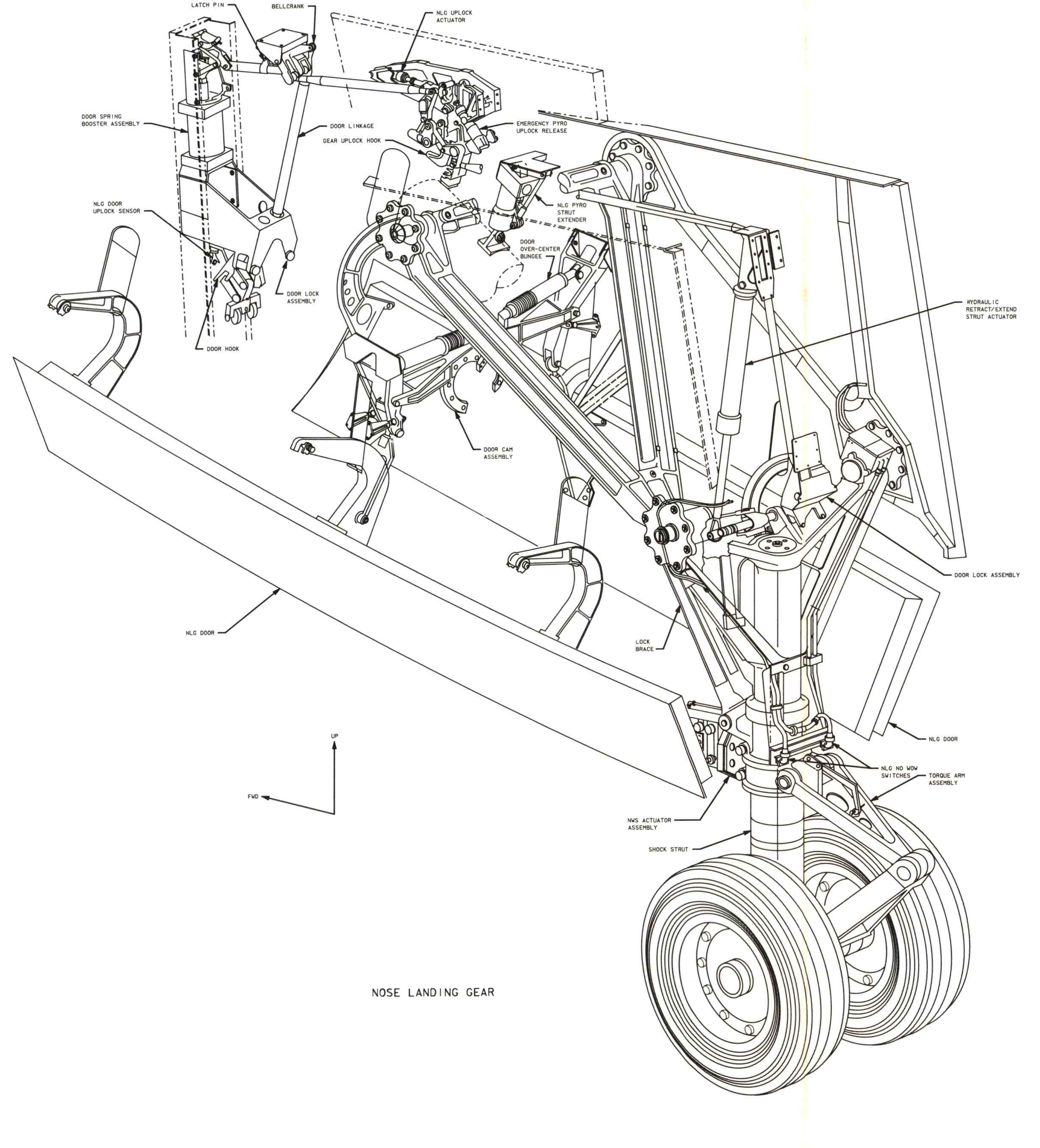
1. WHEN ON CONTROLLER 'B' THE FOLLOWING OUTPUTS ARE LOST: (I.E., NO H_2O QUANTITY COMPUTATION)
   (1) GN_2 TANK TEMPERATURE (V58T0105A)
   (2) GN_2 REGULATOR PRESSURE (V58P0147A)
   (3) H_2O TANK TEMPERATURE (V58T0161A)
   (4) HYD BYPASS VALVE POSITION INDICATOR (V58X0181E)

*1 APU/HYD WSB

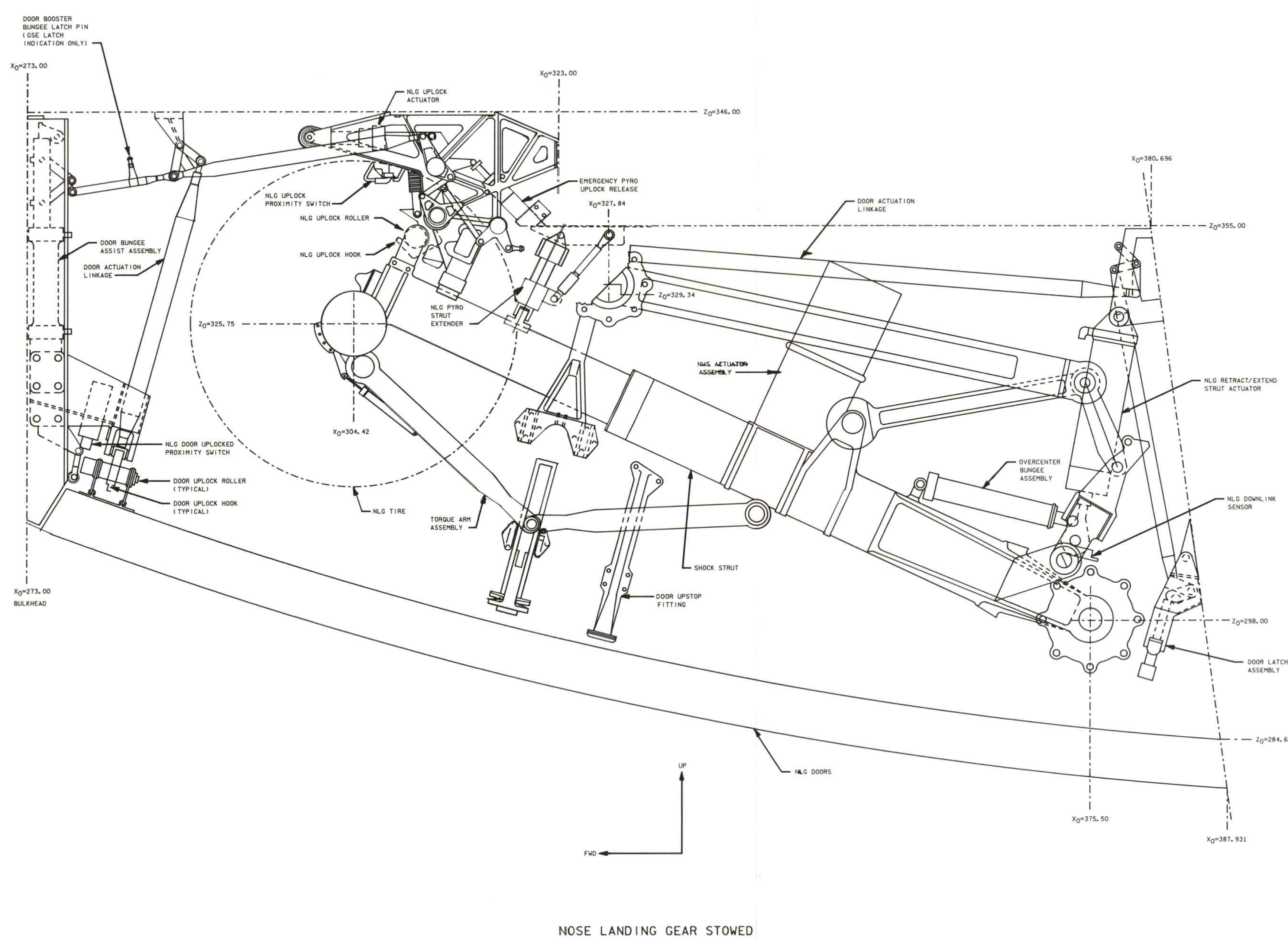
SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS		
DSGN TERRI FORSYTHE	11/6/79	APU/HYD WATER SPRAY BOILER		
DR				
ENGR				
ENGR				
APP				
APP		SPACE SHUTTLE	DWG NO 12.4	
KENTRON		ALL		
LTR C	PCN 2	126.5 X 34	PAGE 12.4-1	SHEET 1 OF 1

DATE: 7/25/83	NAME: JFK	VERSION: INK, 1
DATE: 2/22/84	NAME: LGH	VERSION: BPT, 1
DATE: 3/7/84	NAME: JMB.	VERSION: INK, 2

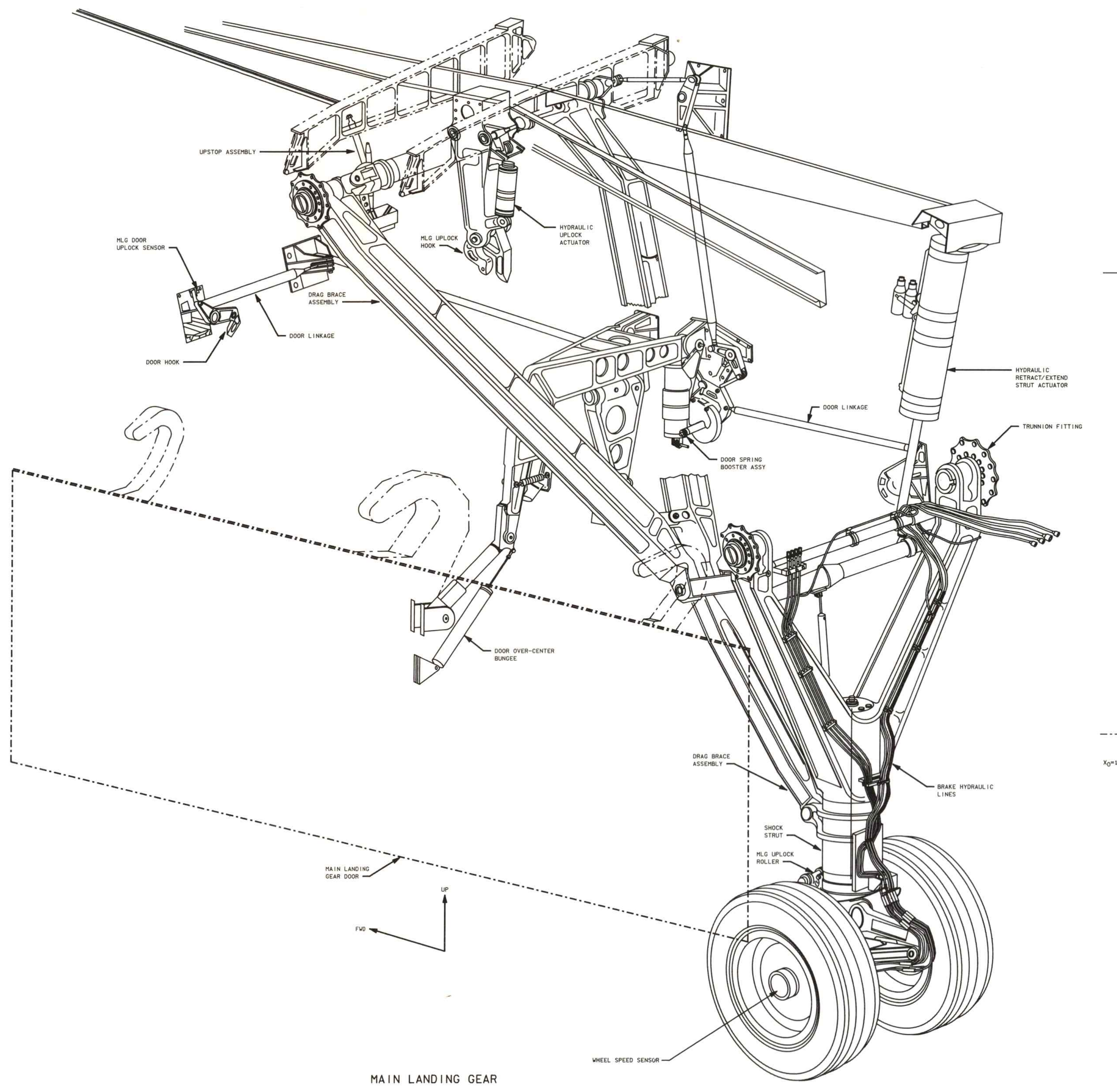
DATE: 7/25/83	NAME: JFK	VERSION: INK, 1
DATE: 2/22/84	NAME: LGH	VERSION: BPT, 1
DATE: 3/7/84	NAME: JMB	VERSION: INK, 2


DOOR BOOSTER BUNGEE LATCH PIN
BELLCRANK
NLG UPLOCK ACTUATOR
DOOR SPRING BOOSTER ASSEMBLY
DOOR LINKAGE
GEAR UPLOCK HOOK
EMERGENCY PYRO UPLOCK RELEASE
NLG DOOR UPLOCK SENSOR
NLG PYRO STRUT EXTENDER
DOOR OVER-CENTER BUNGEE
DOOR LOCK ASSEMBLY
DOOR HOOK
HYDRAULIC RETRACT/EXTEND STRUT ACTUATOR
DOOR CAM ASSEMBLY
DOOR LOCK ASSEMBLY
NLG DOOR
LOCK BRACE
NLG DOOR
NLG NO WOW SWITCHES
TORQUE ARM ASSEMBLY
NWS ACTUATOR ASSEMBLY
SHOCK STRUT
UP
FWD

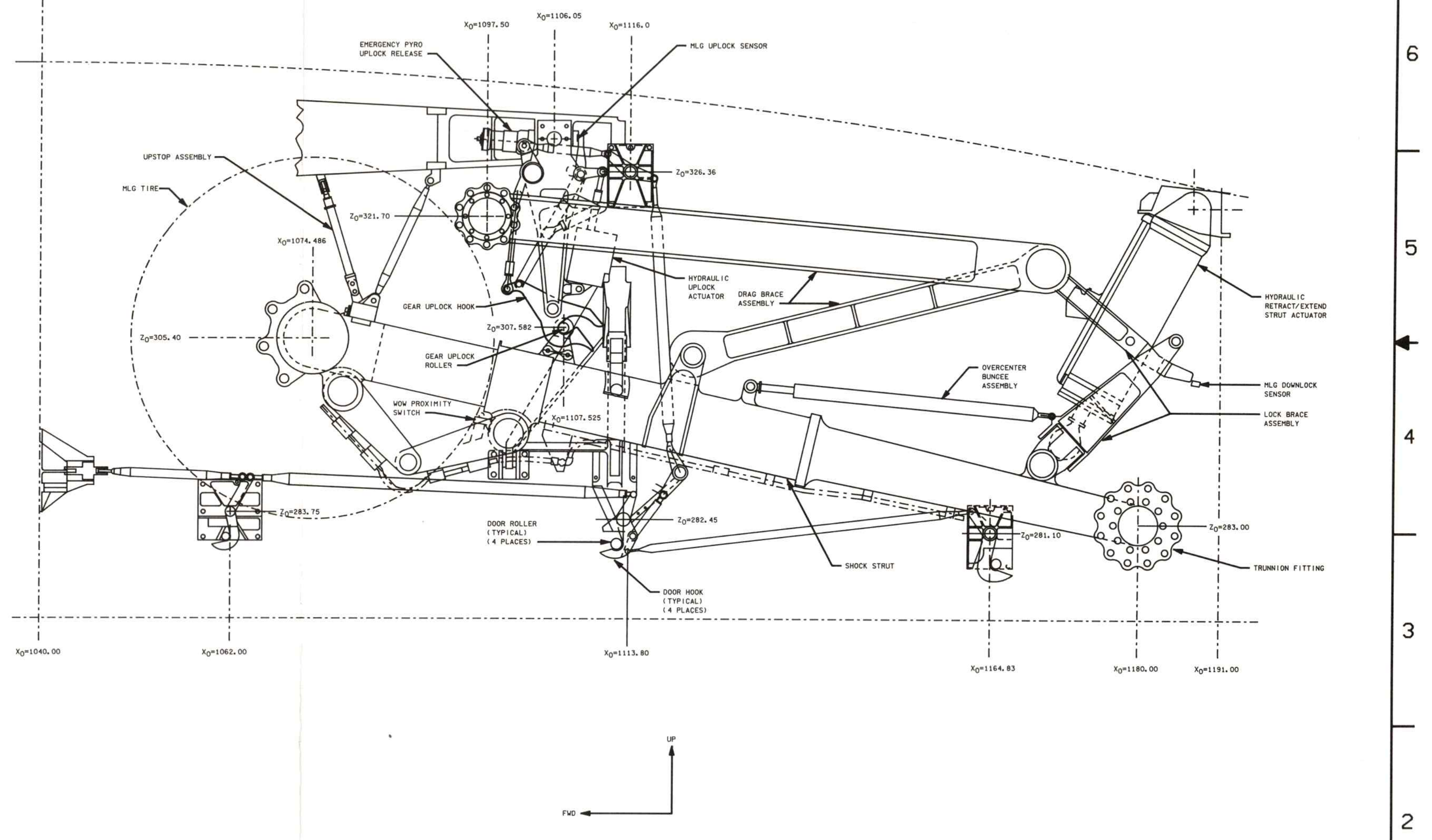
NOSE LANDING GEAR


DOOR BOOSTER BUNGEE LATCH PIN (GSE LATCH INDICATION ONLY)
X0=273.00
NLG UPLOCK ACTUATOR
X0=323.00
Z0=346.00
X0=380.696
EMERGENCY PYRO UPLOCK RELEASE
NLG UPLOCK PROXIMITY SWITCH
NLG UPLOCK ROLLER
X0=327.84
DOOR ACTUATION LINKAGE
Z0=355.00
DOOR BUNGEE ASSIST ASSEMBLY
NLG UPLOCK HOOK
DOOR ACTUATION LINKAGE
Z0=329.34
NLG PYRO STRUT EXTENDER
Z0=325.75
NWS ACTUATOR ASSEMBLY
NLG RETRACT/EXTEND STRUT ACTUATOR
X0=304.42
NLG DOOR UPLOCKED PROXIMITY SWITCH
OVERCENTER BUNGEE ASSEMBLY
DOOR UPLOCK ROLLER (TYPICAL)
NLG DOWNLINK SENSOR
DOOR UPLOCK HOOK (TYPICAL)
NLG TIRE
TORQUE ARM ASSEMBLY
SHOCK STRUT
X0=273.00
BULKHEAD
DOOR UPSTOP FITTING
Z0=298.00
DOOR LATCH ASSEMBLY
Z0=284.665
NLG DOORS
UP
FWD
X0=375.50
X0=387.931

NOSE LANDING GEAR STOWED


UPSTOP ASSEMBLY
HYDRAULIC UPLOCK ACTUATOR
MLG UPLOCK HOOK
MLG DOOR UPLOCK SENSOR
DRAG BRACE ASSEMBLY
DOOR LINKAGE
DOOR HOOK
HYDRAULIC RETRACT/EXTEND STRUT ACTUATOR
DOOR LINKAGE
TRUNNION FITTING
DOOR SPRING BOOSTER ASSY
DOOR OVER-CENTER BUNGEE
DRAG BRACE ASSEMBLY
BRAKE HYDRAULIC LINES
SHOCK STRUT
MLG UPLOCK ROLLER
MAIN LANDING GEAR DOOR
UP
FWD
WHEEL SPEED SENSOR

MAIN LANDING GEAR


X0=1097.50
X0=1106.05
X0=1116.0
EMERGENCY PYRO UPLOCK RELEASE
MLG UPLOCK SENSOR
UPSTOP ASSEMBLY
Z0=326.36
MLG TIRE
Z0=321.70
X0=1074.486
HYDRAULIC UPLOCK ACTUATOR
DRAG BRACE ASSEMBLY
HYDRAULIC RETRACT/EXTEND STRUT ACTUATOR
GEAR UPLOCK HOOK
Z0=307.582
Z0=305.40
GEAR UPLOCK ROLLER
OVERCENTER BUNCEE ASSEMBLY
MLG DOWNLOCK SENSOR
WOW PROXIMITY SWITCH
X0=1107.525
LOCK BRACE ASSEMBLY
Z0=283.75
Z0=282.45
DOOR ROLLER (TYPICAL) (4 PLACES)
Z0=281.10
Z0=283.00
SHOCK STRUT
TRUNNION FITTING
DOOR HOOK (TYPICAL) (4 PLACES)
X0=1040.00
X0=1062.00
X0=1113.80
X0=1164.83
X0=1180.00
X0=1191.00
UP
FWD

MAIN LANDING GEAR STOWED

1 LG 1

SIGNATURE	DATE	
DSGN L. BUCHANAN	1/2/80	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR L. BUCHANAN	1/2/80	LANDING GEAR
ENGR James H. Williams	3/30/84	
ENGR		
APP A. F. Schmitt	4/2/84	
APP Lewis W. Purcell	4-4-84	SPACE SHUTTLE — DWG NO 13.1
OMNIPLAN S. K. Kimbrell	4-30-84	ALL
LTR C — PCN 2		126.5 X 34 — PAGE 13.1-1 — SHEET 1 OF 2

BASIC REV C

BASIC REV C-2

DATE: 10/26/82	NAME: TLF	VERSION: INK, 10
DATE: 11/22/83	NAME: VSH	VERSION: BPT, 2
DATE: 11/28/82	NAME: TMW	VERSION: BPT, 3
DATE: 12/2/83	NAME: TJL	VERSION: INK, 1
DATE: 3/7/84	NAME: JMB	VERSION: BPT, 4
DATE: 3/23/84	NAME: JMB	VERSION: BPT, 5

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1
RIGHT OUTBOARD CIRCUIT
RIGHT INBOARD CIRCUIT
LEFT INBOARD CIRCUIT
BRAKE/SKID CONTROL BOX A
LEFT OUTBOARD CIRCUIT
BRAKES
TO BRAKE COIL
VALVE 4
VALVE 3
VALVE 2
VALVE 1
TO BRAKE COIL FROM BOX B
V51 P0522A LOB BRAKE PRESS 4 0 TO 2000 PSIA 1 S/S
V51 P0528A LIB BRAKE PRESS 3 0 TO 2000 PSIA 1 S/S
V51 P0524A LOB BRAKE PRESS 2 0 TO 2000 PSIA 1 S/S
V51 P0526A LIB BRAKE PRESS 1 0 TO 2000 PSIA 1 S/S
HTRS
A 16W
B 16W
C 16W
A 17W
B 17W
C 17W
TO LEFT OUTBD CIRCUIT BOX A
TO LEFT OUTBD CIRCUIT BOX B
TO LEFT INBD CIRCUIT BOX A
TO LEFT INBD CIRCUIT BOX B
WHEEL SPEED SENSOR (TYP)
LEFT OUTBOARD WHEEL
LEFT INBOARD WHEEL
V58 T1702A LMG OB BV 1 LN T -75 TO +300° F 1 S/S
V58 T1701A LMG IB BV 1 LN T -75 TO +300° F 1 S/S
V58 T1703A LMG OB BV 2 LN T -75 TO +300° F 1 S/S
V58 T1700A LMG IB BV 2 LN T -75 TO +300° F 1 S/S
RIGHT INBOARD WHEEL
RIGHT OUTBOARD WHEEL
1ST STAGE
2ND STAGE
DETAIL A
BRAKE/SKID CONTROL MODULE
SELECTOR VALVE
BYPASS FLOW VALVE
FLUID BARRIER
ARMATURE
MAGNET
CONTROL VALVE
DISPLACEMENT LIMITER
TO LEFT OUTBD BRAKE
TO LEFT INBD BRAKE

3 CONTROL MODULE SHOWN WITH NO PRESSURE TO BRAKES

2 RMG NO WOW AND LMG NO WOW SIGNAL IS 28 VDC
UNTIL VEHICLE TOUCHDOWN.

NOTES: 1. BRAKE/SKID CONTROL BOX B IDENTICAL TO BOX A

BRAKE CONTROL MATRIX

	LEFT OTBD WHEEL	LEFT INBD WHEEL	RIGHT INBD WHEEL	RIGHT OTBD WHEEL
BOX A - BRAKE/ANTI-SKID POWER	CA	CA	CA	CA
BOX B - BRAKE/ANTI-SKID POWER	BC	BC	BC	BC
SERVO VALVE CONTROL	BOX A-SERVO VLV 4 BOX B-SERVO VLV 2	BOX A-SERVO VLV 3 BOX B-SERVO VLV 1	BOX A-SERVO VLV 3 BOX B-SERVO VLV 1	BOX A-SERVO VLV 4 BOX B-SERVO VLV 2
WHEEL SPEED SENSOR INPUT	BOX A-SERVO VLV 4 BOX B-SERVO VLV 2	BOX A-SERVO VLV 3 BOX B-SERVO VLV 1	BOX A-SERVO VLV 3 BOX B-SERVO VLV 1	BOX A-SERVO VLV 4 BOX B-SERVO VLV 2
BOX A WOW INPUT VIA RELAY K9	CA	CA	CA	CA
BOX B WOW INPUT VIA RELAY K11	BC	BC	BC	BC
HYDRAULIC SYSTEM - ACTIVE	1 AND 2	1 AND 2	1 AND 2	1 AND 2
HYDRAULIC SYSTEM - BACKUP	3	3	3	3

2 BRAKES

SIGNATURE		DATE
DR	LINDA S. DUMIS	8/7/78
DR		
DSGN		
ENGR	James H Williams	4/2/84
ENGR		
APP		4/4/84
APP	Kenneth W. Russell	4-4-84
OMNIPLAN	S. K. Kimbrell	4-30-84
REV C	DCN 2	

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

BRAKES

SPACE SHUTTLE
ALL
126.5 X 34
DWG NO 13.2
PAGE 13.2-1
SHEET 1 OF 1

DATE: 10/26/82	NAME: TLF	VERSION: INK, 10
DATE: 11/22/83	NAME: VSH	VERSION: BPT, 2
DATE: 11/28/83	NAME: TMW	VERSION: BPT, 3
DATE: 12/2/83	NAME: TJL	VERSION: INK, 1
DATE: 3/7/84	NAME: JMB	VERSION: BPT, 4
DATE: 3/23/84	NAME: JMB	VERSION: BPT, 5

BASIC REV C-1

BASIC REV C-2

DATE: 12/15/81	NAME: SKK	VERSION: INK: 3
DATE: 3/6/84	NAME: JMB	VERSION: INK: 4

DATE: 7/13/81	NAME: JB	VERSION: INK: 2
DATE: 12/13/81	NAME: LFS	VERSION: BPT: 1
DATE: 12/15/81	NAME: SKK	VERSION: INK: 3
DATE: 3/6/84	NAME: JMB	VERSION: INK: 4

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1
UP
FWD BULKHEAD ROLLER ASSY
AFT BULKHEAD ROLLER ASSY
UPPER CENTERLINE LATCH SYSTEM
PBD CENTERLINE LATCH
FWD
SWITCH MODULE BULKHEAD MOUNTED
AFT
AFT STATION
GANGED LATCHES
PAYLOAD BAY DOOR MECHANISMS DOOR/RADIATOR SYSTEMS
DOOR DRIVE SYSTEM ROTARY GEAR ACTUATOR
DOOR DRIVE SYSTEM PDU
SECTION A-A
PAYLOAD BAY DOOR HINGE
DOOR DRIVE SYSTEM SHAFT/BEARING SUPPORT
DEPLOYABLE RADIATORS
PL BAY MECH PWR
ENABLE
ON
FIRE HOLE
OFF
RADIATOR
STARBOARD
PORT
PL BAY DOORS
OP
(D51)
LAT
(D52)
STO
(D53)
LAT
(D54)
STO
(D55)
OPEN
STOP
(LL)
CLOSE
LATCH RELEASE
OFF
LATCH
RADIATOR DEPLOY
OFF
STOW
LATCH RELEASE
OFF
LATCH
RADIATOR DEPLOY
OFF
STOW
K ANT
STO
(D56)
DIRECT STOW ON
OFF
DEPLOY
GND
STOW

✱PBD/RAD OV

SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS	
DSGN MIKE BECKER	12/7/79	PAYLOAD BAY DOORS/ RADIATOR OVERVIEW	
DR			
ENGR Rodney Lofton			
ENGR	4/9/84		
APP	4/84		
APP	4-4-84	SPACE SHUTTLE	DWG NO 14.1
KENTRON	4/30/84	ALL	
LTR C PCN 2		126.5 X 34	PAGE 14.1-1 SHEET 1 OF 3

BASIC REV C-2

BASIC REV C-2

DATE: 10/14/82	NAME: LSD	VERSION: INK, 12
DATE: 3/6/84	NAME: JMB	VERSION: INK, 15

DATE: 3/6/84	NAME: JMB	VERSION: INK, 15

DATE: 7/19/82	NAME: CAR	VERSION: BPT, 1
DATE: 7/21/82	NAME: EFD	VERSION: INK, 11
DATE: 10/14/82	NAME: LSD	VERSION: INK, 12
DATE: 8/16/83	NAME: VSD	VERSION: INK, 14
DATE: 12/12/83	NAME: BJB	VERSION: BPT, 2

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V72
X3780Y
OPEN
NO 1
1=ON
1 S/S
PF1
PLBD APPLICATIONS
FEEDBACK PROCESSING
DEU
M-MCA-1
M-MCA-2
M-MCA-3
M-MCA-4
CENTERLINE ACTUATOR 5-8
CENTERLINE LATCHES 1-4
CENTERLINE LATCHES 9-12
CENTERLINE LATCHES 13-16
BULKHEAD ACTUATOR RIGHT FORWARD
BULKHEAD ACTUATOR RIGHT AFT
BULKHEAD ACTUATOR LEFT FORWARD
BULKHEAD ACTUATOR LEFT AFT
RIGHT DOOR POWER DRIVE UNIT
LEFT DOOR POWER DRIVE UNIT
PAYLOAD-BAY-DOOR-OPEN SEQUENCE (AUTO)
ENABLE PLBD-OPEN SEQUENCE
℄ LATCH GROUP 5-8 RELEASE
℄ LATCH GROUP 9-12 RELEASE
℄ LATCH GROUP 1-4 RELEASE
℄ LATCH GROUP 13-16 RELEASE
RIGHT FWD BLKHD LATCH GROUP RELEASE
RIGHT AFT BLKHD LATCH GROUP RELEASE
OPEN RIGHT PLBD
LEFT FWD BLKHD LATCH GROUP RELEASE
LEFT AFT BLKHD LATCH GROUP RELEASE
OPEN LEFT PLBD
TERMINATE PLBD-OPEN SEQUENCE
OP
F
● MODE: AUTO
● AC POWER ON
● PLBD OPEN COMMAND
● TALK-BACK-OPEN
● TERMINATE PLBD-OPEN COMMAND
F INDICATES MICROSWITCH FEEDBACK REQUIRED BEFORE PROCEEDING TO NEXT STEP
PAYLOAD BAY DOOR CLOSE SEQUENCE (AUTO)
ENABLE PBD-CLOSE SEQUENCE
CLOSE LEFT DOOR
LEFT FWD BLKHD LATCH GROUP LATCH
LEFT AFT BLKHD LATCH GROUP LATCH
CLOSE RIGHT PLBD
RIGHT FWD BLKHD LATCH GROUP LATCH
RIGHT AFT BLKHD LATCH GROUP LATCH
℄ LATCH GROUP 1-4 LATCH
℄ LATCH GROUP 13-16 LATCH
℄ LATCH GROUP 5-8 LATCH
℄ LATCH GROUP 9-12 LATCH
TERMINATE PLBD-CLOSE SEQUENCE
CL
● MODE: AUTO
● AC POWER ON
● PLBD OPEN COMMAND
● TALK-BACK-CLOSED
● TERMINATE PLBD-OPEN COMMAND
F INDICATES MICROSWITCH FEEDBACK REQUIRED BEFORE PROCEEDING TO NEXT STEP
(V98X3311X)
V37
X3302Y
PBD RIGHT CLOSE 1
1=CLOSE
1 S/S
(V98X3331X)
V37
X3303Y
PBD RIGHT CLOSE 2
(V98X3401X)
V37
X3437Y
R FWD RDY LATCH 3
1=READY
V37
X3436Y
R FWD RDY LATCH 2
(V98X3367X)
V37
X3305Y
LEFT DOOR OPEN 1
1=OPEN
(V98X3372X)
V37
X3307Y
LEFT DOOR CLOSE 1
V37
X3308Y
PBD LEFT CLOSE 2
(V98X3347X)
V37
X3306Y
PBD LEFT OPEN 2
(V98X3361X)
V37
X3327Y
L FWD RDY LATCH 3
(V98X3381X)
CW TO LATCH CCW TO RELEASE (VIEWED LOOKING AFT)
OUTPUT SHAFT TO LEFT FWD BULKHEAD LATCHES

OPEN SEQUENCE

	M-MCA	MCA OPS STATUS	PF MDM	INPUT CARD/CHAN	OUTPUT CARD/CHAN	RELAY	STIMULI	AC BUS	CNTL BUS	DC BUS	TM PASS	TM BFS
5-8	3 2	6 8	1 2	09/00	07/00	K15 K4	V37K2220Y REL CMD 1 V37K2221Y REL CMD 2	AC1 MMC3 AC3 MMC2	AB3 CA3	MMA MMC3 MNC MMC2	V37X3390Y REL 1 V37X3391Y REL 2	V98X3385X REL 1 V98X3405X REL 2
9-12	1 4	3 8	1 2	09/00	07/00	K32 K38	V37K2240Y REL CMD 1 V37K2241Y REL CMD 2	AC1 MMC3 AC3 MMC2	AB3 CA3	MNA MMC1 MNC MMC4	V37X3405Y REL 1 V37X3406Y REL 2	V98X3388X REL 1 V98X3408X REL 2
1-4	3 2	4 4	1 2	09/00	07/00	K3 K50	V37K2200Y REL CMD 1 V37K2201Y REL CMD 2	AC1 MMC3 AC3 MMC2	AB3 CA3	MNA MMC3 MNC MMC2	V37X3380Y REL 1 V37X3381Y REL 2	V98X3383X REL 1 V98X3403X REL 2
13-16	1 4	6 1	2 1	09/00	07/00	K40 K21	V37K2260Y REL CMD 1 V37K2261Y REL CMD 2	AC3 MMC4 AC2 MMC2	BC3 CA3	MNC MMC4 MNB MMC2	V37X3415Y REL 1 V37X3416Y REL 2	V98X3410X REL 1 V98X3390X REL 2
RT FWD BLKHD	1 4	1 4	1 2	03/00	02/00	K35 K47	V37K2100Y REL CMD 1 V37K2101Y REL CMD 2	AC1 MMC1 AC2 MMC4	AB3 BC3	MNA MMC1 MNB MMC4	V37X3430Y REL 1 V37X3431Y REL 2	V98X3303X REL 1 V98X3323X REL 2
RT AFT BLKHD	4 2	7 2	2 1	03/00	02/00	K24 K25	V37K2120Y REL CMD 1 V37K2121Y REL CMD 2	AC3 MMC4 AC2 MMC2	CA3 BC3	MNC MMC4 MNB MMC2	V37X3450Y REL 1 V37X3451Y REL 2	V98X3325X REL 1 V98X3305X REL 2
RIGHT	1 4	5 1	1 2	03/00	02/00	K54 K43	V37K2050Y OP CMD 1 V37K2051Y OP CMD 2	AC1 MMC1 AC2 MMC4	AB3 BC3	MNA MMC1 MNB MMC4	V37X3300Y OPEN 1 V37X3301Y OPEN 2	V98X3307X OPEN 1 V98X3327X OPEN 2
LT FWD BLKHD	1 4	4 3	1 2	06/00	14/00	K79 K45	V37K2150Y REL CMD 1 V37K2151Y REL CMD 2	AC1 MMC1 AC2 MMC4	AB3 BC3	MNA MMC1 MNB MMC4	V37X3320Y REL 1 V37X3321Y REL 2	V98X3343X REL 1 V98X3363X REL 2
LT AFT BLKHD	3 2	2 8	1 2	06/00	14/00	K64 K19	V37K2170Y REL CMD 1 V37K2171Y REL CMD 2	AC1 MMC3 AC3 MMC2	AB3 CA3	MNA MMC3 MNC MMC2	V37X3350Y REL 1 V37X3351Y REL 2	V98X3345X REL 1 V98X3365X REL 2
LEFT	4 2	5 1	2 1	06/00	14/00	K22 K10	V37K2070Y OP CMD 1 V37K2071Y OP CMD 2	AC3 MMC4 AC2 MMC2	CA3 BC3	MNC MMC4 MNB MMC2	V37X3305Y OPEN 1 V37X3306Y OPEN 2	V98X3367X OPEN 1 V98X3347X OPEN 2

CLOSE SEQUENCE

	M-MCA	MCA OPS STATUS	PF MDM	INPUT CARD/CHAN	OUTPUT CARD/CHAN	RELAY	STIMULI	AC BUS	CNTL BUS	DC BUS	TM PASS	TM BFS
LEFT	4 2	8 2	2 1	06/00 06/00	14/00 14/00	K10 K12	V37K2080Y CLS CMD 1 V37K2081Y CLS CMD 2	AC3 MMC4 AC2 MMC2	CA3 BC3	MNC MMC4 MNB MMC2	V37X3307Y CLOSE 1 V37X3307Y CLOSE 2	V98X3372X CLOSE 1 V98X3352X CLOSE 2
LT FWD BLKHD	1 4	3 2	1 2	06/00 06/00	14/00 14/00	K67 K33	V37K2160Y LCH CMD 1 V37K2161Y LCH CMD 2	AC1 MMC1 AC2 MMC4	AB3 BC3	MNA MMC1 MNB MMC4	V37X3330Y LATCH 1 V37X3331Y LATCH 2	V98X3344X LATCH 1 V98X3364X LATCH 2
LT AFT BLKHD	3 2	1 5	1 2	06/00 06/00	14/00 14/00	K62 K7	V37K2180Y LCH CMD 1 V37K2181Y LCH CMD 2	AC1 MMC3 AC3 MMC2	AB3 CA3	MNA MMC3 MNC MMC2	V37X3360Y LATCH 1 V37X3361Y LATCH 2	V98X3343X LATCH 1 V98X3366X LATCH 2
RIGHT	1 4	6 4	1 2	03/00 03/00	02/00 02/00	K42 K31	V37K2060Y CLS CMD 1 V37K2061Y CLS CMD 2	AC1 MMC1 AC2 MMC4	AB3 BC3	MNA MMC1 MNB MMC4	V37X3302Y CLOSE 1 V37X3303Y CLOSE 2	V98X3311X CLOSE 1 V98X3331X CLOSE 2
RT FWD BLKHD	1 4	2 1	1 2	03/00 03/00	02/00 02/00	K23 K35	V37K2110Y LCH CMD 1 V37K2111Y LCH CMD 2	AC1 MMC1 AC2 MMC4	AB3 BC3	MNA MMC1 MNB MMC4	V37X3440Y LATCH 1 V37X3441Y LATCH 2	V98X3304X LATCH 1 V98X3324X LATCH 2
RT AFT BLKHD	4 2	6 1	2 1	03/00 03/00	02/00 02/00	K12 K13	V37K2130Y LCH CMD 1 V37K2131Y LCH CMD 2	AC3 MMC4 AC2 MMC2	CA3 BC3	MNC MMC4 MNB MMC2	V37X3460Y LATCH 1 V37X3461Y LATCH 2	V98X3326X LATCH 1 V98X3306X LATCH 2
1-4	3 2	3 3	1 2	09/00 09/00	07/00 07/00	K1 K38	V37K2210Y LCH CMD 1 V37K2211Y LCH CMD 2	AC1 MMC3 AC3 MMC2	AB3 CA3	MNA MMC3 MNC MMC2	V37X3385Y LATCH 1 V37X3386Y LATCH 2	V98X3384X LATCH 1 V98X3404X LATCH 2
13-16	4 2	7 2	2 1	09/00 09/00	07/00 07/00	K28 K9	V37K2270Y LCH CMD 1 V37K2271Y LCH CMD 2	AC3 MMC4 AC2 MMC2	BC3 CA3	MNC MMC4 MNB MMC2	V37X3410Y LATCH 1 V37X3411Y LATCH 2	V98X3409X LATCH 1 V98X3389X LATCH 2
5-8	3 2	5 7	1 2	09/00 09/00	07/00 07/00	K13 K6	V37K2230Y LCH CMD 1 V37K2231Y LCH CMD 2	AC1 MMC3 AC3 MMC2	AB3 CA3	MNA MMC3 MNC MMC2	V37X3395Y LATCH 1 V37X3396Y LATCH 2	V98X3386X LATCH 1 V98X3306X LATCH 2
9-12	1 4	4 5	1 2	09/00 09/00	07/00 07/00	K20 K26	V37K2250Y LCH CMD 1 V37K2251Y LCH CMD 2	AC1 MMC1 AC3 MMC4	AB3 CA3	MNA MMC1 MNC MMC2	V37X3400Y LATCH 1 V37X3401Y LATCH 2	V98X3387X LATCH 1 V98X3407X LATCH 2

PAYLOAD BAY DOOR OPERATIONAL TIME

	NORMAL (2 MOTORS) (SEC)	FAILURE MODE (1 MOTOR) (SEC)
OPEN/CLOSE		
● ℄ LATCHES		
5-8	20	40
9-12	20	40
1-4	20	40
13-16	20	40
● BULKHEAD LATCHES (RH) FWD & AFT	30	60
● RIGHT DOOR CLOSE	60	120
● BULKHEAD LATCHES (LH) FWD & AFT	30	60
● LEFT DOOR CLOSE	60	120
TOTAL CLOSE TIME - 190 SEC (3 MIN 10 SEC) NORMAL		

NOTES:

3. AC POWER ENABLE CMDS TO SAME MCA'S ENERGIZE THE SAME RELAY COILS
2. READY-TO-LATCH SWITCH ACTUATOR ARM WILL DEPRESS 0.75 INCHES BEYOND THE READY-TO-LATCH ACTUATION TO ACTIVATE DOOR CLOSE INDICATION READY-TO-LATCH INDICATION IS MADE WHEN THE DOOR IS 4° OPEN DOOR CLOSE INDICATION IS ACHIEVED AT APPROXIMATELY 2° OPEN.
1. THE ↑b WILL BE b_p WHEN THE BFS IS TAKEN FROM HALT TO RUN. PROPER STATUS CAN BE OBTAINED WITH A SPEC 63 PRO.

2 PLBD OP/CL 1

SIGNATURE	DATE	
DSGN MIKE BECKER	2/2/81	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR		PLBD OPEN/CLOSE H/W OVERVIEW
ENGR Rodney Lufton	3/9/84	
ENGR	3/9/84	
APP	3/9/84	
APP Kenneth Russell	4-4-84	SPACE SHUTTLE
OMNIPLAN		ALL
LTR C	PCN 2	126.5 X 34

DWG NO 14.2

PAGE 14.2-1 SHEET 1 OF 2

BASIC REV C-2

BASIC REV C-2

DATE: 2/29/80	NAME: LMB	VERSION: BPT, 2
DATE:, 4-28-80	NAME: NS	VERSION: BPT, 3
DATE: 6/10/80	NAME: V.S.D	VERSION: INK, 1
DATE: 2/4/81	NAME: CAR	VERSION: INK, 2
DATE: 6/11/81	NAME: CAR	VERSION: INK, 3
DATE: 6/30/81	NAME: TLF	VERSION: INK, 5
DATE: 12/10/81	NAME: SHO	VERSION: INK, 7
DATE: 12/17/81	NAME: LMB	VERSION: INK, 10
DATE: 1/16/84	NAME: MB	VERSION: BPT, 4
DATE: 3/06/84	NAME: BJB	VERSION: INK, 11

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MOTOR A
MOTOR B
ELECTRO MECHANICAL CLUTCH BRAKE SOLENOID
TORQUE LIMITER
MECHANICAL DIFFERENTIAL
ET UMBILICAL DOOR
CENTERLINE LATCH ACTUATOR 1
CENTERLINE LATCH ACTUATOR 2
LEFT DOOR CLOSURE
LEFT DOOR UPLOCK LATCH
RIGHT DOOR CLOSURE
RIGHT DOOR UPLOCK LATCH

DOWNLIST TELEMETRY PARAMETERS

PASS	BFS	NOMENCLATURE	EVENT	MDM
V56X1205X	V98X4017X	ET UMB DR CL LCH 1 STOW IND 1	STOA	FA1
V56X1215X	V98X4036X	ET UMB DR CL LCH 1 STOW IND 2	STOB	FA2
V56X1255X	V98X4016X	ET UMB DR CL LCH 1 DEPLOY IND 1	DPYA	FA1
V56X1265X	V98X4035X	ET UMB DR CL LCH 1 DEPLOY IND 2	DPYB	FA2
V56X1305X	V98X4056X	ET UMB DR CL LCH 2 STOWED IND 1	STOA	FA4
V56X1315X	V98X4076X	ET UMB DR CL LCH 2 STOWED IND 2	STOB	FA3
V56X1355X	V98X4055X	ET UMB DR CL LCH 2 DEPLOY IND 1	DPYA	FA4
V56X1365X	V98X4075X	ET UMB DR CL LCH 2 DEPLOY IND 2	DPYB	FA3
V56X3010X	V98X4089X	ET L UMB DOOR OPEN IND 1	OPN A	FA1
V56X3015X	V98X4149X	ET L UMB DOOR OPEN IND 2	OPN B	FA3
V56X3110X	V98X4090X	ET L UMB DOOR CLOSED IND 1	CLS A	FA1
V56X3115X	V98X4150X	ET L UMB DOOR CLOSED IND 2	CLS B	FA3
V56X3541X	V98X4093X	ET L UMB DR RDY-TO-LCH IND 1	RDY 1	FA1
V56X3542X	V98X4094X	ET L UMB DR RDY-TO-LCH IND 2	RDY 2	FA1
V56X3543X	V98X4095X	ET L UMB DR RDY-TO-LCH IND 3	RDY 3	FA1
V56X3550X	V98X4091X	ET L UMB DR LATCHED IND 1	LCH A	FA1
V56X3560X	V98X4131X	ET L UMB DR LATCHED IND 2	LCH B	FA4
V56X3650X	V98X4092X	ET L UMB DR LATCH REL IND 1	REL A	FA1
V56X3660X	V98X4132X	ET L UMB DR LATCH REL IND 2	REL B	FA4
V56X4010X	V98X4129X	ET R UMB DOOR OPEN IND 1	OPN A	FA4
V56X4015X	V98X4109X	ET R UMB DOOR OPEN IND 2	OPN B	FA2
V56X4110X	V98X4130X	ET R UMB DOOR CLOSED IND 1	CLS A	FA4
V56X4115X	V98X4110X	ET R UMB DOOR CLOSED IND 2	CLS B	FA2
V56X4541X	V98X4153X	ET R UMB DR RDY-TO-LCH IND 1	RDY 1	FA3
V56X4542X	V98X4154X	ET R UMB DR RDY-TO-LCH IND 2	RDY 2	FA3
V56X4543X	V98X4155X	ET R UMB DR RDY-TO-LCH IND 3	RDY 3	FA3
V56X4550X	V98X4151X	ET R UMB DR LATCHED IND 1	LCH A	FA3
V56X4560X	V98X4111X	ET R UMB DR LATCHED IND 2	LCH B	FA2
V56X4650X	V98X4152X	ET R UMB DR LATCH REL IND 1	REL A	FA3
V56X4660X	V98X4112X	ET R UMB DR LATCH REL IND 2	REL B	FA2

MOTOR DRIVE TIMES

MOTOR	1	2
C/L LATCH	12	6
DOOR DRIVE	48	24
UPLOCK LATCH	12	6

AFT 1 MCA (MNA DC PWR) (AC1 AC PWR)	AFT 2 MCA (MNB DC PWR) (AC2 AC PWR)	AFT 3 MCA (MNC DC PWR) (AC3 AC PWR)
CENTERLINE LATCH 1 MOTOR A	CENTERLINE LATCH 1 MOTOR B	
CENTERLINE LATCH 2 MOTOR A		CENTERLINE LATCH 2 MOTOR B
LEFT DOOR DRIVE MOTOR A		LEFT DOOR DRIVE MOTOR B
LEFT DOOR LATCH MOTOR A	LEFT DOOR LATCH MOTOR B	
	RIGHT DOOR DRIVE MOTOR B	RIGHT DOOR DRIVE MOTOR A
	RIGHT DOOR LATCH MOTOR B	RIGHT DOOR LATCH MOTOR A

2 ARM 1, 2 AND 3 COMMANDS ARE REQUIRED FOR ENABLING THE CONTROL LOGIC FOR DOOR CLOSURE AND UPLOCK LATCHING DURING RTLS OR REAL TIME COMMANDING SEQUENCES W Z 8

NOTE: 1 READY TO LATCH LIMIT SWITCHES ARE ACTIVATED WHEN DOOR ROLLER CONTACTS THE UPLOCK LATCH STRIKER LEVER SWITCHES ARE MOUNTED ON THE TWO INBOARD UPLOCK LATCHES F Z 3 15.2-1

2 ORB/ET DRS 2

SIGNATURE	DATE	
DSGN L. M. BUCHANAN	2-29-80	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR		ORB/ET UMBILICAL CLOSEOUT DOORS (ELECT)
ENGR Dave Thealer	3/4/84	
ENGR T. A. Schmitt	3/7/84	
APP T. A. Schmitt	3/7/84	
APP		SPACE SHUTTLE · DWG NO 15.2
OMNIPLAN S.K. Kimbley	4-30-84	ALL
LTR C · PCN 2		126.5 X 34 · PAGE 15.2-2 · SHEET 2 OF 2

DATE: 12/12/83	NAME: VSH	VERSION: INK, 1
DATE: 02/21/84	NAME: BJB	VERSION: INK, 2

DATE: 12/12/83	NAME: VSH	VERSION: INK, 1
DATE: 02/21/84	NAME: BJB	VERSION: INK, 2

MMC 2
MMC 3
MMC 4
MOTOR 1
MOTOR 2
DEPLOYED ASSEMBLY
ELECTRONICS ASSEMBLY
BOOM STOW ENABLE II
BOOM STOW ENABLE I
BOOM STOW INITIATE
TRANSMIT SCAN ENABLE
STOWED
DEPLOYED
STOW
DEPLOY
PL BAY MECH PWR
KU ANTENNA
KU BAND SEPARATION
KU BAND JETTISON
FWD LCA 1
FWD LCA 3
RADAR ANT JETT NUT PIC
PIC (TYPICAL)
CAP VOLT MEASUREMENT
TO NSI
FROM NSI
NSI

STOW LOGIC DESCRIPTION

DURING THE STOW OPERATION THE DEPLOYED ASSEMBLY AND THE ELECTRONICS ASSEMBLY MICROCOMPUTER WILL PERFORM THE SOFTWARE SEQUENCES LISTED BELOW IN ITEMS 1 THRU 5:

1. EAI COMMAND: DRIVE TO STOW POSITION
   ANTENNA STOW CONFIGURATION
   ✓ ANTENNA GIMBAL ANGLES
   ELEV -29.0(±1°)
   ASMTH -125.0(±1°)
2. EAI COMMAND: INSERT LOCKING PINS
   ANTENNA GIMBAL LOCK MOTOR COMMAND DRIVES THE LOCKING PINS INTO THE LOCKED POSITION
   [AFTER A TIMEOUT OF 30 SEC, EAI COMMAND LOCK MOTORS OFF]
3. DA OUTPUT: BOOM STOW ENABLE II
   WHEN BOTH PINS ARE LOCKED BOOM ENABLE II SENDS A SIGNAL TO MMC2 TO ENABLE MTR 1
4. EAI COMMAND: WIGGLE TEST
   AFTER THE 30 SEC 'TIMEOUT', EAI CONDUCTS A 2.4SEC WIGGLE TEST ⑦
5. EAI COMMAND: BOOM STOW ENABLE 1
   AFTER SUCCESSFUL COMPLETION OF THE WIGGLE TEST, BOOM STOW ENABLE 1 SENDS A SIGNAL TO MMC4 TO ENABLE MTR 2

ACTUATOR TIME

2 MTRS	23SEC
1 MTR	46SEC

⑦ WIGGLE TEST DESCRIPTION

- A TORQUE IS APPLIED TO THE α AND β AXIS AT A RATE OF 20° PER SECOND FOR ONE SECOND. A MEASUREMENT IS TAKEN

CRITERIA:

IF MEASUREMENT <.7° - WIGGLE TEST DEFINED AS PASSED (GO TO STEP 5)

IF MEASUREMENT >.7° - WIGGLE TEST DEFINED AS FAILED

- IF THE WIGGLE TEST FAILED THE SOFTWARE SEQUENCES LISTED IN ITEMS 1 THRU 5 WILL BE CONDUCTED AD INFINITUM OR UNTIL THE WIGGLE TEST PASSES.

DEPLOYED ASSEMBLY

(REF DWG 16.5-2) $_NZ_5$

⟨E⟩ BOOM STOW ENABLE II EXCITATION

A DISCRETE SIGNAL APPLIED TO THE DEPLOYED ASSEMBLY. IT PERMITS GENERATION OF THE BOOM STOW ENABLE II SIGNAL BY THE DEPLOYED ASSEMBLY

⟨F⟩ BOOM STOW ENABLE II

THIS SIGNAL IS OUTPUT (HIGH) WHEN:

A. LOCKING PIN 1 AND LOCKING PIN 2 ARE IN THE LOCKED POSITION
B. BOOM STOW INITIATE SIGNAL IS HIGH

ELECTRONICS ASSEMBLY I

(REF DWG 16.5-1) $_MZ_5$

⟨C⟩ TRANSMIT SCAN ENABLE

AN INPUT (HIGH) TO THE ELECTRONICS ASSY WHENEVER:

A. THE ANTENNA IS FULLY DEPLOYED
B. A DEPLOYED MICROSWITCH IS HIGH

THIS SIGNAL ENABLES THE RF TRANSMITTER IN THE DA AND THE ANTENNA SCANNING CIRCUITS IN THE EA1

⟨B⟩ BOOM STOW ENABLE I

A DISCRETE SIGNAL THAT IS OUTPUT (HIGH) WHEN:

A. BOOM STOW INITIATE SIGNAL IS HIGH
B. ANTENNA IS IN STOW CONFIGURATION
C. KU PWR SWITCH (PNL A1, S12) - 'ON'
D. THE GIMBALS ARE LOCKED, AND
E. THE WIGGLE TEST PASSED

⟨D⟩ BOOM STOW INITIATE

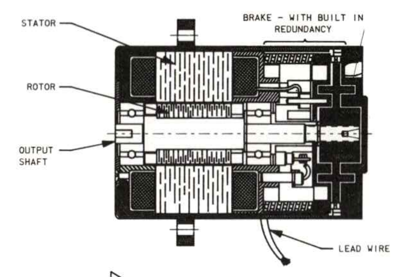
HIGH INPUT WHEN:

A. THE KU ANT SWITCH (PNL R13A2, S8) IS IN THE 'STO' POSITION

THIS SIGNAL ENABLES THE EA1 TO POSITION THE ANTENNA INTO THE STOW CONFIGURATION

MOTOR PHASING

DEPLOY		STOW	
POWER	MOTOR	POWER	MOTOR
ΦA	ΦA	ΦA	ΦA
ΦB	ΦB	ΦB	ΦC
ΦC	ΦC	ΦC	ΦB


STATOR
ROTOR
OUTPUT SHAFT
BRAKE - WITH BUILT IN REDUNDANCY
LEAD WIRE

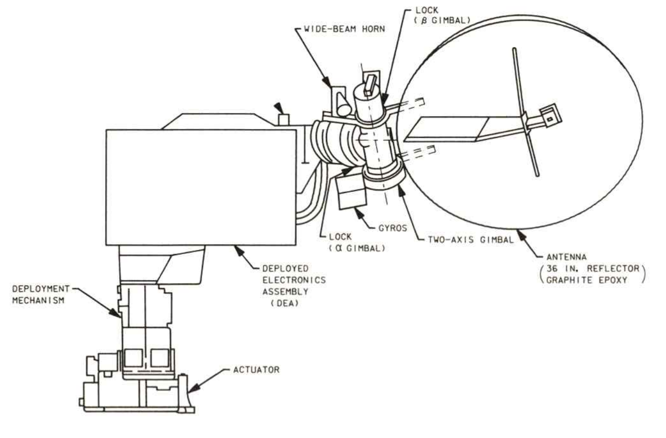
NOTES: ⟨1⟩ NON STANDARD MOTOR
● NO TORQUE LIMITER

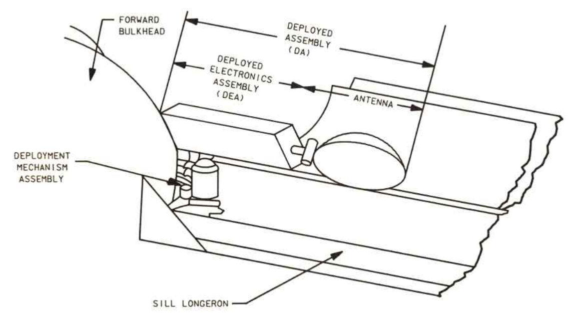
7 KU-BD ANT DPY/STO/JETT

SIGNATURE	DATE	
DSGN TERRI FORSYTHE	1/31/83	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR		KU-BAND ANTENNA DEPLOY/STOW/JETTISON
ENGR		
ENGR		
APP		
APP		SPACE SHUTTLE — DWG NO 15.7A,C
OMNIPLAN		OV099 & 103
LTR C — PCN 2		104.5 X 34 — PAGE 15.7A-1 — SHEET 1 OF 2

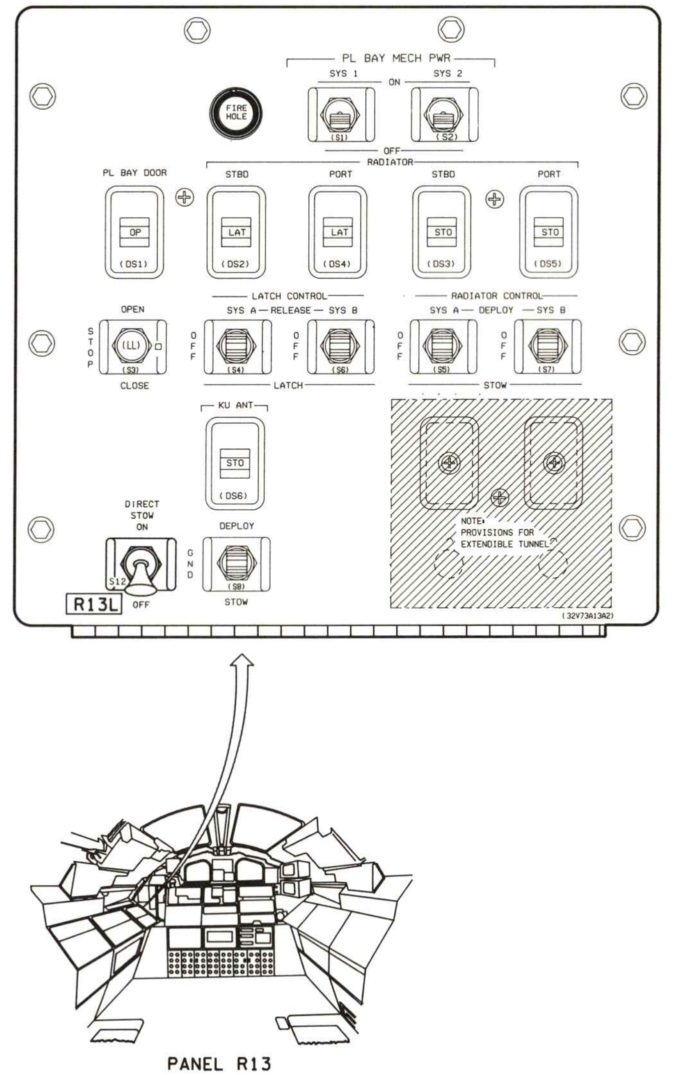
BASIC REV C-2

DATE: 2/29/84	NAME: LMB	VERSION: INK, 5
DATE: 3/7/84	NAME: JN	VERSION: NIT, 1

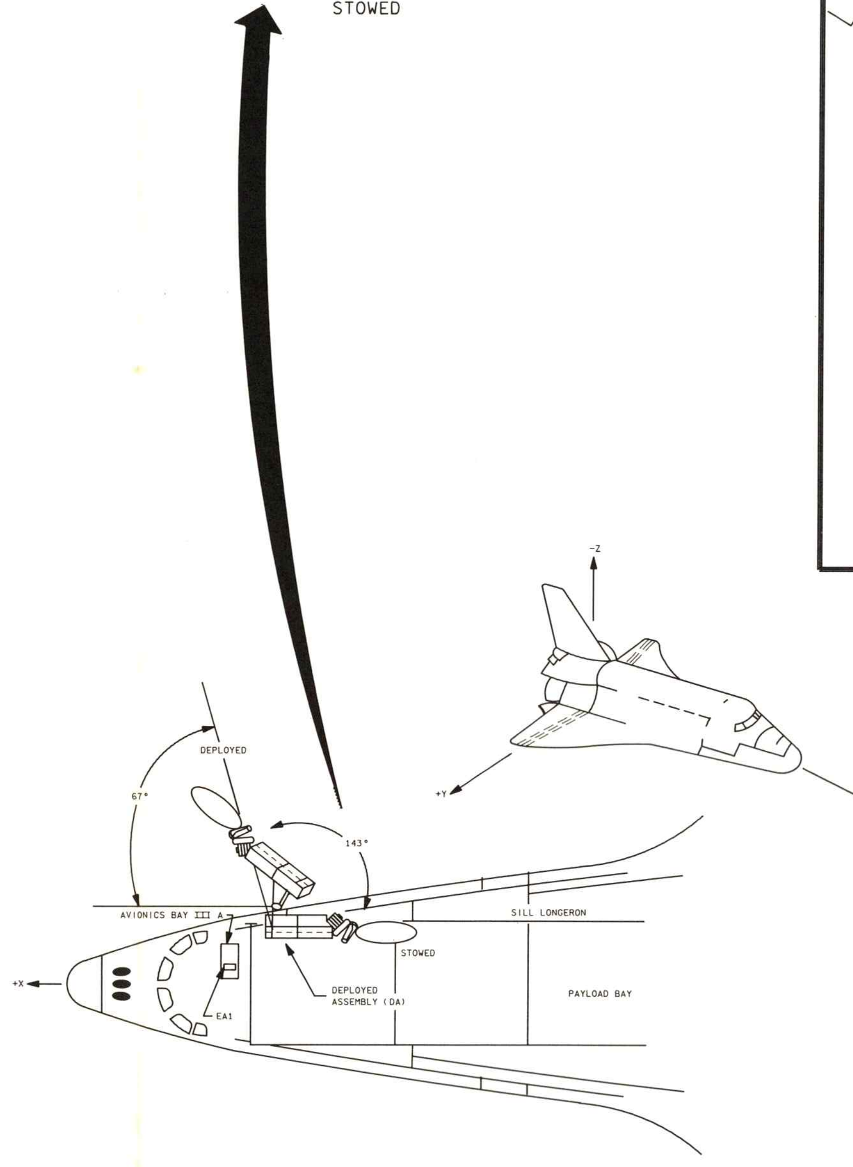

WIDE-BEAM HORN
LOCK (β GIMBAL)
GYROS
LOCK (α GIMBAL)
TWO-AXIS GIMBAL
ANTENNA (36 IN. REFLECTOR GRAPHITE EPOXY)
DEPLOYED ELECTRONICS ASSEMBLY (DEA)
DEPLOYMENT MECHANISM
ACTUATOR


FORWARD BULKHEAD
DEPLOYED ASSEMBLY (DA)
DEPLOYED ELECTRONICS ASSEMBLY (DEA)
ANTENNA
DEPLOYMENT MECHANISM ASSEMBLY
SILL LONGERON

STOWED

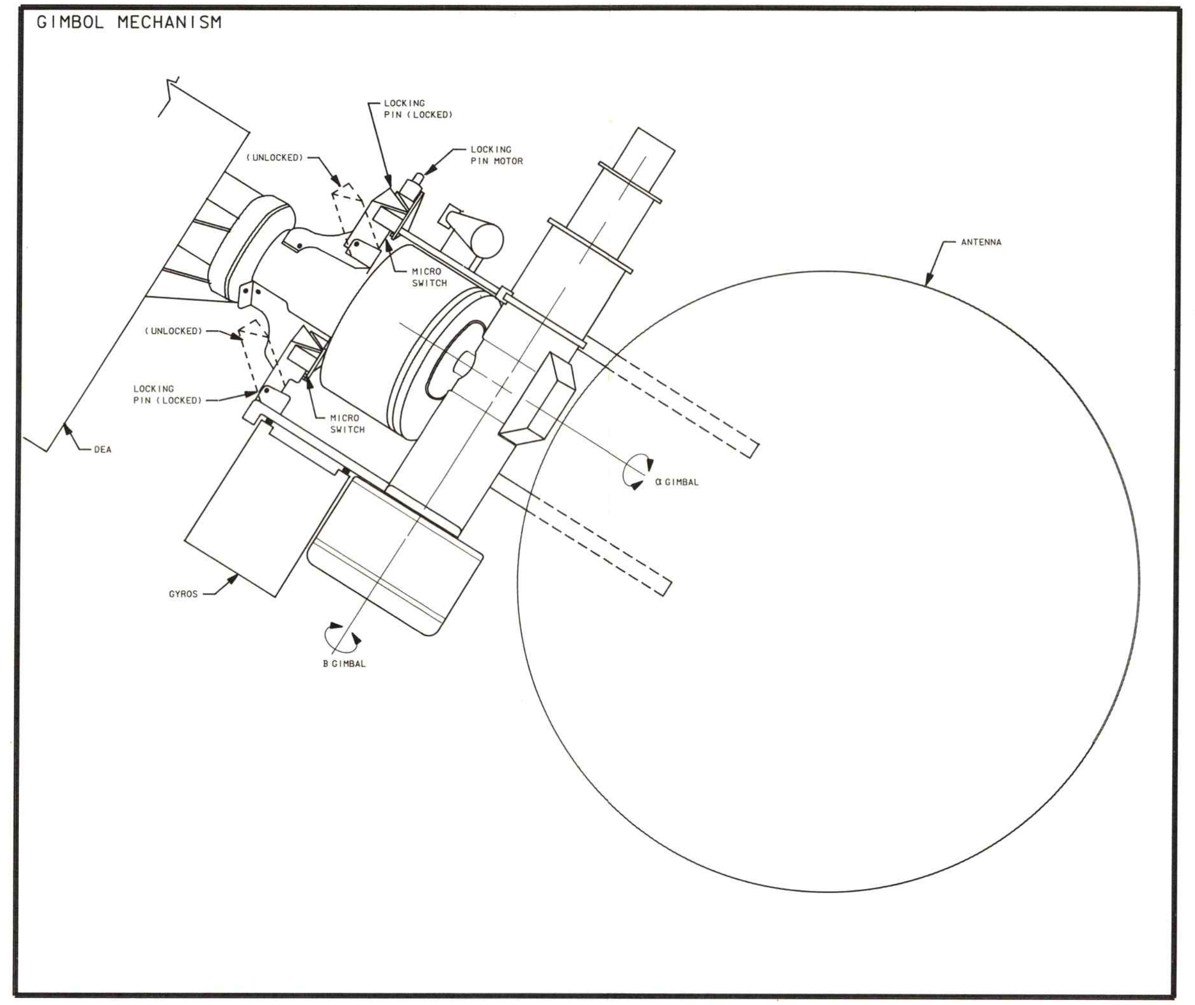

PL BAY MECH PWR
SYS 1
ON
SYS 2
FIRE HOLE
(S1)
(S2)
OFF
RADIATOR
PL BAY DOOR
STBD
PORT
STBD
PORT
OP
LAT
LAT
STO
STO
(DS1)
(DS2)
(DS4)
(DS3)
(DS5)
LATCH CONTROL
SYS A — RELEASE — SYS B
RADIATOR CONTROL
SYS A — DEPLOY — SYS B
OPEN
STOP
(LL)
(S3)
CLOSE
OFF
(S4)
(S6)
(S5)
(S7)
LATCH
STOW
KU ANT
STO
(DS6)
DIRECT STOW ON
S12
R13L
OFF
DEPLOY
GND
(S8)
STOW
NOTE: PROVISIONS FOR EXTENDIBLE TUNNEL
(32V73A13A2)

PANEL R13

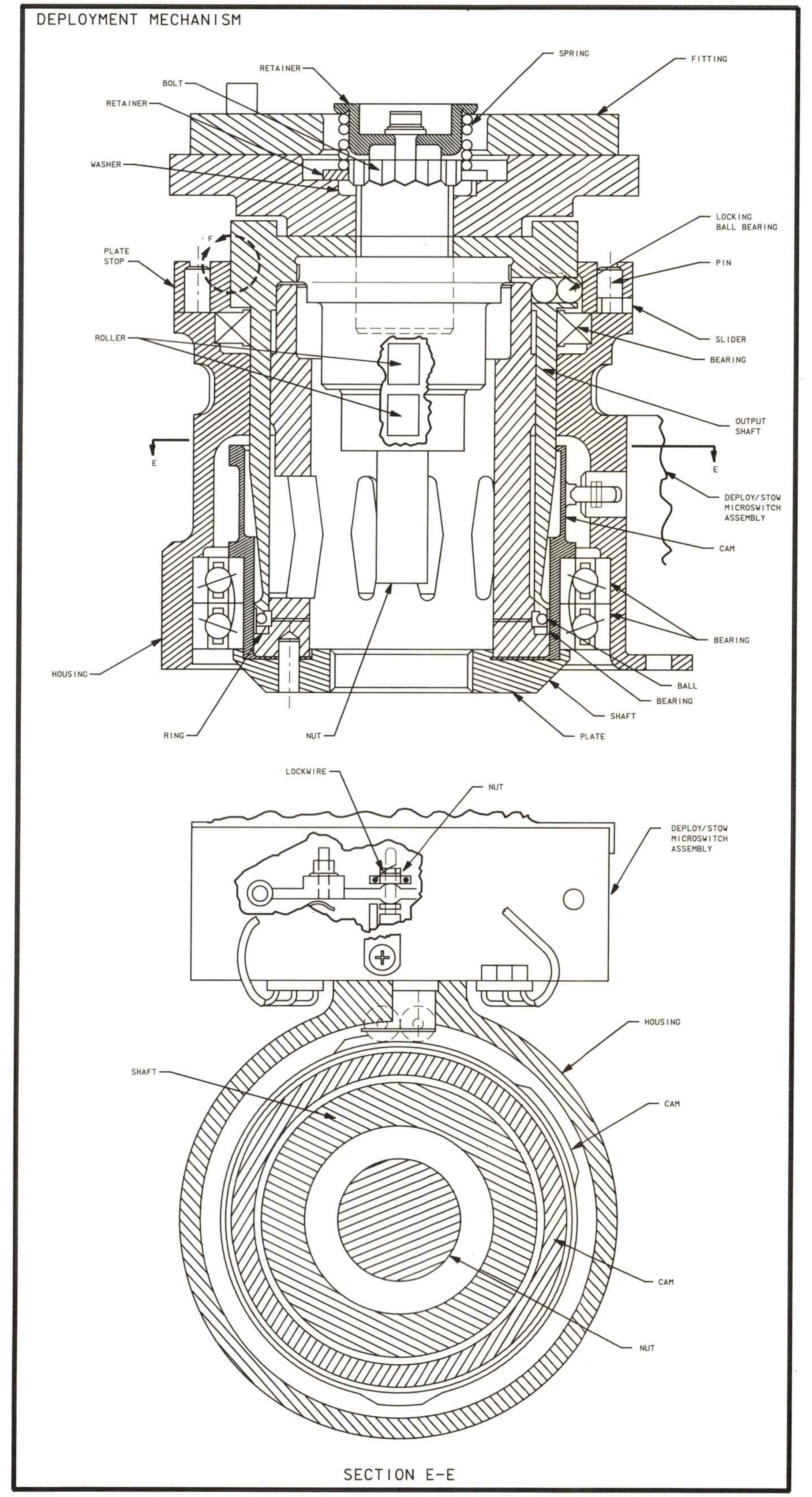

-Z
+Y
+X
DEPLOYED
67°
143°
AVIONICS BAY III A
SILL LONGERON
STOWED
+X
EA1
DEPLOYED ASSEMBLY (DA)
PAYLOAD BAY

DEPLOYED ASSEMBLY LOCATION

GIMBOL MECHANISM

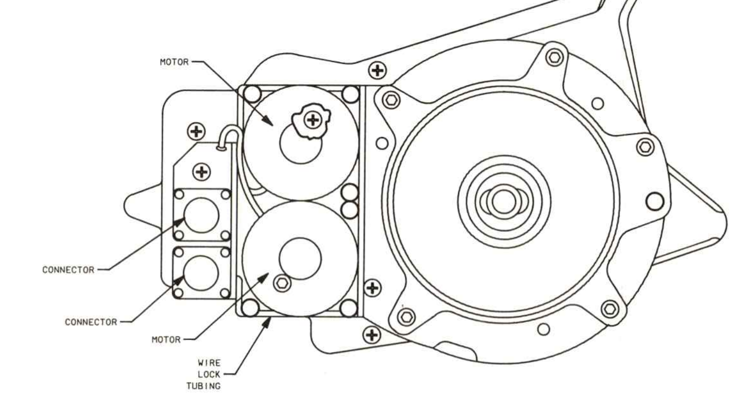

LOCKING PIN (LOCKED)
LOCKING PIN MOTOR
(UNLOCKED)
MICRO SWITCH
(UNLOCKED)
LOCKING PIN (LOCKED)
MICRO SWITCH
DEA
ANTENNA
α GIMBAL
GYROS
β GIMBAL

DEPLOYMENT MECHANISM

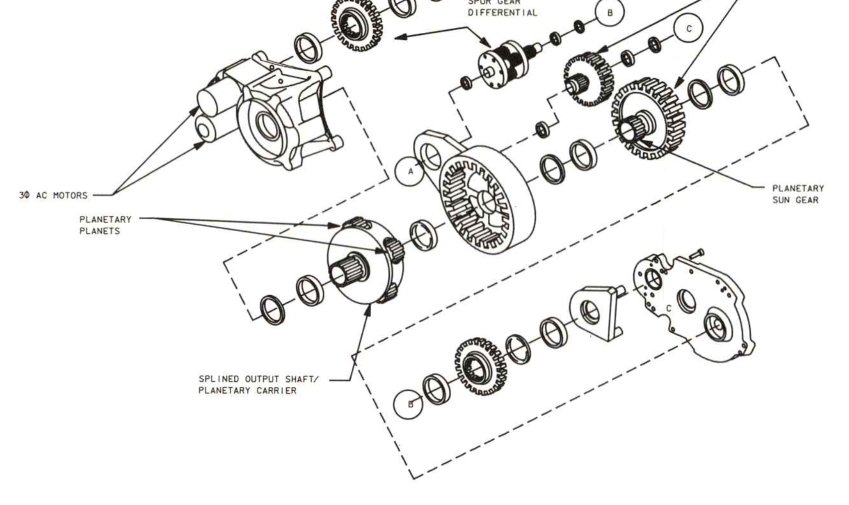

RETAINER
SPRING
FITTING
BOLT
RETAINER
WASHER
F
PLATE STOP
LOCKING BALL BEARING
PIN
SLIDER
BEARING
ROLLER
OUTPUT SHAFT
E
E
DEPLOY/STOW MICROSWITCH ASSEMBLY
CAM
BEARING
HOUSING
BALL
BEARING
SHAFT
PLATE
RING
NUT
LOCKWIRE
NUT
DEPLOY/STOW MICROSWITCH ASSEMBLY
HOUSING
SHAFT
CAM
CAM
NUT

SECTION E-E

ACTUATOR ASSEMBLY


MOTOR
CONNECTOR
CONNECTOR
MOTOR
WIRE LOCK TUBING

TOP VIEW


A
SPUR GEAR DIFFERENTIAL
B
C
INTERMEDIATE GEARING
A
3Φ AC MOTORS
PLANETARY PLANETS
PLANETARY SUN GEAR
SPLINED OUTPUT SHAFT/ PLANETARY CARRIER
C
B

GEAR TRAIN ASSEMBLY

DATE: 3-2-83	NAME:	VERSION: INK, 1
DATE: 6/8/83	NAME: SHO	VERSION: INK, 2
DATE: 6/15/83	NAME: LSD	VERSION: INK, 3
DATE: 2/29/84	NAME: LMB	VERSION: INK, 5
DATE: 3/7/84	NAME: JN	VERSION: NIT, 1

7 KU BAND MECH

SIGNATURE	DATE	
DSGN BARBARA BOWEN	2/9/82	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR BARBARA BOWEN	2/9/82	KU BAND MECHANICAL
ENGR	1/6/84	
ENGR		
APP		
APP		SPACE SHUTTLE — DWG NO 15.7
KENTRON K K	4-10-84	ALL
LTR C — PCN 2		93.5 X 34 — PAGE 15.7-2 — SHEET 2 OF 2

DATE: 5/6/80	NAME: TLF	VERSION: INK, 6
DATE: 5/14/80	NAME: JBH	VERSION: INK, 7
DATE: 11/18/80	NAME: SKK	VERSION: BPT, 1
DATE: 6/12/81	NAME: LSD	VERSION: INK, 10
DATE: 7/16/81	NAME: TLF	VERSION: INK, 11
DATE: 8/22/83	NAME: LGH	VERSION: INK, 13
DATE: 3/5/84	NAME: LMB	VERSION: BPT, 2
DATE: 3/8/84	NAME: LGH	VERSION: INK, 1

DATE: 3/5/84	NAME: LMB	VERSION: BPT, 2
DATE: 3/8/84	NAME: LGH	VERSION: INK, 1

MN A
GCILC
PNL R15, B CB44
MN C
PNL R15, B CB49
S-BAND PM
CONTROL CMD
PANEL
PNL C3 S9
COMMAND MNC
COMMAND MNA
GCIL (XPNDR)
SPREAD SPECTRUM DISABLE (XPNDR 1 & 2)
RANGING DISABLE (XPNDR 1 & 2)
FREQ HI (XPNDR 1 AND 2)
FREQ LOW (XPNDR 1 AND 2)
SGLS MODE (XPNDR 1 AND 2)
STDN LOW MODE (XPNDR 1 AND 2)
STDN HIGH MODE (XPNDR 1 AND 2)
TDRS MODE (XPNDR 1 AND 2)
S-BD R/L DATA ENABLE NSP 1 AND 2 (XPNDR 1 & 2)
COMMAND POWER
XPNDR 1 ON
XPNDR 2 ON
XPNDR 1 ON (NSP1 & NSP2)
XPNDR 2 ON (NSP1 & NSP2)
PNL A1A2 S16
SIGNAL STRENGTH
XPNDR 1 AND 2
XMIT/RCV. XPNDR 2 DIRECT (STDN LOW AND SGLS MODE)
XMIT/RCV. XPNDR 1 DIRECT (STDN LOW AND SGLS MODE)
XPNDR 2 XMIT
XPNDR 1 XMIT
XPNDR 2 RCV
XPNDR 1 RCV
TO PWR AMPL
FROM PREAMPL
XPNDR 1 SEL
XPNDR 2 SEL
SIGNAL STRENGTH S-BAND PM
KU
S-BAND PL
PNL A1A1 S1
PNL A1A1 M1
MODE
STDN LO HI TDRS DATA SGLS RNG
PNL A1A2 S6
S-BD PM MODES (5) XPNDR 1
S-BD PM MODES (5) XPNDR 2
S-BD R/L DATA ENABLE (NSP 1)
S-BD R/L DATA ENABLE (NSP 2)
NSP 1 ON
NSP 2 ON
KU-SIGNAL PROCESSOR
RIGHT ATU
MS ATU
BUFFER AMPLIFIER 0 TO 5VDC
SIGNAL STRENGTH
MAIN VOLTS
ESS VOLTS
FUEL CELL
VOLTS/AMPS
PNL F9 S2
DC AMPS/SIG STR
PNL F9 M3
NETWORK SIGNAL PROC
ENCRYPTION
PWR ON OFF
PNL A1A2 S24
PWR 1
PWR 2
ENCRYPTION ZEROIZE
NORM
PNL R12 S12
ZEROIZE 1
ZEROIZE 2
PAYLOAD STATION
COMSEC 1 AND 2
RTN LINK 96/192 DATA AND CLOCK (NSP1)
RTN LINK 96/192 DATA AND CLOCK (NSP2)
FWD LINK 32/72 KBPS DATA AND CLOCK (NSP1)
FWD LINK 32/72 KBPS DATA AND CLOCK (NSP2)
MODE ALL SELECT
PNL A1A2 S25
T/R RCV BYPASS
PNL A1A2 S26
ALL SELECT RCV/BYPASS
HDR/LDR
OPR 1
OPR 2
NSP 1 AND 2
XPNDR 1 XMIT (VOICE AND DATA)
XPNDR 2 XMIT (VOICE AND DATA)
96 KBPS LDR-STDN AND SGLS
192 KBPS HIGH-STDN AND SGLS
288 KBPS LOW - TDRS
XPNDR 1 RCV (VOICE, CMD, AND DATA)
XPNDR 2 RCV (VOICE, CMD, AND DATA)
32 KBPS LDR - STDN AND SGLS
72 KBPS HDR - STDN AND SGLS
96 KBPS LDR - TDRS
NSP 1/NSP 2
96/192/288/576 KBPS
GSE
NETWORK SIG PROC
CODING XMIT ON OFF
PNL A1A2 S21
CODING RCV ON OFF
PNL A1A2 S22
DATA RATE XMIT HIGH LOW
PNL A1A2 S18
DATA RATE RCV HIGH LOW
PNL A1A2 S19
UPLINK DATA S-BD KU
PNL A1A2 S20
AUDIO CENTER
VOICE RECORD SELECT
CHANNEL 1
CHANNEL 2
OFF A/G1 A/G2 A/A ICOM A ICOM B
PNL A1A3 S15 S16
POWER
PNL A1A2 S23
UPLINK NSP BLOCK
GPC BLOCK
ENABLE
PNL C3 S13
GCIL (NSP)
NSP XMIT CODING ON (NSP1 & 2)
NSP RCV CODING ON (NSP1 & 2)
NSP XMIT DATA RATE (HIGH) (LOW) (NSP1 & 2)
NSP RCV DATA RATE (HIGH) (LOW) (NSP1 & 2)
DATA SOURCE (KU) (S) (NSP1 & 2)
CHANNEL 1/2 VOICE (ON) (OFF) (NSP1 & 2)
MDM FF 1
MDM FF 3
MESSAGE DISCRETE (NSP 2)
MESSAGE DISCRETE (NSP 1)
WORD DISCRETE (NSP 2)
WORD DISCRETE (NSP 1)
NSP 2 DATA
NSP 1 DATA
PCMMU 1
PCMMU 2
PCM 1/2 ENABLE (NSP 1 & 2)
PCMMU DATA AND TIMING (8 LINES) (NSP 1)
PCMMU DATA AND TIMING (8 LINES) (NSP 2)
KU SIGNAL PROC
FWD LINK CMD AND VOICE 72 KBPS (NSP1)
FWD LINK CMD AND VOICE 72 KBPS (NSP2)
RTN LINK VOICE AND DATA, 192 KBPS (NSP1)
RTN LINK VOICE AND DATA, 192 KBPS (NSP2)
ACCU 1 AND 2
VOICE AG1, AG2 (NSP2)
VOICE AG1, AG2 (NSP1)
DOWNLINK VOICE AG1, AG2, RCD CHAN 1 AND 2 (NSP 2)
DOWNLINK VOICE AG1, AG2, RCD CHAN 1 AND 2 (NSP 1)
NSP 1 POWER
NSP 2 POWER
NSP 2 BLOCK
NSP 1 BLOCK
PAYLOAD STATION
PS/ACCU ENABLE (NSP1 & 2)
PS VOICE 1 AND VOICE 1 CLOCK (XMIT) (NSP1 & 2)
PS VOICE 2 AND VOICE 2 CLOCK (XMIT) (NSP1 & 2)
PS VOICE 1 AND VOICE 1 CLOCK (RCV) (NSP1 & 2)
PS VOICE 2 AND VOICE 2 CLOCK (RCV) (NSP1 & 2)
GSE SELECT (NSP 1)
GSE SELECT (NSP 2)
LF 1
V74K5031N
V74K5030N
S-BAND FM
CONTROL COMMAND PANEL
PNL A1A3 S1
POWER
PNL A1A3 S3
MDM LF-1
FM XMTR 1 OFF
FM XMTR 2 OFF
COMMAND
PANEL
XMTR NO 1
XMTR NO 2
CMD PWR 1
CMD PWR 2
GCIL (S-BAND FM)
FM SYSTEM 1 ON
FM SYSTEM 2 ON
PROC 1
PROC 2
DATA SOURCE
TV PL ANLG PL DIGITAL PL RCDR ME OFF OPS RCDR DOD
PNL A1A3 S4
FM SIG PROC 1
FM SIG PROC 2
PROC 1 MODES (8)
PROC 2 MODES (8)
DOD P/L
ENCRYPTED DATA 256 KBPS
CCTV
4.5 MHZ VIDEO
FM SIGNAL PROC 1 MODES
FM SIGNAL PROC 2 MODES
OPS RCDR 1
OPS RCDR 2
RECORDER 1 OUT (128/192 KBPS)
RECORDER 2 OUT (128/192 KBPS)
OPS RCDR1, 2 1.024 KBPS
TO KU-BAND SIG PROC
OPS1PB TO FM SIG PROC
OPS2PB TO KU-BAND SIG PROC
WIDEBAND DATA DIG 200 BPS TO 5 MBPS (NRZ)
ATTACHED P/L DIG 200 BPS TO 2 MBPS (BI-Φ-L)
ATTACHED P/L ANALOG 300 HZ TO 4 MHZ
ATTACHED PAYLOAD
P/L RCDR
RECORDED DATA 1.024 MBPS
MAIN ENGINES (3)
ASCENT DATA 60 KBPS
3-SERIAL LINES
14-LINES PARALLEL
14-LINES ANALOG
S-BD FM SIG PROC 1 AND 2
S-BD FM XMTR NO 1
S-BD FM XMTR NO 2
FM XMTR NO 1 ON
FM XMTR NO 2 ON
FM XMTR NO 1 RF
FM XMTR NO 2 RF
S-BAND FM RF SWITCH
FM WIDEBAND 2250 MHZ
PWR AMPL
STANDBY
PNL A1A2 S11
STBY 1
STBY 2
OPERATE
PNL A1A2 S12
OPR-1
CNTL
OPR-2
CMD PWR
GCIL (PWR AMP)
S-BD PA OPR-1
S-BD PA OPR-2
(1 SEC DELAY)
PA NO 1 NORMAL CMD
PA NO 2 NORMAL CMD
PWR AMP NO 1 STBY
PWR AMP NO 2 STBY
RPC 20A
PWR AMP 1 AND 2
XPNDR 1 SEL
XPNDR 2 SEL
PREAMP 1 HEATER
PREAMP 2 HEATER
PRE AMPL
PNL A1A2 S10
PREAMP POWER AND INTERLOCK
GCIL (PREAMP)
PREAMP 1 PWR
PREAMP 2 PWR
PREAMP 1 POWER
PREAMP 2 POWER
XPNDR 1 FREQ HIGH
XPNDR 1 FREQ LOW
XPNDR 2 FREQ HIGH
XPNDR 2 FREQ LOW
PWR AMPL 1 ON
PWR AMPL 2 ON
POWER AMPL 1 XMIT
POWER AMPL 2 XMIT
XPNDR 1 RCV (TDRS AND STDN HIGH)
XPNDR 2 RCV (TDRS AND STDN HIGH)
S-BAND PREAMP 1 AND 2
XMIT/RCV. FREQ LOW (STDN HIGH AND TDRS MODE)
XMIT/RCV. FREQ HIGH (STDN HIGH AND TDRS MODE)
ANT SW ELEC
PNL A1A2 S5
GCIL (ANT SW)
XPNDR 1 DIRECT (STDN LO AND SGLS)
XPNDR 2 DIRECT (STDN AND SGLS)
ANT SW FREQ LO-1
ANT SW FREQ LO-2
ANT SW FREQ HI-1
ANT SW FREQ HI-2
S-BD ANT ELEC SW-1
S-BD ANT ELEC SW-2
ANTENNA
UL AFT UL FWD UR FWD LL AFT UR AFT LL FWD LR FWD GPC LR AFT
PNL C3 S10
S-BAND PM ANT MANUAL AND GPC CNTL
ANT UPPER LOWER GPC
PNL A1A2 S2
S-BAND FM ANT MANUAL AND GPC CNTL
MDM PF 1
MDM PF 2
ANT GPC COMMANDS - PM ELEC 1
ANT GPC COMMANDS - PM ELEC 2
ANT GPC COMMANDS - FM ELEC 1
ANT GPC COMMANDS - FM ELEC 2
ELEC 1 PWR
ELEC 2 PWR
(FM XMTR 1 AND 2) FM IN NO 1
S-BAND ANT SWITCH ASSY (ELEC 1 AND 2)
MIDDECK TV INPUT STATION
PNL M058F
EMU TV RECEIVER
(EMU) FM IN NO 2
TO TV SYSTEM
VIDEO OUTPUT
MN C
TV
CABIN
PNL R15:D CB48
+28V
PWR ON
CMD
PNL M058F S10
+28V CAMERA ON/OFF CMD
PWR
ELEC 1
ELEC 2
SWITCH BEAM CONTROL ASSY (ELEC 1 AND 2)
LL BEAM CNTL
LR BEAM CNTL
UL BEAM CNTL
UR BEAM CNTL
BEAM CNTL
LL AFT FWD
LR AFT FWD
UL AFT FWD
UR AFT FWD
S-BAND ANTENNA UPPER HEMI
S-BAND ANTENNA LOWER HEMI
S-BAND FM HEMI ANTENNA (STDN ONLY)

1 COMM 1*

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

COMM OVERVIEW
S-BAND

SIGNATURE	DATE
DSGN L. M. BUCHANAN	5-17-78
DR Katherine Edmundy	7-24-78
ENGR J. Hanchett	4-2-84
ENGR	
APP	4-2-84
APP	
OMNIPLAN - J. R. Kinkel	4-30-84

DWG NO 16.1
SPACE SHUTTLE
ALL
SHEET 1 OF 5
PAGE 16.1-1
104.5 X 34
LTR C
PCN 2

BASIC REV C-2

BASIC REV C

W 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
AUDIO CENTER
VOICE RECORD SELECT
CHANNEL 1
CHANNEL 2
A/G 1
A/G 2
A/A
ICOM A
ICOM B
OFF
FIRE HOLE
PNL A1A3
FROM PILOT ATU PWR SUP
FROM MS ATU PWR SUP
TO PILOT ATU
TO MS ATU
DOCKING RING
SPACELAB
TONE
PAGE
ON
UHF
T/R
PLBAY OUTLETS
ORBITER HEADSET
PILOT HELMET HEADSET ASSY
MS COMM CARRIER ASSY
EARPHONE SIG
MIKE SIG
MIKE PWR
HEADSET INTERFACE UNIT
PILOT AUDIO INTERFACE UNIT
XMIT
ICOM
(CLIP-ON)
ESS 1BC
ESS 2CA
AUDIO
LEFT
RIGHT
3A
PNL R15:F
CB4
CB6
LEFT COMM PNL L5
RIGHT COMM
POWER
CCU
SUIT
PNL R6
CRHC
PRHC
NSP 1 AND 2
CDR AUDIO PANEL AND ATU
PILOT AUDIO PANEL AND ATU
RIGHT AUDIO
POWER AUD/TONE
VOX SENS
TACAN ID
MASTER VOL
VOLUME
TACAN
XMIT/ICOM MODE
PTT/HOT
PTT/VOX
PTT/PTT
VOX/VOX
CONTROL
NORM
PAGE▼
MIKE PWR
FROM AUDIO CENTER
FROM AUDIO CTR
CDR MIKE SIG
PLT MIKE SIG
EARPHONE
PTT XMIT
NSP 1 ON
NSP 2 ON
LDR XMIT
SIMPLEX
DUPLEX
PNL 05
PNL 09
PILOT PWR SUP +12V
28V TO UHF MODE SWITCH
28V FROM PILOT AND MS POWER SUPPLY
UHF
XMIT FREQ 296.8
SPLX PWR AMP ON
SQUELCH ON
259.7
UHF MODE
SIMPLEX+G RCV
G T/R
EVA
PNL 06
MN A
MN C
7.5A
PNL R15:B
CB13
CB18
D & C CONTROL
UHF TRANSCEIVER
R 296.8
R 259.7
R 243.0
R 279.0
T
MUX
BYPASS SWITCH
PA
EXTERNAL ANTENNA
AIRLOCK ANTENNA
AUDIO TO UHF
AUDIO FROM UHF
A/A KEY TO UHF
ACCU
SECONDARY ACCU CCTS
PRIMARY ACCU CCTS
VSU
PAYLOAD BAY OUTLETS
LAUNCH UMBILICAL STATION
NSP 1
NSP 2
OPS RCDR 1
OPS RCDR 2
RCDR 1
RCDR 2
SPACE LAB
DOCKING RING
C&W
FROM AIRLOCK AUDIO CONTROL
PWR FROM PS/AIRLOCK CB10
PS AUDIO PANEL AND ATU
MS AUDIO PANEL AND ATU
MISSION STATION AUDIO
MS PWR
TO PS ATU FOR BACKUP
PNL L9
PNL R10
MS PWR SUP +12V
SERIAL DATA WORD (8 LINES)
MIKE SIGNAL TO ACCU (8 LINES)
EARPHONE AUDIO FROM ACCU (8 LINES)
MS AUDIO
OS AUDIO
FROM AIRLOCK AUDIO CONT
MIDDECK SPEAKER AUDIO PANEL AND ATU
MID DECK SPEAKER AUDIO
MASTER SPEAKER VOLUME
TONES ACCU
ACCU BYPASS
SPKR PWR SPKR/MIC
PNL M042F
KLAXON AND SIREN
ALL C & W TONES
MID DECK SPEAKER SIGNAL
MIDDECK SMU M029 J
OS SMU A2
MIC LEVEL
OS SMU PWR
OS SPKR SIGNAL
PWR TO PS ATU
PS/AIRLOCK
CB10
EMU 1
EMU 2
AIRLOCK
AIRLOCK ORBITER HEADSET
EARPHONE 1
EARPHONE 2
MIKE PWR 1
MIKE PWR 2
MIKE 1 SIG
MIKE 2 SIG
XMIT 1
XMIT 2
ICOM 1
ICOM 2
CCU 1
CCU 2
POWER ON
POWER FROM CB10
PNL AW82D
AIRLOCK AUDIO
MASTER VOL 1
MASTER VOL 2
PNL AW18D
MID-DECK
AIRLOCK PANEL AND ATU
AIRLOCK PWR
MIKE 1
MIKE 2
AUD CNTR
CB1
CB9
PNL C3

*1 COM OV AUD 2

SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS	
DSGN PAT SHERRILL			
DR VICKI DOGGETT	5-16-78	COMM OVERVIEW AUDIO	
ENGR Allen W. Baker	1-5-84		
ENGR			
APP	1/30/84		
APP		SPACE SHUTTLE	DWG NO
OMNIPLAN		099, 103	16.1A.C
LTR C PCN 2		126.5 X34	PAGE 16.1A-2 SHEET 2 OF 5

BASIC REV C-2

BASIC REV C-2

DATE: 3/13/79	NAME: JBH	VERSION: INK, 1
DATE: 2/25/80	NAME: JBH	VERSION: BPT, 2
DATE: 3/7/80	NAME: RAP	VERSION: INK, 3
DATE: 5/14/80	NAME: JBH	VERSION: INK, 4
DATE: 5/4/81	NAME: LSD	VERSION: INK, 6
DATE: 6/15/81	NAME: TLF	VERSION: INK, 7
DATE: 7/6/81	NAME: VSD	VERSION: INK, 8

AUDIO CENTER
ORBITER HEADSET
PILOT HELMET HEADSET ASSY
MS COMM CARRIER ASSY
DS COMM CARRIER ASSY
AIRLOCK
AIRLOCK ORBITER HEADSET
COM AUDIO PANEL AND ATU
PILOT AUDIO PANEL AND ATU
RIGHT AUDIO
MIDDECK CCU AUDIO PANEL AND ATU
PS AUDIO PANEL AND ATU
MS AUDIO PANEL AND ATU
MISSION STATION AUDIO
MIDDECK SPEAKER AUDIO PANEL AND ATU
DS AUDIO PANEL AND ATU
AIRLOCK PANEL AND ATU
AIRLOCK AUDIO
UHF TRANSCEIVER
ACCU
SECONDARY ACCU CCTS
PRIMARY ACCU CCTS

*1 COM OV AUD 2

SIGNATURE	DATE	
DSGN PAT SHERRILL		NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR VICKI DOGGETT	5-16-78	COMM OVERVIEW AUDIO
ENGR Robert Reynolds	10/18/83	
ENGR J Hanchett	10/18/83	
APP E Farrell	10/20/83	
APP		SPACE SHUTTLE
OMNIPLAN.		OV 102
LTR C PCN 2		126.5 X34

DWG NO 16.1B

PAGE 16.1B-2 SHEET 2 OF

DATE: 3/4/82	NAME: SKK	VERSION: BPT, 2
DATE: 3/9/82	NAME: CAR	VERSION: INK, 1
DATE: 3/5/84	NAME: VSH	VERSION: BPT, 3

DATE: 3/4/82	NAME: SKK	VERSION: BPT, 2
DATE: 3/9/82	NAME: CAR	VERSION: INK, 1
DATE: 3/5/84	NAME: VSH	VERSION: BPT, 3

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3
2
1
ORBITER HEADSET
HEADSET INTERFACE UNIT
MIKE POWER +28V
MIKE SIGNAL
MIKE SIGNAL RETURN
EARPHONE SIGNAL
EARPHONE SIGNAL RETURN
PTT COMMON
XMIT
ICOM
(CLIP-ON)
MID DECK COMM (PNL M039M)
MID DECK COMM
CCU POWER
ON
OFF
PNL M039M
MIKE POWER
SLEEP STA TONE
TONE B2
RETURN
FROM CAUTION AND WARNING
PNL M058F
MID DECK SMU M029J
MID DECK SMU
PNL M029J
MID DECK
MIC LEVEL
MICROPHONE
PRE-AMP
AMP
POWER SUPPLY
TO LOGIC
MIC SW CONTROL
DRIVER AMP
COMPARATOR > 0 DBM
MIC KEY
FROM ACA5
MID DECK SPEAKER
MID DECK SPEAKER/MIKE
VOX PTT PAGE DETECTOR
DRIVER
SPKR
PWR AMP
SPKR SW CONTROL
SPKR VOX
TONE B
KLAXON (ΔP) AND SIREN (FIRE)
C&W TONE DETECTOR
FROM CAUTION & WARNING
TONES/AUDIO MIXING CIRCUIT
C & W A TONES
TONE A2
MID DECK SPEAKER AUDIO PANEL/ATU M042F
NOT USED
NSP 1 ON
NSP 2 ON
LOW DATA RATE
DUPLEX
SIMPLEX
BIT 21 EVA PAGE
MULTIPLEXER
MIDDECK ATU POWER SUPPLY
EMI FILTER
20V SERIES REG
6V SHUNT REG
12V SERIES REG
10V SHUNT REG
DIGITAL CLOCK GENERATOR
TO MIKE CKTS AND LOGIC
TO EARPHONE CKTS
CLOCK TO MIDDECK DIGITAL CIRCUITS
MID DECK SPEAKER AUDIO
POWER
AUD/TONE
PNL M042F
VOX ENABLE
VOX THRESHOLD DETECTOR
VOX SENS
MIKE SIG TO ACCU
FROM AIRLOCK CCU 2
FROM MID DECK CCU
ICOM B
ICOM A
A/G 2
A/G 1
A/A
ENABLE
T/R
PNL M075F
TRANSMITTER ENCODER
MID DECK SPEAKER SERIAL DATA WORD TO ACCU
BASIC BASIC REV C

8. ON OV102 THE MID DEVK CCU HAS ITS OWN DEDICATED ATU

7▷ THE KLAXON AND SIREN SIGNALS ARE CONNECTED TO A SEPARATE VOICE COIL ON THE SPEAKER. THE SPEAKER POWER SWITCH DOES NOT HAVE TO BE ON IN ORDER FOR THE KLAXON AND SIREN TO BE HEARD.

5▷ SYSTEM CONFIGURATION CONTROL BITS ARE PROVIDED BY THE MS ATU (PRIMARY) AND PILOT ATU (SECONDARY) AND ARE BITS 16-23, 64-87, 96-103, 112-119

4▷ STATION (ATU) CONFIGURATION CONTROL BITS ARE BITS 24-63.

3▷ ORBITER HEADSETS ARE: COMM CAP, MINI-HEADSET, WIRELESS HEADSET OR LIGHTWEIGHT HEADSET.

2. PTT 1 = ICOM PTT OR HOT MIKE
PTT 2 = PTT XMIT POSITION OF THE PTT SWITCH SELECTED.

NOTES: 1. VOX = VOX MODE SELECTED AND VOX THRESHOLD EXCEEDED
VM = VOX XMIT POSITION OF THE MODE SWITCH SELECTED.

10A ATU 3

SIGNATURE	DATE		
DSGN R. COLLINCS JR.	12/30/81	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS	
DR		AUDIO PANEL/ATU MID DECK SMU AND CCU	
ENGR M.T. C. Hex	4/4/84		
ENGR J Hench H	4/4/84		
APP			
APP		SPACE SHUTTLE	DWG NO 16.10
OMNIPLAN		ALL	
LTR C	PCN 2	126.5 X 34	PAGE 16.10-3 SHEET 3 OF 4

BASIC REV C-2

DATE: 1/31/84	NAME: JMB	VERSION: BPT, 11

DATE: 6/16/83	NAME: JFK	VERSION: BPT, 6
DATE: 7/01/83	NAME: TMW	VERSION: INK, 3
DATE: 1/16/84	NAME: JN	VERSION: BPT, 7
DATE: 1/25/84	NAME: SVJ	VERSION: BPT, 10

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2
1
P/L TRANSFER SWITCH
POS 1
(1RHC, 2 LHC)
POS 2
RHCP
LHCP
PAYLOAD ANTENNA
90°
P/L INTERROGATOR NO 2
P/L INTERROGATOR NO 1
PI NO 2
PI NO 1
TRIPLEXER
POWER CONVERTER
CMD PROCESSOR
SYNTHESIZER
RCVR SYNTHESIZER
FIRST IF
SECOND IF
TX SYNTHESIZER
POWER AMPLIFIER
BASEBAND
S-BAND PAYLOAD
CHANNEL SELECT
MODE SELECTION
P/L DATA
RTN
CIU (P/L DATA)
4.4 1,2
IUS SHB
K2B

14 S-BAND PL INTRG

SIGNATURE		DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DSGN	S.K. Kimbrell	6/25/82	
DR			S-BAND PAYLOAD INTERROGATOR
ENGR			
ENGR			
APP			
APP			SPACE SHUTTLE — DWG NO 16.14
KENTRON			ALL
LTR C	PCN 2		126.5 X 34 — PAGE 16.14-1 — SHEET 1 OF 1

BASIC REV C-2

BASIC REV C-2

DATE: 7/5/83	NAME: LMB	VERSION: INK, 5
DATE: 1/26/84	NAME: JHL	VERSION: BPT, 12
DATE: 1/31/84	NAME: JN	VERSION: INK, 6

DATE: 11/3/82	NAME: LMB	VERSION: INK, 4
DATE: 6/16/83	NAME: JFK	VERSION: BPT, 10
DATE: 7/5/83	NAME: LMB	VERSION: INK, 5
DATE: 1/26/84	NAME: JHL	VERSION: BPT, 12
DATE: 1/31/84	NAME: JN	VERSION: INK, 6

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1
PSP NO2
PSP NO 1
PSP NO 2 CMD POWER ON
PSP NO 1 CMD POWER ON
BC 2
BC 1
GCIL 10-10
GCIL 10-5
GCIL 7-6
GCIL 15-6
GCIL 16-7 P/L INTGTR #2
GCIL 8-7 P/L INTGTR #1
S-BAND PAYLOAD POWER
SYSTEM
SELECT
P/L INTGTR NO. 1 ON
P/L INTGTR #2 RTN
P/L INTGTR #2 AGC
P/L INTGTR #1 AGC
P/L INTGTR #1 RTN
OFF
INTRG
PSP
BOTH
PSP 1 ON
PSP 2 ON
P/L INTGTR #2 ON
PNL A1A2 S13
PNL A1A2 S14
V74 S3206E SW SEL PSP ON 1 S/S 1=ON
V74 S3207E SW SEL INTRG ON 1 S/S 1=ON
V74 X4890E GCIL PSP 1 ON 1 S/S 1=ON
V74 X4891E GCIL PSP 2 ON 1 S/S 1=ON
V74 X4894E GCIL CMD OUT INTERROGATOR 1 S/S 1=INTGTR
V74 X4895E GCIL CMD OUT UMB 1 S/S 1=UMB
POWER CONVERTER
S-BAND PM
S-BAND PL
KU
PNL A1A1 S1
SIGNAL STRENGTH
(M1)
S-BAND PAYLOAD
PSP CMD OUTPUT
INTRG
P/L UMB
PNL A1A2 S15
GCIL 7-9
GCIL 7-10
GCIL 15-9
GCIL 15-10
INTRG
UMB
A/D
I/O
TLMCLK
HAMMING CODER MUX AND REG SHIFTER
MICRO F2827-14 PROC
MUX REG 8 X 8
PRGRM CONTLR
FIELD SEL REG
MEM ADD + SEL REG
PREVIOUS ADD REG
PIPELINE REG
ALU OUTPUT F0-F7
DATA BUS 1-8
CB1 THRU CB32
RAM BUS 1-8
PAO 1-11 (PROGRAM ADDRESS)
CB1-32
WRITE ENABLE
12 BUS (12-1 THRU 15-8)
ADDRESS BUS 3 (MA)
RAM BUS 1 THRU 8
CB9 THRU 12 AND CB28 THRU 30
INIT
1.024 CLK
FRAME SYNC LOCK LOGIC
MEMORY I/O CNTLR
SERIAL TO PARALLEL
WRITE/READ CONTROL
FRAME SYNC LOCK LOGIC AND PWR TRANSIENT DETECTOR
TELEMETRY DATA MEMORY BITS 1 AND 2
TELEMETRY DATA MEMORY BITS 3 AND 4
TELEMETRY DATA MEMORY BITS 5 AND 6
TELEMETRY DATA MEMORY BITS 7 AND 8
PARALLEL TO SERIAL SHIFT REGISTER
V74 X6000E FR SYNC 1 S/S 1=SYNC
V74 X6002E B/S LOCK 1 S/S 1=SYNC
TLM DATA OUT
DATA CLOCK OUT
PDI 17.4
TLM DATA CNTLR
TLM DATA FORMATTER
CONFIG/ STATUS READ CNTLR
CONF MSG REGISTER (CONF REFRESH BUFFER)
CONF MSG REGISTER
STATUS MSG REGISTER
FSWD01 TO FSWD02 (FRAME SYNC WORD)
STAT MSG CHK
GSE
P2
TO INTRG 2
16.14
UMB OUT
UMB 3 OUT
UMB 4 OUT
UMB 5 OUT
TO PAYLOAD BAY PAYLOADS (HARDLINE)
+10V
K3
K4
K5

SM DOWNLIST PARAMETERS

MSID NO.	NOMENCLATURE
V92X0325X	PSP 1 BYPASS
V92X0329X	PSP 2 BYPASS
V92X0800X	BUFFER AVAILABLE
V92X0801X	BUFFER BUSY
V92X0802X	REPEAT MESSAGE
V92X0803X	CONFIGURATION MESSAGE ERROR
V92X0804X	CONFIGURATION-INITIALIZED
V92X0805X	PAYLOAD COMMAND ERROR
V92X0806X	NEW CONFIGURATION MESSAGE
V92J0807C	PAYLOAD COMMAND RATE
V92J0808C	PAYLOAD COMMAND DATA TYPE
V92X0809X	IDLE PATTERN ENABLE
V92X0810X	PAYLOAD INTGTL OUTPUT SELECT
V92X0811X	UMBILICAL OUTPUT SELECT
V92X0812X	GSE OUTPUT SELECT
V92X0813X	PAYLOAD INTGTR TLM SELECT
V92X0814X	GSE TLM SELECT
V92J0815C	PSP TLM RATE
V92J0816C	PSP TLM DATA TYPE
V92J0817C	PSP UMBILICAL SELECTED
V92J0818C	PSP FRAME SYNC WORD LENGTH
V92X0819X	PSP BIT SYNC LOCK
V92X0820X	PSP FRAME SYNC LOCK
V92J0821C	PSP TLM FRAME SYNC WORD 1
V92J0822C	PSP TLM FRAME SYNC WORD 2
V92J0823C	PSP TLM FRAME LENGTH
V92X1102X	PSP LOAD REJECT
V92J1103C	LAST PSP CONFIG. MESSAGE ID.
V92J1104C	PSP LOAD REJECT/ INCREMENT CTR.
V92X1115X	PSP ILLEGAL STATUS MESSAGE
V92X1116X	PSP CMD LOAD XFER INCOMPLETE
V92X1120X	PSP TEC REJECT FLAG
V92X1121X	PSP SEQ REJECT FLAG
V92X1124X	PSP UPLINK INVALID REQUEST
V92X1127X	PSP UPLINK REJECT FLAG
V92X1128X	GNC XFER REJECT FLAG
V92X1129X	CC SPEC REJECT FLAG

15 P/L SIG PROC

SIGNATURE	DATE	
DSGN VICKI S. HUNTER	5/12/82	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR		
ENGR	3/6/84	PAYLOAD SIGNAL PROCESSOR
ENGR	3/7/84	
APP	3/9/84	
APP		SPACE SHUTTLE
KENTRON S.K. Kimura	4-30-84	ALL
LTR C	PCN 2	126.5 X 34

DWG NO 16.15

PAGE 16.15-1 SHEET 1 OF 1

BASIC REV C-2

BASIC REV C-2

DATE: 1/24/84	NAME: TMW	VERSION: BPT, 1
DATE: 1/31/84	NAME: BJB	VERSION: INK, 2

DATE: 9/1/83	NAME: JFK	VERSION: INK, 1
DATE: 1/24/84	NAME: TMW	VERSION: BPT, 1
DATE: 1/31/84	NAME: BJB	VERSION: INK, 2

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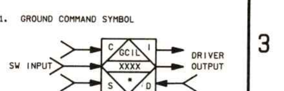
GCIL
MDM A PF 1
MDM B PF 2
SELECT A
S-BAND FM
S-BAND PM
KU-BAND
TV POWER
CONTROL
COMMAND
PANEL
ISOLATOR
POWER SUPPLY A19
POWER SUPPLY A20
REGULATOR
MDM A DATA BUFFER A2
MDM A DATA BUFFER A1
DECODER DRIVER A3, A4, A5, A6, A7, A8, A9, A11, A12, A13, A14, A15, A16, A17, A18
DRIVER 1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13, 14
DRIVER 7, 8, 15, 16
DECODER DRIVER A10
DRIVER 1, 2, 3, 6, 7, 8
DRIVER 4, 5, 9, 10
SEL DEC A
SEL DECODER A
A0 THROUGH A8
A CMD ON
B CMD ON
A CMD OFF
B CMD OFF
STROBE A
STROBE B
SEL DEC B
DRIVER SENSE
MUX
FLIP FLOP
ONE SHOT
TD 25MS
CMD
PNL
ENABLE
DISABLE
SERIES INTLK
CMD PWR
INTLK
DRIVER OUTPUT
TLM
SWITCH INPUT
CMD CNTL

4 GCIL ACTIVE TELEMETRY PARAMETER 1 = GCIL ACTIVE, AND 0 = REVERT TO PANEL

3 PROVIDES THE COMMAND CONTROL VOLTAGE TO THE COMMAND DRIVERS ASSOCIATED WITH ITS SYSTEM

2 PROM CMD OUTPUTS CONNECT TO RESPECTIVE DRIVER INPUTS (I.E. CMD NO 1 TO DRIVER NO 1)

NOTES: 1. GROUND COMMAND SYMBOL


C
GCIL
I
XXXX
S
D
SW INPUT
DRIVER OUTPUT

DESIGNATIONS

XXXX - CARD NUMBER/DRIVER NUMBER
PM - S-BAND PM CREW CONTROL SWITCH
FM - S-BAND FM CREW CONTROL SWITCH
KU - KU-BAND CREW CONTROL SWITCH
PL - PAYLOAD CREW CONTROL SWITCH
N - NO CREW CONTROL SWITCH

SERIES INTLK - S - (WHEN HIGH, ENABLES THE COMMAND DRIVER)

DRIVER SENSE - D - (WHEN HIGH, WILL HOLD THE DRIVER OUTPUT ON WHEN THE CONTROL SWITCH IS MOVED FROM THE PANEL POSITION TO THE COMMAND POSITION)

DRIVER OUTPUT - STIMULUS TO THE LRU

INTERLOCK OUTPUT 1 (PRESENT WHEN EITHER COMMAND OR PANEL DRIVER ON)

CMD PWR - C

SWITCH INPUT - STIMULUS FROM THE LRU CONTROL SWITCH

17 GCIL

SIGNATURE	DATE		
DSGN HEILIG/BUCHANAN	9/26/79	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS	
DR		GROUND COMMAND INTERFACE LOGIC (GCIL) CONTROLLER	
ENGR J. E. Conner	2/8/84		
ENGR Thomas Hamlett	2/8/84		
APP	2/10/84		
APP		SPACE SHUTTLE	DWG NO 16.17
KENTRON S. L. Kinnitil	4-30-84	ALL	
LTR C / PCN 2		126.5 X 34	PAGE 16.17-1 / SHEET 1 OF 1

DATE: 9/1/83	NAME: JFK	VERSION: INK, 1
DATE: 10/26/83	NAME: VSH	VERSION: INK, 2
DATE: 3/9/84	NAME: JMB	VERSION: INK, 3

DATE: 9/1/83	NAME: JFK	VERSION: INK, 1
DATE: 10/26/83	NAME: VSH	VERSION: INK, 2
DATE: 3/9/84	NAME: JMB	VERSION: INK, 3

POWER DISTRIBUTION ASSEMBLY
MADS BUS 1
MADS BUS 2
MADS BUS 3
5A
3A
TO MADS PCM MULTIPLEXER
HALF WAVE STRAIN GUAGE SIGNAL CONDITIONER
TYPICAL 4 CHANNELS
HALF WAVE STRAIN GUAGE
EXCITATION VOLTAGE REGULATOR
EMI PLTER
PRE REG
DC-DC CONV
REG
INTERNAL POWER SUPPLY
ORBITER TIMING BUFFER
IRIG B GMT
TO MADS PCMU
WIDE BAND SIGNAL CONDITIONER (TYPICAL)
SENSOR
CHARGE AMP
ACTIVE FILTER
OVDC
-9VDC
5VDC P-P
TO FDM SENSOR INPUTS
EMI FILTER
DC-DC CONVERTER
VOLTAGE REGULATOR
CONVERTER MODULE
PRESSURE SENSORS (10)
TO PCM MADS MULTIPLEXER
FASCOS NO 1
FASCOS NO 2
TO FDM MUX 3 INPUT
TO FDM MUX 4 INPUT
ACIP PCM MASTER/SLAVE
TO MCM
ET PCM
16KBPS
TO FDM MUX 4 CHANNEL 15 INPUT
V78 X9309E FDM WIDE BAND DATA MODE 1=DATA 1 S/S
CAL SIGNALS TO ET
MDM PF 1
AUTO CAL ON/OFF
MADS FDM CONTROL
AUTO CALIB
MAN CALIB
PNL A7A2 S7
PNL A7A2 S8
FREQUENCY DIVISION MULTIPLEXER
FM ANALOG COMPOSITE MUX 1
CH 1
SENSOR INPUTS
CH 2 INPUT (TYPICAL OF 14)
LOW PASS FILTER 500 HZ
VCO 12 ± 1 KHZ
VCO
REMAINING CHANNEL INPUTS
REFERENCE CRYSTAL OSCILLATOR 240 KHZ
LEVEL DETECTOR
V78 X9380E WIDE BAND MUX 1 BITE 1=GOOD 1S/S
T-0 UMB
DATA ENBL
CAL ENBL
CAL SIGNAL
FM ANALOG COMPOSITE MUX 2
CH 15
V78 X9381E WIDE BAND MUX 2 BITE 1=GOOD 1S/S
POWER SUPPLY A
PRE REGULATOR
DC/DC CONV
+24V REGULATOR
-12V REGULATOR
+12V REGULATOR
+5V REGULATOR
TO MUX 1 MUX 2 AND CALIBRATION
POWER SUPPLY B
DETAIL SAME AS POWER SUPPLY A
TO MUX 3 AND MUX 4
MUX 3
V78 X9382E WIDE BAND MUX 3 BITE 1=GOOD 1S/S
MUX 4
V78 X9383E WIDE BAND MUX 4 BITE 1=GOOD 1S/S
CH INPUT (TYPICAL OF 15)
VCO 184 ± 16 KHZ
CALIBRATION
OPTICAL ISOLATOR
LOGIC DECODER
CALIBRATION POSITION SWITCH DRIVERS
0 PCT
25 PCT
50 PCT
75 PCT
100 PCT
50 HZ AC
0.0 VDC
1.25 VDC
2.5 VDC
3.75 VDC
5.0 VDC
+12V DC
50 HZ OSC
50 HZ AC CAL TO ET FDM
V78 T9607A SHELF 8 HEAT SINK TEMP 2 -75°TO+175° 1S/S
TO MCM
PCM MULTIPLEXER UNIT
+28V FROM MADS BUS 1
SWITCHING PREREGULATOR
DC - DC CONVERTER
REGULATED VOLTAGES
BRIDGE COMPLETION CIRCUIT (TYPICAL)
TEMPERATURE SENSOR (TYPICAL)
+ EXCITATION
+ SENSOR OUT
- SENSOR OUT
- EXCITATION
BUS A
BUS B
PROGRAMMABLE GAIN CIRCUITS
TOLERANCE LIMITS
BITE CIRCUIT
ANLG UPR LIMIT EXCEED
ANLG LOWER LIMIT EXCEED
BI-LEVEL LOW
BI-LEVEL HIGH
ANALOG COMPARATOR
LOW LEVEL BI-LEVEL COMPARATOR
V78 X9611E PCM MUX BITE 1=NORMAL 1S/S
V78 T9606A SHELF 8 HEAT SINK TEMP 1 -75°TO+175° 1S/S
LOW LEVEL ANALOG SENSORS 0-60 MILLIVOLTS
BIPOLAR ANALOG SENSORS ±5V
HIGH LEVEL ANALOG SENSORS 0-5V
HIGH LEVEL DISCRETES 0-28V
LOW LEVEL DOSCRETES 0-5V
PASSIVE LOW PASS FILTER
BUFFER ATTENUATOR
ANALOG MULTIPLEXER
DIGITAL MULTIPLEXER
ANALOG DATA BUS
DIGITAL DATA BUS
A/D CONVERTER
OUTPUT COMBINER
BI-PHASE PCM OUTPUT
MCM
T-0 UMBILICAL
FROM ORBITER TIMING BUFFER
IRIG B GMT 100 PPS
IRIG B GMT RCVR/DCDR
FORMAT PROM
FORMAT 1 32 KBPS
FORMAT 2 64 KBPS
FORMAT 3 (NOT USED)
FORMAT 4 (NOT USED)
FROM MCM
FORMAT SELECT (1=64 KBPS, 0=32 KBPS)
SELECTED PROM ADDRESS BUS
BUFFER
FORMAT ADDRESS BUS A
FORMAT ADDRESS BUS B
17.12
10.13

NOTES:

8. ET PCM DATA SUPPLIED BY HEAVY WIECHT ET ONLY

7. MUX CHAN FREQ

CHAN	FREQ(KHZ)
1	12
2	16
3	20
4	24
5	28
6	32
7	36
8	48
9	64
10	80
11	96
12	112
13	128
14	144
15	184

6. THE BITE CIRCUITRY MONITORS FOR AN INCREASE OR DECREASE OF 3 ± 1 DB IN THE FDM COMPOSITE OUTPUT VOLTAGE

5. LOW LEVEL ANALOGS ARE GROUPED INTO 0-10 MV, 0-15MV, 0-20MV, 0-30MV, 0-40MV AND 0-60MV RANGES

4. FOR OV-099 12 WIDEBAND MEASUREMENTS ARE NEEDED AND APPROXIMATELY/85 STRAIN MEASUREMENTS ARE TAKEN

3. BOTH POWER SUPPLIES ARE REQUIRED FOR PROPER PCMU OPERATION , i.e. THEY ARE NOT REDUNDANT

2. FASCO STANDS FOR MAIN ENGINE FLIGHT ACCELEROMETER SYSTEMS CUTOFF. EACH UNIT SUPPLIES 6 VIBRATION MEASUREMENTS TO THE FDM

1. SHELF TEMPERATURE TRANSDUCERS ARE ACTUALLY LOCATED ADJACENT TO THESE LRU'S ON THE SHELF SURFACE AND THESE TEMPS WILL LAG LRU TEMPS

11 MADS EQUIP

SIGNATURE	DATE	
DSGN TOM LENERS	8/13/82	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR TOM LENERS	8/13/82	MADS EQUIP
ENGR R Rodriguez	[illegible]	
ENGR	[illegible]	
APP	[illegible]	
APP		SPACE SHUTTLE
KENTRON S.L. Kinney	4-30-84	OV 099
LTR C	PCN 2	121 X 34

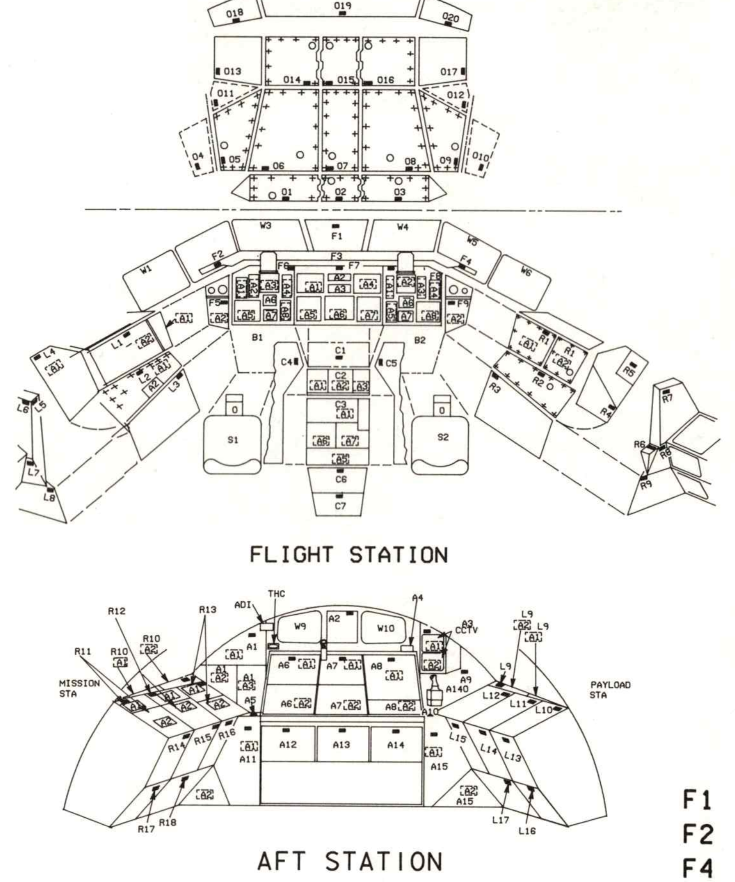
DWG NO 17.11A

PAGE 17.11A-1 SHEET 1 OF 1

DATE: 4/3/84	NAME: JHL	VERSION: INK, 1

DATE: 12/12/83	NAME: LMB	VERSION: BPT, 2
DATE: 12/15/83	NAME: TMW	VERSION: BPT, 3
DATE: 1/19/84	NAME: VSH	VERSION: BPT, 4
DATE: 2/21/84	NAME: TJL	VERSION: BPT, 5
DATE: 3/20/84	NAME: LMB	VERSION: BPT, 6
DATE: 4/3/84	NAME: JHL	VERSION: INK, 1

F1
DC UTILITY POWER
AC UTILITY POWER
F2
PITCH
ROLL YAW
MASTER ALARM
F3
HUD
TRIM
F6
DATA BUS
INSTRUMENT POWER
AIR DATA
ADI
ATTITUDE
ERROR
RATE
F5
LANDING GEAR
HSI SELECT
ABORT MODE
RCS COMMAND
CRT 1
CRT 2
CRT 3
F7
OMS PRESS
EVENT TIME
MPS PRESS
MAIN ENGINE STATUS
F8
HYDRAULIC
F9
F4
SEAT PANEL (PORT SIDE OF SEAT)
PANEL F7 METERS
PANEL F8 METERS
APU
PANEL F9 METERS
AC VOLTS
DC VOLTS
DC AMPS/ SIG STR


FLIGHT STATION
AFT STATION

ORBITER PANEL CONFIGURATION

F1
F2
F4
F5
F6
F7
F8
F9
SEATS

4. EVENT INDICATOR LEGENDS ARE AS FOLLOWS:

DRAWING LEGEND CODE	EVENT IND LEGEND	TYPE IND.	LEGEND MEANING
CL	OP-CL	2 STATE (2A)	OPEN-CLOSE
OFF	ON-OFF	2 STATE (2B)	ON-OFF
B.P.*	GRAY-B.P.	2 STATE (2C)	YES-NO, GOOD-BAD
X10	X10-X1	2 STATE (2D)	TIMES 10, TIMES 1
OP	OP-B.P.-CL	3 STATE (3A)	OPEN-B.P.-CLOSE
UP	UP-B.P.-DN	3 STATE (3B)	UP-0-DOWN
STO	STO-B.P.-DPY	3 STATE (3C)	DEPLOY-0-STOW
ENA	ENA-B.P.-CL	3 STATE (3D)	ENABLE-0-CLOSE
RUN	RUN-B.P.-IPL	3 STATE (3E)	RUN-0-IPL
RCD	RCD-B.P.-PB	3 STATE (3F)	RCD-0-PLAYBACK
LAT	LAT-B.P.-REL	3 STATE (3G)	LATCH-0-RELEASE
ICH	ICH-B.P.-PL	3 STATE (3H)	INTERCHANGER-0-PAYLOAD
RAD	RAD-B.P.-BYP	3 STATE (3I)	RADIATOR-0-BYPASS

* B.P. INDICATES A BARBER POLE

0 INDICATES EITHER 'IN TRANSIT' OR THAT NEITHER OF THE TWO STATES IS ENERGIZED

3. SYMBOLS ▼ OR ▲ INDICATES MOMENTARY SWITCH POSTION

2 G = GREEN = ▤

Y = YELLOW = - - - - -

R = RED = ———

NOTE: 1 BARS ARE GREEN DECAL MARKINGS

1A D&C FWD 1

SIGNATURE	DATE	
DSGN D. J. LAVATO	6/1/78	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR C. A. RILEY	7/30/82	DISPLAYS AND CONTROLS FORWARD STATIONS
ENGR R. O. MIESSLER		
ENGR R. Miessler	4/16/84	
APP Paul M Joyce	4/16/84	
APP		SPACE SHUTTLE
KENTRON - S. K. Kimball	4-30-84	OV 099
LTR C	PCN 2	121 X 34

DWG NO 20.1A

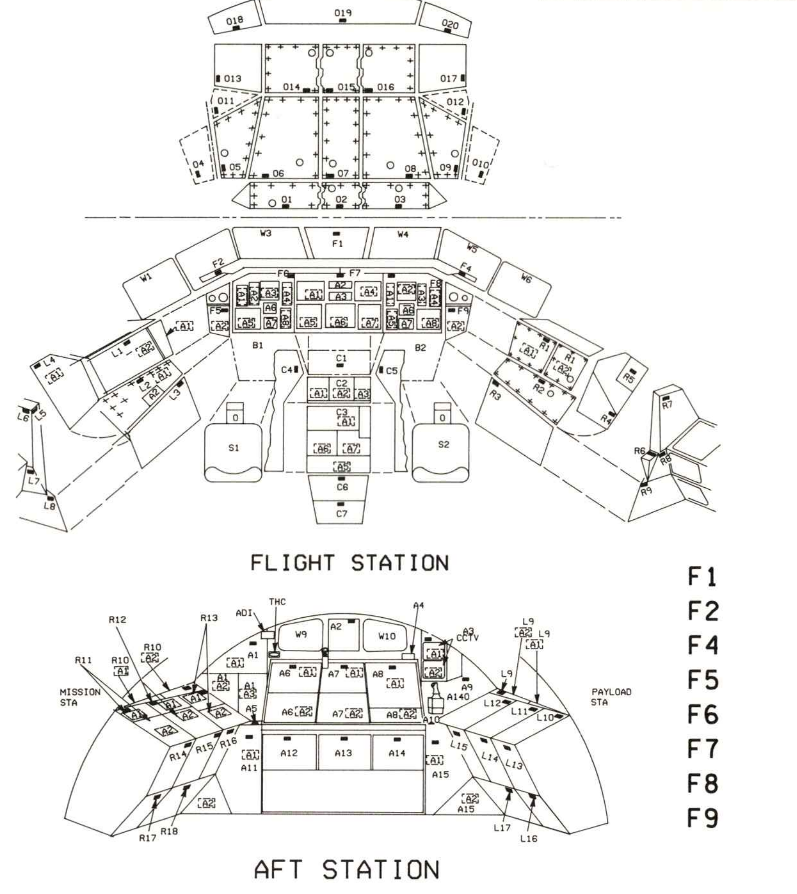
PAGE 20.1A-1

SHEET 1 OF 4

DATE: 4/4/2/84	NAME: JHL	VERSION: INK, 1

F1
DC UTILITY POWER
AC UTILITY POWER
F2
F4
F5
F6
F7
F8
F9
EVENT SEQUENCE
CRT 1
CRT 2
CRT 3
MAIN ENGINE STATUS
PANEL F7 METERS
OMS PRESS
MPS PRESS
PANEL F8 METERS
HYDRAULIC
APU
PANEL F9 METERS
AC VOLTS
DC AMPS/ SIG STR
DC VOLTS

DATE: 6/24/83	NAME: SKK	VERSION: BPT, 3
DATE: 7/22/83	NAME: LMB	VERSION: BPT, 4
DATE: 2/22/84	NAME: TJL	VERSION: BPT, 5
DATE: 4/2/84	NAME: JHL	VERSION: INK, 1


FLIGHT STATION
AFT STATION
F1
F2
F4
F5
F6
F7
F8
F9
MISSION STA
PAYLOAD STA

ORBITER-102 PANEL CONFIGURATION

6. EVENT INDICATOR LEGENDS ARE AS FOLLOWS:

DRAWING LEGEND CODE	EVENT IND LEGEND	TYPE IND.	LEGEND MEANING
CL	OP-CL	2 STATE (2A)	OPEN-CLOSE
OFF	ON-OFF	2 STATE (2B)	ON-OFF
B.P.*	GRAY-B.P.	2 STATE (2C)	YES-NO, GOOD-BAD
X10	X10-X1	2 STATE (2D)	TIMES 10, TIMES 1
OP	OP-B.P.-CL	3 STATE (3A)	OPEN-B.P.-CLOSE
UP	UP-B.P.-DN	3 STATE (3B)	UP-0-DOWN
STO	STO-B.P.-DPY	3 STATE (3C)	DEPLOY-0-STOW
ENA	ENA-B.P.-CL	3 STATE (3D)	ENABLE-0-CLOSE
RUN	RUN-B.P.-IPL	3 STATE (3E)	RUN-0-IPL
RCD	RCD-B.P.-PB	3 STATE (3F)	RCD-0-PLAYBACK
LAT	LAT-B.P.-REL	3 STATE (3G)	LATCH-0-RELEASE
ICH	ICH-B.P.-PL	3 STATE (3H)	INTERCHANGER-0-PAYLOAD
RAD	RAD-B.P.-BYP	3 STATE (3I)	RADIATOR-0-BYPASS

* B.P. INDICATES A BARBER POLE

0 INDICATES EITHER 'IN TRANSIT' OR THAT NEITHER OF THE TWO STATES IS ENERGIZED

5. SYMBOL ■ INDICATES THE LOCKED POSITION OF A LEVER LOCK SWITCH (DOES NOT APPEAR ON THE HARDWARE).

4. SYMBOLS ▼ OR ▲ INDICATES MOMENTARY SWITCH POSITION.

3▷ He IS SELECTED AS He X10

2. G = GREEN = ▤

Y = YELLOW = - - - - - - -

R = RED = ———

NOTE: 1▷ SHADED AREA INDICATES NONFUNCTIONAL SWITCHES

1B D&C FWD 1

SIGNATURE		DATE	
DSGN	D. J. LAVATO	6/1/78	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR	C. A. RILEY	7/30/82	DISPLAYS AND CONTROLS FORWARD STATIONS
ENGR	R. O. MIESSLER		
ENGR	R. Smith	4/16/84	
APP	W. M. Joyce	4/16/84	
APP			SPACE SHUTTLE / DWG NO 20-1B
KENTRON	S K Kenig	4-30-84	OV 102
LTR C	PCN 2	121 X 34	PAGE 20.1B-1 / SHEET 1 OF 4

DATE: 11/14/83	NAME: VSH	VERSION: BPT, 1
DATE: 12/12/83	NAME: LMB	VERSION: BPT, 2
DATE: 12/13/83	NAME: MB	VERSION: BPT, 3
DATE: 1/19/84	NAME: VSH	VERSION: BPT, 4
DATE: 2/22/84	NAME: TJL	VERSION: BPT, 5
DATE: 4/3/84	NAME: MFB	VERSION: INK, 1

L1
H2O
FIRE SUPPRESSION
SMOKE DETECTION
L5
L2
C2
C3
R2
R6
R1
POWER DISTRIBUTION
CRYO
C6
C5
C7
MAIN PROPULSION SYSTEM
NOTE: NUMBERS ON ROW D IN BRACKETS ARE OV102 ONLY

C2
C3
C5
C6
C7
L1
L2
L4
L5
R1A1
R1A2
R2
R4
R6

NOTE: FOR OV102 SWITCHES ARE MOVED OVER TO LEFT AND PANEL IS SHAPED ACCORDING TO DASHED LINE

2 ▷ SHADED AREA IS OV102 ONLY

NOTES: 1 ▷ OV102 READS 'MASTER DFI POWER', THIS SWITCH IS NOT ON OV103

1 D&C FWD 2

SIGNATURE	DATE	
DSGN		NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR C. A. RILEY	7/23/82	DISPLAYS AND CONTROLS FORWARD STATIONS
ENGR R. O. MIESSLER		
ENGR	4/16/84	
APP Paul M Joyce	4/16/84	
APP		SPACE SHUTTLE — DWG NO 20.1
KENTRON S. K. K.	4-12-84	ALL
LTR C — PCN 2		126.5 X 34 — PAGE 20.1-2 — SHEET 2 OF 4

DATE: 3/8/84	NAME: LMB	VERSION: INK, 1

DATE: 12/12/83	NAME: LMB	VERSION: BPT, 2
DATE: 12/15/83	NAME: TMW	VERSION: BPT, 3
DATE: 1/20/84	NAME: VSH	VERSION: BPT, 4
DATE: 2/23/84	NAME: TJL	VERSION: BPT, 5
DATE: 3/8/84	NAME: LMB	VERSION: INK, 1

013
014
015
016
017
01
02
03
019
MISSION TIME
365:23:59:59
66 67 65
PANEL 01 METERS
AIR TEMP
H2O PUMP OUT PRESS
FREON
FLOW
EVAP OUT TEMP
CABIN dP/dT PSIA/MIN
O2/N2 FLOW
CABIN PRESS
PPO2
(M1)
(M2)
(M3)
(M4)
PANEL 03 METERS
RCS/OMS PRESS
LEFT
FWD/KIT
RIGHT
OXID
FUEL
PSIA
500 He
(M9)
(M10)
(M11)
PANEL 02 METERS
CRYO
O2 HTR ASSY TEMP
O2
H2
PRESS
QTY
FUEL CELL
STACK TEMP
(M5)
(M6)
(M7)
(M8)

3 EXPANDED VIEW ON RIGHT OF DRAWING

2 G = GREEN = ▤

Y = YELLOW = - - - - -

R = RED = ———

NOTES: 1 He IS SELECTED AS He X10

01
02
03
013
014
015
016
017
019

1A D&C FWD 3

SIGNATURE		DATE	
DSGN	L. M. BUCHANAN	7/26/82	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR	L. M. BUCHANAN	7/26/82	DISPLAYS AND CONTROLS FORWARD STATIONS
ENGR		4/16/84	
ENGR			
APP	Paul M Joyce		
APP			SPACE SHUTTLE — DWG NO 20-1A
KENTRON			OV 099
LTR C	PCN 2		121 X 34 — PAGE 20.1A-3 — SHEET 3 OF 4

OV099 BASIC REV C-2

BASIC REV C-2

DATE: 3/8/84	NAME: LMB	VERSION: INK, 3

DATE: 6/24/83	NAME: LMB	VERSION: BPT, 10
DATE: 7/22/83	NAME: MPM	VERSION: INK, 2
DATE: 1/20/84	NAME: VSH	VERSION: BPT, 11
DATE: 2/23/84	NAME: TJL	VERSION: BPT, 12
DATE: 3/8/84	NAME: LMB	VERSION: INK, 3

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
013
014
015
016
017
01
02
019
PANEL 02 METERS
CRYO
O2 HTR ASSY TEMP
O2 PRESS QTY
H2 PRESS QTY
FUEL CELL STACK TEMP
PANEL 03 METERS
RCS/OMS PRESS
LEFT OXID FUEL
FWD/KIT OXID FUEL
RIGHT OXID FUEL
PANEL 01 METERS
AIR TEMP
H2O PUMP OUT PRESS
FREON FLOW EVAP OUT TEMP
CABIN dP/dT PSIA/MIN
O2/N2 FLOW
CABIN PRESS
PPO2
MISSION TIME
365:23:59:59
66 67 65
(33V73A17)

NOTES: 1 He IS SELECTED AS He X10

2 G = GREEN = ▤

Y = YELLOW = - - - - -

R = RED = ——

3 EXPANDED VIEW OF METERS ON RIGHT OF DRAWING

01
02
03
013
014
015
016
017
019

1B D&C FWD 3

	SIGNATURE	DATE	
DSGN	L. M. BUCHANAN	7/26/82	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR	L. M. BUCHANAN	7/26/82	DISPLAYS AND CONTROLS FORWARD STATIONS
ENGR	R.O. MIESSLER		
ENGR	R. Miessler	4/16/84	
APP	Paul O'Mongue	4/16/84	
APP			SPACE SHUTTLE / DWG NO 20-1B
KENTRON			OV 102
LTR C	PCN 2	121 X 34	PAGE 20.1B-3 / SHEET 3 OF 4

DATE: 3/8/84	NAME: LMB	VERSION: INK, 3

DATE: 6/23/83	NAME: LMB	VERSION: BPT, 4
DATE: 7/01/83	NAME: TMW	VERSION: INK, 2
DATE: 1/19/84	NAME: LMB	VERSION: BPT, 5
DATE: 2/22/84	NAME: LMB	VERSION: BPT, 6
DATE: 3/8/84	NAME: LMB	VERSION: INK, 3

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
LEFT AUDIO
(ALL EXCEPT OV102)
05
(OV102 ONLY)
05
LIGHTING PANEL
STAR TRACKER
(LIGHT)
LEFT GLARESHIELD FLOOD
ANNUNCIATOR
GENERAL PURPOSE COMPUTER
IPL SOURCE
(ALL)
06
TACAN 1
TACAN 2
TACAN 3
AFT LEFT RCS
AFT RIGHT RCS
(ALL EXCEPT OV102)
07
(OV102 ONLY)
07
RADAR ALTIMETER
OMS KIT
LEFT OMS
RIGHT OMS
FWD RCS
RIGHT GLARESHIELD FLOOD
(ALL)
08
RIGHT AUDIO
(OV102 ONLY)
09
(ALL EXCEPT OV102)
09

05
06
07
08
09

2 DASHED LINE IS SHAPE OF PANEL FOR OV102

NOTES: 1 SHADED HINGES AND NUTS ARE THE OV102 CONFIGURATION

1 D&C FWD 4

SIGNATURE	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS		
DSGN				
DR CONNIE RILEY	7-19-82	DISPLAYS AND CONTROLS FORWARD STATIONS		
ENGR R. O. MIESSLER				
ENGR R. Miessler	4/16/84			
APP Paul M Joyce	4/16/84			
APP		SPACE SHUTTLE	DWG NO	
KENTRON		ALL	20.1	
LTR C	PCN 2	121 X 34	PAGE 20.1-4	SHEET 4 OF 4

DATE: 11/14/83	NAME: VSH	VERSION: BPT,1
DATE: 1/19/84	NAME: MB	VERSION: BPT,2
DATE: 2/23/84	NAME: TJL	VERSION: BPT,3
DATE: 4/1/84	NAME: VSH	VERSION: INK,1

A1L
A1R
A1U
S-BAND PAYLOAD
S-BAND FM
NETWORK SIG PROC
OPS RECORDERS
PAYLOAD RECORDER
AUDIO CENTER
KU-BAND
A6U
A6U
(ONLY OV102)
PAYLOAD RETENTION LATCHES
A7U
A7L
MADS
A8U
PARAMETER
+58.70
-6.535
-3.725
Canada
A8L
A2
LINE OF SIGHT RATES
(PAYLOADS)
A3
MON 1
MON 2
A4
(OV102)
EVENT TIME
MISSION TIMER
59:59
365:23:59:55
(ALL EXCEPT OV102)
(36V73A134)

(AIU) A1A1
(AIL) A1A2
(AIR) A1A3
A2
A3A1
A3A2
A4
(A6U) A6A1
1 (A6L) A6A2
(A7L) A7A1
(A7U) A7A2
(A8U) A8A1
(A8L) A8A2

5 FOR OV102 INHIBIT AND ENABLE ARE REVERSED

4 SHADED AREA INDICATES OV102 ONLY

3 FOR OV099 AND SUBS NOMENCLATURE READS

XMTR
UPPER
RCVR
LOWER
G
P
C
(S2)
LOWER
UPPER

2 ONLY FLIGHTS USING RMS

NOTES: 1 REFER D&C PROCEDURAL NOMENCLATURE-BOOK

2 D&C AFT 1

SIGNATURE	DATE	
DSGN LAVATO		NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR BUCHANAN		DISPLAYS AND CONTROLS AFT STATIONS
ENGR R.O. MIESSLER		
ENGR	4/10/84	
APP Paul M Joyce	4/16/84	
APP		SPACE SHUTTLE / DWG NO 20.2
KENTRON [illegible]	[illegible]	ALL
LTR C / PCN 2		121 X 34 / PAGE 20.2-1 / SHEET 1 OF 3

BASIC REV C-2

BASIC REV C-2

DATE: 4/3/84	NAME: MFB	VERSION: INK, 1

DATE: 11/14/83	NAME: VSH	VERSION: BPT, 1
DATE: 12/14/83	NAME: LMB	VERSION: BPT, 2
DATE: 1/19/84	NAME: SVJ	VERSION: BPT, 3
DATE: 2/22/84	NAME: TJL	VERSION: BPT, 4
DATE: 4/3/84	NAME: MFB	VERSION: INK, 1

A11
CYRO TANK 4 HEATERS
(ALL EXCEPT OV102)
A11
CYRO TANK 4/5 HEATERS
(OV102 ONLY)
APU HEATER
A12
GPS
OS AUDIO
(ALL EXCEPT OV102)
A13
OS AUDIO
(OV102 ONLY)
A13
A15
L10 IUS POWER CONTROL
S/C SUPPORT
IUS SUPPORT
TILT TABLE ACTUATOR
PYRO BUS
UMBILICALS
IUS DEPLOYMENT
RCS/OMS HEATERS
A14
L11
COMMUNICATION INTERFACE UNIT AUXILIARY CONTROLS
COMMUNICATION INTERFACE UNIT
L12 STANDARD SWITCH PANEL
STANDARD SWITCH PANEL
DEPLOYMENT
L12
MANUAL POINTING CONTROL
MANUAL POINTING CONTROLLER
L10
L11
L12
A11
A12
A13
A14
A15

4 IUS MISSIONS ONLY

3 REFER PROCEDURAL NOMENCLATURE BOOK FOR LABELING

2 SHADED AREA INDICATES OV102 ONLY

NOTE: 1 SHOWN WITH HINGED COVER OPEN

2 D&C AFT 2

SIGNATURE	DATE	
DSGN CONNIE RILEY	7-12-82	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
DR CONNIE RILEY	7-12-82	DISPLAYS AND CONTROLS AFT STATIONS AND MISSION UNIQUE PANELS
ENGR R.O. MIESSLER		
ENGR R. Miessler	4/16/84	
APP Paul M. Joyce	4/16/84	
APP		SPACE SHUTTLE — DWG NO. 20.2
KENTRON S. K. Kimbley	4-30-84	ALL
LTR C — PCN 2		126.5 X 34 — PAGE 20.2-2 — SHEET 2 OF 3

DATE: 4/1/84	NAME: LGH	VERSION: INK, 1

DATE: 11/14/83	NAME: VSH	VERSION: BPT, 1
DATE: 1/19/84	NAME: TMW	VERSION: BPT, 2
DATE: 2/27/84	NAME: TJL	VERSION: BPT, 3
DATE: 4/1/84	NAME: LGH	VERSION: INK, 1

L9
PAYLOAD STATION AUDIO
R10
MISSION STATION AUDIO
MS LIGHTING
R11U
(FOR OV102, VTR LOCATED ON L12)
(R11L)
R12U
FUEL CELL
R12L
SUPPLY H2O
R13U
CAUTION/WARNING
(ALL)
PL BAY MECH PWR
R13L
(ALL)
R15
(ALL EXCEPT OV102)
R15
R15
(OV102 ONLY)
R15
(32V73A15)

L9
▷1 R7
R10
R11U
R11L
(R12A1) R12U
(R12A2) R12L
(R13A1) R13U
(R13A2) R13L
R15

▷2 SHADED AREA INDICATES OV102 ONLY

▷1 SPACELAB ONLY, REFER TO SPACELAB SYSTEMS HANDBOOK

NOTE:

2 D&C AFT 3

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ENGR R. Miessler	4/16/84	
APP Paul M. Joyce	4/16/84	SPACE SHUTTLE / DWG NO 20.2
APP		
KENTRON F. K. Kinney	4-30-84	ALL
LTR C / PCN 2		104.5 X 34 / PAGE 20.2-3 / SHEET 3 OF 3

DATE: 11/10/83	NAME: VSH	VERSION: BPT;1
DATE: 1/19/84	NAME: JHL	VERSION: BPT;2
DATE: 2/22/84	NAME: TJL	VERSION: BPT;3
DATE: 3/29/84	NAME: VSH	VERSION: INK;1

MO32M
MO69M
MO10W
MO24K
ML26C
MD12H
TELEPRINTER LOCKER DOOR
LOCKER LOCATION (MA9F)
TELEPRINTER
INSIDE LOCKER
EMU SERVICE IN PROGRESS
WCS
ML31C
MO29J
MO62M
ML18F
MO52J
MO30F
MO13Q
MO39M
MA73C
MO42F
MO58F
MID DECK CEILING
MID DECK
ML86B
(ALL EXCEPT OV102)
ML86B
(OV102)

MA73C
MD12H
MD24K
ML18F
ML26C
ML31C
ML86B
MO10W
MO13Q
MO29J
MO30F
MO32M
MO39M
MO42F
MO52J
MO62M
MO69M
WCS
TELEPRINTER

3 D&C MIDDECK

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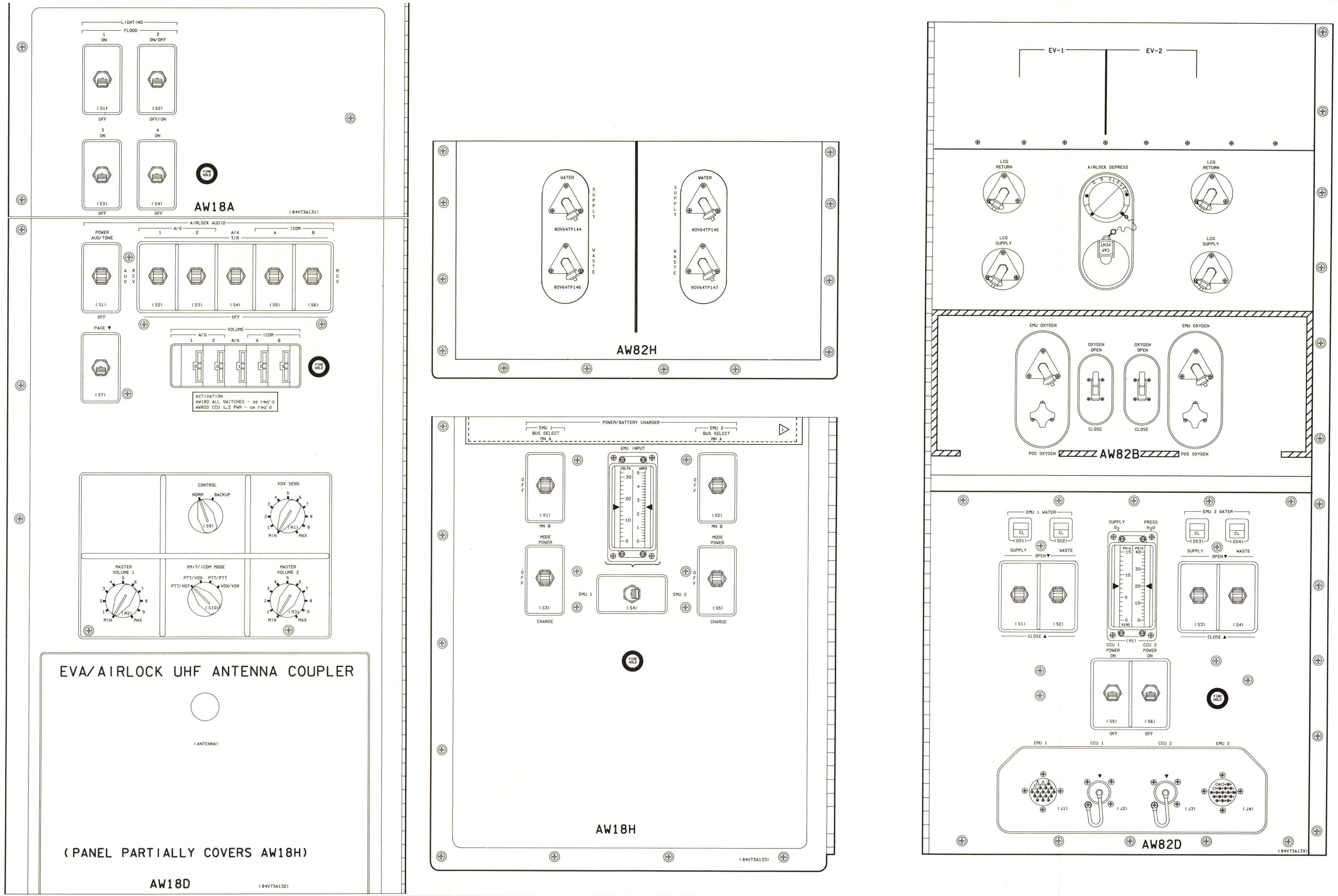
APP		SPACE SHUTTLE / DWG NO 20.3
KENTRON K. Kimisce	4-30-84	ALL
LTR C / PCN 2		126.5 X 34 / PAGE 20.3-1 / SHEET 1 OF 1

BASIC REV C-2

DATE: 11/10/83	NAME: VSH	VERSION: BPT,1
DATE: 2/22/84	NAME: TJL	VERSION: BPT,2

DATE: 11/10/83	NAME: VSH	VERSION: BPT,1
DATE: 2/22/84	NAME: TJL	VERSION: BPT,2


LIGHTING
FLOOD
1 ON
2 ON/OFF
(S1)
(S2)
OFF
OFF/ON
3 ON
4 ON
(S3)
(S4)
OFF
OFF
FIRE HOLE
AW18A
(84V73A131)
AIRLOCK AUDIO
POWER AUD/TONE
A/G
1
2
A/A
T/R
ICOM
A
B
AUD
RCV
(S1)
(S2)
(S3)
(S4)
(S5)
(S6)
RCV
OFF
OFF
PAGE ▼
(S7)
VOLUME
A/G
1
2
A/A
ICOM
A
B
0
0
1
2
5
FIRE HOLE
ACTIVATION
AW18D ALL SWITCHES - as req'd
AW82D CCU 1,2 PWR - as req'd
CONTROL
NORM
BACKUP
(S9)
VOX SENS
MIN
MAX
(R1)
MASTER VOLUME 1
(R2)
MIN
MAX
XMIT/ICOM MODE
PTT/VOX
PTT/PTT
PTT/HOT
VOX/VOX
(S10)
MASTER VOLUME 2
(R3)
MIN
MAX
EVA/AIRLOCK UHF ANTENNA COUPLER
(ANTENNA)
(PANEL PARTIALLY COVERS AW18H)
AW18D
(84V73A132)
WATER
SUPPLY
80V64TP144
WASTE
80V64TP146
WATER
SUPPLY
80V64TP145
WASTE
80V64TP147
AW82H
POWER/BATTERY CHARGER
EMU 1
BUS SELECT
MN A
EMU 2
BUS SELECT
MN A
1
EMU INPUT
VOLTS
AMPS
OFF
(S1)
MN B
OFF
(S2)
MN B
MODE POWER
OFF
(S3)
CHARGE
EMU 1
(S4)
EMU 2
MODE POWER
OFF
(S5)
CHARGE
FIRE HOLE
AW18H
(84V73A133)
EV-1
EV-2
LCG RETURN
AIRLOCK DEPRESS
0 5 CLOSED
CAP VENT
LCG RETURN
LCG SUPPLY
LCG SUPPLY
EMU OXYGEN
OXYGEN OPEN
OXYGEN OPEN
EMU OXYGEN
CLOSE
CLOSE
POS OXYGEN
AW82B
POS OXYGEN
EMU 1 WATER
CL
CL
(DS1)
(DS2)
SUPPLY
OPEN ▼
WASTE
SUPPLY
O_2
PRESS
H_2O
PSIA
PSIG
X100
(M1)
EMU 2 WATER
CL
CL
(DS3)
(DS4)
SUPPLY
OPEN ▼
WASTE
(S1)
(S2)
CLOSE ▲
(S3)
(S4)
CLOSE ▲
CCU 1 POWER ON
CCU 2 POWER ON
(S5)
(S6)
OFF
OFF
FIRE HOLE
EMU 1
CCU 1
CCU 2
EMU 2
(J1)
(J2)
(J3)
(J4)
AW82D
(84V73A139)

AW18A
AW18D
AW18H
AW82B
AW82D
AW82H

NOTES: 1 LOGO COVERED BY EVA/AIRLOCK UHF ANTENNA COUPLER

4 D&C AIRLOCK

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Vol. II

Sections 12 through 20

Rev C
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