FLIGHT CREW ABBREVIATED CHECKLIST

PREPARED BY
SPACECRAFT SYSTEMS BRANCH
FLIGHT CREW SUPPORT DIVISION

THIS CHECK LIST REPLACES THE CSM 104 CHECK LIST, DATED JANUARY 1, 1969, FOR USE IN CREW TRAINING FOR CSM 104

LAUNCH 3-3-69

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

FEBRUARY 1, 1969
LAUNCH OPERATIONS
LAUNCH OPERATIONS

Basic Date: Feb. 1, 1969

Changed: 

CSM 104.
SECTION 1. PRELAUNCH LIFTOFF CONFIGURATION

PANEL 1

EMS FUNC - ΔV
EMS MODE - STBY
GTA - off (down)
EMS GTA COVER - Secure
CMC ATT - IMU
FDAI SCALE - 5/5
FDAI SEL - 1/2
FDAI SOURCE - CMC
ATT SET - GDC
MAN ATT ROLL - RATE CMD
MAN ATT PITCH - ACCEL CMD
MAN ATT YAW - RATE CMD
LIM CYCLE - OFF
ATT DBD - MIN
RATE - HIGH
TRANS CONT PWR - on (up)
RHC PWR NORM (2) - AC/DC
RHC PWR DIR (2) - MNA/MNB
SC CONT - SCS
CMC MODE - FREE
BMAG MODE ROLL - RATE 1
BMAG MODE PITCH - RATE 1
BMAG MODE YAW - RATE 1
SPS THRUST - NORMAL
ΔV THRUST (2) - OFF (guarded)
SCS TVC PITCH - AUTO
SCS TVC YAW - AUTO
SPS GMBL MOT PITCH (2) - OFF
SPS GMBL MOT YAW (2) - OFF
ΔV CG - CSM
ELS LOGIC - OFF (guarded)
ELS AUTO - MAN
CM RCS LOGIC - on (up)
CM PRPLNT DUMP - OFF (guarded)
CM PRPLNT PURG - off (down) (guarded)
IMU CAGE - off (down) (guarded)
EMS ROLL - OFF
.05G sw - OFF
LV/SPS IND - \( \alpha \)
LV/SPS IND SII/SIVB - SII/SIVB
TVC GMBL DR PITCH - AUTO
TVC GMBL DR YAW - AUTO
FCSM (2) - RESET/OVERRIDE
EVNT TMR RSET - center
EVNT TMR STRT - center (START*)
EVNT TMR MIN - center
EVNT TMR SEC - center

PANEL 2

PL VENT VLV UNLOCK - push (lock)
PROBE EXTD/REL - OFF (guarded)
PROBE EXTD/RETR (2) tb - gray
DOCK PROBE RETR PRIM - OFF
DOCK PROBE RETR SEC - OFF
EXT RUN/EVA LT - OFF
EXT RNDZ LT - off (center)
TUNL LT - OFF
LM PWR - OFF
SM RCS He 1 (4) - center (on,up*)
SM RCS He 1 tb(4) - gray
UP TLM CM - BLOCK
UP TLM IU - BLOCK
CM RCS PRESS - off (down) (guarded)
SM RCS IND sw - PRPLNT QTY
SM RCS He 2 (4) - center (on,up*)
SM RCS He 2 (4) tb - gray
SM RCS HTRS (4) - OFF
SM RCS PRIM PRPLNT (4) - center (on,up*)
SM RCS PRIM PRPLNT tb (8) - gray
RCS CMD - center (OFF*)
RCS TRNFR - center (SM*)
CM RCS PRPLNT (2) - center (on,up*)
CM RCS PRPLNT (2) tb - gray
SM RCS SEC PRPLNT (4) - center (off,down*)
EDS AUTO - on (up)
CSM/LM FINAL SEP (2) - off (down) (guarded)
CM/SM SEP (2) - off (down) (guarded)
SIVB/LM SEP - off(down)(guarded)  
ABRT SYS PRPLNT - DUMP AUTO  
2 ENG OUT - AUTO  
LV RATES - AUTO  
TWR JETT (2) - AUTO (guarded)  
LV GUID - IU  
LV SII/SIVB - off(down)(guarded)  
LV XLUNAR - INJECT  
MN REL - off(down)(guarded)  
MSN TMR HR - off (center)  
MSN TMR MIN - off (center)  
MSN TMR SEC - off (center)  
C/W NORM - BOOST  
C/W CSM - CSM  
C/W PWR - l  
C/W LAMP TEST - off (center)  
MSN TMR - START  
RCS IND sel - SM D  
CAB FAN (2) - on (up)  
H2 HTRS (2) - AUTO  
O2 HTRS (2) - AUTO  
O2 PRES IND sw - TANK l  
H2 FANS (2) AUTO  
O2 FANS (2) - AUTO  
ECS IND sel - PRIM  
ECS RAD FLOW AUTO CONT - AUTO  
ECS RAD tb - gray  
ECS RAD FLOW PWR CONT - off (center)  
ECS RAD MAN SEL - RAD 1  
ECS RAD PRIM HTR - off (center)  
ECS RAD SEC HTR - OFF  
POT H2O HTR - OFF  
SUIT CKT H2O ACCUM AUTO - l  
SUIT CKT H2O ACCUM ON - center  
SUIT CKT HT EXCH - off (center)  
SEC COOL LOOP EVAP - off (center)  
SEC COOL LOOP PUMP - off (center)  
H2O QTY IND sw - POT  
GLY EVAP IN TEMP - MAN  
GLY EVAP STM PRESS AUTO - MAN  
GLY EVAP STM PRESS INCR - center  
GLY EVAP H2O FLOW - off (center)
AB TEMP - MAN
AB AUTO TEMP tw - max decr
I GAIN ANT TRACK - AUTO
I GAIN ANT BEAM - WIDE
I GAIN ANT PITCH POS - 0°
I GAIN ANT YAW POS - 180°
I GAIN ANT PWR - OFF
I GAIN ANT SERVO ELECT - PRIM

ANEL 3

HF ANT - SM LEFT
PS ENG INJ vlv (4) - ind - CLOSE
C RAD (3) - center (NORMAL*)
C RAD (3) tb - N/A
C HTRS (3) - on (up)
C IND sel - 3
PS QTY TEST - off (center)
XID FLOW VLV INCR - NORM
XID FLOW VLV PRIM - PRIM
UG MODE - NORM
C PURG (3) - OFF
C REAC (3) - center (on,up*)
C REAC tb (3) - gray
C 1 MN BUS A - center (on,up*)
C 1 MN BUS A tb - gray
C 2 MN BUS A - center (on,up*)
C 2 MN BUS A tb - gray
C 3 MN BUS A - OFF
C 3 MN BUS A tb - bp
N BUS A RSET - center (RESET*)
C 1 MN BUS B - OFF
C 1 MN BUS B tb - bp
C 2 MN BUS B - center (on,up*)
C 2 MN BUS B tb - gray
C 3 MN BUS B - center (on,up*)
C 3 MN BUS B tb - gray
N BUS B RSET - center (RESET*)
C IND sel - MAIN BUS A
AT CHARGE - OFF
PS He vlv (2) - AUTO
PS He vlv tb (2) - bp
SPS LINE HTRS - off (center)
SPS PRESS IND sw - He
S BD NORM XPNDR - SEC
S BD NORM PWR AMPL PRIM - PRIM
S BD NORM PWR AMPL HI - HIGH
PWR AMPL tb - gray
S BD NORM MODE VOICE - VOICE
S BD NORM MODE PCM - PCM
S BD NORM MODE RNG - RANGING
S BD AUX TAPE - off (center)
S BD AUX TV - off (center)
UP TLM DATA - DATA
UP TLM CMD - NORM
S BD ANT OMNI A - B
S BD ANT OMNI - OMNI
VHF AM A - OFF
VHF AM B - SIMPLEX B
VHF AM RCV ONLY - A
VHF BCN - OFF
FC REACS vlv - LATCH
H2 PURG LINE HTR - OFF
TAPE RCDR PCM/ANLG - PCM/ANLG
TAPE RCDR RCD - RECORD
TAPE RCDR FWD - FWD
TAPE MOTION tb - gray
SCE PWR - NORM
PMP PWR - NORM
PCM BIT RATE - HIGH
AC INV 1 - MNA
AC INV 2 - MNB
AC INV 3 - OFF
AC INV 1 AC BUS 1 - on (up)
AC INV 2 AC BUS 1 - OFF
AC INV 3 AC BUS 1 - OFF
AC BUS 1 RSET - center (RESET*)
AC INV 1 AC BUS 2 - OFF
AC INV 2 AC BUS 2 - on (up)
AC INV 3 AC BUS 2 - OFF
AC BUS 2 RSET - center (RESET*)
AC IND sel - BUS 20C
PANEL 4

PS GAUGING - AC1
TELCOM GRP 1 - AC1
TELCOM GRP 2 - AC2
ECS GLY PUMPS - 1 - AC1
SUIT COMPR 1 - AC1
SUIT COMPR 2 - OFF
CB Panel 4 - all closed

PANEL 5

FC1 PUMPS - AC1
FC2 PUMPS - AC2
FC3 PUMPS - AC2
G/N PWR - AC1
IN N BUS TIE BAT A/C - on (up)
IN N BUS TIE BAT B/C - on (up)
BAT CHGR - AC1
NONESS BUS - MNB
INT INTGL LT - on
INT FLOOD LT - as desired
INT FLOOD LT DIM - as desired
INT FLOOD LT FIXED - as desired
CB Panel 5 all closed except:
CB INST SCI EQUIP SEB 1 - open
CB INST SCI EQUIP SEB 2 - open
CB INST SCI EQUIP HATCH - open
CB WASTE H2O/UR DUCT HTR (2) - open

PANEL 6

MODE - INTER/PTT
PWR - AUDIO/TONE
INTERCOM - T/R
PAD COMM - OFF
S BD - T/R
/HF AM - T/R
AUDIO CONT - NORM
SUIT PWR - on (up)
PANEL 7

- EDS PWR - on (up)
- SCS TVC SERVO PWR (1) - AC1/MNA
- SCS TVC SERVO PWR (2) - AC2/MNB
- FDAI/GPI PWR - BOTH
- LOGIC 2/3 PWR - on (up)
- SCS ELEC PWR - GDC/ECA
- SCS SIG CONDR/DR BIAS 1 - AC1
- SCS SIG CONDR/DR BIAS 2 - AC2
- BMAG PWR (2) - ON
- DIRECT O2 v1v - open (CCW)

PANEL 8

- CB Panel 8 - all closed
- AUTO RCS SEL A/C ROLL A1 - OFF
- AUTO RCS SEL A/C ROLL C1 - OFF
- AUTO RCS SEL A/C ROLL A2 - OFF
- AUTO RCS SEL A/C ROLL C2 - OFF
- AUTO RCS SEL B/D ROLL B1 - MNB
- AUTO RCS SEL B/D ROLL D1 - MNB
- AUTO RCS SEL B/D ROLL B2 - MNB
- AUTO RCS SEL B/D ROLL D2 - MNB
- AUTO RCS SEL PITCH A3 - MNB
- AUTO RCS SEL PITCH C3 - MNB
- AUTO RCS SEL PITCH A4 - MNB
- AUTO RCS SEL PITCH C4 - MNB
- AUTO RCS SEL YAW B3 - MNB
- AUTO RCS SEL YAW D3 - MNB
- AUTO RCS SEL YAW B4 - MNB
- AUTO RCS SEL YAW D4 - MNB
- INT NUM LT - as desired
- INT FLOOD LT - as desired
- INT INTGL LT - as desired
- FLOOD DIM - 2
- FLOOD FIXED - OFF
- FLOAT BAG (3) - VENT
- SECS LOGIC (2) - on (up)
- SECS PYRO ARM (2) - on (up)
ANL 9

MODE - INTER/PTT
WR - AUDIO/TONE
INTERCOM - T/R
AD COMM - OFF
BD - T/R
HF AM - T/R
AUDIO CONT - NORM
SUIT PWR - on (up)

ANL 10

MODE - INTER/PTT
WR - AUDIO/TONE
AD COMM - OFF
INTERCOM - T/R
BD - T/R
HF AM - T/R
AUDIO CONT - NORM
SUIT PWR - on (up)

ANL 12

M TUNL VENT VLV - OFF

ANL 13

DAI sw (2) - INRTL
EARTH/LUNAR - PWR OFF
ALT SET - 150
TG - OFF
MODE - HOLD/FAST
SLEW - off (center)

ANL 15

COAS PWR - OFF
UTIL PWR - OFF
PL BCN LT - off (center)
PL DYE MARKER - off (down)(guarded)
PL VENT - OFF
PANEL 16

DOCK TRGT - OFF
UTIL PWR - OFF
COAS PWR - OFF

PANEL 100

UTIL PWR - OFF
FLOOD DIM - as desired
FLOOD FIXED - as desired
G/N OPT PWR - OFF
G/N IMU PWR - on (up)
RNDZ XPNDR - OFF
LEB NUM LT - as desired
LEB FLOOD LT - as desired
LEB INTGL LT - as desired

PANEL 101

SYS TEST (LH) - 4
SYS TEST (RH) - B
CM RCS HTRS - OFF
UR DUMP - HTR A
WASTE H2O DUMP - HTR A

PANEL 122

OPT ZERO - ZERO
OPT TELTRUN - SLAVE TO SXT
OPT COUPLING - DIRECT
OPT MODE - MAN
OPT SPEED - LO
COND LAMPS - ON
UP TLM - ACCEPT

PANEL 162

SCI INST PWR - OFF
PANEL 163

SCI/UTIL PWR - OFF

PANEL 225

CB Panel 225 - all closed except:
  CB HI GAIN ANT FLT BUS - open
  CB HI GAIN ANT GRP 2 - open
  CB RNDZ XPONDER FLT BUS - open

PANEL 226

CB Panel 226 - all closed except:
  CB FC REACS (3)-open
  CB FC RAD (3) - open

PANEL 227

SCI INST PWR - OFF

PANEL 229

  CB MAIN REL PYRO (2)- open

PANEL 250

CB Panel 250 - all closed except:
  CB PYRO A TIE TO BAT BUS A - open
  CB PYRO B TIE TO BAT BUS B - open
  CB BAT C TO BAT BUS A - open
  CB BAT C TO BAT BUS B - open

PANEL 251

WASTE MGMT OVBD DRAIN vlv - OFF

PANEL 252

BAT VENT vlv - CLOSED
WASTE STOWAGE VENT vlv - VENT
PANEL 275
CB Panel 275 - all closed except:
- CB MNA BAT C - open
- CB MNB BAT C - open
- CB FLT/PL BAT BUS A - open
- CB FLT/PL BAT BUS B - open
- CB FLT/PL BAT C - open

PANEL 276
CB Panel 276 - all closed

PANEL 278
CB Panel 278 - all closed

PANEL 300
Suit flow vlv - SUIT FULL FLOW

PANEL 301
Suit flow vlv - SUIT FULL FLOW

PANEL 302
Suit flow vlv - FUIT FULL FLOW

PANEL 303
- PRIM CAB TEMP vlv - C (CW)
- SEC CAB TEMP vlv - COOL-MAX (CW)

PANEL 304
DRNK H2O SUPPLY vlv - OFF (CW)

PANEL 305
- FOOD PREP H2O COLD vlv - rel
- FOOD PREP H2O HOT vlv - rel
PANEL 306

MSN TMR - START
EVNT TMR RSET - UP
EVNT TMR STRT - center (START*)
EVNT TMR MIN - center
EVNT TMR SEC - center
MSN TMR HR - center
MSN TMR MIN - center
MSN TMR SEC - center

PANEL 325

CAB PRESS RELF vlv (RH) - BOOST ENTRY
CAB PRESS RELF vlv (LH) - BOOST ENTRY
PRIM GLY TO RAD vlv - pull to bypass

PANEL 326

02 PLSS vlv - ON
02 SM SUPPLY vlv - ON
02 SURGE TK vlv - ON
GLY RSVR IN vlv - OPEN
GLY RSVR BYPASS vlv - CLOSE
GLY RSVR OUT vlv - OPEN

PANEL 350

CO₂ cstr divert vlv - both (center)

PANEL 351

MAIN REG vlv (2) - OPEN
H₂O/GLY TK PRESS REG vlv - BOTH
H₂O/GLY TK PRESS RELF vlv - BOTH
EMER CAB PRESS vlv - OFF
CAB REPRESS vlv - close (CCW)

PANEL 352

WASTE TK SERVICING vlv - CLOSE
PRESS RELF vlv - BOTH

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CSM 104
POT TK IN vlv - OPEN
WASTE TK IN vlv - AUTO

PANEL 375
SURGE TK PRESS RELF vlv - OPEN (CW)

PANEL 376
PLVC - NORMAL (up)

PANEL 377
GLY TO RAD SEC vlv - BYPASS (CCW)

PANEL 378
PRIM GLY ACCUM vlv - open (CCW)

PANEL 379
PRIM ACCUM FILL vlv - OFF (CW)

PANEL 380
O2 DEMAND REG vlv - BOTH
SUIT TEST vlv - OFF
SUIT CKT RET vlv - push to close

PANEL 382
SUIT HT EXCH PRIM GLY vlv - FLOW (CCW)
SUIT FLOW RELF vlv - OFF
PRIM GLY EVAP IN TEMP vlv - MIN (CCW)
SUIT HT EXCH SEC GLY vlv - FLOW (CCW)
EVAP H2O CONT SEC vlv - AUTO (CW)
EVAP H2O CONT PRIM vlv - AUTO (CW)
H2O ACCUM vlv (2) - RMTE (CCW)

PANEL 600
EMER O2 vlv - close
PANEL 601
REPRESS 02 vlv - close

FWD HATCH
PRESS EQUAL vlv - close

PANEL 602
REPRESS 02 RELF vlv - close (CCW)

SIDE HATCH
PRESS EQUAL vlv - close
GEAR BOX sel - LATCH
HANDLE sel - UNLATCH

• - last momentary position before liftoff.
**LAUNCH PREPARATION**

- **30:00**
  - CTE UPDATE VERIFICATION
  - Change X STABLE MEMBER AZIMUTH, if necess
  - *V78E
  - *F 06 29 X SM AZ (.01°)*
  - *V21E
  - *Load new Azimuth***
  - *PRO
  - *GDC ALIGN, Pg L-8***

- **20:00**
  - SM RCS PRIM PROP (4)-open (up)
  - SM RCS PRIM PROP tb (8)-Gray

- **15:00**
  - FDAI-1 - total att R=90+AZ, P=90, Y=
  - BMAG MODE(3) - RATE 1
  - FDAI SCALE - 5/5
  - RATE - HIGH
  - RHC(2)-unlocked
  - ROT CONT PWR DIRECT(2)-MNA/MNB
  - CMC MODE - FREE
  - TRANS CONTR PWR -on(up) (verify)

ASTRO LAUNCH OPERATIONS VOICE CHECK

VOICE CHECK WITH MCCH

- S-bd VOL tw(CDR) - full decr
- PAD COMM-OFF
- ADJUST MASTER VOL CONTROLS
- SPS THRUST - NORMAL
- ΔV THRUST (2) - OFF
- α/PC - α
- SII/SIVB/GPI - SII/SIVB
- EDS AUTO - on (up)
- LV RATE - AUTO
- 2 ENG OUT - AUTO
- CM RCS PROP tb(2)-gray (verify)
- RCS CMD - OFF
- FC REACT vlv - LATCH

- **10:00**

- **06:00**
  - SCS TVC SERVO PWR 1 - AC1/MNA
  - SCS TVC SERVO PWR 2 - AC2/MNB
-04:00  ASTRO LAUNCH OPERATIONS COMM CHECK

-03:00  DSKY - Verify P02
        V75 (NO ENTR)

        TAPE RCD FWD - FWD (tb-gray)

-2:00   GLY RAD PRI - pull (bypass)

-1:15   MN BUS TIES (2)-ON

-00:45  GDC ALIGN pb - PUSH & HOLD
        R=90+AZ, P=90, Y=0
        FDAI 2 Total att - NO MOTION
        GDC ALIGN pb - release
SECTION 2 - BOOST-INSERTION

-00:09 Ignition CMD
-00:01 L/V ENGINES lts (5) - out
00:00 LIFT OFF lt - on

*LIFTOFF VERIFIED:
* If LIFTOFF lt out - push
* If NO AUTO ABORT lt on - push

Clock Running (auto) - report
MET Resets & starts counting up auto
Pll auto

* NO Pll - Key ENTR
* START DET & RSET MET

06 62 VI,H DOT, H PAD (fps,fps,.1nm)

+00:02 Yaw Maneuv.
+00:12 Roll & Pitch Program - report
+00:31 Roll complete

+00:42 MODE IB - report
PRPLNT DUMP - RCS CMD
+00:50 Monitorα to T +02:00 (100%, 6° Roll error)

* LV Guid & LV Rate lts on
* 00:50 - 01:25 ABORT

CABIN PRESSURE DECREASING

* NO PRESSURE DECREASE by 25K
* CAB PRESS RELIEF vlv (RH) - DUMP
* NO DUMP-HATCH REL vlv-OPEN

+01:21 MAX Q
+01:54 MODE IC - report (R3 = 16.5NM)
02:00 EDS AUTO - OFF - report
2 ENG OUT - OFF
L/V RATES - OFF
α/Pc sw - Pc

GO/NO GO FOR STAGING - report

02:14 INBOARD CUTOFF - report (lt 5 on)
LIFTOFF LIGHT - out

02:40 OUTBOARD CUTOFF - report (lts 1,2,3,4 on)

02:41 SIC/SII STAGING (lts out)
SII Ign Command (lts on)
SII SEP lt - on

02:44 SII 65% - lts out
FDAI Scale - 50/10
GMBL MOT (4) - START - ON (LMP CK MNA)
Check GPI
SII/SIVB/GPI - GPI (Momentarily)

03:11 SII SEP lt - out report

03:16 TWR JETT (2) - ON (TFF>1+20)
* NO TWR JETT *
* LES MOT FIRE pb - push *
* No response go to Pg L/6-6*
MAN ATT PITCH - RATE CMD
Twr Jett & MODE II - report

GLY EVAP STEAM PRESS - AUTO
GLY EVAP H2O FLOW - AUTO

03:21 Guidance Initiate - report (OECO +41 Sec)
03:53 Guidance Good
04:00 Report Status
05:00 Report Status
05:50 Upstage Capability
06:00 Report Status
06:15 SBD ANT OMNI-D
07:00 Report Status
07:10 PU shift
+08:00 Report Status
+08:20 GO/NO GO FOR STAGING - report
+08:54 SII Cutoff - lts on
+08:55 SII Staging - lts out
+08:56 SIV Ign Cmd - lt on
+09:00 SIV 65% lt - out
Report Status
+09:23 Mode IV - Report
(VI 23,400, H DOT 0)
V82E - F 16 44 (HA, HP, TFF)
+10:00 GO/NO GO FOR ORBIT - report
+10:49 SIVB CO (lt on) - report
(Begin TB5)
  * If no SECO, *
  * THC CCW for 1 sec *
  * SII/SIVB sw-LV STAGE *
+10:59 INSERTION
N62
  VI _____
  HDOT _____
  H _____

N44
  HA _____
  HP _____

POO V 37 E 00 E
1 POST INSERTION CHECKS

- GMBL MOTS (4) - OFF (LMP Confirm)
- EDS PWR - OFF
- MN BUS TIES (2) - OFF
- TVC SERVO PWR (2) - OFF
- SECS PYRO ARM (2) - SAFE
- SECS LOGIC (2) - OFF
- ELS - MAN
- CM RCS LOGIC - OFF
- ROT CONTR PWR DIRECT (2) - OFF
- AUTO RCS SELECT (16) - OFF
- VHF AM A - SIMPLEX
- REC ONLY - OFF
- VHF AM B - OFF
- CB RCS LOGIC (2) - open
- CB DOCK PROBE (2) - open
- CB ELS BAT (2) - open
- CB PL VENT - open
- CB FLOAT BAG (3) - open
- CB SECS ARM (2) - open
- DIRECT O2 - OFF (CW)
- SM RCS HTRS (4) - PRIM
- CM RCS PRPLNT (2) - OFF (tb-bp)
- C/W FUNCTION - NORMAL
- FC REACS vl v - NORM
- H2 PURGE LINE HTR - ON
- PCM BIT RATE - LOW
- CB UPRIGHT COMPR (2) - open
- HATCH ACTUATOR HANDLE - LATCH

2 ECS POSTINSERTION CONFIGURATION

- CAB PRESS REL vl v (2) - NORMAL
- CB WASTE H2O/UR DUMP HTR (2) - close
- GLY RSVR BYPASS vl v - OPEN (CCW)
- GLY RSVR OUT vl v - CLOSE (CW)
- GLY RSVR IN vl v - CLOSE (CW)
- ECS RAD FLOW CONT PWR - PWR
- GLY TO RAD PRIM vl v - push (normal)
- ECS RAD HTR - PRIM 1
- ECS RAD TEMP PRIM OUT below PRIM IN
* If OUTLET TEMP ABOVE INLET TEMP: *
* GLY TO RAD PRIM vlv - pull (bypass) *
* recheck in 5 minutes

ECS RAD tb - gray
GLY EVAP TEMP PRIM IN - AUTO
CABIN TEMP - AUTO
DRINKING WATER SUPPLY vlv - ON (CCW)

3 ECS REDUNDANT COMPONENT CHECK

Suit compressor
SUIT COMPR (2) - redundant compressor
SUIT COMPR ΔP - 0.3-0.4 psi
CMP to LEB for MN REG CK
MAIN REG B vlv - CLOSE
EMER CABIN PRESS vlv - 1
PUSH TO TEST pb - push (O2 FLOW INC)
O2 PRESS - 90-110 psig (MSFN)
MAIN REG B vlv - OPEN
MAIN REG A vlv - CLOSE
EMER CABIN PRESS vlv - 2
PUSH TO TEST pb - push (O2 FLOW INC)
O2 PRESS - 90-110 psig (MSFN)
MAIN REG A vlv - OPEN
EMER CABIN PRESS vlv - BOTH (OFF if suited)
PNL COMM - NORMAL
SUIT CKT RET vlv - OPEN
CMP DOFF HELMET & GLOVES & MAE WEST
UNSTOW HELMET BAGS FROM A-1
STOW CMP HELMET IN L-SHAPED BAG

SEC RAD LEAK CK
ECS IND sel - SEC
Monitor Sec ACCUM QTY while CMP sets SEC GLY
to RAD vlv to NORMAL 30 sec then back to
BYPASS

Secondary Glycol Loop (if req'd)
EVAP H2O CONT SEC vlv - AUTO
SEC COOL LOOP PUMP - AC 1
GLY DISCH SEC PRESS - 39-51 psig
ACCUM SEC QTY ind - 30-55%
SEC COOL LOOP EVAP - EVAP
SEC EVAP STEAM PRESS .1-.15 boiling
> .16 not boiling

After 5 min
SEC EVAP TEMP OUT - 40-50.5°F
SEC COOL LOOP EVAP - RESET for 1 min
then off (ctr)
SEC COOL LOOP PUMP - off (ctr)
ECS IND sw - PRIM

4 ECS MON CK (LMP)
BAT CHG (LMP)

GDC ALIGNMENT TO IMU GIMBAL ANGLES
ATT SET tw - FDAI GIMB ANG
FDAI SELECT - 1
FDAI SOURCE - ATT SET
ATT SET - IMU
ATT SET dials - null FDAI 1 err needles
ATT SET - GDC
GDC ALIGN PB - push until needles nulled

EMS TEST
CB EMS (2) - close (verify)
EMS MODE - STBY
EMS FUNCT - ΔV SET (wait 5 sec)
EMS MODE - AUTO
ΔV ind - 1586.8 fps
EMS FUNCT - ΔV TEST
- SPS THRUST lt - on
- ΔV ind - decr in 10 sec
- SPS THRUST lt - out (at -0.1 fps)
- ΔV ind - stop at -20.8 +20.7 fps
EMS MODE - STBY

7 EPS MON CHECKS (LMP)

3 INSTALL OPTICS (CMP)
9 SM RCS MON CK
SM RCS He tb (8) - gray
SM RCS PRIM PRPLNT tb (4) - gray
SM RCS SEC PRPLNT tb (4) - gray
RCS IND sel - SM A, B, C, D
PKG TEMP ind - 105-195°F
He PRESS ind - record
He TK TEMP - record
PRPLNT QTY ind - record
SEC FUEL PRESS ind - 178-192 psia
(192-207 psia until jets fired)

10 CM RCS MONITORING CHECK
CM RCS PRPLNT tb (2) - bp
RCS IND sel - CM 1, 2
He TEMP ind - 60-90°F
He PRESS ind - 4000-4450 psia
MANF PRESS ind - 25-105 psia

11 JETT DUST COVERS (CMP)

12 BACKUP COMM CHECK (LMP)

13 P52 (REFSMMAT) (CMP)

14 PIPA BIAS CK
(1:15 with MER-OPTIONAL)

DET - RESET
S/C RATES <0.1°/sec

V25N 21E, E,E,E/Start Event Timer
V16 N21E

16 21
XYZ PIPA COUNTS

At T + 4:16 - VERB
T4:16
(X) R1 ____ (Y) R2 ____ (Z) R3 ____ (XXXX)
V21N 01E
F 21 01
LOAD 1452 E (CALCULATED X BIAS) E,E,(+ABXXX)
1454 E (CALCULATED Y BIAS) E,E
1456 E (CALCULATED Z BIAS) E

15 RH WINDOW PHOTOGRAPHY (LMP)
16 FC PURGE CK (LMP)
17 C/W SYSTEM CHECKS (LMP)

18 SCS ATTITUDE REFERENCE COMPARISON
Key V37E00E
Key V16 N20E, (pres IMU angs)
FDAI SELECT - 1
FDAI SOURCE - ATT SET
ATT SET - GDC
ATT SET dials - null FDAI 1 err needles
Key V (when nulled to freeze display)
RECORD FROM DSKY:
V06 N20
R=____°, P=____°, Y=____°
ATT SET dials (3) - Record
R=____°, P=____°, Y=____°
Key V37E 00E

19 SPS MON CHECK (LMP)
20 MOUNT & INIT ORDEAL (CDR)
21 PREPARE COAS (CDR)
22 UNSTOWAGE (CMP)
SECTION 3, SEPARATIONS

CSM/SLA SEPARATION THRU WITHDRAWAL

1 PRE SEPARATION

Stow optics eyepieces
Change seats & umbilicals
CB SIVB/LM SEP (2) - close (verify)
CB DOCK PROBE (2) - close (verify)
DOCK PROBE EXTD/REL - EXTD/REL until tb-bp
DOCK PROBE tb - grey at full extension
DOCK PROBE EXTD/REL - OFF
DOCK PROBE EXTD/REL - RETRACT (tb-gray)
COAS mounted
COAS PWR - on

RCS DAP loaded and activated
R1 - 11102  Noun 46 Display
R2 - 11111  "
N17 - (SEP ATT)  181.43  94.63  14.78
N22 - (DOCK ATT)  121.43  184.63  345.22

2 SEPARATION PREP

SIVB attitude, DB & H2 Vent rate, Confirmed by MSFN
Donn helmets (Helmet visor on CDR) and gloves
WASTE STOWAGE VENT vlv - close
SUIT CKT RET vlv - CLOSE
EMERG CAB PRESS TEST - press
    until cabin reaches 5.7
EMERG CAB PRESS - OFF
EMS MODE - STBY
EMS FCN - OFF
ΔV ind - zero
ALIGN GDC
FDAI 1 - INRTL
FDAI 2 - V83 - adjust ORDEAL

Key V37E OOE

CB SECS ARM (2) - close
SECS LOGIC (2) - on (up)
Obtain GO from MSFN for PYRO ARM
MAN ATT (3) - RATE CMD
LIMIT CYCLE - OFF
ATT DB - MIN
RATE - LOW
TRANS CONT PWR - on (up)
ROT CONT PWR NORMAL (2) - AC/DC
ROT CONT PWR DIRECT (2) - MNA/MNB
SC CONT - CMC
CMC MODE - FREE
BMAG MODE (3) - RATE 2
LV/SPS IND - SII/SIVB
LV GUIDANCE - IU
XLUNAR - SAFE
UP TLM IU - BLOCK
AUTO RCS SEL (16) - MNB
CB RCS LOGIC (2) - close
DET RSET - RESET
DET - 00:00
Key V46 E (activates DAP)

3 CRO
Receive GO for PYRO ARM
UP TLM - ACCEPT
Receive MSFN update
UP TLM - BLOCK
(2:25-148, 2:30-128, 2:34-112)

4 SEPARATIONS

SEPARATION V46E
2:34:30
SIVB MNVR to 181.43 4.63 14.78
THC - ARMED
RHC (2) - ARMED
MAN ATT (3) - MIN IMP
SC CONT - SCS
RCS CMD - ON
CHECK RCS (audible)
SC CONT - CMC
MAN ATT (3) - RATE CMD
EMS FUNCT - ΔV
EMS MODE - AUTO
Key V63E
V66E (transfer CSM state vector to LM storage)
Key V37E 47E
SECS PYRO ARM (2) - on (up)
CMC MODE - AUTO
THC - +X and hold
CSM/LV SEP pb - push and hold and release
LV TANK PRESS - full scale

00:00
DET - start up

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

No separation:
THC - CCW (leave in detent)
until 1 fps
LV TK PRESS - full scale low (SEP ind)
Event Timer reset and counting up (auto)

00:04 max
THC - release
ΔV ind - 1 fps
EMS MODE - STBY
EMS FUNCT - OFF
ΔV ind - zero

5 POST SEPARATION
MAN ATT PITCH - ACCEL CMD
Key V62E

6 TRANSPOSITION
AT :30 Pitch up 180° to acquire SIVB
MAN ATT PITCH - RATE CMD
EMS FUNCT - ΔV
EMS MODE - AUTO
Null translation and rates
MAN ATT ROLL - ACCEL CMD
ROLL left 60° to null error needles
MAN ATT ROLL - RATE CMD
EXT RNDZ LT - SPOT
DOCK PROBE EXTD/REL - RTRACT
CB HI GAIN ANT FLT BUS - close
CB HI GAIN ANT GRP 2 - close
HI GAIN ANT TRACK - MAN
HI GAIN ANT PWR - POWER

7 DOCKING GET

Stabilize & align CSM at 50 ft
BMAG MODE (3) - ATT 1/RATE 2
SC CONT - SCS
CMC MODE - FREE
THC +X to close at .25 to .5 fps
At contact (ASAP):
  PROBE EXTD/RETR tb - bp
SC CONT - CMC
Allow probe to damp SC motions (approx 10 sec)

Divergent oscillations or abnormal motions:
  EXTD/REL - EXTD/REL
  Withdraw to stationkeeping
  Evaluate and repeat sequence

Align pitch & yaw with THC (<3°)
DOCK PROBE RETRACT PRIM - 1
After dock latches have engaged:
  PROBE EXTD/RETR tb - grey (A-1,5,9; B-3,7,11)
  SECS PYRO ARM (2) - SAFE
  SECS LOGIC (2) - OFF
  CB SECS ARM (2) - OPEN
  EXTD/REL - OFF
  RETRACT 1 - OFF
  CB DOCK PROBE (2) - open

8 POST DOCKING
RATE - HIGH
SC CONT - CMC
PRO

F 37 - OOE

COAS PWR - OFF
CB RCS LOGIC (2) - open
THC, RHC - locked
EMS MODE - STBY
EMS FUNCT - OFF
Verify Suit Integrity
COUCHES: CDR-90°, CMP-0°, LMP-180°
LM PWR - OFF
TUNNEL lights - ON

9 CM/LM PRESSURE EQUILIZATION
PLSS - OFF
SURGE TANK - ON
02 PRESS ind - SURGE TANK
EMERG CABIN PRESS - OFF
CABIN REPRESS OFF
WASTE STORAGE VENT - CLOSED
LM/CM PRESS vlv - LM/CM ΔP
CABIN PRESS - 5.7 psi
HATCH PRESS EQUAL vlv - open full
At Cabin = 4.5 psi, PRESS EQUAL vlv - close
LM/CM ΔP - 2.5 psi
Check LM pressure stabilization
HATCH PRESS EQUAL vlv - OPEN
When CABIN PRESS = 4.0, REPRESS 02 - OPEN

CAUTION
If CAB PRESS=5.7, REPRESS 02 - CLOSED
Recycle until 02 REPRESS PRESS ~100
& CAB PRESS~4.0

REPRESS 02 - CLOSED

If cabin <4.0, HATCH PRESS EQUAL vlv - closed

Verify LM/CM ΔP <.2
EMERG CABIN PRESS - BOTH
LM/CM ΔP <.2
PLSS - FILL when Cabin reaches 5.0 psi
RHC #1 - stow on mount on A-6
10 TUNNEL HATCH REMOVAL
HATCH PRESS EQUAL vlv - open (CCW)
PUMP HANDLE - unstow, pull to stop, set to U
- Push to stop
Verify gearbox disconnect socket - U
PUMP HANDLE sel - stow
- push to stow
Remove hatch, pass to LMP

11 DOCKING LATCH VERIFICATION

Power Bungee Fairing - parallel to +X
Latch handle - Pull to verify hook engaged (12 latches)
Latch Ind Button (red) - flush (12 latches)

Unlocked Latches:
Bungee Fairing - push +X end to seat
or cock latches if it doesn't seat
Hook does not release:
AUX RLSE (yellow)-push
cock latch
Release latch - push man release
(fish tail)

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

12 LM UMBILICAL CONNECTION

LM Connector Fairings (2) (orange) - open
Unstow one connector
SYS TEST - 4D volts
Connect and lock
SYS TEST - 4D volts
Position umbilical in slot, close fairing
Repeat for second umbilical
SYS TEST - 4D volts
LM PWR - CSM, volts
SYS TEST ind - 5.0 - 6.5 amps (2.5-3.3 volts)
13 HATCH INSTALLATION

Align Hatch in tunnel
PUMP HANDLE - unstow
  - push to stop
  - set to L
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
x (Irreversible)(cannot remove hatch) x

PUMP HANDLE sel - stow
  - push to stow

HATCH PRESS EQUAL vlv - closed (CW)
LM TUNNEL LTS - OFF
GET : : :

14 PRE LM EJECTION 4810:00 GET (nominal)

LOAD DAP: N46: 21102
V62E
V49E
V06 N22
Load N22: 142.8 318.6 365.60
PRO
50 18
Set ET: 00:00
CB SECS ARM (2) - close
SECS LOGIC (2) - (up)
Obtain GO from MSFN
  SECS PYRO ARM (2) - on (up)

15 LM EJECTION

EMS FUNCT - ∆V
EMS MODE - AUTO
SIVB/LM SEP - on (up)
Start DET
16 EVASIVE MNVR

After clear of SIVB - CMC MODE - AUTO
50 18
PRO to pitch down 50° at Sep +15 sec (15 ft)
THC, RHC - Unlocked
At completion of mnvr: ENTR
V 37E 47E
AT ET = 02 + 30
Thrust Aft (-X) 3 sec.

17 POST EVASIVE MNVR
SECS PYRO ARM (2) - OFF
SECS LOGIC (2) - OFF
CB SECS ARM (2) - open
CB SIVB/LM SEP (2) - open
When clear of SIVB:
CMC MODE - FREE
PRO
F 37 - OOE
Reload DAP: N46: 21111
EMS FUNCT - OFF
EMS MODE - STBY
TRANS HAND CONT PWR - OFF
ROT CONT PWR NORM (2) - OFF
ROT CONT PWR DIRECT (2) - OFF
LV/SPS IND - GPI
RHC, THC - locked

18 SIVB MNVR TO LCL HORIZ, ORG RATE: 4:25:00
SIVB INERTIAL 4:45:51
### MODE IA PAD → 42 SEC

<table>
<thead>
<tr>
<th>TIME</th>
<th>CDR</th>
<th>CMP</th>
<th>LMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>:00</td>
<td>THC - CCW</td>
<td>SM SEP (2) - ON</td>
<td>START TIME</td>
</tr>
<tr>
<td>:14</td>
<td>ELS LOGIC - ON ELS AUTO - AUTO</td>
<td>TWR JETT (2) - ON APEX COVER JETT pb - push DROGUE DEPLOY pb - push</td>
<td></td>
</tr>
<tr>
<td>:28</td>
<td>IF BELOW 3700': MAINS DEPLOY MAINS DEPLOY pb - push</td>
<td></td>
<td>EARTH LANDING, pg L/4-6</td>
</tr>
</tbody>
</table>

### MODE IB → 42 SEC 100,000K (R3=16.5NM) FTA: 1+45

<table>
<thead>
<tr>
<th>TIME</th>
<th>CDR</th>
<th>CMP</th>
<th>LMP</th>
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<tr>
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<td>THC - CCW</td>
<td>SM SEP (2) - ON</td>
<td>START TIME</td>
</tr>
<tr>
<td>:11</td>
<td></td>
<td>CANARD DEPLOY pb - push</td>
<td></td>
</tr>
<tr>
<td>:14</td>
<td>ELS LOGIC - ON ELS AUTO - AUTO</td>
<td>TWR JETT (2) - ON APEX COVER JETT pb - push DROGUES DEPLOY pb - push</td>
<td></td>
</tr>
<tr>
<td>23K</td>
<td></td>
<td></td>
<td>CABIN PRESS-INCREASING</td>
</tr>
<tr>
<td>20K</td>
<td>(CABIN PRESS REL. vlv.-DUMP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10K</td>
<td>MAINS DEPLOY pb - push</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EARTH LANDING, pg L/4-6
### 4. ABORTS

<table>
<thead>
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<th>CMP</th>
<th>LMP</th>
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</thead>
<tbody>
<tr>
<td>00</td>
<td>THC - CCW</td>
<td>SM SEP (2) - ON</td>
<td>START TIME</td>
</tr>
<tr>
<td>11</td>
<td>PLATFORM NO GO:</td>
<td>CANARD DEPLOY pb - push</td>
<td>(LM Final Sep)</td>
</tr>
<tr>
<td></td>
<td>P+5°/sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>*High P</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>*Roll 90° *</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Damp Rates</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P+5°/s</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40K</td>
<td>ELS LOGIC - ON</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ELS AUTO - AUTO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24K</td>
<td></td>
<td>TWR JETT (2) - ON</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>APEX COVER JETT pb - push</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DROGUES DEPLOY pb - push</td>
<td></td>
</tr>
<tr>
<td>23K</td>
<td>(CABIN PRESS REL. vlv. - DUMP)</td>
<td></td>
<td>CABIN PRESS-INCREASING</td>
</tr>
<tr>
<td>20K</td>
<td>MAINS DEPLOY pb - push</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10K</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

EARTH LANDING, pg L/4-6

Basic Date: 1, 1969

Changed
### MODE II - TWR JETT 9:23

<table>
<thead>
<tr>
<th>TIME</th>
<th>CDR</th>
<th>CMP</th>
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<tbody>
<tr>
<td>:00</td>
<td>THC-CCW</td>
<td></td>
<td>START TIME</td>
</tr>
<tr>
<td>:03</td>
<td></td>
<td>LV SEP pb - push</td>
<td></td>
</tr>
<tr>
<td>:05</td>
<td>THC NEUTRAL +X (20 sec)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| :06   | RATES: ΔV THRUST (1)-NORMAL
THRUST on PB
DIR. ULL PB
ΔV THRUST (1)-OFF
SPS THRUST-NORMAL |                            |                   |
| :24   | +X OFF
0,120,0
BMAG (3) - ATT 1/RATE 2
EMS-ENTRY, AUTO
RCS SINGLE RING
AT .05G-.05G ON | SM SEP (2) - ON
LM FNL SEP (2)-ON |                   |
| 40K   | ELS LOGIC - ON
ELS AUTO - AUTO |                            |                   |
| 24K   |                          | APEX COVER JETT pb-push    |                   |
| 23K   |                          | DROGUES DEPLOY pb-push     |                   |
| 20K   |                          |                             |                   |
| 10K   | (CABIN PRESS REL. vlv-DUMP) |                          |                   |
|      | MAINS DEPLOY pb-push     |                             |                   |
|      | EARTH LANDING, pg L/4-6  |                             |                   |

*Basic Date: Feb 1, 1969
Changed:__

FTA: 4+30 and 9+20

THC-CCW START TIME
LV SEP pb - push
THC NEUTRAL +X (20 sec)
RATES: ΔV THRUST (1)-NORMAL
THRUST on PB
DIR. ULL PB
ΔV THRUST (1)-OFF
SPS THRUST-NORMAL
4-3

CABIN PRESS-INCREASING
<table>
<thead>
<tr>
<th>TIME</th>
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<th>CMP</th>
<th>LMP</th>
</tr>
</thead>
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<td></td>
<td>START TIME</td>
</tr>
<tr>
<td>:03</td>
<td></td>
<td>LV SEP pb - push</td>
<td></td>
</tr>
<tr>
<td>:05</td>
<td>THC-NEUTRAL - +X(20 sec)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>:06</td>
<td>RATES: ( \Delta V ) THRUST (1)-NORMAL THRUST PB-push DIR. ULL PB-push ( \Delta V ) THRUST (1)-OFF SPS THRUST-NORMAL</td>
<td></td>
<td>1 27'13&quot; -18'55&quot;</td>
</tr>
<tr>
<td>:24</td>
<td>( \Delta V ) OFF 180,194,0 BMAG(3)-ATT 1/RATE 2 ( \Delta V ) THRUST (1) (NORMAL) EM: ( \Delta V ) - AUTO</td>
<td></td>
<td>ATT: HORIZ,BEF,HDS UP</td>
</tr>
<tr>
<td>2:05</td>
<td>TH. PB. -push DIR. ULL. PB - push ( \Delta V ) THRUST (1) - OFF SM SEP RCS SINGLE RING EMS-ENTRY,AUTO 0,105,0 AT .05G-.05G AT .2g 305,105,17</td>
<td></td>
<td>SM SEP(2) - ON LM FNL SEP(2) - On ΔR -368 To 0 - NO BURN (N50E) CW MODE - CM</td>
</tr>
<tr>
<td></td>
<td>40K</td>
<td>24K</td>
<td>23K</td>
</tr>
<tr>
<td>---</td>
<td>-------</td>
<td>------------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td></td>
<td>ELS LOGIC-ON</td>
<td>APEX COVER JETT pb-push</td>
<td>CABIN PRESS - INCREASING</td>
</tr>
<tr>
<td></td>
<td>ELS AUTO-AUTO</td>
<td>DROGUES DEPLOY pb-push</td>
<td></td>
</tr>
<tr>
<td>TIME</td>
<td>CDR</td>
<td>CMP</td>
<td>LMP</td>
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<td>----------------------------</td>
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<tr>
<td>:00</td>
<td>THC-CCW</td>
<td></td>
<td>START TIME</td>
</tr>
<tr>
<td>:03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>:05</td>
<td>THC-NEUTRAL +X (20 sec)</td>
<td>LV SEP pb - push</td>
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<tr>
<td>:06</td>
<td>RATES: ΔV THRUST(1)-NORMAL</td>
<td>ULL, PB - push</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Th. PB - push</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ΔV THRUST (1)-OFF</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPS THRUST - NORMAL</td>
<td></td>
</tr>
<tr>
<td>:24</td>
<td>+X OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>180,347,0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BMAG(3) - ATT 1/RATE 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ΔV THRUST (1) - OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2:05</td>
<td>EMS-AUTO</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ULL. PB</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Th. PB</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ΔV THRUST (1) - OFF</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GO TO POSTINSERTION CHECKLIST, pg L/2-4

Basic Date 1, 1969

CS: 104
ABORT EARTH LANDING

10K
- MAINS DEPLOYED (MAIN DEPLOY PB)
- VHF ANT - RECY
- VHF AM - SIMPLEX A, BCN-ON
- VOICE REPORT
- CABIN PRESS REL vlv (2) - close
- DIRECT O2 - OPEN (CCW)
- CM RCS LOGIC - ON (UP)
- CM PRPLNT DUMP - ON (Burn Audible)

*No Burn, Use Both RHC's*
*Do NOT Fire Pitch Jets*

CM PRPLNT PURGE - PURGE(up)(To Zero He PRESS)

*CM RCS He Dump pb - Push*
*RHC(2) 30 sec - No Pitch*

CAB PRESS REL vlv(2) - Boost/Entry
- STRUT LOCKS - UNLOCK
- CB FLT & PL BAT BUS A,B,&BAT C(3) - close
- CB FLT & PLS MNA & B(2) - open
- FLOOD POST LDG
- CM RCS PRPLNT(2)-OFF

3K
- CAB PRESS REL vlv - DUMP
- ROT CONT PWR DIRECT (2) - OFF

4000
- CAB PRESS REL vlv (2) - close
- MN BUS TIES (2) - OFF
<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>AK</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔV</td>
<td></td>
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<td>VC</td>
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<td>PITCH (BURN)</td>
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<td>BT</td>
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<td>GET 300K</td>
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<td>PITCH (300K)</td>
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<td>GET DROGUE</td>
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</tbody>
</table>

**MODE III NO COMM-NO PNGS**

\( (-9:50) \times 2 \)

**BT** = abort time
SECTION 5. POSTLANDING TOUCHDOWN AND STABILIZATION
ELS AUTO - AUTO (verify)  
CB MAIN RELEASE PYRO (2) - closed  
DIRECT O2 - closed (CW)  
ELS LOGIC - ON (verify)  
MAIN RELEASE - on (up)  
SECS PYRO ARM (2) - SAFE  
SECS LOGIC (2) - OFF  
CB BAT RELAY BUS (2) OPEN  
VHF AM B - OFF (center)  
CB UPRT COMPR (2) - close (verify)  
CB FLT/PL VENT - close  
CB FLOAT BAG (3) - close  
If Stable II  
FLOAT BAG (3) - FILL till 2 min after upright, then OFF  
VHF AM A & BCN - OFF while inverted

IF STABLE I  
After 10 min Cooling Period,  
FLOAT BAG (3) - FILL 7 min  
FLOAT BAG (3) - OFF

2. POST STABILIZATION AND VENTILATION
CB MNA BAT BUS A AND BAT C (2) - open  
CB MNB BAT BUS B AND BAT C (2) - open  
CB FLT/PL BAT C - open  
CB PYRO A SEQ A - open  
CB PYRO B SEQ B - open  
PL DUCT COVER - remove  
PL VENT VLV handle - pull  
PL VENT - HIGH or LOW  
PL BCN LT & DYE MARKER - ON (swimmer COMM)  
INTERCOM (3) - PTT  
DEPLOY GRAPPLING HOOK if required  
Install directional air flow ducts  
\*xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx\*  
\*EACH HR - CHECK DC VOLTS< 27.5 V  
If Not:  
CB FLT & PL BAT BUS A&B (2) - open  
CB FLT & PL BAT C - close  
GO TO LOW POWER CHECKLIST  
\*xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx\*
3. POSTLANDING COMMUNICATIONS
   VHF ANT-RECY (verify)
   VHF BCN - ON (verify)
   If no contact with recovery forces
   MONITOR VHF BEACON Transmission with survival radio
   VHF Beacon not operating:
   Connect survival transceiver to ant
   cable and place radio in BCN mode

4. LOW POWER CHECKLIST
   VHF BCN - OFF
   VHF (3) - RCV
   FLOOD FIXED - OFF
   VHF AM B- off (center)
   VHF AM REC ONLY - A (verify)
   COUCH LIGHTS - OFF
   POSTLANDING VENT SYS: minimize use
   SURV RADIO - plug into VHF BCN ANT cable
   CONN & turn radio on in BCN mode

5. STABLE I EGRESS
   CB BAT A, B, C PWR ENT/PL (3) - open
   CONNECT SURVIVAL RUCKSACKS TOGETHER
   CONNECT RAFT WHITE LANYARDS TO SUITS
   CONNECT RAFT GREEN LANYARD TO CM
   OPEN HATCH - INFLATE RAFT
   INFLATE WATER WINGS AND EGRESS

6. STABLE II EGRESS
   RECONFIGURE COUCH
   CONNECT RAFT TO CM WITH GREEN LANYARD
   CONNECT RAFT WHITE LANYARDS TO "H2O" WINGS
   VERIFY CABIN PRESSURE RELIEF VALVES (2) - closed
   PRESSURE EQUALIZATION VALVE - open
   REMOVE AND STOW FWD PRESSURE HATCH
   WHEN TUNNEL HAS FLOODED
   CB BAT A, B, C PWR ENT/PL (3) - open
   REMOVE & STOW ABLATIVE HATCH
   DROP HARDWARE RUCKSACK DOWN TUNNEL, EXIT FEET
   FIRST WITH RAFT: WHEN CLEAR OF CM INFLATE
   WATER WINGS AND RAFT
SECTION 6. LAUNCH EMERGENCY PROCEDURES

RAPID HATCH OPENING

1. Actr handle rel - push or squeeze Side Hatch

2. Actr handle - operate (until hatch is unlatched)
   * If hatch fails to open
   * GN2 change knob (2) - CW
   * GN2 vlv handle - unlock and push (outboard)

POWER DISTRIBUTION

1. MN A (B) LOST
   A. EDS AUTO - OFF
   B. CB MN B (A) BAT C - CLOSED
   C. INV 1 (2) MN A (B) - OFF
   D. INV 2 MN B (A) - AC1 (2) IF MAIN B - INV T 2 AC BUS 2 - OFF
   E. FC 2 - MN B (A)
   F. FC 1 (3) - OFF
   G. SCS TVC - RATE CMD
   H. FDAI SELECT 2 (1)
   I. TVC GMBL DR 2 (1) (SPS GMBL INTL CB (4)-OUT) IF SPS ABORT RQD.
   J. BMAG MODE - RATE 2 (RATE 1)
   K. S/C ROLL INFO RSI (FDAI No. 1 ROLL BUS)
   L. ΔV THRUST B (A) - ON
   M. IF CM/SM SEP REQUIRED - PRIOR TO SEP CONFIGURE AUTO RCS SELECT SW FOR RING 2 - MN B (1 - MN A) ALL OTHER - OFF

2. BAT BUS A (B) LOST
   A. EDS AUTO - OFF
   B. CB MN A (B) TO BAT C - CLOSE
   C. IF CM/SM REQUIRED PRIOR TO SEP CONFIGURE AUTO RCS SELECT SW FOR RING 2 - MN B (1 MN A) ALL OTHER - OFF AFTER SEP RCS TRANSFER - CM
RING 1 (2) MAY BE ACTIVATED
AFTER APEX JETT - SCS CONTR/DIRECT (2) - OPEN

D. GIMBAL MOTOR - ON

TVC GIMBAL DRIVE - 1 (AUTO) (SPS GIMBAL CONTROL CB (4) - OPEN) IF SPS ABORT REQUIRED

GIMBAL MOTOR - OFF

TVC GIMBAL DRIVE - 2 (1) (SPS GIMBAL CONTROL CB (4) - OPEN) IF SPS ABORT REQ

3. AC 1 (2) LOST

A. INV 1 (2) MN A (B) - OFF
B. S-BAND P.A. - SEC (PRI)
C. S-BAND XPONDER - SEC (PRI)
D. BMAG MODE - RATE 2 (RATE 1)
E. FDAI SELECT 2 (1)
F. TVC GIMBAL DRIVE P,Y - 2(1)

SCS TVC (P,Y) - RATE CMD

The following procedures will be used for the loss of 3 fuel cells at lift off.

1. Tie Bat C to Main Bus A & B

Panel 275
Main A/Bat C CLOSE
Main B/Bat C CLOSE

2. Turn off cyro heaters and fans and fuel cell pumps.

Panel 5
FC pumps all OFF

Panel 2
H2/O2 Fans (all) OFF
H2/O2 Heaters (all) OFF
3. At insertion 12 + 40 perform the following + insertion checklist.

**POWER DOWN**

Panel 2
Caution/Warning
Cabin Fans - both
SMPCS Heaters (A,B,C,D)
Pot. H2O Heater

Panel 3
SPS Line Heaters
Select Single Inverter Operation
Tape Recorder
S-Band Norm Power Amp

Panel 5
Guidance & Navigation CB(all)

Panel 8
SCS Channels 16

4. GET 1:11:00
EMS ΔV Set

5. Logic Arm
Pyro Arm
CMRCS Press
Logic & Pyro Safed

6. GET 1:21:00
Gimbal Motors On

7. GET 1:21:45
Ullage

8. to = Ignition 1:22:00

9. to + 9 seconds
Gimbal Motors Off

SPS Burn=15 minutes

SPS Burn- 5 minutes

SPS Burn- 15 seconds
10. to + 2 minutes
   Logic Arm
   Pyro Arm

11. to + 5 minutes
   CM/SM SEP
   Configure RCS jet select logic for 1 ring operation

**FIRE IN CM DURING BOOST**
1. CABIN FAN (2) - OFF

   Immediately remove power from affected bus.
   If in abort modes I or II:
   Verify suit compressor on good AC bus
   If in abort mode III with affected bus Main A (B):
   TVC GMBL DRIVE (2) - 2(1)
   AC INV 1 (2) AC BUS 1 (2) - OFF
   AC INV 2 (1) AC BUS 1 (2) - ON(up)

3. CAB PRESS RELF vlv (RH) - DUMP

4. ABORT using appropriate mode

**FIRE/SMOKE IN CM DURING ENTRY**
1. CABIN FAN (2) - OFF

   Immediately remove power from affected bus.

3. ROT CONTR PWR DIRECT (2) - MNA/MNB
   & maintain attitude if required.

4. If affected bus is:
   MNA
   AC INV 1 AC BUS 1 - OFF
   AC INV 2 AC BUS 1 - ON
   Set up for CM/RCS sys 2
   AUTO RCS SEL A/C ROLL (4) - OFF
CM 1(6) - OFF
CM 2(6) - MNB

Follow normal RCS dump procedure using TBD deviations for a fuel rich dump.

MNB:
- AC INV 2 AC BUS 2 - OFF
- AC INV 1 AC BUS 2 - ON

Follow normal RCS dump procedures using TBD deviations for an oxidizer rich dump.

5 CAB PRESS RELF vlv (RH) - DUMP

6 Continue ENTRY

Contamination in CM
- Don O2 masks and/or PGA's immediately
- Evaluate contamination level (isolate & correct source of contamination if possible) and proceed with one of the following steps:
  a. Retain O2 masks or remain in suit and accept contamination level in cabin.

  **CAUTION**
  If in PGA's, adjust DIRECT O2 to maintain suit to cabin AP 1 0.38 psi.

  b. Retain O2 masks and scrub cabin atmosphere through suit loop. If initially suited, establish partially suited or shirtsleeve configuration and don O2 masks.

  **CAUTION**
  Change LiOH cartridges after scrub completed.

  c. Retain PGA's or don PGA's

Verify suit integrity (visually)
Perform Cabin Dump
Perform Cabin Repress
Contamination In Suit

1. SUIT COMPR 2 - AC1
2. SUIT COMPR 1 - OFF
3. DIRECT O2 vlv - OPEN (CCW) for 1 minute then close (CW)

If condition persists:
4. SUIT COMPR 2 - OFF
5. DIRECT O2 vlv - OFF
6. Doff helmet
7. Don emergency O2 masks

LET FAILS TO JETTISON
LEGS CUT/NO MOTOR FIRE (pyro audible)
LEMS MOTOR FIRE pb - push
NO RESPONSE to ABRT SYS TWR JETT switches
CB SECS ARM (2) - close (verify)
CB SECS LOGIC (2) - close (verify)
CB EDS (3) - close (verify)
SECS LOGIC (2) - on (up) (verify)
SECS PYRO ARM (2) - ARM (verify)
EDS PWR - on (up) (verify)
ABRT SYS TWR JETT (2) - on (up) (verify)

EMERGENCY CSM/LV SEPARATION

COASTING
LV XLUNAR - SAFE
SECS ARM cb (2) - close
SECS LOGIC (2) - ON
SECS PYRO ARM (2) - ARM
ROT CONTR PWR DIRECT (2) - MNA/MNB
SC CONT - SCS
BMAG MODE (3) - ATT 1/RATE 2
SCS TVC SERVO PWR 1 - AC1/MNA
2 - AC2/MNB
(Continue through thrusting)

THRU$TING

00:00
TRANS CONTR - CCW (4 Sec)
MN BUS TIE (2) - ON
GMBL MTRS (4) - ON (LMP Confirm)

00:04
TRANS CONTR - NEUTRAL & +X
ΔV THRUST A&B - NORMAL
THRUST ON PB - PUSH
TRANS CONTR +X - RELEASE
ΔV THRUST A&B - OFF When Clear
CMP CHECKLIST
SECTION 1 - CMP Insertion Activities

1. Mount optics

2. OPTICS DUST COVER JETT PROCEDURE
   Install Eyepieces
   OPTICS ZERO - OFF
   G/N OPT PWR - ON (up)
   OPT MODE - MAN
   OPT COUPLING CONT - DIRECT
   OPT SPEED CONT - HI
   OHC - Max Right - Observe ejection thru eyepiece

3. P52 IMU REALIGN
   BMAG MODE (3) - RATE 2
   G/N PWR OPTICS - on (verify)
   CMC MODE - FREE
   OPT ZERO - ZERO (verify)
   OPT MODE - CMC

   F 04 06  R1 00001  IMU ALIGN OPTION
             R2 00001  PREF   PRO to 4
                    2  NOM   PRO to 2
                    3  REFSMMAT PRO to 5
                    4  LDG SITE PRO to 2

   F 06 34  GET ALIGN (0,0, 0 initially) (hr, min, sec)
            Load desired GET
            TO SPECIFY PRESENT TIME - PRO on (0,0,0)
            PRO (NOM go to 4)

   F 06 89  LAT, LONG/2, ALT (±0.001°, ±0.001°, ±0.01nm)
            Load ldg site coords
            PRO

   F 06 22  NEW ICDU ANGLES OG, IG, MG (±0.01°)
            (IF MG>70°, MNVR) V32E - to 4
            PRO NO ATT lt - on then off

   F 50 25  00015 STAR SELECT
            (MNVR If Necessary)
            (PICAPAR) PRO
(MAN ACQ) ENTR

F 01 70  OODEE STAR CODE
Load desired code
  OPT MODE - CMC (verify)
  OPT ZERO - OFF
  PRO to 8 (to 7 if DE=00)
  *F 05 09 00404 (TA>90°)*
  *MNVR - PRO To 8  *

F 06 88  CELESTIAL BODY VECTOR
Load desired vector
  PRO
  *F 05 09 00404 (TA>90°)*
  *MNVR - PRO To 8  *

06 92  SHAFT, TRUN
  (.01°,.001°)
  *PROG ALARM (TA>50°)*
  *V5N9E 00407  *
  *KEY RLSE  *
  *MNVR till R2<49775  *

(MARK ROUTINE) OPTICS MODE - MAN

F 51  PLEASE MARK
  MARK

F 50 25  00016 TERMINATE MARKS
  PRO

F 01 71  OODEE STAR CODE
Load code (if necessary)
  PRO to 6 after 1st MARK (to 12 if DE=00)
  to 13 after 2nd MARK (to 12 if DE=00)
F 06 88 CELESTIAL BODY VECTOR
Load vector
PRO to 6 after 1st MARK
to 13 after 2nd MARK

F 06 05 STAR ANGLE DIFFERENCE
(REJECT) V32E to 15
(ACCEPT) PRO

F 06 93 TORQUING ANGLES OG, IG, MG
(TORQUE) PRO (CMC - FREE)
(BYPASS) V32E

F 50 25 00014 ALIGNMENT CHECK
(RECHECK) PRO To 5
(BYPASS) ENTR

F 37 OPT ZERO - ZERO
XXE

4 Stow optics

5 Unstow:
   a. Helmet bags from A-1, Pass to CDR/LMP
   b. Update books from R1,2,3
   c. Aux straps from R-5
   d. R-12 from R-12
   e. TSB A-1
   f. Cameras
      Hass  B-3
      Film  B-3
      Seq   B-3
      Lens  B-3
      Film  B-3
      Bracket R-10
      Spotmeter B-3

6 EXTEND DOCK PROBE
# SECTION 2. REFERENCE DATA

## STAR LIST

<table>
<thead>
<tr>
<th>STAR NAME (Numerical)</th>
<th>STAR NAME (Alphabetical)</th>
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<tbody>
<tr>
<td>00 Planet</td>
<td>Acamar 6</td>
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<tr>
<td>1 Alpheratz</td>
<td>Achernar 4</td>
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<tr>
<td>2 Diphda</td>
<td>Acrux 25</td>
</tr>
<tr>
<td>3 Navi</td>
<td>Aldebaran 11</td>
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<td>Alphard 21</td>
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<td>Alphecca 32</td>
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<td>Alpheratz 1</td>
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<td>10 Mirfak</td>
<td>Altair 40</td>
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<td>11 Aldebaran</td>
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<td>12 Rigel</td>
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<td>Nunki 37</td>
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<td>41 Dabih</td>
<td>Rasalhague 35</td>
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<td>42 Peacock</td>
<td>Regor 17</td>
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2. REFERENCE DATA

VERB LIST (Decimal)

01 Display Oct Compnt 1 (R1)
02 Display Oct Compnt 2 (R1)
03 Display Oct Compnt 3 (R1)
04 Display Oct Compnt 1, 2 (R1, R2)
05 Display Oct Compnt 1, 2, 3 (R1, R2, R3)
06 Display Decimal (R1 or R1, R2 or R1, R2, R3)
07 Display DP Decimal - (R1, R2)
11 Monitor Oct Compnt 1 (R1)
12 Monitor Oct Compnt 2 (R1)
13 Monitor Oct Compnt 3 (R1)
14 Monitor Oct Compnt 1, 2 (R1, R2)
15 Monitor Oct Compnt 1, 2, 3 (R1, R2, R3)
16 Monitor Decimal (R1 or R1, R2 or R1, R2, R3)
17 Monitor DP Decimal - (R1, R2)
21 Load Compnt 1 (R1)
22 Load Compnt 2 (R2)
23 Load Compnt 3 (R3)
24 Load Compnt 1, 2 (R1, R2)
25 Load Compnt 1, 2, 3 (R1, R2, R3)
27 Display Fixed Memory
30 Request Executive
31 Request Waitlist
32 Recycle Prog
33 Proceed Without DSKY inputs
34 Terminate Function
35 Test Lights
36 Request Fresh Start
37 Change Prog (Major Mode)
*40 Zero ICDU (N20)
41 Coarse Align CDU (N20 & N91)
42 Fine Align IMU
43 Load FDAI ATT Error needles
*44 Set SURFACE FLAG
*45 Reset Surface Flag
*46 ACTIVATE DAP
*47 Set LM State Vector into CSM State Vector
48 Load DAP (R03)
49 Start Crew Defined MNVR (R62)
50 Please Perform
51 Please Mark
*52 Marked on offset landing site
53 Please Mark alternate LOS
54 Start REND backup sighting mark (R23)
55 Increment CMC Time (Decimal)
*56 Terminate Tracking (P20)
57 Start REND sighting mark (R21)
*58 Reset Stick FLAG (rate drive)
59 Please Calibrate
*60 Set N17 = N20
*61 Display DAP att error
*62 Display total att error (22-20)
*63 Display total astro att error (17-20)
64 Start S-band ant routine (R05)
*65 Verify Prelaunch Align Optics (CSM)
*66 Set CSM State Vector into LM State Vector
67 W-Matrix RMS Error Display
*68 CSM Stroke Test on (CSM)
*69 Restart
70 Update Liftoff Time (P27)
71 Univ Update-BLOCK ADR (P27)
72 Univ Update-SINGLE ADR (P27)
73 Update CMC Time (Octal) (P27)
*74 Initialize erasable dump via downlink
*75 Backup Liftoff
*76 Set preferred att flag (track axis)
*77 Reset preferred att flag (X-axis)
*78 Update prelaunch azimuth
79 Start Lunar LMK selection (R35)
*80 Update LM State Vector
*81 Update CSM State Vector
82 Start Orbit Param Disp (R30)
83 Start REND Param Display (R31)
85 Start REND Param Display No.2 (R34)
*86 Reject REND backup sighting mark
*87 Set VHF range flag
*88 Reset VHF range flag
89 Start REND Final ATT Routine (R63)
90 Request REND out of plane display (R36)
91 Compute Banksum
*92 Start IMU performance test (P07)
*93 Enable W matrix initialization
*94 Enable CISLUNAR Tracking recycle
*96 Terminate integration and go to POO
97 SPS Thrust Fail (R40)
99 Enable engine ignition
*Callable with other extended verb in use and does not lock out other extended verbs.

NOUN LIST (Decimal)

01 Specify Machine Address (Fract) (R1,R2,R3)
02 Specify Machine Address (Whole) (R1,R2,R3)
03 Specify Machine Address (can be R1,R2,R3)
05 Angular Error/Diff
06 Option Code (R1 & R2)
07 FLAGWORD operator,FCADR,BIT ID, Action
08 Alarm Data
09 Alarm Codes
10 Channel to be Specified (R1)
12 Same as 06 in R30
15 Increment Machine Address (R1)
16 Time of event hrs,min,.Olsec
17 Astronaut total att R,P,Y .01°
18 Auto Maneuver R,P,Y .01°
20 Present ICDU Angles R,P,Y .01°
21 PIPA PULSES X,Y,Z Pulses
22 New ICDU Angles R,P,Y .01°
24 Delta CMC Clock Time hrs,min,.Olsec
25 Checklist (please perform)
26 Prio/Delay, ADRES, OCTAL
   BBCON(R1,R2 & R3)
27 Self-Test on/off sw
29 X SM LAUNCH Azimuth .01°
<table>
<thead>
<tr>
<th>CMP 2-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Target Code (Gyrocomp verif)</td>
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<tr>
<td>31 Time of landing site hrs, min, .01 sec</td>
</tr>
<tr>
<td>32 Time from Perigee hrs, min, .01 sec</td>
</tr>
<tr>
<td>33 Time of Ignition (GETI) hrs, min, .01 sec</td>
</tr>
<tr>
<td>34 Time of Event hrs, min, .01 sec</td>
</tr>
<tr>
<td>35 Time from Event hrs, min, .01 sec</td>
</tr>
<tr>
<td>36 Time of CMC Clock hrs, min, .01 sec</td>
</tr>
<tr>
<td>37 GETI-TPI hrs, min, .01 sec</td>
</tr>
<tr>
<td>38 State Vector Time hrs, min, .01 sec</td>
</tr>
<tr>
<td>39 Δ Time of Transfer hrs, min, .01 sec</td>
</tr>
<tr>
<td>40 TF GETI/TFC min-sec</td>
</tr>
<tr>
<td>VG .1 FPS</td>
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<tr>
<td>ΔV (Accumulated) .1 FPS</td>
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<tr>
<td>41 Target Azimuth .01°</td>
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<tr>
<td>42 Apogee Alt (HA) .1 NM</td>
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<tr>
<td>Perigee Alt (HP) .1 NM</td>
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<tr>
<td>ΔV (Required) .1 FPS</td>
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<tr>
<td>43 Lat .01°</td>
</tr>
<tr>
<td>(+ North) .01°</td>
</tr>
<tr>
<td>Long (+ East) .01°</td>
</tr>
<tr>
<td>44 Apogee Alt (HA) .1 NM</td>
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<tr>
<td>Perigee Alt (HP)(N50) .1 NM</td>
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<tr>
<td>TFF min-sec</td>
</tr>
<tr>
<td>45 Marks XXBXX min-sec</td>
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<tr>
<td>TF GETI of next burn</td>
</tr>
<tr>
<td>MGA</td>
</tr>
<tr>
<td>46 DAP Config (R1&amp;R2) OCTAL</td>
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<tr>
<td>47 CSM weight LBS</td>
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<tr>
<td>LM Weight LBS</td>
</tr>
<tr>
<td>48 Pitch Trim .01°</td>
</tr>
<tr>
<td>Yaw Trim .01°</td>
</tr>
<tr>
<td>49 ΔR .1 NM</td>
</tr>
<tr>
<td>ΔV .1 FPS</td>
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<tr>
<td>SOURCE CODE 0000X</td>
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<tr>
<td>50 ΔR (miss distance) .1 NM</td>
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<tr>
<td>PERIGEE (HP) .1 NM</td>
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<tr>
<td>TFF min-sec</td>
</tr>
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</table>
51 RHO .01°
GAMMA .01°
52 CENTANG (active veh) .01°
53 RANGE .01 NM
RANGE RATE .1 FPS
PHI (lcl horiz) .01°
54 Range .01 NM
Range Rate .1 FPS
Theta (lcl horiz) .01°
55 Perigee code CODE
R2 E(ELEV ANGLE) .01°
R3 CENTANG (passive veh) .01°
57 ΔR offset (SOR) .1 NM
(+ indicates behind passive vehicle)
58 HP alt (post TPI)(SOR for P38) .1 NM
ΔV (TPI)(SOR for P38) .1 FPS
ΔV (TPF)(SOR FINAL for P38) .1 FPS
59 ΔV LOS 1 .1 FPS
ΔV LOS 2 .1 FPS
ΔV LOS 3 .1 FPS
60 G Max .01 G
V Pred FPS
Gamma EI .01°
61 Impact Lat .01°
(+ North)
Impact Long .01°
(+ East)
Head Up/Down +/-.00001
(+ Heads up)
62 VI-Inertial Vel Mag FPS
H Dot-Alt Rate FPS
H-Alt Above Pad Radius .1 NM
63 RTGO from 0.05 G .1 NM
To Splash
VIO, Predicted Iner Vel FPS
TFE, time from .05G min-sec
64 Drag Acceleration .01 G
VI, Inertial Velocity FPS
RTGO to Target .1 NM
65 Sampled CMC Time hrs,min,.01 sec
(fetched in interrupt)
<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Value 3</th>
<th>Value 4</th>
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</thead>
<tbody>
<tr>
<td>66</td>
<td>Beta, CMD Bank Angle</td>
<td>0.01°</td>
<td></td>
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<tr>
<td></td>
<td>CRSRNG Range Error</td>
<td>0.1 NM</td>
<td></td>
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<td>DNRNG Range</td>
<td>0.1 NM</td>
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<tr>
<td>67</td>
<td>RTOGO to Target</td>
<td></td>
<td></td>
<td>(+ North)</td>
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<tr>
<td></td>
<td>Lat, Present Position</td>
<td>0.01°</td>
<td></td>
<td>(+ East)</td>
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<td>Long, Present Position</td>
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<td>68</td>
<td>Beta, CMD Bank Angle</td>
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<td>FPS</td>
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<td>VI, Inertial Vel.</td>
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<td>H Dot, Alt Rate</td>
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<td>DL</td>
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<td>VL</td>
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<td>FPS</td>
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<tr>
<td>70</td>
<td>Star Code(before mark)</td>
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<td>OCTAL</td>
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<tr>
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<td>LMK Data</td>
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<td>OCTAL</td>
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<td>Horiz data</td>
<td></td>
<td></td>
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<td>OCTAL</td>
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<tr>
<td>71</td>
<td>Star code (after mark)</td>
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<td>OCTAL</td>
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<tr>
<td></td>
<td>LMK Data</td>
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<td>OCTAL</td>
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<td>Horiz data</td>
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<td>OCTAL</td>
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<tr>
<td>72</td>
<td>Δ ang</td>
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<td>0.01°</td>
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</tr>
<tr>
<td></td>
<td>Δ alt</td>
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<td></td>
<td>0.1 NM</td>
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<td>Search option</td>
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<td>81</td>
<td>ΔVX,Y,Z (lcl vert)</td>
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<td>0.1 FPS</td>
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<td>83</td>
<td>ΔVX,Y,Z (Body Control Axis)</td>
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<td>0.1 FPS</td>
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<td>84</td>
<td>ΔVX,Y,Z (Other Vehicle)</td>
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<td>0.1 FPS</td>
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<td>VGX,Y,Z (Body Control Axis)</td>
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<td>0.1 FPS</td>
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<td>87</td>
<td>Opt Calib Data - Shaft (R1)</td>
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<td>0.01°</td>
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<td>Trunnion(R2)</td>
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<td>0.001°</td>
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<td>88</td>
<td>Planet</td>
<td>X</td>
<td>XXXXXX</td>
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<td>Y</td>
<td>XXXXXX</td>
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<td>Z</td>
<td>XXXXXX</td>
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<td>89</td>
<td>Landmark - Lat</td>
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<td>(+ North)</td>
<td>0.001°</td>
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<td></td>
<td></td>
<td></td>
<td>(+ East)</td>
<td>0.001°</td>
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<td>90</td>
<td>REND out of Plane para</td>
<td></td>
<td>Y DOT</td>
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<td>PSI</td>
<td>0.01°</td>
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<tr>
<td>91</td>
<td>OCDU Angles</td>
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<td></td>
<td>0.01°</td>
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<td>Shaft (R1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trunnion (R2)</td>
<td></td>
<td></td>
<td>0.001°</td>
<td></td>
</tr>
</tbody>
</table>
92 New OCDU Angles Shaft (R1) .01°
    Trunnion (R2) .001°
93 Delta Gyro Angles X,Y,Z .001°
94 OCDU ANGLES (R56)(R23)
    R1 SHAFT .01°
    R2 TRUNNION .001°
95 Pref att ICDU angles .01°
96 +X axis att ICDU angles .01°
97 System Test Inputs Xxxxx.
98 System Test Results Xxxxx.
99 POS ERR .01 NM
    VEL ERR 0.1 FPS
    OPTION Code OCTAL

V05 N09 ALARM CODES

00110 Mark reject has been entered but ignored
00112 Mark reject with no marks being accepted
00113 No inbits (chan 16) (reattempt entry)
00114 More marks made than desired
00115 V41 N91 keyed with OPTICS MODE not in CMC (OPTICS MODE - CMC & OPTICS ZERO - OFF)
00116 Optics switch altered before 15 sec zero time elapsed (OPTICS ZERO - ZERO)
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 - ZERO)
(m)00121  In 0.05 sec following mark, an ICDU changed by more than 0.033° (repeat MK)(G&N 10/1)

00122  Marking not called for

00124  P17 (77) TPI search unsuccessful (V32E—Readjust GETI and/or change search option)

(m)00205  PIPA saturated (use SCS control & IMU malf pr (G&N 12)

00206  The IMU zero routine has been entered with both the GMBL LOCK 1t and NO ATT 1t on (V41 N20 & load three 00000E)

(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 (ROO & IMU turn on)

(m)00211  Coarse align error

(m)00212  PIPA fail, but PIPA is not being used (PIPA BIAS check)

(m)00213  IMU not operating with turn-on request (IMU turn on & reinitiate prog)

00214  Program using IMU when turned OFF (same as 00213)

(m)00217  IMU coarse align or pulse torque difficulty has occurred (Reinitiate prog or term use of IMU)

00220  IMU orientation unknown (ROO & alignment)

00401  Desired middle gimbal angle is excessive (use other angles or maneuver SC)

00404  Target out of view (90 deg test) (Maneuver SC & PRO or terminate)

00405  Acceptable star pair is not available (maneuver SC & PRO or maneuver & V32E)

00406  Rend navigation not operating (KEY RLSE)

00407  Target out of view (50° test) (For landmark coord., V25 N43E. For LM tracking, maneuver SC to preferred attitude or allow auto maneuver and use V58E.)
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00421</td>
<td>W-matrix over flow (update or P22)</td>
</tr>
<tr>
<td>00605</td>
<td>Number of iterations exceeds loop maximum (V32E &amp; load new data)</td>
</tr>
<tr>
<td>00611</td>
<td>No TIG for given ELEV angle (PRO &amp; new elev)</td>
</tr>
<tr>
<td>00612</td>
<td>State vector in wrong sphere of influence (see code 605)</td>
</tr>
<tr>
<td>00613</td>
<td>Reentry angle out of limits (see code 605)</td>
</tr>
<tr>
<td>00777</td>
<td>ISS warning caused by PIPA fail</td>
</tr>
<tr>
<td>01102</td>
<td>CMC self test error (try once more)</td>
</tr>
<tr>
<td>01103</td>
<td>Unused CCS branch executed (terminate &amp; reinitialize)</td>
</tr>
<tr>
<td><strong>01104</strong></td>
<td>Delay routine busy (see code 1103)</td>
</tr>
<tr>
<td>(m)01105</td>
<td>Downlink too fast (notify MSFN)</td>
</tr>
<tr>
<td>(m)01106</td>
<td>Uplink too fast (notify MSFN and/or voice update)</td>
</tr>
<tr>
<td>(m)01107</td>
<td>Phase table failure assume erasable memory is destroyed (reinitialize erasable memory)</td>
</tr>
<tr>
<td><strong>01201</strong></td>
<td>Executive overflow - no vac. area (reinitialize program)</td>
</tr>
<tr>
<td><strong>01202</strong></td>
<td>Executive overflow - no core sets (reinitialize program)</td>
</tr>
<tr>
<td><strong>01203</strong></td>
<td>Waitlist overflow - too many tasks (reinitialize program)</td>
</tr>
<tr>
<td>*01206</td>
<td>Second job attempts to go to sleep via keyboard and display program (reinitialize program)</td>
</tr>
<tr>
<td><strong>01207</strong></td>
<td>No vac area for marks (reinitialize program)</td>
</tr>
<tr>
<td>*01210</td>
<td>Second attempt is made to stall (reinitialize program)</td>
</tr>
<tr>
<td><strong>01211</strong></td>
<td>Illegal interrupt of extended verb (reinitialize program)</td>
</tr>
<tr>
<td>01301</td>
<td>Arcsin or arccos input is greater than one (reinitialize program)</td>
</tr>
<tr>
<td>*01302</td>
<td>SQRT called with negative argument (reinitialize program)</td>
</tr>
<tr>
<td>(m)01407</td>
<td>VG increasing (terminate thrust &amp; reinitialize)</td>
</tr>
<tr>
<td>01426</td>
<td>IMU unsatisfactory (realign or use SCS)</td>
</tr>
<tr>
<td>01427</td>
<td>IMU reversed (note FDAI operation is inverted)</td>
</tr>
<tr>
<td>*01501</td>
<td>Keyboard and display alarm during internal use (NVSUB). (reinitialize program)</td>
</tr>
<tr>
<td>*01502</td>
<td>Illegal flashing display (reinitialize program)</td>
</tr>
<tr>
<td>01520</td>
<td>V37 request not permitted at this time</td>
</tr>
</tbody>
</table>
Overflow in drift test
Bad IMU torque abort
Bad optics during verification
Insufficient time for integration,
  TIG slipped

03777 ISS warning caused by ICDU fail
04777 ISS warning caused by ICDU & PIPA fail
07777 ISS warning caused by IMU fail
10777 ISS warning caused by IMU & PIPA fail
13777 ISS warning caused by IMU & ICDU fail
14777 ISS warning caused by IMU, ICDU & PIPA fail

(m) - Malf procedure indicated
* - Generates restart, F 37 (no lt)
** - Restart (no lt), and program continues
  (i.e. attempted recovery)

NOTE: All * alarms act as ** type if they
  occur when AVE-g is on.

Alarms for 005 N 09
R1 First alarm to occur
R2 Second
R3 Last

(Example of the form

Hxxxxx or 5xxxx

Hxxxxx indicates more
than three alarms
5xxxx indicates more
than three alarms
one of which was 1xxxx
SECTION 3. G&N GENERAL

CMC POWER UP PROCEDURE
PRO, push until STBY lt - out
(repeat, if necessary)
*CMC warning, RESTART, PROG ALARM*
*RSET and continue

OPTICS POWER UP PROCEDURE
G/N PWR OPTICS - on (up)
OPTICS ZERO - OFF
OPTICS ZERO - ZERO (15 sec)
OPTICS ZERO - OFF

OPTICS POWER DOWN
G/N PWR OPTICS - OFF

IMU POWER UP PROCEDURE
LOGIC POWER 2/3 - on
FDAI POWER - BOTH
FDAI SELECT - 1/2
CMC MODE - FREE
G/N IMU PWR - on (up)
NO ATT lt - on (90 sec)
NO ATT lt - out
Wait 20 sec

V37E XXE
*If CMC Failed:
* G/N IMU PWR - on (up)
* Wait 90 sec
* IMU CAGE - on (up) 5 sec,*
* then off

PO6 - CMC POWER DOWN PROGRAM
V48E
F 04 46 Load 0 (NO DAP) in left digit of R1
PRO
PRO
IMU POWER DOWN PROCEDURE
CMC MODE - FREE

1. G/N IMU PWR - OFF
   *ISS warning*
   *RSET*

2. F 06 84 ΔV XYZ
   Load ΔV
   PRO

3. F 37

V41 N91 COARSE ALIGN OCDU's
CMC - on
ISS - on
G/N PWR OPTICS - on
OPT MODE - CMC
OPT ZERO - OFF

1. V41N 91E

2. F 21 92 SHAFT, TRUN NEW OCDU (.01°,.001°)
   Load desired shaft and trun

3. 41 OPTICS DRIVE TO SPECIFIED ANGLES
V41 N20 COARSE ALIGN ICDU's
CMC - on
ISS - on

1. V41N 20E

2. F 21 22 NEW ICDU ANGLES RPY
Load desired ICDU angles (.01°)

3. 41 NO ATT lt - on
*POSS PROG ALARM
*V5 N9E 211 Coarse align error*
*Repeat V41 N20*

4. V40 N20E
NO ATT lt - off
Wait 20 sec

5. V37E XXE

---

V42 GYRO TORQUING
CMC MODE - FREE

V42E
F 21 93 LOAD DELTA GYRO ANGLES (XYZ) (.001°)
(In flight - 90° max)

2. 42 NO ATT lt - off
Monitor Gyro Torquing on FDAI

---

V48 - DAP DATA LOAD PROCEDURE
V48E
F 04 46 R1 ABCDE
R2 ABCDE

---

<table>
<thead>
<tr>
<th>VEHICLE CONFIG</th>
<th>QUAD A/C FOR</th>
<th>QUAD B/D for</th>
<th>ERR DEADBAND</th>
<th>RATE SELECT</th>
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<tbody>
<tr>
<td>R1</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>0 - No DAP</td>
<td>0 - Fail A/C</td>
<td>0 - Fail B/D</td>
<td>0 ± 0.5°</td>
<td>0 ± 0.05°/sec</td>
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<tr>
<td>1 - CSM</td>
<td>1 - Use A/C</td>
<td>1 - Use B/D</td>
<td>1 ± 5.0°</td>
<td>1 ± 0.2°/sec</td>
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<tr>
<td>2 - CSM &amp; LM</td>
<td></td>
<td></td>
<td></td>
<td>2 ± 0.5°/sec</td>
</tr>
<tr>
<td>3 - CSM &amp; SIVB</td>
<td></td>
<td></td>
<td></td>
<td>3 ± 4.0°/sec</td>
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<tr>
<td>6 - Ascent Stg only</td>
<td></td>
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<table>
<thead>
<tr>
<th>Roll Quad Select</th>
<th>Quad A</th>
<th>Quad B</th>
<th>Quad C</th>
<th>Quad D</th>
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<tbody>
<tr>
<td>R2</td>
<td>0 - Fail</td>
<td>0 - Fail</td>
<td>0 - Fail</td>
<td>0 - Fail</td>
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<tr>
<td></td>
<td>1 - Use</td>
<td>1 - Use</td>
<td>1 - Use</td>
<td>1 - Use</td>
</tr>
</tbody>
</table>

---

CSM 104 Feb. 1, 1969
2  F 06 47  CSM WT, LM WT  
Load correct values  
PRO

3  F 06 48  TRIM ENGINE GMBL  
Load correct values  
PRO (To Prog In Progress)

4  V46E if AOT N46 R1 changed

V49 CREW DEFINED MANEUVER
CMC - on  
ISS - on  
SCS - operating

1  V37E 00E  
V62E  

2  F 06 22  NEW ICDU ANGLES RPY  
Load desired angles  
PRO

3  F 50 18  REQ MNVR TO FDAI RPY ANGLES  
(AUTO)  
BMAG MODE (3) - RATE 2  
SC CONT - CMC  
CMC MODE - AUTO  
PRO  
(MAN)  
MNVR - To 5

4  06 18  AUTO MNVR TO FDAI RPY ANGLES  
(.01°)

5  F 50 18  REQ TRIM MNVR TO FDAI RPY ANGLES  
(TRIM)  
PRO to 4  
(BYPASS)  
ENTR
1. **V55 - CMC TIME UPDATE**
   - V55E
   - F 21 24
   - LOAD Δ CMC TIME (hrs, min, .01 sec)

2. **V64 START S-BAND ANTENNA**
   - V37E 00E
   - F 06 51
   - RHO, GAMMA
   - S-BAND ANT - S
     - TRACK - MAN
     - Check P&Y Angle Ind
     - TRACK - AUTO
   - PRO

3. **V67 - W-MATRIX ERROR DISPLAY**
   - V67E
   - F 06 99
   - POS ERR, VEL ERR, OPT CODE (.01 nm, .1 fps)
     - R3 00001 = Rend
     - 00002 = Orbital
     - 00003 = Cislunar
   - Load desired data to reinitialize Cislunar W-matrix.
   - Load: R1 +00094 +00028
   - R2 +00057 +00017
   - R3 +00003 +00001
   - PRO

1. (If needed) **V74 CMC DOWNLINK**
   - V21 NOTE 333E
   - R3 333
   - R1 200000E for 4 Dumps
   - or 100000E for 2 Dumps
   - or 040000E for 1 Dump

2. **V74E** (Places erasable memory on downlink)
1. **V79 LUNAR LANDMARK**
   - V37E 00E

2. **V79E**
   - **F 06 34** LAT-LONG TIME
     - Load desired time
     - PRO

3. **F 06 31** LDG SITE TIME
   - PRO

4. **F 05 70** LMK CODE
   - R2=0000DE
   - (RECYCLE) V32E to 4
   - PRO

5. **F 06 34** LMK TIME
   - PRO To 4 Until 5 LMK Are Cycled Then Exit

**V82 ORBIT PARAMETER DISPLAY**

Note: If high CMC activity (e.g. P4Xw.Lambert)
- POSS PROG ALARM and restart (no light)
- code 1201 or 1202 stored.

1. **F 04 12** Rl 00002 Specify Vehicle
   - R2 00001 CSM
   - 00002 LM
   - PRO

2. **F 16 44** HA, HP, TFF (.1nm,1nm,min-sec)
   - (RECYCLE) V32E To 2 (Not Nec If AVE g On)
   - (ΔR-miss dist DISP-P11 & POO) N50E To 3
   - (TF PER) N32E To 4
   - (EXIT) PRO

3. **F 16 50** ΔR(miss dist) hP,TFF(.1nm,1nm,min-sec)
   - KEY RLSE to 2

4. **F 16 32** TIME FROM PER (Useful only if TFF=-59B59)
   - (hrs,min,.01sec)
   - KEY RLSE to 2
V83 RNDZ PARAMETER DISPLAY #1

Note: If high CMC activity (e.g. P3X or P7X w/ P20), POSS PROG ALARM and restart (no light) - code 1201 or 1202 stored

If alt above earth or moon >432 nm:
  P23 running - do not key V83 (or 85)
  P23 not running:
  Wait for no integration (COMP ACTY not on continuously)
  V96E (selects POO)
  V83E (or 85E) - perform routine
  V37E OOE

V83E
F 16 54 RANGE, RANGE RATE, THETA (.01nm,.lfps,.01°)
PRO

V85 - RNDZ PARAMETER DISPLAY #2

Note: See V83 restrictions

V85E
F 16 53 RANGE, RANGE RATE, PHI (.01nm,.lfps,.01°)
PRO

V89 - RENDEZVOUS FINAL ATTITUDE

Note: This routine will change N17 cells
  CMC - on
  ISS - on
  SCS - operating

V37E OOE
V62E MODE II

V89E
F 04 06 R1 00003 SPECIFY TRACKING ATTITUDE
  R2 00001 (PREF)
  00002 (+X AXIS)
PRO
3 F 06 18 FINAL FDAI RPY ANGLES (MNVR) PRO (UPDATE DISPLAY) V32E

4 F 50 18 REQ MNVR TO FDAI RPY ANGLES (AUTO) BMAG MODE (3) - RATE 2 SC CONT - CMC CMC MODE - AUTO
   PRO
   (MAN) MNVR To 6

5 06 18 AUTO MNVR TO FDAI RPY ANGLES

5 F 50 18 REQ MNVR TO FDAI RPY ANGLES (TRIM) ALIGN SC In ROLL
   PRO To 5
   (BYPASS) ENTR

V90 - OUT-OF-PLANE DISPLAY
V90E
F 06 16 GET EVENT (hrs,min,.01sec)
Load desired time
PRO

2 F 06 90 Y,YDOT,PSI (RECYCLE) V32E to 1
   (EXIT) PRO

V91 - COMPUTE BANKSUM
CMC - on (req)

1 V37E 00E

2 V91E
F 05 01 R1 - Sum of all cells in bank
R2 - Bank number
R3 - Bugger word
Verify R1=R2 or R1 + R2 = 77777
   (If not, rcd R2)
   (NEXT BANK) PRO
   (TERM) V34E
CMC SELF CHECK
V25 N01E, 1365E

F 21 01 E,E,E

V15 N01E, 1365E
15 01 R1 NUMBER OF ERRORS
R2 NUMBER OF TESTS STARTED
R3 NUMBER OF TESTS SUCCESSFUL

V21 N27E IOE SELF TEST, FIXED & ERASABLE
(4E SELF CHECKS ERASABLE
5E SELF CHECKS FIXED)

KEY REL
15 01 TEST SUCCESSFUL WHEN R2>3 (78 sec)
*IF PROG 1t - on *
*V05 N09E 01102 SELF* TEST ERROR*
(TERM) V21N27E OE *N08E RECORD FOR

MEASUREMENT & LOADING OF PIPA BIAS
DET - RESET
SC RATES <0.1°/sec

V25N 21E, E,E,E/Start Event Timer

V16 N21E
16 21 XYZ PIPA COUNTS

At T + 4:16 - VERB
T4:16
(X) R1 ___ (Y) R2 ___ (Z) R3 ___ (XXXAB)

V21N 01E
F 21 01 LOAD 1452 E (CALCULATED X BIAS) E,E,(+ABXXX)
1454 E (CALCULATED Y BIAS) E,E
1456 E (CALCULATED Z BIAS) E
FLAG WORD SET/RESET

V25N 07E
F 21 07 (LOAD FLAG WORD ADDRESS) E

F 22 07 (LOAD CODE FOR BIT TO BE CHANGED) ABCDE ENTR

F 23 07 (SET BIT) Key 1E
(RESET BIT) Key 0E

(To Verify) V01 NO1E (FLAG Word ADD) ENTR

EXAMPLE: To cause reinitialization of W-matrix for mid-course (P23) or landmark (P22) navigation

Key:

V25N 07E
77E
40E
0E

EXAMPLE: To set REFSMMAT flag:

Key:

V25N 07E
77E
10000E

This sets bit 13 of flagword 3
Verification should show A odd

1E

BINARY-TO-OCTAL CONVERSION

<table>
<thead>
<tr>
<th>Binary</th>
<th>Octal</th>
</tr>
</thead>
<tbody>
<tr>
<td>000-0</td>
<td>100-4</td>
</tr>
<tr>
<td>001-1</td>
<td>101-5</td>
</tr>
<tr>
<td>010-2</td>
<td>110-6</td>
</tr>
<tr>
<td>011-3</td>
<td>111-7</td>
</tr>
</tbody>
</table>
OCTAL-TO-DECIMAL CONVERSION

<table>
<thead>
<tr>
<th>Octal</th>
<th>Decimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1</td>
<td>11-9</td>
</tr>
<tr>
<td>2-2</td>
<td>12-10</td>
</tr>
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<td>3-3</td>
<td>13-11</td>
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<tr>
<td>4-4</td>
<td>14-12</td>
</tr>
<tr>
<td>5-5</td>
<td>15-13</td>
</tr>
<tr>
<td>6-6</td>
<td>16-14</td>
</tr>
<tr>
<td>7-7</td>
<td>17-15</td>
</tr>
<tr>
<td>10-8</td>
<td>20-16</td>
</tr>
</tbody>
</table>

REVIEW DATA IN ERASABLE MEMORY
Perform During Any Flashing Display

V01 N01E (OCTAL ADD) E

R1 DATA R3 OCTAL ADD

N15E (For next succeeding word)

ENTR (For each succeeding word)

TO CHANGE DATA IN ERASABLE MEMORY

V21 N01E (ADDRESS) E

R3 ADDRESS

Load New Data in R1 E

N15E (For next succeeding word)

ENTR (For each succeeding word)

COAS LOS DETERMINATION

CMC - on
ISS - on
SCS - operating
SC CONT - SCS
MAN ATT (3) - MIN IMP
G/N PWR OPTICS - on
OPT MODE - CMC
OPT ZERO - ZERO (verify)

1 V37E 52E
F 04 06 00001
V22E 3E
PRO

F 50 25 00015
ENTR

F 01 70 0000E STAR CODE
LOAD BORESIGHT STAR CODE
OPT ZERO - OFF
PRO (Ignore PROG ALARM)

06 92 SHAFT, TRUN
Center target
MARK with VERB key
Record SHAFT, TRUN

(Repeat) KEY RLSE
(EXIT) V37E XXE
OPTICS ZERO - ZERO

P22 RAW DATA READOUT
CMC - on, HOLDING AT 06 49 FLASH IN P22

F 06 49 V1N1E

F 01 01 3537E
Rcrd R1
N15E
Rcrd R1

F 01 15 ENTR
Rcrd R1

Repeat 3 till 7 pieces of data recorded for each mark

KEY RLSE

F 06 49 Continue P22
DSKY CONDITION LIGHT TEST
CMC - on

Key V37E 00E (desired)

DSKY - POO

DON'T DO WITH AVE ON

Key V35E

Monitor the following events
a. All DSKY condition lights - on
b. ISS warning light - on
   CMC warning light - on
c. All DSKY numerical windows display 8
   Sign positions in R1, R2, R3 show + V, N windows flash

Wait 5 sec
d. All DSKY warning lights - off
e. ISS light - off
   CMC light - off
f. Old PROG number will be displayed
   Interrupted display (if any) will be restarted

MONITOR OF INPUT/OUTPUT CHANNELS
V11 NTOE
F 11 10 (LOAD CHANNEL ADDRESS) E
R1 Octal Contents of Specified Channel

LOAD OUTPUT CHANNELS
V21 NTOE
F 21 10 (LOAD CHANNEL ADDRESS) E
R1 (Load Octal Data) E
PITCH ORBIT RATE MANEUVER
NOMINAL ALIGNMENT, MGA 0

V49 AUTO MANEUVER TO DESIRED INITIAL
ATTITUDE (V49 Also Initializes Erasable
for ORB Rate MNVR)

P00

V21 NOTE 3200E 42676E - 1°/sec, 54142E -
.068°/sec
(Sets Low Order of DELCDUY)

Execution of E INITIATES ORB RATE MNVR

NOTE:

a) MAGNITUDE OF RATE CAN BE VARIED FOR
ATTITUDE

b) FIXED RATE MANEUVERS ABOUT X AXIS CAN
BE PERFORMED BY SETTING VALUES INTO
ADDRESS 3176, SUCH AS FOR LANDMARK
TRACKING AND PTC (if X stable
member is aligned along desired
PTC axis).

TO STOP
1. Set 3200E To 00000E
or 2. CMC MODE To Hold (Auto Then Ok)
or 3. RHC Out of Detent
or 4. Reinitialize Dap With v46E
## FLAG WORD LISTING

<table>
<thead>
<tr>
<th>TITLE</th>
<th>ADDRESS</th>
<th>BIT</th>
<th>WHEN SET</th>
<th>WHEN RESET</th>
</tr>
</thead>
<tbody>
<tr>
<td>RNDZ</td>
<td>00074</td>
<td>7</td>
<td>P20 initiated</td>
<td>P20 terminated</td>
</tr>
<tr>
<td>UPDATE</td>
<td>00075</td>
<td>7</td>
<td>State vector update by marks allowed</td>
<td>State vector updating by marks not allowed</td>
</tr>
<tr>
<td>Track</td>
<td>00075</td>
<td>5</td>
<td>RNDZ Tracking</td>
<td>Rendezvous tracking not allowed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rendezvous</td>
<td></td>
</tr>
<tr>
<td>Pref Att</td>
<td>00076</td>
<td>4</td>
<td>Pref Att computed</td>
<td>Preferred S/C attitude not computed</td>
</tr>
<tr>
<td>Steer</td>
<td>00076</td>
<td>11</td>
<td>Steering to be done</td>
<td>Steering omitted</td>
</tr>
<tr>
<td>REFSMMAT</td>
<td>00077</td>
<td>13</td>
<td>REFSMMAT good</td>
<td>REFSMMAT not good</td>
</tr>
<tr>
<td>IMU</td>
<td>00074</td>
<td>8</td>
<td>IMU in use</td>
<td>IMU not in use</td>
</tr>
<tr>
<td>State Vector</td>
<td>00075</td>
<td>8</td>
<td>CSM State vector updated</td>
<td>LM state vector updated</td>
</tr>
<tr>
<td>Item</td>
<td>Code</td>
<td>Value</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------</td>
<td>-------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Terminate R52,R53</td>
<td>00103</td>
<td>15</td>
<td>Do not terminate</td>
<td></td>
</tr>
<tr>
<td>Trunnion drive</td>
<td>00074</td>
<td>4</td>
<td>Enables CMC control of optics trunnion</td>
<td></td>
</tr>
<tr>
<td>Target 1</td>
<td>00075</td>
<td>10</td>
<td>LM sighting</td>
<td></td>
</tr>
<tr>
<td>Target 2</td>
<td>00075</td>
<td>9</td>
<td>LMK Sighting</td>
<td></td>
</tr>
<tr>
<td>W-matrix (REND)</td>
<td>00101</td>
<td>1</td>
<td>W-matrix valid</td>
<td></td>
</tr>
<tr>
<td>W-matrix (ORB)</td>
<td>00077</td>
<td>6</td>
<td>P22,23 W-matrix valid</td>
<td></td>
</tr>
<tr>
<td>3 axis</td>
<td>00101</td>
<td>6</td>
<td>MNVR Specified by 3 axes</td>
<td></td>
</tr>
<tr>
<td>External ΔV</td>
<td>00076</td>
<td>8</td>
<td>Ext ΔV VG comp</td>
<td></td>
</tr>
<tr>
<td>Active vehicle</td>
<td>00076</td>
<td>5</td>
<td>LM active</td>
<td></td>
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</table>

Basic Date: Feb. 1, 1969
<table>
<thead>
<tr>
<th></th>
<th>Final comp.</th>
<th>Sighting mark</th>
<th>Stick flag</th>
<th>Stick flag</th>
<th>CMOON flag</th>
<th>NON-FLAGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interim pass through rendezvous program computations</td>
<td>00076</td>
<td>00074</td>
<td>00075</td>
<td>00075</td>
<td>00104</td>
<td>Permanent CSM SV in Lunar Sphere of Influence</td>
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<tr>
<td>V51 initiated</td>
<td>6</td>
<td>6</td>
<td>14</td>
<td>14</td>
<td>12</td>
<td>Permanent CSM SV in Earth Sphere of Influence</td>
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<tr>
<td>V51 not initiated</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>RHC in detent (auto maneuver enabled)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>After mark</td>
</tr>
<tr>
<td>RHC in detent (auto maneuver enabled)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>After mark reject</td>
</tr>
<tr>
<td>IMU not operating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IMU operating</td>
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<tr>
<td>IMU operating</td>
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<td></td>
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</tbody>
</table>

**Basic Date:** Jan. 1, 1969

**Changed:**
<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>1 Set</th>
<th>BINARY</th>
<th>OCTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>15,14,13</td>
<td>12,11,10</td>
<td>9,8,7</td>
<td>6,5,4</td>
<td>3,2,1</td>
<td>0 Reset</td>
<td>000</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>001</td>
<td>1</td>
</tr>
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<td></td>
<td></td>
<td>010</td>
<td>2</td>
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<td></td>
<td></td>
<td>011</td>
<td>3</td>
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<td></td>
<td>100</td>
<td>4</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>101</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>110</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>111</td>
<td>7</td>
</tr>
</tbody>
</table>

Legend:
- A, B, C, D, E: Binary input signals
- 1 Set, 0 Reset:
- BINARY: Binary output codes
- OCTAL: Octal output codes

Conversion from Binary to Octal:
- Binary 000 corresponds to Octal 0
- Binary 001 corresponds to Octal 1
- Binary 010 corresponds to Octal 2
- Binary 011 corresponds to Octal 3
- Binary 100 corresponds to Octal 4
- Binary 101 corresponds to Octal 5
- Binary 110 corresponds to Octal 6
- Binary 111 corresponds to Octal 7

CSM 104  Basic Date  Feb. 1, 1969
PITCH ORBIT RATE MANEUVER
NOMINAL ALIGNMENT, MGA 0

V49 AUTO MANEUVER TO DESIRED INITIAL ATTITUDE (V49 Also Initializes Erasable for ORB Rate MNVR)

POO

V21 NOTE 3200E XXXXXE

(Sets Low Order of DELCDUY)

Execution of E INITIATES ORB RATE MNVR

NOTE:

a) MAGNITUDE OF RATE CAN BE VARIED FOR ATTITUDE
b) FIXED RATE MANEUVERS ABOUT X AXIS CAN BE PERFORMED BY SETTING VALUES INTO ADDRESS 3176, SUCH AS FOR LANDMARK TRACKING AND PTC (if X stable member is aligned along desired PTC axis).

TO STOP
1. Set 3200E To 00000E
or 2. CMC MODE To Hold (Auto Then Ok)
or 3. RHC Out of Detent
or 4. Reinitialize Dap With v46E

PITCH RATE OCTAL REP

<table>
<thead>
<tr>
<th>Pitch Rate</th>
<th>OCTAL REP</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.100</td>
<td>42676</td>
</tr>
<tr>
<td>-0.095</td>
<td>44250</td>
</tr>
<tr>
<td>-0.090</td>
<td>45622</td>
</tr>
<tr>
<td>-0.085</td>
<td>47173</td>
</tr>
<tr>
<td>-0.080</td>
<td>50545</td>
</tr>
<tr>
<td>-0.075</td>
<td>52117</td>
</tr>
<tr>
<td>-0.070</td>
<td>53467</td>
</tr>
<tr>
<td>-0.065</td>
<td>55041</td>
</tr>
<tr>
<td>-0.060</td>
<td>56413</td>
</tr>
<tr>
<td>-0.055</td>
<td>57765</td>
</tr>
<tr>
<td>-0.050</td>
<td>61337</td>
</tr>
</tbody>
</table>
DSKY CONDITION LIGHT TEST
CMC - on

Key V37E 0OE (desired)
DSKY - POO

Key V35E

Monitor the following events
a. All DSKY condition lts - on
b. ISS warning lt - on
   CMC warning lt - on
c. All DSKY numerical windows display 8
   Sign positions in R1, R2, R3 show +
   V, N windows flash

Wait 5 sec
d. All DSKY warning lts - off
e. ISS lt - off
   CMC lt - off

f. Old PROG number will be displayed
   Interrupted display (if any) will
   be restarted

MONITOR OF INPUT/OUTPUT CHANNELS
V11 NTOE
F 11 10 (LOAD CHANNEL ADDRESS) E
R1 Octal Contents of Specified
   Channel

LOAD OUTPUT CHANNELS
V21 NTOE
F 21 10 (LOAD CHANNEL ADDRESS) E
R1 (Load Octal Data) E
SECTION 4. NAVIGATION

P17 - TPI SEARCH

or

P77 - LM TPI SEARCH

CMC - on (req)

1. F 06 37 V37E 17E or V37E 77E
   GETI (TPI) (hrs, min, .01 sec)
   Load desired GETI
   PRO

2. F 06 72 \( \Delta \text{ANG(TPI)}, \Delta \text{ALT(TPI)}, \text{SEARCH OPT} \)
   (.01°, 1nm, 0000X)
   R3 = SEARCH OPT
   00001 < 180°
   00002 > 180°

   (change GETI TPI) V32E to 1
   (change Search opt) V23E
   PRO
   *F 05 09 00124 alarm code*
   *V32E, RSET to 1 *

3. F 06 58 HP, \( \Delta \text{V(TPI)}, \Delta \text{V(TPF)} \) (.1nm, .1fps, .1fps)
   (RECYCLE) V32E to 1 to adjust
   GETI or Search option
   PRO

4. F 06 55 R1 = Perigee Code, R3 = CENTANG(0000X, .01°)
   00001, perigee between TPI and TPF
   00002, perigee after TPF
   (RECYCLE) V32E to 1 to adjust
   GETI or Search option
   PRO

5. F 37 XXE

P20 - RENDEZVOUS NAVIGATION

CMC - on (req)
ISS - on and aligned (req)
SCS - on (des)
BMAG MODE (3) - RATE 2
G/N OPT PWR - on (verify)
OPT ZERO - ZERO (verify)
OPT MODE - CMC

1

V37E 20E
F 50 18 Request MNVR to FDAI RPY angles (.01°)
    (AUTO) SC CONT - CMC
    CMC MODE - AUTO
PRO
06 18 RPY (.01) to 1 (when MNVR complete)
    (MAN) SC CONT - SCS
PRO to 1
or V62E
RHC - MNVR to 1

When attitude OK:
CMC MODE - AUTO

ENTR
OPTIC ZERO - OFF
*POSS prog alarm
*Key V5N9E 00407 (TA>50°)
*V16N 22E
*GMBL ANGLES RPY (.01) *
*or V16N 92E
*OPTICS SHAFT,TRUN(.01°, .001°)*
*(AUTO) SC CONT - CMC
* CMC MODE - AUTO
* V58E
*(MAN) MNVR to 2 (SXT)
* or to 3 (COAS)

2

V57E (SXT)
F 51
OPT MODE - MAN
OHC - Cntr Target in SXT
MARK (repeat as necessary)
*POSS F 06 49 ΔR,ΔV,source code*
* (.1nm,.1fps,00001) *
*(REJECT) V32E
*(ACCEPT) PRO

Drive Trunnion to < 5°
OPT ZERO - ZERO
P20,21

PRO (return to program in process)
(To terminate P20 - V56E)

3

V54E (COAS)

F 06 94 SHAFT, TRUNNION (.01°, .001°)

PRO

4

F 53 Request Alt LOS MARK
RHC - ALIGN Target in COAS
ENTR (V86E to reject)
*POSS F 06 49 ΔR, ΔV, source code
* (.1nm, .1fps, 00001)
*(REJECT) V32E
*(ACCEPT) PRO

PRO (return to Program in process)
(To Terminate P20 - V56E)

P21 GROUND TRACK DETERMINATION
CMC - on (req)

1

V37E 21E

F 04 06 00002, Specify Vehicle
00001, CSM
00002, LM

PRO

2

F 06 34 GET LAT, LONG (hrs, min, .01sec)
Load desired GET
PRO

3

F 06 43 LAT, LONG, ALT (.01°, .01°, .1nm)
(RECYCLE) V32E to 2 (Increment GET 10 min)
(EXIT) PRO

4

F 37 XXE
P22 - ORBITAL NAVIGATION

CMC - on (req)
ISS - on and aligned (req)
SCS - on (req)
BMAG MODE (3) - RATE 2
G&N PWR OPTICS - on (verify)
COUPLING - RESOLVED
SPEED - MED
OPT ZERO - ZERO (verify)
OPT MODE - CMC

V37E 22E

F 06 45  R3=MAX MGA
(REJECT) R3>60° to P52
R3<60° IMU ALIGNED
MNVR to SIGHTING ATTITUDE
Roll to keep shaft axis >10° from
plane defined by X axis & LOS to LMK

(MAN) OPT MODE - MAN
OPT ZERO - OFF
PRO (To 3 for earth orbit)

(AUTO) OPT ZERO - OFF
PRO (To 3 for earth orbit)

F 05 70  (lunar orbit only)
R2 ABCDE lmk code
Load lmk code
A=1 (known), 2 (unknown)
B=INDEX OF OFFSET designator
C=not used
DE=LMK ID
IF A=2
OPT MODE - MAN
PRO to 5
or IF A=1 & DE≠00
PRO to 4 (To 5 if OPTICS - MAN)
or IF A=1 & DE=00
PRO to 3

F 06 89  LAT, LONG/2, ALT (.001°, .001°, .01nm)
Load lmk coords
PRO (To 5 IF OPTICS - MAN)
4 06 92 SHAFT, TRUN NEW OCDU (.01°, .001°)
   *POSS Prog Alarm It (Trun>50°)
   * MNVR to acquire
   * F 05 09 00404 (TRUN>90°)
   * MNVR to acquire
   * PRO
   * or V34E, F 37
   Establish proper pitch rate
   OPTICS MODE - MAN

5 F 51 MARK REQUEST
   MARK (wait 10 sec between MARKS)
   After sufficient MARKS:
      *After 5 MARKS:
        * F 50 25 00016 TERM MARKS*
   PRO

6 F 05 71 R2 ABCDE LMK DATA
   Load lmk code (if nec)
   A=1 if KNOWN LMK
   A=2 if UNKNOWN LMK
   B=INDEX OF OFFSET DESIGNATOR
      (If only 1 mark made, insure B=0)
   C=Not used in P22
   DE=LMK ID no.
   PRO - if A=2 (or A is 1 & DE ≠ 0) to 8

7 F 06 89 LAT, LONG/2, ALT (.001°, .001°, .01nm)
   PRO

8 F 06 49 ΔR, ΔV (ORB PARA) (.1nm, .1fps)
   (RECYCLE) V32E to 2
   (ACCEPT) PRO

9 F 06 89 LAT, LONG/2, ALT LMK ID (.001°, .001°, .01nm)
   (DON'T STORE) V32E to 2
   (EXIT) V34E

10 F 37 XXE
P23 OPTICS CALIBRATION

CMC - on
OPT ZERO - ZERO (verify)
OPT MODE - MAN

1
F 05 70
V37E 23E (IMU NOT ALIGNED - To 3)
STAR ID(ABCDE)/LMK ID/HOR ID
Insure R1 DE≠00 and R3≠00000

2
F 50 25
00202 MNVR/CALIB REQUEST
ENTR

3
F 59
PERFORM OPTICS CALIB
OPT MODE - MAN (verify)
OPTICS COUPLING - DIRECT
SPEED - LOW
OPT ZERO - OFF
SUPERIMPOSE LLOS TO SLOS
MARK

4
F 06 87
R2 TRUNNION ANGLE BIAS (.001°)
(Repeat until 2 measurements
agree within .003°)
(ACCEPT) PRO
(REJECT) V32E - to 3

5
F 51
V37E XXE
OPT ZERO - ZERO

P23 - CISLUNAR MIDCOURSE NAV MEASUREMENT
(Auto Maneuver first)
If alt above earth or moon < 432 nm, do not
mark on secondary body.
CMC - on
SCS - on
ISS - on & aligned
G/N PWR OPTICS - on (30 min prior)
OPT ZERO - ZERO (verify)
OPT MODE - CMC
Load codes

**STAR/ENH** | **STAR/LNH** | **STAR/EL**
---|---|---
00000 | 00000 | 00100
00110 | 00210 | 00000

**STAR/EFH** | **STAR/LFH** | **STAR/LL**
---|---|---
00000 | 00000 | 002XX
00120 | 00220 | 00000

(STAR/LMK) PRO to 2 (XX#00 to 3)

(STER/HOR) PRO to 3

**2** F 06 89 LAT, LONG/2, ALT(LMK) (.001°, .001°, .01nm)
Load lmk coords
PRO

**3** F 50 25 00202 MNVR REQUEST
PRO
REJECT ENTR TO 6

**4** F 50 18 REQUEST MNVR TO FDAI RPY ANGLES (.01°)
(AUTO) SC CONT - CMC
CMC MODE - AUTO
PRO
(BYPASS MNVR/TRIM) - ENTR to 7 (If no cal go to 6)

**5** 0 06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)
AUTO MNVR complete return to 4
MAN MNVR - V62E
RHC - NULL ERROR NEEDLES Return to 4

**6** F 59 REQUEST OPTICS CALIB
OPT MODE - CMC (verify)
OPT ZERO - OFF
ENTR (Until step 10, auto mnvr repeat - V94E to 4)
P23

**CMP**

4-8

*F 05 09 00404 (TA>90°) *

*V94E to 4 (AUTO MNVR) *

* or MAN MNVR - PRO to 7 *

**MNVR TO POSITION LMK/HOR IN FOV**

**OPT MODE - MAN**

7 06 92 AUTO OPTICS SHAFT, TRUN (.01°, .001°)

*PROG ALARM *

*V94E to 4 (AUTO MNVR) *

* or MAN MNVR - KEY RLSE to 7 *

8 F 51 REQUEST MARK

OPTICS COUPLING - RESOLVED
SPEED - LOW
SUPERIMPOSE STAR ON LMK/HOR
MARK

9 F 50 25 00016 TERMINATE MARKS

(MARK REJECT) To 8

(TERM) PRO

10 F 05 71 STAR ID/LMK ID/HOR ID (OCTAL)

Verify codes

(STAR/LMK) PRO to 11 (LMK XX#00 to 12)

(STAR/HOR) PRO to 12

11 F 06 89 LAT, LONG/2, ALT (LMK) (.001°, .001°, .01nm)

Verify coords

PRO

12 F 06 49 ΔR, ΔV (SV Para) (.1nm, .1fps)

Rcrd data (R1&R2)

Wait 30 sec

V1 N1E
2754E

Rcrd data (R1-Trun in octal)

Wait 30 sec

KEY RLSE
N38E. Record MARK time, KEY RLSE
(REJECT i.e. ΔR, ΔV 0050.0)V37E 23E to 1
(UPDATE) PRO
13 F 37 23E to 1
or 00E
OPT ZERO - ZERO

P27 CMC UPDATE
CMC - on (req)

Auto Update:

V37E 00E
UP TLM CM - ACCEPT
NOTE: UPTLM (LEB) always ACCEPT
UPLINK ACTY lt - on
* POSS LOS before completion *
* If V33 NO2 showing:
  * Key PRO
  * UPLINK ACTY lt - out
  * POO displayed
* If V21 NO1
* or V21 NO2
  * Key V34E
  * UPLINK ACTY lt - out
  * POO displayed
* UP TLM CM - BLOCK

Update complete:
UPLINK ACTY lt - out
V37E 00E
UP TLM CM - BLOCK

Voice Transmission Update:

V37E 00E

2
V70E LIFT-OFF TIME UPDATE
or V71E LOAD DATA CONSEC ADD
or V72E LOAD DATA IN NON CONSEC
or V73E CMC TIME UPDATE

3 P27 Displayed
4 F 21 01 R3 UPDATE BUFFER ADD (initially 304)
R1 Data E (R3 Increments)
(If change - To 6)
Repeat Step 4 for all data

5 F 21 02 R3 330
(Verify Data) V1 N1E
R3 304E
R1 Verify Data
N15E (R3 305)
R1 Verify Data
Consecutive ENTR's display
remaining comps. Note
octal ident (01-24) of
comps which need change
KEY REL to 6

6 F 21 02 R3 330
(CHANGE) Load octal ident, XXE to 4
(ACCEPT UPDATE) PRO

7 POO Displayed
SECTION 5, PRETHRUST

P30 EXTERNAL ΔV
If uplinked REFSMMAT, do P52 (PREF OPT) before P30

1
F 06 33
V37E 30E
GETI
Load desired GETI
PRO

2
F 06 81
ΔVXYZ(LV)
Load desired ΔV's
PRO

3
F 06 42
HA, HP, ΔV(REQ)
Set ΔV CTR
PRO

4
F 16 45
M, TFI, MGA
Set DET
PRO (MGA Set to -00002 IF REFSMMAT FLAG NOT SET)

5
F 37

P31 GENERAL LAMBERT PRETHRUST
TARG PARAMS - LOADED FROM GND (P27)

1
F 06 33
V37E 31E
GETI
Load desired GETI
PRO

2
F 06 81
ΔVXYZ(LV)
PRO

3
F 06 42
HA, HP, ΔV(REQ)
Set ΔV CTR
PRO

hm, min, .01sec

.1fps

.1nm, .1nm, .1fps

.1fps

.1nm, .1nm, .1fps
P31,34

PRETHRUST

4 F 16 45 M,TFI,MGA (0,min-sec,.01°)
Set DET
PRO (MGA Set to -00002 IF
REFSMMAT FLAG NOT SET)

5 F 37

P34 TPI PRETHRUST (P74 LM)

1 F 06 37 V37E (34E or 74E) (hrs,min,.01sec)
TIG (TPI)
Load desired TIG
PRO

2 F 06 55 R2 ELEV ANG, R3ωt (.01°,.01°)
Load desired values
(+00000 in R2 to CALC ELEV
ANGLE AT TIG TIME)
PRO

3 F 16 45 MARKS,TFI,-00001 (min-sec)
(RECYCLE) V32E
(FINAL PASS) PRO (Term Marking)

*F 05 09 (00611 NO SOL)*
*PRO To 1*

4 F 06 37 TIG (TPI) (hrs,min,.01sec)
(IF ELEV ANGLE COMPUTED BY CMC
THIS DISPLAY WILL BE REPLACED
BY F 06 55 AS IN 2 ABOVE)
PRO

5 F 06 58 HP,ΔV(TPI),ΔV(TPF) (.1nm,.1fps,.1fps)
PRO (If Recycle - To 7)
(If Final - To 6)

6 F 06 81 ΔVXYZ(LV)TPI (.1fps)
(For Out-Of-Plane Corr in final Comp only)
Key V90E
F 06 16 GET EVENT (hrs, min, .01 sec)
PRO
F 06 90 Y, YDOT, PSI (.01 nm, .1 fps, .01°)
RECORD YDOT __________
PRO
INSERT - (YDOT) in R2 of ΔV TPI
*LOAD OF NEW DATA INTERRUPTED*
*BY F 06 49, F 50 18 OR RESTART*
*HANDLE INTERRUPTION*
*RELOAD DATA WHEN*
*N81 REAPPEARS*

7 F 06 59 ΔVXYZ(LOS) TPI
PRO (If Recycle - To 3)

8 F 16 45 MARKS, TFI, MGA (marks, min-sec, .01°)
PRO (MGA SET To -00002 IF NO
REFSMMAT SET or If P74)

9 F 37
P74 - Transmit Mnvr Parameters To LM

P35 TPM PRETHRUST (P75 LM)

V37E (35E or 75E)
F 16 45 MARK, TFI, -00001 (marks, min-sec)
(RECYCLE) V32E To 3
(FINAL PASS) PRO (Terminate Marking)

2 F 06 81 ΔVXYZ(LV) TPM
(.1 fps)
(For Out-of-Plane Corr V90E)
F 06 16 GET EVENT (hrs, min, .01 sec)
PRO
F 06 90 Y, YDOT, PSI (.01 nm, .1 fps, .01°)
RECORD YDOT __________
PRO
ZERO Out-of-Plane Corr (R2) on First TPM
*LOAD OF NEW DATA INTERRUPTED*
*BY F 06 49, F 50 18 OR RESTART*
*HANDLE INTERRUPTION*
*RELOAD DATA WHEN*
*N81 REAPPEARS*

PRO

3  F 06 59  \( \Delta V \)XYZ(LOS)TPM (.1fps)
   PRO (If Recycle - To 1)

4  F 16 45  MARKS,TFI,MGA (marks,min-sec,.01°)
   PRO (MGA SET TO -00002 IF NO
   REFSSMAT SET or If P75)

5  F 37
   P75 - Transmit Mnvr Parameters To LM
   P37 RETURN TO EARTH PROGRAM

1  F 06 33  V37E 37E (hrs,min,.01sec)
   Load desired TIG
   PRO

2  F 06 60  BLANK,V PRED,GAMMA EI (fps,.01°)
   Load desired values
   FOR MIN \( \Delta V \)-LOAD + 00000 IN R2
   PRO

   *F 05 09 00605-Solution Not
   *Convergent
   *00612-State Vector in
   *Lunar Influence
   *V32E,RSET To 1

3  F 06 61  IMPACT LAT, IMPACT LONG (.01°)
   (RECYCLE) V32E To 1
   PRO

4  F 06 39  AT TRANSFER
   (RECYCLE) V32E To 1
   PRO

   (hrs,min,.01sec)
5  F 06 60  BLANK,VPRED,GAMMA EI  (RECYCLE) V32E To 1  PRO

6  F 06 81  ΔVXYZ(LV) TIG  (fps,.01°)
    PRO (To 3 on first pass)

   *F 05 09 00605  Solution Not *
   *              Convergent *
   *              00613  Flt Path Angle *
   *              Not Reached *
   *              RSET *
   *              V32E To 1 *

7  F 04 06  THRUST OPTION
    R1 00007
    R2 0000X
    X=1(SPS)
    2(RCS)
    PRO

8  F 06 33  TIG  (hrs,min,.01sec)
    PRO

9  F 16 45  MARK,TFI MGA  (mark,min-sec,.01°)
    PRO (MGA SET TO -00002 If No
    REFSMMAT SET)

10 F 37  (40E or 41E)

    P38 SOR TARGETING (P78 LM)

1  F 06 33  TIG (SOR)  (hrs,min,.01sec)
    Load desired TIG
    PRO

2  F 06 55  R3ωt  (.01°)
    Load desired ωt
    PRO
P38,39

3 F 04 06  R1 00005 Specify Phase Option
     R2 0000X X=1 or 2
     PRO (To 6 If R2=2)

4 F 06 57  ΔR SOR
     Load desired ΔR
     PRO

5 F 06 34  SOR TIME
     (hrs,min,.01sec)
     PRO

6 F 16 45  MARK,TFI,-00001
     (RECYCLE) V32E
     (FINAL PASS) PRO (Terminate Marks)

7 F 06 58  ΔV(SOR),ΔV(SOR),ΔV(SOR-FINAL)
     PRO
     (.1nm,.1fps,.1fps)

8 F 06 81  ΔVXYZ(LV)
     PRO (If Recycle - To 6)

9 F 16 45  MARKS,TFI,MGA
     (marks,min-sec,.01°)
     PRO (MGA SET TO -00002 IF NO
     REFSMMAT SET OR P78)

10 F 37  P78 - Transmit Mnvr Parameters To LM

P39 STABLE ORBIT MID (P79 LM)

1 V37E (39E or 79E)

2 F 16 45  MARK,TFI,-00001
     (RECYCLE) V32E
     (FINAL PASS) PRO (Terminate Marks)

3 F 06 81  ΔVXYZ(LV)
     PRO (If Recycle - To 2)
4 F 16 45 MARK, TFI, MGA (mark, min-sec, .01°) PRO (MGA SET TO -00002 IF NO REFSMMAT SET or P79)

5 F 37

P79 - Transmit Mnvr Parameters To LM
SECTION 6, THRUSTING

P40 - SPS THRUSTING
CMC - on (Req)
ISS - on and aligned (Req)
SCS - on (Req)
TEST C/W Lamps
CRYO O2 & H2 MAN FAN OPERATION
RCS DAP - LOAD & ACTIVATE
ULLAGE SELECTION
TVC ROLL JETS

V37E 40E
F 50 18 REQUEST MNVR TO FDAI RPY ANGLES (.01°)
(AUTO) BMAG MODE (3)-Rate 2
SC CONT - CMC
CMC MODE - AUTO

FOR 3 AXIS MANEUVER:
V37E 00E V49E
LOAD 06 22
PRO
AT COMPLETION P40

MAN) ENTR to 3

06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)
SPS He tb(2)-bp
SPS He vlv(2)-AUTO

3 F 50 18 ATTITUDE TRIM ENABLE (.01°)
BMAG MODE(3)-RATE 2
ALIGN SC IN ROLL

PRO to 2
CHECK BORE SIGHT STAR (OPTICS & COAS)
CHECK PNL 8
AUTO RCS SELECT-A/C (B/D) ROLL(4)-OFF
SET ΔV ind (verify)
EMS FUNCT - ΔV
ROT CONT PWR DIRECT(2)-OFF
MAN ATT - RATE CMD
ATT DB - MIN
RATE - LOW
P40

CMC
6-2

TRANS CONT PWR - ON
SCS TVC(2)-RATE CMD
ΔV CG-LM or CSM

-06:00
TVC GMBL DRIVE P&Y - AUTO
MN BUS TIES (2)-on
NON ESS BUS - MNB
TVC SERVO PWR 1 - AC1/MNA
TVC SERVO PWR 2 - AC2/MNB
ROT CONT PWR NORMAL 2 - AC
ROT CONT PWR DIRECT (2)-OFF
BMAG MODE - ATT 1 RATE 2
SC CONT - SCS
RHC #2 - unlocked

Primary TVC Check
GMBL MOT PITCH 1 - START - ON
GMBL MOT YAW 1 - START - ON
Verify Trim Control & Set
Verify MTVC
SCS Only:
SCS TVC (2)-AUTO

**************************************************

THC-CW
Verify no MTVC

Secondary TVC Check
GMBL MOT Pitch 2 - START - ON
GMBL MOT YAW 2 - START - ON
VERIFY MTVC
CONFIRM & SET GPI TRIM
SC CONT - CMC (SCS)
THC - NEUTRAL
VERIFY NO MTVC

PRO
ROT CONT PWR NORMAL - 2 AC/DC
ROT CONT PWR DIRECT (2)-MNA/MNB

F 50 25 ENTR
R1 00204 ENABLE ENG. GIMBAL TEST
(REJECT) ENTR
(Accept) PRO

If SCS - Null Error Needles
*PROG ALM - TIG Slipped*
*RSET *
*or V5N9E 01703 *
*KEY RLSE to 5 *
-02:00  
5 06 40 TF GETI, VG, AVM (min-sec., 1fps, 1fps) 
FDAI SCALE - 5/5 
UPDATE DET 
ΔV THRUST A or B - NORMAL 
HAND CONTROLLERS - armed 
LIMIT CYCLE - OFF
-00:35 DSKY clears
-00:30  
06 40 Ave g on 
TAPE RCDR - RECORD HBR/FWD 
CHECK PIPA BIAS ≤ 2 FPS in 5 sec 
EMS MODE - AUTO

PERFORM ULLAGE (if req) 
(BACKUP) DIRECT ULLAGE pb 
CONTROL ATT w/RHC 
MONITOR ΔVM COUNTING UP
-00:05  
6 F 99 40 ENG ON ENABLE 
(AUTO) PRO (IGN WHEN TFI≥:00 sec) 
(BYPASS) ENTR to 9
00:00  
IF SCS, THRUST ON PB - PUSH FOR IGNITION

IGN 06 40 TFC, AVG, AVM (min-sec., 1fps, 1fps) 
*SPS THRUST FAIL:* 
*F 97 40 TFC, VG, AVM* 
*(RESTART) ENTR to 6* 
*(CONTINUE) PRO* 
*Poss Prog ALARM* 
*Key VO5, NO9E* 
*01407 (VG increasing)* 
*TERM BURN of SELECT*

SPS THRUST 1t - on 
Monitor thrusting: 
Pc=95-105 psia 
SPS ENG INJ vlvs - OPEN
ECO

3 F 16 40 TFC(STATIC), VG, ΔV  (min-sec, 1fps, 1fps)
ECO+1 sec ΔV THRUST (2) -OFF
VERIFY ALL THRUST OFF CUES
GMBL MOTS(4)-OFF
TVC SERVO PWR 1&2 -OFF
MN BUS TIES (2)-OFF
ECO+10 sec
TAPE RCDR-OFF (tb-bp)
PRO

9 F 16 85 ΔVG XYZ  (.1fps)
(A/C or B/D ROLL - ON)
NULL OUT VG COMPONENTS
ENS MODE - STBY
GIVE GROUND RESIDUALS
RECORD ΔV COUNTER
PRO
BMAG MODE - RATE 2

10 F 37 Key 00E
EMS FUNC - OFF
HAND CONTROLLERS - locked
THC PWR - OFF
V82E

11 F 16 44 HA, HP, TFF  (.1nm, .1nm, min-sec)
IF HP>49.4 R3= -59B59
PRO

P41 - RCS THRUST
CMC - on (Req)
ISS - on and aligned (Reg)
SCS - on (Reg)
TEST C/W LAMPS
LOAD & ACTIVATE DAP
SET DET
1 F 50 18 REQUEST MNVR TO FDAI RPY ANGLES (.01°)
   (AUTO) BMAG MODE (3)-RATE 2
   PRO
   (MAN) ENTR to 3

2 06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)

3 F 50 18 ATT TRIM ENALBE RPY
   ALIGN SC in ROLL
   ENTR to 4
   PRO (TRIM to 2)

4 06 85 VGX, VGY, VGZ (.1fps)
   CHECK BORESIGHT STAR (COAS & OPTICS)
   MAN ATT (3) - RATE CMD
   ATT DB - MIN
   RATE - LOW

   -00:35 DSKY BLANKS

   -00:30 TRANS CONT PWR - ON
   BMAG MODE ATT1/RATE 2

5 16 85 VG XYZ (Ave g on) (.1fps)
   HAND CONTROLLERS - armed
   LIMIT CYCLE - OFF
   TAPE RCDR - RCD/FWD

   00:00 EMS MODE - AUTO

6 F 16 85 VG XYZ (.1fps)
   NULL OUT COMPONENTS
   BURN COMPLETE
   PRO
   EMS FUNC - OFF
   EMS MODE - STBY
   RECORD ΔV COUNTER/COMPONENTS
   TAPE RCDR - OFF (tb-bp) 5-6
   TRANS CONTR PWR - OFF
   THC - neutral, locked
P47-THRUST MONITOR

CMC - ON
ISS - ON & ALIGNED
G/N PWR OPTICS - OFF

V37E 47E

ΔV XYZ(CSM) (.1fps)

*VI, HDOT, H available by N62E*
*KEY RLSE to return to N83*

(RECYCLE) V32E
(TERM) PRO

2 F 37 XXE
SECTION 7, ALIGNMENTS

P51 - IMU ORIENTATION
CMC - on
ISS - on
SCS - operating
BMAG MODE (3) - RATE 2
G/N PWR OPTICS - on (verify)
OPT ZERO - ZERO (verify)
OPT MODE - MAN

1  V37E 51E
   F 50 25 00015 MNVR TO ACQ STARS
   (Coarse Align IMU To 0,0,0) - ENTR to 2
   (BYPASS) PRO to 3

2  41 22 DESIRED GIMBAL ANGLES (0,0,0)
   NO ATT lt - on then off, to 1

3  F 51 PLEASE MARK
   OPT ZERO - OFF MARK

4  F 50 25 00016 TERMINATE MARKS
   PRO

5  F 01 71 000DE STAR CODE
   Load desired code
   PRO to 3 after 1st MARK (to 6 if DE=00)
   to 7 after 2nd MARK (to 6 if DE=00)

6  F 06 88 CELESTIAL BODY VECTOR
   Load desired vector
   PRO to 3 after 1st MARK
   to 7 after 2nd MARK

7  F 06 05 STAR ANGLE DIFFERENCE (.01°)
   (RECYCLE) V32E to 1
   (ACCEPT) PRO

8  F 37 52E-bypass ZERO OPTICS
    or XXE-OPT ZERO - ZERO
P52 IMU REALIGN
CMC - on
ISS - on
SCS - operating
BMAG MODE (3) - RATE 2
G/N PWR OPTICS - on (verify)
CMC MODE - FREE
OPT ZERO - ZERO (verify)
OPT MODE - CMC

1 F 04 06 V37E 52E
   R1 00001 IMU ALIGN OPTION
   R2 00001 PREF PRO to 4
2   2 NOM PRO to 2
3   3 REFSMMAT PRO to 5
4   4 LDG SITE PRO to 2

2 F 06 34 GET ALIGN (0,0,0 initially) (hr,min,sec)
   Load desired GET
   TO SPECIFY PRESENT TIME - PRO on (0,0,0)
   PRO (NOM go to 4)

3 F 06 89 LAT, LONG/2, ALT (0.001°, 0.001°, 0.01nm)
   Load ldg site coords
   PRO

4 F 06 22 NEW ICDU ANGLES OG, IG, MG (0.01°)
   (IF MG>70°, MNVR) V32E - to 4
   PRO NO ATT lt - on then off

5 F 50 25 00015 STAR SELECT
   (MNVR If Necessary)
   (PICAPAR) PRO
   *F 05 09 00405 NO PAIR *
   *(CREW SPECIFY) PRO - to 6 *
   *(PICAPAR) V32E to 5 *
   (MAN ACQ) ENTR

6 F 01 70 000DE STAR CODE
   Load desired code
   OPT MODE - CMC (verify)
OPT ZERO - OFF
PRO to 8 (to 7 if DE=00)
*F 05 09 00404 (TA>90°)*
*MNVR - PRO To 8 *

CELESTIAL BODY VECTOR
Load desired vector
PRO
*F 05 09 00404 (TA>90°)*
*MNVR - PRO To 8 *

SHAFT, TRUN
*PROG ALARM (TA>50°)*
*V5N9E 00407 *
*KEY RLSE *
*MNVR till R2<49775 *

(MARK ROUTINE) OPTICS MODE - MAN

PLEASE MARK
MARK

TERMINATE MARKS
PRO

Load code (if necessary)
PRO to 6 after 1st MARK (to 12 if DE=00)
to 13 after 2nd MARK (to 12 if DE=00)

CELESTIAL BODY VECTOR
Load vector
PRO to 6 after 1st MARK
to 13 after 2nd MARK

STAR ANGLE DIFFERENCE
(ReJECT) V32E to 15
(AcCEPT) PRO

TORQUING ANGLES OG, IG, MG
(TORQUE) PRO (CMC - FREE)
(BYPASS) V32E
15  F  50  25  00014  ALIGNMENT CHECK
    (RECHECK)  PRO To 5
    (BYPASS)  ENTR
16  F  37  OPT ZERO - ZERO
    XXE

P53 - BACKUP IMU ORIENT DETERMINATION
CMC - on
ISS - on
SCS - operating
MAN ATT (3) - MIN IMP
COAS LOS DETERMINATION - Complete
pg CMP/3-12

1  F  50  25  00015  MNVR To ACQ STARS
    (BYPASS)  Coarse Align IMU to 0,0,0) - ENTER to 2
    PRO to 3
2  41 22  DESIRED GIMBAL ANGLES (0,0,0)
    NO ATT lt - on then off, to 1
3  F  06  94  ALT LOS OPT ANGS SHAFT, TRUN (.01°,.001°)
    Load proper angles
    PRO
4  F  53  PLEASE MARK
    Center Target
    ENTR  (DO NOT  PRO)
    RECOVERY  RESLECT PROG
5  F  50  25  00016  TERMINATE MARKS
    (REJECT)  ENTR to 4
    PRO
6  F  01  71  000DE STAR CODE
    Load desired code
    PRO to 3 after 1st MARK (to 7 if DE=00)
    to 8 after 2nd MARK (to 7 if DE=00)
7  F  06  88  CELESTIAL BODY VECTOR
    Load desired vector
PRO to 3 after 1st MARK
to 8 after 2nd MARK

8 F 06 05 STAR ANGLE DIFFERENCE
(RECYCLE) V32E to 1
(ACCEPT) PRO

9 F 37 XXE

P54 - BACKUP IMU REALIGN
CMC - on
ISS - on
SCS - operating
MAN ATT (3) - MIN IMP
COAS LOS DETERMINATION - complete
pg CMP/3-12

1 V37E 54E
F 04 06 R1 00001 IMU ALIGN OPTION
R2 00001 PREF PRO to 4
2 NOM PRO to 2
3 REFSMMAT PRO to 5
4 LDG SITE PRO to 2

2 F 06 34 GET ALIGN (0,0,0 initially)(hr,min,sec)
Load desired GET
TO SPECIFY PRESENT TIME - PRO on (0,0,0)
PRO (NOM go to 4)

3 F 06 89 LAT, LONG/2, ALT (.001°,.001°,.0lnm)
Load ldg site coords
PRO

4 F 06 22 NEW ICDU ANGLES OG, IG, MG
(IF MG>70°, MNVR) V32E to 4
PRO - NO ATT lt - on then off

5 F 50 25 00015 STAR SELECT
(Mnvr If Necessary)
(PICAPAR) PRO
**MAN ACQ) ENTR**

6  F 01 70  OOODE STAR CODE
Load desired code
PRO to 8 (to 7 if DE=00)

7  F 06 88  CELESTIAL BODY VECTOR
Load desired vector
PRO

8  F 06 94  ALT LOS OPT ANGS SHAFT, TRUN(.01°,.001°)
Load angles
PRO

9  F 53  PLEASE MARK
Center Target
ENTR (DO NOT PROG - RECOVERY
RESELECT PROG)

10 F 50 25  00016 TERMINATE MARKS
(REJECT) ENTR to 9
PRO

11 F 01 71  OOODE STAR CODE
Load code (if necessary)
PRO to 6 after 1st MARK (to 12 if DE=00)
to 13 after 2nd MARK (to 12 if DE=00)

12 F 06 88  CELESTIAL BODY VECTOR
Load vector
PRO to 6 after 1st MARK
to 13 after 2nd MARK

13 F 06 05  STAR ANGLE DIFFERENCE (REJECT) V32E to 15
(ACCEPT) PRO
14 F 06 93 TORQUING ANGLES O, I, MG
   (TORQUE) PRO (CMC - FREE)
   (BYPASS) V32E

15 F 50 25 00014 ALIGNMENT CHECK
   (RECHECK) PRO to 5
   (BYPASS) ENTR

16 F 37 XXE
SCS POWER UP

AUTO RCS SELECT (16) - OFF
BMAG MODE (3) - RATE 2
CMC MODE - FREE
SC CONT - CMC
CB SCS LOGIC PWR (4) - close
ΔV CG - as required
LOGIC PWR 2/3 - on (up)
SIG COND/DRIVER BIAS PWR (2) - AC1
SCS ELEC PWR - GDC/ECA (170 watts)
FDAI PWR - OFF
BMAG PWR (2) - ON (110 watts)
FDAI PWR - BOTH (104 watts)
AUTO RCS SELECT (16) - enable

SCS POWER DOWN

EMS FUNCTION - OFF
EMS MODE - STBY
FDAI SCALE - 5/1
FDAI SELECT - 1/2
FDAI SOURCE - ATT SET
ATT SET - IMU
MAN ATT (3) - MIN IMP
ATT DEADBAND - MAX
RATE - LOW
ROT CONT PWR NORMAL (2) - OFF
ROT CONTR PWR DIRECT (2) - OFF
AUTO RCS SELECT (16) - OFF
CMC MODE - FREE
BMAG MODE (3) - RATE 2
SCS TVC (2) - RATE CMD
.05G sw - OFF
α/Pc sw - Pc
TVC GMBL DRIVES PITCH & YAW - AUTO
BMAG PWR (2) - WARMUP (38 watts)
TVC SERVO PWR (2) - OFF
FDAI PWR - OFF
LOGIC PWR 2/3 - OFF
SCS ELEC PWR - OFF
GDC ALIGNMENT TO IMU GIMBAL ANGLES

1
IMU - ON (Req)
SCS - ON (Req)

2
ESTAB SCS ATT HOLD IN TIGHT DB

3
ATT SET dials - set to IMU angles on FDAO 1
FDAO SELECT - 1
FDAO SOURCE - ATT SET
ATT SET - IMU
ATT SET dials - null FDAO 1 error needles
ATT SET - GDC
GDC ALIGN pb - push until needles nulled

SCS ATTITUDE REFERENCE COMPARISON

1
CMC - ON (Req)
IMU - ON (Req)
SCS - ON (Req)
SIVB SEPARATED:
ESTAB SCS ATT HOLD IN TIGHT DB

2
Key V37E00E
Key V16 N20E, (press IMU angs)

3
FDAO SELECT - 1
FDAO SOURCE - ATT SET
ATT SET - GDC
ATT SET dials - null FDAO 1 error needles
Key V (when nulled to freeze display)
RECORD FROM DSKY:
VBB N20 R, P, Y (DEG)
R=____°, P=____°, Y=____°
ATT SET dials (3) - Record
R=____°, P=____°, Y=____°

4
Key V37E 00E

BACKUP GDC AND/OR IMU ALIGNMENT

1
SCS - ON (Req)

2
CMC - OFF or STANDBY
RECORD: R, P, Y ALIGN from MSFN
1. SCT, SHFT - 180, TRUN - 7.5
2. ATT SET DIALS - R, P, Y ALIGN
   FDAI SELECT - 1/2
   CAGE IMU when near 0,0,0 on FDAI 1
3. MNVR To STARS:
   ACRUX (No. 25) on 50° MARK
   ATRIA (NO. 34) on R Line in SCT
4. FDAI SELECT - 1
   ATT SET - GDC
   GDC ALIGN - push
5. ATT SET dials - 0,0,0 or 180,180,0
6. MNVR SC To ΔV attitude on GDC Ball & null error needles
7. Perform SXT/STAR check and adjust in pitch and yaw if necessary
8. UNCAGE IMU
9. FDAI SELECT - 1/2
10. PGNS ORDEAL INITIALIZATION
    FDAI 1 or 2 - ORB RATE
    EARTH/LUNAR - EARTH

V82E
F 04 12 R1 00002 SPECIFY VEHICLE
R2 1E (CSM)
PRO

F 16 44 HA, HP
   (1nm, 1nm)
   Calculate Average
   ALT SET - Set Average
PRO

Basic Date: Feb. 1, 1969
Basic Date Changed: CSM 104
V83E
F16 54 R, RDOT, THETA (.01nm, .1fps, .01°)
MODE - HOLD/FAST
SLEW - To THETA
MODE - OPR/SLOW

PRO

SCS ORDEAL INITIALIZATION

1
FDAI 1 or 2 - ORB RATE
EARTH/LUNAR - EARTH

2
MSFN Supply Altitude
ALT SET - Set

3
SC INPLANE (0° YAW)
(GDC INPLANE ALIGNMENT DES)
SC +X At the Horizon

4
MODE - HOLD/FAST
Slew FDAI
MODE - OPR/SLOW
SECTION 9 - LM INTERFACE

LM ACTIVE DOCKING

1 COAS - installed
   Docking target - installed & on

2 CONFIGURE SC
   TRANS CONT PWR - on (up)
   ROT CONT PWR DIRECT (2) - MNA/MNB
   SC CONT - CMC
   CMC MODE - HOLD
   BMAG MODE (3) - RATE 2
   AUTO RCS (16) - MNA
   MAN ATT (3) - RATE CMD
   HAND CONTROLlers - armed
   ATT DB - MIN
   RATE - LO
   EXT RUN/EVA LT - on (verify)
   COAS PWR - on (up)
   CB DOCK PROBE (2) - close
   CB SECS ARM (2) - close
   SECS LOGIC (2) - on (up)
   Obtain GO from MSFN
   SECS PYRO ARM(2)-on(up)
   PROBE RETR (2) - OFF
   Confirm SC status with LM
   Monitor LM closing maneuvers

3 INITIATE LATCHES
   Monitor EXTD/RED tb (2)
   PROBE EXTD/REL (2) - bp
   Confirm capture to LM
   CMC MODE - FREE
   PROBE RETR SEC - 1 or 2
   Observe retroaction movement of vehicles
   No retraction:
   DOCK PROBE RETR PRIM & SEC - fire
   alternate GN2 bottles
   X
PROBE EXTD/REL tb (2) - gray

If PROBE tb remain bp:
Use alternate GN2 if cues unsatisfactory
or Perform tunnel pressure integrity check & use alternate GN2 if pressure integrity is unsatisfactory

4 SAFE DOCKING SYSTEM
PROBE EXTD/REL - OFF
EXT RUN/EVA LT - OFF
EXT RNDZ LT - off (center)
COAS PWR - OFF
CB DOCK PROBE (2) - open
SECS PYRO ARM (2) - SAFE
SECS LOGIC (2) - OFF
CB SECS ARM (2) - open
CMC MODE - HOLD

CSM ACTIVE DOCKING

1 COAS - mounted
COAS PWR - on
Docking target - installed & on

2 CONFIGURE SC
TRANS CONT PWR - on (up)
ROT CONT PWR DIRECT (2) - MNA/MNB
SC CONT - CMC
CMC MODE - HOLD
BMAG MODE (3) - RATE 2
AUTO RCS (16) - MNA
MAN ATT (3) - RATE CMD
HAND CONTROLLERS - armed
ATT DB - MIN
RATE - LO
EXT RUN/EVA LT - on (verify)
COAS PWR - on (up)
CB DOCK PROBE (2) - close
CB SECS ARM (2) - close
SECS LOGIC (2) - on (up)
Obtain GO from MSFN
   SECS PYRO ARM(2)-on(up)
PROBE RETR (2) - OFF
Confirm SC status with LM
Monitor LM closing maneuvers

3 INITIATE LATCHES
Align CSM X axis with LM Z axis
Establish max .05 fps closing rate
THC - +X at contact (for 4 sec)
PROBE EXTD/REL tb (2) - bp

If PROBE tb gray after 4 sec +X translation:
CMC MODE - FREE
THC - neutral
COAS - adjust alignment to +3°
PROBE RETR PRIM - 1
or THC - -X to 15 feet separation
Realign CSM with LM
Go to Step 3 above

CMC MODE - FREE
THC - +X, then neutral
Adjust in pitch, yaw, and roll (+3°)
PROBE RETR SEC - 1 or 2
Observe retroaction movement of vehicles

No retraction:
DOCK PROBE RETR PRIM & SEC - fire
   alternate GN2 bottles

PROBE EXTD/REL tb (2) - gray

If PROBE tb remain bp:
   Use alternate GN2 if cues unsatisfactory
or Perform tunnel pressure integrity check & use alternate GN2 if pressure integrity is unsatisfactory

4 SAFE DOCKING SYSTEM
PROBE EXTD/REL - OFF
EXT RUN/EVA LT - OFF
EXT RNDZ LT - off (center)
COAS PWR - OFF
CB DOCK PROBE (2) - open
SECS PYRO ARM (2) - SAFE
SECS LOGIC (2) - OFF
CB SECS ARM (2) - open
CMC MODE - HOLD

IVT TO LM
Verify Suit Integrity
Couches: CDR - 90°, CMP-0°, LMP-18°
TUNNEL LIGHT - ON
EXT/REL - RETRACT
Verify EXT/REL tb (2) - grey
EXT/REL - OFF

TUNNEL HATCH REMOVAL
PRESS EQUAL vlv - OPEN (CCW)
PUMP HANDLE - unstow, pull to stop, set to U
  - Push to stop
Verify gearbox disconnect socket - U
PUMP HANDLE sel - stow
  - push to stow
Remove hatch, stow

DOCKING LATCH VERIFICATION
Power Bungee Fairing - parallel to +X
Latch handle - Pull to verify hook engaged (12 latches)
Latch Ind Button (red) - flush (12 latches)

Unlocked Latches:
  Bungee Fairing - push +X end to seat or cock latches
Hook does not release:
Aux RLSE (yellow)-push cock latch
Release latch - push man release (fish tail)

LM UMBILICAL CONNECTION
LM Connector Fairings (2) (orange) - open
Unstow one connector
Connect and lock
Position umbilical in slot, close fairing
Repeat for second umbilical
Verify continuity check complete
LM PWR - CSM
SYS TEST - 4D
SYS TEST ind - 5.0 - 6.5 amps

PROBE REMOVAL (CM Side)
GN2 BLEED button (red) - press (10 sec)
Verify Extend Latch engaged indicator (red) not visible

Extend latch not engaged
PRELOAD HANDLE - sel lever CW
- Rotate CCW until indicator (red)
  flush with housing
PRELOAD SEL LEVER - rotate ccw(parallel to "orange stripe")
PRELOAD HANDLE - Torque (CW) unload support beams

Probe umbilicals (2) (yellow) - disconnect and stow
Elec. connector covers (2) (yellow) - close
PRELOAD HANDLE - position against umbilical connector
PRELOAD SEL LEVER - mid position

INSTALLATION STRUT - unstow, position on tunnel wall (yellow marks)
RATCHET HANDLE - unstow to full extension
- push to first detent (red band)
- push outboard and hold to fold

Verify probe folded - Teflon block against ratchet mech

Ratchet handle - pull to full extension
- ratchet probe one stroke only

Restow RATCHET HANDLE and INSTALLATION STRUT

CAPTURE LATCH RLSE HANDLE - Pull, rotate To unlock (180° CW)
- push to detent

Capture latches will not release:
Ratchet probe forward
Preload probe until latches release
Remove probe by above procedure

Remove PROBE - pull aft to release (25 lbs)

DROGUE REMOVAL
DROGUE LOCK LEVER (2)- Pull, rotate 90° CCW

DROGUE - rotate CW, push clear of support
- remove from tunnel

CREW TRANSFER (TO LM) (LMP, CDR)
Connect transfer 02 umbilicals to left
PGA Connectors
RH SUIT FLOW vlv - FULL FLOW
Connect protective plugs to right PGA connectors
Transfer to LM in face forward position
Set audio switches as desired by LMP
LM PWR - OFF (coordinate with LMP)
RH SUIT FLOW vlv - OFF (coordinate with LMP)
When requested by LMP:
PWR - OFF
SUIT PWR - OFF
AUDIO CONT - NORM
CDR receive transfer umbilicals from LMP
CTR SUIT FLOW vlv - CAB FLOW
Connect 02 transfer umbilicals to left PGA Connectors
RH SUIT FLOW vlv - FULL FLOW
Disconnect 02 hose from right PGA Connectors
Connect protective plugs to right PGA Connectors
Install interconnect CDR 02 hose on CDR audio panel:
PWR-OFF
SUIT PWR - OFF
AUDIO CONT - NORM
Remove CCU from PGA connector
Verify on LMP audio panel:
PWR-OFF
SUIT PWR-OFF
Connect transfer CCU to PGA LMP audio panel switches as desired by CDR Transfer to LM in face forward position RH SUIT FLOW vlv - OFF (coordinate with CDR) When requested by CDR:
PWR-OFF
SUIT PWR-OFF
CMP Obtain & Stow transfer umbilicals Install suit hose interconnect on 02 hoses

CREW TRANSFER (TO CSM)

1. From LM ECS
RH SUIT FLOW vlv - as desired
Connect hose interconnect to transfer umbilicals
On LMP audio panel:
PWR-OFF
SUIT PWR - OFF
AUDIO CONT - NORM
Pass transfer umbilicals to LM on request from LM:
RH SUIT FLOW vlv - FULL FLOW
PWR - AUDIO/TONE
SUIT PWR - on (up)
CDR transfer to CSM
Remove protective plugs from right PGA Connectors
Remove suit hose interconnect from CDR 02 hoses
Connect CDR 02 umbilicals to right PGA connectors
LH SUIT FLOW vlv - FULL FLOW
RH SUIT FLOW vlv - OFF
Disconnect LMP 02 hose from left PGA connectors
Connect protective plugs to left PGA connectors
Install suit hose interconnect on 02 hoses
PWR-OFF
SUIT PWR -OFF
AUDIO CONT-NORM
Remove transfer CCU from PGA connector
Verify on CDR audio panel:
PWR-OFF
SUIT PWR-OFF
AUDIO CONT-NORM
Connect CDR CCU to PGA Audio panel switches as desired
RH SUIT FLOW vlv -OFF
Connect hose interconnect to transfer umbilicals
On LMP audio panel:
PWR-OFF
SUIT PWR-OFF
AUDIO CONT-NORM
Pass transfer umbilicals to LM on request from LMP/CDR:
RH SUIT FLOW vlv-FULL FLOW
PWR-AUDIO/TONE
SUIT PWR - on(up)
on request from LMP:
LM PWR-CSM
Transfer to CSM
2. From PLSS/OPS & LM ECS
   RH SUIT FLOW vlv-OFF
   on LMP audio panel:
   PWR-OFF
   SUIT PWR-OFF
   AUDIO CONT-NORM
   Pass transfer umbilicals to LM
   RH SUIT FLOW vlv - as desired
   on request from LM:
   PWR-AUDIO/TONE
   SUIT PWR-on(up)
   LH SUIT FLOW vlv -OFF
   Remove protective plugs from left PGA
   Connect CDR 02 umbilical to left PGA connectors
   LH SUIT FLOW vlv - FULL FLOW
   RH SUIT FLOW vlv -OFF
   Disconnect 02 transfer umbilicals from
   right PGA connectors
   Connect protective plugs to right
   PGA connectors
   Install interconnect on 02 hose
   on LMP audio panel:
   PWR-OFF
   SUIT PWR-OFF
   on CDR audio panel:
   PWR-OFF
   SUIT PWR-OFF
   AUDIO CONT-NORM
   Remove transfer CCU from PGA
   Audio panel switches - as desired
   LH SUIT FLOW vlv-OFF
   Connect hose interconnect to transfer
   umbilicals
   on LMP audio panel:
   PWR-OFF
   SUIT PWR-OFF
   AUDIO CONT-NORM
   Pass transfer umbilicals to LM
on request
RH SUIT FLOW vlv-FULL FLOW
PWR-AUDIO/TONE
SUIT PWR-on(up)
on request from LM:
LM PWR-CSM
Transfer to CSM

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

INSTALL DROGUE
DROGUE - Align Lugs with fittings
- Rotate CCW to stops

LOCK LEVER (2) - Rotate 90° CW to detent

INSTALL PROBE
CAPTURE LATCH RLSE HNDL - Pull, rotate CCW to cock pos (150°)
Push Probe into Drogue

CAPTURE LATCH RLSE HNDL - rotate CCW to LOCK position (do not force)
push to detent

Verify capture latches engaged (CDR)

INSTALLATION STRUT - unstow, position on tunnel wall (yellow marks)

RATCHET HANDLE - unstow to full extension (green band)
- ratchet probe fwd to orange hash mk
Restow RATCHET HNDL & INSTALLATION STRUT

CAUTION
For stowage - ratchet to base of orange arrow only; verify probe loose.
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 in to detent

CAPTURE LATCH RLSE HNDL - Set in detent
INSTALLATION STRUT - stow

PROBE UMBILICALS (2) (yellow) - connect to dock ring
Close connector covers (yellow).
NOTE: for stowage, umbilical connection not required

PRELOAD PROBE
- Preload Sel Lever - rotate CCW (parallel to orange stripe)
- PRELOAD HANDLE - torque (CW) to release
- Verify capture latches engaged
- PRELOAD HANDLE - Push inboard to detent
  - parallel to support beam.
  - sel lever to mid position

HATCH INSTALLATION
- Align Hatch in tunnel
- PUMP HANDLE - unstow
  - push to stop
  - set to L
- 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
PUMP HANDLE sel - stow
   - push to stow

HATCH PRESS EQUAL vlv - closed (CW)

HATCH INTEGRITY CHECK
Verify LM Hatch Closed, Dump Valve - Auto
Verify CABIN PRESS ind - 4.8-5.2 psi

TUNL VENT vlv - TUNL VENT for 30 sec
   - LM/CM ΔP, check ΔP
   - Recycle to TUNL VENT until ΔP>2.5
Verify LM/CM ΔP ind constant (+.2) at last vlv for 2 min
Verify O2 flow ind - no increase
LM TUNL VENT vlv - OFF
TUNNEL LIGHTS - OFF

MANNED LM SEP FROM CSM

1 PREPARATION
Set conference COMM mode
Configure couches
LM PWR - OFF
Disconnect 2 LM umbilical connectors
IVT to LM completed, pg CMP/9-4
Drogue installed, LM X-LIST
Probe installed, LM X-LIST
Preload probe, LM X-LIST

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
*Probe cannot be preloaded:
   x TBD x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Recock docking latches
Tunnel hatches installed
CAB PRESS ind - 4.8-5.2 psia
O2 FLOW ind - 0.4-0.6 lb/hr
TUNL VENT vlv - TUNL VENT
   after 1 min, - LM/CM ΔP
Recycle vlv until ΔP ind - 2.5 psid
Monitor ind another minute - no change

LM/CM ΔP ind - decrease below 2.5 psid:

Reconfigure couch

2 SEPARATION
Install docking target
MAN ATT (3) - RATE CMD
ATT DB - MAX
RATE - HI
TRANS CONT PWR - on (up)
ROT CONT PWR NORMAL (2) - AC/DC
ROT CONT PWR DIRECT (2) - MNA/MNB
HAND CONTROLLERS - armed
SC CONT - SCS
BMAG MODE (3) - RATE 2
CB DOCK PROBE (2) - closed
Verify status with LM
Maneuver to sep attitude
DET - set
DET RSET - DOWN
DET START - START (on signal from CDR)
PROBE EXTD/REL - EXTD/REL
   (hold for full probe extension
   but not more than 20 sec)
PROBE EXTD/REL tb (2) - gray to bp to gray
Monitor vehicle motions

3 POST SEPARATION
PROBE EXTD/REL - RETR
CB DOCT PROBE (2) - open
SECS PYRO ARM (2) - SAFE
SECS LOGIC (2) - OFF
CB SECS ARM (2) - open
PROBE RETR PRIM - 2 (prior to 2nd docking)
PROBE RETR SEC - 1 (prior to 2nd docking)
PROBE RETR PRIM - 2 (prior to 3rd docking)  
PROBE RETR SEC - 2 (prior to 3rd docking)  
EXT RUN/EVA LT - on (up) (verify)  
EXT RNDZ LT - RNDZ (verify)  

LM/CSM FINAL SEP

1 PREPARATION  
Final IVT to CSM completed  
CB SECS ARM (2) - close  
SECS LOGIC (2) - on (up)  
Obtain GO from MSFN  
   SECS PYRO ARM (2) - on (up)

2 SEPARATION  
CSM/LM FNL SEP 1 - on (up)  
   xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx  
   X If no separation:  
   x CSM/LM FNL SEP 2 - on (up) x  
   xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

3 POST SEPARATION  
SECS PYRO ARM (2) - SAFE  
SECS LOGIC (2) - OFF  
CB SECS ARM (2) - open
SECTION 10 - EVA

PRE IVT UNSTOWAGE

Umbilical Interconnects (2): A-1 to Strap on R-10
Probe Stowage Straps (2): R-8 to Right Seat Pan
ISA Equipment: Temp Stow in F-1
16mm Camera, Brackets (Window, Hatch), Lens (18,5),
remote control cable, pwr cable - mount in Left
window on hatch.
16mm mags, one to camera, one to left leg pocket
Docking Target - U-3 to right window
Diostimeter and mount
Helmet Shield - PGA bag to CDR helmet
EVA gloves - U-4 to helmet bag, IV gloves to U-4
Helmet bag to beneath right couch
Check lists and clips to R-12
EVA utility bag - to beneath girth shelf
Jackscrews, Tool B, Tool Tether - A-8 to EVA
utility bag
Hasselblad, SO 368, handle - To Tool Tether
to TV mount
Couch restraint straps - A-1 to left couch
MDC Bars - A-8 to MDC
Thermal Sample Tether - A-1 to L-3, large hook
to L-3 handhold
TSB to left girth ring

CM PREP

1 After hatch closure: LM/CM Press - LM/CM ΔP
2 Umbilicals: CDR route above panel 10 to strap
near right XX strut; attach interconnect
LMP route above panel 10 to R4 to
hockey stick to Right headset under Drogue
stowage strap
Secure to hockey stick with utility strap (R 5)
3 L and R Suit Flow - OFF
4 L and R Hoses Interconnected and Stowed so
Accessible
5 L and R SUIT FLOW - OFF
6 EVA Stabilizer Strut Attached
Seat, Leg, and Foot Pans Folded Against Back Pan
With Seat Pan Locked
Left Foot X-X Strut Disconnected and Tied
Disconnect L-Shape bag, stow under right couch
Center Couch Removed and Stowed
Marmon Clamps Closed and Locked
THC on bracket on LiOH A-3
RHC #1, on bracket - LEB
RHC #2, on left armrest THC mount
Controller mounts (2) tied down with utility straps

CREW STATUS
SUIT RET - open (pull)
EMER CABIN PRESS - BOTH
COMM Carrier Donned
C O2 Blue Hose to PGA Red Connector and Red to Blue
SUIT FLOW - CABIN FLOW
C ELEC UMB Connected to PGA
UCTA Empty
Chronometer on Left PGA Sleeve

PLSS COMM CHECK
Panel 9 Audio Panels - 6 and 9 Intercon/PTT, T/R except PAD COMM-OFF, POWER-OFF, SUIT
POWER-OFF
Panel 10 Same, except CONTROL-BACK UP
MODE - VOX
S-BAND NORMAL MODE VOICE - RELAY
VHF AM A - DUPLEX
VHF AM RCV ONLY - A
Standby for Voice COMM Check with LMP and CDR
Verify MSFN Received PLSS Voice and Data via CSM Relay. Proceed as Noted Below.

If CSM Relay is not Useable, Perform the Following -
Left Audio Panel -
S-BAND VOL TW - FULL DECREASE
MDC PANEL 3 -
MODE - VOICE
If CSM Relay is useable, perform the following:

- Left Audio Panel -
  - S-BAND VOL TW - FULL DECREASE
  - STANDBY FOR VOICE COMM CHECK WITH LMP

NOTE - CSM COMM System Remains in this Configuration for EVA

SYSTEM PREP FOR DEPRESS

G&N - After maneuver to EVA attitude
  - DISABLE RCS JETS - AUTO RCS SELECT -
  - A/C ROLL - A1, A2 - OFF
  - B/D ROLL - B1, D2, B2, D1 - OFF
  - PITCH - A3, A4 - OFF
  - YAW - B3, D4 - OFF

ECS -
  - O2 PRESS IND sw-SURGE TANK
  - CRYO TK O2 PRESS 1 ind - 865-935 psia
  - WASTE STOWAGE VENT-CLOSED

ECS REDUNDANT COMPONENT CHECK

- O2 Demand Reg vlv - 1
  - Close demand reg cabin bleed port with finger
  - O2 FLOW ind - momentary increase
  - O2 DEMAND REG vlv - 2
  - Close demand reg cabin bleed port with finger
  - O2 FLOW ind - momentary increase
  - O2 DEMAND REG vlv - BOTH

Suit Compressor
  - SUIT COMPR (BOTH) - sw to other compr
  - SUIT COMPR ΔP ind - 0.3-0.4 psid

Main O2 Regulators
  - MAIN REG B vlv - close over MSFN
  - EMER CABIN PRESS vlv - 1
  - PUSH TO TEST PB-PUSH (O2 FLOW INC)
  - O2 press - 90-110 psig (from MSFN if avail)
  - MAIN REG B vlv - open
  - MAIN REG A vlv - close
  - EMER CABIN PRESS vlv - 2
  - PUSH TO TEST PB - PUSH (O2 FLOW INC)
O2 press - 90-110 psig (from MSFN if avail)
MAIN REG A vlv - open
EMER CABIN PRESS vlv - BOTH (OFF if suited)

FINAL PREP FOR DEPRESS
VERIFY REPRESS O2 PRESS - 865-935 psi
EMER O2 - CLOSED
O2 PRESS IND SW - SURGE TK
VERIFY SURGE TANK PRESS - 865-935 psi
VERIFY SURGE TANK - ON
EXTERIOR LTS - RUN/EVA - on (up)
SPOT - OFF (DN)

SUIT COMPR (1) - OFF
Connect O2 Hoses, Red to Red, Blue to Blue
Suit Flow Valve - SUIT FLOW
SUIT COMPR (1) - AC 1
VERIFY PGA FLOW DIVERTER - HORIZ
Stow IV Gloves
Unstow Helmet
Verify Feed Port Cover Installed and Wipe Helmet with Anti-Fog
Verify PGA COMM Lead Inside PGA and Clear of Suit Neck Ring
Helmet Attaching Neck Ring - Engage
Position Mike, Don Helmet and Lock
Suit Wrist Disconnects - Engage
Don EV Gloves and Lock
Secure Helmet Stowage Bag
SUIT CIRCUIT REG - CLOSED (PUSH)
EMER CAB PRESS - OFF
Check All PGA Connections - hose, wrist, helmet, zipper - and verify Locked, Check Zipper
Ingress LH Couch

PRESSURE INTEGRITY CHECK
DIRECT O2 - CLOSED (CW)
VERIFY SUIT PRESS - 4.8-5.2 PSIA
VERIFY O2 FLOW IND - 0.2-0.4 LB/HR
**CAUTION**

SUIT Test Should Remain in Press Until Suit Circuit Stabilized

---

**SUIT TEST - PRESS**

02 FLOW IND - 1.0 lb/hr (pegged)
VERIFY 02 FLOW HI LT - ON
VERIFY MASTER ALARM pb/lt (3) and tone - on, push
Verify Tone and LTS Off After Push

SUIT PRESS IND - 8.9-9.7 PSIA
PGA PRESS GAGE - 4.1-4.5 PSIG

When suit press stable:
- 02 DEMAND REG - OFF
- 02 FLOW IND - 0.2 lb/hr (pegged)
VERIFY 02 FLOW HI - OUT

Suit Press Ind Less Than 0.5 PSI/MIN
Press Decay
02 DEMAND REG - BOTH

---

**CAUTION**

If Repositioning of Suit Test vlv from Press is Req’d Prior to Suit Press Stabilization Perform the Following -
- 02 DEMAND REG - OFF
- AFTER 15 SEC, SUIT TEST - DEPRESS OR OFF
- When Suit Press Stabilized,
- 02 DEMAND REG - BOTH

---

**SUIT TEST - DEPRESS**

02 FLOW IND - 0.2-0.4 lb/hr
SUIT PRESS ind - GREATER THAN CABIN PRESS ind
SUIT TEST - OFF
CABIN DEPRESS
Confirm Go For Cabin Depress with MSFN and CDR

Proceed with the Following Procedure at T-(TBD) Minutes from Scheduled Cabin Depress
CABIN FAN (2) - OFF
02 PLSS VLV - OFF
VERIFY CABIN PRESS REL (2) - NORMAL (safety latch on)
Move to Side Hatch
Hatch Counterbalance - vented
Adjust RH Strut Mirror to Read Cabin Press
SIDE HATCH DUMP - OPEN

NOTE - 02 Flow HI Warning Light May Come on Prior to Cabin Press Reg Lock-Up

CABIN PRESS - 3.25 psia
SIDE HATCH DUMP - CLOSE
VERIFY 02 FLOW IND APPROX 0.24 lb/hr
VERIFY CABIN PRESS IND 3.25 psia
VERIFY CM SUIT CKT PRESS - 3.5-4.0 psia
SIDE HATCH DUMP - OPEN
CABIN PRESS IND - 0.0 PSIA

HATCH OPENING
SHEAR PIN RELEASE KNOB - UNLOCK (down)
Verify Shear Pin Indicator (red) extended
GEAR BOX sel - UNLATCH
BPC JETT - FLIGHT (CCW)
PUMP HANDLE SEL - U
Unstow Pump Handle
Unlock Hatch
Verify Hatch Unlocked
PUMP HANDLE SEL - L
GEAR BOX sel - LATCH
Stow Pump Handle
Open Hatch to Full Open Position
Ingress LH Couch
LMP CHECKLIST
SECTION 1. LMP INSERTION ACTIVITIES

1 ECS MONITORING CHECK
SUIT CAB ΔP ind - -1.0 to -3.5 in. H2O
O2 FLOW ind - 0.2-0.45 lb/hr
O2 PRESS IND sw - SURGE TANK
CRYO TK 1 O2 PRESS ind - 865-935 psia
O2 PRESS IND sw - TANK 1
REPRESS O2 >865 psia
ECS RAD tb - gray
ECS IND sel - PRIM
ECS RAD PRIM IN TEMP ind - 65-105°F
ECS RAD PRIM OUT TEMP ind -
-20 to +102°F
GLY EVAP PRIM OUT TEMP ind - 40-50.5°F
GLY EVAP PRIM STM PRESS ind -
0.10-0.15 psia (when boiling)
>0.16 psia (not boiling)
GLY DISCH PRIM PRESS ind - 40.52 psig
SUIT TEMP ind - 45-55°F
CAB TEMP ind - 70-80°F
CAB AUTO TEMP tw - INC/DEC as desired
SUIT PRESS ind - 4.7-5.3 psia
CAB PRESS ind - 4.8-5.2 psia
PART CO2 PRESS ind - <7.6 mm Hg
SUIT COMPR ΔP ind - 0.3-0.4 psia
ACCUM PRIM QTY ind - 30.70%
If quantity <30%
PRIM ACCUM FILL vlv - ON until 40-70%
POT H2O QTY - 10-100%
WASTE H2O QTY - 20-85 (>85%, dump)

3 EPS MON CHECKS

FC POWER PLANT CHECK
FC HTRS (all) - on (up)
FC REACS tb (all) - gray
FC IND sel - 1, 2, 3
FC H2 FLOW - 0.03-0.15 lb/hr
FC O2 FLOW - 0.25-1.2 lb/hr
FC MOD SKIN TEMP ind - 390-450°F
LMP
1-2

FC MOD COND EXH TEMP ind - 150-175°F
FC PH HI tb - gray
FC RAD TEMP LO tb - gray

DC VOLTAGE-AMPERAGE CHECK
MN BUS TIE (2) - OFF
FC MNA tb - 1 & 2 gray, 3 bp
FC MNB tb - 1 bp, 2 & 3 gray
FC 1, 2, & 3 (RECORD AMPS)
MAIN BUS A, B, (26.5-31 vdc-Record)
BAT BUS A, B, & BAT C (34-38 vdc <3 amp)
PYRO BAT A, B (37 VDC)
DC IND sel - MNA
SYS TEST 4B (BAT RLY BUS - 3.7-4.1 vdc)

A-C VOLTS - 113-117 ALL PHASES

4 PREPARE CAMERAS
HASSEL
16mm SEQ
CRO AOS
(____:____:____)

5 BACKUP COMM CHECK (CRO)
S-BD XPNDR - OFF (4 sec) - PRI
S-BD AUX TAPE - TAPE
PWR PMP - AUX
INITIAL CONTACT ON VHF A
S-BD VOL - UP
RECEIVE GO FOR COMM CHECK ON S-BD
S-BD NORMAL MODE - PCM
RECEIVE GO FOR BU VOICE CHECK
S-BD AUX TAPE - DB VOICE BU
PWR PMP - NORM
VOICE CHECK WITH MCCH
S-BD VOL - down
S-BD AUX TAPE - OFF

6 PHOTO R/H RENDZ WINDOW
(add procedures)
7 C&W Operational Check
- C/W LAMP TEST - 1 (LH MA & 16 lts)
- C/W LAMP TEST - 2 (RH MA & 23 lts)
- C/W LAMP TEST - off (center)
- C/W CSM - CM (CM RCS lt (2) - on)
- C/W CSM - CSM (CM RCS lt (2) - out)
- C/W PWR - OFF (C/W lt - on)

8 SPS MONITORING CHECK
- SPS PRPLNT TK TEMP ind - +55 to +75°F
  If <45°F, SPS LINE HTRS - A
  If >75°F, SPS LINE HTRS - OFF
- SPS PRESS IND sw - He, N2A, and N2B
- SPS PRPLNT TK PRESS ind
  He 3900 psia max
  N2A 2900 psia max
  N2B 2900 psia max
- SPS PRESS IND sw - He
- FUEL PRESS ind - 170-195 psia
- OXID PRESS ind - 170-195 psia
- SPS ENG INJ VLV ind (4) - CLOSE
- SPS QTY % OXID ind - record
- SPS QTY % FUEL ind - record
- SPS QTY OXID UNBAL ind - record
- OXID FLOW VLV PRIM - PRIM
- SPS He vlv (2) - AUTO (tb - bp)
SECTION 2. SYSTEMS MANAGEMENT

PROPULSION SYSTEM

1

SPS MONITORING CHECK

SPS PRPLNT TK TEMP - 55° to +75° F
SPS PRPLNT TK PRESS: He - 3900 psia max.
N2A & B - 2900 psia max.

SPS PRESS IND sw - He
FUEL PRESS - 170-195 psia
OXID PRESS - 170-195 psia
SPS ENG INJ VLVS (4) - CLOSE
SPS OX, FUEL & UNBAL QTY - record
OXID FLOW VLV - PRIM
SPS He VLV (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 - 105°-195° F
He PRESS - record
MANF PRESS - 178-192 psia
He TK TEMP - record
PRPLNT QTY - record
When MANIF PRESS < 150 psia
RCS SEC PRPLNT A (B, C, D) - OPEN

3

CM RCS MONITORING CHECK

CM RCS PRPLNT tb (2) - bp
RCS IND sw - CM 1,2
He TEMP - 60-90°F
He PRESS - 4000-4450 psia
MANIF PRESS - 25-125 psia
(287-302 after activation)
CM RCS HTRS - OFF (on 20 min prior to sep)
1. EPS SYSTEM

- Cryogenic Pressure - Quantity Check
  - H2 PRESS (2) - 225-260 psia
  - O2 PRESS (2) - 865-935 psia
  - SURGE TK PRESS - 865-935 psia
  - H2 QTY (2) - record
  - O2 QTY (2) - record
  - Fans and Heaters as required

2. FC Power Plant Check

- FC HTRS (3) - on (up)
- 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 - 390-450° 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
- FC MNA tb - 1 & 2 gray, 3 bp
- FC MNB tb - 1 BP, 2 & 3 gray
- FC 1, 2, & 3 (RECORD AMPS)
- MAIN BUS A, B, (26.5-31 vdc-Record)
- BAT BUS A, B, & BAT C (34-38 vdc < 3 amp)

**CAUTION**

Leave DC IND sw in PYRO position only long enough to check voltage or pyro battery will be depleted.

- PYRO BAT A, B (37 VDC)
- DC IND sel - MNA
- SYS TEST 4B (BAT RLY BUS - 3.7-4.1 vdc)

4. A-C VOLTS - 113 - 117 all phases
5 Battery Charging
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
CB BAT RLY BUS BAT A(B) - open
DC IND sel - BAT CHARGER
BAT CHARGE - A(B,C)
  DC VOLTS - 37.5-40 vdc
  DC AMPS - ~ .6 amps
BAT CHARGE - OFF at 0.4 amps
CB BAT RLY BUS BAT A(B) - closed
DC IND sel - MNA
SYS TEST 4A (BAT VENT < 1.5)
  *If >1.5: BAT VENT vlv -*
  *VENT (5 sec) then CLOSED*

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-02 Flow incr 0.6 lb/hr
      (may exceed C/W limit)
   FC PURGE - 1(2,3) - OFF

B. H2 PURGING
   H2 PURGE LINE HTR - ON, 20 min
   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/Reset
   FC PURGE - 1(2,3) - OFF
   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)
CB FC REACS - close
CB FC PURGE - open
FC REAC - OFF
FC HTRS - OFF
FC PUMPS - OFF
CB FC PUMPS AC - open
(IF FC 1 or 3, FC PUMPS sw - ON)

AT Tskin ≤ 200° F
H2 PURGE LINE HTR - ON (for 30 min)
CB FC PURGE - close
FC PURGE - O2 (TIL O2 PRESS = N2 PRESS)
FC PURGE - H2 (TIL PRESS STABILIZES)
FC PURGE - OFF
H2 PURGE LINE HTR - OFF
CB FC PURGE - open

9 FUEL CELL SWITCHING
PRIOR TO DISCONNECTING, INSURE THAT AT LEAST ONE FUEL CELL IS POWERING EACH MAIN BUS.

10 CRYO O2 & H2 MANUAL FAN OPERATION
H2 & O2 FANS - ON (seq for 1 min each)
   a. Prior to every SPS or SIVB ΔV
   b. If quantity = 80-100%, every 4 hrs
   c. If quantity = 50-80%, every 8 hrs
   d. If quantity < 50%, no cycling

CAUTION
If CRYO PRESS lt on, do not turn off fan until lt ex­
tinguishes.

ECS SYSTEM
1 ECS MONITORING CHECK
   ECS IND sel - PRIM
   ECS RAD tb - gray
   ECS RAD TEMP PRIM IN - 67-97°F
   ECS RAD TEMP PRIM OUT - -20° to + 63°F
   O2 SURGE TANK PRESS - 865-935 psia
   REPRESS O2 > 865
   GLY EVAP PRIM TEMP OUT - 40-50.5°F
   GLY EVAP PRIM STEAM PRESS
     .1-.15 boiling
     >.16 not boiling
   GLY DISCH PRIM PRESS - 40-52 psig
SUIT TEMP - 45-55°F
CABIN TEMP - 70-80°F
SUIT PRESS/CABIN PRESS - 4.7-5.3 psia
PART PRESS CO2 < 7.6 mm Hg
SUIT COMP ΔP - 0.3-0.4 psid
GLY ACCUM PRIM QTY 30-70% (fill if < 30%)
POT H2O QTY - 10-100%
WASTE H2O QTY - 25-85% (if > 85%, dump)
CABIN ΔP - -1 to -3.5 in H2O
O2 FLOW - 0.3-0.45 lb/hr

**ECS Redundant Component Check**

ECS INDS sel - PRIM
SUIT COMPR (2) - redundant compr
SUIT COMPR ΔP - 0.3-0.4 psid
SUIT COMPR (2) - Reselect Pri Compr
O2 DEMAND REG vlv - 1
CLOSE BLEED PORT (O2 FLOW GOES HI)
O2 DEMAND REG vlv - 2
CLOSE BLEED PORT (O2 FLOW GOES HI)
O2 DEMAND REG vlv - BOTH
MAIN REG B vlv - close
EMER CABIN PRESS vlv - 1
PUSH TO TEST pb - push (O2 FLOW INC)
O2 press - 90-110 psig (from MSFN)
MAIN REG B vlv - open
MAIN REG A vlv - close
EMER CABIN PRESS vlv - 2
PUSH TO TEST pb - push (O2 FLOW INC)
O2 press - 90-110 psig (from MSFN)
MAIN REG A vlv - open
EMER CABIN PRESS vlv - BOTH (OFF if all suited)
SUIT CKT H2O ACCUM AUTO - MAN
SUIT CKT H2O ACCUM ON - Redund Accum
MONITOR O2 FLOW FOR CYCLIC ACCUM STROKING
SUIT CKT H2O ACCUM AUTO - PRIM ACCUM
Open coolant attenuation panel
EVAP WATER CONT SEC vlv - AUTO
ECS IND sel - SEC
GLY EVAP STEAM PRESS - MAN
GLY EVAP STEAM PRESS - INCR for 1 min
GLYCOL TO RAD SEC - NORMAL
ECS RAD HTR PRIM - off (center)
ECS GLY PUMPS - OFF
SEC COOL LOOP PUMP - AC 1
  GLY DISCH SEC PRESS - 39-51 psig
  GLY ACCUM SEC QTY - 30-55%
SEC COOL LOOP EVAP - EVAP
ECS RAD HTR - SEC (CK amp inc)
GLY EVAP STEAM PRESS .1-.15 boiling
  7.16 not boiling
After 20-30 minutes:
  ECS RAD TEMP SEC IN - 60-97°F
  ECS RAD TEMP SEC OUT - 40-63°F
  GLY EVAP SEC TEMP OUT - 40-50.5°F
SEC COOL LOOP PUMP - AC 2
  GLY DISCH SEC PRESS - 39-51 psig
SEC COOL LOOP - RESET for 1 min, THEN OFF
ECS RAD HTR SEC - OFF
GLYCOL TO RAD SEC - BYPASS
SEC COOL LOOP PUMP - off (center)
ECS IND sw - PRIM
GLY EVAP STEAM PRESS - AUTO
ECS GLY PUMPS - redundant pump
  GLY DISCH PRIM PRESS - 40-52 psig
  GLY ACCUM PRIM QTY - 30-70%
ECS RAD HTR - redundant PRIM heater
EVAP WATER CONT SEC vlv - OFF
Close coolant attenuation panel - Install strut

CO2 ABSORBER FILTER REPLACEMENT

CAUTION

Connect ground wire when removing or replacing filter from canister or stowage.

Obtain unused filter
Open CO2 Canister Attenuation Panel
CO2 Cstr Divert vlv - A (or B)
CAUTION
Apply pressure to latching handle to allow pressure interlock pin to withdraw otherwise latching handle may not disengage

Canister Manual Bleed valve - Press
Cover latching handle - Unlock
Replace used filter
Cover latching handle - Lock
CO2 Cstr Divert valve - Both (Ctr)
Close CO2 Cstr Attenuation Panel
Stow used Filter & Excess Shims

4 GLYCOL ACCUMULATOR REFILL (IF<30%)
PRIM ACCUM FILL valve - ON
GLY ACCUM PRIM QTY - 40-70%
PRIM ACCUM FILL valve - OFF
IF OVER FILL
GLYCOL RESVR INLET - OPEN (MOMEN)

5 DEBRIS SCREEN CHECK
Check cabin ht exch inlet screen
Check SUIT RET AIR valve screen
   CABIN FANS (2) - OFF
   SUIT RET AIR valve - CLOSE (push)
Clean screens
   SUIT RET AIR valve - OPEN (pull)
   CABIN FANS (2) - on (up)

6 O2 STORAGE REFILL PROCEDURE
O2 REPRESS PRESS - <865 psia
O2 PLSS valve - FILL
O2 REPRESS PRESS - >865 psia
O2 PLSS valve - OFF

7 DOFFING PGA
EMER CABIN PRESS valve - BOTH
SUIT RET AIR valve - OPEN (pull)
Install hose screen on return hose
PWR - OFF
SUIT PWR - OFF for disconnect
PWR - OFF
SUIT FLOW vlv - CABIN FLOW (for unsuited crewman)
    (FULL FLOW for 3 unsuited)

8 DONNING PGA
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
AUIT FLOW vlv - SUIT FULL FLOW (for suited crewman)
SUIT RET AIR vlv - CLOSED (push)
EMERG CABIN PRESS vlv - OFF (if all suited)

9 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

10 URINE DUMP MODES
A PGA Urine Coll Bag - dump
    Connect Urine transfer hose & filter to urine feces QD.
    Connect urine transfer hose to thigh QD
WASTE MGT DRAIN vlv - DUMP
Disconnect urine transfer hose from PGA
LMP
2-9

Replace cap on PGA
Purge dump line 30 sec
WASTE MGT OVBD DRAIN vlv - CLOSED
Disconnect hose & stow - clean up

D UTS (Collection)
Obtain UTS & verify vlv - Closed
Attach UTS - open vlv - Perform task
UTS vlv - Closed & disconnect UTS
Clean up
UTS - stow (temp)

C UTS (Dump)
Connect UT hose/filter to urine/
feces QD
Attach UTS to hose
WASTE MGT OVBD DRAIN vlv - DUMP-complete-
Purge lines for 30 sec
WASTE MGT OVBD DRAIN vlv - CLOSED
Stow UTS & Hose

11 CABIN PRESSURIZATION
(NORMAL - 30 min)
CAB PRESS REL vlv (2) - NORMAL (latch on)
MONITOR SURGE TANK PRESS
PLSS vlv - FILL
REPRESS O2 vlv - OPEN
AT 150 psia ON SURGE TANK:
PLSS vlv - OFF
CABIN REPRESS vlv - ADJUST TO 150 psia on
SURGE TANK

AT ZERO psia on EMERG O2 GAUGE:
REPRESS O2 vlv - CLOSE
CAB REPRESS vlv - OPEN (CW)
WHEN CABIN PRESS > 4.7
CAB REPRESS - CLOSE (CW)
CAB FAN (2) - ON
O2 PRESS ind - TANK 1

(ALTERNATE - 52 min)
CAB PRESS REL vlv (2) - NORMAL (Safety latch off)
EMER CAB PRESS vlv - BOTH
CAB REPRESS vlv - OPEN (CW)
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
- WHEN CAB PRESS > 14.7
  CAB REPRESS vlv - CLOSE (CCW)
  CAB FAN (2) - ON
02 PRESS IND - TANK 1

12 SUIT CKT INTEGRITY CHECK
DIRECT 02 vlv - CLOSE (CW)
SUIT PRESS - 4.7-5.3 psia
02 FLOW - 0.2-0.4 lb/hr
SUIT TEST vlv - PRESS
  02 FLOW - 1.0 lb/hr (pegged)
  02 FLOW HI lt - on
  M/A - on, Reset
SUIT PRESS - 8.8-9.8 psia
PGA PRESS (3) - 4.1-4.5 psig
02 DEMAND REG vlv - OFF
  02 FLOW - 0.2 lb/hr (pegged)
  02 FLOW HI lt - out
  PGA PRESS (3) - < 0.5 psi/min decay
02 DEMAND REG vlv - Both (02 flow inc)
SUIT TEST vlv - DEPRESS
  02 FLOW - 0.2-0.4 lb/hr
  SUIT PRESS - slightly > CAB PRESS
SUIT TEST vlv - OFF

13 PGA INTEGRITY CHECK
DIRECT 02 vlv - CLOSE (CW)
SUIT PRESS - 4.7-5.3 psia
02 FLOW - 0.2-0.4 lb/hr
SUIT TEST vlv - PRESS
  02 FLOW - 1.0 lb/hr (pegged)
  02 FLOW HI lt - ON
  M/A - ON, Reset
SUIT PRESS - 8.8-9.8 psia
PGA PRESS (3) - 4.1-4.5 psig
SUIT FLOW vlv - OFF
LMP 2-11

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

14 CM PRESSURE DUMP
EMER CABIN PRESS vlv - OFF (verify)
CAB REPRESS vlv - OFF (verify)
SUIT RTN AIR vlv - CLOSED (verify)
CABIN FANS (2) - OFF
DIR 02 vlv - CLOSE (CW)
CAB PRESS REL vlv (RH) - DUMP
CABIN PRESS - 3.0-3.25 psia
  CAB PRESS REL vlv (RH) - BOOST ENTRY
  02 FLOW ->0.2 lb/hr
SUIT PRESS - 3.5-4.0 psia
CAB PRESS REL vlv (RH) - DUMP
  CABIN PRESS - 0.0 psia
CAB PRESS REL vlv (2) - NORMAL (latch on)

15 SUIT CKT H2 PURGE
DIRECT 02 vlv - OPEN (CCW) for 1 min
  02 FLOW - 1.0 lb/hr (pegged)
  02 FLOW HI lt - on
MASTER ALARM pb/lt (3) - on, push
DIRECT 02 vlv- close (CW)
  02 FLOW - 0.2 lb/hr

16 CABIN COLD SOAK
ACTIVATE
SUIT HT EXCH SEC GLY vlv - FLOW
EVAP H2O CONT SEC vlv - AUTO
GLY TO RAD SEC vlv - BYPASS
CAB TEMP - MAN
PRIM CAB TEMP vlv - C (CW)
SEC CAB TEMP vlv - OFF (CCW)
SUIT CKT HT EXCH - BYPASS (20sec), Then OFF
ECS IND sel - SEC
SEC COOL LOOP PUMP - AC1
GLY DISCH SEC PRESS - 39-51 psig
SEC ACCUM QTY - 30-70%
SEC COOL LOOP EVAP - EVAP
SEC GLY EVAP OUT TEMP - 40-50.5°F
SEC GLY EVAP STM PRESS - 0.1-0.15 psia
ECS IND - PRIM
PRIM ECS RAD OUT TEMP - ≥-20°F
*IF<-20°F, deactivate*

DEACTIVATE
SEC CAB TEMP vlv - COOL MAX (CW)
CAB TEMP - AUTO
SUIT CKT HT EXCH - ON (20 sec), then OFF
SEC COOL LOOP EVAP - RESET for 1 min, then OFF
SEC COOL LOOP PUMP - OFF
GLY TO RAD SEC vlv - NORMAL
EVAP H2O CONT SEC vlv - OFF

POTABLE WATER CHLORINATION
Unstow chlorination unit
Remove chlor part cap
Attach needle assembly to injection port
Insert chlorine ampoule into casing
Connect knob assembly & rotate until piston contacts ampoule
Install ampoule assembly on needle assembly (push & turn CW)
Rotate knob (CW) until ampoule is empty (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 H2O - open
Wait 10 min
Remove an ampoule of H2O
Replace chlor port cap
Stow chlorination unit
Don't drink for 30 min
18 WASTE WATER TANK DRAIN
Used as req to maintain water level between 25 & 85%
Attach Urine Transfer Hose/Filter to Urine/Feces QD
Install Female QD on Waste Water Panel
Attach Free-end of Urine Transfer Hose to QD on Waste Water Panel

WASTE MGT DRAIN vlv - DUMP
Open waste tank servicing vlv
Monitor waste tank decreasing
Monitor potable tank quantity stable
At approximately 25% waste H2O - close waste tank svc vlv
Detach UT hose at Waste Tank QD
Install UTS on UT hose
UTS vlv - open - purge 30 sec - then closed
OVDB DRAIN vlv - CLOSE
Detach UTS & UTS & UT hose & stow

19 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
Connect cable to heater connector (optional)
Util Pwr - off
Connect cable to outlet
Util Pwr - on (wait 1 hr before dumping)
Connect Urine Dump Hose to Dump Nozzle QD
Connect other end of UT hose to UTS/
Waste Servicing Tank (as req)
Dump Waste Water/Urine
Disconnect UT hose from UTS/Waste Servicing Tank and Purge
Disconnect UT Hose from Dump Nozzle & stow
Util Pwr - off
Disconnect Cable from heater & outlet & stow
Install plug & dump nozzle connector
20 WATER COLLECTION
Connect urine transfer hose-filter to urine/feces QD.

Connect cabin purge QD to urine transfer hose

WASTE MGMT DRAIN vlv - DUMP
Collect water
After collection is complete
Purge for 30 secs
WASTE MGMT DRAIN vlv - CLOSE

C/W SYSTEM

A C/W SYSTEM OPERATIONAL CHECK
C/W LAMP TEST - 1 (LH MA & 16 lts)
C/W LAMP TEST - 2 (RH MA & 23 lts)
C/W CSM - CM (CM RCS lt (2) - on)
C/W CSM - CSM (CM RCS lt (2) - out)
C/W PWR - OFF (C/W lt - on)

TELECOMM SYSTEM

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 START S-BAND ANTENNA 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 OMNI - 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

CAUTION

HI-GAIN ANT TRACK-MAN when omni antenna operation is selected to prevent damage to the HGA due to jitter.
<table>
<thead>
<tr>
<th>Systems Test Meter Display</th>
<th>$N_2$, $O_2$, $H_2$ Pressure (PSIA)</th>
<th>EPS Radiator Outlet Temperature ($^\circ$F)</th>
<th>CM-RCS Oxidizer Valve Temperature ($^\circ$F)</th>
<th>LM Power (Amps)</th>
<th>SPS Temperature ($^\circ$F)</th>
<th>Battery Manifold Pressure (PSIA)</th>
<th>Battery Relay Bus (VDC)</th>
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**CM W EQUIP STOWAGE**

A1
Container A1-1
Penlights-5
Helmet stowage bag-3
Accessory bag-3
Utility towel assy. (RWB)-1 ea.
Thermal sample kit (bag & tether)-1
WMS/QD press. cap-2
Snag line w/cont.-1
Temporary stowage cont.-3
Suit exhaust hoses caps/screens w/cont.-3
PLV duct w/cont.-1
PGA O2 intercon. coupling assy w/cont.-1
WMS coupling assy-1
Sea water pump w/cont.-1
WMS power cable-1
Inflight retainer strap-1
WMS water panel QD-1

A3
Container A3-1
CO2 absorber & shims-4

A4
Container A4-1
CO2 absorber & shims-4

A5
Container A5-1
EV gloves-1 pr.
Headrest pads-3
Heel restraints-3 pr.
Remote control cable (LM)-1
Sleep restraint rope-5

A6
Container A6-1
CO2 absorber & shims-2
Optical range finder-1

A7
Container A7-1
SWA Hasselblad-1
70mm film magazine-4
16mm film magazine-5

A8
Container A8-1
LCG-1
FCS-3
EMU maintenance kit-1
CG's (w/univ. ear tubes in pockets) 3 pr
PPK’s-3
CWG’s-5
Inflight exercisor-1
L/W headsets (w/earmolds inst.)-3
Tool kit assy-1
Electrical CWG adapter w/cont.-4
Optical range finder bracket-1

A9
Container A9-1
Food & hygiene-1

B2
Medical kit-1
Nasal emollient (in med. kit)-1

B3
Container B3-1
Cushion B3-1
Lens 18mm-1
Power cable-1
Spotmeter-1
70mm Hassel. w/80mm lens inst.-1
Ring sight-1
LMP/2-20

led filter-1
Hot air filter-2A-1
light angle mirror-1
5mm lens w/cover-2
6mm film magazine-1
5mm lens-1
6mm data acquisition camera-1
Inflight retainer strap-1

B4
container B4-1
chlorination ampules-3
buffer ampules-3
chlorination needle-1
chlorination syringe casing-1
chlorination syringe knob-1
chlorination equip. cont.-1

B5
container B5-1
O2 absorber & shims-4

B6
container B6-1
O2 absorber & shims-4

B7
chlorination ampules-3
buffer ampules-3
chlorination ampules cont.-1

B8
Cushion B8-1
power cable-1
6mm data acquisition camera-1
6mm film magazine-5
Inflight retainer strap-1

L2
Electrostatic ground cable-1
adapter tool E-1
CU control head w/cont.-1
CU spare cable-1
CU cable strap-1
Inflight retainer strap-1

L3
Good packages-1

R1
Light data file books-4
i&N handles-2
UA hi density sun filters(G&N)-2
issue dispenser-2

R2
Light data file books-8

R3
Light data file card kit-1
Light data file books-8
Light data file clips-6
Bloodlight glare shield-1
Meter cover-2

R4
Survival kits-2

R5
Gas & Liquid WMS Q.D. filt assy-2
Inflight retainer strap-4

R6
Cabin vent Q.D.-1
Chlorination ampules-4
Buffer ampules-3
Chlorination ampules cont.-1
Probe stowage strap-2
Inflight retainer strap-2

R8
Medical kit-1

R10
Fecal collection assy.-30
Sanitation supply box(aft)-1
Remote control cable(CM)-1
Data Acquisition camera bracket-1
EVA camera bracket-1
EVA camera equip.stowage box(fwd)-1

R11
Roll on cuffs (RWB)-1 pkg.ea.
UTS w/roll-ons-3
UTS spare w/roll-on-1

R12
Container R12-1
Flight data file books-4

R13
Tape-1 roll
Camera handle-2
2-speed interval timer-1
Thermal sample box-1
MDC sun shades (DSKY,EMCA & mission timer)-3

U3
Docking target adapter assy.-1
Data acquisition camera bracket-1
LM docking target-1
COAS Light bulb-2

U4
Container U4-1

MISC
Docking probe & fwd.hatch (in tunnel)-1
Fwd. hatch container (under L/H couch)-1
Radiation survey meter (G&N panel LEB)-1
H2O disp. (L/H FEB)-1
O2 mask & hose w/cont.(O2 repress.sys)-3
PQ bag w/UCTA clamps-3
Helmet shield-1
Couch restraint strap-3
O2 umb.clamp position lock (on umb.)-3
O2 umb. (lower MDC L/H FEB)-3
Urine hose assy w/cont.(aft blkhd under A6)-1
CCU control head (on CCU)-3
MDC guards w/cont.(LCR) (on side of A8)-1
Shades w/cont. (on UEB O2 repress.sys)-5
Fire extinguisher (on side of A3)-1
COAS w/bulb (above L/H window)-1
Sleep restraints(L&R) (aft UEB)-1 ea
CO2 absorber (in ECU)-2
Inflight retainer strap (on O2 cont)-3
Rotational contr. mount (LEB on side of A6)-1
Translational contr. mount (LEB on side of A3)-1
CCU cables (LC&R on lwr. MDC TUBER)
SECTION 3. FLIGHT EMERGENCY PROCEDURES

FIRE/SMOKE IN CM (CREW SUITED)

1. CAB FAN (2) - OFF

2. Monitor EPS for excessive current and remove power from affected bus

3. Verify suit compressor on good AC bus

4. Use fire extinguisher as appropriate

**FIRE IS OUT**

5. Remove smoke from cabin per "Contamination in CM" procedures before removing helmets

**FIRE PERSISTS - DUMP CABIN**

6. Verify:
   - SUIT CKT RET vlv - PUSH TO CLOSE
   - EMER CAB PRESS vlv - OFF
   - 02 PLSS vlv - OFF

7. Visually check suit integrity

8. CAB PRESS RELF (RH) - DUMP to 3.0 psia
   then to BOOST ENTRY
   REMARK: Provides controlled cabin dump until suit circuit pressure is verified

9. Verify Suit pressure 3.5 psia

10. CAB PRESS RELF (RH) - DUMP
    and/or Hatch Vent vlv - open

11. CAB PRESS ind 0.0 psia for 6 min
12 CAB PRESS RELF (RH) - NORMAL
13 Hatch Vent vlv - close
14 Do not repress cabin until fire source is removed

FIRE/SMOKE IN CM (CREW UNSUITED)

1 CAB FAN (2) - OFF
2 SUIT COMPR (2) - OFF
3 Monitor EPS for excessive current and remove power from affected bus
4 Don emergency O2 masks
5 Use fire extinguishers as appropriate

FIRE IS OUT

6 Remove smoke from cabin per "Contamination in CM" procedure before removing O2 masks

FIRE PERSISTS - DON SUITS and DUMP CABIN

7 Don PGA's except helmets and verify O2 connectors (Use O2 masks as long as possible)

FIRE PERSIST - DON SUITS and DUMP CABIN

3. FLIGHT EMERGENCY

8 DIRECT O2 vlv - OPEN (CCW)
   REMARK: Purges suit circuit of smoke and fumes

9 Don helmet

10 Suit flow vlv (3) - SUIT FULL FLOW

11 SUIT COMPR 1 (2) - AC1 (AC2)

12 DIRECT O2 vlv - CLOSE (CW)
13. **EMER CAB PRESS vlv - OFF**

14. Visually check suit integrity

15. **CAB PRESS RELF (RH) - DUMP to 3.0 psia**
   *then to BOOST/ENTRY*

16. Verify Suit pressure holding 3.5 psia

17. **CAB PRESS REL (RH) - DUMP**
   *and/or Hatch Vent vlv - open*

18. **CAB PRESS ind 0.0 psia for 6 min.**

19. **CAB PRESS RELF (RH) - NORMAL**

20. **Hatch Vent vlv - close**

21. Do not repress cabin until fire source is removed

**Contamination in CM**

1. **Don O2 masks and/or PGA's immediately**

2. **Evaluate contamination level (isolate & correct source of contamination if possible) and proceed with one of the following steps:**
   a. Retain O2 masks or remain in suit and accept contamination level in cabin.

   **CAUTION**
   
   *If in PGA's, adjust DIRECT O2 to maintain suit to cabin ΔP 0.38 psi.*

   b. Retain O2 masks and scrub cabin atmosphere through suit loop. If initially suited, establish partially suited or shirtsleeve configuration and don O2 masks.

   **CAUTION**
   
   *Change LiOH cartridges after scrub completed.*
c. Retain PGA's or don PGA's
Verify suit integrity (visually)
Perform Cabin Dump
Perform Cabin Repress

Contamination In Suit

1. SUIT COMPR 2 - AC1
2. SUIT COMPR 1 - OFF
3. DIRECT O2 vlv - OPEN (CCW) for 1 minute then close (CW)
   
   If condition persists:
4. SUIT COMPR 2 - OFF
5. DIRECT O2 vlv - OFF
6. Doff helmet
7. Don emergency O2 masks
SC CONT-SCS, If out in 5 sec, check 2; if not: 1

1. Input Channel Check:
   CMC Fail input if: V11 N10E 33E=R1: 0,1,4,5

2. CMC Self Check, Scaler Fail Check, Counter Check.

SC CONT-SCS, G&N PWR - AC1
Both Lamps on: G&N PWR OFF, check V5N9
One lamp: V35 for lamp test

RSET, If V11N10E, 30E, R1A=0,1,2,3: Temp in limits
If not, 15 min available.

If: V5N9=121, RSET, REMARK; or RSET

FUEL/OX ΔP <20: Hi: He vlv-off, Lo: He vlv-on
>20: Noncritical burn: ΔV THRUST OFF

Non Critical Burn - ΔV THRUST-OFF
Non Burn: heat soak back.

He 1 & 2-CLOSE; PKG TEMP<70 : Isolate Quad
>70 : Htrs Off

MANF PRESS <260, He PRESS Low: CM RCS PRPLNT-OFF

Any Lo: Fans and HTRS-ON
Both Hi: Fans and HTRS-OFF

Skin Temp>450 : HTRS Off, Check VI Perf.
<360 : Check VI Perf.
Con Ex Temp>175 : if>200 Open CKT, Check RAD OUT TEMPS
<150 : check CB FC PUMPS AC,
Check Tskin Hi
Rad Temp Lo : Check TCE, RAD OUT TEMPS
Ph Hi : If current < 5 amps, shut-
down: PUMPS-OFF
POTABLE TANK INLET VLV-CLOSE

\[
\begin{align*}
\text{FC O2 (H2)} & : 0.8(0.1) \quad \text{If current} < (8)(H2): \text{Cycle Purge} \\
\text{FLOW Hi} & : 0.2 < (8)(H2): \text{Check amps vs. flow}
\end{align*}
\]

FC O2 (H2) : 0.3(0.04) Check VI perf., REG PRESS
FLOW Lo

AC BUS 1 RSET: <98: Replace Inv.
>128: Replace Inv.
NORM: EPS Sensor Unit Out, RESET to OFF

AC BUS + MAN BUS 
UNDER

UNDER 
DC Volts < 26, AMPS Hi:
Replace Inv.

BUS B UNDER + BUS A UNDER + FC 3 + FC 2

FC 2 and 3 OFF MNB, Check Volts,
Isolate Bus A
(FC 2 TB on good bus. FC 2 lite
on bad bus)

AC BUS + MAIN BUS + AC BUS 
UNDER

UNDER

OVERLOAD

Disconnect Inverter, Connect 2nd
Inverter - if still have
OVERLOAD - Disconnect 2nd inverter

MAIN BUS UNDER

Volts < 26, AMPS Hi: Replace Inv.

INV TEMP Hi
Check Gly Out Temp, AC volts

FC BUS 1 or 3: Connect 1 to B, 3 to A
DISCONNECT 2 : Attempt Reconnect
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<th>Action</th>
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<td>O2 FLOW Hi</td>
<td>Indicator, Cabin Press, Surge OK: Waste Mgt Valve Cabin Press Rel; Direct O2; Demand Reg; Repress O2; Emerg. Reg; H2O/Gly Tank Reg.</td>
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<td>SUIT COMPRESSOR</td>
<td>ΔP &lt; .22, other comp to other bus</td>
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<td>CO2 PP Hi</td>
<td>&gt; 7.6mm: Direct O2 10 sec.</td>
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<td>Prim Rad Out T &lt; -30: Redud. RAD PRIM HTR, Redun. FLOW CONT</td>
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<td>GLY EVAP TEMP Hi</td>
<td>&gt;60° Actuate Secondary Loop</td>
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<td><strong>PGA</strong></td>
<td></td>
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<tr>
<td><strong>PCM</strong></td>
<td></td>
</tr>
</tbody>
</table>
BUS LOSS RECONFIGURATION CONT'D

II. To remove pwr from MN A (B)
   A. FC 1, 2, 3 to MN A (B) - Off
   B. 1) Main Bus Tie A/C (B/C) - Off
      or
      2) cb MN A (B) Bat Bus A (B) - Open
         cb MN A (B) Bat C - Open

III. To isolate Bat Bus A (B)
   A. cb MN A (B) Bat Bus A (B) - Open
   B. cb Bat A (B) Pwr Entry/Post LDG - Open
   C. cb Bat C to Bat Bus A (B) - Open

IV. SPS burn reconfiguration after loss of MN A (B)
   A. FC 2 to MN B (A)
   B. TVC GMBL DR - 2 (1)
   C. SPS P&Y Gimbal Motors 2 (1) (pull SPS Gimbal Mtr Control cb (4))
   D. FDAI Select 2 (1)
   E. BMAG Mode Rate 2 (1)

V. Reconfiguration for SPS burn following loss of Bat Bus A (B)
   A. Main Bus Ties A/C & B/C - Off
   B. TVC Gimbal Drive P&Y - 2 (1)
   C. SPS Gimbal Motors P&Y 2 (1) - Start (4 SPS Gimbal Mtr Control cb - OPEN)

VI. For loss of AC 2 Ø A stay on G&N - not SCS TVC.

Loss of Two Fuel Cell Power Down

1. Power Down the Following:

   Panel 2
   O2 & H2 tank fans & Htrs (4) - off; cycle as required to maintain tank pressure 860 psia
Caution & Warning - ACK
Cabin Fans (2) - Off
Pot. H2O Heater - Off
High Gain Ant Power - On (up)
GLYCOL Evap Steam Press - Man
GLYCOL Evap Temp in - Man
GLYCOL Evap H2O Flow - Off

Panel 3
SPS Inline Heaters - off; cycle as required
Tape recorder - off
S-Band Normal Power Amp - off
Remaining Fuel Cell to Both Main Buses
Select single inverter operation

Panel 5
ECS Rad Htr ovld CB (2) - Open
Noness Bus - off

Panel 7
SCS Logic Power 2/3 - off
BMAG Power (2) - off *Note: If in Lunar Orbit*
   * place to warmup for IMU/GDC alignment. *
FDAI/GPI - off
SCS Electronics - off

Panel 8
Auto RCS Select (16) - off

Panel 226
Failed Fuel Cell Pump CB (2) - open

2. If SPS Burn Required

A. If in Lunar Orbit realign IMU/GDC per checklist and proceed with TTI=6 min., 5 min.
   and 2 min. in coasting flight configuration.

   NOTE: If optics is required for alignment and main bus voltage is 26.0 VDC perform the following.
1. If sufficient battery energy is available place battery with highest energy on both main buses.

2. If insufficient battery energy available perform:

   SM RCS heaters - off
   Glycol pump - off to be turned back on within 1 1/2 hours
   Suit compressor - off turned back on within 1 hour
   * Instrumentation ESS CB (2) - open, to be closed when batteries placed on line at TTI=6 min.
   Lights as required.

B. Coasting Flight

   TTI=2 hours SM RCS Quad heaters (4) - off
   IMU/G&N power up per checklist
   TTI=1 hour BMAG power (2) - warmup for IMU/GDC realignment
   TTI=6 minutes perform normal TTI=6 min. check except configure
   Bat A - Main A
   Bat B - Main B
   Bat C - Main A & B
   Dual Inverter Operation
   TTI=5 minutes perform normal TTI=5 min. check except noness bus - off
   TTI=2 minutes perform normal TTI=2 min. check except Flt Rec - off

C. After burn, reconfigure per power down list and SM RCS Quad heaters (4) - on up;
   instrumentation ESS CB (2) - closed; glycol pump-on; suit comp on, IMU/CMC & SCS power down.
3. If no SPS burn required (coasting phase)
   a. Power down IMU & CMC per checklist
   b. Power down SCS per checklist

4. MCC/RCS Maneuver

   TTI=2 hours  SM RCS heater (4) - off
                Power G&N, IMU, Optics up per
                checklist to perform IMU
                alignment

   TTI=1 hour  BMAG power (2) - warmup for
                IMU/GDC realignment proceed
                with normal burn preps

   TTI=5 min  Configure
                Bat A - Main A
                Bat B - Main B
                Dual Inverter Operation
                After Burn (If last MCC Normal
                EI - 2:45 hr)
                BMAG Power (2) - warmup
                SCS Logic Power 2/3 - off
                FDAI/GPI - off
                SCS Electronics - off
                SM RCS Heater (4) - on

   If not last MCC reconfiguration
   per power down list.

5. Star Sightings

   T-1:30 power up IMU, CMC and optics for sight-
   ing per checklist. After sighting power down
   CMC, optics and IMU, and repower following
   equipment if powered down.

   NOTE: If main bus voltage decreases 26.0
       VDC perform following:
       SM RCS heaters - off
       Cabin fan (2) - off
       Suit compressor - off to be
       powered up within 1 hour
       * Instrumentation ESS CB(2)-open
6. Entry Preps

a. If IMU/G&N left powered from last MCC at 7:00, power up SCS for IMU/GDC alignment and proceed with normal preps.

b. After Batts on line - Dual inverter Operation.

** NOTES: ** Crew Option

1. Attempt to maintain F/ skin temp 430 F by cycling loads.
2. Use Batt charger to recharge batts.

The following procedure will be used for the loss of 3 fuel cells while in earth orbit.

Loss of 3 fuel cells - perform the following:

1. Tie batteries to Main Bus A & B
   
   NOTE: PNL 275
   Main A/Bat C Close
   Main B/Bat C Close

2. Turn off cryo heaters and fans and fuel cell pumps.
   
   PNL 5
   FC pumps (all) OFF
   
   PNL 2
   H2/O2 fans(all) OFF
   H2/O2 heaters(all) OFF

3. SPS Burn - 4 hours 30 minutes
   Perform the following power down

   **POWER DOWN**

   Panel 2
   Caution/Warning   ACK
   Cabin Fans - Both   OFF
   SMRCS Heaters (A,B,C,D)   OFF-CENTER
   Pot. H2O Heater   OFF-CENTER
Panel 3

SPS Line Heaters OFF
Select Single Inverter Operation
Tape Recorder OFF/STOP
S-Band Normal Power Amp OFF

Panel 4

*Telecom - Group 1 OFF
*Telecom - Group 2 OFF

Panel 5

Guidance & Nav CB (ALL) Open

Panel 7

BMAG Power - Both OFF If time to go 1 hour
Logic Power 2/3 OFF

Panel 8

SCS Logic (CB23, 24, 62, 63) OPEN
SCS Channels (16) OFF

Panel 225

*Flt. Bus Both (CB3, CB4) OPEN

Panel 276

*Instrumentation Power Control OPEN
(CB1, 2, 3, 4)

Panel 6, 9, 10

Audio Centers As Required

*These will be cycled approximately 10% duty cycle over MSFN to provide Telemetry monitoring.

4. SPS Burn - 55 minutes
BMAG Warm Up

Panel 7

BMAG Power Both Warm Up
5. A. Logic & Pyro Arm  
   CMRCS Press  
B. Logic & Pyro Safed

6. SPS Burn - 15 minutes  
   Power up SCS for Auto SCS/SPS ΔV (deorbit)

7. SPS Burn - 5 minutes  
   Gimbal Motors On

8. SPS Burn - 15 seconds  
   4 Jet Ullage (+x)

9. to = SPS Ignition

10. to + 9 sec Gimbal Motors OFF

11. Logic and pyro armed

12. to + 5 minutes CM/SM SEP

Configure CMRCS Jet select for 1 ring operation

Emergency power down procedures (to be used only after energy sources lost and NO SHORT verification)

Reconfiguration per mission phase for main bus voltage 26.0 VDC. Power down equipment in sequence until bus voltage 26.5 VDC.

Launch

1. O2 heaters (both) - off
2. If GET 2 min. (EDS safe)  
   Main A Batt C CB close  
   Main B Batt C CB close
3. Power amp - off
4. FC pumps - off
5. Pot. H20 heater - off
6. H2 heater (both) - off
7. Cabin fans (both) - off
8. H2 fans (both) - off
9. O2 fans (both) - off
10. SPS line heaters - off  
   = 1.025 A/B = 2.05
11. Lights (as required)
12. Tape recorder Fwd/Rwd - off  
13. VHF/AM A - off  
14. *SEC gimbal motors off  
15. CMC standby per procedures  
   From operate to standby 2.0 amps  
16. G&N power - off  
17. IMU power down per procedures  
   From operate to standby 5.7 amps  
18. ECS glycol pumps (both) - off  2.77 for 1 pump  
19. ECS radiator cont/htr CB - open  
   2.69 for radiator prop Vlv contr. radiator  
   radiator Htr. contr.  
20. Power SCE - off  
21. Telecom group 1 & 2 - off  
   2.2 Pcm, Tm, S-Band Xmitter, Xponder  
22. Instrumentation ESS main A & B CB - open  
   5.538 amps  

* Crew Option  

SPS Burn  
1. O2 heater (both) - off  
2. Power main from Batt C  
   Main A Batt C CB - close  
   Main B Batt C CB - close  
3. ECS radiator heaters prim - off  
   sec - off  
4. All FC pumps - off  
5. SMRCS heaters A,B,C,D - off  2.86 per Quad  
7. Pot. H2O heater - off  
8. H2 heater (both) - off  
9. Cabin fans (both) - off  
10. H2 fans (both) - off  
11. O2 fans (both) - off  
12. SPS line heater - off  
   A=1.025 A/B=2.05  
13. Lights (as required)  
14. If unsuited  
   Suit compressor (both) - off  
15. Power Amp  
16. Tape recorder Fwd/Rwd - off  
17. SPS guaging - off
LMP
3-18

18. ECS glycol pumps (both) - off 2.77 for 1 pump
19. ECS radiator cont/htr CB (both) - open 2.69
20. Power SCE - off 0.65
21. Telecom group 1&2 - 2.2
22. Instrumentation ESS main A/B CB - open 5.538

ENTRY

1. Tape recorder Fwd/Rwd - off 1.82
2. Power amp - off 3.53
3. Potable H2O htr - off 1.6
4. Lights (as required) 1.94
5. Cabin fans (both) - off 8.4
   (0g') Increase as Press increase

5. If unsuited suit compressor (both) - off
6. Sec. coolant loop - reset
7. Sec. glycol pump - off 4.26
8. Pri. glycol pump (both) - off 2.27 per pump
9. ECS radiator cont/htr CB (Pnl 5) - open 2.35
10. Power SCE - off 0.65
11. Telecom group 1&2 - off 2.2
12. Instrumentation ESS main A/B CB - open 5.538

*NOTE:

After tracking update 0.05g Guidance & Navigation CB (10) - open
ENTRY OPERATIONS
SECTION 1. VEHICLE PREPARATION

INITIAL STOWAGE COMPLETED

CABIN COLD-SOAK OPERATION

Open coolant control attenuation panel
- SUIT HT EXCH SEC GLY vlv - FLOW
- EVAP H2O CONT SEC vlv - AUTO

Close coolant control attenuation panel
- GLY to RAD SEC vlv-BYPASS
- CAB TEMP - MAN
- PRIM CAB TEMP vlv - C (CW)
- SEC CAB TEMP vlv - OFF (CCW)
- SUIT CKT HEAT EXCH - BYPASS for 20 secs, then OFF
- ECS IND sel - SEC
- SEC COOL LOOP PUMP - AC 1
- GLY DISCH SEC PRESS ind - 39-51 psig
- ACCUM SEC QTY ind - 30-55%
- SEC COOL LOOP EVAP - EVAP
- GLY EVAP SEC OUT TEMP ind - 40-50.5°F
- GLY EVAP SEC STM PRESS ind - 0.10-0.15
- ECS IND sel - PRIM
- ECS RAD PRIM OUT TEMP ind - <20°F

If <20°F
- SEC COOL LOOP EVAP - RESET
  for 1 min, then off (center)
- SEC COOL LOOP PUMP - off (center)
- SUIT CKT HT EXCH - ON for 20 secs, then OFF

CSM GNCS STARTUP

G/N PWR - ACT
- PRO (STBY 1t - out)
- V37E OOE
- G/N IMU PWR - on (up) (NO ATT 1t - on (90 sec))
- V37 EXXE (20 sec after NO ATT 1t - out)

SCS POWER UP

- AUTO RCS SELECT (16) - OFF
- BMAG MODE (3) - RATE 2
- CMC MODE - FREE
- SC CONT - CMC
- CB SCS LOGIC PWR (4) - CLOSE
- ΔV CG - CSM
<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>P51</strong></td>
<td></td>
</tr>
<tr>
<td><strong>E</strong></td>
<td>1-2</td>
</tr>
<tr>
<td><strong>LOGIC PWR 2/3</strong></td>
<td>on (up)</td>
</tr>
<tr>
<td><strong>SIG COND/DRIVER BIAS PWR (2)</strong></td>
<td>AC1</td>
</tr>
<tr>
<td><strong>SCS ELEC PWR</strong></td>
<td>GDC/ECA</td>
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<tr>
<td><strong>FDAI PWR</strong></td>
<td>OFF</td>
</tr>
<tr>
<td><strong>BMAG PWR (2)</strong></td>
<td>ON</td>
</tr>
<tr>
<td><strong>FDAI PWR</strong></td>
<td>BOTH</td>
</tr>
<tr>
<td><strong>AUTO RCS SELECT (16)</strong></td>
<td>enable</td>
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<tr>
<td><strong>P51 - IMU ORIENTATION</strong></td>
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</tr>
<tr>
<td><strong>BMAG MODE (3)</strong></td>
<td>RATE 2</td>
</tr>
<tr>
<td><strong>G/N PWR OPTICS</strong></td>
<td>on</td>
</tr>
<tr>
<td><strong>OPT ZERO</strong></td>
<td>ZERO</td>
</tr>
<tr>
<td><strong>OPT MODE</strong></td>
<td>MAN</td>
</tr>
<tr>
<td>1</td>
<td>V37E 51E</td>
</tr>
<tr>
<td>F 50 25</td>
<td>00015 MNVR TO ACQ STARS</td>
</tr>
<tr>
<td></td>
<td>(Coarse Align IMU To 0,0,0) - ENTR to 2</td>
</tr>
<tr>
<td></td>
<td>(BYPASS) PRO to 3</td>
</tr>
<tr>
<td>2</td>
<td>41 22</td>
</tr>
<tr>
<td>DESIRED GIMBAL ANGLES</td>
<td>(0,0,0)</td>
</tr>
<tr>
<td>NO ATT lt</td>
<td>on then off, to 1</td>
</tr>
<tr>
<td>3</td>
<td>F 51</td>
</tr>
<tr>
<td>PLEASE MARK</td>
<td></td>
</tr>
<tr>
<td>OPT ZERO</td>
<td>OFF</td>
</tr>
<tr>
<td>MARK</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>F 50 25</td>
</tr>
<tr>
<td>00016 TERMINATE MARKS</td>
<td>PRO</td>
</tr>
<tr>
<td>5</td>
<td>F 01 71</td>
</tr>
<tr>
<td>000DE STAR CODE</td>
<td></td>
</tr>
<tr>
<td>Load desired code</td>
<td></td>
</tr>
<tr>
<td>PRO to 3 after 1st MARK</td>
<td>(to 6 if DE=00)</td>
</tr>
<tr>
<td>to 7 after 2nd MARK</td>
<td>(to 6 if DE=00)</td>
</tr>
<tr>
<td>6</td>
<td>F 06 88</td>
</tr>
<tr>
<td>CELESTIAL BODY VECTOR</td>
<td></td>
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<tr>
<td>Load desired vector</td>
<td></td>
</tr>
<tr>
<td>PRO to 3 after 1st MARK</td>
<td></td>
</tr>
<tr>
<td>to 7 after 2nd MARK</td>
<td></td>
</tr>
</tbody>
</table>
7  F 06 05  STAR ANGLE DIFFERENCE
(RECYCLE) V32E to 1
(ACCEPT) PRO

8  F 37  XXE-OPT ZERO - ZERO

MNVR to DEORBIT ATT (approx)
R=180°, P=180°, Y=0°

INITIAL VEHICLE PREPARATION

1  ECS CHECKS

A. 02 STORAGE REFILL (if necessary)
   02 PRESS IND sw - SURGE TANK
   02 PRESS - < 865 psia
   02 PLSS vlv - FILL
   02 PRESS - > 865 psia
   02 PLSS vlv - OFF

B. PGA VERIFICATION CHECK (5.0 psia CAB PRESS)
   (If suited)

   SUIT PRESS ind - 4.8-5.2 psia
   02 FLOW ind - 0.2-0.4 lb/hr
   SUIT TEST vlv - PRESS
   02 FLOW ind - > 1.0 lb/hr
   02 FLOW HI lt - on
   MASTER ALARM pb/lt (3) - on, push
   SUIT PRESS ind - 8.9-9.5 psia
   PGA press ind (3) - 4.1-4.5 psig
   02 DEMAND REG vlv - OFF
   02 FLOW ind - < 0.2 lb/hr
   02 FLOW HI lt - OFF
   PGA press ind (3) - 0.5 psi/min
   pressure decay
   02 DEMAND REG vlv - BOTH
   SUIT TEST vlv - DEPRESS
   02 FLOW ind - 0.2-0.4 lb/hr
   SUIT PRESS ind - slightly
   CAB PRESS ind
   SUIT TEST vlv - OFF
C. ECS MONITORING CHECK

SUIT CAB ΔP ind - -1.0 to -3.5 in. H2O
02 FLOW ind - 0.2-0.45 lb/hr
02 PRESS IND sw - SURGE TANK
CRYO TK 1 02 PRESS ind - 865-935 psia
02 PRESS IND sw - TANK 1
ECS RAD tb - gray
ECS IND sel - PRIM
ECS RAD PRIM IN TEMP ind 67-97°F
ECS RAD PRIM OUT TEMP ind -
-20 to +63°F
GLY EVAP PRIM OUT TEMP ind - 40-50.5°F
GLY EVAP PRIM STM PRESS ind -
0.10-0.15 psia (when boiling)
> 0.16 psia (not boiling)
GLY DISCH PRIM PRESS ind - 40-52 psig
SUIT TEMP ind - 45-55°F
CAB TEMP ind - 70-80°F
CAB AUTO TEMP tw - INC/DEC as desired
SUIT PRESS ind - CAB PRESS
CAB PRESS ind - 4.7-5.3 psia
PART CO2 PRESS ind - <7.6 mm Hg
SUIT COMPR ΔP ind - 0.3-0.4 psi
ACCUM PRIM QTY ind - 30-70%
If quantity <30%
PRIM ACCUM FILL vlv - ON until
40-70% is reached
POT H2O QTY - 10-100%
WASTE H2O QTY - 25-85% (If >85, dump)

EPS CHECKS

A. D-C VOLTAGE-AMPERAGE CHECK

MN BUS TIE (2) - OFF
FC MNA tb - 1 & 2 gray, 3 bp
FC MNB tb - 1 bp, 2 & 3 gray
FC 1, 2, & 3 (RECORD AMPS)
MAIN BUS A, B, (26.5-31 vdc-RECORD)
BAT BUS A, B, & BAT C (34-38 vdc < 3 amp)
PYRO BAT A, B (37 VDC)
DC IND sel - MNA
SYS TEST 4B (BAT RLY BUS - 3.7-4.1 vdc)
B  A-C VOLTS - 113 - 117 ALL PHASES

C  CRYO O2 & H2 MAN FAN OPERATION
   O2 & H2 FANS - ON (sequentially for one
   min each)

   CAUTION
   If CRYO PRESS It on, do not
   turn off fan until light ex-
   tinguishes.

3  SPS MONITORING CHECK
   SPS PRPLNT TK TEMP - +55° to +75°F
   SPS PRPLNT TK PRESS:
      He - 3900 psia max.
      N2A - 2900 psia max.
      N2B - 2900 psia max
   SPS PRESS IND sw - He
   FUEL PRESS - 170-195 psia
   OXID PRESS - 170-195 psia
   SPS ENG INJ VLVS (4) - CLOSE
   SPS OX & FUEL QTY - record
   SPS OXID QTY UNBAL - record
   OXID FLOW VLV - PRIM
   SPS He VLV (2) - AUTO (tb-bp)

4  RCS CHECKS
   A. SM RCS CK:
      SM RCS PRI & SEC PRPLNT tb (8) - gray
      SM RCS He 1 & 2 tb (8) - gray
      SM RCS SEC PRPLNT FUEL PRESS (4) - OPEN
      RCS IND sel - SM A, B, C, D
      PKG TEMP - 105-195°F
      He PRESS - record
      MANF PRESS - 178-192 psia
      He TK TEMP - record
      PRPLNT QTY - record
B. CM RCS CK:
CM RCS PRPLNT tb (2) - bp
RCS IND sw - CM 1,2
He TEMP - 60-90°F
He PRESS - 4000-4450 psia
MANIF PRESS - 25-105 psia

P52 IMU REALIGN

BMAG MODE (3) - RATE 2
G/N PWR OPTICS - on
CMC MODE - FREE
OPT ZERO - ZERO
OPT MODE - CMC

1 F 04 06 V37E 52E
   R1 00001 IMU ALIGN OPTION
   R2 00001 PREF PRO to 4
   2 NOM PRO to 2
   3 REFSMMAT PRO to 5
   4 LDG SITE PRO to 2

2 F 06 34 GET ALIGN (0,0, 0 initially) (hr,min,sec)
   Load desired GET
   TO SPECIFY PRESENT TIME - PRO on (0,0,0)
   PRO (NOM go to 4)

3 F 06 89 LAT, LONG/2, ALT (.001°, .001°, .01nm)
   Load ldg site coords
   PRO

4 F 06 22 NEW ICDU ANGLES OG, IG, MG (.01°)
   (IF MG>70°, MNVR) V32E - to 4
   PRO NO ATT'lt - on then off

5 F 50 25 00015 STAR SELECT
   (MNVR If Necessary)
   (PICAPAR) PRO
   *F 05 09 00405 NO PAIR *
   *(CREW SPECIFY) PRO to 6*
   *(PICAPAR) V32E to 5 *
(MAN ACQ) ENTR

6  F 01 70  OOODE STAR CODE
   Load desired code
   OPT MODE - CMC (verify)
   OPT ZERO - OFF
   PRO to 8 (to 7 if DE=00)
   *F 05 09 00404 (TA>90°)*
   *MNVR - PRO to 8 *

7  F 06 88  CELESTIAL BODY VECTOR
   Load desired vector
   PRO
   *F 05 09 00404 (TA>90°)*
   *MNVR - PRO to 8 *

8  06 92  SHAFT, TRUN
   (.01°, .001°)
   *PROG ALARM (TA>50°)*
   *V5N9E 00407 *
   *KEY RLE *
   *MNVR till R2+49775 *

(MARK ROUTINE) OPTICS MODE - MAN

9  F 51  PLEASE MARK
    MARK

10 F 50 25  00016 TERMINATE MARKS

11 F 01 71  OOODE STAR CODE
   Load code (if necessary)
   PRO to 6 after 1st MARK (to 12 if DE=00)
   to 13 after 2nd MARK (to 12 if DE=00)

12  F 06 88  CELESTIAL BODY VECTOR
   Load vector
   PRO to 6 after 1st MARK
   to 13 after 2nd MARK
13 F 06 05 STAR ANGLE DIFFERENCE (.01°)
(ACCEPT) Pro
14 F 06 93 TORQUING ANGLES OG, IG, MG (.001°)
(TORQUE) Pro (CMC - FREE)
(BYPASS) V32E
15 F 50 25 00014 ALIGNMENT CHECK
(RECHECK) Pro To 5
(BYPASS) ENTR
16 F 37 OPT ZERO - ZERO
XXE

EMS DEORBIT CHECK
EMS FUNC - OFF
CB EMS (2) - close (verify)
EMS MODE - STBY
EMS FUNC - EMS TEST 1
Wait 5 secs
EMS MODE - AUTO (wait 10 sec)
Check ind lts - off
RANGE ind - 0.0
Slew scroll until hairline is superimposed
on notch in self-test pattern
EMS FUNC - EMS TEST 2 (wait 10 sec)
.05G lt - on (all others out)
EMS FUNC - EMS TEST 3
.05G lt - on
RSI Lower lt - on (10 sec after .05G lt)
Set RANGE counter to 58 NM + 0.0
EMS FUNC - EMS TEST 4
.05G lt - on (all others out)
G-V trace within test pattern for 10 secs
then stops at lower right corner at ≈ 9g
RANGE ind counts toward zero for
10 sec, then stops at 0 ± 0.2
EMS FUNC - EMS TEST 5
.05G lt - on
RSI upper lt - on (10 sec after .05G lt)
RANGE ind - 0.0
Scribe traces vertical line ~ 9g to
0.22 + 0.1 and stops within test pattern
ALIGN SCROLL TO ENTRY PATTERN (on 37K ft sec line)

EMS FUNC - RNG SET
G-V scroll assy. traces vertical line
0.22g to ± 0.1 and stops. (Trace within test pattern)

Set ΔV ind to +1586.8
EMS FUNC - Vo SET
Slew G-V scroll assy to predicted inertial entry velocity
EMS FUNC (CCW) - ΔV Test
SPS THRUST lt - on
ΔV ind decreases (10 secs)
SPS THRUST lt - out at -0.1 on ΔV ind
ΔV ind stops at -20.8 ± 20.7 fps
EMS MODE - STBY

C&WS Operational Check
C/W LAMP TEST - 1 (LH MA & 16 lts)
C/W LAMP TEST - 2 (RH MA & 23 lts)
C/W LAMP TEST - off (center)
C/W CSM - CM (CM RCS lt(2) - on)
C/W CSM - CSM RCS lt(2) - out)
C/W PWR - OFF (C/W lt - on)

CMC SELF CHECK
V25 NO1E, 1365E
F 21 01 E,E,E
V15 NO1E, 1365E
15 01 R1 NUMBER OF ERRORS
R2 NUMBER OF TESTS STARTED
R3 NUMBER OF TESTS SUCCESSFUL
V21 N27E 10E SELF TEST, FIXED & ERASABLE
(4E SELF CHECKS ERASABLE
5E SELF CHECKS FIXED)

KEY REL

15 01 TEST SUCCESSFUL WHEN R2≥3 (78 sec)
*IF PROG lit - on *
*V05 N09E 01102 SELF *
*TEST ERROR *

(TERM) V21N27E OE N08 RECORD

MEASUREMENT AND LOADING OF PIPA BIAS & EMS DRIFT CK

EMS FUNCT - AV
EMS MODE - AUTO
(allow 25 FPS/100 sec)
PIPA BIAS (ground or pg CMP/3-9)

DSKY COND lt test (V35E)

P30 EXTERNAL ΔV

V37E 30E

1. F 06 33 GETI PRO (hrs,min,.01secs)

2. F 06 81 ΔVXYZ(LV) PRO (.1fps)

3. F 06 42 HA,HP,ΔV(Req) SET ΔV IND PRO (.1nm,.1nm,.1fps)

4. F 16 45 M,TFI,MGA SET DET PRO (0,min-sec,.01°)

5. F 37 00E
FINAL PREPARATION

-1:00 (hrs, min)

- Suit Ret Air VLV - push (close)
- Emerg Cab Press vlv - off
- CB RCS Logic (2) - close
- CM RCS Logic - ON
- CB CM RCS HTRS - close
- UP TLM CM - BLOCK (verify)
- CM RCS HTRS - on for 20 min or until rdg > 4.2
  (Sys test 5c, d, 6a, b, c, d)
- WASTE H2O DUMP - OFF
- Urine Dump HTR - OFF
- CB WASTE H2O/UR DUMP (2) - open
- Set RSI & REALIGN GDC
- Set ORB RATE FDAI #2, Stow ORDEAL

-0:45 (min)
- Dump & Rewind Tape rcdr (CRO)

-0:40 (min)
- UP TLM-BLOCK (verify before next step)
- RCS HTRS - OFF
- CB PYRO A SEQ A - close (verify)
- CB PYRO B SEQ B - close (verify)
- Check PYRO BAT (DC VOLTS - 37.0-37.5)
- DC IND sel - MNA

WARNING
If PYRO BAT A (B) < 35 VDC,
- CB PYRO A (B) SEQ A (B) - open
- CB PYRO A (B) BAT BUS A (B) to PYRO TIE - close

- CB MNA BAT C - close
- CB MNB BAT C - close

Panel 8 - CB's all closed except:
- PL VENT (1) & FLOAT BAGS (3) - open
- CB CM HTRS (2) - open
- CB EDS (3) - open
- CB Dock Probe (2) - open
- CB SPS GAUGING - open

CM RCS ACTIVATION (MSFN CONTACT)
- CB SECS LOGIC (2) - close (verify)
- CB SECS ARM (2) - close
- SECS LOGIC (2) - on (up)
- ELS - AUTO
- ELS LOGIC - on (up)
- MSFN Confirm GO for PYRO ARM
SECS PYRO ARM (2) - on (up)
CM RCS PRPLNT (2) - on(up), tb gray
RCS IND sel - CM 1, 2
CM RCS PRESS - on (up)
   He PRESS - 3300-3750 psia
   MANIF PRESS - 287-302
SECS PYRO ARM (2) - SAFE
ELS - MAN
ELS LOGIC - OFF

SPS DEORBIT & ENTRY, pg E/2-1

SM RCS DEORBIT & ENTRY, pg E/3-1
SM/RCS DEORBIT & ENTRY (HYBRID), pg E/4-1
SECTION 2. SPS DEORBIT

P40 - SPS THRUSTING
RCS DAP
11102
01111

1

V37E 40E
F 50 18 REQUEST MNVR TO FDAI RPY ANGLES (.01°)
(AUTO) BMAG MODE (3) - RATE 2
SC CONT - CMC
CMC MODE - AUTO

FOR 3 AXIS MANEUVER:
V37E 00E V49E
LOAD 06 22 (180,180,0)
PRO
AT COMPLETION P40
PRO
(MAN) ENTR to 3

2

06 18 AUTO MNVR TO FDAI RPY ANGLES (.01°)
SPS Ht b(2) - bp
SPS H v1v(2) - AUTO

3

F 50 18 ATTITUDE TRIM ENABLE (.01°)
BMAG MODE (3) - RATE 2
ALIGN SC IN ROLL
PRO to 2
CHECK BORE SIGHT STAR (OPTICS & COAS)
CHECK PNL 8
A/C ROLL (4) - OFF
Set ΔV ind (verify)
EMS FUNCT - ΔV
MAN ATT - RATE CMD
ATT DB - MIN
RATE - LOW
TRANS CONT PWR - ON
SCS TVC(2)-RATE CMD
ΔV CG-CSM
TVC GMBL DRIVE P&Y - AUTO

OPTICS OFF
STOW
-07:00
MN BUS TIES (2) - ON (sequentially)
TVC SERVO PWR 1 - AC1/MNA
TVC SERVO PWR 2 - AC2/MNB
ROT CONTR PWR NORMAL 2 - AC
ROT CONT PWR DIR (2) - OFF
BMAG MODE - ATT 1/RATE 2
SC CONT - SCS
RHC #2 - unlocked

Primary TVC Check

-05:00
GMBL MOT PITCH 1 - START - ON
GMBL MOT YAW 1 - START - ON
Verify Trim Control & Set
Verify MTVC

SCS Only:
SCS TVC (2) - AUTO

******************************************************************************

THC-CW
Verify no MTVC

Secondary TVC Check

GMBL MOT Pitch 2 - START - ON
GMBL MOT YAW 2 - START - ON
VERIFY MTVC
CONFIRM & SET GPI TRIM
THC - NEUTRAL
SC CONT - CMC (SCS)
Verify no MTVC

PRO
ROT CONT PWR NORMAL - 2 AC/DC
ROT CONT PWR DIRECT(2)-MNA/MNB

4  F 50 25 ENTR
R1 00204 ENABLE ENG. GIMBAL TEST
(REJECT) ENTR
(ACCEPT) PRO

If SCS - Null Error Needles
*PROG ALM - TIG SLIPPED*
*RSET *
*or V5N9E 01703 *
* KEY RLSE to 5 *

-02:00
TF GETI, VG, ΔVM (min-sec, lfps, lfps)
FDAI SCALE - 5/5
UPDATE DET
\( \Delta V \) THRUST A or B - NORMAL
THC - armed
RHC (2) - armed
LIMIT CYCLE - OFF

00:35
00:30
00:40

Aveng on
TAPE RCDR - RECORD/FWD/HBR
CHECK PIPA BIAS \( \leq 2 \) FPS in 5 sec
EMS MODE-AUTO
PERFORM ULLAGE (if req)
(BACKUP) DIRECT ULLAGE pb
CONTROL ATT w/RHC
MONITOR \( \Delta VM \) COUNTING UP

-00:05

6 F 99 40 ENG ON ENABLE
(AUTO) PRO (IGN WHEN TFI \( \geq 00 \) sec)
(BYPASS) ENTR to 9

00:00

7 IF SCS, THRUST ON pb - push for ignition

IGN 06 40 TFC, \( \Delta VG, \Delta VM \) (min-sec, .1fps, .1fps)

*SPS THRUST FAIL: *
*F 97 40 TFC, VG, \( \Delta V \) *
*(RESTART) ENTR to 6 *
*(CONTINUE) PRO *
*Poss Prog ALARM *
*Key VO5, NO9E *
* 01407(VG increasing)*

SPS THRUST lt - on
Monitor thrusting:
Pc=95-105 psia
SPS ENG INJ vlvs - OPEN
SPS He VLV tb(2) - gray
SPS PRPLNT TK FUEL PRESS-170-195 psia
SPS PRPLNT TK OXID PRESS-170-195 psia

ECO
8 F 16 40 TFC(STATIC), VG, \( \Delta VM \) (min-sec, .1fps, .1fps)
ΔV THRUST (2) -OFF
VERIFY ALL THRUST OFF CUES
FC 2 MNA&B - OFF (tb-bp)

PRO

VG XYZ
(A/C or B/D ROLL - ON)
NULL OUT VG COMPONENTS
EMS MODE - STBY
GIVE GROUND RESIDUALS
RECORD ΔV COUNTER

IF HP>49.4 NM R3=-59B59

PRO

P61 - MNVR TO CM/SM SEP ATT

Key V37E 61E
EMS FUNC - OFF
THC - locked
THC PWR - OFF
SC CONT - SCS
RATE - HIGH
Yaw right 45° (SEP ATT)
RATE - LOW
RCS TRANS - CM

Test Thrusters
RCS TRANS-SM
PRIM GLY TO RAD - pull to bypass
GLY RSVE IN v1v - OPEN
GLY RSVR BYPASS v1v - CLOSE
GLY RSVR OUT v1v - OPEN
O2 PLSS v1v - ON
O2 SM SUPPLY v1v - OFF
CAB PRESS REL v1v - (2)-BOOST/ENTRY
1. F 06 61  IMPACT LAT, LONG, HDS UP/DWN  
   (.01°, .01°, +/- 00001)  
   PRO
2. F 06 60  GMAX, VPRED, GAMMA EI  
   (.01 G, fps, .01°)  
   PRO
3. F 06 63  RTGO, VIO, TFE  
   (.1 nm, fps, min-sec)  
   RECORD & COMPARE WITH MSFN  
   PRO
   CMC DISPLAYS P62 (or Key V37E 62E)  
   *NO EXT V IN P62*
4. F 50 25  R1 00041 (PERFORM SEP X-LIST)  
   VHF AM (2) - OFF  
   S BAND ANT - OMNI C  
   SM RCS PRIM & SEC PROP (4)-on (8  
   (8 tb gray)  
   SEC FUEL PRESS 4 -on (verify)  
   ABORT SYS PRPLNT - RCS CMD (verify)  
   FC PUMPS (3) - OFF  
   HI GAIN ANT PWR -OFF  
   Verify single suit compr oper  
   S-BD PWR AMP - LOW  
   CB ECS RAD CONT/HTR(2)-open  
   CB HTRS OVLD (2) - open  
   POT H2O HTR-OFF  
   CAB FANS (2)-OFF  
   GLY EVAP TEMP IN - MAN  
   CM RCS LOGIC -on(up)(verify)  
   SECS PYRO ARM(2)-on(up)  
   CSM/LM FINAL SEP(2)-on(up) (verify)  
   ATT DB-MAX  
   RATE-HIGH  
   -00:15m
5. CM/SM SEP (2) -on(up)  
   C/W MODE -CM  
   RCS TRANS - CM  
   CM RCS LOGIC-OFF  
   SECS PYRO ARM (2)-SAFE  
   SECS LOGIC (2)-OFF  
   Monitor Vm A/B  
   If< 25 vdc go to EMERG  
   POWERDOWN pg ___
6 F 06 61 IMPACT LAT, LONG, HDS UP/DWN
   (.01°, .01°, +/- 00001)

7 F 06 22 FLY TO GMBL ANGS AT EI RPY
   MNVR TO ENTY ATT (0, 68, 0)
   EMS MODE - STBY
   EMS FCN - CCW TO RNG SET
   SET RNG COUNTER FOR RTGO
   EMS FCN - Vo SET
   ALIGN SCROLL Vo to display index
   EMS FCN - ENTRY
   ATT DEADBAND - MAX
   RATE - HIGH
   FDAI SCALE - as desired

8 P63 AUTO

9 06 64 G, VI, RTGO (+ overshoot)
   V82 to monitor TFF, then N64 for g
   Start EMS manually at RET .05g

10 .05g P64 AUTO
    06 68 BETA, VI, HDOT (monitor)
       SC CONT - CMC
       .05g 1t - on
       MAN ATT (3) - RATE CMD
       .05g sw - on (up)
       EMS ROLL - on (up)
P67 (AUTO AT .2G)
BETA, CRS ERR, DWN ERR (monitor)

Key VERB

Compare chart DRE with R3 for G&N acceptance

DRE > +100, MAN ATT ROLL-ACCL CMD

Fly BBA & EMS

V82E
F 16 44 HA, HP, TFF
F 16 64 G, VI, RTGO
F 16 68 BETA, VI, HDOT

MON RTGO, PRES LAT, LONG (.1nm,.01°,.01°)
(AT V REL=1000 fps, 65K)

IF RTGO=-, LIFT UP
=+, LIFT DOWN

MONITOR ALTIMETER

EARTH LANDING, pg E/5-1
SECTION 3. SM RCS DEORBIT

Obtain new maneuver & entry update from MFSN

P30 EXTERNAL ΔV

1
F 06 33
V37E30E
GETI
PRO

NOTE: COMPUTE TIG
TFP (N32)
+ 43+00
GIVES TIG

2
F 06 81
ΔVXYZ(LV)
PRO

3
F 06 42
HA,HP,ΔV(Req)
SET ΔV ind
PRO

4
F 16 45
M,TFI,MGA
SET DET
PRO

5
F 37

P41 - RCS THRUST

1
41E
F 50 18
REQUEST MNVR TO FDAI RPY ANGLES (.01°)
(AUTO) BMAG MODE (3) - RATE 2
PRO

(MAN) ENTR to 3

2
06 18
AUTO MNVR TO FDAI RPY ANGLES (.01°)

3
F 50 18
ATT TRIM ENABLE RPY
ALIGN SC in ROLL
ENTR to 4
PRO (TRIM to 2)

4
06 85
VGX,VGY,VGZ
(.1fps)
CHECK BORESIGHT STAR (COAS & OPTICS)
MAN ATT (3) - RATE CMD
P41

E
3-2

ATT DB - MIN
RATE - LOW
TRANS CONT PWR - ON

-00:35
DSKY clears
-00:30
BMAG MODE (3) - ATT1/RATE 2

5 16 85 VGXYZ (Ave g on) (.1fps)
HAND CONTROLLERS - armed
LIMIT CYCLE - OFF
TAPE RCDR - RCD/FWD
EMS MODE - AUTO

00:00
6 F 16 85 VG XYZ
NULL OUT COMPONENTS
BURN COMPLETE
PRO
EMS FUNC - OFF
EMS MODE - STBY
RECORD ΔV COUNTER/COMPONENTS
TAPE RCDR motion - STOP (center)
TRANS CONTR PWR - OFF
THC - neutral, locked

7 F 37 Key 00E
V82E

8 F 16 44 HA, HP, TFF (.1nm, .1nm, min-sec)
IF HP > 49.4 NM, R3 = -59B59
PRO

EI-27:00
MN BUS TIES (2) - on (up)

EI-25:00
GMBL MTRS (4) - START
PRIM GLY TO RAD - pull to bypass
GLY RSVR IN vlv - OPEN
GLY RSVR BYPASS vlv - CLOSE
GLY RSVR OUT vlv - OPEN
02 PLSS vlv - ON
02 SM SUPPLY vlv - OFF
CAB PRESS REL vlv - (2)-BOOST/ENTRY
EI-23:00

FC 2 MNA&B - OFF (tb-bp)

P61 - MNVR TO CM/SM SEP ATT

Key V37E 61E
EMS FUNC - OFF
THC - locked
THC PWR - OFF
SC CONT - SCS
RATE - HIGH
Yaw left 45° (SEP ATT)
RATE - LOW
RCS TRANS - CM
Test Thrusters
RCS TRANS - SM

1 F 06 61 IMPACT LAT, LONG, HDS UP/DWN
(.01°, .01°, +/- .00001)
PRO

2 F 06 60 GMAX, VPRED, GAMMA EI
(.01G, fps, .01°)
PRO

3 F 06 63 RTGO, VIO, TFE
(.1nm, fps, min-sec)
RECORD & COMPARE WITH MSFN
PRO
CMC DISPLAYS P62 (or Key V37E 62E)

4 F 50 25 R1 00041 (PERFORM SEP X-LIST)
VHF AM (2) - OFF
S BAND ANT - OMNI C
SM RCS PRIM & SEC PROP (4)-on (8 tb gray) (verify)
SEC FUEL PRESS (4) - on
ABORT SYS PRPLNT - RCS CMD (verify)
FC PUMPS (3) - OFF
HI GAIN ANT PWR - OFF
Verify single suit compr oper
S-BD PWR AMP - LOW
CB ECS RAD CONT/HTR (2) - open
CB HTRS OVLD (2) - open
POT H2O HTR - OFF
P61,63

3-4

CAB FANS (2) - OFF
GLY EVAP TEMP IN - MAN
CM RCS LOGIC - on (up)(verify)
SECS LOGIC (2)-on(up)(verify)
SECS PYRO ARM (2) - on (up)
CSM/LM FINAL SEP (2) - on (up)(verify)
ATT DB - MAX
 RATE - HIGH

-00:15m

5

CM/SM SEP (2) - on (up)
C/W MODE - CM
RCS TRANS - CM
CM RCS LOGIC - OFF
SECS PYRO ARM (2) - SAFE
SECS LOGIC (2) - OFF
Monitor VmA/C
If < 25 vdc go to EMERG POWERDOWN,
AUTO RCS SEL CM 1 (6) - MNA
AUTO RCS SEL CM 2 (6) - OFF
AUTO RCS SEL A/C ROLL (4) - OFF
MAN ATT (3) - MIN IMP
BMAG MODE (2) - RATE 2

PRO

6 F 06 61 IMPACT LAT, LONG, HDS UP/DWN
 (.01°, .01°, +/-00001)

PRO

7 F 06 22 FLY TO GMBL ANGS AT EI RPY
 (.01°)
MNVR TO ENTRY ATT (0,68,0)
EMS MODE - STBY
EMS FCN - CCW TO RNG SET
SET RNG COUNTER FOR RTGO
EMS FCN - Vo SET
ALIGN SCROLL Vo to display index
EMS FCN - ENTRY
ATT DEADBAND - MAX
RATE - HIGH
FDAO SCALE - as desired

8 P63 AUTO
9 06 64 G,VI,RTGO (+ overshoot)
V82 to monitor TFF, then N64 for g
Start EMS manually at RET .05g

10 .05g
06 68 P64 AUTO
BETA,VI,HDOT (monitor)
SC CONT - CMC
.05g lt - on
MAN ATT (3) - RATE CMD
.05g sw - on (up)
EMS ROLL - on (up)

11 P67 AUTO AT .2G
06 66 BETA,CRS,ERR,DWN ERR (monitor)
Key VERB
Compare chart DRE with R3 for G&N acceptance
DRE ± 100, MAN ATT ROLL-ACCL CMD
Fly BBA & EMS

12 V82E
F 16 44 HA,HP,TFF
F 16 64 G,VI,RTGO
F 16 68 BETA,VI,HDOT

13 F 16 67 MON RTGO,PRES LAT,LONG (.1nm,.01°,.01°)
(At V REL = 100 fps, 65K)
IF RTGO = -, LIFT UP
= +, LIFT DOWN
MONITOR ALTIMETER

EARTH LANDING, pg E/5-1
SECTION 4. SM/CM RCS DEORBIT (HYBRID)

Obtain new maneuver and entry update from MFSN

P30 EXTERNAL \( \Delta V \)

1. F 06 33 V37E 3OE TIG PRO NOTE: COMPUTE TIG
   
   \[ TFP (N32) + 43+00 \]
   
   GIVES TIG

2. F 06 81 \( \Delta V \) XYZ(LV) PRO

3. F 06 42 HA, HP, \( \Delta V \) EMS \( \Delta V \) to DESIRED \( \Delta V \) PRO

4. F 16 45 N, TFI, MGA Set Det PRO
   RSI to Lift Down

5. F 37 41 E (RCS Thrusting)

6. F 50 18 Request man. (0, 150, 0) BMAG MODE (3) - RATE 2 PRO

7. 06 18 AUTO MANEUVER

8. F 50 18 ATT TRIM ENABLE ALIGN SC IN ROLL 0° PRO (TRIM to 7) ENTR to 9

9. 06 85 VGX, VGY, VGZ CHECK BORESIGHT STAR (COAS & OPTICS) VERIFY THRUSTING ATT & HOLD N17E
   LOAD FDAI R, P, Y FOR CM RCS
   ADD 110° TO SM RCS PITCH ATT. (0, 260, 0) KEY RLSE
   \[ \text{v258} \]
   \[ \text{v23 NHOE +000000E} \]
10 TIG-10:00 CM/SM PRE-SEPAREATION

CB RCS LOGIC-closed(verify)
MN BUS TIE(2)-on (up)
PRIM GLY TO RAD - pull to bypass
GLY RSVR IN vlv - OPEN
GLY RSVR BYPASS vlv - CLOSE
GLY RSVR OUT vlv - OPEN
O2 PLSS vlv - ON
O2 SM SUPPLY vlv - OFF
CAB PRESS REL vlv (2) - BOOST/ENTRY
VHF AM (2) - OFF
S-BAND ANT - C
SM RCS PRIM & SEC PROP (4) - OPEN
SEC FUEL PRESS (4) - on
ABORT SYS PRPLNT - RCS CMD (verify)
TVC SERVO PWR 1 - AC1/MNA
TVC SERVO PWR 2 - AC2/MNB
SPS GIMB MOT (4) - START/ON
(sequentially)
FC 2 MN BUS A&B (2) - OFF (tb-bp)
FC PUMPS (3) - OFF
HI GAIN ANT PWR - OFF
Verify single suit compr oper
S-BD PWR AMP - LOW
CB ECS RAD CONT/HTR (2) - open
CB HTRS OVLD (2) - open
POT H2O HTR - OFF
CAB FANS (2) - OFF
GLY EVAP TEMP IN - MAN
CM RCS LOGIC - on(up)(verify)
SECS LOGIC (2) - on (up)(verify)
AUTO RCS SELECT CM1(6) - MNA
AUTO RCS SELECT CM2(6) - MNB
ROT CONTR PWR NORMAL (2) - AC/DC
MAN ATT (3) - RATE CMD
LIMIT CYCLE - OFF
ATT DBD - MIN
RATE - LOW
TRANS CONTR PWR - ON
DSKY clears

-00:35
BMAG MODE (3) - ATT1/RATE 2

-00:30

CAB PRESS REL vlv (2) - BOOST/ENTRY
11 16 85 VG XYZ (AVE g ON)
   HAND CONTROLLERS – armed
   TAPE RCDR – RCD/FWD
   EMS MODE – AUTO

12 00:00
   BURN EMS ΔV CNTR TO ZERO
   PRO

13
   SC CONT – SCS
   MAN ATT PITCH – ACCEL CMD
   KEY V63E
   PITCH-UP TO CM RCS DE-ORBIT ATT
   Key V23 N40E
   V16 N40E

14 F 16 40 SECS PYRO ARM (2) – on (up)
   CSM/LM FINAL SEP(2)–on(up)(verify)
   ATT DB – MAX
   RATE – HIGH
   CM/SM SEP(2) – on (up)
   C/W MODE – CM
   RCS TRNSFR – CM
   CM RCS LOGIC – OFF
   Monitor Vm A/B
   If < 25 vdc go to EMERGENCY
   POWERDOWN, Pg
   AUTO RCS SELECT A/C ROLL(4)–OFF

15
   SM RCS CUT-OFF +1:00
   RHC #1 PITCH DOWN
   RHC #2 MODULATE PITCH TO NULL ERROR NEEDLE

16
   N40(R3) to MONITOR ΔVM
   V82E to MONITOR HP
   RECORD HP

17
   BURN COMPLETION
   PRO (to terminate V82)
   PRO
SECS PYRO ARM (2) - SAFE
SECS LOGIC (2) - OFF
AUTO RCS SELECT CM 2 (6) - OFF
MAN ATT (3) - MIN IMP
BMAG MODE (3) - RATE 2

Load LAT, LONG, HDS UP (.01°, .01°, +/-00001) PRO

GMAX, VPRED, GAMMA EI (.01G, fps, .01°) PRO

RTGO, VIO, TFE (.1nm, fps, min-sec) RECORD & COMPARE WITH MSFN PRO
CMC DISPLAYS P62 (or Key V37E 62E)

IMPACT LAT, LONG, HDS UP/DWN (.01°, .01°, +/-00001) PRO

GLY TO GMBL ANGS AT EI RPY (.01°) MNVR TO ENTRY ATT (0, 68, 0) EMS MODE - STBY
EMS FCN - CCW TO RNG SET
SET RNG COUNTER FOR RTGO EMS FCN - Vo SET
ALIGN SCROLL Vo to display index EMS FCN - ENTRY
ATT DEADBAND - MAX
RATE - HIGH
FDAI SCALE - as desired

P63 AUTO
27 06 64 G,VI,RTGO (+ overshoot)  
V82 to monitor TFF, then N64 for g  
Start EMS manually at RET .05g  

28 .05g  
P64 AUTO  
06 68 BETA,VI,HDOT (monitor)  
SC CONT - CMC  
.05g lt - on  
MAN ATT (3) - RATE CMD  
.05g sw - on (up)  
EMS ROLL - on (up)  

29  
P67 AUTO at .2G)  
06 66 BETA,CRS ERR,DWN ERR (monitor)  
Key VERB  
Compare chart DRE with R3 for G&N acceptance  
DRE > ± 100, MAN ATT ROLL-ACCL CMD  
Fly BBA & EMS  

30  
F 16 44 HA,HP,TFF  
F 16 64 G,VI,RTGO  
F 16 68 BETA,VI,HDOT  

31 F 16 67 MON RTGO PRES LAT,LONG (.1nm,.01°,.01°)  
(AT V RET = 1000 fps, 65K)  
IF RTGO = -,LIFT UP  
= +,LIFT DOWN  
MONITOR ALTIMETER  

16 67  

EARTH LANDING, pg E/5-1
SECTION 5. EARTH LANDING

50K'
SECS LOGIC (2) - on (up)
SECS PYRO ARM (2) - on (up)

CM UNSTABLE
RCS CMD - OFF

<40K'
APEX COVER JETT pb - push
DROGUE DEPLOY pb - push
(2 sec after apex cover jett)

40K'
ELS LOGIC - on
ELS - AUTO

24K'
SCS RCS disable ...(RCS CMD - OFF)
Apex cover jett ...(APEX COVER pb)
(WAIT 2 SECS)
Drogues deployed ...(DROGUE pb)

23.5K'
CAB PRESS increasing (IF NO INCR BY 17K,
CAB PRESS REL vlv (2) - DUMP)

10K'
Mains deployed ...(MAIN DEPLOY pb)
VHF ANT - RECY
VHF AM - SIMPLEX A, BCN - ON
VOICE REPORT
CAB PRESS REL vlv (2) - close
DIRECT O2 - OPEN (CCW)
CM RCS LOGIC - on (up)
CM PRPLNT DUMP - on (burn audible)
No burn, use both RHC's
(DO NOT FIRE PITCH JETS)
CM PRPLNT PURGE - PURGE (to Zero He press)
*CM RCS He DUMP pb-push*
No decrease, use both RHC's
(DO NOT FIRE PITCH JETS)
CAB PRESS REL vlv (2) - BOOST/ENTRY
Strut lock - unlock
CB FLT & PL BAT BUS A, B, & BAT C (3) - close
CB FLT & PLT MNA & B (2) - open
FLOOD POST LDG
CM RCS PRPLNT (2) - OFF
CAB PRESS REL vLV (2) - OFF
ROT CONT PWR DIRECT (2) - OFF
CAB PRESS REL vLV (2) - CLOSE
MN BUS TIES (2) - OFF

Postlanding check pg E/6-1

3K' ≤ 1000

5', EARTH LANDING
SECTION 6. POST LANDING

1. TOUCHDOWN AND STABILIZATION
   ELS AUTO - AUTO (verify)
   CB MAIN RELEASE PYRO (2) - closed
   DIRECT O2 - closed (CW)
   ELS LOGIC - ON (verify)
   MAIN RELEASE - on (up)
   SECS PYRO ARM (2) - SAFE
   SECS LOGIC (2) - OFF
   CB BAT RELAY BUS (2) OPEN
   VHF AM B - OFF (center)
   CB UPRT COMPR (2) - close
   CB FLT/PL VENT - close
   CB FLOAT BAG (3) - close
   If Stable II
      FLOAT BAG (3) - FILL till 2 min after upright, then OFF
   VHF AM A & BCN - OFF while inverted
   If STABLE I
   After 10 min Cooling Period,
   FLOAT BAG (3) - FILL 7 min
   FLOAT BAG (3) - OFF

2. POST STABILIZATION AND VENTILATION
   CB MNA BAT BUS A AND BAT C (2) - open
   CB MNB BAT BUS B AND BAT C (2) - open
   CB FLT/PL BAT C - open
   CB PYRO A SEQ A - open
   CB PYRO B SEQ B - open
   PL DUCT COVER - remove
   PL VENT VLV handle - pull
   PL VENT - HIGH or LOW
   PL BCN LT & DYE MARKER - ON (swimmer COMM)
   INTERCOM (3) - PTT
   DEPLOY GRAPPLING HOOK if required
   Install directional air flow ducts
      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
      EACH HR - CHECK DC VOLTS 27.5 V
      If Not:
      CB FLT & PL BAT BUS A&B (2) - open
      CB FLT & PL BAT C - close
      GO TO LOW POWER CHECKLIST
      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3. POSTLANDING COMMUNICATIONS
VHF ANT-RECY (verify)
VHF BCN - ON (verify)
If no contact with recovery forces
MONITOR VHF BEACON Transmission with survival radio
VHF Beacon not operating:
Connect survival transceiver to ant
cable and place radio in BCN mode

4. LOW POWER CHECKLIST
VHF BCN - OFF
VHF (3) - RCV
FLOOD FIXED - OFF
VHF AM B- off (center)
VHF AM REC ONLY - A (verify)
COUCH LIGHTS - OFF
POSTLANDING VENT SYS: minimize use
SURV RADIO - plug into VHF BCN ANT cable
CONN & turn radio on in BCN mode

5. STABLE I EGRESS
CB BAT A, B, C PWR ENT/PL (3) - open
CONNECT SURVIVAL RUCKSACKS TOGETHER
CONNECT RAFT WHITE LANYARDS TO SUITS
CONNECT RAFT GREEN LANYARD TO CM
OPEN HATCH - INFLATE RAFT
INFLATE WATER WINGS AND EGRESS

6. STABLE II EGRESS
RECONFIGURE COUCH
CONNECT RAFT TO CM WITH GREEN LANYARD
CONNECT RAFT WHITE LANYARDS TO "H2O" WINGS
VERIFY CABIN PRESSURE RELIEF VALVES (2) - closed
PRESSURE EQUILIZATION VALVE - open
REMOVE AND STOW FWD PRESSURE HATCH
WHEN TUNNEL HAS FLOODED
CB BAT A, B, C PWR ENT/PL (3) - open
REMOVE & STOW ABLATIVE HATCH
DROP HARDWARE RUCKSACK DOWN TUNNEL, EXIT FEET
FIRST WITH RAFT: WHEN CLEAR OF CM INFLATE
WATER WINGS AND RAFT
SECTION 7. ENTRY EMERGENCY PROCEDURES

FIRE/SMOKE IN CM DURING ENTRY

1 CABIN FANS (2) - OFF

2 Monitor EPS indicators for excessive current. Immediately remove power from affected bus.

3 ROT CONTR PWR DIRECT (2) - MNA/MNB & maintain attitude if required.

4 If affected bus is:
   MNA
   AC INV 1 AC BUS 1 - OFF
   AC INV 2 AC BUS 1 - ON
   Set up for CM/RCS sys 2
   AUTO RCS SEL A/C ROLL (4) - OFF
   CM 1(6) - OFF
   CM 2(6) - MNB
   Follow normal RCS dump procedure using TBD deviations for a fuel rich dump.
   MNB:
   AC INV 2 AC BUS 2 - OFF
   AC INV 1 AC BUS 2 - ON
   Follow normal RCS dump procedures using TBD deviations for an oxidizer rich dump.

5 CAB PRESS RELF vlv (RH) - DUMP

6 Continue ENTRY

Contamination in CM

1 Don 02 masks and/or PGA's immediately

2 Evaluate contamination level (isolate & correct source of contamination if possible) and proceed with one of the following steps:
   a. Retain 02 masks or remain in suit and accept contamination level in cabin.
CAUTION
If in PGA's, adjust DIRECT O2 to maintain suit to cabin AP 0.38 psi.

b. Retain O2 masks and scrub cabin atmosphere through suit loop. If initially suited, establish partially suited or shirtsleeve configuration and don O2 masks.

CAUTION
Change LiOH cartridges after scrub completed.

c. Retain PGA's or don PGA's
Verify suit integrity (visually)
Perform Cabin Dump
Perform Cabin Repress

Contamination In Suit
1 SUIT COMPR 2 - AC1
2 SUIT COMPR 1 - OFF
3 DIRECT O2 vlv - OPEN (CCW) for 1 minute then close (cw)

If condition persists:
4 SUIT COMPR 2 - OFF
5 DIRECT O2 vlv - OFF
6 Doff helmet
7 Don emergency O2 masks
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**CONFIRMATION:** 61 66
| PURPOSE | HR TIG | MIN | SEC | ΔVX | LOCAL VERT | ΔVY | ΔVZ | ΔVR | ΔVC | BT | CSM WT | PTRM | YTRM | SXTS | SFT | TRUN | \(\phi(\pm N)\) NAV | \(\lambda(\pm E)\) CHECK (TIG-30) |
|---------|-------|-----|-----|-----|----------|-----|-----|-----|-----|----|-------|------|------|------|-----|------|-----------------|
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REMARKS

RESIDUALS

ΔVC