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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

APOLLO CSM 104 #9

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

Basic Date FEB. 1, 1965
Changed

LAUNCH OPERATIONS

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 CONTR 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

1. PRELAUNCH

.05G sw - OFF
LV/SPS IND -α
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 - 1
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 1
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 - 1
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 2ØC

PANEL 4

SPS 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
MN BUS TIE BAT A/C - on (up)
MN 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
VHF 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 vlv - 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)

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PANEL 9

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

PANEL 10

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

PANEL 12

LM TUNL VENT vlv - OFF

PANEL 13

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

PANEL 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

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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

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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

O2 PLSS vlv - ON
O2 SM SUPPLY vlv - ON
O2 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

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

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PANEL 601

REPRESS O2 vlv - close

FWD HATCH

PRESS EQUAL vlv - close

PANEL 602

REPRESS O2 RELF vlv - close (CCW)

SIDE HATCH

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

* - last momentary position before liftoff.

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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

-10:00 FC REACT vlv - LATCH

-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

* LIFT OFF 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,.lnm)

+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 Monitor ∝ 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)

00:00

+4°/SEC P,Y
±20°/SEC R

MODE IA

00:42

+4°/SEC P,Y
±20°/SEC R

MODE IB

1:50

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+02:00 EDS AUTO - OFF - report
2 ENG OUT - OFF
L/V RATES - OFF
α/Pc sw - Pc

GO/NO GO FOR STAGING - report — MODE IC
+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) — 02:32
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) — +9°/SEC P,Y; ±20°/SEC R
YAW - TBD
PITCH - TBD

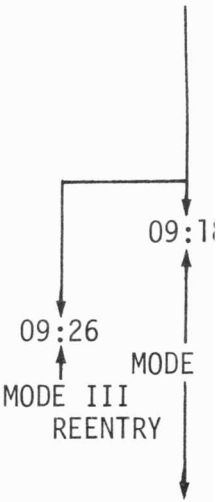
+03:11 SII SEP lt - out report — MODE IC

+03:16 TWR JETT (2) - ON (TFF>1+20) — 3:05
* 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

MODE II
+03:21 Guidance Initiate - report (OECO +41 Sec)
+03:53 Guidance Good
+04:00 Report Status
+05:00 Report Status
+05:50 Upstage Capability — MODE II
+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		N44	
VI	_____	HA	_____
HDOT	_____	HP	_____
H	_____		

~~P00~~ V 37 E 00 E

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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 vlv - 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 vlv (2) - NORMAL
CB WASTE H2O/UR DUMP HTR (2) - close
GLY RSVR BYPASS vlv - OPEN (CCW)
GLY RSVR OUT vlv - CLOSE (CW)
GLY RSVR IN vlv - CLOSE (CW)
ECS RAD FLOW CONT PWR - PWR
GLY TO RAD PRIM vlv - push (normal)
ECS RAD HTR - PRIM 1
ECS RAD TEMP PRIM OUT below PRIM IN

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                * 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          CYI AOS
      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
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Basic Date _____
Changed _____

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)

5 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

6 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)

8 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 ____ (XXXA

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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)

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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 00E

CB SECS ARM (2) - close
SECS LOGIC (2) - on (up)
Obtain GO from MSFN for PYRO ARM
MAN ATT (3) - RATE CMD

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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)

3. SEPARATIONS

4 SEPARATION
V46E
2:34:30
SIVB MNVR to 181.43 94.36 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 Display 17-20
V66E (transfer CSM state vector to LM storage)

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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
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
x No separation: x
THC - CCW (leave in detent)
until 1 fps
LV TK PRESS-full scale low(SEP ind)
Event Timer reset and
counting up (auto)
00:00 THC - neutral
x Confirm ΔV - 1 fps x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

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

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

V83E LOOK
V47E

F 37 - 00E

COAS PWR - OFF
CB RCS LOGIC (2) - open
THC,RHC - locked
EMS MODE - STBY
EMS FUNCT - OFF

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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
O2 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 O2 - OPEN

CAUTION
If CAB PRESS=5.7, REPRESS O2 - CLOSED
Recycle until O2 REPRESS PRESS $\approx$100
& CAB PRESS $\approx$4.0

REPRESS O2 - 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)

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

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

RECORD DOCKING ANGLE _____

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)

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13 HATCH INSTALLATION

Align Hatch in tunnel
PUMP HANDLE - unstow
- push to stop
- set to L
Verify gearbox disconnect socket - L
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
x If latches cannot be closed: x
GEARBOX DISCONNECT - 180° CCW (tool B)
AUX LATCH DRIVE - LATCH (113° CW)
Verify hatch latched, remove tool B
x (Irreversible)(cannot remove hatch) x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

PUMP HANDLE sel - stow
- push to stow

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

14 PRE LM EJECTION 4:10:00 GET (nominal)

LOAD DAP: N46: 21102
V62E
V49E
V06 N22 142.8 313.1 345.50
Load N22: ~~128~~.9 ~~21~~7.3 -33.8
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 CB SIVB/LM SEP (2) - closed
EMS FUNCT - ΔV
EMS MODE - AUTO
SIVB/LM SEP - on (up)
Start DET

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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 - 00E
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

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MODE IA PAD ⟶ 42 SEC

TIME	CDR	CMP	LMP
:00	THC - CCW	SM SEP (2) - ON	START TIME
:14	ELS LOGIC - ON ELS AUTO - AUTO	TWR JETT (2) - ON APEX COVER JETT pb - push DROGUE DEPLOY pb - push	
:28 10K	IF BELOW 3700': MAINS DEPLOY MAINS DEPLOY pb - push		

EARTH LANDING, pg L/4-6

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

TIME	CDR	CMP	LMP
:00 :11 :14	THC - CCW ELS LOGIC - ON ELS AUTO - AUTO	SM SEP (2) - ON CANARD DEPLOY pb - push TWR JETT (2) - ON APEX COVER JETT pb - push DROGUES DEPLOY pb - push	START TIME
23K 20K 10K	(CABIN PRESS REL. vlv.-DUMP) MAINS DEPLOY pb - push		CABIN PRESS-INCREASING

EARTH LANDING, pg L/4-6

4. ABORTS

MODE IC ——→16.5 NM TWR JETT			FTA: 3+00
TIME	CDR	CMP	LMP
:00	THC - CCW	SM SEP (2) - ON	START TIME
:11	PLATFORM NO GO: GO: P+5°/sec (TWR JETT)† *High P DAMP *Roll 90° * 0,135,0 Damp Rates BMAG 1/2 P+5°/s P: RATE CMD EMS:ENTRY,AUTO RCS SINGLE RING .05G - ON	CANARD DEPLOY pb - push (LM Final Sep)	
40K	ELS LOGIC - ON ELS AUTO - AUTO		
24K		TWR JETT (2) - ON APEX COVER JETT pb - push DROGUES DEPLOY pb - push	
23K 20K 10K	(CABIN PRESS REL. vlv. - DUMP) MAINS DEPLOY pb - push		CABIN PRESS-INCREASING

EARTH LANDING, pg L/4-6

MODE II ⟶ TWR JETT 9:23		FTA: 4+30 and 9+20	
TIME	CDR	CMP	LMP
:00	THC-CCW		START TIME
:03		LV SEP pb - push	
:05	THC NEUTRAL +X (20 sec)		
: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	CW MODE - CM
40K	ELS LOGIC - ON ELS AUTO - AUTO		
24K		APEX COVER JETT pb-push DROGUES DEPLOY pb-push	
23K 20K 10K	(CABIN PRESS REL.vlv-DUMP) MAINS DEPLOY pb-push		CABIN PRESS-INCREASING
EARTH LANDING, pg L/4-6			

MODE III ——→ 9:26 INSERTION			
TIME	CDR	CMP	LMP
:00	THC-CCW		START TIME
:03		LV SEP pb - push	
:05	THC-NEUTRAL - +X(20 sec)		
:06	RATES: ΔV THRUST (1)-NORMAL THRUST PB-push DIR. ULL PB-push ΔV THRUST (1)-OFF SPS THRUST-NORMAL		12713 -1855
:24	+X OFF 180,194,0 BMAG(3)-ATT 1/RATE 2 ΔV THRUST (1) (NORMAL)		ATT: HORIZ,BEF,HDS UP
	EMS: ΔV - AUTO		
2:05	TH. PB. -push DIR. ULL. PB - push ΔV THRUST (1) - OFF SM SEP RCS SINGLE RING EMS-ENTRY,AUTO 0,105,0 AT .05G-.05G AT .2g 305,105,17	SM SEP(2) - ON LM FNL SEP(2) - On	ΔR -368 To 0 - NO BURN (N50E) CW MODE - CM

L
4-4

40K	ELS LOGIC-ON ELS AUTO-AUTO		
24K		APEX COVER JETT pb- push DROGUES DEPLOY pb - push	
23K			CABIN PRESS - INCREASING
20K	(CABIN PRESS REL.vlv.-DUMP)		
10K	MAINS DEPLOY pb-push		

EARTH LANDING, pg L/4-6
7

MODE IV ⟶ 9:23 INSERTION			
TIME	CDR	CMP	LMP
:00	THC-CCW		START TIME
:03		LV SEP pb - push	
:05	THC-NEUTRAL +X (20 sec)		
:06	RATES: ΔV THRUST(1)-NORMAL ULL,PB - push Th. PB - push ΔV THRUST (1)-OFF SPS THRUST - NORMAL		
:24	+X OFF 180,347,0 BMAG(3) - ATT 1/RATE 2 ΔV THRUST (1) - NORMAL		ATT: HORIZ,SEF,HDS DWN
2:05	EMS-AUTO ULL. PB Th. PB ΔV THRUST (1) - OFF		
GO TO POSTINSERTION CHECKLIST, pg L/2-4			

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

≤1[illegible]0

CAB PRESS REL vlv (2) - close
MN BUS TIES (2) - OFF

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ABORT DATA

	I	II	III	IV	AK
TIG					
ΔV					
VC					
PITCH (BURN)					
BT					
GET 300K					
PITCH (300K)					
GET DROGUE					

MODE III NO COMM-NO PNGS
(_____-9:50) X2
BT= abort time

SECTION 5. POSTLANDING

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 (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

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X EACH HR - CHECK DC VOLTS < 27.5 V X
  If Not:
  CB FLT & PL BAT BUS A&B (2) - open
  CB FLT & PL BAT C - close
  GO TO LOW POWER CHECKLIST
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

3. POSTLANDING COMMUNICATIONS
VHF ANT-RECY (verify)
VHF BCN - ON (verify)
If no contact with recovery forces
MONITOR VHF BEACON Transmission with survival radio
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
VHF Beacon not operating:
Connect survival transceiver to ant
cable and place radio in BCN mode
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

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 - INVT 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 SEP

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

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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
H2/02 Fans (all) OFF
H2/02 Heaters (all) OFF

3. At insertion 12 + 40 perform the following + insertion checklist.

POWER DOWN

Panel 2	
Caution/Warning	ACK
Cabin Fans - both	OFF
SMPCS 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 Norm Power Amp	OFF
Panel 5	
Guidance & Navigation CB(all)	OPEN
Panel 8	
SCS Channels 16	OFF

4. GET 1:11:00 — SPS Burn=15 minutes
   EMS ΔV Set

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

6. GET 1:~~21~~17:00 — SPS Burn- 5 minutes
   Gimbal Motors On

7. GET 1:21:45 — SPS Burn- 15 seconds
   Ullage

8. to = Ignition 1:22:00

9. to + 9 seconds
   Gimbal Motors Off

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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

2 Monitor EPS indicators for excessive current.
    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

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 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 accep contamination level in cabin.

CAUTION
If in PGA's, adjust DIRECT O2 to maintain suit to cabin ΔP 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 - ACl

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)
LES 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

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SCS TVC SERVO PWR 1 - AC1/MNA
2 - AC2/MNB
(Continue through thrusting)

THRUSTING

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

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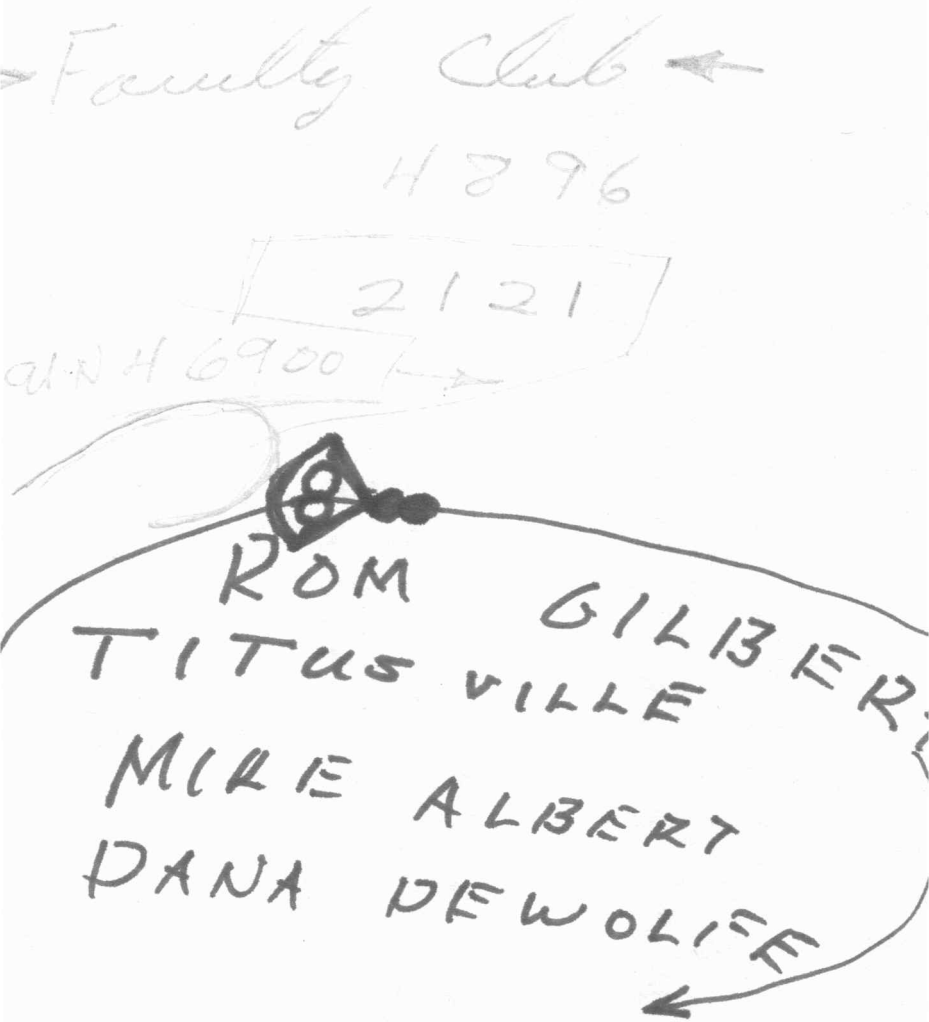
Faculty Club
H896
2121
UNH 6900
ROM GILBER
TITUS VILLE
MIKE ALBERT
DANA DEWOLFE
269 5844

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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

V37E 52E
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 (.001°,.001°,.01nm)
Load ldg site coords
PRO

F 06 22 NEW ICDU ANGLES OG, IG, MG (.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

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```
                    *F 05 09 00405 NO PAIR    *
                    *(CREW SPECIFY) PRO - to 6*
                    *(PICAPAR) V32E to 5      *

     (MAN ACQ) ENTR

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       *

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   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)
```

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 (.01°)
(REJECT) V32E to 15
(ACCEPT) PRO

F 06 93 TORQUING ANGLES OG, IG, MG (.001°)
(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-7, 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

STAR NAME (Numerical)		STAR NAME (Alphabetical)	
00	Planet	Acamar	6
1	Alpheratz	Achernar	4
2	Diphda	Acrux	25
3	Navi	Aldebaran	11
4	Achernar	Alkaid	27
5	Polaris	Alphard	21
6	Acamar	Alphecca	32
7	Menkar	Alpheratz	1
10	Mirfak	Altair	40
11	Aldebaran	Antares	33
12	Rigel	Arcturus	31
13	Capella	Atria	34
14	Canopus	Canopus	14
15	Sirius	Capella	13
16	Procyon	Dabih	41
17	Regor	Deneb	43
20	Dnoces	Denebola	23
21	Alphard	Diphda	2
22	Regulus	Dnoces	20
23	Denebola	Earth	47
24	Gienah	Enif	44
25	Acrux	Fomalhaut	45
26	Spica	Gienah	24
27	Alkaid	Menkar	7
30	Menkent	Menkent	30
31	Arcturus	Mirfak	10
32	Alphecca	Moon	50
33	Antares	Navi	3
34	Atria	Nunki	37
35	Rasalhague	Peacock	42
36	Vega	Planet	00
37	Nunki	Polaris	5
40	Altair	Procyon	16
41	Dabih	Rasalhague	35
42	Peacock	Regor	17

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43	Deneb	Regulus	22
44	Enif	Rigel	12
45	Fomalhaut	Sirius	15
46	Sun	Spica	26
47	Earth	Sun	46
50	Moon	Vega	36

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 P00
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)	.XXXXX
02	Specify Machine Address (Whole) (R1,R2,R3)	
03	Specify Machine Address (can be R1,R2,R3)	.01°
05	Angular Error/Diff	.01°
06	Option Code (R1 & R2)	OCTAL
07	FLAGWORD operator,FCADR,BIT ID, Action	
08	Alarm Data	OCTAL
09	Alarm Codes	OCTAL
10	Channel to be Specified (R1)	OCTAL
12	Same as 06 in R30	
15	Increment Machine Address (R1)	OCTAL
16	Time of event	hrs,min,.01sec
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,.01sec
25	Checklist (please perform)	
26	Prio/Delay, ADRES, BBCON(R1,R2 & R3)	OCTAL
27	Self-Test on/off sw	
29	X SM LAUNCH Azimuth	.01°

30	Target Code(Gyrocomp verif)	
31	Time of landing site	hrs,min,.01sec
32	Time from Perigee	hrs,min,.01sec
33	Time of Ignition (GETI)	hrs,min,.01sec
34	Time of Event	hrs,min,.01sec
35	Time from Event	hrs,min,.01sec
36	Time of CMC Clock	hrs,min,.01sec
37	GETI-TPI	hrs,min,.01sec
38	State Vector Time	hrs,min,.01sec
39	Δ Time of Transfer	hrs,min,.01sec
40	TF GETI/TFC	min-sec
	VG	.1 FPS
	ΔV (Accumulated)	.1 FPS
41	Target	Azimuth .01°
		Elevation .001°
		Ident 0000X
42	Apogee Alt (HA)	.1 NM
	Perigee Alt (HP)	.1 NM
	ΔV (Required)	.1 FPS
43	Lat	.01° (+ North)
	Long	.01° (+ East)
	Alt	.1 NM
44	Apogee Alt (HA)	.1 NM
	Perigee Alt (HP)(N50)	.1 NM
	TFF	min-sec
45	Marks	XXBXX
	TF GETI of next burn	min-sec
	MGA	.01°
46	DAP Config (R1&R2)	OCTAL
47	CSM weight	LBS
	LM Weight	LBS
48	Pitch Trim	.01°
	Yaw Trim	.01°
49	ΔR	.1 NM
	ΔV	.1 FPS
	SOURCE CODE	0000X.
50	ΔR (miss distance)	.1 NM
	PERIGEE (HP)	.1 NM
	TFF	min-sec

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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 To Splash	.1 NM
	VIO, Predicted Iner Vel	FPS
	TFE, time from .05G	min-sec
64	Drag Acceleration	.01 G
	VI, Inertial Velocity	FPS
	RTOGO to Target	.1 NM
65	Sampled CMC Time (fetched in interrupt)	hrs,min,.01 sec

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66	Beta, CMD Bank Angle		.01°
	CRSRNG Range Error		.1 NM
	DNRNG Range		.1 NM
67	RTOGO to Target		.1 NM
	Lat, Present Position		.01° (+ North)
	Long, Present Position		.01° (+ East)
68	Beta, CMD Bank Angle		.01°
	VI, Inertial Vel.		FPS
	H Dot, Alt Rate		FPS
69	Beta		.01°
	DL		.01 G
	VL		FPS
70	Star Code(before mark)		OCTAL
	LMK Data		OCTAL
	Horiz data		OCTAL
71	Star code (after mark)		OCTAL
	LMK Data		OCTAL
	Horiz data		OCTAL
72	Δ ang		.01°
	Δ alt		.1 NM
	Search option		
81	ΔVX,Y,Z (lcl vert)		.1 FPS
83	ΔVX,Y,Z (Body Control Axis)		.1 FPS
84	ΔVX,Y,Z (Other Vehicle)		.1 FPS
85	VGX,Y,Z (Body Control Axis)		.1 FPS
87	Opt Calib Data - Shaft (R1)		.01°
	Trunnion(R2)		.001°
88	Planet	X	.XXXXX
		Y	.XXXXX
		Z	.XXXXX
89	Landmark - Lat		.001° (+ North)
	Long/2		.001° (+ East)
	Alt		.01 NM
90	REND out of	Y	.01 NM
	Plane para	Y DOT	.1 FPS
		PSI	.01°
91	OCDU Angles Shaft (R1)		.01°
	Trunnion (R2)		.001°

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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.
		XXXXX.
		XXXXX.
98	System Test Results	XXXXX.
		.XXXXX
		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 lt and NO ATT lt 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.)

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00421 W-matrix over flow (update or P22)
00605 Number of iterations exceeds loop maximum (V32E & load new data)
00611 No TIG for given ELEV angle (PRO & new elev)
00612 State vector in wrong sphere of influence (see code 605)
00613 Reentry angle out of limits (see code 605)
(M) 00777 ISS warning caused by PIPA fail
01102 CMC self test error (try once more)
*01103 Unused CCS branch executed (terminate & reinitiate)
**01104 Delay routine busy (see code 1103)
(m)01105 Downlink too fast (notify MSFN)
(m)01106 Uplink too fast (notify MSFN and/or voice updat
(m)01107 Phase table failure assume erasable memory is destroyed (reinitialize erasable memory)
**01201 Executive overflow - no vac. area (reinitiate program)
**01202 Executive overflow - no core sets (reinitiate program)
**01203 Waitlist overflow - too many tasks (reinitiate program)
*01206 Second job attempts to go to sleep via keyboard and display program (reinitiate program)
**01207 No vac area for marks (reinitiate program)
*01210 Second attempt is made to stall (reinitiate program)
**01211 Illegal interrupt of extended verb (reinitiate program)
01301 Arcsin or arccos input is greater than one (reinitiate program)
*01302 SQRT called with negative argument (reinitiate program)
(m)01407 VG increasing (terminate thrust & reinitiate)
01426 IMU unsatisfactory (realign or use SCS)
01427 IMU reversed (note FDAI operation is inverted)
*01501 Keyboard and display alarm during internal use (NVSUB). (reinitiate program)
*01502 Illegal flashing display (reinitiate program)
01520 V37 request not permitted at this time

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01600	Overflow in drift test
01601	Bad IMU torque abort
01602	Bad optics during verification
01703	Insufficient time for integration, TIG slipped CMP 6-2, E 2-2
(M) 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
(M) 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 V05 N09
R1 First alarm to occur
R2 Second " " "
R3 Last " " "
(May be of the form
HXXXX or 5XXXX
HXXXX indicates more
than three alarms
5XXXX indicates more
than three alarms
one of which was 1XXXX

CMP
2-12
V50 N25 CODES

V04 N06 CODES

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 *

2 F 37 00E

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

1 G/N IMU PWR - on (up)
NO ATT lt - on (90 sec)
NO ATT lt - out
Wait 20 sec

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

P06 - CMC POWER DOWN PROGRAM

V48E

F 04 46 Load 0 (NO DAP) in left digit of R1
PRO
PRO

Basic Date FEB. 1, 1969
Changed
CSM 104

PRO
V46E

2 V37E 06E
F 50 25 00062 CMC PWR DN
PRO, push until STBY lt - on

IMU POWER DOWN PROCEDURE
CMC MODE - FREE

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

P76 - TARGET ΔV
1 V37E 76E
F 06 84 ΔV XYZ (.1fps)
Load ΔV
PRO

2 F 06 33 TIG (hrs,min,.01sec)
Load TIG
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

Basic Date Feb. 1, 1969
Changed
CSM 104

V41 N20 COARSE ALIGN ICDU's

CMC - on
ISS - on

1 V41N 20E

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

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

Reduce drift s/c

4 V40 N20E
NO ATT lt - off
Wait 20 sec

5 V37E XXE

V42 GYRO TORQUING

CMC MODE - FREE

1 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

1 V48E
F 04 46 R1 ABCDE
R2 ABCDE

	VEHICLE CONFIG	QUAD A/C FOR X	QUAD B/D for X	ERR DEADBAND	RATE SELECT
R1	0 = No DAP 1 = CSM 2 = CSM & LM 3 = CSM & SIVB 6 = CSM & LM (Ascent Stg only	0 = Fail A/C 1 = Use A/C	0 = Fail B/D 1 = Use B/D	0 = $\pm$ 0.5° 1 = $\pm$ 5.0°	0 = 0.05°/sec 1 = 0.2°/sec 2 = 0.5°/sec 3 = 4.0°/sec
	Roll Quad Select	Quad A	Quad B	Quad C	Quad D
R2	0 = Use B/D 1 = Use A/C	0 = Fail 1 = Use	0 = Fail 1 = Use	0 = Fail 1 = Use	0 = Fail 1 = Use

PRO

2 F 06 47 CSM WT, LM WT (lbs,lbs)
Load correct values
PRO

3 F 06 48 TRIM ENGINE GMBL (.01°)
Load correct values
PRO (To Prog In Progress)

4 V46E if AOT N46 R1 changed

AOF

V49 CREW DEFINED MANEUVER

CMC - on
ISS - on
SCS - operating

1 V37E 00E
V62E MODE II

2 V49E
F 06 22 NEW ICDU ANGLES RPY (.01°)
Load desired angles
PRO

3 F 50 18 REQ MNVR TO FDAI RPY ANGLES (.01°)
(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

Basic Date Feb. 1, 1969
Changed

CSM 104

V37 E 00E

V55 - CMC TIME UPDATE

1 V55E

F 21 24 LOAD Δ CMC TIME (hrs,min,.01sec)

V64 START S-BAND ANTENNA

1 V37E 00E

2 V64E

F 06 51 RHO, GAMMA (.01°,.01°)

S-BAND ANT - S

TRACK - MAN

Check P&Y Angle Ind

TRACK - AUTO

PRO

V67 - W-MATRIX ERROR DISPLAY

1 V67E

F 06 99 POS ERR, VEL ERR, OPT CODE(.01nm,.1fps)

R3 00001=Rend

00002=Orbital

00003=Cislunar

Load desired data Rend

To reinitialize ~~Cislunar~~ W-matrix,

Load: R1 +00094 +00028

R2 +00057 +00017

R3 +00003 +00001

PRO

V74 CMC DOWNLINK

1 (If needed) V21 N01E 333E

F 21 01 R3 333

R1 20000E for 4 Dumps

or 10000E for 2 Dumps

or 04000E for 1 Dump

2 V74E (Places erasable memory on downlink)

DO NOT USE

V79 LUNAR LANDMARK

1 V37E 00E

2 V79E

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

3 F 06 31 LDG SITE TIME (hrs,min,.01sec)
PRO

4 F 05 70 LMK CODE
R2=000DE
(RECYCLE) V32E to 4
PRO

5 F 06 34 LMK TIME (hrs,min,.01sec)
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 V82E (IF AVE g On Go to 2)
F 04 12 R1 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 & P00) 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

Basic Date Feb. 1, 1969
Changed
CSM 104

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 P00)
~~V83E (or 85E) - perform routine~~
~~V37E 00E~~

1 V83E
F 16 54 RANGE, RANGE RATE, THETA (.01nm,.1fps,.01°)
PRO

V85 - RNDZ PARAMETER DISPLAY #2

Note: See V83 ~~restrictions~~ NOTE

V85E
F 16 53 RANGE, RANGE RATE, PHI (.01nm,.1fps,.01°)
PRO

V89 - RENDEZVOUS FINAL ATTITUDE

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

1 V37E 00E
V62E MODE II

2 V89E
F 04 06 R1 00003 SPECIFY TRACKING ATTITUDE
R2 00001 (PREF)
00002 (+X AXIS)
PRO

3 F 06 18 FINAL FDAI RPY ANGLES (.01°)
(MNVR) PRO
(UPDATE DISPLAY) V32E

4 F 50 18 REQ MNVR TO FDAI RPY ANGLES (.01°)
(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 (.01°)

6 F 50 18 REQ MNVR TO FDAI RPY ANGLES (.01°)
(TRIM) ALIGN SC In ROLL
PRO To 5
(BYPASS) ENTR

V90 - OUT-OF-PLANE DISPLAY

1 V90E
F 06 16 GET EVENT (hrs,min,.01sec)
Load desired time
PRO

2 F 06 90 Y,YDOT,PSI (.01nm,.1fps,.01°)
(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

1 V25 N01E, 1365E

F 21 01 E,E,E

2 V15 N01E, 1365E

15 01 R1 NUMBER OF ERRORS
R2 NUMBER OF TESTS STARTED
R3 NUMBER OF TESTS SUCCESSFUL

3 V21 N27E 10E SELF TEST, FIXED & ERASABLE
(4E SELF CHECKS ERASABLE
5E SELF CHECKS FIXED)

4 KEY REL

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

(TERM) V21N27E 0E *N08E RECORD FOR *
* MSFN *

MEASUREMENT & LOADING OF PIPA BIAS

1 DET - RESET
SC RATES <0.1°/sec

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

3 V16 N21E

16 21 XYZ PIPA COUNTS

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

5 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

Basic Date ____ Changed ____

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

	A			B			C			D			E		
BIT	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
CODE	4	2	1	4	2	1	4	2	1	4	2	1	4	2	1

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

(To Verify) V01 N01E (FLAG Word ADD) ENTR

F 01 01 R1 FLAG WORD (ABCDE)
R3 FLAG WORD ADDRESS

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

V25N 07E	This resets bit 6 of
77E	flagword 3.
40E	Verification should show D<4
0E	

EXAMPLE: To set REFSMMAT flag:
Key:

V25N 07E	This sets bit 13 of
77E	flagword 3
10000E	Verification should show A odd
1E	

BINARY-TO-OCTAL CONVERSION

000-0	100-4
001-1	101-5
010-2	110-6
011-3	111-7

OCTAL-TO-DECIMAL CONVERSION

1-1	11-9	21-17	31-25	41-33
2-2	12-10	22-18	32-26	42-34
3-3	13-11	23-19	33-27	43-35
4-4	14-12	24-20	34-28	44-36
5-5	15-13	25-21	35-29	45-37
6-6	16-14	26-22	36-30	46-38
7-7	17-15	27-23	37-31	47-39
10-8	20-16	30-24	40-32	50-40

REVIEW DATA IN ERASABLE MEMORY

1 Perform During Any Flashing Display

2 V01 N01E (OCTAL ADD) E

3 01 01 R1 DATA R3 OCTAL ADD

4 N15E (For next succeeding word)

ENTR (For each succeeding word)

TO CHANGE DATA IN ERASABLE MEMORY

1 V21 N01E (ADDRESS) E

F 21 01 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

Basic Date Feb. 1, 1969
Changed

CSM 104

F 04 06 00001
V22E 3E
PRO

F 50 25 00015
ENTR

F 01 70 00ODE STAR CODE
LOAD BORESIGHT STAR CODE
OPT ZERO - OFF
PRO (Ignore PROG ALARM)

06 92 SHAFT, TRUN (.01°,.001°)
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

Basic Date Feb. 1, 1969
Changed

CSM 104

DSKY CONDITION LIGHT TEST

CMC - on

Key V37E 00E (desired)
DSKY - P00

DON'T DO WITH AVE G ON

2 Key V35E

3 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

1 V11 N10E

F 11 10 (LOAD CHANNEL ADDRESS) E
R1 Octal Contents of Specified Channel

LOAD OUTPUT CHANNELS

1 V21 N10E

F 21 10 (LOAD CHANNEL ADDRESS) E
R1 (Load Octal Data) E

Basic Date Feb. 1, 1969
Changed

CSM 104

PITCH ORBIT RATE MANEUVER

1 NOMINAL ALIGNMENT, MGA 0

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

3 P00

4 V21 N01E 3200E 42676E - 1°/sec, 54142E - .068°/sec
(Sets Low Order of DELCDUY)

5 Execution of E INITIATES ORB RATE MNVR

6 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

Redone 3-14 3-14A 3-14B 3-14C

FLAG WORD LISTING

TITLE	ADDRESS	BIT	WHEN SET	WHEN RESET
RNDZ	00074	7	P20 initiated	P20 terminated
UPDATE	00075	7	State vector update by marks allowed	State vector updating by marks not allowed
Track	00075	5	RNDZ Tracking allowed	Rendezvous tracking not allowed
Pref Att	00076	4	Pref Att computed	Preferred S/C attitude not computed
Steer	00076	11	Steering to be done	Steering omitted
REFSMMAT	00077	13	REFSMMAT good	REFSMMAT not good
IMU	00074	8	IMU in use	IMU not in use
State Vector	00075	8	CSM State vector updated	LM state vector updated

Terminate	00103	15	Terminate R52,R53	Do not terminate
Trunnion drive	00074	4	Enables CMC contr of trunnion	CMC control of optics trunnion not enabled
Target 1	00075	10	LM sighting	Not sighting LM
Target 2	00075	9	LMK Sighting	Sighting star
W-matrix (REND)	00101	1	W-matrix valid	W-matrix for rendezvous navigation is invalid
W-matrix (ORB)	00077	6	P22,23 W-matrix valid	W-matrix for rendezvous navigation is invalid
3 axis	00101	6	MNVR Specified by 3 axes	Maneuver specified by 1 axis
External ΔV	00076	8	Ext ΔV VG comp	Lambert VG computations
Active vehicle	00076	5	LM active	CSM active

Final comp.	00076	6	Final RNDZ comp	Interim pass through rendez-vous program computations
Sighting mark	00074	6	V51 initiated	V51 not initiated
Stick flag	00075	14	RHC out of detent	RHC in detent (auto maneuver enabled)
~~Stick flag~~	00075	14	RHC out of detent	RHC in detent (auto maneuver enabled)
CMOON flag	00104	12	Permanent CSM SV in Lunar Sphere of Influence	Permanent CSM SV in Earth Sphere of Influence
NON-FLAGS				
MARKSTAT	1330	10	After mark	After mark reject
IMODES 30	1320	9	IMU not operating	IMU operating

A	B	C	D	E
15,14,13	12,11,10	9,8,7	6,5,4	3,2,1

1 Set
0 Reset

BINARY	-	OCTAL
000		0
001	-	1
010	-	2
011	-	3
100	-	4
101	-	5
110	-	6
111	-	7

PITCH ORBIT RATE MANEUVER

1 NOMINAL ALIGNMENT, MGA 0

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

3 P00

4 V21 N01E 3200E XXXXXE

(Sets Low Order of DELCDUY)

5 Execution of E INITIATES ORB RATE MNVR

6 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 (XXXXXE)
-0.100	42676
-0.095	44250
-0.090	45622
-0.085	47173
-0.080	50545
-0.075	52117
-0.070	53467
-0.065	55041
-0.060	56413
-0.055	57765
-0.050	61337

Basic Date — Feb. 1, 1969
Changed — Feb. 12, 1969

M 104

DSKY CONDITION LIGHT TEST

CMC - on

1 Key V37E 00E (desired)
DSKY - P00

2 Key V35E

3 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

1 V11 N10E

F 11 10 (LOAD CHANNEL ADDRESS) E
R1 Octal Contents of Specified Channel

LOAD OUTPUT CHANNELS

1 V21 N10E

F 21 10 (LOAD CHANNEL ADDRESS) E
R1 (Load Octal Data) E

Basic Date Feb. 1, 1969
Changed Dec. 12, 1969
CSM 104

P17(77),20

SECTION 4. NAVIGATION

P17 - TPI SEARCH
or
P77 - LM TPI SEARCH
CMC - on (req)

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

2 F 06 72 ΔANG(TPI),ΔALT(TPI),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,ΔV(TPI),ΔV(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
```

Basic Date Feb. 1, 1969
Changed

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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 (.01°)
(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 lt (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

KEY VSN9E 00404

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

OPTICS ZERO - ZERO

Feb. 1, 1969
Basic Date
Changed

CSM 104

P23 OPTICS CALIBRATION

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

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

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

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Changed
CSM 104

1 V37E 23E
F 05 70 STAR ID/LMK ID/HOR ID (OCTAL)
Load codes

STAR/ENH	STAR/LNH	STAR/EL
000DE	000DE	000DE
00000	00000	00100
00110	00210	00000

STAR/EFH	STAR/LFH	STAR/LL
000DE	000DE	000DE
00000	00000	002XX
00120	00220	00000

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

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CSM 104

*F 05 09 00404 (TA>90°) *
*V94E to 4 (AUTO MNVR) *
* or MAN MNVR - PRO to 7 *

7 06 92 AUTO OPTICS SHAFT,TRUN (.01°,.001°)
*PROG ALARM *
*V5N9E - 00407 (TA>50°) *
*V94E to 4 (AUTO MNVR) *
*or MAN MNVR - KEY RLSE to 7 *

MNVR TO POSITION LMK/HOR IN FOV
OPT MODE - MAN

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
Rcdr 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

START

13 F 37 23E to 1
or 00E
OPT ZERO - ZERO

P27 CMC UPDATE
CMC - on (req)

Auto Update:

1 V37E 00E
UP TLM CM - ACCEPT
NOTE: UPTLM (LEB) always ACCEPT
UPLINK ACTY lt - on
* POSS LOS before completion *
* If V33 N02 showing: *
* Key PRO *
* UPLINK ACTY lt - out *
* P00 displayed *
* If V21 N01 *
* or V21 N02 *
* Key V34E *
* UPLINK ACTY lt - out *
* P00 displayed *
* UP TLM CM - BLOCK *

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

Voice Transmission Update:

1 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 P00 Displayed

SECTION 5, PRETHRUST

P30 EXTERNAL ΔV

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

1		V37E 30E	
	F 06 33	GETI	(hrs,min,.01sec)
		Load desired GETI	
		PRO	
2	F 06 81	ΔVXYZ(LV)	(.1fps)
		Load desired ΔV's	
		PRO	
3	F 06 42	HA,HP,ΔV(REQ)	(.1nm,.1nm,.1fps)
		Set ΔV CTR	
		PRO	
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		

P31 GENERAL LAMBERT PRETHRUST

TARG PARAMS - LOADED FROM GND (P27)

1		V37E 31E	
	F 06 33	GETI	(hrs,min,.01sec)
		Load desired GETI	
		PRO	
2	F 06 81	ΔVXYZ(LV)	(.1fps)
		PRO	
3	F 06 42	HA,HP,ΔV(REQ)	(.1nm,.1nm,.1fps)
		Set ΔV CTR	
		PRO	

P31,34

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

2 F 06 55 R2 ELEV ANG, R3 ωt (.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

P34,35

F 06 16 GET EVENT (hrs,min,.01sec)
PRO
F 06 90 Y,YDOT,PSI (.01nm,.1fps,.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 *
PRO

7 F 06 59 ΔVXYZ(LOS)TPI (.1fps)
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)

1 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 (.1fps)
(For Out-of-Plane Corr
V90E
F 06 16 GET EVENT (hrs,min,.01sec)
PRO
F 06 90 Y,YDOT,PSI (.01nm,.1fps,.01°)
RECORD YDOT _____
PRO
ZERO Out-of-Plane Corr (R2) on First TPM)

P35,37

*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 ΔVXYZ(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
REFSMMAT SET or If P75)

5 F 37
P75 - Transmit Mnvr Parameters To LM

P37 RETURN TO EARTH PROGRAM

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

2 F 06 60 BLANK,V PRED,GAMMA EI (fps,.01°)
Load desired values
FOR MIN ΔV-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 ΔT TRANSFER (hrs,min,.01sec)
(RECYCLE) V32E To 1
PRO

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5 F 06 60 BLANK,VPRED,GAMMA EI (fps,.01°)
(RECYCLE) V32E To 1
PRO

6 F 06 81 ΔVXYZ(LV) TIG (.1fps)
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 V37E (38E or 78E)
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	(.1nm)
5	F 06 34	SOR TIME PRO	(hrs,min,.01sec)
6	F 16 45	MARK,TFI,-00001 (RECYCLE) V32E (FINAL PASS) PRO (Terminate Marks)	(mark,min-sec,.01°)
7	F 06 58	HP(SOR),ΔV(SOR),ΔV(SOR-FINAL) PRO	(.1nm,.1fps,.1fps)
8	F 06 81	ΔVXYZ(LV) PRO (If Recycle - To 6)	(.1fps)
9	F 16 45	MARKS,TFI,MGA PRO (MGA SET TO -00002 IF NO REFSMMAT SET OR P78)	(marks,min-sec,.01°)
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)	(mark,min-sec,.01°)
3	F 06 81	ΔVXYZ(LV) PRO (If Recycle - To 2)	(.1fps)

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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

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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

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
PRO
AT COMPLETION P40
PRO
(MAN) ENTR to 3

2 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

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 CONTR PWR NORMAL 2 - AC
ROT CONT PWR DIRECT (2)-OFF
BMAG MODE - ATT 1 RATE 2
SC CONT - SCS
RHC #2 - unlocked

6. THRUSTING

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

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 *

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Changed

CSM 104

P40

-02:00

5 06 40 TF GETI,VG,ΔVM (min-sec.,lfps,lfps)
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

7 IF SCS, THRUST ON PB - PUSH FOR IGNITION

IGN 06 40 TFC,ΔVG,ΔVM (min-sec,.lfps,.fps)
*SPS THRUST FAIL: *
*F 97 40 TFC,VG,ΔVM *
*(RESTART) ENTR to 6 *
*(CONTINUE) PRO *
*Poss Prog ALARM *
*Key V05 N09E *
* 01407 (VG increasing)*
* TERM BURN or SELECT
SPS THRUST lt - on
Monitor thrusting:
Pc=95-105 psia
SPS ENG INJ vlvs - OPEN

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P40,41

SPS He vlv tb(2)-gray
SPS PRPLNT TK FUEL PRESS-170-195 psia
SPS PRPLNT TK OXID PRESS-170-195 psia

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

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Changed
CSM 104

1			V37E 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 ENALBE RPY	(.01°)
			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	

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Changed
CSM 104

P41,47

7 F37 KEY 00E
V82E

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

P47-THRUST MONITOR
CMC - ON
ISS - ON & ALIGNED
G/N PWR OPTICS - OFF

1 V37E 47E
F 16 83 ΔV XYZ(CSM) (.1fps)
VI,HDOT,H availible by N62E
*KEY RLSE to return to N83 *
(RECYCLE) V32E
(TERM) PRO

2 F 37 XXE

P51

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 lst 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 lst 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

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Changed

7. ALIGNMENTS

CSM 104

P52

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 V37E 52E
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°,.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)

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CSM 104

P52

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 RLSE *
*MNVR till R2<49775 *

(MARK ROUTINE) OPTICS MODE - MAN

9 F 51 PLEASE MARK
MARK

10 F 50 25 00016 TERMINATE MARKS
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 (.01°)
(REJECT) V32E to 15
(ACCEPT) PRO

14 F 06 93 TORQUING ANGLES OG, IG, MG (.001°)
(TORQUE) PRO (CMC - FREE)
(BYPASS) V32E

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CSM 104

P52,53

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 V37E 53E
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 RESELECT PROG

5 F 50 25 00016 TERMINATE MARKS
(REJECT) ENTR to 4
PRO

6 F 01 71 00ODE 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

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CSM 104

P53,54

PRO to 3 after 1st MARK
to 8 after 2nd MARK

8 F 06 05 STAR ANGLE DIFFERENCE (.01°)
(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°,.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 00ODE 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 00ODE 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°)
(REJECT) V32E to 15
(ACCEPT) PRO

P54

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 XXE

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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) - ACl
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 FDAI 1
FDAI SELECT - 1
FDAI SOURCE - ATT SET
ATT SET - IMU
ATT SET dials - null FDAI 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 FDAI SELECT - 1
FDAI SOURCE - ATT SET
ATT SET - GDC
ATT SET dials - null FDAI 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

SCS - ON (Req)
CMC - OFF or STANDBY
RECORD: R, P, Y ALKGN from MSFN

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

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PGNS ORDEAL INITIALIZATION

1		FDAI 1 or 2 - ORB RATE EARTH/LUNAR - EARTH
2		V82E
	F 04 12	R1 00002 SPECIFY VEHICLE R2 1E (CSM) PRO
3	F 16 44	HA, HP (.1nm,.1nm) Calculate Average ALT SET - Set Average PRO

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4 V83E

F 16 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

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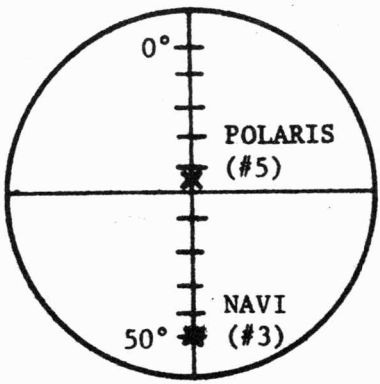
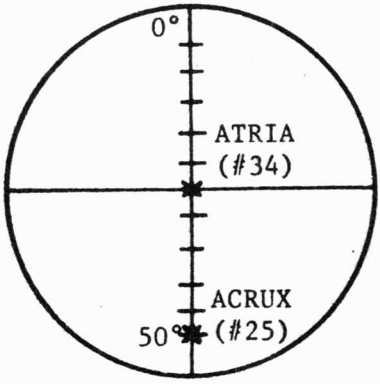
NORTHERN



SHFT 180° TRUN 7.5°

REFS			
R			
P			
Y			
REFS			
R			
P			
Y			

SOUTHERN



SHFT 180° TRUN 7.5°

REFS			
R			
P			
Y			
REFS			
R			
P			
Y			

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

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

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PROBE EXTD/REL tb (2) - gray

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

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

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
x If PROBE tb gray after 4 sec +X translation: x
   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
x Go to Step 3 above   x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

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

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

PROBE EXTD/REL tb (2) - gray

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
x If PROBE tb remain bp: x
   Use alternate GN2 if cues unsatis-
   factory

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

xxxxxxxxxxxxxxxxxxxxxxxxx
Hook does not release:
Aux RLSE (yellow)-push
cock latch
xxxxxxxxxxxxxxxxxxxxxxxxx
Release latch - push man release
(fish tail)
x x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
GN2 BLEED button (red) - press (10 sec)

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

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
x x
Extend latch not engaged
PRELOAD HANDLE - sel lever CW
-Rotate CCW until indicator (red)
flush with housing
x x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

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 connecto
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 probe

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

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xCapture latches will not release: x
Ratchet probe forward
Preload probe until latches release
x Remove probe by above procedure x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

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 O2 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

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CTR SUIT FLOW vlv - CAB FLOW
Connect O2 transfer umbilicals to left
PGA Connectors
RH SUIT FLOW vlv - FULL FLOW
Disconnect O2 hose from right PGA
Connectors
Connect protective plugs to right
PGA Connectors
Install interconnect CDR O2 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 O2 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
   O2 hoses
Connect CDR O2 umbilicals to right
   PGA connectors
LH SUIT FLOW vlv - FULL FLOW
RH SUIT FLOW vlv - OFF
Disconnect LMP O2 hose from left
   PGA connectors
Connect protective plugs to left
   PGA connectors
Install suit hose interconnect on
   O2 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
Connectors
Connect CDR O2 umbilical to left PGA connectors
LH SUIT FLOW vlv - FULL FLOW
RH SUIT FLOW vlv -OFF
Disconnect O2 transfer umbilicals from
right PGA connectors
Connect protective plugs to right
PGA connectors
Install interconnect on O2 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.

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Verify ratchet pawl indicator(red)flush with housing

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xRatchet pawl indicator not flush: x
Hold RATCHET HANDLE full outboard
Press Pawl indicator to seat (flush)
Release RATCHET HANDLE
x x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Preload Shaft - push in to detend

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

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xIf latches cannot be closed: x
GEARBOX DISCONNECT - 180° CCW (tool B)
AUX LATCH DRIVE - LATCH (113° CW)
x Verify hatch latched, remove tool B x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

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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 ($\pm$.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

xxxxxxxxxxxxxxxxxxxxxxxxxxx
x Probe cannot be preloaded: x
x TBD x
xxxxxxxxxxxxxxxxxxxxxxxxxxx

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

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xLM/CM ΔP ind - decrease below 2.5 psid:x
x TBD x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

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)

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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)
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
x If no separation: x
x CSM/LM FNL SEP 2 - on (up) x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

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

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SECTION 10 - EVA

PRE IVT UNSTOWAGE

Umbillical 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

7 Seat, Leg, and Foot Pans Folded Against Back Pan With Seat Pan Locked
Left Foot X-X Strut Disconnected and Tied
8 Disconnect L-Shape bag, stow under right couch
9 Center Couch Removed and Stowed
Marmon Clamps Closed and Locked
10 THC on bracket on LiOH A-3
11 RHC #1, on bracket - LEB
12 RHC #2, on left armrest THC mount
13 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

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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)

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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
O2 FLOW IND - 1.0 lb/hr (pegged)
VERIFY O2 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:
    O2 DEMAND REG - OFF
    O2 FLOW IND - 0.2 lb/hr (pegged)
VERIFY O2 FLOW HI - OUT
Suit Press Ind Less Than 0.5 PSI/MIN
    Press Decay
O2 DEMAND REG - BOTH

```
*****************************************
*                                       *
*              CAUTION                  *
* If Repositioning of Suit Test vlv from *
* Press is Reqd Prior to Suit Press      *
* Stabilization Perform the Following -  *
*   O2 DEMAND REG - OFF                 *
*   AFTER 15 SEC, SUIT TEST -           *
*     DEPRESS OR OFF                    *
*   When Suit Press Stabilized,         *
*   O2 DEMAND REG - BOTH                *
*****************************************
```

SUIT TEST - DEPRESS
O2 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
O2 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 - O2 Flow HI Warning Light May
Come on Prior to Cabin Press
Reg Lock-Up

CABIN PRESS - 3.25 psia
SIDE HATCH DUMP - CLOSE
VERIFY O2 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

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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

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1. LMP INSERT C/L

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)

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7 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 (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)

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EPS SYSTEM

1 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

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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 - $\approx$ .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-O2 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 extinguishes.

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

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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

2 ECS Redundant Component Check

ECS INDS sel - PRIM
SUIT COMPR (2) - redundant compr
SUIT COMP 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

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

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

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

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

7 DOFFING PGA
EMER CABIN PRESS vlv - BOTH
SUIT RET AIR vlv - OPEN (pull)
Install hose screen on return hose
PWR - OFF

SUIT PWR - OFF for disconnect
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

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

B 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
O2 PRESS IND - TANK 1

12 SUIT CKT INTEGRITY CHECK
DIRECT O2 vlv - CLOSE (CW)
SUIT PRESS - 4.7-5.3 psia
O2 FLOW - 0.2-0.4 lb/hr
SUIT TEST vlv - PRESS
  O2 FLOW - 1.0 lb/hr (pegged)
  O2 FLOW HI lt - on
  M/A - on, Reset
  SUIT PRESS - 8.8-9.8 psia
  PGA PRESS (3) - 4.1-4.5 psig
O2 DEMAND REG vlv - OFF
  O2 FLOW - 0.2 lb/hr (pegged)
  O2 FLOW HI lt - out
  PGA PRESS (3) - < 0.5 psi/min decay
O2 DEMAND REG vlv - Both (O2 flow inc)
SUIT TEST vlv - DEPRESS
  O2 FLOW - 0.2-0.4 lb/hr
  SUIT PRESS - slightly > CAB PRESS
SUIT TEST vlv - OFF

13 PGA INTEGRITY CHECK
DIRECT O2 vlv - CLOSE (CW)
SUIT PRESS - 4.7-5.3 psia
O2 FLOW - 0.2-0.4 lb/hr
SUIT TEST vlv - PRESS
  O2 FLOW - 1.0 lb/hr (pegged)
  O2 FLOW HI lt - ON
  M/A - ON, Reset
  SUIT PRESS - 8.8-9.8 psia
  PGA PRESS (3) - 4.1-4.5 psig
SUIT FLOW vlv - OFF

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PGA PRESS - <0.5 psi/min decay
SUIT FLOW vlv - SUIT FULL FLOW
SUIT TEST vlv - DEPRESS
  O2 FLOW HI lt - OFF
  O2 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 O2 vlv - CLOSE (CW)
CAB PRESS REL vlv (RH) - DUMP
CABIN PRESS - 3.0-3.25 psia
  CAB PRESS REL vlv (RH) - BOOST ENTRY
  O2 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 O2 vlv - OPEN (CCW) for 1 min
O2 FLOW - 1.0 lb/hr (pegged)
O2 FLOW HI lt -on
MASTER ALARM pb/lt (3) -on, push
DIRECT O2 vlv- close (CW)
O2 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

17 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

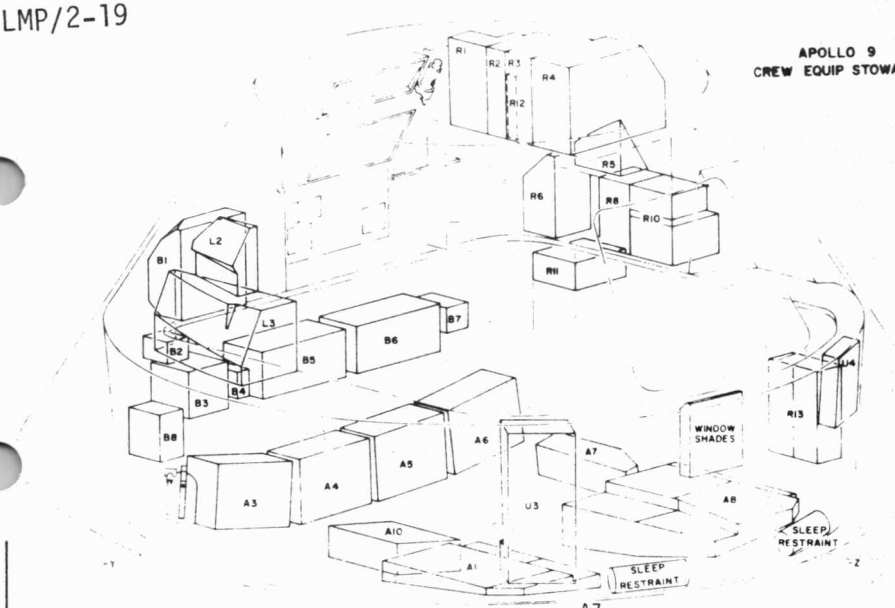
d. Switch to narrow beam and acquire manually
HI-GAIN ANT PITCH & YAW POS (2) - Set in required coordinates

*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.

Systems Test Meter Display	N_2, O_2, H_2 Pressure (PSIA)	EPS Radiator Outlet Temperature (°F)	CM-RCS Oxidizer Valve Temperature (°F)	LM Power (Amps)	SPS Temperature (°F)	Battery Manifold Pressure (PSIA)	Battery Relay Bus (VDC)
0.0	0	-50	-50	0	0	0.00	0
0.2	3	-36	-46	0.4	8	0.72	1.8
0.4	6	-22	-42	0.8	16	1.44	3.6
0.6	9	-8	-38	1.2	24	2.16	5.4
0.8	12	+6	-34	1.6	32	2.88	7.2
1.0	15	+20	-30	2.0	40	3.60	9.0
1.2	18	+34	-26	2.4	48	4.32	10.8
1.4	21	+48	-22	2.8	56	5.04	12.6
1.6	24	+62	-18	3.2	64	5.76	14.4
1.8	27	+76	-14	3.6	72	6.48	16.2
2.0	30	+90	-10	4.0	80	7.20	18.0
2.2	33	+104	-6	4.4	88	7.92	19.8
2.4	36	+118	-4	4.8	96	8.64	21.6
2.6	39	+132	0	5.2	104	9.36	23.4
2.8	42	+146	+4	5.6	112	10.08	25.2
3.0	45	+160	+10	6.0	120	10.80	27.0
3.2	48	+174	+14	6.4	128	11.52	28.8
3.4	51	+188	+18	6.8	136	12.24	30.6
3.6	54	+202	+22	7.2	144	12.96	32.4
3.8	57	+216	+26	7.6	152	13.68	34.2
4.0	60	+230	+30	8.0	160	14.40	36.0
4.2	63	+244	+34	8.4	168	15.12	37.8
4.4	66	+258	+38	8.8	176	15.84	39.6
4.6	69	+272	+42	9.2	184	16.56	41.4
4.8	72	+286	+46	9.6	192	17.28	43.2
5.0	75	+300	+50	10.0	200	18.00	45.0



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A1
Container A1-1
Penlights-5
Helmet stowage bag-3
Accessory bag-3
Utility towel assy.(RWB)-1 ea.
Tissue disp.-5
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.-3
PGA O_2 intercon. coupling assy w/cont.-3
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
CO_2 absorber & shims-4

A4
Container A4-1
CO_2 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
CO_2 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
LCG'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

A10

SO65 camera bracket-1
SO65 elect. Hasselblad camera-4
SO65 70mm film magazine-4
SO65 filters-4

B1
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

Red filter-1
Photar filter-2A-1
Right angle mirror-1
80mm lens w/cover-2
70mm film magazine-1
250mm lens-1
16mm data acquisition camera-1
16mm magazine-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
CO_2 absorber & shims-4

B6
Container B6-1
CO_2 absorber & shims-4

B7
Chlorination ampules-3
Buffer ampules-4
Chlorination ampules cont.-1

B8
Cushion B8-1
Power cable-1
16mm data acquisition camera-1
16mm film magazine-5
Inflight retainer strap-1

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

L3
Food packages-1

R1
Flight data file books-4
G&N handles-2
DUA hi density sun filters(G&N)-2
Tissue dispenser-2

R2
Flight data file books-8

R3
Flight data card kit-1
Flight data file books-8
Flight data file clips-6
Floodlight 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
H_2O disp. (L/H FEB)-1
O_2 mask & hose w/cont.(O_2 repress.sys)-3
PGA bag w/UCTA clamps-3
helmet shield-1
couch restraint strap-3
-(under center couch)
O_2 umb.clamp position lock (on umb.)-3
O_2 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.(LC&R) (on side of A8)-3
Shades w/cont. (on UEB O_2 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
CO_2 absorber (in ECU)-2
Inflight retainer strap (on O_2 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 LHFEB)

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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

O2 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)

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)

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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 - ACl 4

2 SUIT COMPR 1 - OFF

3 DIRECT O2 vlv - OPEN (CCW) for 1 minute 7
then close (CW)

If condition persists:

4 SUIT COMPR 2 - OFF

5 DIRECT O2 vlv - OFF

6 Doff helmet

7 Don emergency O2 masks

CMC	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.
ISS	SC CONT-SCS, G&N PWR - AC1 Both Lamps on: G&N PWR OFF, check V5N9 One lamp: V35 for lamp test
TEMP	RSET, If V11N10E, 30E, R1A=0,1,2,3: Temp in limits If not, 15 min available.
TRACKER	If: V5N9=121, RSET, REMARK; or RSET
SPS PRESS	FUEL/OX ΔP <20: Hi: He vlv-off, Lo: He vlv-on >20: Noncritical burn: ΔV THRUST OFF
SPS FLANCE Temp Hi	Non Critical Burn - ΔV THRUST-OFF Non Burn: heat soak back.
SM RCS	He 1 & 2-CLOSE; PKG TEMP <70 : Isolate Quad >70 : Htrs Off
CM RCS	MANF PRESS <260, He PRESS Low: CM RCS PRPLNT-OFF
CYRO PRESS	Any Lo: Fans and HTRS-ON Both Hi: Fans and HTRS-OFF
FC 1	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,

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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

FC O2 (H2) FLOW Hi .8(.1) O2 < (8)(H2): Cycle Purge
O2 > (8)(H2): Check amps vs. flow

FC O2 (H2) FLOW Lo .3(.04) Check VI perf., REG PRESS

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

AC BUS + MAN BUS UNDERVOLT 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 UNDER + AC BUS 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 DISCONNECT 1 or 3: Connect 1 to B, 3 to A
2 : Attemp Reconnect

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O2 FLOW Hi	Indicator, Cabin Press, Surge OK: Waste Mgt Valve Cabin Press Rel; Direct O2; Demand Reg; Repress O2; Emerg. Reg; H2O/Gly Tank Reg.
SUIT COMPRESSOR	$\Delta P < .22$, other comp to other bus
CO2 PP Hi	> 7.6mm: Direct O2 10 sec.
GLYCOL TEMP LOW	Prim Rad Out T < -30: Redud. RAD PRIM HTR, Redun. FLOW CONT
GLY EVAP TEMP Hi	>60° Actuate Secondary Loop

BUS LOST

COMPONENT	MNA	MNB	AC1	AC2	BAT A	B
INV 1	OFF	MNA/AC 1	OFF	MNA/AC1		
INV 2	MNB/AC2	OFF	MNB/AC2	OFF		
INV 3	MNB/AC1	MNA/AC2				
Flood Lite RH	Variable	Fixed				
Fuel Cell Pumps (3)			AC2	AC1		
G&N PWR (Lighting)			AC2	AC1		
Bat Charger			AC2	AC1		
Nonessential Bus	MNB	MNA				
SPS Gaging			AC2	AC1		
Pri Glycol Pump			1 AC2/ 2 AC2	1 AC1/ 2 AC1		
Suit Compressor			AC2	AC1		
SPS Line Htrs	A/B					
Pot H2O Htr	MNB	MNA				
H2O Accumulator	2 Auto/On	1 Auto/On				
Sec Coolant Pump			AC2	AC1		
ECS Rad: a) Flow Cont b) Prim Htr	PWR-2 1	PWR-Auto/ MAN 2	PWR-2	PWR-1	2	1
TVC GMBL Drive (P&Y)	2	1				
SCS TVC (P&Y)	Rate CMD	Rate CMD	Rate CMD	Rate CMD		
SPS GMBL Mtrs (4)	P-2/Y-2	P-1/Y-1			P&Y2	P&Y1
V Thrust (A&B)	B	A				
BMAG Mode (3)	Rate 2	Rate 1	Rate 2	Rate 1		
Rot Cntl Pwr Norm (2)			1 AC/DC	2 AC/DC		

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Rot Cntl Pwr Direct 1	MNA/MNB	MNA		
2	MNB	MNA/MNB		
FDAI Select	2	1	2	1
BMAG PWR	1 Off	2 Off	1 Off	1 On
	2 On	1 On	2 On	2 Off
SIG Cond/Driver Pwr (2)			AC 2	AC 1
FDAI/GPI Pwr	2	1	2	1
TVC Servo Pwr (2)	P Off	P AC1/MNA	AC2/MNB	AC1/MNA
	S AC2/MNB	S Off		
Flood Lights LH	Fixed	Variable		
AUTO RCS	MNB	MNA		
Urine Htr/Water H2O Htr	MNB	MNA		
Flood Lights LEB	Fixed	Variable		
FC 1	Off	MNA		
2	MNB	MNA		
3	MNB	Off		
Cabin Fan			2	1
Telecom Gp 1 Pri Xpndr Pri PA FM Xmtr Flt Qual Hook DSE PCM			AC2	AC1
Telecom Gp 2 Sec Xpndr Sec PA PGA PCM			AC2	AC1

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 Gmbl Drive P&Y - 2 (1)
C. SPS Gimbal Motors P&Y 2 (1) - Start (4 SPS Gmbl 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

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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 mir 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 sighting 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
   H2/02 fans(all) OFF
   H2/02 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

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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 (CB1, 2, 3, 4)	OPEN

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	11.0
2.	If GET 2 min. (EDS safe) Main A Batt C CB close Main B Batt C CB close	
3.	Power amp - off	3.5
4.	FC pumps - off	12.2
5.	Pot. H2O heater - off	1.6
6.	H2 heater (both) - off	1.44
7.	Cabin fans (both) - off	1.94
8.	H2 fans (both) - off	0.72
9.	O2 fans (both) - off	5.4
10.	SPS line heaters - off	=1.025 A/B=2.05

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11.	Lights (as required)	
12.	Tape recorder Fwd/Rwd - off	1.82
13.	VHF/AM A - off	1.0
14.	*SEC gimbal motors off	10.0
15.	CMC standby per procedures From operate to standby 2.0 amps	
16.	G&N power - off	1.5
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	0.65
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	11.0
2.	Power main from Batt C Main A Batt C CB - close Main B Batt C CB - close	
3.	ECS radiator heaters prim - off	17.3
	sec - off	17.3
4.	All FC pumps - off	10.0
5.	SMRCS heaters A,B,C,D - off 2.86 per Quad	
7.	Pot. H2O heater - off	1.6
8.	H2 heater (both) - off	1.44
9.	Cabin fans (both) - off	1.94
10.	H2 fans (both) - off	0.72
11.	O2 fans (both) - off	5.4
12.	SPS line heater - off A=1.025 A/B=2.05	
13.	Lights (as required)	
14.	If unsuited Suit compressor (both) - off	8.4
15.	Power Amp	3.53
16.	Tape recorder Fwd/Rwd - off	1.82
17.	SPS guaging - off	2.95

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

*NOTE:

After tracking update 0.05g Guidance & Navigation CB (10) - open

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ENTRY OPERATIONS

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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 - AC1
PRO (STBY lt - out)
V37E 00E
G/N IMU PWR - on (up) (NO ATT lt - on (90 sec))
V37 EXXE (20 sec after NO ATT lt - 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

LOGIC PWR 2/3 - on (up)
SIG COND/DRIVER BIAS PWR (2) - AC1
SCS ELEC PWR - GDC/ECA
FDAI PWR - OFF
BMAG PWR (2) - ON
FDAI PWR - BOTH
AUTO RCS SELECT (16) - enable

P51 - IMU ORIENTATION

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

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

INITIAL VEHICLE PREPARATION

1 ECSCHECKS
A. O2 STORAGE REFILL (if necessary)
O2 PRESS IND sw - SURGE TANK
T O2 PRESS - <865 psia
O2 PLSS vlv - FILL
O2 PRESS - >865 psia
O2 PLSS vlv - OFF

B. PGA VERIFICATION CHECK (5.0 psia CAB PRESS)
(If suited)
SUIT PRESS ind - 4.8-5.2 psia
O2 FLOW ind - 0.2-0.4 lb/hr
SUIT TEST vlv - PRESS
O2 FLOW ind - >1.0 lb/hr
O2 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
O2 DEMAND REG vlv - OFF
O2 FLOW ind - <0.2 lb/hr
O2 FLOW HI lt - OFF
PGA press ind (3) - 0.5 psi/min
pressure decay
O2 DEMAND REG vlv - BOTH
SUIT TEST vlv - DEPRESS
O2 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
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
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 lt on, do not turn off fan until light extinguishes.

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 V37E 52E
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°,.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 *

& TARGET ATTITUDE

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(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 RLSE *
*MNVR till R2±49775 *

(MARK ROUTINE) OPTICS MODE - MAN

9 F 51 PLEASE MARK
MARK

10 F 50 25 00016 TERMINATE MARKS
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

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13 F 06 05 STAR ANGLE DIFFERENCE (.01°)
(REJECT) V32E to 15
(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 $\pm$ 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 $\approx$9g
RANGE ind counts toward zero for 10 sec, then stops at 0 $\pm$ 0.2

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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 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

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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 lt - on *
*V05 N09E 01102 SELF *
* TEST ERROR *
(TERM) V21N27E 0E ^NOT RECORD FOR MSFN

MEASUREMENT AND LOADING OF PIPA BIAS & EMS DRIFT CK
EMS FUNCT - ΔV
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		

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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

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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

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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 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 OPTICS OFF & STOW
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

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```
   -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
5      06 40   TF GETI,VG,ΔVM      (min-sec,.1fps,.1fps)
               FDAI SCALE - 5/5
```

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UPDATE DET
ΔV THRUST A or B - NORMAL
THC - armed
RHC (2) - armed
LIMIT CYCLE - OFF

00:35 DSKY clears

00:30

06 40 Ave g on
TAPE RCDR - RECORD/FWD/HBR
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

7 IF SCS, THRUST ON pb - push for ignition

IGN 06 40 TFC, ΔVG, ΔVM (min-sec,.1fps,.1fps)
*SPS THRUST FAIL: *
*F 97 40 TFC,VG,ΔV *
*(RESTART) ENTR to 6 *
*(CONTINUE) PRO *
*Possible Prog ALARM *
*Key V05 N09E *
* 01407(VG increasing)*
~~X T[illegible]~~ SELECT ~~SCS~~ MTVC
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,ΔVM (min-sec,1fps,1fps)

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ECO+1 sec — ΔV THRUST (2) -OFF
VERIFY ALL THRUST OFF CUES
FC 2 MNA&B - OFF (tb-bp)

ECO+10 sec
PRO

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

10 F 37 — 00E
V82E

11 F 16 44 — HA,HP,TFF (.1nm,.1nm,min-sec)
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 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

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)
– NO EXT V IN P62 – just in / crew

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_____

Basic Date_____ Changed_____ Feb. 1, 1969 CSM 104

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 (3)-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 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

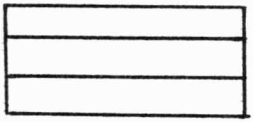
10 .05g P64 AUTO
06 68 BETA,VI,HDOT (monitor)
SC CONT - CMC
.05g lt - on
MAN ATT (3) - RATE CMD
.05g sw - on (up)
EMS ROLL - on (up)

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=1000 fps, 65K)
IF RTGO=-,LIFT UP
=+,LIFT DOWN
MONITOR ALTIMETER

16 67



EARTH LANDING, pg E/5-1

SECTION 3. SM RCS DEORBIT

Obtain new maneuver & entry update from MFSN

P30 EXTERNAL ΔV

1		V37E30E	NOTE:	COMPUTE TIG
	F 06 33	GETI	TFP	_____ (N32)
		PRO	+	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	(.01°)
		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
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 (.1fps)
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
O2 PLSS vlv - ON
O2 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

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
-00:15m RATE - HIGH

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, pg _____
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
FDAI SCALE - as desired

8 P63 AUTO

Basic Date Feb. 1, 1969
Changed
CSM 104

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 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 = 1000fps, 65K)
IF RTGO = -, LIFT UP
= +, LIFT DOWN
MONITOR ALTIMETER

VI-2300f

16 67 [ ]

EARTH LANDING, pg E/5-1

Basic Date _____
Changed _____

SECTION 4. SM/CM RCS DEORBIT (HYBRID)

Obtain new maneuver and entry update from MFSN

P30 EXTERNAL ΔV

1		V37E 30E	NOTE: COMPUTE TIG
	F 06 33	TIG	TFP _____(N32)
		PRO	+ 43+00
			GIVES TIG _____
2	F 06 81	ΔV XYZ(LV)	
		PRO	
3	F 06 42	HA,HP,ΔV	
		EMS ΔV to DESIRED ΔV	
		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	
	V25	N17E	
		LOAD FDAI R,P,Y FOR CM RCS	
		ADD 110° TO SM RCS PITCH ATT. (0,260,0)	
		KEY RLSE	
		V 23 N40E +00000E	

Basic Date Feb. 1, 1969
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CSM 104

10 TIG-10:00	CM/SM PRE-SEPARATION
	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
-00:35	DSKY clears
-00:30	BMAG MODE (3) - ATT1/RATE 2

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CSM 104

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 +00000E 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

Basic Date _____
Changed _____

18	F 37	61E
19		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
20	F 06 61	Load LAT,LONG,HDS UP (.01°,.01°,+00001) PRO
21	F 06 60	GMAX,VPRED,GAMMA EI (.01G,fps,.01°) PRO
22	F 06 63	RTGO,VIO,TFE (.1nm,fps,min-sec) RECORD & COMPARE WITH MSFN PRO CMC DISPLAYS P62 (or Key V37E 62E)
23	F 50 25	R1 00041 (SEP) PRO
24	F 06 61	IMPACT LAT,LONG,HDS UP/DWN (.01°,.01°,+/-00001) PRO
25	F 06 22	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
26		P63 AUTO

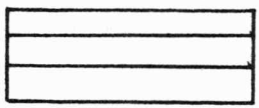
27 06 64 G,VI,RTGO (+ overshoot)
V82 to monitor TFF, then N64 for g
Start EMS manually at RET .05g

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 V82E
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 REL = 1000 fps, 65K)
IF RTGO = -,LIFT UP
= +,LIFT DOWN
MONITOR ALTIMETER

16 67 

VI 2300

EARTH LANDING, pg E/5-1

SECTION 5. EARTH LANDING

50K' SECS LOGIC (2) - on(up)
SECS PYRO ARM (2) - on(up)

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
CM UNSTABLE
RCS CMD - OFF
<40K' APEX COVER JETT pb - push
DROGUE DEPLOY pb - push
(2 sec after apex cover jett)
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

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 vlvs (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

5. EARTH LANDING

3K'	CAB PRESS REL vlv - DUMP
	ROT CONT PWR DIRECT (2) - OFF
≤1000	CAB PRESS REL vlv (2) - CLOSE
	MN BUS TIES (2) - OFF
	Postlanding check pg E/6-1

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
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
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
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

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3. POSTLANDING COMMUNICATIONS
VHF ANT-RECY (verify)
VHF BCN - ON (verify)
If no contact with recovery forces
MONITOR VHF BEACON Transmission with survival radio
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X VHF Beacon not operating: X
X Connect survival transceiver to ant X
X cable and place radio in BCN mode X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

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

Basic Date Dec. 1, 1969
Changed _____
C 104

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 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 - ACl

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

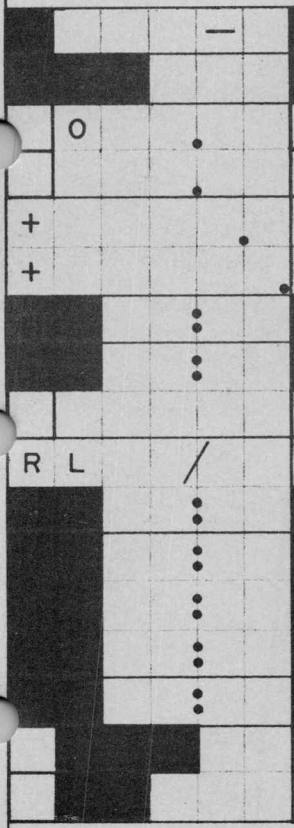
5 DIRECT O2 vlv - OFF

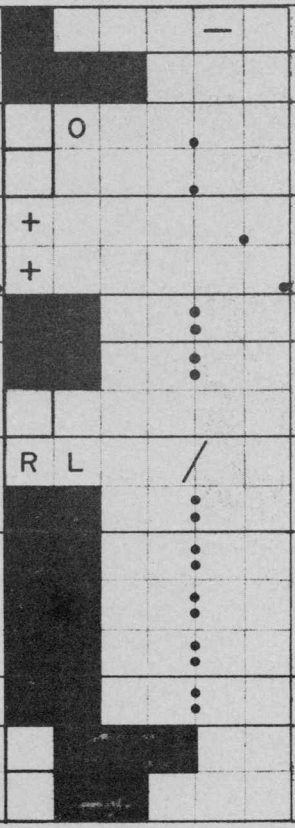
6 Doff helmet

7 Don emergency O2 masks

Basic Date eb. 1, 1969
Changed

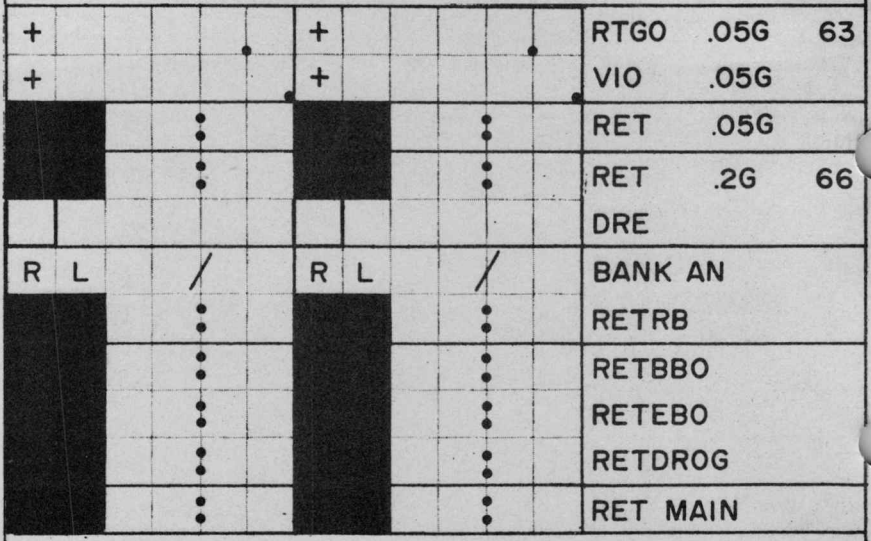
ENTRY UPDATE





AREA
P300K
LAT 61
LONG
RTGO .05G
VIO .05G
RET .05G
RET .2G
DRE 66
BANK AN
RET RB
RETBBO
RETEBO
RETDROG
RET MAIN
BBA(ΔV@90)CHART
DRE(@90) UPDATE

POSTBURN UPDATE



P27 UPDATE

V	V	V	PURP
INDEX	INDEX	INDEX	01
			02
			03
			04
			05
			06
			07
			10
			11
			12
			13
			14
			15
			16
			17
			20
			21
			22
			23
			24
: :	: :	: :	T 34
			ϕ 43
			λ NAV CHECK
+	+	+	H

REMARKS

MANEUVER UPDATE (P30)

		PURPOSE	
+ 0 0	+ 0 0	HR TIG	33
+ 0 0 0	+ 0 0 0	MIN	
+ 0	+ 0	SEC	
		ΔVX	81
		ΔVY LOCAL VERT	
		ΔVZ	
+	+	ΔVR	42
+	+	ΔVC	
		BT	
+	+	CSM WT	47
0 0	0 0	PTRM	48
0 0	0 0	YTRM	
		SXTS	
		SFT	
		TRUN	
0	0	φ(+N) NAV CHECK (TIG−30)	43
		λ(+E)	
+ 0	+ 0	h	

REMARKS R_____ P_____ Y_____

RESIDUALS_____ _____ _____ ΔVC_____