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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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APOLLO 15 40 P

CSM 112

DOUBLE

BASIC

# CSM SYSTEMS CHECKLIST

PREPARED BY

GUIDANCE & CONTROL PROCEDURES SECTION

SYSTEMS PROCEDURES BRANCH

CREW PROCEDURES DIVISION

INDEXING DATA  
DATE 3/15/71  
OPR MSC



MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

MARCH 15, 1971

APOLLO 15

CSM SYSTEMS CHECKLIST

MARCH 15, 1971

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## CSM SYSTEMS CHECKLIST

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SYSTEMS MANAGEMENT

PROPULSION SYSTEM

1 SPS MONITORING CHECK

SPS PRPLNT TK TEMP ind - +45 to +75°F

\*IF < 45°F, SPS LINE HTRS - A \*

\*IF > 75°F, SPS LINE HTRS - off (ctr) \*

SPS PRESS IND sw - He, N2A, & N2B

SPS PRPLNT TK PRESS ind

He 3900 psia max

N2A 2900 psia max

N2B 2900 psia max

SPS PRESS IND sw - He

FUEL & OXID PRESS ind - 170 to 195 psia

SPS ENG INJ VLVS (4) - CLOSE

SPS OXID, FUEL & UNBAL QTY - record

OXID FLOW VLV PRIM - PRIM

SPS He VLV (1&2) - AUTO @ tb - bp

2 SM RCS MONITORING CHECK

SM RCS PRPLNT tb (8) - gray

SM RCS He 1 & 2 tb (8) - gray

RCS IND sel - SM A, B, C, D

PKG TEMP - 115°-175°F (C/W 75°-205°)

He PRESS - record

MANF PRESS - 178-192 psia (C/W 145-215 psia)

He TK TEMP - record

PRPLNT QTY - record

When MANF PRESS < 150 psia

RCS SEC FUEL PRESS A (B, C, D) - OPEN

3 CM RCS MONITORING CHECK

CM RCS PRPLNT tb (2) - gray

RCS IND sw - CM 1,2

He TEMP - 60-90°F

He PRESS - 4100-4200 psia

MANF PRESS - 80-105 psia

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EPS SYSTEM

1 Cryogenic Pressure - Quantity Check

H2 PRESS (2) - 225-260 psia  
O2 PRESS (3) - 865-935 psia  
SURGE TK PRESS - 865-935 psia  
H2 QTY (2) - record  
O2 QTY (3) - record  
CRYO FANS - OFF; ON as req'd

2 FC Power Plant Check

FC HTRS (3) - on (up)  
FC RAD tb (3) - gray  
FC REACT tb (3) - gray  
FC IND sel - 1, 2, 3  
H2 FLOW - 0.03-0.15 lb/hr  
O2 FLOW - 0.25-1.2 lb/hr  
MOD SKIN TEMP - 390-440°F  
MOD COND EXH TEMP - 150-175°F  
FC pH HI tb - gray  
FC RAD TEMP LO tb - gray

3 D-C Voltage-Amperage Check

MN BUS TIE (2) - OFF (verify)  
FC MNA tb - 1 & 2 gray, 3 bp  
FC MNB tb - 1 bp, 2 bp, & 3 gray  
FC 1, 2, & 3 (RECORD AMPS)  
MAIN BUS A, B, (26.5-31 vdc - Record)  
BAT BUS A, B, & BAT C (31.5-38 vdc < 3 amp)  
PYRO BAT A, B (36.5 - 37.5 vdc)  
DC IND sel - MNB  
SYS TEST 4B (BAT RLY BUS - 3.4-4.1 vdc)  
SYS TEST 4A (BAT COMPT PRESS - <1.5 vdc)  
(NA until 1st Vent)

\*If >1.5: BAT VENT vlv -\*  
\*VENT (to ~0) then CLOSED\*

If LM PWR - CSM

SYS TEST (2) - 4D (LM PWR - 0.5-3.2 vdc)

4 A-C VOLTS - 113 to 117 all phases

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- 5 Battery Charging BAT A(B,C)  
MAIN BUS TIE A/C (B/C) - OFF  
cb BAT BUS A & B PYRO BUS TIE - open (verify)  
cb BAT C BAT BUS A & B - open (verify)  
cb BAT RLY BUS BAT A(B) - open  
DC IND sel - BAT CHARGER  
BAT CHARGE - A(B,C)  
DC VOLTS - 37.5-39.5 vdc  
BAT CHARGE - OFF at 39.5 vdc or 100% recharge  
cb BAT RLY BUS BAT A(B) - closed  
SYS TEST - 4A (BAT VENT <1.5)  
\*If >1.5: BAT VENT vlv -\*  
\*VENT (to ~0) then CLOSED\*  
SYS TEST - 4B

6 Fuel Cell Power Plant Purging

A O2 PURGING

FC IND sw - 1(2,3)  
FC PURGE 1(2,3) - O2 (2 min)  
FC FLOW - O2 Flow incr 0.6 lb/hr  
M/A FC 1(2,3) - On/RSET  
FC PURGE - 1(2,3) - OFF

B H2 PURGING

H2 PURGE LINE HTR - ON, 20 min prior to purge  
FC IND sw - 1(2,3)  
FC PURGE 1(2,3) - H2 (1 min, 20 sec)  
FC H2 FLOW - Flow incr 0.67 lb/hr  
(will exceed C/W limit)  
M/A FC 1(2,3) - On/RSET  
FC PURGE - 1(2,3) - OFF  
After 10 minutes:  
H2 PURGE LINE HTR - OFF

- 7 H2 or O2 Quantity Balance Correction  
ON LOW Tank, H2 or O2 HTRS 1(2) - OFF,  
THEN AUTO, WHEN BALANCED

8 FUEL CELL SHUTDOWN (APPLICABLE FC)

- FC REAC - OFF
- FC HTRS - OFF
- FC PUMPS - OFF
- cb FC PUMPS AC - open
- AT T<sub>skin</sub> < 200° F
  - H2 PURGE LINE HTR - ON (for 20 min)
  - FC PURGE - O2 (TIL O2 PRESS = N2 PRESS)
  - FC PURGE - H2 (TIL PRESS STABILIZES)
  - FC PURGE - OFF
  - H2 PURGE LINE HTR - OFF
  - cb FC RAD/REACS - open

9 FUEL CELL SWITCHING

PRIOR TO DISCONNECTING, INSURE THAT AT LEAST ONE FUEL CELL IS POWERING EACH MAIN BUS  
Possible MA & FC DISCONNECT It

10 INVERTER CHANGEOVER

- A One inverter on each AC bus at all times (if available)
- B If all three AC bus ties for the same bus are on, inverter power to that bus may be lost
- C When switching DC power on inverter 3, pause in OFF position

11 CRYO MANUAL FAN OPERATION

- CRYO FANS - ON (seq at 1 sec intervals for 1 min each)
- a. Prior to every SPS or SIVB ΔV
  - b. Presleep
  - c. Postsleep
  - d. Pre LM Extraction

CAUTION

If CRYO PRESS It on, do not turn off fan until it extinguishes

## ECS PERIODIC VERIFICATION

### 1 ECS MONITORING CHECK

CABIN  $\Delta P$  - -1 to -3.5 in. H<sub>2</sub>O

O<sub>2</sub> FLOW - 0.2-0.45 lb/hr (after changeover)

O<sub>2</sub> SURGE TANK PRESS - 865-935 psia

REPRESS O<sub>2</sub> >865 psia

PRIM RAD tb - gray

\*If PRIM RAD tb - 2

\* ECS RAD FLOW AUTO CONT - 1 until

\* tb gray, then AUTO

ECS RAD TEMP PRIM IN - 67-97°F

ECS RAD TEMP PRIM OUT - -20° to +63°F (-20° to  
97°F for lunar orb)

PRIM GLY EVAP TEMP OUT - 38-50.5°F

PRIM GLY DISCH PRESS - 40-52 psig

SUIT TEMP - 45-70°F w/o evap; 45-55°F with evap

CABIN TEMP - 70-80°F

SUIT PRESS/CABIN PRESS - 4.7-5.3 psia

PART PRESS CO<sub>2</sub> < 7.6 mm Hg

SUIT COMP  $\Delta P$  - 0.3-0.4 psid

PRIM GLY ACCUM QTY 30-65%

\*If <30% - PRIM ACCUM FILL vlv -

\* ON (Until 40-55%)

POT H<sub>2</sub>O QTY - 10-100%

WASTE H<sub>2</sub>O QTY - 25-85%

\*If >85% - Dump\*

### 2 ECS PERIODIC REDUNDANT COMPONENT CK

Suit Compressor

Sw to other compr

SUIT COMPR  $\Delta P$  ind - 0.3-0.4 psid

Main O<sub>2</sub> Regulators

MAIN REG B vlv - close

EMER CABIN PRESS sel - 1

PUSH TO TEST PB - PUSH (O<sub>2</sub> FLOW INC)

MAIN REG B vlv - open

MAIN REG A vlv - close

EMER CABIN PRESS sel - 2

PUSH TO TEST PB - PUSH (O<sub>2</sub> FLOW INC)

MAIN REG A vlv - open

EMER CABIN PRESS sel - BOTH (OFF if all suited)

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### Secondary Glycol Loop

Open cool atten panel (If req'd)

EVAP H2O CONT SEC vlv - AUTO

ECS IND sw - SEC

SEC COOL LOOP PUMP - AC 1 (AC 2)

GLY DISCH SEC PRESS - 39-51 psig

ACCUM SEC QTY IND - 30-55%

SEC COOL LOOP EVAP - EVAP

After 5 min

SEC EVAP TEMP OUT - 38-50.5°F

SEC COOL LOOP EVAP - RESET for 1 min minimum,  
then off (ctr)

SEC COOL LOOP PUMP - off (ctr)

ECS IND sw - PRIM

### 3 C02 ABSORBER FILTER REPLACEMENT

Open C02 Canister attenuation pnl

#### CAUTION

Connect ground wire when re-  
moving or replacing filter  
from canister or stowage

C02 CSTR DIVERT vlv - up (or dn)

#### CAUTION

Apply pressure to latching  
handle to allow pressure  
interlock pin to withdraw  
otherwise latching handle  
may not disengage

CANISTER MANUAL BLEED vlv - PRESS

COVER LATCHING HANDLE - UNLOCK

Replace used filter

COVER LATCHING HANDLE - LOCK

C02 CSTR DIVERT vlv - ctr

Close C02 Canister attenuation pnl

SHIM Stowage - B5 & B6

- 4 DEBRIS SCREEN CHECK  
Check SUIT RET AIR vlv screen  
SUIT RET AIR vlv - CLOSE (push)  
Clean screens  
SUIT RET AIR vlv - OPEN (pull)
- 5 CM O2 SUPPLY REFILL  
SURGE TANK PRESS >500 psia  
CAB REPRESS vlv - OFF  
REPRESS O2 vlv - CLOSE  
REPRESS PKG vlv - FILL  
SURGE TANK PRESS - 865-935 psia  
CRYO PRESS IND - 1/2  
REPRESS PKG vlv - OFF
- 6 DOFFING PGA  
EMER CABIN PRESS vlv - BOTH  
SUIT RET AIR vlv - OPEN (pull)  
Install hose screen on return hose  
PWR - OFF  
SUIT PWR - OFF for disconnect  
AUDIO CONT - NORM  
SUIT FLOW vlv - CABIN FLOW (for unsuited crewman)  
(FULL FLOW for 3 unsuited)
- 7 DONNING PGA (with helmet & gloves)  
SUIT PWR - OFF (for comm cable connect)  
PWR - OFF  
AUDIO CONT - NORM  
Connect supply and return hoses to PGA  
Connect Comm Control Head to PGA  
SUIT FLOW vlv - FULL FLOW (for suited crewman)  
SUIT RET AIR vlv - CLOSED (push)  
EMERG CABIN PRESS vlv - OFF (if all suited)
- 8 PARTIAL SUIT CKLIST  
EMER CAB PRESS vlv - BOTH  
SUIT CKT RET vlv - OPEN (pull)  
Reverse O2 umbilicals  
Before disconnecting umbilical from head set:  
SUIT PWR - OFF  
POWER - OFF  
AUDIO CONT - NORM

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9 URINE DUMP MODES  
USING UTS

A PGA URINE COLL BAG DUMP

Connect Urine transfer hose & filter  
to urine feces QD  
Remove cap from PGA thigh QD  
Connect urine transfer hose to thigh QD  
WASTE MGT DRAIN vlv - DUMP  
Disconnect urine transfer hose from PGA  
Replace cap on PGA thigh QD  
Connect UTS to urine transfer hose/filter QD  
UTS vlv - OPEN  
Purge dump line 1 minute (min)  
WASTE MGT OVBD DRAIN vlv - OFF  
UTS vlv - CLOSED  
Disconnect hose & stow

B UTS (Collection)

Obtain UTS & verify vlv - CLOSED  
Attach UTS - open vlv - Perform task  
UTS vlv - CLOSED  
Disconnect UTS & stow

C UTS (Dump)

Verify UTS vlv - CLOSED  
Connect UT hose/filter to urine/feces QD  
Attach UTS to hose  
WASTE MGT OVBD DRAIN vlv - DUMP  
When UTS Bag Empty  
UTS vlv - OPEN  
Purge lines 1 minute (min)  
WASTE MGT OVBD DRAIN vlv - OFF  
UTS vlv - CLOSED  
Stow UTS & Hose

USING URINE RECEPTACLE ASSY (URA)

Connect urine line filter to urine  
transfer hose.  
Connect urine transfer hose/filter  
to urine feces QD  
Connect Urine Receptacle/Plenum  
Assy to urine transfer hose  
URA vlv - VENT  
Remove receptacle cover  
WASTE MGMT DRAIN vlv - DUMP

NOTE: Direct water stream parallel to honeycomb to prevent splash-back.  
Avoid acceleration to URA during use.  
Remove last drop by touching screen at top of URA.

Perform task

Flush screen and honeycomb with water gun  
Replace receptacle cover after liquid has cleared from URA

URA vlv - CLOSE

Stow Urine Receptacle/Plenum Assy for next use with urine transfer hose connected and WASTE MGMT DRAIN vlv - DUMP

For stowage prior to entry:

WASTE MGMT DRAIN vlv - OFF

Remove and stow URA, urine transfer hose, and urine filter

10 CABIN PRESSURIZATION

A NORMAL 30 min

CAB PRESS REL vlv (2) - NORMAL (latch on)

REPRESS PKG vlv - FILL

CRYO PRESS IND - SRG/3

REPRESS O2 vlv - OPEN

\*If SURGE TANK PRESS decreases to 150 psia

\* REPRESS O2 vlv - CLOSE

CAB PRESS ind - ~3.0 psia (1 min)

REPRESS PKG vlv - OFF

CAB REPRESS vlv - OPEN (CW), Adjust to maintain >150 psia in SURGE TANK

REPRESS O2 PRESS ind - ~0 psia

REPRESS O2 vlv - CLOSE

CAB PRESS = 4.7-5.3 psia

CAB REPRESS vlv - OFF

B ALTERNATE, 52 min

CAB PRESS REL vlv (2) - NORMAL (Safety latch or EMER CAB PRESS vlv - BOTH

CAB REPRESS vlv - OPEN

MONITOR SURGE TANK PRESS

At 150 psia on SURGE TANK:

EMER CAB PRESS vlv - OFF

CAB REPRESS vlv - Adj to 150 psia on SURGE TANK

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WHEN CAB PRESS >4.7  
CRYO PRESS IND - 1/2  
CAB REPRESS vlv - OFF

11 SUIT CKT INTEGRITY CHECK  
DIRECT O2 vlv - CLOSE  
SUIT PRESS - 4.7-5.3 psia  
O2 FLOW - 0.2-0.4 lb/hr

CAUTION

SUIT TEST vlv should remain  
in the PRESS position until  
suit circuit pressure is sta-  
bilized to preclude seal scarring.  
If repositioning of SUIT TEST  
vlv from PRESS is required prior  
to suit pressure and O2 flow  
stabilization, perform the  
following:  
a. O2 DEMAND REG vlv - OFF  
b. Allow 15 sec (min)  
stabilization time  
c. Reposition SUIT TEST vlv -  
DEPRESS or OFF as applicable  
d. When suit pressure stabilized,  
O2 DEMAND REG vlv - BOTH

SUIT TEST vlv - PRESS  
O2 FLOW - 1.0 lb/hr (pegged)  
O2 FLOW HI lt - on  
M/A - ON, Reset  
SUIT PRESS - 8.8-9.8 psia  
PGA PRESS - 4.1-4.5 psig  
O2 FLOW HI lt - out  
Allow O2 flow to stabilize 15 sec  
O2 flow will remain below 0.8 lb/hr  
for 30 sec after stabilization  
SUIT TEST vlv - DEPRESS  
O2 FLOW - 0.2-0.4 lb/hr  
SUIT PRESS - slightly > CAB PRESS  
SUIT TEST vlv - OFF  
O2 DEMAND REG vlv - BOTH (verify)

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- 12 PGA INTEGRITY CHECK  
DIRECT O2 vlv - CLOSE  
SUIT PRESS - 4.7-5.3 psia  
O2 FLOW - 0.2-0.4 lb/hr

CAUTION

see pg S/1-10

- SUIT TEST vlv - PRESS  
O2 FLOW - 1.0 lb/hr (pegged)  
O2 FLOW HI lt - ON  
M/A - ON, Reset  
SUIT PRESS - 8.8-9.8 psia  
PGA PRESS - 4.1-4.5 psig

WARNING

SUIT FLOW vlv(s) may remain in OFF position for no longer than one minute or asphyxiation may result. If all SUIT FLOW vlvs are closed simultaneously the suit compressors must be shut off to prevent compressor damage due to suit loop deadheading.

- SUIT FLOW vlv - OFF  
Monitor for <0.5 psi/min decay  
SUIT FLOW vlv - SUIT FULL FLOW  
SUIT TEST vlv - DEPRESS  
O2 FLOW HI lt - out  
O2 FLOW - 0.2-0.4 lb/hr  
SUIT PRESS - slightly > CAB PRESS  
SUIT TEST vlv - OFF

- 13 CM PRESSURE DUMP  
EMER CABIN PRESS vlv - OFF (verify)  
CAB REPRESS vlv - OFF (verify)  
SUIT CKT RET vlv - CLOSED (verify)  
CABIN FANS (2) - OFF (verify)  
DIRECT O2 vlv - CLOSE  
CAB PRESS REL vlv (RH) - DUMP (latch off)

S  
1-12

CABIN PRESS - 3.0-3.25 psia  
CAB PRESS REL vlv (RH) - BOOST/ENTRY  
O2 FLOW - 0.24 lb/hr  
SUIT PRESS - 3.5-4.0 psia  
CAB PRESS REL vlv (RH) - DUMP  
CABIN PRESS - 0.0 psia (within 6 min)  
CAB PRESS REL vlv (2) - NORMAL (latch on)

14 SUIT CKT H2 PURGE  
DIRECT O2 vlv - OPEN for 1 min  
O2 FLOW - 1.0 lb/hr (pegged)  
O2 FLOW HI lt - on  
MASTER ALARM pb/lt (3) - on, push  
DIRECT O2 vlv - CLOSE  
O2 FLOW HI lt - out  
O2 FLOW - 0.2 lb/hr

15 CABIN COLD SOAK  
ACTIVATE  
SUIT HT EXCH SEC GLY vlv - FLOW  
EVAP H2O CONT SEC vlv - AUTO  
GLY TO RAD SEC vlv - BYPASS (verify)  
SUIT CKT HT EXCH - BYPASS (20sec), then off (ctr)  
ECS IND sel - SEC  
SEC COOL LOOP PUMP - AC2  
GLY DISCH SEC PRESS - 39-51 psig  
SEC ACCUM QTY - 30-55%  
SEC COOL LOOP EVAP - EVAP  
SEC GLY EVAP OUT TEMP - 38-50.5°F  
ECS IND - PRIM  
PRIM ECS RAD OUT TEMP - >-20°F  
\*IF <-20°F, DEACTIVATE\*

DEACTIVATE  
SUIT CKT HT EXCH - ON (20 sec), then off (ctr)  
SEC COOL LOOP EVAP - RESET 1 min min, then off (ctr)  
SEC COOL LOOP PUMP - off (ctr)  
EVAP H2O CONT SEC vlv - OFF (AUTO for ENTRY)

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16 ACTIVATE PRIMARY EVAP  
GLY EVAP H2O FLOW - AUTO  
GLY EVAP STM PRESS - AUTO

DEACTIVATE PRIMARY EVAP  
GLY EVAP H2O FLOW - off (ctr)  
GLY EVAP STM PRESS AUTO - MAN  
GLY EVAP STM PRESS INCR - INCR for 1 minute

PRIM EVAP RESERVICE  
GLY EVAP STM AUTO - MAN  
GLY EVAP STM INCR - INCR  
for 1 min  
Wait 15 min  
GLY EVAP H2O FLOW - ON  
for 2 min, then AUTO  
GLY EVAP STM AUTO - AUTO

17 ACTIVATE SEC EVAP  
SEC EVAP H2O CONT - AUTO  
SEC COOL LOOP EVAP - EVAP  
SEC COOL LOOP PUMP - ACT

DEACTIVATE SEC EVAP  
SEC COOL LOOP EVAP - RESET for 1 minute  
SEC EVAP H2O CONT - OFF  
SEC COOL LOOP PUMP - OFF

18 POTABLE WATER CHLORINATION  
Check WASTE TK qty; if <15%,  
no chlorination if evaporators operating.  
Check POT TK qty; if >90%,  
withdraw 8 oz of water  
Unstow chlorination unit  
Remove chlor port cap  
Attach needle assembly to injection port  
Insert chlorine ampoule into casing  
Connect knob assembly & rotate (CW) until  
piston contacts ampoule  
Install ampoule assembly on needle assembly  
(push & turn CW)  
Rotate knob (CW) until ampoule is empty  
(3 times for half empty if H2O quantity <50%

Disconnect ampoule assembly from needle assembly

Rotate knob CCW & stow used ampoule

Repeat above steps with buffer ampoule

POT TK IN vlv - OPEN (verify)

Wait 10 min & remove ampoule of H2O

Replace chlor port cap

Stow chlorination unit

Do not drink for 30 min

19 WASTE WATER TANK DRAIN

H2O QTY IND - WASTE

WATER CONT PRESS REL vlv - DUMP A

Monitor H2O QTY (WASTE) ind - decreasing

When H2O QTY (WASTE) ind reads 25%:

WATER CONT PRESS REL vlv - 2

20 SIDE HATCH URINE/WATER DUMP

Remove Dump Nozzle Conn Cover

Remove Plug & Stow

Withdraw Wire Guard & Wires from slot

Install Male QD on Dump Nozzle

Install Female QD on Waste Tank Service Port

Connect cable to heater connector (crew option)

UTIL PWR - OFF

Connect cable to utility outlet

UTIL PWR - ON

Connect Urine Dump Hose to Dump Nozzle QD

Connect other end of UT hose to Female QD on

Waste Tank Service Port (as req)

Dump Waste Water/Urine

If Waste Water Dump:

WASTE TANK SERV vlv - OPEN

until WASTE H2O QTY ind

25%, then CLOSE

Disconnect UT hose from UTS/Waste Servicing Tank and Purge

Disconnect UT Hose from Dump Nozzle & stow

UTIL PWR - OFF (verify)

Disconnect Cable from heater & outlet

& stow (verify)

Install plug & dump nozzle connector

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21 WATER COLLECTION

Connect urine transfer hose-filter to urine/feces  
Disconnect "T" adapter QD from urine transfer hose  
WASTE MANAGEMENT DRAIN vlv - DUMP  
Collect water  
After collection complete:  
Purge for 1 minute (min)  
WASTE MANAGEMENT DRAIN vlv - CLOSE

22 WATER/GAS SEPARATOR SERVICING

Remove separator from stowage  
Attach separator to water pistol  
Trigger water pistol in short pulses until water  
is observed at separator outlet port  
Wait 10 minutes  
CAUTION - Membrane can be damaged by pencils,  
screwdrivers, and other pointed objects  
Separator may be used on water pistol or on food  
prep unit as needed

23 PRE LOI SEC GLY LOOP CHECK

ECS IND sw - SEC  
SEC GLY TO RAD vlv - NORM  
SEC COOL LOOP PUMP - ACT  
GLY DISCH SEC PRESS - 39-51 psia  
ACCUM SEC QTY ind - 30-55%  
SEC EVAP TEMP OUT - decreases  
(verifies flow)  
SEC COOL LOOP PUMP - off (ctr)  
SEC GLY TO RAD vlv - BYPASS  
ECS IND sw - PRIM

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24 CONTAMINATION CONTROL

Note: If water is to be collected,  
use water collection procedure.

Unstow vac cleaner & components

AC UTIL PWR - OFF (verify)

Assemble components & connect pwr cable

AC UTIL PWR - on (up)

Vac cleaner pwr sw - ON

Vacuum/brush CM interior with special  
attention to the following:

Transfer tunnel wall and top hatch surfaces

Open B5 and B6 cover and clean compartment  
and SRC bags surfaces

Open A5 and clean compartment and CSC bag and  
film cassette bags surfaces

Open R13 and clean compartment and film  
magazine bag surface

Open food containers and clean compartment  
and helmet stowage bags surfaces

PGA bag surfaces

Move vacuum cleaner brush into all potential  
"dead air" pockets to ensure thorough  
mixing of CM atmosphere.

Vac cleaner pwr sw - OFF

AC UTIL PWR - OFF

Disconnect pwr cable & disassemble components

Stow vac cleaner & components

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C/W OPERATIONAL CHECKS

- 1 C/W SYSTEM OPERATIONAL CHECK  
C/W LAMP TEST - 1 (LH MA & 15 lts)  
C/W LAMP TEST - 2 (RH MA & 20 lts)  
C/W CSM - CM (CM RCS lt (2) - on)  
C/W CSM - CSM (CM RCS lt (2) - out)
- 2 ACKNOWLEDGE/RESET MASTER ALARM INDICATION  
A Normal mode  
MA tone/lt (3) - on  
MA pb/lt (1) - push  
MA tone/lt (3) - out  
applicable C/W lt remains on  
  
B Acknowledge mode (C/W NORM in ACK)  
MA tone/lt (3) - on  
MA pb/lt (1) - push & hold  
MA tone/lt (3) - out  
applicable C/W lt remains on for  
malfunction indication  
MA pb/lt - release  
applicable C/W lt - out
- 3 MASTER ALARM TONE HEADSET CONTROL  
A Inhibit tone (PWR - AUDIO)  
  
B Permit tone (PWR - AUDIO/TONE)
- 4 C/W TONE BOOSTER ASSEMBLY  
A Installation  
UTIL PWR - OFF  
Install connector  
Position sensor over MA lt  
UTIL PWR - on (up)  
Install beeper on  
LH (RH) girth shelf  
  
B Operational Check  
C/W LAMP TEST - 1(2) (hold)

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TELECOMM PROCEDURES

1 HI-GAIN ANTENNA OPERATION

cb HI-GAIN ANT FLT BUS - closed  
cb HI-GAIN ANT ac GRP 2 - closed  
HI-GAIN ANT TRACK - MAN  
HI-GAIN ANT SERVO ELEC - PRIM  
HI-GAIN ANT BEAM - WIDE  
HI-GAIN ANT PWR - POWER

Go to V64 HI GAIN ANTENNA POINTING procedures  
Verify required coordinates within full  
coverage region

- \*If required coordinates are in scan limit \*
- \* zone or skin reflection zone, one or more \*
- \* of the following may be done: \*
- \*a. Change CSM attitude to provide antenna \*
- \* coordinates in the full coverage region \*
- \*b. Allow up to 60 seconds for the expected \*
- \* CSM attitude variation to alleviate the \*
- \* condition \*
- \*c. In attitude hold condition, operate in \*
- \* wide beam mode \*
- \*d. Switch to narrow beam and acquire manually \*

HI-GAIN ANT PITCH & YAW POS (2) - Set in required  
coordinates

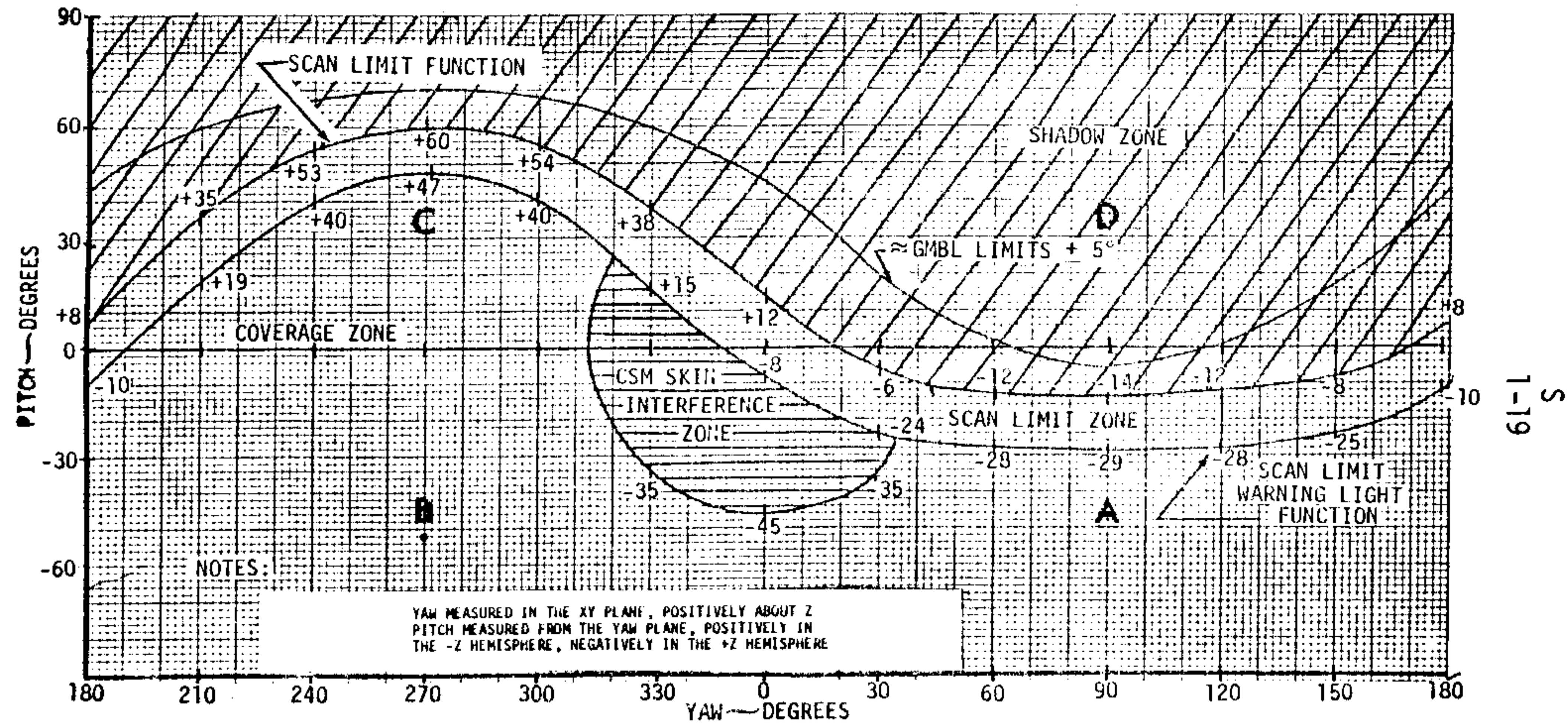
\*If in earth orbit, S BD NORM PWR AMPL HI-off(ctr)\*

S BD ANT - HI GAIN  
HI-GAIN ANT S BD ANT ind - >1/2 scale  
HI-GAIN ANT TRACK - AUTO or REACQ  
HI-GAIN ANT BEAM - as required depending on range  
HI-GAIN ANT S BD ANT ind - >1/2 scale

When omni antenna operation is desired:

HI-GAIN ANT TRACK - MAN  
HI-GAIN ANT PITCH POS - -52°  
HI-GAIN ANT YAW POS - 270°

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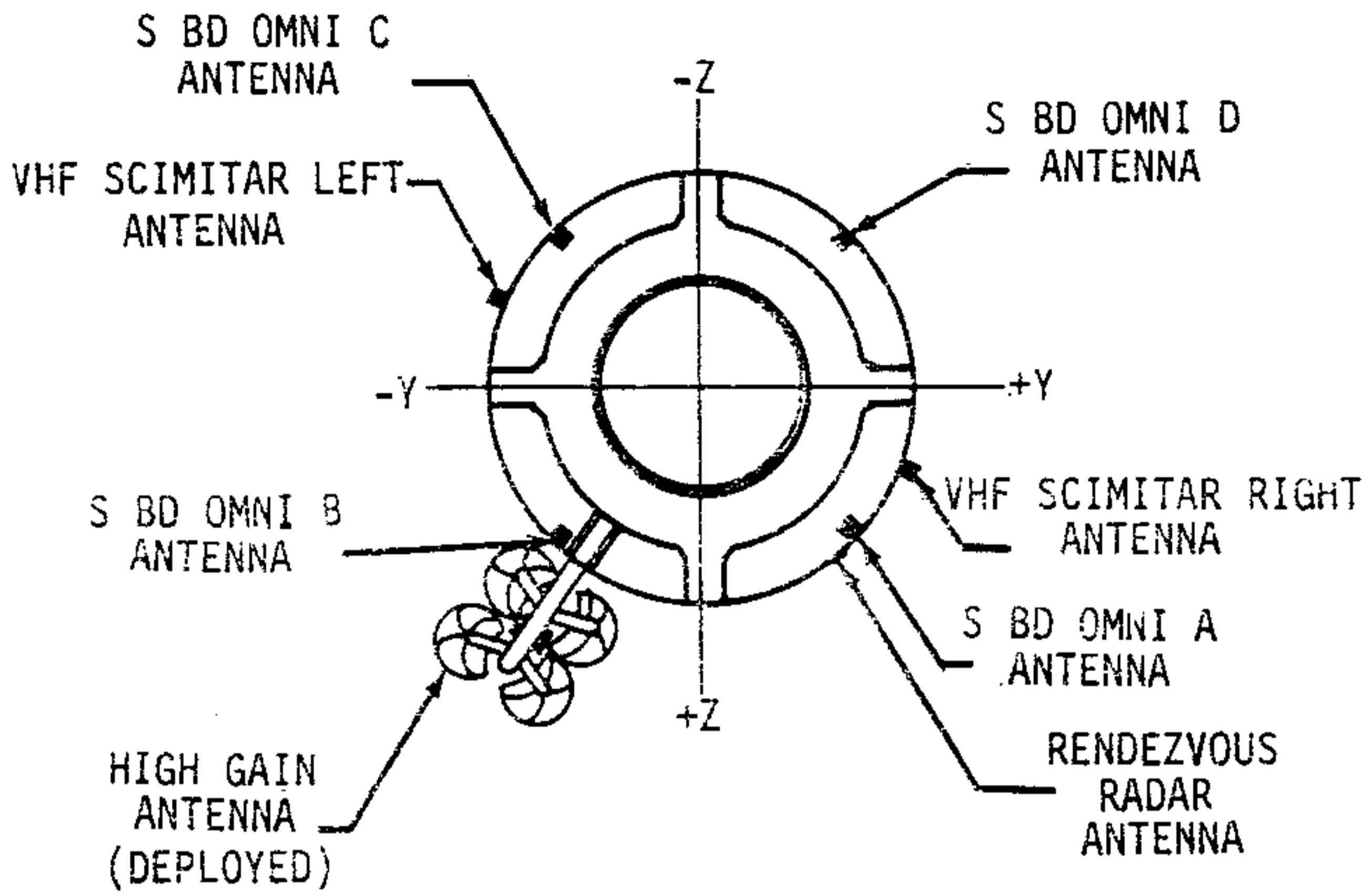
NOTES:

YAW MEASURED IN THE XY PLANE, POSITIVELY ABOUT Z  
 PITCH MEASURED FROM THE YAW PLANE, POSITIVELY IN  
 THE -Z HEMISPHERE, NEGATIVELY IN THE +Z HEMISPHERE

HIGH-GAIN ANTENNA SCAN AND WARNING LIMIT,  
 YAW-PITCH COORDINATES (CSM)

1-19 S

S  
1-20



RENDEZVOUS RADAR ANTENNA

VHF SCIMITAR ANTENNA RIGHT (COVER REMOVED)

VHF SCIMITAR ANTENNA LEFT (COVER REMOVED)

HIGH GAIN ANTENNA (DEPLOYED)

MICRO WAVE ELECTRONICS

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2 TV CAMERA OPERATION (COLOR)

Unstow TV camera, monitor, camera cable, and monitor cable  
Verify monitor power sw is in off position  
Transmit/Standby sw - STANDBY  
TV camera ALC sw - AVG  
Set focus to 4ft, zoom control to 25, aperture control to f/44  
Connect monitor cable to camera and to monitor (arrow-to-arrow)  
S BD AUX TAPE - off (ctr) or DN VOICE BU  
Verify S BD AUX TV - off (ctr)  
Connect TV camera cable to TV camera and s/c  
S BD AUX TV - TV  
TV monitor power sw - ON  
Rotate monitor brightness and contrast controls until monitor picture is properly adjusted  
Adjust cabin lighting to full max  
By using monitor, adjust camera lens aperture, zoom control, and focus control  
When TV transmission to MSFN is desired:  
Transmit/Standby sw - XMITT  
(xmsn will begin immediately)  
When TV operation is completed: S BD AUX TV - off (ctr)  
Disassemble and stow TV camera, monitor, and cables

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- 3 VHF RANGING OPERATION  
VHF AM A - off (ctr)  
VHF AM B - DUPLEX  
VHF RNG - on (up)  
P20 operating  
V87E, TRACKER It - on  
EMS FUNC - ΔV SET/VHF RNG  
EMS MODE - BACKUP/VHF RNG

CAUTION

No VHF voice transmission for  
~12 sec after VHF RNG - RESET

VHF RNG - RESET (1 sec min)  
EMS RANGE ind - BBBB00  
P20 operating, TRACKER It - out  
EMS RANGE ind - BXXX XX  
V83E (if desired)  
R1 = RANGE  
R2 = RANGE RATE  
R3 = 0  
V85E (if desired)  
R1 = RANGE  
R2 = RANGE RATE  
R3 = 0

- 4 RNDZ XPNDR ACTIVATION & SELF TEST  
cb RNDZ XPNDR FLT BUS - close (verify)  
RNDZ XPNDR - HTR for 24 min  
(1 min if self test only)  
RNDZ XPNDR - PWR  
SYS TEST (lh) - XPNDR  
SYS TEST (rh) - A (RRT XMTR OUT PWR)  
SYS TEST ind - >1 vdc  
SYS TEST (rh) - B (RRT AGC SIG)  
RNDZ XPNDR - TEST (hold)  
SYS TEST ind - >1 vdc  
RNDZ XPNDR - OPERATE  
SYS TEST ind - 0 - 4.5 vdc  
SYS TEST (rh) - C (RRT FREQ LOCK)  
SYS TEST ind - <.8 vdc unlocked, >4 vdc locked)  
SYS TEST (rh) - B

5 COMM MODES  
NORMAL LUNAR CONFIGURATION  
S BD XPNDR - PRIM  
S BD PWR AMPL - PRIM  
S BD PWR AMPL HI - HI  
S BD MODE VOICE - VOICE  
S BD MODE PCM - PCM  
S BD RNG - RNG  
S BD AUX TAPE - DN VOICE BU  
S BD AUX TV - off (ctr)  
UP TLM DATA - DATA  
UP TLM CMD - NORM  
VHF AM A - off (ctr)  
VHF AM B - off (ctr)  
VHF RCV ONLY - off (ctr)  
VHF RNG - OFF  
TAPE RCDR PCM - PCM/ANLG  
TAPE RCDR RCD - RCD  
TAPE RCDR FWD - FWD  
SCE PWR - NORM  
PMP PWR - NORM  
PCM BIT RATE - LOW  
S BD SQUELCH - OFF  
HI GAIN ANT PWR - PWR  
HI GAIN ANT TRACK - MAN  
HI GAIN ANT BEAM - WIDE  
HI GAIN ANT SERVO ELEC - PRIM

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For the following mission phases select the NORMAL LUNAR CONFIGURATION plus the specified deltas:

- A COAST AWAKE  
S BD AUX TAPE - off (ctr)  
TAPE RCDR FWD - off (ctr)
- B COAST ASLEEP  
S BD SQUELCH - ENABLE  
S BD AUX TAPE - off (ctr)  
S BD NORM MODE VOICE - off (ctr)  
1 HI GAIN OPERATION:  
P, Y = +40, 270 (ROLL RIGHT)  
P, Y = -40, 90 (ROLL LEFT)  
HI GAIN ANT BEAM - NARROW  
HI GAIN ANT TRACK - REACQ  
S BD ANT - HI GAIN  
2 OMNI OPERATIONS:  
S BD ANT - OMNI  
S BD ANT OMNI - B  
TAPE RCDR FWD - off (ctr)
- C LUNAR ORBIT AWAKE  
USE NORMAL LUNAR CONFIGURATION
- D LUNAR ORBIT ASLEEP  
S BD SQUELCH - ENABLE  
HI GAIN ANT TRACK - REACQ  
HI GAIN ANT BEAM - NARROW  
HI GAIN ANT P, Y, = \_\_\_\_\_, \_\_\_\_\_
- E VHF RANGING $\theta$  VOICE  
VHF AM B - DUPLEX  
VHF RNG - on (up)  
VHF RCV ONLY - B DATA (MINIMIZES CREW SWITCHING)
- F VHF LM-CSM VOICE DATA  
VHF AM A - SIMPLEX  
VHF RCV ONLY - B DATA

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G CONTINGENCY  
VHF AM A - SIMPLEX  
VHF AM B - SIMPLEX

H RELAY MODE (LM VOICE TO MSFN)  
Voice Relay (With VHF Ranging)  
MODE - VOX (Pnl 10)  
VOX SENS tw - 5  
S BD - OFF  
INTERCOM - OFF  
VHF AM - T/R  
AUDIO CONT - BU  
MODE - VOX (Pnl 9)  
VOX SENS tw - as req  
S BD MODE VOICE - RELAY  
VHF AM B - DUPLEX  
VHF RNG - on (up)

Voice Relay (With LM LBR PCM record)  
MODE - VOX (Pnl 10)  
VOX SENS tw - 5  
S BD - OFF  
INTERCOM - OFF  
VHF AM - T/R  
AUDIO CONT - BU  
MODE - VOX (Pnl 9)  
VOX SENS tw - as req  
S BD MODE VOICE - RELAY  
VHF AM A - SIMPLEX  
VHF RCV ONLY - B DATA

I LUNAR STAY  
VHF AM B - DUPLEX  
VHF AM - RCV (Pnl 9)  
HI GAIN ANT BEAM - NARROW  
HI GAIN ANT TRACK - REACQ  
HI GAIN ANT P \_\_\_\_\_, Y \_\_\_\_\_  
S BD SQUELCH - ENABLE

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PRESLEEP CHECKLIST

CREW STATUS REPORT (MEDICATION)

ONBOARD READOUTS

CYCLE CRYO FANS

CHLORINATE POTABLE WATER

VERIFY:

WASTE MNGMT OVBD DRAIN - OFF

WASTE STOW VENT vlv - CLOSED

OPTICS ZERO - ZERO

G&N POWER OPTICS - OFF

EMERGENCY CABIN PRESS - BOTH

SURGE TANK O2 vlv - ON

REPRESS PKG O2 vlv - OFF

CABIN PRESS RELF vlv (RH/LH) - NORMAL

PRESS EQUAL vlv - CLOSE

LM TUNNEL VENT vlv - LM/CM  $\Delta P$  (LM on)

- OFF (LM off)

DIRECT O2 vlv - OPEN (Until 5.7 psia - CLOSE)

"E" MEMORY DUMP

CONFIGURE COMMUNICATIONS (S/1-24)

POSTSLEEP CHECKLIST

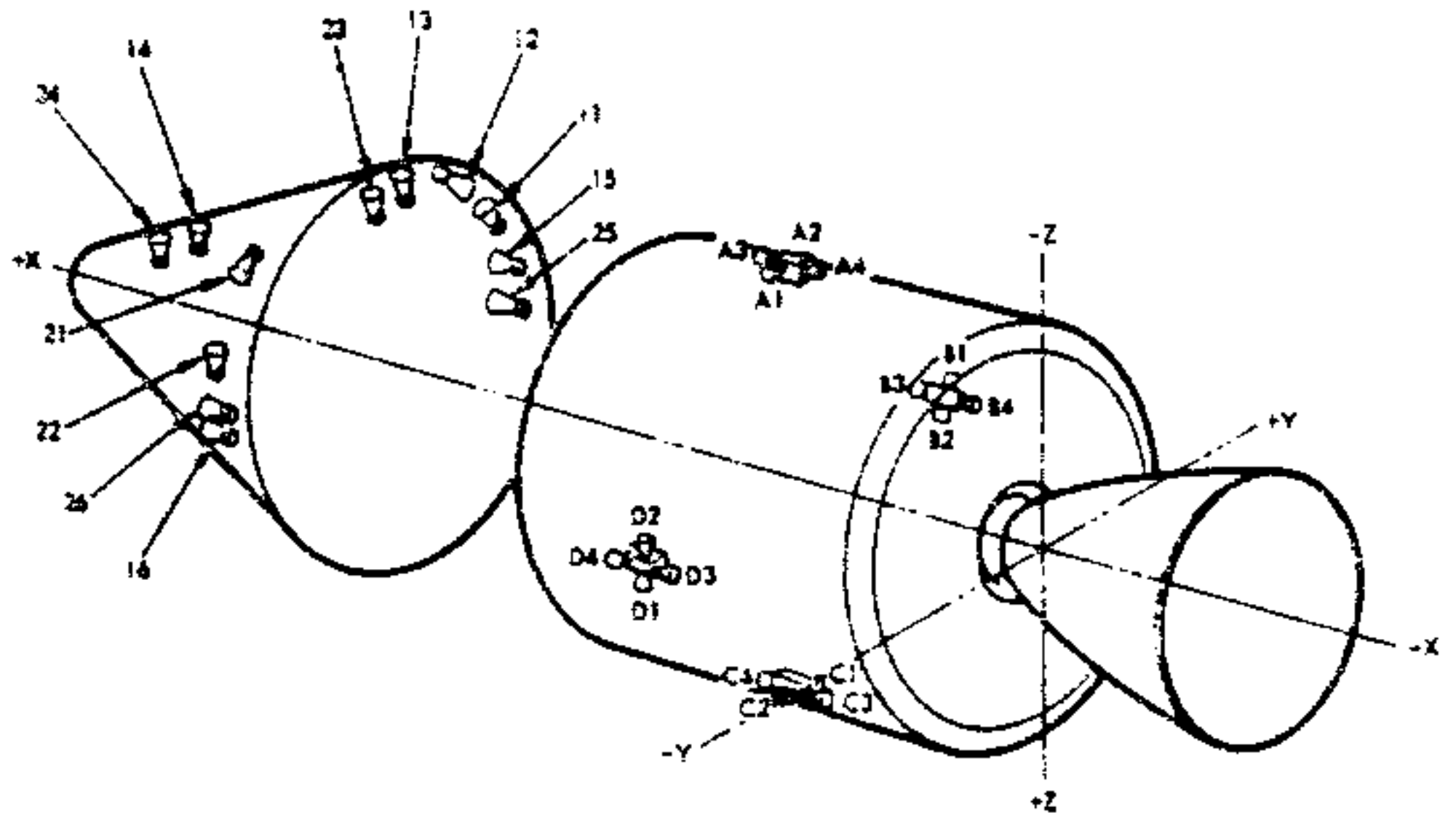
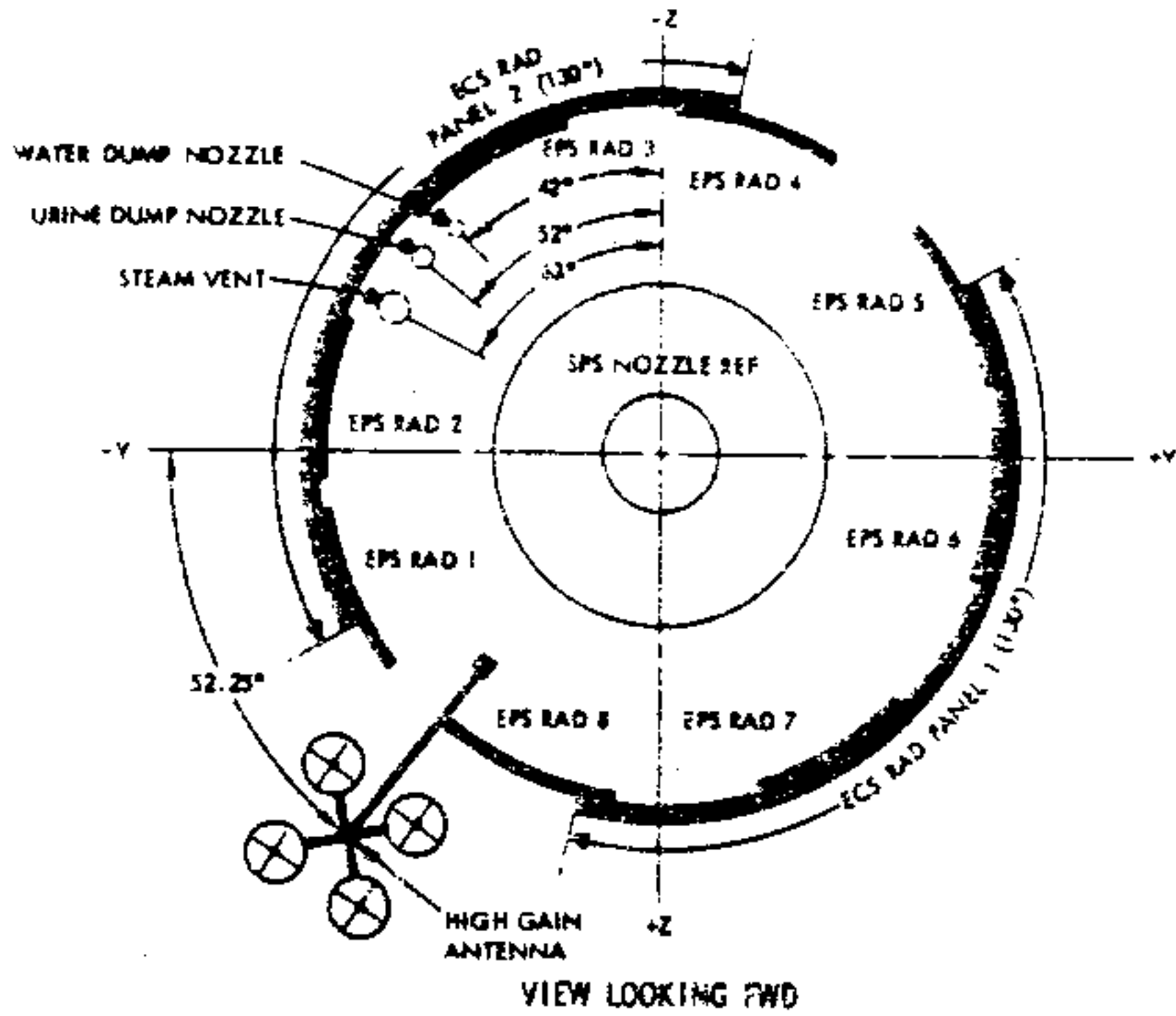
CREW STATUS REPORT (SLEEP & RADIATION)

CONSUMABLES UPDATE

CYCLE CRYO FANS

CONFIGURE COMMUNICATIONS (S/1-24)

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CM RCS CODE

FIRST DIGIT: SYSTEM (1 OR 2)  
SECOND DIGIT: 1, 2 (+, -ROLL) 3, 4 (+, -PITCH) 5, 6 (+, -YAW)

SM RCS CODE

1 AND 2 ARE ROLL ENGINES  
3 AND 4 ARE A/C PITCH OR B/D YAW ENGINES  
1 AND 3 = + ROTATION, 2 AND 4 = - ROTATION

RCS Engine, Vent, and Radiator Locations

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# System Test Indicator Conversion Chart

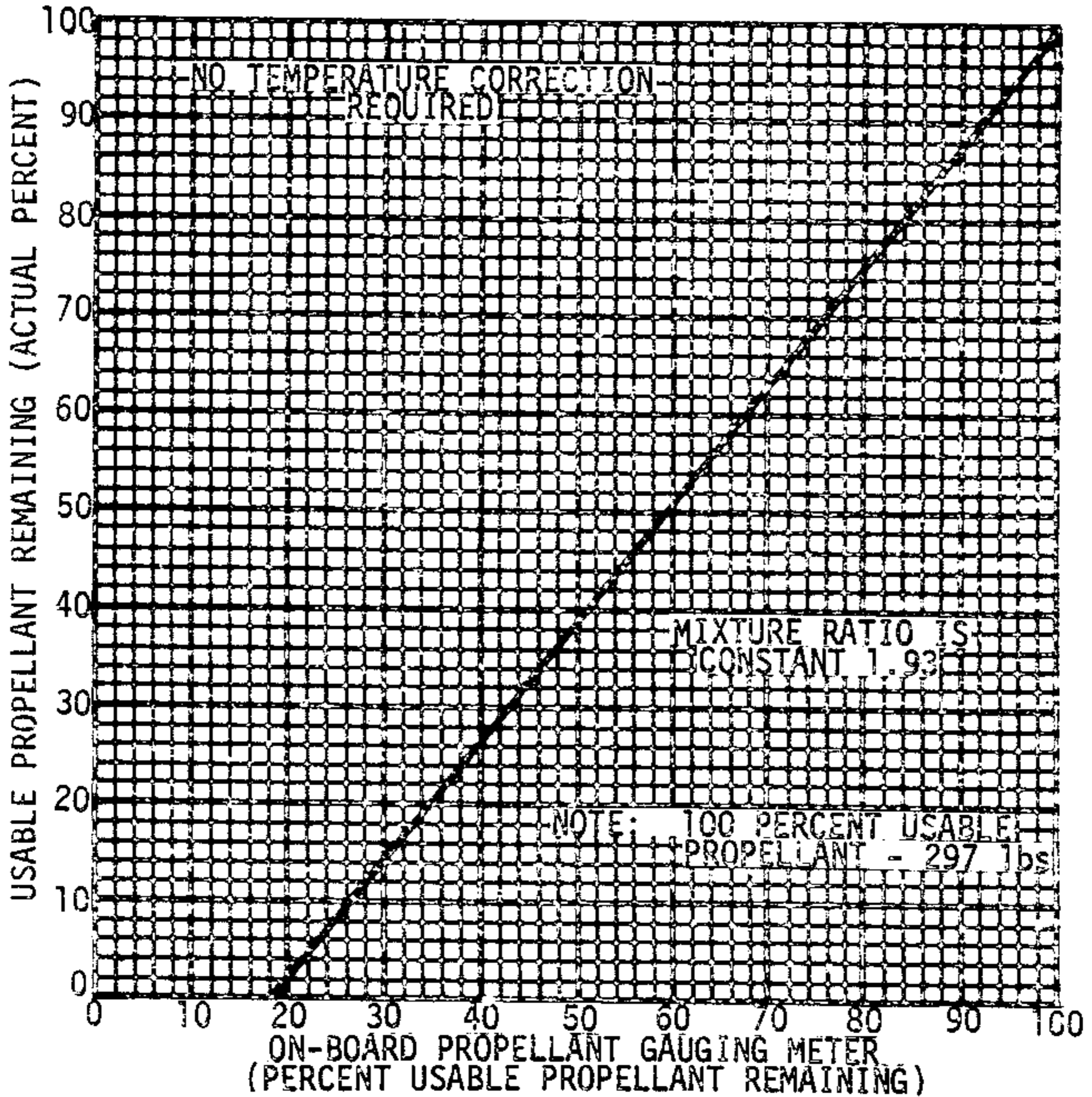
SYSTEMS TEST Indicator Display	Cryo O2 Htr Temp (°F)	O2, H2 Pressure (psia)	EPS Rad Out Temp (°F)	CM-RCS Oxid Vlv Temp (°F)	LM Power (amps)	SPS Temp (°F)	Battery Compartment Manifold Pressure (psia)	Battery Relay Bus (vdc)
0.0	-300	0 0	-50	-50	0	0	0.00	0
0.2	-264	3 3	-36	-46	0.4	8	0.80	1.8
0.4	-228	6 6	-22	-42	0.8	16	1.60	3.6
0.6	-192	9 9	-8	-38	1.2	24	2.40	5.4
0.8	-156	12 12	+6	-34	1.6	32	3.20	7.2
1.0	-120	15 15	+20	-30	2.0	40	4.00	9.0
1.2	-84	18 18	+34	-26	2.4	48	4.80	10.8
1.4	-48	21 21	+48	-22	2.8	56	5.60	12.6
1.6	-12	24 24	+62	-18	3.2	64	6.40	14.4
1.8	+24	27 27	+76	-14	3.6	72	7.20	16.2
2.0	+60	30 30	+90	-10	4.0	80	8.00	18.0
2.2	+96	33 33	+104	-6	4.4	88	8.80	19.8
2.4	+132	36 36	+118	-2	4.8	96	9.60	21.6
2.6	+168	39 39	+132	+2	5.2	104	10.40	23.4
2.8	+204	42 42	+146	+6	5.6	112	11.20	25.2
3.0	+240	45 45	+160	+10	6.0	120	12.00	27.0
3.2	+276	48 48	+174	+14	6.4	128	12.80	28.8
3.4	+312	51 51	+188	+18	6.8	136	13.60	30.6
3.6	+348	54 54	+202	+22	7.2	144	14.40	32.4
3.8	+384	57 57	+216	+26	7.6	152	15.20	34.2
4.0	+420	60 60	+230	+30	8.0	160	16.00	36.0
4.2	+456	63 63	+244	+34	8.4	168	16.80	37.8
4.4	+492	66 66	+258	+38	8.8	176	17.60	39.6
4.6	+528	69 69	+272	+42	9.2	184	18.40	41.4
4.8	+564	72 72	+286	+46	9.6	192	19.20	43.2
5.0	+600	75 75	+300	+50	10.0	200	20.00	45.0
SYS TEST sel	1A, 1B, 1C	(O2) 1D, 2A, 2B (H2) 2C, 2D, 3A	3B, 3C, 3D	5C, 5D, 6A 6B, 6C, 6D	7D	5A	7A	5B

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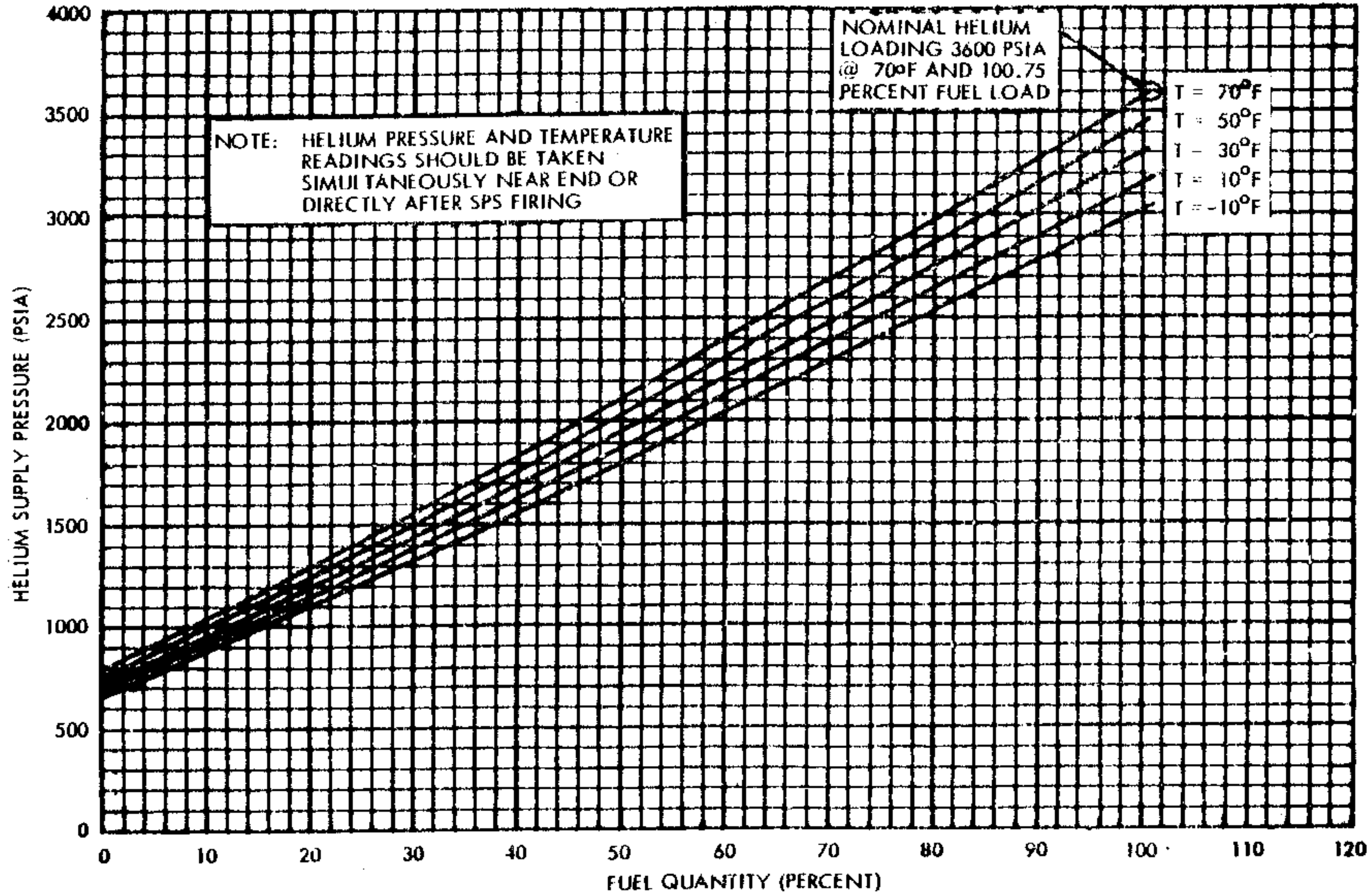
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Minus Two-Sigma SM RCS On-Board Propellant Gauging Meter Correction Nomograph

# SPS Propellant Nomograph



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SIM Experiments

- 1 Preparation - TBD
- 2 Gamma Ray Spectrometer - TBD
- 3 X-Ray Fluorescence Spectrometer - TBD
- 4 Alpha-Particle Spectrometer - TBD
- 5 Panoramic Camera - TBD
- 6 S-Band Transponder - TBD
- 7 Mass Spectrometer - TBD
- 8 Mapping Camera - TBD
- 9 Subsatellite - TBD
- 10 Laser Altimeter - TBD

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LM INTERFACE

IVT TO LM (CHECKOUT, TLC)

At 2 hours prior to IVT to LM:

TUNL VENT vlv - LM/CM ΔP

Verify LM/CM ΔP ≥2.7 psid

\*LM/CM ΔP <2.7 psid \*

\*TUNL VENT vlv - VENT \*

\* till LM/CM ΔP ≥2.7 psid\*

At least 30 min. prior to IVT to LM:

DIRECT 02 vlv - OPEN until

CAB PRESS = 5.7 psia, then close.

Couches: CDR - 0°, CMP - 0°, LMP - 180°

TUNL LTS - ON

Equalize CM/LM pressure (Decal B) (1B)

Remove tunnel hatch (Decal) (2)

Remove probe & stow (Decal) (3)

Remove drogue & stow (Decal) (4)

Read docking tunnel index angle \_\_\_\_\_

Open LM hatch

LMP Transfer to LM (5)

Transfer items per LM Activation Checklist

At LM request

LM PWR - RESET, then OFF

Report GET to MSFN - GET \_\_\_\_\_:\_\_\_\_\_:\_\_\_\_\_

SYS TEST - 7D

SYS TEST ind - 0 volts

Perform comm checks with LM

At LM request

LM PWR - CSM

SYS TEST - 7D

SYS TEST ind - 0.5 - 3.2 volts

LMP Transfer to CSM (6)

Close LM hatch

Install drogue (Decal) (8)

Install probe (Decal) (9)

Install tunnel hatch (Decal) (11)

TUNL VENT vlv - LM/CM ΔP

TUNL LTS - OFF

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LM INTERFACE

IVT TO LM (UNDOCKING, PDI)

Couches: CDR - 0°, CMP - 0°, LMP - 180°  
TUNL LTS - ON  
TUNL VENT vlv - LM/CM ΔP  
Verify LM/CM ΔP < 0.2

\*LM/CM ΔP > 0.2 \*  
\* Equalize CM/LM Pressure\*  
\* (Decal) (1) \*

Remove tunnel hatch (Decal) (2)

Remove probe & stow (Decal) (3)

Remove drogue & stow (Decal) (4)

Verify docking tunnel index angle

Open LM hatch

LMP transfer to LM (5)

At LM request,

LM PWR - RESET, then OFF

SYS TEST - 7D

SYS TEST ind - 0 volts

Transfer items per LM Activation Checklist

CDR transfer to LM (5)

Remove LM umbilicals (7)

Install drogue (Decal) (8)

Install probe (Decal) (9)

Preload probe (Decal) (10)

LM hatch closed

Verify CSM roll cmds inhibited

until LM/CM ΔP > 3.5 psid (>3.5, 2 jet; >4, 4 jet)

Release docking latches (Decal) (13)

Install tunnel hatch (Decal) (11)

Perform hatch integrity check (Decal) (12)

Perform Contingency EVA Prep (C/7-1)(optional)

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FINAL IVT TO CSM

- CDR FWD DUMP vlv - AUTO (verify)
- CMP Equalize CSM/LM Pressure (LOD)(Decal) (14)  
 Remove tunnel hatch (Decal) (2)  
 Verify docking latches engaged (at least 3)  
 Remove & temp stow probe (Decal) (3)  
 Remove & temp stow drogue (Decal) (4)  
 Transfer items to CDR at his request  
 Receive items from LM & stow
- CDR Transfer to CSM (6)  
 Transfer CSM jettison items to LM
- LMP Close LM hatch  
 Transfer to CSM (6)
- CMP DIRECT 02 vlv - close (CW)  
 Install tunnel hatch (Decal) (11)  
 Perform hatch integrity check (Decal) (12)

SUB-CHECKLIST

1 CM/LM PRESSURE EQUALIZATION (Decal)

A. LM/CM  $\Delta P < 2.4$  PSID

- CRYO PRESS IND - SRG/3  
 Verify CRYO 02 PRESS 1/SRG ind - 865-935 ps  
 EMER CAB PRESS sel - OFF  
 REPRESS PKG vlv - OFF  
 DIRECT 02 vlv - CLOSE (verify)  
 PRESS EQUAL vlv - OPEN (C)  
 02 FLOW ind - 1.0 lb/hr (Pegged)  
 02 FLOW HI lt - on  
 MASTER ALARM pb/lt (3) - ON, push  
 LM/CM  $\Delta P \sim 0.0$  psia  
 CAB PRESS ind  $\sim 5.0$  psia  
 EMER CAB PRESS sel - BOTH

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B. LM/CM ΔP >2.4 PSID

(Overpressurization of CM to 5.7 psia required at least 30 min. in advance)

CRYO PRESS IND - SRG/3

Verify CRYO 02 PRESS 1/SRG ind - 865-935 psia

EMER CAB PRESS sel - OFF

REPRESS PKG vlv - OFF

DIRECT 02 vlv - CLOSE (verify)

TUNL VENT vlv - LM/CM ΔP

LM/CM ΔP ind - >3.1 psid

PRESS EQUAL vlv - OPEN (C)

LM/CM ΔP - 2.0 psid

PRESS EQUAL vlv - CLOSE

MONITOR LM/CM ΔP ind for 3 min

and verify ΔP stable

PRESS EQUAL vlv - OPEN

CAB PRESS ind - 4.0 psia

REPRESS 02 vlv - OPEN

CAB PRESS ind 5.7 psia

Cycle REPRESS 02 as required

between 4.0 and 5.7 psia limits

until REPRESS 02 PRESS ind

~0.0 psia

REPRESS 02 - CLOSE

CAB PRESS ind >4.0 psia

\*If CAB PRESS ind <4.0 psia\*

\* PRESS EQUAL vlv - CLOSE \*

LM/CM ΔP ind - ~0.0 psid

CAB PRESS ind - ~5.0 psia

EMER CAB PRESS sel - BOTH

CRYO 02 PRESS 1/SRG ind (SURGE TK) - >400 psia

REPRESS PKG vlv - FILL to 865-935

TUNL VENT vlv - OFF

WASTE STOW vlv - VENT (until cabin purge complete at 8 hrs)

- 2 TUNNEL HATCH REMOVAL (Decal) HATCH  
PRESS EQUAL vlv - open (CCW) 1  
ACTR HNDL - unstow, pull to stop, set to U (C)  
- push to stop  
Verify gearbox disconnect socket - U  
ACTR HNDL SEL - stow, push handle to stow  
Remove hatch, stow

3 PROBE REMOVAL (CM Side) (Decal)

A. Translunar Docking:

Verify EXTEND LATCH engaged indicator  
(red) not visible

- \*EXTEND LATCH not engaged:
- \* PRELOAD SEL LEVER-rotate CW(away from  
orange stripe)
- \* PRELOAD HNDL - Torque CCW to engage
- \* extend latch (red ind. not visible)

GN2 BLEED button (red) - press (10 sec)  
PRELOAD SEL LEVER - rotate CCW (parallel  
to orange stripe)

PRELOAD HNDL - Torque (CW) to unload support  
beams

B. Lunar Orbit Docking:

NOTE: Probe may be hot from stay in Lunar orbit  
PRELOAD SEL LEVER - rotate CW(away from orange  
stripe)

PRELOAD HNDL - torque CCW to engage EXTEND LATCH:  
(red indicator not visible)

GN2 BLEED button (red) - press (10 sec)

C. Both TLD & LOD:

- PROBE UMBILICALS(2)(yellow) - disconnect and stow
- Elec connector covers (2)(yellow) - close
- PRELOAD HNDL - position against umbilical connector
- PRELOAD SEL LEVER - mid position
- INSTALLATION STRUT - unstow, position on tunnel wall (yellow marks)
- CAPTURE LATCH RLSE HNDL LOCK - Rotate CCW to unlock (orange stripe visible)
- RATCHET HNDL - unstow to full extension
- push to first detent (red band)
- push outbd and hold to fold probe
- RATCHET HNDL - pull to full extension DOCK 1
- ratchet one stroke only
- Restow RATCHET HANDL and INSTALLATION STRUT
- CAPTURE LATCH RLSE HNDL - Pull, rotate to unlock (180° CW)
- push to recess

- \*Capture latches will not release: \*
- \* Ratchet probe forward \*
- \* Preload probe until latches release\*

Remove PROBE - pull aft to release (25 lbs)

4 DROGUE REMOVAL (Decal)

- LOCK LEVER - Pull, rotate 90° CCW
- DROGUE - rotate CW, push clear of support, remove from tunnel

5 CREW TRANSFER TO LM (Suited)

- CDR and LMP Audio Panels:
  - PWR - OFF
  - SUIT PWR - OFF
  - AUDIO CONT - NORM
- CDR and LMP SUIT FLOW vlv - OFF
- Connect to TRANSFER UMB if desired

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- 6 CREW TRANSFER TO CSM (Suited)  
CDR and LMP Audio Panels:  
Verify/set PWR - OFF  
Verify/set SUIT PWR - OFF  
Verify/set AUDIO CONT - NORM  
Verify/set CDR and LMP SUIT FLOW vlv - OFF  
Connect to TRANSFER UMB if desired  
LMP transfer to CSM
- 7 REMOVE LM UMBILICALS (FINAL)  
LM Connector Fairings (2) (orange) - open  
Connectors (2) - release and remove  
Fairings (2) - close  
Pull lanyard on LM end of umbilical  
Remove umbilicals from tunnel, stow in F1 or F2
- 8 INSTALL DROGUE (Decal)  
DROGUE - Align Lugs with fittings,  
rotate CCW to stops  
LOCK LEVER - Rotate 90° CW to detent
- 9 INSTALL PROBE (Decal)  
CAPTURE LATCH RLSE HNDL - Pull, rotate CCW to  
cock pos (150°)  
Push PROBE into DROGUE  
CAPTURE LATCH RLSE HNDL -rotate CCW to LOCK pos  
tion (do not force)  
-push to recess  
Verify capture latches engaged (CDR)  
INSTALLATION STRUT - unstow, position on tunnel  
wall (yellow marks)  
RATCHET HNDL -unstow to full extension(green ba  
-ratchet probe fwd to orange hash  
mark (F)  
Restow RATCHET HNDL and INSTALLATION STRUT
- CAUTION: For stowage, adjust PRELOAD HANDLE unt  
probe loose in tunnel and position at  
45° to support beam.

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Verify RATCHET PAWL indicator(red) flush with housing

- \*Ratchet pawl indicator not flush: \*
- \* Hold RATCHET HANDLE full outboard \*
- \* Press Pawl indicator to seat (flush)\*
- \* Release RATCHET HANDLE \*

Preload Shaft - push up into detent  
CAPTURE LATCH RLSE HNDL - Set in detent  
CAPTURE LATCH RLSE HNDL LOCK - Rotate CW to lock  
(orange stripe not visible)  
PROBE UMBILICALS(2)(yellow) -connect to dock ring

NOTE: For stowage, umbilical connection not req.

- 10 PRELOAD PROBE (Decal)  
PRELOAD SEL LEVER - rotate CCW(parallel to orange stripe)  
PRELOAD HNDL - torque (CW) to release  
Verify capture latches engaged (CDR)  
PRELOAD HNDL - Push inboard to detent,  
pos 45° to support beam  
PRELOAD SEL LEVER - mid position  
Verify CAPTURE LATCH RLSE HNDL LOCK is locked  
(orange stripe not visible)

- 11 HATCH INSTALLATION (Decal) HATCH  
Align Hatch in tunnel 2  
ACTR HNDL SEL - unstow, pull to stop, set to L  
push to stop  
Verify gearbox disconnect socket - L

- \*If latches cannot be closed: \*
- \*GEARBOX DISCONNECT - 180° CCW (tool B)\*
- \*AUX LATCH DRIVE - LATCH (113° CW) \*
- \*Verify hatch latched, remove tool B \*
- \*(Cannot remove hatch from LM side) \*

ACTR HNDL SEL - stow, push handle to stow  
PRESS EQUAL vlv - CLOSED (CW) (B)

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12 HATCH INTEGRITY CHECK (Decal)

Verify LM Hatch Closed, DUMP vlv - AUTO (CDR)

Verify CABIN PRESS ind - 4.7-5.3 psi

TUNL VENT vlv - TUNL VENT for 30 sec

- LM/CM  $\Delta P$ , check  $\Delta P$

- Recycle to TUNL VENT until  $\Delta P > 3$   
(~8 1/2 min)

\*Cannot vent tunnel:

\* If O2 FLOW ind increases, open hatch,

\* wipe seal surfaces, close hatch

\* If O2 FLOW ind does not increase, dump

\* tunnel through LM during reg check

\* Monitor LM/CM  $\Delta P$  & flow to check

\* integrity

Verify LM/CM  $\Delta P$  ind constant ( $\pm .2$ ) at last value  
for 2 min

Verify O2 FLOW ind - no increase

Before Undocking only:

TUNL VENT vlv - LM TUNL VENT

for 10 min, then LM/CM  $\Delta P$

Verify LM/CM  $\Delta P > 4.0$  (pegged)

TUNL VENT vlv - OFF

TUNNEL LIGHTS - OFF

Before Jettison only:

TUNL VENT vlv - TUNL VENT (at least 10 min)

TUNNEL LIGHTS - OFF

13 DOCKING LATCH RELEASE (Decal)

(G) (H)

RELEASE BUTTON - depress

LATCH HNDL - pull one or two strokes until bung  
recocks

Verify LATCH HOOK rotated inboard  
to clear LM RING

\* Hook does not dis-engage\*

\* AUX REL(yellow)- push \*

\* Release latch \*

Verify/push LATCH HNDL outboard  
against LATCH HOOK

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14 CSM/LM PRESSURE EQUALIZATION (LOD)(Decal)

CRYO PRESS IND - SRG/3

Verify CRYO O2 PRESS 1/SRG ind - 865-935 psia

REPRESS PKG vlv - OFF

Direct O2 vlv - OPEN until CAB PRESS

5.5 psia then CLOSE until O2 FLOW

<.5 lb/hr.

- OPEN adjust O2 FLOW

0.6 lb/hr.

TUNL VENT vlv - LM/CM ΔP

LM/CM ΔP ind - +4 psid (pegged)

PRESS EQUAL vlv - OPEN until LM/CM ΔP (C)

ind ~3 psid then CLOSE

Monitor LM/CM ΔP ind for 3 min and

verify ΔP stable

PRESS EQUAL vlv - OPEN

15 DOCKING LATCH VERIFICATION (Decal)

LATCH HNDL - Pull to verify hook en-  
gaged (12 latches)

\* Not Engaged - Attempt to engage \*  
\* before releasing\*

LATCH IND BUTTON (Red) - Flush (12 latches)

Power BUNGEE FAIRING - Parallel to +X

\* Not parallel - Push +X end of \*  
\* bungee before releasing\*

\*UNLOCKED LATCHES: \*

\* Release Latches \*

\* \* Hook does not dis-engage: \*

\* \* AUX REL (yellow)-push \*

\* \* Release latch \*

\*Engage Latch - push man-release\*

Verify EXTEND LATCH engaged indicator (red)  
not visible

GN2 BLEED button (red) - press (10 sec)

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16 LM UMBILICAL CONNECTION (Decal)

- LM connector fairings (2) (orange) - open
- LM umbilical connectors (2) - install & lock
- LM connector fairings (2)(orange) - close
- SYS TEST - 7D
- LM PWR - CSM
- SYS Test ind - 0.5-3.2 volts

17 MALFUNCTION LIST

DOCKING

- A Positive Indication Of No Capture
  - THC -X, withdraw to formation flight distance
  - PROBE EXTND/REL - EXTND/REL for 5 sec
    - RETR
  - PROBE EXTND/REL tb (2) - gray (verify)
  - Attempt redocking as before

TUNNEL HATCH

- B Pressure Equalization Valve Will Not Close
  - Remove Hatch
  - Use Tool B In External Tool Interface For Additional Leverage
- C Pressure Equalization Valve Will Not Open For TLD:
  - Vent CM
  - Perform Tunnel Operations
  - Repress CM

For Subsequent IVT

TUNL VENT vlv - LM PRESS  
(May require up to 12 hrs  
to equalize pressure)

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PROBE

- D Do Not Get Retraction Using PRIM 1 (< 30 sec)
- Initiate retraction using bottles in the following order:
    - PROBE RETRACT - PRIM 2
    - If no retraction, initiate PROBE RETRACT - SEC 1
- E Both tb's Not Gray After Undocking
- PROBE EXTND/REL - EXTND/REL for 5 sec
  - PROBE EXTND/REL - RETR
  - PROBE EXTND/REL tb (2) - gray (verify)
- F Pushing Ratchet Handle Outboard Does Not Ratchet Probe Forward
- Push ratchet handle to first detent (red band)
  - Slowly push ratchet handle outboard ~25° until audible click. (If pushed outboard past point of click, probe will release).
  - Repeat until orange hash mark is visible.

DOCKING LATCHES

- G Cannot Release Docking Latch By Pulling Handle
- Depress aft end of RH no-back pawl while pulling on latch handle.
  - If unsuccessful, use tools E&R to depress LH no-back pawl while pulling on Latch Handle

TUNNEL

- H High O2 Flow While Releasing Docking Latches
- Re-engage/verify 3 latches ~120° apart are engaged
  - Slowly torque PRELOAD HNDL (CW) until breakout releases; repeat (3) times
  - Release docking latches

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CM EVA

- 1 CM EVA Prep - TBD
- 2 EVA Operations - TBD
- 3 Post EVA Procedures - TBD

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S  
3-2

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S  
4-1

*John K. Kelly - ~~4371~~ 4371*

SAFE OF APEX COVER JETT

*Apex cover is only cover which can occur and be treated on one bus due to power circuit.*

If MSFN NO GO For Pyro Arm Indicates Apex

Cover Jettison,

SECS LOGIC (2) - OFF

cb ELS/CM-SM SEP (2) - open

SECS LOGIC (2) - ON

If MSFN GO, Go To Step A

If Still Apex Cover Jettison,

cb SECS LOGIC A - open

If MSFN GO, Go To Step C

If Still Apex Cover Jettison,

cb SECS LOGIC A - close

cb SECS LOGIC B - open

If MSFN GO, Go To Step D

If Still Apex Cover Jettison,

ELS - MAN

ELS LOGIC - OFF

SECS LOGIC (2) - OFF

cb SECS LOGIC (2) - open

cb SECS ARM (2) - open

CMP To LEB

cb SEQ A&B PYRO A&B (2) - open (Pn1 250)

Verify PYRO BUS A&B voltage = 0

Use Tool E, (5/32 allen head) to remove

closeout panel located beneath panel

276 (approx 10 fasteners on panel).

Remove, or cut all wires to, connector

marked "cut" with white tag (P545). Tape

ends of any wires cut. Replace closeout

panel.

cb SEQ A&B PYRO A&B - close

Verify PYRO BUS A&B voltage >35 vdc

cb ELS/CM-SM SEP (2) - close

cb SECS LOGIC (2) - close

cb SECS ARM (2) - open (verify)

DO NOT ARM PYRO BUSES

*(check the power on nearby case  
metallic wire bundle not really  
related to schematic)*

Continue Normal Entry Except,

SAFE OF APEX

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S  
4-2

Perform CM RCS pressurization & CM/SM  
Separation together at which time ARM  
PYRO's in the following manner:

SECS PYRO ARM (B) - SAFE (verify)  
SECS PYRO ARM (A) - ARM

To Jettison Apex Cover At 24K':  
SECS PYRO ARM (B) - ARM

STEP A

cb ELS/CM-SM SEP BAT A - close  
cb ELS/CM-SM SEP BAT B - open (verify)  
If MSFN GO, Go to STEP B

If Still Apex Cover Jettison,  
cb ELS/CM-SM SEP BAT B - close  
cb ELS/CM-SM SEP BAT A - open  
SECS LOGIC (2) - OFF, then ON

MSFN confirm GO,

cb ELS/CM-SM SEP BAT A - open (verify), close  
at or after apex cover jettison at 24K'  
Continue normal entry

STEP B

cb ELS/CM-SM SEP BAT B - open (verify), close  
at or after apex cover jettison at 24K'  
Continue normal entry

STEP C

cb SECS LOGIC A - open (verify), close  
at or after apex cover jettison at 24K'  
Continue normal entry

STEP D

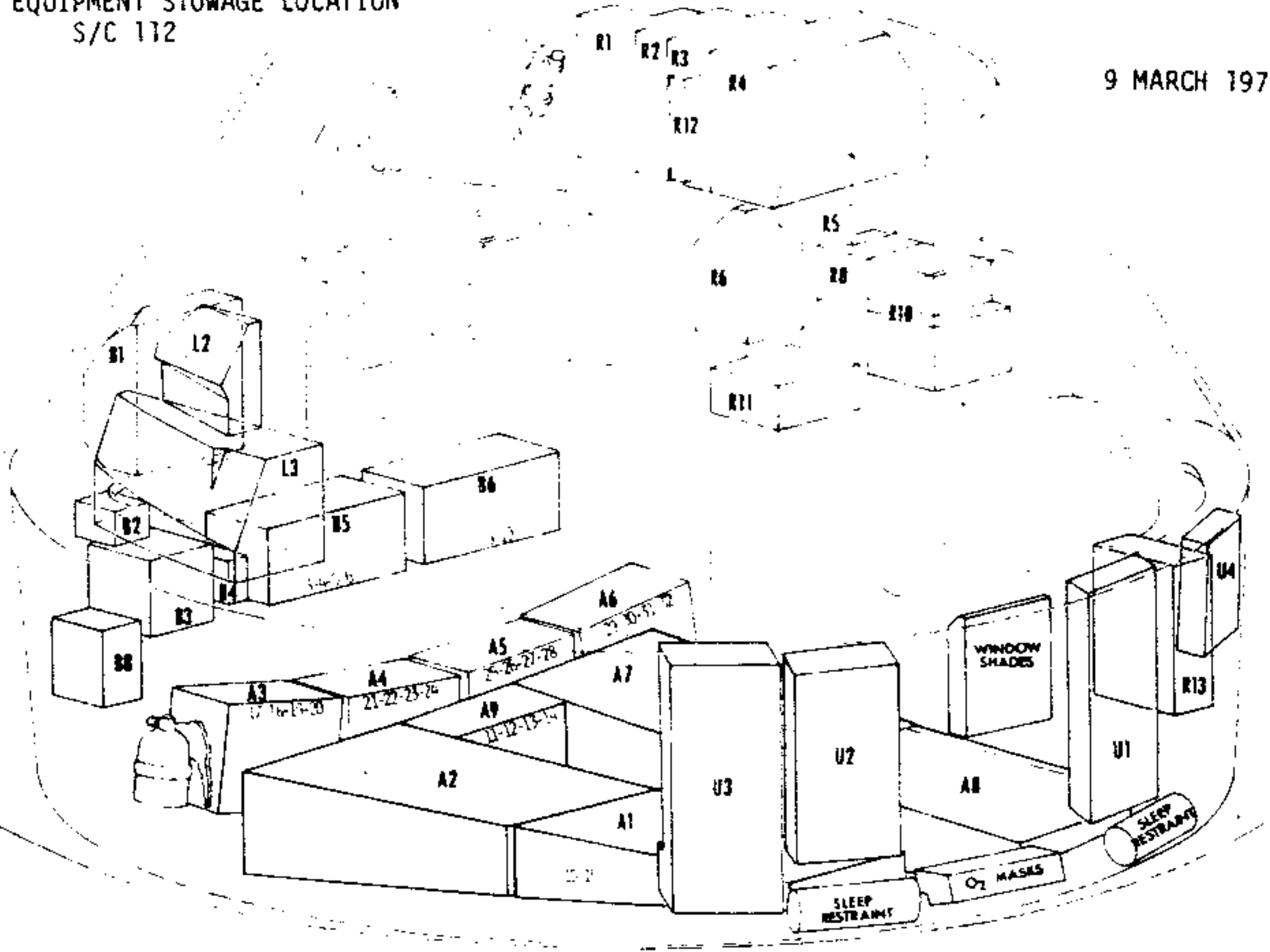
cb SECS LOGIC B - open (verify), close  
at or after apex cover jettison at 24K'  
Continue normal entry

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S  
5-1

CREW EQUIPMENT STORAGE LOCATION  
S/C 112

9 MARCH 1971



A-1

- 16MM Mags-7 in 2 Bags
- 70MM Mags-2 in Bag
- Interval Timer
- Voice Recorder
- Remote Control Cable W/Strap
- TV Camera & Zoom Lens
- TV Monitor
- TV Monitor Cable W/Strap
- TV 15' Cable W/Strap
- TV Ringsight
- TV Mounting Brkt
- 16MM Camera Sext Adapt
- 70MM Camera Adapt
- UV Camera Mounting Brkt
- UV Filter Assy
- 70MM UV Mag
- CO<sup>2</sup> Absorber-2

A-2

- PPK-3
- Tissue Dispenser-8
- FCS-3 (2\*)
- Headrest Pads-3
- Head Rest 3 Pr in Bag
- Jet Storage Bag (1\*)(2\*\*)
- EV Gloves (CMP)

A-2 Cont

- Tiedown Ropes-5 in Bag
- Panel 603 Gauge
- EVA Equipment Container
- Pressure Cont Vlv
- PGA Adapter
- Tether IV Crewman
- Waist Tether
- A7 Straps-3
- OPS PGA Attach Straps-4

Top of A-2

- ISA Decontamination Bag
- Cont Lunar Sample Ret
- Decom Ctr
- SRC Decon Bags-3
- Lunar Sample Ret Decom
- Bag
- 70MM Decom Bags-2
- 16MM Decom Bag
- Penetrometer Drum Decom
- Bag

A-3

- Fire Ext (Side of A-3)
- CO<sup>2</sup> Absorbers-4

A-4

- CO<sup>2</sup> Absorbers-4

A-5

- CO<sup>2</sup> Absorbers-4

A-6

- CO<sup>2</sup> Absorbers-4

A-7

- Food Package \*\*
- Fecal Col Assy in Bag-12
- Fecal Col Assy in Bag-12

Side of A-7

- EVA Umbilical in Bag

A-8

- 70MM Mags-3 in Bag
- Inflight Exerciser
- CM Towel (RWB)-3 Ea
- CWG-9
- EMU Maint Kit
- Tape Cassette Kit
- CWG Elect Adapt-4 in Bag
- Relief Recep in Bag W/St
- H2 Gas Separator in Bag
- Lightweight Headset-3 (2

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\* LM TRANSFER ITEM  
\*\* LM TRANSFER AFTER FINAL DOCK

A-8 Cont

Tool Kit  
PLV Ducts-3 in Bag  
Urine Filter Assy-3 in Bag  
PGA O2 Interconn-3 in Bag (1\*\*)  
Snag Line in Bag W/Strap  
Tone Booster in Bag  
16MM Mag-2 in Bag

WMS Backup Bag

WMS Water Panel QD  
Water Panel Coupling Assy  
WMS Power Cable  
WMS QD Pressure Cap

Side of A-8 in Bag

Vacuum Hose Brush  
Urine Hose W/Adpt & 2 Straps  
EVA Guards, L, Ctr, R  
Unipod Pole Assy

A-9

CO<sup>2</sup> Absorbers-4

B-1

Food & Hygiene Items \*\*

B-2

35MM Camera W/55MM Lens  
& Film Cassette Plus  
(3) 35MM Film Cassettes  
in Bag

B-3

16MM Camera & Mag  
18MM Lens  
75MM Lens  
10MM Lens  
16MM Power Cable W/Strap  
Right Angle Mirror  
70MM Cam & Mag  
Spotmeter

B-5

CO<sup>2</sup> Absorber-4

B-6

CO<sup>2</sup> Absorber-4

B-5/B-6 Closeout Curtain

Stowage Pouch-2  
Data Ret Snap  
6-Short 6-Long  
Data Ret Hook  
2-Short 2-Long  
Clamps-8  
Clips-8

B-8

Chlor & Buffer Ampules-32  
In (2) Bags

L-2

CCU Cont Head in Bag  
CCU Cable-Spare W/Strap  
Tool "E" W/Strap  
Ground Cable  
70MM PCM Cable W/Strap  
16MM PCM Cable W/Strap

L-3

Food Package  
Cont feeding system

R-1

Flight Data File

R-2

Flight Data File

R-3

Flight Data File  
LM XFR Data Card Kit\*  
LM Data File\*

Data Card Kit

Meter Covers-2  
16MM Cam Fuse  
Data File Clips-6  
Eyepatch  
Ctr R-12 W/Books

R-4

Survival Kits #1/#2

R-5

Gen use Ret Straps-7  
Couch Straps-2  
Probe Stg Straps-2  
Utility Straps-6

R-6

Tape  
OUA Sunfilters-2  
Penlights-5 in Bag  
Chlor Syringe Bag with:  
Knob, Casing, Needle

R-8

Med Kit

R-11

Urine Transfer Sys-3  
Urine Rec Spare  
Roll-on-cuff (RWB)

R-13

16MM Mag W/Dos-6 in Bag\*  
16MM Mag-2 in Bag\*  
70MM Mag-4 in Bag\*  
70MM Mag-3 in Bag\*

U-1

LCG (2\*)  
Temp Stg Bag-3  
Rad Dos-Hze (Sewn in Ctr)

U-2

Helmet Stg Bag-3  
ACC Bag-3  
ICG W/Eartube-3  
Cabin Fan Filter in Bag

U-3

Coas Filter  
Coas Bulb  
16MM Cam Brkt  
LM Docking Target  
Docking Target Adapter

U-4

Tape Recorder Cass-4  
Tape Rec Batteries-4  
Monocular\*  
Intervalometer (70MM)  
250MM Lens

PGA BAG

UCTA Clamps-3  
Helmet Phot Shield  
Elect Conn Covers-3  
O2 Hose Screen Caps-3  
Urine Bag-2  
Water Bag Assy  
Fecal Bag XFR Bag

LH FEB

Water Gun  
CCU Cables-3

UEB

Window Shades-5  
S-178 Shade  
UV Shade in Bag  
Panel 603 EVA Guard

AFT UEB

O2 Mask & Hose W/Strap  
(3) in Bag  
Sleep Rest-3'

LEB

Radiation Survey Meter  
G&N Handholds-2

Above L/H Window  
COAS

\* LM TRANSFER ITEM  
\*\* LM TRANSFER AFTER FINAL DOCK



ENTRY STOWAGE CHANGES FROM EARTH LAUNCH

A. LM to CM XFER (ADDITIONS)

<u>QTY</u>	<u>NOMENCLATURE</u>	<u>CM STOWAGE LOCATION</u>
3	LM PPK	A8 (In Decontam. Comp.)
1	Flag Kit	A8
1	DSEA	A8
1	SRC #1	B6
1	SRC #2	B5
1	SRC #3	A9
1	ISA	Top A2
1	Surface Ret Bag	Top A7
1	Cont. Ret Bag	R13

B. CM TO LM XFER (Final Docking Off Load)

<u>QTY</u>	<u>NOMENCLATURE</u>	<u>CM STOWAGE LOCATION</u>
1	B5 Container W/4 CO2 Absorber	From B5
1	B6 Container W/4 CO2 Absorbers	From B6
1	A9 Container W/4 CO2 Absorbers	From A9
1	Jettison Bag (full)	From A2
2	FCS	From A2
1	Food Package	From A7
1	O2 Interconnect	From A8
1	Fecal Coll. Assy.	From A7

C. Relocations - For Re-Entry

<u>QTY</u>	<u>NOMENCLATURE</u>	<u>LAUNCH STOW</u>	<u>RE-ENTRY STOW</u>
3	Helmet Bag	3 - U2	3 - On Helme
3	Accesory Bag	3 - U2	2 - PGA 1 - RH Sleep Restrain
3	ICG W/Eartube	3 - U2	3 - On Crew

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3	Headrest Pad	3 - A2	3 - On Couch
3	Heel Restraint	3 - A2	3 - On Crew
3	CWG Elect. Adapter	3 - A8	3 - On Crew
3	PGA	3 - On Crew	2 - PGA Bag
			1 - Top A7
2	Helmet	2 - On Crew	2 - PGA Bag
			1 - Top A7
3	O2 Interconnect	3 - A8	2 - CCU (1-LM)
1	EVA Eqpt. Ctr	1 - A2	1 - A7
3	Gloves, IV	3 - On Crew	2 - PGA Bag
			1 - Top A7
1	Gloves, EV	1 - A2	1 - RH Sleep Restraint
5	Ropes	5 - A2	Over PGA Bag & Over RH Sleep Restraint
3	PGA Elect. Covers	3 - PGA Bag	3 - On PGA
1	RH Sleep Rest.	1 - UEB (RH)	1 - Top A7
1	C Sleep Rest.	1 - UEB (RH)	1 - UEB (LH)
TBD	Decontam. Bag	TBD - TBD	2 - W/Hassel Mag, R13
		TBD - TBD	1 - SRC #1-B6
			1 - SRC #2-B5
			1 - SRC #3-A9
			1 - ISA, Top A2
			1 - 16mm, R13
			1 - Cont Ret Bag, R13
			1 - Surface Ret Bag, Top A7
			1 - Cabin Fan Filter Bag, Top A1
3	LM PPK	3 - LM	3 - A8 (In decontam. Comp)
1	Flag Kit	1 - LM	1 - A8
1	DSEA	1 - LM	1 - A8
1	OPS	1 - LM	1 - A7
1	LM Helmet Stg Bag	1 - LM	1 - PGA Bag
1	24" Pan Mag	1 - SM	1 - A2
1	3" Map Mag	1 - SM	1 - B1

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EMERGENCY CSM/LV SEPARATION

**IF POWERED FLT**

TRANS CONTR - CCW (4 SEC)

MN BUS TIES - ON

TVC SERVO PWR 1 - AC1/MNA

TVC SERVO PWR 2 - AC2/MNB

BMAG MODE (3) - ATT 1/RATE 2

GMBL MTRS (4) - ON

$\Delta V$  THRUST A - NORMAL

DIR ULLAGE & THRUST ON PB - PUSH

SPS BURN (5 SEC) - THEN  $\Delta V$  THRUST (2) - OFF

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1-2

**IF COASTING FLT**

cb SECS ARM (2) (Pn1 8) - CLOSE  
SECS LOGIC (2) - ON  
SECS PYRO ARM (2) - ARM  
ROT CONTR PWR DIR (2) - MNA/MNB  
SC CONT - SCS  
SEPARATE FROM LV AS APPLICABLE -  
IF BEFORE DOCKING, THC CCW (4 SEC)  
IF DOCKED, UMBIL NOT CONNECTED,  
CSM/LM FINAL SEP (2) - ON  
IF DOCKED, UMBIL CONNECTED, SIVB/LM SEP - ON  
TRANSLATE AWAY FROM LV & MANEUVER TO BURN ATTITUDE  
 $\Delta$ VCG - CSM OR LM/CSM AS APPLICABLE  
MN BUS TIE (2) - ON  
TVC SERVO PWR 1 - AC1/MNA  
TVC SERVO PWR 2 - AC2/MNB  
BMAG MODE (3) - ATT1/RATE 2  
GMBL MTRS (4) - ON  
 $\Delta$ V THRUST A - NORMAL  
DIR ULLAGE & THRUST ON PB - PUSH  
SPS BURN (5) SEC - THEN  $\Delta$ V THRUST (2) - OFF

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1-3

SUIT COMPRESSOR LITE - CLOSED SUIT LOOP

SWITCH TO OTHER COMPRESSOR ON OTHER BUS

SEE ECS 9

O2 FLOW HI + RAPID LOSS OF SURGE TK PRESS  
+ CABIN PRESS < 4.6 PSI

CABIN PRESS RELF v1vs (2) - CLOSE

✓TUNNEL EQUALIZATION v1v - CLOSED

REPRESS PKG v1v - ON (WHEN SURGE TK PRESS < 150 PSI)

✓EMERG CABIN PRESS REGS - BOTH

DON SUITS

CONTAMINATION IN CM

DON O2 MASKS

CONTAMINATION IN CLOSED SUIT LOOP

CHANGE TO OTHER SUIT COMPR

DIRECT O2 v1v - FULL OPEN THEN ADJUST FOR SUIT  
TO CABIN ΔP OF 2 IN OF H2O

**IF CONDITION PERSISTS**

SUIT COMPR (2) - OFF

DOFF HELMETS

DIRECT O2 v1v - CLOSE

DON O2 MASKS

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EMER  
1-4

FIRE/SMOKE IN CM

MONITOR DC FOR HI CURRENT - REMOVE POWER  
FROM ASSOCIATED INVERTER

IF CURRENT REMAINS HI - REMOVE POWER FROM  
ASSOCIATED DC BUS

IF CLOSED SUIT LOOP, SWITCH SUIT COMPR TO GOOD AC BUS  
IF HELMET OFF, SUIT COMPR (2) - OFF

RECONFIGURE INVERTER 3 ON LOST AC BUS

VERIFY RCS CONTROL POWER CONFIGURATION

IF HELMETS [DON O2 MASKS  
OFF [USE FIRE EXTINGUISHER OR H2O GUN (OPTIONAL)

IF CLOSED [USE FIRE EXTINGUISHER OR H2O GUN (OPTIONAL)  
SUIT LOOP [ ✓ EMERG CABIN PRESS REGS - OFF  
[IF FIRE PERSISTS - DUMP CABIN

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1-5

G&C

CMC LITE

SC CONT - SCS  
SEE G&N 5

ISS LITE + PROG ALARM LITE

SC CONT - SCS  
SEE G&N 6

ABNORMAL DYNAMICS - CRITICAL SPS BURN

THC - CW  
DAMP RATES USING RATE NEEDLES  
AFTER SHUTDOWN, AUTO RCS SEL (16) - OFF  
SEE G&C 1

SPS

PREMATURE SHUTDOWN - CRITICAL SPS BURN

✓ $\Delta$ V THRUST (BOTH) - NORMAL  
SC CONT - SCS  
SPS THRUST - DIRECT

SPS PRESS LITE - CRITICAL SPS BURN

**CONTINUE CRITICAL BURN**

**IF FUEL & OX PRESS (BOTH) > 200 PSI**

SPS HE v1vs (2) - OFF, THEN CONTROL MANUALLY  
BETWEEN 170-200 PSI

**IF FUEL/OX  $\Delta$ P > 20 PSI**

SPS HE v1vs (2) - ON  
IF CONDITION PERSISTS, SPS HE v1vs(2)-OFF(Until Pc <70

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EMER

1-6

EMERGENCY POWER DOWN

CAUTION USE BATTS ONLY WHEN MAIN BUS VOLTS < 24.5

CONFIGURE FOR USE OF AUX BATTERY

FUEL CELL 2 MNA & MNB (2) - OFF	
cb CRYO O2 ISOL/AUX BAT - CLOSE (Pnl 226)	
SM PWR SOURCE - AUX BAT (mom) (Pnl 278)	
O2 TANK 3 ISOL - CLOSE (✓TB-bp) (Pnl 278)	
FUEL CELL 2 MN A(B) - as desired	
INSURE DSE IS RECORDING	DC AMPS
IF UNSUITED, SUIT COMP (2) - OFF	4.0
FC PUMPS (3) - OFF (Until Tskin > 475°F)	8.7 TOTAL
ALL SW'S, Pnl 181 (5) - OFF	
NON ESS BUS - OFF	5.1
cb G&N OPTICS MNA & MNB (2) - OPEN (Pnl 5)	3.1
G&N PWR (AC) - OFF (Pnl 5)	0.9
O2 HTRS (3) - OFF (CTR)	17.0
H2 HTRS (2) - OFF (CTR)	1.4 EA
H2 FANS (3) - OFF (CTR)	1.0
C/W NORMAL - ACK	
LM PWR - RESET - OFF	15.0 MAX
ECS RAD HTRS (2) - OFF	17.2 EA
POT H2O HTR - OFF	1.6 MAX
SM RCS HTRS (4) - OFF	3.3 MAX EA
HGA PWR - OFF	2.9
LIGHTS - Min Req'd	5.3 MAX
EXT LTS - OFF	4.6
VHF RANGING - OFF	1.4
S BD AUX TV - OFF (CTR)	5.3
SPS LINE HTR - OFF (CTR)	6.2 (A/B)
RNDZ XPNDR PWR - OFF or HEATER (Pnl 100)	3.0
SIG CONDR/DRIVER BIAS PWR (2) - OFF	
SECURE ONE BMAG	2.6
SELECT SINGLE JET CONTROL	
EMS FUNC - OFF	
RHC PWR DIRECT (2) - OFF	
THC PWR - OFF	
CONFIGURE FOR SINGLE INVERTER OPERATION	
TURN OTHER INVERTER OFF	4.0 MAX
BAT CHGR - OFF	
NOTE MISSION TIME	
cb TIMERS (2) - OPEN (Pnl 229)	
AC INVERTER (9) - OFF	
CM RCS HTRS - OFF	
ISOLATE FAILED FC's from MAIN BUSES	

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<b>ECS POWER DOWN</b>	<b>3.7 TOTAL</b>
ECS GLY PUMP sel - OFF (ISS LIMIT 2.5 HRS)	2.6
ECS RAD FLOW CONT PWR - off (CTR)	0.7
GLY EVAP TEMP IN - MAN	
ECS RAD HTRS (2) - OFF	
GLYCOL EVAP H2O FLOW - OFF	~0.1
GLYCOL EVAP STEAM PRESS - MAN	~0.2

<b>COMM POWER DOWN</b>	<b>13.0 TOTAL</b>
IF VOICE DESIRED	
UP TLM CMD RESET - RESET then OFF	
S-BD AUX TAPE - DN VOICE BU	
S-BD MODE PCM - OFF	
PCM BIT RATE - HIGH	
S-BD PWR AMP - OFF (CTR)	4.0
TAPE RCDR - OFF (CTR)	1.6
SCE PWR - OFF (CTR)	0.7
cb INSTR ESS MNA & MNB (2) - OPEN (Pnl 5)	4.9
TELCOM GRP 1 & 2 (2) - OFF	1.6

<b>CMC/IMU POWER DOWN</b>	<b>6.0 IMU</b>
COMPLETE ALIGNMENT TRANSFER	
CMC MODE - FREE	PROVIDES CMC MIN IMP
cb G&N IMU MNA & MNB (2) - OPEN (Pnl 5)	
V37E06E	<b>3.0 CMC</b>
F V50 N25, 00062, CMC PWR DN	
PRO, HOLD (~5 SEC) UNTIL STBY LT - ON	

<b>SCS POWER DOWN</b>	<b>6.0</b>
ACCEPTABLE S/C ATTITUDE	
BMAG PWR (2) - OFF	
FDAI/GPI PWR - OFF	PROVIDES MIN IMP
SCS ELECTRONICS PWR - ECA	(REQUIRES AC1 & MNB)
ORDEAL PWR & LIGHTING - OFF	
cb SCS LOGIC BUS (4) - OPEN (Pnl 8)	<b>2.0</b>
SCS ELECTRONICS PWR - OFF	
RHC PWR NORM (2) - OFF	

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EMER  
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ALL FC'S DISCONNECTED - POWERED FLT  
ATTEMPT FC RECONNECT (ONE BUS AT A TIME)

**IF RECONNECT NOT SUCCESSFUL**

FC 1 - MN B  
FC 2 - MN B  
FC 3 - MN A

**IF STILL NO SUCCESS**

SCE PWR - AUX  
EDS AUTO/OFF - OFF  
cb MNA BAT C (Pn1 275) - CLOSED  
cb MNB BAT C (Pn1 275) - CLOSED

AC BUS OVERLD + AC BUS + MN BUS UNDER V LITES  
AFFECTED AC BUS - OFF (REASON - AC BUS SHORT)

FC 1 (2,3) LITE

VERIFY FC 1 (2,3) REAC tb - gray

**IF tb BP**

FC 1 (2,3) REAC vlv - OPEN (up)

**IF tb STILL BP & REAC FLOW ~0**

OPEN CIRCUIT FC 1 (2,3)

LAUNCH BUS LOSS

MN BUS A LOST - LAUNCH

EDS AUTO/OFF - OFF  
TVC GMBL DR (P,Y) - 2  
√SCS TVC (P,Y) - RATE CMD  
BMAG MODE (3) - RATE 2  
FDAI SEL - 2  
√FDAI SOURCE - CMC  
AC INV 3 - MNB  
AC INV 3 AC 1 - ON  
AC INV 1 AC 1 - OFF  
ATT F/C MNA - OFF  
ALL F/C MNB - MNB (BEFORE CM/SM SEP)  
cb MNA BAT BUS A (Pn1 275) - OPEN  
cb MNB BAT C (Pn1 275) - CLOSED

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MN BUS B LOST - LAUNCH

EDS AUTO/OFF - OFF  
TVC GMBL DR (P,Y) - 1  
✓SPS TVC (P,Y) - RATE CMD  
BMAG MODE (3) - RATE 1  
FDAI SEL - 1  
✓FDAI SOURCE - CMC  
AC INV 3 - MNA  
AC INV 3 AC 2 - ON  
AC INV 2 AC 2 - OFF  
A11 F/C MNB - OFF  
A11 F/C MNA - MNA (BEFORE CM/SM SEP)  
cb MNB BAT BUS B (Pn1 275) - OPEN  
cb MNA BAT C (Pn1 275) - CLOSED

AC BUS 1 LOST - LAUNCH

BMAG MODE (3) - RATE 2  
AC INV 1 MNA - OFF  
FDAI SEL - 2  
✓FDAI SOURCE - CMC  
SUIT COMPR - AC 2  
ECS GLY PUMP - AC 2  
S BD NORM XPNDR - SEC  
S BD NORM PWR AMP - SEC

AC BUS 2 LOST - LAUNCH

BMAG MODE (3) - RATE 1  
AC INV 2 MNB - OFF  
FDAI SEL - 1  
✓FDAI SOURCE - CMC  
✓SUIT COMPR - AC 1  
✓ECS GLY PUMP - AC 1

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BAT BUS A LOST - LAUNCH

EDS AUTO/OFF - OFF  
AUTO RCS SEL (RING 1) - OFF  
TVC GMBL DR (P,Y) - 2  
(IF BUS LOST BEFORE GMBL MTRS ON)  
cb MNA BAT C (Pnl 275) - CLOSED

BAT BUS B LOST - LAUNCH

EDS AUTO/OFF - OFF  
AUTO RCS SEL (RING 2) - OFF  
TVC GMBL DR (P,Y) - 1  
(IF BUS LOST BEFORE GMBL MTRS ON)  
cb MNB BAT C (Pnl 275) - CLOSED

SPS BURN BUS LOSS

MN BUS A LOST - SPS BURN

TVC GMBL DR (P,Y) - 2  
√SCS TVC (P,Y) - RATE CMD  
ΔV THRUST B - NORM  
cb SPS P2 & Y2 (Pnl 8) - OPEN  
(CRIT BURNS - AFTER GMBL MTRS ON)  
BMAG MODE (3) - RATE 2  
FDAI SEL - 2  
√FDAI SOURCE - CMC  
AC INV 3 - MNB  
AC INV 3 AC 1 - ON  
AC INV 1 AC 1 - OFF  
A11 F/C MNA - OFF  
ALL F/C MNB - MNB  
cb MNA BAT BUS A (Pnl 275) - OPEN

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MN BUS B LOST - SPS BURNS

TVC GMBL DR (P,Y) - 1  
✓SPS TVC (P,Y) - RATE CMD  
ΔV THRUST A - NORM  
cb SPS P1 & Y1 (Pn1 8) - OPEN  
(CRIT BURNS - AFTER GMBL MTRS ON)  
BMAG MODE (3) - RATE 1  
FDAI SEL - 1  
✓FDAI SOURCE - CMC  
AC INV 3 - MNA  
AC INV 3 AC 2 - ON  
AC INV 2 AC 2 - OFF  
A11 F/C MNB - OFF  
A11 F/C MNA - MNA  
cb MNB BAT BUS B (Pn1 275) - OPEN

AC BUS 1 LOST - SPS BURNS

TVC SERVO PWR 1 - AC 2/MNB  
✓SCS TVC (P&Y) - RATE CMD  
BMAG MODE (3) - RATE 2  
AC INV 1 MNA - OFF  
FDAI SEL - 2  
✓FDAI SOURCE - CMC  
SUIT COMPR - AC 2  
ECS GLY PUMP - AC 2  
S BD NORM XPNDR - SEC  
S BD NORM PWR AMP - SEC

AC BUS 2 LOST - SPS BURNS

TVC SERVO PWR 2 - AC 1/MNA  
SCS TVC (P&Y) - AUTO  
ΔVCG - LM/CSM  
MTVC WITH TRIM THUMBWHEELS (SCS)  
BMAG MODE (3) - RATE 1  
AC INV 2 MNB - OFF  
FDAI SEL - 1  
✓FDAI SOURCE - CMC  
✓SUIT COMPR - AC 1  
✓ECS GLY PUMP - AC 1

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BAT BUS A LOST - SPS BURNS

TVC GMBL DR (P,Y) - 2  
(IF BUS LOST BEFORE GMBL MTRS ON)  
cb SPS P2 & Y2 (Pn1 8) - OPEN  
(CRIT BURNS - AFTER GMBL MTRS ON)  
cb MNA BAT C (Pn1 275) - CLOSED

BAT BUS B LOST - SPS BURNS

TVC GMBL DR (P,Y) - 1  
(IF BUS LOST BEFORE GMBL MTRS ON)  
cb SPS P1 & Y1 (Pn1 8) - OPEN  
(CRIT BURNS - AFTER GMBL MTRS ON)  
cb MNB BAT C (Pn1 275) - CLOSED

ENTRY BUS LOSS

MN BUS A LOST - ENTRY

cb SCS B/D ROLL, P&Y (MNB) (3) (Pn1 8) - CLOSED  
BMAG MODE (3) - RATE 2  
FDAI SEL - 2  
✓FDAI SOURCE - CMC  
AC INV 3 - MNB  
AC INV 3 AC 1 - ON  
AC INV 1 AC 1 - OFF  
A11 F/C MNA - OFF  
ALL F/C MNB - MNB (BEFORE CM/SM SEP)  
cb MNA BAT BUS A (Pn1 275) - OPEN  
cb MNB BAT C (Pn1 275) - CLOSED

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MN BUS B LOST - ENTRY

✓cb SPS B/D ROLL, P&Y (MNA) (3) (Pn1 8) - CLOSED  
BMAG MODE (3) - RATE 1  
FDAI SEL - 1  
✓FDAI SOURCE - CMC  
AC INV 3 - MNA  
AC INV 3 AC 2 - ON  
AC INV 2 AC 2 - OFF  
A11 F/C MNB - OFF  
A11 F/C MNA - MNA (BEFORE CM/SM SEP)  
cb MNB BAT BUS B (Pn1 275) - OPEN  
cb MNA BAT C (Pn1 275) - CLOSED

AC BUS 1 LOST - ENTRY

BMAG MODE (3) - RATE 2  
AC INV 1 MNA - OFF  
FDAI SEL - 2  
✓FDAI SOURCE - CMC  
SUIT COMPR - AC 2  
ECS GLY PUMP - AC 2  
S BD NORM XPNDR - SEC  
S BD NORM PWR AMP - SEC

AC BUS 2 LOST - ENTRY

BMAG MODE (3) - RATE 1  
AC INV 2 MNB - OFF  
FDAI SEL - 1  
✓FDAI SOURCE - CMC  
✓SUIT COMPR - AC 1  
✓ECS GLY PUMP - AC 1

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BAT BUS A LOST - ENTRY

cb SCS B/D ROLL, P&Y (MNA) (3) (Pn1 8)  
Before CM/SM SEP - OPEN  
After RCS transfer to CM - CLOSE  
cb B/D ROLL, P&Y (MNB) (3) (Pn1 8) - CLOSED  
cb SCS CONTR/AUTO (2) (Pn1 8) - OPEN  
(AFTER APEX COVER JET)  
cb MNA BAT C (Pn1 275) - CLOSED

BAT BUS B LOST - ENTRY

cb SCS B/D ROLL, P&Y (MNB) (3) (Pn1 8)  
Before CM/SM SEP - OPEN  
After RCS transfer to CM - CLOSE  
✓cb SCS B/D ROLL, P&Y (MNA) (3) (Pn1 8) - CLOSED  
cb SCS CONTR/AUTO (2) (Pn1 8) - OPEN  
(AFTER APEX COVER JET)  
cb MNB BAT C (Pn1 275) - CLOSED

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SM RCS THRUSTER FAILED ON

CHG TO OTHER SC CONT MODE  
ROT CONT PWR DIR (2) - MNA/MNB  
STOP SPACECRAFT RATES WITH DIRECT RCS  
AUTO RCS SEL (16) - OFF

IF CONDITION PERSISTS

AUTO RCS SEL (16) - ON (AS REQ'D)  
MAN ATT (3) - ACCEL CMD  
STOP SPACECRAFT RATES  
cb SCS DIR ULL (2)(Pnl 8) - open  
ROT CONT PWR DIR (2) - OFF

IF CONDITION PERSISTS

NEUTRALIZE RHC  
SM RCS PRPLNT (AFFECTED AXIS) - OFF

SM RCS LITE

SM RCS HE (2) - CLOSE  
SEE RCS 1

SM RCS QUAD SECURE

SM RCS He 1 & 2 (AFFECTED QUAD) (2) - CLOSE  
SM RCS PRIM PRPLNT (AFFECTED QUAD) - CLOSE  
Fire one jet in affected quad - 2 sec continuously  
AUTO RCS SELECT (AFFECTED QUAD) (4) - OFF(except BDC)

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CM RCS FAILS TO PRESSURIZE OR FEED PRPLNT

**IF NO PRESSURIZATION**

✓cb EPS BAT BUS (2) (Pn1 229) - CLOSE  
✓cb PYRO A/B SEQ A/B (2) (Pn1 250) - CLOSE  
✓cb SECS ARM (2) (Pn1 8) - CLOSE  
✓SECS PYRO ARM (2) - ARM  
✓SECS LOGIC (2) - ON  
CM RCS - PRESS

**IF NO RCS PRPLNT FEED**

✓cb EPS GRP 1 & 3 (Pn1 229) - CLOSE  
✓cb SM RCS HTR A&B (Pn1 8) - CLOSE  
✓cb RCS PRPLNT ISOL (2) (Pn1 8) - CLOSE  
CM RCS PRPLNT - ON

**IF STILL NO FEED**

cb EPS GRP 5 (Pn1 229) - CLOSE  
cb RCS LOGIC (2) (Pn1 8) - CLOSE  
CM RCS LOGIC - ON  
CM PRPLNT - DUMP MOMENTARILY, THEN OFF

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V05 N09 ALARM CODES

- 00110 Mark reject has been entered but ignored  
Continue
- 00113 No inbits (chan 16)  
Continue: if alarm recurs use MDC DSKY.
- 00114 More marks made than desired  
Continue
- 00115 V41 N91 keyed with OPTICS MODE not in CMC  
OPTICS MODE - CMC and OPTICS ZERO - OFF
- 00116 Optics switch altered before 15 sec zero time elapsed  
OPTICS ZERO - ZERO (15 sec).
- 00117 V41 N91 keyed but CMC has reserved OCDU (from start of gimbal test in P40 until termination of TVC functional allocation of the "optics" CDU Driving Output)  
V41 N91 not yet available
- 00120 Optics torque has been requested but optics have not been zeroed since last FRESH START or RESTART  
OPTICS ZERO - OFF then ZERO (15 sec).
- 00121 In 0.05 sec following mark, an OCDU changed by more than 0.033°  
Repeat MK.
- (m)00205 PIPA saturated  
Use SCS control (G&N 12).
- 00206 The IMU zero routine has been entered with both the GMBL LOCK It and NO ATT It on  
Coarse align to 0,0,0 Reselect V40.
- (m)00207 ISS turn-on request not present for 90 sec  
Redo IMU turn on (G&N 12).
- (m)00210 The IMU is not operating  
Redo IMU turn on. If alarm recurs perform fresh start (V36E).  
Consult MSFN. (G&N 12).

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- (m)00211 Coarse align error  
If P51(3)/52(4) in progress record gyro  
torquing angles and perform fine align  
check in P52(4)  
Otherwise, see G/1-25. (G&N 12).
- (m)00212 PIPA fail, but PIPA is not being used  
PIPA BIAS check (G&N 6/8).
- (m)00213 IMU not operating with turn-on request  
See 00210
- 00214 Program using IMU when turned OFF  
See 00210 or exit program.
- (m)00217 IMU coarse align or pulse torque  
difficulty has occurred  
If code 211 also, perform 211 cure only  
Reinitiate current program.  
If alarm recurs, terminate use of  
ISS (G&N 12).
- 00220 IMU orientation unknown  
Align or if aligned set REFSMMAT flag
- 00401 Desired middle gimbal angle is excessive  
Call N22 - maneuver if MGA < 85° or  
realign IMU.
- 00402 Second MINKEY pulse torque must be done.
- 00404 Target out of view (90 deg test)  
(G/3-6,3-10,6-3)
- 00405 Acceptable star pair is not available  
(G/6-3,6-6)
- 00406 Rend navigation not operating  
Select P20 or continue.
- 00421 W-matrix overflow  
Notify MSFN but continue.  
W-matrix automatically reinitialized at  
next mark.
- 00600 No solution on first iteration in  
P32/72  
(G/4-2)
- 00601 Post CSI Perigee/lune alt <85nm/ 5.8nm  
(G/4-2)
- 00602 Post CDH Perigee/lune alt <85nm/ 5.8nm  
(G/4-2)
- 00603 Time from TIG (CSI) to TIG (CDH)  
<10 min  
(G/4-2)

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- 00604 Time from TIG (CDH) to TIG (TPI)  
<10 min  
(G/4-2)
- 00605 Number of iterations exceeds loop  
maximum  
(G/4-2,4-7,4-8)
- 00606  $\Delta V$  (CSI) has been >1000 fps for last  
two iterations  
(G/4-2)
- 00611 No TIG for given ELEV angle  
(G/4-4,4-5)
- 00612 State vector in wrong sphere of influence  
at TIG  
(G/4-7)
- 00613 Reentry angle out of limits  
(G/4-8)
- (m)00777 ISS warning caused by PIPA fail  
(G&N 6).
- 01102 CMC self test error  
(G/2-3)
- (m)01105 Downlink too fast  
Rset. If alarm recurs DOWNLINK FAILURE.  
(G&N 12).
- (m)01106 Uplink too fast  
Rset. If alarm recurs UPLINK FAILURE.  
(G&N 12).
- (m)01107 Phase table failure-assume erasable  
memory is destroyed  
If Comm: 1. V74 CMC DOWNLINK  
2. P27 As Necessary.  
3. V48 As Necessary (V46).  
4. Reestablish REFSMMAT via  
P51 As Necessary.  
If FRESH START recurs, CMC FAILURE  
(SSR-3).  
If no Comm, pg G/9-1
- 01301 Arcsin or arccos input is greater than  
one  
Notify MSFN, continue.
- (m)01407 VG increasing  
(G/5-6,L/7-6) (G&N 12).
- 01426 IMU unsatisfactory  
Realign or use SCS.

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- 01427 IMU reversed  
Note FDAI operation is inverted.
- 01520 V37 request not permitted at this time  
Wait till COMP ACTY lt.  
not on continuously - reselect V37 or if  
P62-67, select P00 and then desired  
program.
- 01600 Overflow in drift test  
This is gnd test alarm only.
- 01601 Bad IMU torque abort  
See 01600
- 01703 Insufficient time for integration.  
TIG slipped  
(G/5-4,5-14,L/7-5)
- (m)03777 ISS warning caused by ICDU fail  
(G&N 6)
- (m)04777 ISS warning caused by ICDU & PIPA fail  
(G&N 6)
- (m)07777 ISS warning caused by IMU fail  
(G&N 6)
- (m)10777 ISS warning caused by IMU & PIPA  
fail (G&N 6)
- (m)13777 ISS warning caused by IMU & ICDU fail  
(G&N 6)
- (m)14777 ISS warning caused by IMU,ICDU & PIPA  
fail  
(G&N 6)
- \*\*20430 Orbital integration has been  
terminated to avoid possible  
infinite loop.  
Notify MSFN.  
Probable S.V. uplink required
- \*\*20607 No solution to conic subroutine  
Reselect program.
- \*\*20610 Alt at specified TIG in P37 < 400K ft  
Reselect P37 and decrease TIG.
- \*\*21204 Negative or zero time waitlist call.  
If ave-g on, continue.  
Otherwise reselect program.
- \*\*21206 Second job attempts to go to sleep via  
keyboard and display program  
See 21204.

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- \*\*21210 Second attempt is made to stall  
Reselect program  
Do not attempt use of IMU while CMC is  
using it.
- \*\*21302 SQRT called with negative argument  
See 21204
- \*\*21501 Keyboard and display alarm during  
internal use  
See 21204
- \*\*21502 Illegal flashing display  
See 21204
- \*\*21521 P01 selected and P11 has already been  
performed  
Select correct program
- \*31104 Delay routine busy  
Reselect extended verb or continue with  
program.  
Notify MSFN.
- \*31201 Executive overflow - no vac area  
Reselect Extended Verb and/or Continue  
Program.
- \*31202 Executive overflow - no core sets  
See 31201
- \*31203 Waitlist overflow - too many tasks  
See 31201
- \*31211 Illegal interrupt of extended verb  
Reselect extended verb after optics  
marking is completed.  
(m) - Malfunction procedure indicated
- \*\* (2xxxx) - Generates restart, F37 (no 1t)(POOD00)
- \* (3xxxx) - Restart (no 1t) and program  
continues (i.e. attempted  
recovery)(BAILOUT)
- NOT - All \*\*alarms act as \*type if  
they occur when Ave-g is on or  
display type extended verb  
is active.

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