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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

TRANSLUNAR, LUNAR PARKING ORBIT, AND TRANSEARTH PROCEDURES

C-PRIME MISSION

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TRANSLUNAR, LUNAR PARKING ORBIT, AND TRANSEARTH PROCEDURES

C-PRIME MISSION

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1.0 PURPOSE

This document contains the nominal primary crew procedures for the CSM-103 spacecraft during the lunar Mission C-Prime. The specific time period covered by these procedures is from CSM/S-IVB separation at 3:20 GET through the last TEMCC (MCC7) at 144:50 GET.

The purpose of the Translunar, Lunar Parking Orbit and Transearth procedures document is to provide a single source of guidance, navigation and control procedures information for use in flight planning, in crew training, and in preparation of onboard checklists.

This document is a control document for this phase of the Mission C-Prime nominal crew procedures. Revisions to this document are subject to approval by the Procedures Configuration Control Board. Comments should be directed to Mr. Duane K Mosel, Flight Procedures Branch, Extension 5340 or to Stephen G. Paddock, Jr., Apollo Flight Crew Support Group, Houston Operations, McDonnell Douglas Astronautics Company, Extension 6101.

2.0 LIST OF ACRONYMS AND ABBREVIATIONS

AOS	Acquisition of Signal
ATT	Attitude
BEF	Blunt End Forward
CB	Circuit Breaker
CDR	Commander
CM	Command Module
CMC	Command Module Computer
CMP	Command Module Pilot
COAS	Crew Optical Alignment Sight
CSM	Command and Service Module
DAP	Digital Autopilot
DB	Deadband
DSKY	Display and Keyboard
DV	Delta Velocity
EMS	Entry Monitor System
ET	Event Timer
FDAI	Flight Director Attitude Indicator
FPS	Feet Per Second
GDC	Gyro Display Coupler
GETI	Ground Elapsed Time of Ignition
GMBL	Gimbal
GND	Ground
GPI	Gimbal Position Indicator
HA	Apogee Altitude
HOR	Horizon
HP	Perigee Altitude
IMU	Inertial Measurement Unit
LEB	Lower Equipment Bay

LOS	Loss of Signal
LM	Lunar Module
LMK	Landmark
LMP	Lunar Module Pilot
LOI	Lunar Orbit Injection
LV	Launch Vehicle
MDC	Main Display Console
MGA	Middle Gimbal Angle
MTVC	Manual Thrust Vector Control
OPT	Optics
ORDEAL	Orbital Rate Drive Earth and Lunar
OSS	Optical Subsystem
PAD	Data Voiced to Crew From Ground
PB	Pushbutton
PGNCS	Primary Guidance, Navigation, and Control System
PIPA	Pulse Integrating Pendulous Accelerometers
R	Range
R DOT	Range Rate
REFSMMAT	Reference Stable Member Matrix
RCS	Reaction Control System
RHC	Rotation Hand Controller
S-IVB	Saturn S-IVB Stage
SCS	Stabilization and Control System
SCT	Scanning Telescope
SECS	Sequence Events Control System
SEF	Small End Forward
SEP	Separation
SM	Service Module
SPS	Service Propulsion System
SC	Spacecraft

S/U	Setup
SXT	Sextant
TEMCC	Transearth Midcourse Correction
TFI	Time From Ignition
THC	Translation Hand Controller
THETA	Angle Between SC +X Axis and Local Horizontal
TIGN	Time of Ignition
TLI	Translunar Injection
TEI	Transearth Injection
TLM	Telemetry
TLMCC	Translunar Midcourse Correction
TRUN	Trunnion
TVC	Thrust Vector Control
VG	Velocity to be Gained
(XX:XX)	Inidcates ground elapsed time from liftoff in hours: minutes

3.0 NOMINAL MISSION PROCEDURES

The nominal Mission C-Prime Translunar, Lunar Parking Orbit, and Transearth flight crew procedures presented in this document are divided into two sections, a major activities timeline and standard procedures. The timeline identifies all guidance, navigation, and control related activities as a function of GET. The procedures necessary to successfully perform an activity required only once during the mission, e.g. CSM/S-IVB separation, are presented in detail within the timeline. Whereas, the procedures for an activity reoccurring periodically throughout the mission, e.g. an IMU alignment, are presented in detail in an addendum to avoid repetition. The timeline identifies how and when the standard procedure should be applied and the standard procedure is sufficiently flexible to cover any option required during the mission.

3.1 Major Activities

3.1.1 Introduction

The major procedures timeline for the Mission C-Prime includes activities from after the TLI (2:51 GET) through the last Transearth midcourse correction (144:50 GET). Figure 3-1 shows the locations in time and approximate positions in space of selected major activities during the Translunar and Transearth phases. Figure 3-2 is a CSM attitude profile for the Lunar Parking Orbit phase. The nominal Mission C-Prime timeline assumes a 21 December 1968 launch, a 72 degree launch azimuth, and a nominal TLI ignition time of 02:50:31 GET.

The procedures presented in this document include primarily guidance, navigation, and control functions. Management of other systems, such as electrical power and environmental control are recommended as identified in Reference (1).

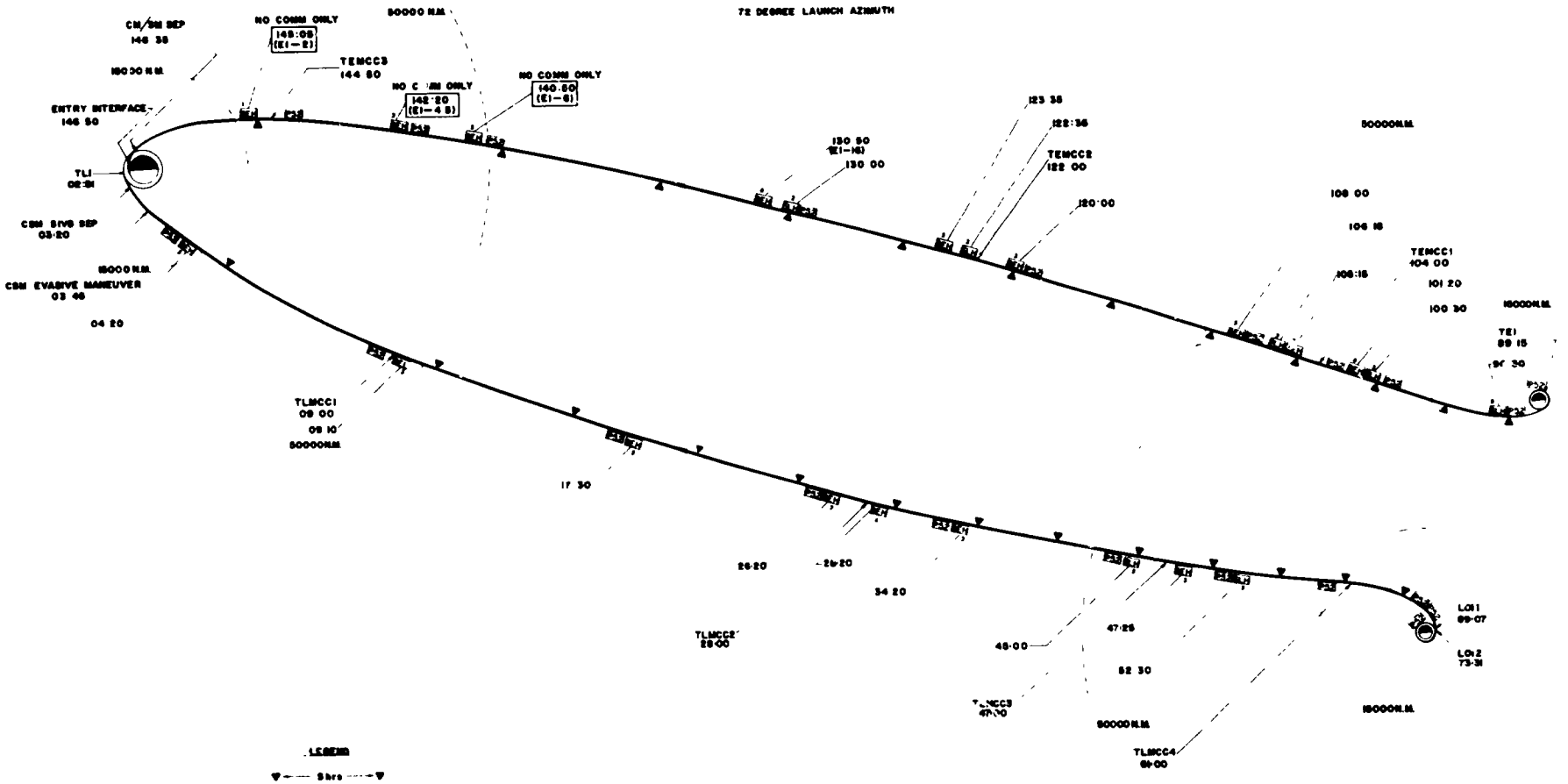
MISSION C-PRIME
TRAJECTORY AND PROCEDURAL PROFILE

FIGURE 3-1

-5A-

21 DECEMBER 1968 LIFTOFF

72 DEGREE LAUNCH AZIMUTH



LEGEND

▼—— 5 hrs ——▼

ALL EVENT TIMES (XX hrs XX min) ARE GROUND ELAPSED TIME (GET).

STAR/EARTH LANDMARK SIGHTINGS

STAR/EARTH HORIZON SIGHTINGS

STAR/LUNAR HORIZON SIGHTINGS

IMU ALIGNMENT

NOTE:

TRAJECTORY PROJECTION IN EARTH EQUATORIAL PLANE.

TRAJECTORY SCALE APPROXIMATELY —— 5000 N.M.

EARTH & MOON NOT TO SCALE.

LUNAR PARKING ORBIT CSM ATTITUDE PROFILE

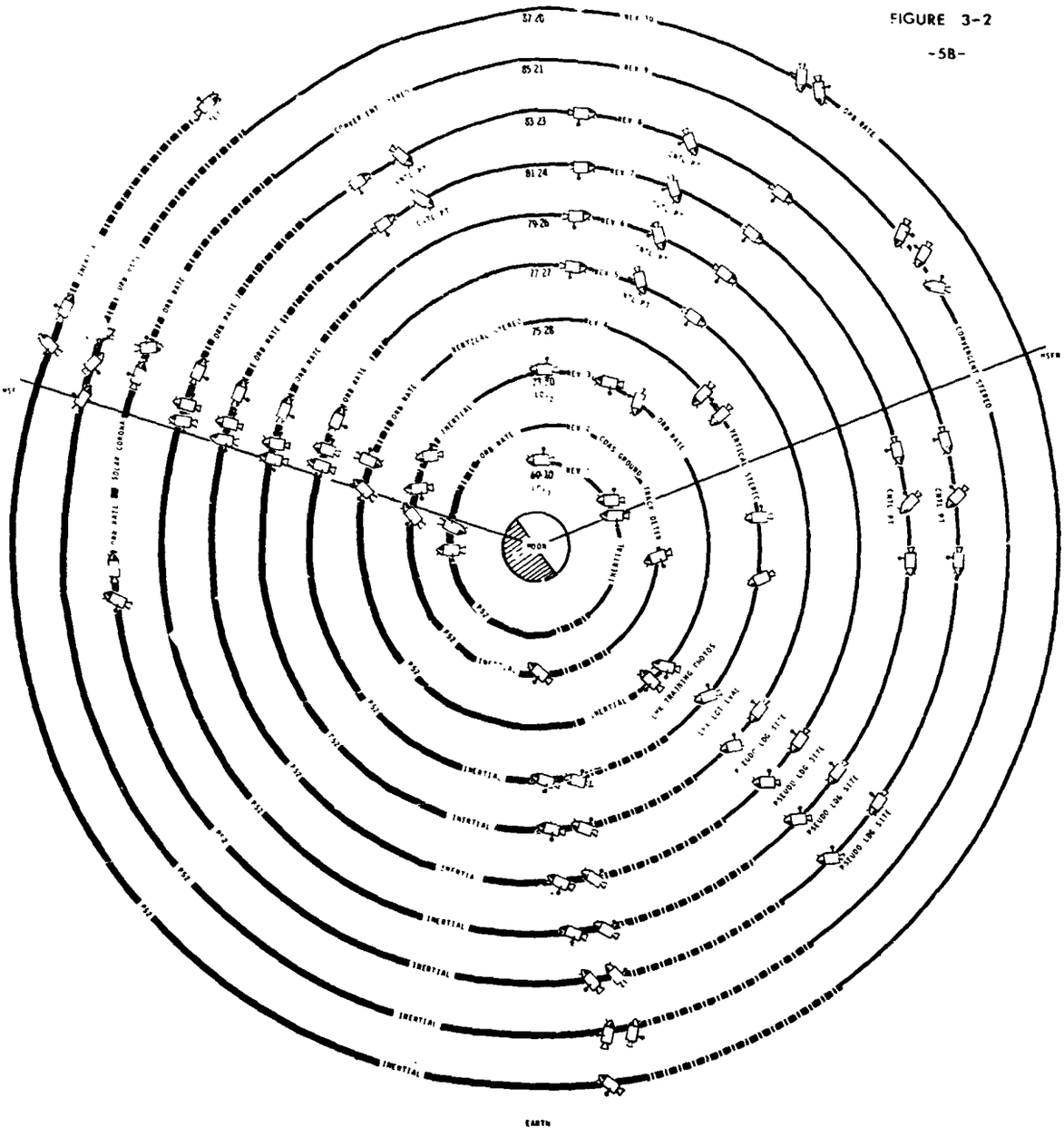


FIGURE 3-2

****
****
MISSION C-PRIME PROCEDURES
TLI TO CM/SM SEP
MAJOR PROCEDURE TIMELINE
****
****

GET | DISP PLAY | CREW PROCEDURES | PANEL

(00+00)

LIFT OFF

(02+51)

TRANSLUNAR INJECTION

ASSUMED PRE-CSM/S-IVB SEPARATION
SWITCH POSITIONS AND DAP
CONFIGURATION
(ADDENDUM 1)

(03+07)

CMP LOAD N17 WITH SEP ATTITUDE
KEY V63E
CDR MONITOR S-IVB MANEUVER TO
INERTIAL SEP ATTITUDE

(03+14)

PROCEDURES FOR CSM/S-IVB SEP
(ASSUMES P47 BEING MONITORED)

CDR SET ET=58+00(COUNT UP)
P47 F 16 83 (DVX,DVY,DVZ)
FDAI SEL-1/2 1
MAN ATT(3)-RATE CMD
ATT DB-MIN 1
RATE-LOW
CDR TRANS CONT PWR-ON(UP) 1
RHC PWR DIRECT(BOTH)-MNA/MNB 1
SC CONT-CMC
CMC MODE-FREE 1
BMAG MODE(3)-RATE2
AUTO RCS SEL(16)-MNA 8
VERIFY CB EDS(ALL)-CLOSED 8
VERIFY CB RCS LOGIC(2)-CLOSED 8
TVC SERVO PWR 1-AC1/MNA 7
EDS PWR-ON(UP) 7
VERIFY LV ENG LT-ON 1
FDAI/SW(BOTH)(ORDEAL)-INER 13

-2MIN CDR START ET COUNT UP
THC-ARMED
RHC-ARMED
CB PYRO A SEQ A-CLOSED 250
CB PYRO B SEQ B-CLOSED 250
CB SECS ARM(BOTH)-CLOSED 8
SECS LOGIC(BOTH)-ON(UP) 8
LMP REPORT LOGIC ARM TO GND
RECEIVE GO FROM GND
NONESS BUS-MNA
FLT RCDR-RECORD
TLM INPUTS PCM-HIGH
UP TLM CMD-RESET THEN NORM
TAPE RCDR PCM-PCM/ANLG

	TAPE RCDR RCD-RCD		
	TAPE RCDR FWD-FWD		
	TAPE MOTION TB-RP		
	CMP COPY POST TLI DVS FROM DSKY		
	KEY V32E		
	VERIFY DSKY DVS ZERO		
-1MIN	CDR SECS PYRO ARM(BOTH)-ON(UP)	8	
	CM RCS LOGIC-ON(UP)	1	
	RCS CMD-ON	2	
	CMP KEY V60E (N17=N20)		
	CDR EMS FUNCTION-DV	1	
	EMS MODE-AUTO	1	
	CMC MODE-HOLD		
-2SEC	THC-THRUST(+)X AND HOLD (PRESEP TENSION)		
(03+20)			
-0SEC	CSM/LV SEP PB-PUSH AND HOLD	1	
	VERIFY LV ENG 1 LT-OFF	1	
	CSM/LV SEP PB-RELEASE	1	
+5SEC	THC-RELEASE		
	VERIFY EMS DV IND READS 1FPS (APPROXIMATE)	1	
	MAINTAIN INERTIAL SEP ATT USING FDAI		
	RHC PWR DIRECT(BOTH)-OFF	1	
	CM RCS LOGIC-OFF	1	
	EDS PWR-OFF	7	
	TVC SERVO PWR 1-OFF	7	
	SECS LOGIC(BOTH)-OFF	8	
	SECS PYRO ARM(BOTH)-SAFE	8	
	CB SECS ARM(BOTH)-OPEN	8	
	CB SECS LOGIC(BOTH)-OPEN	8	
	CB RCS LOGIC-OPEN	8	
	CB EDS(ALL)-OPEN	8	
	CB PYRO A SEQ A-OPEN	250	
	CB PYRO B SEQ B-OPEN	250	
+40SEC	LMP FLT RCDR-OFF(CTR)	2	
	TAPE RCDR FWD-OFF(CTR)		
	NONESS BUS-OFF	5	
+1MIN	CDR THC-THRUST(-)X FOR 5SEC		
	EMS MODE-STBY	1	
	EMS FUNCTION-OFF	1	
	CMP PRO		
	F 37 88		
P00	KEY 00E		
	CDR CMC MODE-AUTO	1	
	BMAG MODE(3)-RATE2	1	
	MAN ATT(3)-RATE CMD	1	
	CMP KEY V16 N20E		
	16 20 (CURRENT R,P,Y)		
	COPY CURRENT R,P,Y		
	COMPUTE COMMANDED R,P,Y FOR 180 DEG PITCH AND 60 DEG ROLL LEFT ATT MANEUVER		
	PRO		
	KEY V49E		
	F 06 22 (COMMANDED R,P,Y)		
	LOAD COMPUTED R,P,Y		
	KEY V62E		
	PRO		
	F 50 18 (COMMANDED R,P,Y)		
	PRO		
	06 18 (COMMANDED R,P,Y)		
	MONITOR ATT MANEUVER		
	OBSERVE S-IVB IN CMD WINDOW		

```
      F 50 18 (COMMANDED R,P,Y)
              KEY ENTER

              KEY V48E
      F 04 46 (DAP CONFIGURATION)
              LOAD
                   11102 (MIN DB,LOW RATE)
                   11111
                     8

              PRO
      F 06 47 (CSM AND LM WT)
              VERIFY PAD DATA
              PRO
      F 06 47 (SPS GMBL TRIM)
              VERIFY PAD DATA
              PRO

(03+24)
           CDR PERFORM FORMATION FLYING
                AT 50 TO 100 FT
               TAKE PHOTOGRAPHS OF S-IVB

(03+30)
           PROCEDURES FOR CSM EVASIVE
            MANEUVER

P00        CMP WHEN COMP LT-OUT(NO INTEG)
                KEY V96E
               KEY V83E
        F 16 54 (R,RDOT,THETA)
           CDR MAN ATT(3)-ACC CMD
               MANEUVER SC TO LOCAL
                VERTICAL(+X AXIS TOWARD
                EARTH) WHILE TRANSLATING TO
                MAINTAIN S-IVB IN CMD WINDOW
                ATT DB-MIN                    1
                RATE-LOW                      1
                MAN ATT(3)-RATE CMD           1
                HOLD LOCAL VERTICAL ATTITUDE
                 (DSKY THETA APPROX 270 DEG)
                 WITH S-IVB BETWEEN SC
                 AND EARTH
             CMP PRO

P47             KEY V37E47E
        F 16 83 (DVX,DVY,DVZ)

             CDR BMAG MODE(3)-ATT1/RATE2
                 EMS FUNCTION-DV
                 EMS MODE-AUTO

 (03+35)
                 THC-THRUST AFT (-X) UNTIL
                  DSKY READS 1.5FPS
                 VERIFY S-IVB RANGE OPENING
                  VISUALLY
                 THC-LOCKED
                 PITCH UP FOR MSFN COVERAGE
             CMP PRO
        F 37 88

P00              KEY 00E

                 KEY V66E (TRANSFER CSM SV
                  FROM CSM SLOTS TO LM SLOTS)

                 KEY V48E
        F 04 46  (DAP CONFIGURATION)
                 LOAD
                      11112 (MAX DB,LOW RATE)
                      11111
```

PRO
F 06 47 (CSM AND LM WT)
VERIFY PAD DATA
PRO
F 06 48 (SPS GMBL TRIM)
VERIFY PAD DATA
PRO
CDR MONITOR SC INERTIAL ATTITUDE
HOLD UNTIL APROX (04+00)

(04+00)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(04+15)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(04+20)

PROCEDURES FOR STAR/EARTH
HORIZON SIGHTINGS - 5 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 14(CANOPUS) (FAR HOR)
NO. 15(SIRIUS) (FAR HOR)
NO. 1[illegible](SIRIUS) (FAR HOR)
NO. 15(PROCYON) (FAR HOR)
NO. 16(PROCYON) (FAR HOR)

(05+00)

LMP RECEIVE BLOCK DATA PAD
FROM GND

(05+20)

PROCEDURES FOR LOI POSITION
DETERMINATION
(ADDENDUM 5) (P21)

(05+40)

PROCEDURES FOR HI GAIN PWR UP

P00 LMP CB HI GAIN ANT
FLT BUS-CLOSED 225
GRP 2-CLOSED 225
HI GAIN ANT TRACK-MAN 2
HI GAIN ANT SERVO ELEC-PRIM 2
HI GAIN ANT BEAM-WIDE 2
HI GAIN ANT PWR-POWER 2
CMP KEY V64E
F 06 51 (RHO,GAMMA,BLANK)
LMP RECORD HI GAIN ANT
GMBL COORDINATES
CMP PRO
LMP HI GAIN ANT POSITION
SET ANT PITCH TO RHO 2
SET ANT YAW TO GAMMA 2
S-BAND ANT OMNI-HI GAIN 3
VERIFY HI GAIN ANT S-BAND
ANT IND GREATER THAN
HALF SCALE 2
HI GAIN ANT TRACK-AUTO 2

```
            HI GAIN ANT BEAM-AS REQUIRED
            PERFORM HI GAIN ANT CHECK-OUT

(07+30)
        PROCEDURES FOR GDC DRIFT CHEC-
            (ADDENDUM 7)

(07+40)
        PROCEDURES FOR IMU REALIGN TO
         REFSMMAT FOR DRIFT CHECK
            (ADDENDUM 2)                    (P52)

            BACKUP ALIGN NAV STARS
             NO. 14(CANOPUS)
             NO. 12(RIGEL)
            BACKUP ALIGN CHECK NAV STAR
             NO. 15(SIRIUS)

(07+55)
        PROCEDURES FOR GDC ALIGN TO IMU
            (ADDENDUM 3)

(08+00)
        PROCEDURES FOR GND UPLINK OF CSM
         STATE VECTOR AND P30 TARGET LOAD
            (ADDENDUM 8)                    (P27)

            FOLLOWING GND UPLINK

P00         LEB WHEN COMP LT-OUT(NO INTEG)
             KEY V96E
            KEY V83E
     F 16 54 (R,RDOT,THETA)
            COPY R AND RDOT
            PRO
            KEY V89E
     F 04 06 (TRACK AXIS OPTION)
            LOAD 00002 IN R2
            PRO
     F 06 18 (COMPUTED R,P,Y)
            COPY R,P,Y
            KEY V34E

P00         KEY V37E00E

            KEY V47E (TRANSFER CSM SV
             FROM LM SLOTS TO CSM SLOTS)

(0A+20)
        PROCEDURES FOR EXT DV TARGETING
            (ADDENDUM 9)                    (P30)

        **********************************
        PROPULSION SYSTEM SELECTION
            USE RCS FOR DV GREATER THAN
             1FPS AND LESS THAN OR EQUAL
             TO 5FPS
            USE SPS FOR DV GREATER THAN
             5FPS

            TRIM DVS TO ZERO
        **********************************

(0A+25)
        PROCEDURES FOR SM RCS PROPULSION
         MONITOR CHECK
            (ADDENDUM 10)

(0A+30)
        PROCEDURES FOR SPS THRUST SETUP
            (ADDENDUM 11)                   (P40)
```

(09+00)
FIRST TRANSLUNAR MIDCOURSE

(09+05)
PROCEDURES FOR SM RCS AND SPS
PROPULSION MONITOR CHECK
(ADDENDUM 10)

(09+10)
PROCEDURES FOR STAR/EARTH
LANDMARK SIGHTINGS - 3 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 15(SIRIUS)
NO. 15(SIRIUS)
NO. 16(PROCYON)
RECOMMENDED LANDMARK
NO. 5(ALTERNATES-7,10,20,32,
40,41,56,69,70,100,
115,127,128)

(09+50)
PROCEDURES FOR LOI POSITION
DETERMINATION
(ADDENDUM 5) (P21)

(09+55)
PROCEDURES FOR ESTABLISHING PTC
(ADDENDUM 13)

(12+00)
LMP RECEIVE BLOCK DATA PAD
FROM GND

(17+05)
PROCEDURES FOR TERMINATING PTC
(ADDENDUM 14)

(17+10)
PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(17+25)
PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(17+30)
PROCEDURES FOR STAR/EARTH
HORIZON SIGHTINGS - 5 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 22(REGULUS) (FAR HOR)
NO. 22(REGULUS) (FAR HOR)
NO. 16(PROCYON) (FAR HOR)
NO. 16(PROCYON) (FAR HOR)
NO. 16(PROCYON) (FAR HOR)

(18+20)
PROCEDURES FOR LOI POSITION
DETERMINATION

(ADDENDUM 5) (P21)

(18+25)

PROCEDURES FOR ESTABLISHING PTC
(ADDENDUM 13)

(25+10)

LMP RECEIVE BLOCK DATA PAD
FROM GND

(25+55)

PROCEDURES FOR TERMINATING PTC
(ADDENDUM 14)

(26+00)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(26+15)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(26+20)

PROCEDURES FOR STAR/EARTH
HORIZON SIGHTINGS - 3 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 16(PROCYON) (FAR HOR)
NO. 22(REGULUS) (FAR HOR)
NO. 26(SPICA) (NEAR HOR)

(26+50)

PROCEDURES FOR LOI POSITION
DETERMINATION
(ADDENDUM 5) (P21)

(27+00)

PROCEDURES FOR GND UPLINK OF CSM
STATE VECTOR AND P30 TARGET LOAD
(ADDENDUM 8) (P27)

FOLLOWING GND UPLINK

P00 LEB WHEN COMP LT-OUT(NO INTEG)
KEY V96E
KEY V83E
F 16 54 (R,RDOT,THETA)
COPY R AND RDOT
PRO

KEY V89E
F 04 06 (TRACK AXIS OPTION)
LOAD 00002 IN R2
PRO
F 06 18 (COMPUTED R,P,Y)
COPY R,P,Y
KEY V34E

P00 KEY V37E00E

KEY V47E (TRANSFER CSM SV
FROM LM SLOTS TO CSM SLOTS)

(27+30)

PROCEDURES FOR EXT DV TARGETING
(ADDENDUM 9) (P30)

****

PROPULSION SYSTEM SELECTION
USE RCS FOR DV GREATER THAN
1FPS AND LESS THAN OR EQUAL
TO 5FPS (A DV GREATER THAN
5FPS REQUIRES SCHEDULING THE
MIDCOURSE AT THE EARLIEST
POSSIBLE TIME.HENCE THE SPS
SHOULD NOT BE REQUIRED FOR
THIS MIDCOURSE CORRECTION)

TRIM DVS TO ZERO

****

(27+35)

PROCEDURES FOR SM RCS PROPULSION
MONITOR CHECK
(ADDENDUM 10)

(27+40)

PROCEDURES FOR RCS THRUST SETUP
(ADDENDUM 12) (P47)

(28+00)

SECOND TRANSLUNAR MIDCOURSE

(28+05)

PROCEDURES FOR SM RCS AND SPS
PROPULSION MONITOR CHECKS
(ADDENDUM 10)

(28+20)

PROCEDURES FOR STAR/EARTH
HORIZON SIGHTINGS - 4 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 16(PROCYON)(FAR HOR)
NO. 22(REGULUS)(FAR HOR)
NO. 21(ALPHARD)(FAR HOR)
NO. 26(SPICA) (NEAR HOR)
(NO. 21(ALPHARD) HAS
MAG 2.2 AND MAY NOT BE
VISIBLE.IF NOT SELECT
NO. 22(REGULUS))

(29+00)

PROCEDURES FOR LOI POSITION
DETERMINATION
(ADDENDUM 5) (P21)

(29+05)

PROCEDURES FOR ESTABLISHING PTC
(ADDENDUM 13)

(33+55)

PROCEDURES FOR TERMINATING PTC
(ADDENDUM 14)

(34+00)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)

BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(34+15)
PROCEDURES FOR GDC ALIGN TO I..U
(ADDENDUM 3)

(34+20)
PROCEDURES FOR STAR/EARTH
HORIZON SIGHTINGS - 3 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P24)

RECOMMENDED NAV STARS
NO. 16(PROCYON)
NO. 22(REGULUS)
NO. 26(SPICA)

(34+50)
PROCEDURES FOR LOI POSITION
DETERMINATION
(ADDENDUM 5) (P21)

(34+55)
LMP RECEIVE BLOCK DATA PAD
FROM GND

(35+00)
PROCEDURES FOR ESTABLISHING P.C
(ADDENDUM 13)

(44+00)
LMP RECEIVE BLOCK DATA PAD
FROM GND

(44+35)
PROCEDURES FOR TERMINATING PTC
(ADDENDUM 14)

(44+40)
PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(44+55)
PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(45+00)
PROCEDURES FOR STAR/LUNAR
HORIZON SIGHTINGS - 5 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 33(ANTARES) (NEAR HOR)
NO. 33(ANTARES) (NEAR HOR)
NO. 37(NUNKI) (NEAR HOR)
NO. 45(FOMALHAUT) (FAR HOR)
NO. 42(PEACOCK) (FAR HOR)

(45+50)
PROCEDURES FOR LOI POSITION
DETERMINATION
(ADDENDUM 5) (P21)

```
(46+00)
        PROCEDURES FOR GND UPLINK OF CSM
         STATE VECTOR AND P30 TARGET LOAD
            (ADDENDUM 8)                (P27)

            FOLLOWING GND UPLINK

P00         LEB WHEN COMP LT-OUT(NO INTEG)
             KEY V96E
            KEY V83E
      F 16 54 (R,RDOT,THETA)
            COPY R AND RDOT
            PRO

            KEY V89E
      F 04 05 (TRACK AXIS OPTION)
            LOAD 00002 IN R2
            PRO
      F 06 18 (COMPUTED R,P,Y)
            COPY R,P,Y
            KEY V34E

P00         KEY V37E00E

            KEY V47E (TRANSFER CSM SV
             FROM LM SLOTS TO CSM SLOTS)

(46+30)
        PROCEDURES FOR EXT DV TARGETING
            (ADDENDUM 9)                (P30)

        ************************************
        PROPULSION SYSTEM SELECTION
            USE RCS FOR DV GREATER THAN
             1FPS AND LESS THAN OR EQUAL
             TO 5FPS (A DV GREATER THAN
             5FPS REQUIRES SCHEDULING THE
             MIDCOURSE AT THE EARLIEST
             POSSIBLE TIME,HENCE THE SPS
             SHOULD NOT BE REQUIRED FOR
             THIS MIDCOURSE CORRECTION)

            TRIM OVS TO ZERO
        ************************************

(46+35)
        PROCEDURES FOR SM RCS PROPULSION
         MONITOR CHECK
            (ADDENDUM 10)

(46+40)
        PROCEDURES FOR RCS THRUST SETUP
            (ADDENDUM 12)               (P41)

(47+00)
        THIRD TRANSLUNAR MIDCOURSE

(47+05)
        PROCEDURES FOR SM RCS AND SPS
         PROPULSION MONITOR CHECKS
            (ADDENDUM 10)

(47+25)
        PROCEDURES FOR STAR/EARTH
         HORIZON SIGHTINGS - 3 SETS
         OF 3 MARKS EACH
            (ADDENDUM 4)                (P23)

            RECOMMENDED NAV STARS
             NO. 16(PROCYON) (FAR HOR)
             NO. 22(REGULUS) (FAR HOR)
             NO. 26(SPICA)   (NEAR HOR)
```

(47+55)

PROCEDURES FOR LOI POSITION DETERMINATION
(ADDENDUM 5) (P21)

(48+00)

PROCEDURES FOR ESTABLISHING PTC
(ADDENDUM 13)

(51+00)

LMP RECEIVE BLOCK DATA PAD FROM GND

(52+05)

PROCEDURES FOR TERMINATING PTC
(ADDENDUM 14)

(52+10)

PROCEDURES FOR IMU REALIGN TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(52+25)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(52+30)

PROCEDURES FOR STAR/LUNAR HORIZON SIGHTINGS - 5 SETS OF 3 MARKS EACH
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 37(NUNKI) (NEAR HOR)
NO. 37(NUNKI) (NEAR HOR)
NO. 33(ANTARES) (NEAR HOR)
NO. 33(ANTARES) (NEAR HOR)
NO. 33(ANTARES) (NEAR HOR)

(53+20)

PROCEDURES FOR LOI POSITION DETERMINATION
(ADDENDUM 5) (P21)

(53+25)

PROCEDURES FOR ESTABLISHING PTC
(ADDENDUM 13)

(59+25)

PROCEDURES FOR TERMINATING PTC
(ADDENDUM 14)

(59+30)

PROCEDURES FOR GND UPLINK OF CSM STATE VECTOR,P30 TARGET LOAD,AND PREFERRED LUNAR ORBIT REFSMMAT
(ADDENDUM 8) (P27)

LMP RECEIVE GND BLOCK DATA PAD

(60+00)

PROCEDURES FOR IMU ALIGN TO UPLINKED PREFERRED REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STARS
NO. 15(SIRIUS)

(60+25)
PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(60+30)
PROCEDURES FOR EXT DV TARGETING
(ADDENDUM 9) (P30)

****
PROPULSION SYSTEM SELECTION
USE RCS FOR DV LESS THAN OR
EQUAL TO 5FPS (A DV GREATER
THAN 5FPS WILL BE SCHEDULED
AT THE EARLIEST POSSIBLE TIME
AND HENCE THIS MIDCOURSE
SHOULD NOT REQUIRE THE SPS)

TRIM DVS TO ZERO
****

(60+35)
PROCEDURES FOR SM RCS PROPULSION
MONITOR CHECK
(ADDENDUM 10)

(60+40)
PROCEDURES FOR RCS THRUST SETUP
(ADDENDUM 12) (P47)

(61+00)
FOURTH TRANSLUNAR MIDCOURSE

(61+05)
PROCEDURES FOR SM RCS AND SPS
PROPULSION MONITOR CHECKS
(ADDENDUM 10)

(61+10)
PROCEDURES FOR LOI1 POSITION
DETERMINATION
(ADDENDUM 5) (P21)

(61+15)
PROCEDURES FOR ESTABLISHING PTC
(ADDENDUM 13)

(65+55)
PROCEDURES FOR TERMINATING PTC
(ADDENDUM 14)

(66+00)
PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)
BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(66+15)
PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(66+20)
P00 LMP RECEIVE LOI1 PAD FROM GND

```
          FOR STAR CHECK
          (ROLL GMBL WILL BE THAT
          WHICH PROVIDES COMM)

     CDR  FDAI SCALE=5/1
          FDAI SELECT=1/2
          MAN ATT(3)=RATE CMD
          LIMIT CYCLE=OFF
          ATT DB=MAX
          RATE=LOW
          SC CONT=CMC
          CMC MODE=AUTO
          RMAG MODE(3)=RATE2
          RHC=ARMED

       LEB KEY V49E
F 06 22   (FINAL GMBL ANGLES)
          LOAD BURN ATT STAR
           CHECK GMBL ANGLES
          KEY V62E
          PRO
F 50 18   (COMMANDED R,P,Y)
          PRO
  06 18   (COMMANDED R,P,Y)
    CDR   MONITOR ATT MANEUVER
           FOR GMBL LOCK
F 50 18   (COMMANDED R,P,Y)
          VERIFY R,P,Y AGREE WITH
           PAD R,P,Y WITHIN 5 DEG
          NULL FDAI NEEDLES WITH RHC
       LEB PRO

          G/N PWR,OPTICS=ON
          OPT ZERO=ZERO(15SEC)
          OPT TELTRUN=SLAVE TO SXT
          RETICLE BRT TW=ADJUST
          OPT ZERO=OFF
          OPT MODE=CMC
          KEY V41N91E
F 21 92   (BLANK,BLANK,BLANK)
          LOAD PAD SHAFT ANGLE(+XXX.XX)
           IN R1 AND PAD TRUNNION ANGLE
           (+XX.XXX) IN R2
  41 88   (SHAFT,TRUNNION,BLANK)
          MONITOR OPT DRIVE TO PAD
           VALUES
          VERIFY PAD STAR IN SXT
          OPT MODE=MAN
          DRIVE TRUN LESS THAN 5 DEG
          OPT ZERO=ZERO
          RETICLE BRT TW=MIN BRTNESS

(66,30)
          PROCEDURES FOR ESTABLISHING PTC
           (ADDENDUM 13)

(67,30)
          PROCEDURES FOR TERMINATING PTC
           (ADDENDUM 14)

(67,35)
          PROCEDURES FOR GDC DRIFT CHECK
           (ADDENDUM 7)

(67,40)
          PROCEDURES FOR IMU REALIGN TO
           REFSMMAT FOR DRIFT CHECK
           (ADDENDUM 2)                    (P52)

          BACKUP ALIGN NAV STARS
           NO. 14(CANOPUS)
           NO. 12(RIGEL)
```

BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(67+55)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(68+00)

CDR RECEIVE GO/NO-GO FOR LOI1

PROCEDURES FOR GND UPLINK OF CSM
STATE VECTOR AND P30 TARGET LOAD
(ADDENDUM 8) (P27)

LMP INITIATE PRE-LOI SYSTEMS CHECK

(68+20)

PROCEDURES FOR LOI POSITION
DETERMINATION
(ADDENDUM 5) (P21)

(68+25)

PROCEDURES FOR EXT DV TARGETING
(ADDENDUM 9) (P30)

****
PROPULSION SYSTEM SELECTION
USE SPS AND DO NOT TRIM DVS
****

(68+30)

PROCEDURES FOR SM RCS PROPULSION
MONITOR CHECKS
(ADDENDEM 10)

(68+35)

PROCEDURES FOR SPS THRUST SETUP
(ADDENDUM 11) (P40)

MSFN LOS
(68+57)

(69+07)

FIRST LUNAR ORBIT INJECTION

*** BEGIN REV 1 ***
(69+09)

LMP TLM INPUTS PCM-LBR
TAPE RCDR-FWD

(69+20)

PROCEDURES FOR SM RCS AND SPS
PROPULSION MONITOR CHECKS
(ADDENDUM 10)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

PROCEDURES FOR ORDEAL SETUP
(ADDENDUM 18)

(69+28)

CDR ATT DB-MAX
RATE-LOW
BMAG MODE(3)-ATT1/RATE2
SC CONT-SCS
MAN ATT(R)-ACC CMD

MAN ATT(P,Y)-RATE CMD
MANEUVER SC IN ROLL 180 DEG
MAN ATT(3)-RATE CMD

LMP SELECT S BD ANT OMNI-A OR B
DVBU-ON
SH RANGING-OFF

MSFN AOS
(69+30)

PROCEDURES FOR HI GAIN ACQUISITION
OF MSFN
(ADDENDUM 19)

LMP RECEIVE BLOCK DATA FOR
TEI FROM MSFN

SUNDOWN
(70+14)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(70+30)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

PROCEDURES FOR ORDEAL
VERIFICATION
(ADDENDUM 18)

LMP UP TLM-CMD RESET
UP TLM-NORMAL

MSFN LOS
(70+55)

CDR MAN ATT(P)-ACC CMD
MANEUVER SC TO 315 DEG PITCH
AND 180 DEG ROLL W.R.T.
LOCAL HORIZONTAL
MAN ATT(P)-MIN IMP
INITIATE ORBITAL PITCH RATE

SUNUP
(71+00)

(71+05)

CMP CONTROL POINT LMK
FAMILIARIZATION
IDENTIFY IDENTIFICATION POINTS
AND CONTROL POINTS AT
RESPECTIVE TIMES OF CLOSEST
APPROACH

*** BEGIN REV 2 ***
(71+21)

(71+30)

PREPARE FOR TV PICTURES

CDR MAN ATT(Y)-ACCEL CMD
YAW SC RIGHT TO 45 DEG YAW
315 DEG PITCH AND 180 DEG
ROLL W.R.T. LOCAL HORIZONTAL
MAN ATT(Y)-RATE CMD
MAINTAIN ORBITAL PITCH RATE
FOR TV PICTURES

LMP SELECT S BD ANT OMNI-A OR B
OVBU-ON
SB RANGING-OFF

MSFN AOS
(71+38)

PROCEDURES FOR HI GAIN ACQUISITION
OF MSFN
(ADDENDUM 19)

(71+40)
PROCEDURES FOR GND UPLINK OF CSM
STATE VECTOR AND P30 TARGET LOAD
(ADDENDUM 8)

(71+50)
CDR MAN ATT(Y)-ACCEL CMD
YAW SC LEFT TO 0 DEG YAW
315 DEG PITCH AND 180 DEG
ROLL W.R.T. LOCAL HORIZONTAL
MAN ATT(Y)-RATE CMD
MAINTAIN ORBITAL PITCH RATE

(72+00)
CMP PSEUDO LANDING SITE
FAMILIARIZATION
IDENTIFY IDENTIFICATION POINTS
AND PSEUDO LANDING SITE AT
RESPECTIVE TIMES OF CLOSEST
APPROACH

CDR STOP PITCH RATE BY SWITCHING
MAN ATT(3)-RATE CMD

(72+15)
CDR RECEIVE GO/NO-GO FOR LOI2

SUNDOWN
(72+22)

LMP RECEIVE BLOCK DATA FOR
TEI FROM MSFN

(72+30)
PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(72+45)
PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(72+50)
PROCEDURES FOR EXT DV TARGETING
(ADDENDUM 9) (P30)

****

PROPULSION SYSTEM SELECTION
USE SPS/DO NOT TRIM DV
****

(72+55)

PROCEDURES FOR SM RCS PROPULSION
MONITOR CHECK
(ADDENDUM 10)

LMP UP TLM-CMD RESET
UP TLM-NORMAL

MSFN LOS
(73+03)

PROCEDURES FOR SPS THRUST SETUP
(ADDENDUM 11) (P40)

SUNUP
(73+09)

(73+31)

SECOND LUNAR ORBIT INJECTION

LMP TLM INPUTS PCM-LBR
TAPE RCDR-FWD

*** BEGIN REV 3 ***
(73+31)

(73+35)

PROCEDURES FOR SM RCS AND SPS
PROPULSION MONITOR CHECKS
(ADDENDUM 10)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(73+40)

PROCEDURES FOR ORDEAL SETUP
(ADDENDUM 18)

(73+45)

CDR ATT DB-MAX
RATE-LOW
BMAG MODE(3)-ATT 1/RATE 2
SC CONT-SCS
MAN ATT(R,P)-ACCEL CMD
MAN ATT(Y)-RATE CMD
MANEUVER SC TO 307 DEG PITCH
AND 180 DEG ROLL W.R.T.
LOCAL HORIZONTAL
MAN ATT(R)-RATE CMD
MAN ATT(P)-MIN IMP
INITIATE ORBITAL PITCH RATE

LMP SELECT S BD ANT OMNI-A OR B
OVBU-ON
SB RANGING-OFF

MSFN AOS
(73+47)

PROCEDURES FOR HI GAIN ACQUISITION
OF MSFN
(ADDENDUM 19)

(74+15)

CDR WHEN PSEUDO LANDING SITE IS

ACQUIRED IN COAS-INCREASE
THE PITCH RATE TO KEEP X-AXIS
CAMERAS POINTED AT IT
TERMINATE PITCH RATE WHEN
LANDMARK IS NO LONGER VISABLE
CDR MAN ATT(P)-ACCEL CMD
PITCH SC DOWN TO 0 DEG PITCH
AND 180 DEG ROLL W.R.T.
LOCAL HORIZONTAL
MAN ATT(P)-RATE CMD

SUNDOWN
(74+22)

LMP RECEIVE BLOCK DATA FOR
TEI FROM MSFN

(74+30)
PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO 14(CANOPUS)
NO 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO 15(SIRIUS)

(74+45)
PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(74+50)
PROCEDURES FOR ORDEAL
VERIFICATION
(ADDENDUM 18)

(74+55)
LMP BEGIN PHOTOGRAPHIC PREPARATION
FOR VERTICAL STEREO
NAVIGATION PHOTOGRAPHYY

LMP UP TLM-CMD RESET
UP TLM-NORMAL

MSFN LOS
(74+59)

CDR MAN ATT(P)-ACCEL CMD
PITCH SC UP TO 270 DEG PITCH
AND 180 DEG ROLL W.R.T.
LOCAL HORIZONTAL
MAN ATT(P)-MIN IMP
INITIATE ORBITAL PITCH RATE

SUNUP
(75+09)

(75+13)
LMP KEY V06N65
(75+15)
CDR,LMP WHEN X-AXIS CROSSES TERMINATOR
KEY ENTER/START CAMERA FOR
VERTICAL STEREO NAVIGATION
PHOTOGRAPHY
06 65 (GET)
LMP RECORD GET
CDR KEY N20E
06 20 (R,P,Y)
LMP RECORD PRESENT GMBL ANGLES

LMP MONITOR PHOTOGRAPHY

CDR MONITOR ORBITAL PITCH RATE

*** BEGIN REV 4 ***
(75+30)

(75+40)
CDR MAN ATT(R)-ACCEL CMD
AT THE SUBSOLAR POINT-
ROLL SC 180 DEG TO 0 DEG ROLL
AND 270 DEG PITCH W.R.T.
LOCAL HORIZONTAL
MAN ATT(R)-RATE CMD
REINITIATE ORBITAL PITCH RATE

LMP SELECT S BD ANT OMNI-C OR D
DVBU-ON
SB RANGING-OFF

MSFN AOS
(75+46)

(75+55)
CDR KEY V06N65
CDR,LMP KEY ENTER/STOP CAMERA
06 65 (GET)
LMP RECORD GET
CDR KEY N20E
06 20 (R,P,Y)
LMP RECORD PRESENT GMBL ANGLES
CDR STOP PITCH RATE

(76+00)-(TCA OF 70 DEG LONGITUDE WILL
BE UPDATED REALTIME)

CDR MAN ATT(P)-ACCEL CMD
PITCH UP TO 5 DEG PITCH
AND 0 DEG ROLL W.R.T.
LOCAL HORIZONTAL
MAN ATT(P)-MIN IMP
INITIATE ORBITAL PITCH RATE
LMP ENTER LEB

(76+05)

**BEGIN LANDING SITE LIGHTING
EVALUATION**

LEB KEY V37E22E
P22
F 06 45 (BLANK,BLANK,MAX MGA)
LEB PRO
F 05 70 (LANDMARK CODE)
LOAD 10001 IN R2
LEB OPT ZERO-OFF
OPT MODE-MAN
POSITION TRUNNION TO 10 DEG
LEB IDENTIFY IDENTIFICATION POINTS
AND PSEUDO LANDING SITE AT
THEIR RESPECTIVE ACQUISITION
TIMES
EVALUATE THE LIGHTING BETWEEN
THE LANDING SITE AND THE
TERMINATOR
LEB UPON ACQUISITION OF THE
TERMINATOR-
OPT MODE-CMC
LEB PRO
06 92 (SHAFT,TRUN,BLANK)
EVALUATE AUTO OPTICS ACQUISI-
TION OF THE PSEUDO LANDING

SITE
CDR ROLL TO AVOID SHAFT AXIS
WITHIN 10 DEG OF LANDING SITE
LEB WHEN LANDING SITE NO LONGER
VISABLE-
OPT MODE-MAN
EVALUATE EARTHSHINE TRACKING
FEASABILITY
LEB POSITION TRUNNION TO 5 DEG
OPT ZERO-ZERO
OPT MODE-MAN
LEB KEY V37E00E

P00

(76+20)

CDR MAN ATT(P)-RATE CMD
MAN ATT(R)-ACCEL CMD
ROLL SC 180 DEG TO ABOUT
0 DEG PITCH AND 180 DEG
ROLL W.R.T. LOCAL HORIZONTAL
MAN ATT(R)-RATE CMD

SUNDOWN
(76+21)

PROCEDURES FOR HI GAIN ACQUISITION
OF MSFN
(ADDENDUM 19)

(76+25)

PROCEDURES FOR GND UPLINK OF MSM
STATE VECTOR
(ADDENDUM 8)

CMP KEY V47E

LMP RECEIVE BLOCK DATA FOR
TEI FROM MSFN

(76+30)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO 14(CANOPUS)
NO 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO 15(SIRIUS)

(76+45)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(76+50)

PROCEDURES FOR ORDEAL VERIFICATION
(ADDENDUM 18)

LMP UP TLM-CMD RESET
UP TLM-NORMAL

MSFN LOS
(76+58)

CDR MAN ATT(R,P)-ACCEL CMD
MANEUVER SC TO 5 DEG PITCH
AND 0 DEG ROLL W.R.T.
LOCAL HORIZONTAL
MAN ATT(R)-RATE CMD
MAN ATT(P)-MIN IMP
INITIATE ORBITAL PITCH RATE
FOR LANDMARK SIGHTINGS

SUNUP
(77+07)

(77+25)

PROCEDURES FOR TRACKING THE
SECOND CONTROL POINT LANDMARK
(NO AUTO OPTICS)
(ADDENDUM 16) (P22)

*** BEGIN REV 5 ***
(77+29)

LMP SELECT S BD ANT OMNI-C OR D
OVRU-ON
SR RANGING-OFF

MSFN AOS
(77+44)

(78+05)

PROCEDURES FOR TRACKING THE
PSEUDO LANDING SITE
(ADDENDUM 15) (P22)

(78+15)

CDR MAN ATT(R)-ACCEL CMD
ROLL SC 180 DEG TO ABOUT
300 DEG PITCH AND 180 DEG
ROLL W.R.T. LOCAL HORIZON TAI
MAN ATT(R,P)-RATE CMD

(78+20)

SUNDOWN

PROCEDURES FOR HI GAIN ACQUISITION
OF MSFN
(ADDENDUM 19)

(78+25)

PROCEDURES FOR GND UPLINK OF CSM
STATE VECTOR
(ADDENDUM 8)

CMP KEY V47E

LMP RECEIVE BLOCK DATA FOR
TEI FROM MSFN

(78+30)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 12) (P52)

BACKUP ALIGN NAV STARS
NO 14(CANOPUS)
NO 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO 15(SIRIUS)

(78+45)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(78+50)

PROCEDURES FOR ORDEAL VERIFICATION
(ADDENDUM 18)

LMP UP TLM-CMD RESET

UP TLM-NORMAL

MSFN LOS
(78+56)

CDR MAN ATT(R+P)-ACCEL CMD
MANEUVER SC TO 5 DEG PITCH
AND 0 DEG ROLL W.R.T.
LOCAL HORIZONTAL
MAN ATT(R)-RATE CMD
MAN ATT(P)-MIN IMP
INITIATE ORBITAL PITCH RATE
FOR LANDMARK SIGHTINGS

SUNUP
(79+06)

(79+25)

PROCEDURES FOR TRACKING THE
SECOND CONTROL POINT LANDMARK
(WITH AUTO OPTICS)
(ADDENDUM 17) (P29)

*** BEGIN REV 6 ***
(79+28)

LMP SELECT S BD ANT OMNI-C OR D
DVBU-ON
SB RANGING-OFF

MSFN AOS
(79+42)

(80+00)

PROCEDURES FOR TRACKING THE
PSEUDO LANDING SITE
(ADDENDUM 15) (P22)

(80+15)

CDR MAN ATT(R)-ACCEL CMD
ROLL SC 180 DEG TO ABOUT
300 DEG PITCH AND 180 DEG
ROLL W.R.T. LOCAL HORIZONTAL
MAN ATT(R+P)-RATE CMD

SUNDOWN
(80+18)

PROCEDURES FOR HI GAIN ACQUISITION
OF MSFN
(ADDENDUM 19)

(80+25)

PROCEDURES FOR GND UPLINK OF CSM
STATE VECTOR
(ADDENDUM 8)

CMP KEY VATE

LMP RECEIVE BLOCK DATA FOR
TEI FROM MSFN

(80+30)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 12) (P52)

BACKUP ALIGN NAV STARS
NO 14(CANOPUS)

NO 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO 15(SIRIUS)

(80+45)

PROCEDURES FOR GDC ALIGN TO I.U
(ADDENDUM 3)

(80+50)

PROCEDURES FOR ORDEAL VERIFICATION
(ADDENDUM 18)

LMP UP TLM-CMU RESET
UP TLM-NORMAL

MSFN LOS
(80+54)

CDR MAN ATT(R,P)-ACCEL CMD
MANEUVER SC TO 5 DEG PITCH
AND 0 DEG ROLL W.R.T.
LOCAL HORIZONTAL
MAN ATT(R)-RATE CMD
MAN ATT(P)-MIN IMP
INITIATE ORBITAL PITCH RATE
FOR LANDMARK SIGHTINGS

SUNUP
(81+04)

(81+10)

PROCEDURES FOR TRACKING THE
FIRST CONTROL POINT LANDMARK
(NO AUTO OPTICS)
(ADDENDUM 16) (P22)

(81+25)

PROCEDURES FOR TRACKING THE
SECOND CONTROL POINT LANDMARK
(WITH AUTO OPTICS)
(ADDENDUM 17) (P22)

*** BEGIN REV 7 ***
(81+27)

LMP SELECT S BD ANT OMNI-C OR D
DVBU-ON
SB RANGING-OFF

MSFN AOS
(81+40)

PROCEDURES FOR TRACKING THE
THIRD CONTROL POINT LANDMARK
(NO AUTO OPTICS)
(ADDENDUM 16) (P22)

(82+00)

PROCEDURES FOR TRACKING THE
PSEUDO LANDING SITE
(ADDENDUM 15) (P22)

(82+15)

CDR MAN ATT(R)-ACCEL CMD
ROLL SC 180 DEG TO ABOUT
300 DEG PITCH AND 180 DEG
ROLL W.R.T. LOCAL HORIZONTAL
MAN ATT(R,P)-RATE CMD

SUNDOWN
(82+17)

PROCEDURES FOR HI GAIN ACQUIS+TION
OF MSFN
(ADDENDUM 19)

(2+25)

PROCEDURES FOR GND UPLINK OF SM
STATE VECTOR
(ADDENDUM 8)

CMP KEY V47E

LMP RECEIVE BLOCK DATA FOR
TEI FROM MSFN

(82+30)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 12) (P53)

BACKUP ALIGN NAV STARS
NO 14(CANOPUS)
NO 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO 15(SIRIUS)

(82+45)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(82+50)

PROCEDURES FOR ORDEAL VERIFICATION
(ADDENDUM 18)

LMP UP TLM=CMD RESET
UP TLM=NORMAL

MSFN LOS
(82+52)

CDR MAN ATT(R,P)=ACCEL CMD
MANEUVER SC TO 5 DEG PITCH
AND 0 DEG ROLL W.R.T.
LOCAL HORIZONTAL
MAN ATT(R)=RATE CMD
MAN ATT(P)=MIN IMP
INITIATE ORBITAL PITCH RATE
FOR LANDMARK SIGHTINGS

SUNUP
(83+03)

PROCEDURES FOR TRACKING THE
FIRST CONTROL POINT LANDMARK
(WITH AUTO OPTICS)
(ADDENDUM 17) (P22)

(83+20)

PROCEDURES FOR TRACKING THE
SECOND CONTROL POINT LANDMARK
(WITH AUTO OPTICS)
(ADDENDUM 17) (P22)

*** BEGIN REV 8 ***
(83+26)

LMP SELECT S BD ANT OMNI=C OR D

DVBU-ON
SR RANGING-OFF

MSFN AOS
(83+39)

PROCEDURES FOR TRACKING THE
THIRD CONTROL POINT LANDMARK
(WITH AUTO OPTICS)
(ADDENDUM 17) (P22)

(84+00)

PROCEDURES FOR TRACKING THE
PSEUDO LANDING SITE
(ADDENDUM 15) (P22)

(84+10)

CDR MAN ATT(R)-ACCEL CMD
ROLL SC 180 DEG TO ABOUT
300 DEG PITCH AND 180 DEG
ROLL W.R.T. LOCAL HORIZONTAL
MAN ATT(R,P)-RATE CMD

(84+15)
SUNDOWN

PROCEDURES FOR HI GAIN ACQUISITION
OF MSFN
(ADDENDUM 19)

(84+20)

PROCEDURES FOR GND UPLINK OF CSM
STATE VECTOR
(ADDENDUM 8)

CMP KEY V47E

LMP RECEIVE BLOCK DATA FOR
TEI FROM MSFN

(84+25)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 12) (P52)

BACKUP ALIGN NAV STARS
NO 14(CANOPUS)
NO 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO 15(SIRIUS)

(84+40)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

PROCEDURES FOR ORDEAL VERIFICATION
(ADDENDUM 18)

LMP BEGIN PHOTOGRAPHIC PREPARATION
FOR DARKSIDE AND SOLAR CORONA
PHOTOGRAPHY

CDR MAN ATT(P)-ACCEL CMD
PITCH SC UP TO 0 DEG PITCH
AND 180 DEG ROLL W.R.T.
LOCAL HORIZONTAL
MAN ATT(P)-MIN IMP
INITIATE ORBITAL PITCH RATE

(84+45)

LMP PERFORM DARKSIDE AND SOLAR
CORONA PHOTOGRAPHY

LMP UP TLM-CMD RESET
UP TLM-NORMAL

MSFN LOS
(84+51)

(85+00)
LMP BEGIN PHOTOGRAPHIC PREPARATION
FOR CONVERGENT STEREO
NAVIGATION PHOTOGRAPHY
CDR MAN ATT(P)-ACCEL CMD
PITCH SC UP TO 290 DEG PITCH
AND 180 DEG ROLL W.R.T.
LOCAL HORIZONTAL
MAN ATT(P)-MIN IMP
INITIATE ORBITAL PITCH RATE

SUNUP
(85+02)

(85+05)
LMP KEY V06N65

CDR,LMP WHEN X-AXIS CROSSES TERMINATOR
KEY ENTER/START CAMERA FOR
CONVERGENT STEREO NAVIGATION
PHOTOGRAPHY
06 65 (GET)
LMP RECORD GET
CDR KEY N20E
06 20 (R,P,Y)
LMP RECORD PRESENT GMBL ANGLES

LMP MONITOR PHOTOGRAPHY
CDR MONITOR ORBITAL PITCH RATE

*** BEGIN REV 9 ***
(85+25)

(85+35)
CDR MAN ATT(P)-ACCEL CMD
PITCH SC UP 40 DEG TO 250 DEG
PITCH AND 180 DEG ROLL W.R.T.
LOCAL HORIZONTAL AT THE
SUBSOLAR POINT
MAN ATT(P)-MIN IMP
REINITIATE ORBITAL PITCH RATE
(ROLL AS REQUIRED TO SHADE
WINDOWS)

LMP SELECT S BD ANT OMNI-C OR D
DVBU-ON
SB RANGING-OFF

MSFN AOS
(85+37)

(86+10)
CDR KEY V06N65
CDR,LMP KEY ENTER/STOP CAMERA
06 65 (GET)
LMP RECORD GET
CDR KEY N20E
06 20 (R,P,Y)
LMP RECORD PRESENT GMBL ANGLES
CDR STOP PITCH RATE

SUNDOWN

(86+14)

CDR MAN ATT(P)-ACCEL CMD
PITCH SC DOWN 60 DEG TO ABOUT
310 DEG PITCH AND 180 DEG
ROLL W.R.T. LOCAL HORIZONTAL
(ROLL 180 DEG IF REQUIRED)
MAN ATT(R.P)-RATE CMD

PROCEDURES FOR HI GAIN ACQUISITION
OF MSFN
(ADDENDUM 19)

(86+20)

PROCEDURES FOR GND UPLINK OF CSM
STATE VECTOR
(ADDENDUM 8)

CMP KEY V47E

LMP RECEIVE BLOCK DATA FOR
TEI FROM MSFN

(86+25)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 12) (P52)

BACKUP ALIGN NAV STARS
NO 14(CANOPUS)
NO 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO 15(SIRIUS)

(86+40)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

PROCEDURES FOR ORDEAL VERIFICATION
(ADDENDUM [illegible])

LMP UP TLM-CMD RESET
UP TLM-NORMAL

MSFN LOS
(86+49)

CDR MAN ATT(P)-ACCEL CMD
PITCH SC UP TO 270 DEG PITCH
AND 180 DEG ROLL W.R.T.
LOCAL HORIZONTAL
MAN ATT(P)-MIN IMP
INITIATE ORBITAL PITCH RATE
FOR LUNAR OBSERVATION

SUNUP
(87+00)

*** BEGIN REV 10 ***
(87+24)

LMP SELECT S BD ANT OMNI-A OR B
OVRU-ON
SB RANGING-OFF

MSFN AOS
(87+35)

CDR MAN ATT(P)-RATE CMD

```
        PROCEDURES FOR HI GAIN ACQUISITION
         OF MSFN
            (ADDENDUM 19)

(87+40)
        PROCEDURES FOR GND UPLINK OF CSM
         STATE VECTOR AND P30 TARGET LOAD
            (ADDENDUM 8)                 ,P27)

        LMP RECEIVE BLOCK DATA FOR
             TEI FROM MSFN

(87+55)
        PROCEDURES FOR TEI BURN ATT
         CHECK EXCEPT ROLL

        CDR FDAI SCALE-5/1
            FDAI SELECT-1/2
            MAN ATT(3)-RATE CMD
            LIMIT CYCLE-OFF
            ATT DB-MAX
            RATE-LOW
            SC CONT-CMC
            CMC MODE-AUTO
            RMAG MODE(3)-RATE2
            RHC-ARMED

          LEB KEY V49E
    F 06 22 (FINAL GMBL ANGLES)
            LOAD BURN ATT STAR
             CHECK GMBL ANGLES
            KEY V62E
            PRO
    F 50 18 (COMMANDED R,P,Y)
            PRO
      06 18 (COMMANDED R,P,Y)
        CDR MONITOR ATT MANEUVER
             FOR GMBL LOCK
    F 50 18 (COMMANDED R,P,Y)
            VERIFY R,P,Y AGREE WITH
             PAD R,P,Y WITHIN 5 DEG
            NULL FDAI NEEDLES WITH RHC
        LEB PRO

            G/N PWR,OPTICS-ON
            OPT ZERO-ZERO(15SEC)
            OPT TELTRUN-SLAVE TO SXT
            RETICLE BRT TW-ADJUST
            OPT ZERO-OFF
            OPT MODE-CMC
            KEY V41N91E
    F 21 92 (BLANK,BLANK,BLANK)
            LOAD PAD SHAFT ANGLE(+XXX,XX)
             IN R1 AND PAD TRUNNION ANGLE
             (+XX,XXX) IN R2
      41 88 (SHAFT,TRUNNION,BLANK)
            MONITOR OPT DRIVE TO PAD
             VALUES
            VERIFY PAD STAR IN SXT
            OPT MODE-MAN
            DRIVE TRUN LESS THAN 5 DEG
            OPT ZERO-ZERO
            RETICLE BRT TW-MIN BRTNESS

(8R+05)
        PROCEDURES FOR GDC DRIFT CHECK
            (ADDENDUM 7)

(8R+10)
        CDR RECEIVE GO/NO-GO FOR TEI
```

LMP INITIATE PRE-TEI SYSTEMS CHECK

SUNDOWN
(88+13)

(88+15)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT FOR DRIFT CHECK
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(88+30)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(88+35)

PROCEDURES FOR EXT DV TARGETING
(ADDENDUM 9) (P30)

****
PROPULSION SYSTEM SELECTION
USE SPS AND TRIM DVS TO 2FPS
****

(88+40)

PROCEDURES FOR SM RCS PROPULSION
MONITOR CHECK
(ADDENDUM 10)

LMP UP TLM CMD-RESET THEN NOR

MSFN LOS
(88+48)

(88+45)

PROCEDURES FOR SPS THRUST SETUP
(ADDENDUM 11) (P40)

SUNUP
(88+59)

(89+15)

TRANSEARTH INJECTION

(89+20)

PROCEDURES FOR SM RCS AND SPS
PROPULSION MONITOR CHECKS
(ADDENDUM 10)

P00 CDR MAN ATT(P)-ACC CMD
RHC-ARMED
MANEUVER SC IN PITCH(UP) TO
MONITOR MOON IN CMD WINDOW
MAN ATT(3)-RATE CMD

MSFN AOS
(89+20)

PROCEDURES FOR HIGH GAIN
ANT ACQUISITION
(ADDENDUM 19)

(90+00)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(90+15)
PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(90+30)
PROCEDURES FOR STAR/LUNAR
HORIZON SIGHTINGS - 8 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 1(ALPHERATZ)(NEAR HOR)
NO. 1(ALPHERATZ)(NEAR HOR)
NO. 10(MIRFAK) (FAR HOR)
NO. 10(MIRFAK) (FAR HOR)
NO. 11(ALDEBARAN)(FAR HOR)
NO. 11(ALDEBARAN)(FAR HOR)
NO. 2(DIPHDA) (NEAR HOR)
NO. 2(DIPHDA) (NEAR HOR)

(91+50)
PROCEDURES FOR ESTABLISHING PTC
(ADDENDUM 13)

(91+55)
PROCEDURES FOR RETURN TO
EARTH TARGETING
(ADDENDUM 6) (P37)

(100+05)
PROCEDURES FOR TERMINATING PTC
(ADDENDUM 14)

(100+10)
PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(100+25)
PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(100+30)
PROCEDURES FOR STAR/LUNAR
HORIZON SIGHTINGS - 3 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 1(ALPHERATZ)(NEAR HOR)
NO. 11(ALDEBARAN)(FAR HOR)
NO. 2(DIPHDA) (NEAR HOR)

(101+20)
PROCEDURES FOR STAR/EARTH
HORIZON SIGHTINGS - 6 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS

```
                NO. 22(REGULUS)  (FAR HOR)
                NO. 22(REGULUS)  (FAR HOR)
                NO. 26(SPICA)    (NEAR HOR)
                NO. 26(SPICA)    (NEAR HOR)
                NO. 31(ARCTURUS) (NEAR HOR)
                NO. 31(ARCTURUS) (NEAR HOR)

(102.20)
          PROCEDURES FOR RETURN TO
           EARTH TARGETING
              (ADDENDUM 6)                    (P37)

(102.50)
          PROCEDURES FOR GND UPLINK OF CSM
           STATE VECTOR,P30 TARGET LOAD,AND
           PREFERRED ENTRY REFSMMAT
              (ADDENDUM 9)

              FOLLOWING GND UPLINK
P00       LEB WHEN COMP LT-OUT(NO INTEG)
               KEY V96E
              KEY V83E
      F 16 54 (R,RDOT,THETA)
              COPY R AND RDOT
              PRO
              KEY V89E
      F 04 06 (TRACK AXIS OPTION)
              LOAD 00002 IN R2
              PRO
      F 06 18 (COMPUTED R,P,Y)
              COPY R,P,Y
              KEY V34E

P00           KEY V37E00E
                KEY V47E (TRANSFER CSM SV
                 FROM LM SLOTS TO CSM SLOTS)

(103.10)
          PROCEDURES FOR IMU ALIGN TO
           UPLINKED PREFERRED REFSMMAT
              (ADDENDUM 2)                    (P52)

              BACKUP ALIGN NAV STARS
               NO. 14(CANOPUS)
               NO. 12(RIGEL)
              BACKUP ALIGN CHECK NAV STAR
               NO. 15(SIRIUS)

(103.25)
          PROCEDURES FOR GDC ALIGN TO IMU

(103.30)
          PROCEDURES FOR EXT DV TARGETING
              (ADDENDUM 9)                    (P30)

          ************************************
          PROPULSION SYSTEM SELECTION
              USE RCS FOR DV LESS THAN OR
               EQUAL TO 12FPS
              USE SPS FOR DV GREATER
               THAN 12FPS

              TRIM DVS TO ZERO
          ************************************

(103.35)
          PROCEDURES FOR SM RCS PROPULSION
           MONITOR CHECK
              (ADDENDUM 10)
```

(103+40)

PROCEDURES FOR RCS THRUST SETUP
(ADDENDUM 12) (P41)

(104+00)

FIRST TRANSEARTH MIDCOURSE

(104+05)

PROCEDURES FOR SM RCS AND SPS
PROPULSION MONITOR CHECKS
(ADDENDUM 10)

(105+15)

PROCEDURES FOR STAR/EARTH
HORIZON SIGHTINGS - 5 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)
RECOMMENDED NAV STARS
NO. 22(REGULUS) (FAR HOR)
NO. 22(REGULUS) (FAR HOR)
NO. 26(SPICA) (NEAR HOR)
NO. 31(ARCTURUS) (NEAR HOR)
NO. 31(ARCTURUS) (NEAR HOR)

(106+15)

PROCEDURES FOR STAR/LUNAR
HORIZON SIGHTINGS - 3 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 1(ALPHERATZ) (NEAR HOR)
NO. 11(ALDEBARAN) (FAR HOR)
NO. 2(DIPHDA) (NEAR HOR)

(106+45)

PROCEDURES FOR RETURN TO
EARTH TARGETING
(ADDENDUM 6) (P37)

(107+40)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(107+55)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(108+00)

PROCEDURES FOR STAR/EARTH
HORIZON SIGHTINGS - 5 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 22(REGULUS) (FAR HOR)
NO. 22(REGULUS) (FAR HOR)
NO. 26(SPICA) (NEAR HOR)
NO. 31(ARCTURUS) (NEAR HOR)
NO. 31(ARCTURUS) (NEAR HOR)

(108+50)

PROCEDURES FOR ESTABLISHING PTC
(ADDENDUM 13)

(108+55)

PROCEDURES FOR RETURN TO
EARTH TARGETING
(ADDENDUM 6) (P37)

(119+35)

PROCEDURES FOR TERMINATING PTC
(ADDENDUM 14)

(119+40)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(119+55)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(120+00)

PROCEDURES FOR STAR/EARTH
HORIZON SIGHTINGS - 3 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 22(REGULUS) (FAR HOR)
NO. 26(SPICA) (NEAR HOR)
NO. 31(ARCTURUS)(NEAR HOR)

(120+30)

PROCEDURES FOR RETURN TO
EARTH TARGETING
(ADDENDUM 6) (P37)

(121+00)

PROCEDURES FOR GND UPLINK OF CSM
STATE VECTOR AND P30 TARGET LOAD
(ADDENDUM 8) (P30)

FOLLOWING GND UPLINK
P00 LEB WHEN COMP LT-OUT(NO INTEG)
KEY V96E
KEY V83E
F 16 54 (R,RDOT,THETA)
COPY R AND RDOT
PRO
KEY V89E
F 04 06 (TRACK AXIS OPTION)
LOAD 00002 IN R2
PRO
F 06 18 (COMPUTED R,P,Y)
COPY R,P,Y
KEY V34E

P00 KEY V37E00E

KEY V47E (TRANSFER CSM SV
FROM LM SLOTS TO CSM SLOTS)

(121+30)

PROCEDURES FOR EXT DV TARGETING
(ADDENDUM 9) (P30)

****
PROPULSION SYSTEM SELECTION

USE RCS FOR DV LESS THAN OR
EQUAL TO 12FPS
USE SPS FOR DV GREATER
THAN 12FPS

TRIM DVS TO ZERO

****

(121+35)

PROCEDURES FOR SM RCS PROPULSION
MONITOR CHECKS
(ADDENDUM 10)

(121+40)

PROCEDURES FOR RCS THRUST SETUP
(ADDENDUM 12) (P41)

(122+00)

SECOND TRANSEARTH MIDCOURSE

(122+05)

PROCEDURES FOR SM RCS AND SPS
PROPULSION MONITOR CHECKS
(ADDENDUM 10)

(122+35)

PROCEDURES FOR STAR/LUNAR
HORIZON SIGHTINGS - 3 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 2(DIPHDA) (NEAR HOR)
NO. 2(DIPHDA) (NEAR HOR)
NO. 1(ALPHERATZ) (NEAR HOR)

(123+35)

PROCEDURES FOR STAR/EARTH
HORIZON SIGHTINGS - 5 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)
RECOMMENDED NAV STARS
NO. 22(REGULUS) (FAR HOR)
NO. 22(REGULUS) (FAR HOR)
NO. 26(SPICA) (NEAR HOR)
NO. 31(ARCTURUS) (NEAR HOR)
NO. 31(ARCTURUS) (NEAR HOR)

(124+25)

PROCEDURES FOR ESTABLISHING PTC
(ADDENDUM 13)

(124+30)

PROCEDURES FOR RETURN TO
EARTH TARGETING
(ADDENDUM 6) (P37)

(129+35)

PROCEDURES FOR TERMINATING PTC
ADDENDUM 14)

(129+40)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STARS
NO. 15(SIRIUS)

(129+55)
PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(EI-17HRS)

(130+00)
PROCEDURES FOR STAR/LUNAR
HORIZON SIGHTINGS - 2 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 2(DIPHDA) (NEAR HOR)
NO. 2(DIPHDA) (NEAR HOR)

(EI-16HRS)

(130+50)
PROCEDURES FOR STAR/EARTH
HORIZON SIGHTINGS - 6 SETS
OF 3 MARKS EACH
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 22(REGULUS)
NO. 22(REGULUS)
NO. 26(SPICA)
NO. 24(SPICA)
NO. 31(ARCTURUS)
NO. 31(ARCTURUS)

(131+50)
PROCEDURES FOR ESTABLISHING PTC
(ADDENDUM 13)

(131+55)
PROCEDURES FOR RETURN TO
EARTH TARGETING
(ADDENDUM 5) (P37)

(EI-15HRS)

(132+05)
PROCEDURES FOR GND UPLINK
OF CSM STATE VECTOR
(UPLINK INTO LM SLOTS ONLY)
(ADDENDUM 8) (P27)

FOLLOWING GND UPLINK

P00 LEB WHEN COMP I.T-OUT(NO INTEG)
KEY V96E
KEY V83E
F 16 54 (R,RDOT,THETA)
COPY R AND RDOT
PRO
KEY V89E
F 04 06 (TRACK AXIS OPTION)
LOAD 00002 IN R2
PRO
F 06 18 (COMPUTED R,P,Y)
COPY R,P,Y
KEY V34E

P00 KEY V37E00E

(140+25)
PROCEDURES FOR TERMINATING PTC
(ADDENDUM 14)

(140+30)

PROCEDURES FOR IMU ALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(140+45)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(140+50)

PROCEDURES FOR ESTABLISHING PTC
(**ONLY IF COMM AVAILABLE**)
(ADDENDUM 13)

****
****
THE FOLLOWING SIGHTING PERIODS
REQUIRED ONLY FOR A COMM FAILURE

(EI-6HRS)

(140+50)

PROCEDURES FOR STAR/EARTH
HORIZON SIGHTINGS - 3 SETS
OF 3 MARKS EACH
(COMM FAILURE ONLY)
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 22(REGULUS) (FAR HOR)
NO. 26(SPICA) (NEAR HOR)
NO. 31(ARCTURUS) (NEAR HOR)

(141+20)

PROCEDURES FOR RETURN TO
EARTH TARGETING
(ADDENDUM 6) (P37)

(142+00)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(142+15)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(EI-4.5HRS)

(142+20)

PROCEDURES FOR STAR/EARTH
HORIZON SIGHTINGS - 2 SETS
OF 3 MARKS EACH
(COMM FAILURE ONLY)
(ADDENDUM 4) (P23)

RECOMMENDED NAV STARS
NO. 22(REGULUS) (FAR HOR)
NO. 26(SPICA) (NEAR HOR)

(142+40)

PROCEDURES FOR RETURN TO
EARTH TARGETING
(ADDENDUM 6) (P37)

****

****

(143+25)

PROCEDURES FOR TERMINATING PTC
(**ONLY IF COMM AVAILABLE**)
(ADDENDUM 14)

(143+30)

PROCEDURES FOR IMU REALIGN
TO REFSMMAT
(ADDENDUM 2) (P52)

BACKUP ALIGN NAV STARS
NO. 14(CANOPUS)
NO. 12(RIGEL)
BACKUP ALIGN CHECK NAV STAR
NO. 15(SIRIUS)

(143+45)

PROCEDURES FOR GDC ALIGN TO IMU
(ADDENDUM 3)

(143+50)

PROCEDURES FOR GND UPLINK OF CSM
STATE VECTOR AND P30 TARGET LOAD
(ADDENDUM 8) (P27)

(144+20)

PROCEDURES FOR EXT DV TARGETING
(ADDENDUM 9) (P30)

****

PROPULSION SYSTEM SELECTION
USE RCS FOR DV LESS THAN OR
EQUAL TO 12FPS
USE SPS FOR DV GREATER
THAN 12FPS

TRIM DV TO ZERO

****

(144+25)

PROCEDURES FOR SM RCS PROPULSION
MONITOR CHECKS
(ADDENDUM 10)

(144+30)

PROCEDURES FOR RCS THRUST SETUP
(ADDENDUM 12) (P41)

(144+50)

THIRD TRANSEARTH MIDCOURSE

(144+55)

PROCEDURES FOR SM RCS AND SPS
PROPULSION MONITOR CHECKS
(ADDENDUM 10)

****

****

THE FOLLOWING SIGHTING PERIOD
REQUIRED ONLY FOR A COMM FAILURE

(145+05)

PROCEDURES FOR STAR/EARTH
HORIZON SIGHTINGS - 1 SET
OF 3 MARKS
(COMM FAILURE ONLY)
(ADDENDUM 4) (P23)

RECOMMENDED NAV STAR
NO. 33(ANTARES)(NEAR HOR)

****
****

(146+35)
CM/SM SEPARATION

(146+50)
ENTRY INTERFACE

****
****
SUMMARY OF ADDENDUMS
****
****

ADDENDUM 1
ASSUMED PRE-SEP SC CONFIGURATION

ADDENDUM 2
IMU ALIGN(OR REALIGN) (P52)

ADDENDUM 3
GDC ALIGN TO IMU

ADDENDUM 4
STAR/EARTH(OR LUNAR) HORIZON
(OR LANDMARK) SIGHTINGS (P23)

ADDENDUM 5
GROUND TRACK DETERMINATION (P21)

ADDENDUM 6
RETURN TO EARTH TARGETING (P37)

ADDENDUM 7
GDC DRIFT CHECK

ADDENDUM 8
GND UPLINK (P27)

ADDENDUM 9
EXTERNAL DV TARGETING (P30)

ADDENDUM 10
SM RCS AND SPS PROPULSION CHECKS

ADDENDUM 11
SPS THRUST SETUP (P40)

ADDENDUM 12
RCS THRUST SETUP (P41)

ADDENDUM 13
ESTABLISH PTC

ADDENDUM 14
TERMINATE PTC

ADDENDUM 15
ORBITAL NAVIGATION PROCEDURES (P22)
(PSEUDO LANDING SITE TRACKING)

ADDENDUM 16
ORBITAL NAVIGATION PROCEDURES (P22)
(LANDMARK TRACKING-NO AUTO OPTICS)

ADDENDUM 17
ORBITAL NAVIGATION PROCEDURES (P22)
(LANDMARK TRACKING-WITH AUTO OPT)

ADDENDUM 18
ORDEAL INITIALIZATION/VERIFICATION

ADDENDUM 19
HIGH GAIN ANT ACQUISITION

****
ADDENDUM 1
ASSUMED PRE-SEP SC CONFIGURATION
****

PROG	DISPLAY	CRAFT	PROCEDURES	PANEL
			CDR**ASSUMED SWITCH POSITIONS**	
			CMC ATT-IMU	1
			FDAI SCALE-5/1	1
			FDAI SELECT-1/2	1
			FDAI SOURCE-CMC	1
			ATT SET-GDC	1
			MAN ATT(3)-RATE CMD	1
			LIMIT CYCLE-OFF	1
			ATT DB-MAX	1
			RATE-LOW	1
			THC LOCKED	
			RHC-LOCKED	
			TRANS CONT PWR-OFF	1
			RHC PWR NORM(BOTH)-AC/DC	1
			RHC PWR DIRECT(BOTH)-OFF	1
			SC CONT-CMC	1
			CMC MODE-FREE	1
			RMAG MODE(3)-RATE 2	1
			SPS THRUST DIRECT-NORMAL	1
			DV THRUST(A,B)-OFF	1
			SCS TVC(2)-AUTO	1

PROG	DISPLAY	CRAFT	PROCEDURES	PANEL
			SPS GMBL MTR(4)-OFF	1
			DV CG-CSM	1
			ELS LOGIC-OFF	1
			ELS AUTO-MAN	1
			CM RCS LOGIC-OFF	1
			CM PRPLNT DUMP-OFF	1
			CM PRPLNT PURG-OFF(DOWN)	1
			IMU CAGE-OFF	1
			EMS ROLL-OFF	1
			.05 G-OFF	1
			LV/SPS IND(2)-PC,GPI	1
			TVC GMBL DRIVE(BOTH)-AUTO	1
			FCSM(A,B)-RESET/OVERRIDE	1
			EMS FUNCTION-OFF	1
			EMS MODE-STBY	1
			COAS PWR-ON	15
			UTIL PWR-ON	15
			PL BCN LT-OFF(CENTER)	15
			PL DYE MARKER-OFF(DOWN)	15
			PL VENT-OFF	15
			UP TLM(CM,IU)-BLOCK	2
			RCS TRNFR-SM	2
			PANEL 8 CB CLOSED EXCEPT	8
			ELS BAT A,BAT B(2)-OPEN	8
			SECS ARM(BOTH)-OPEN	
			SECS LOGIC(BOTH)-OPEN	8
			PL VENT FLT/PL-OPEN	8
			FLOAT BAG(3)-OPEN	8
			RCS LOGIC(2)-OPEN	8
			AUTO RCS SEL(16)-OFF	8
			FLOAT BAG(ALL)-VENT	8
			SECS LOGIC(BOTH)-OFF	8
			SECS PYRO ARM(2)-SAFE	8

```
     EDS PWR-OFF                          7

     TVC SERVO PWR(2)-OFF                 7
     FDAI/GPI PWR-BOTH                    7
     LOGIC PWR 2/3-ON(UP)                 7
     SCS ELEC PWR-GDC/ECA                 7
     SIG CONDR/DR BIAS(2)-ACI             7
     RMAG PWR(BOTH)-ON                    7

LMP**ASSUMED SWITCH POSITIONS**

     G/N PWR-ACI                          5
     MN BUS TIE(2)-OFF                    5
     BATT CHGR-ACI                        5
     NONESS BUS-MNB                       5
     PANEL 5 G/N CB(10)-CLOSED            5

     PANEL 229 CB CLOSED EXCEPT           229
      MN REL PYRO(2)-OPEN                 229
     S-BAND ANT OMNI-
      SELECT REQD OMNI ANT                3
     S-BAND NORM MODE VOICE-VOICE         3
     S-BAND NORM MODE PCM-PCM             3
     S-BAND NORM MODE RNG-RANGING         3
     S-BAND AUX TAPE-OFF                  3
     S-BAND AUX TV-OFF                    3
     UP TLM DATA-DATA                     3
     UP TLM CMD-NORM                      3

LEB**ASSUMED SWITCH POSITIONS**

     G/N PWR,OPTICS-ON
     G/N PWR IMU-ON                       100

     OPT MODE-MAN                         122
     OPT ZERO-ZERO                        122

                  5
```

```
     OPT SPEED-HI                         122
     OPT COUPLING-DIRECT                  122
     OPT TELTRUN-SLAVE TO SXT             122
     COND LAMPS-ON                        122
     UP TLM(LEB)-ACCEPT                   122

**ASSUMED DAP CONFIGURATION**

     KEY V48E

F 04 46 (DAP CONFIGURATION)
     LOAD
          11103
          11111
            B

     PRO
F 06 47 (CSM AND LM WT)
     LOAD PAD DATA
          +XXXXX.
          +00000.
            B

     PRO
F 06 48 (SPS GMBL TRIM)
     LOAD PAD DATA
          +XXX.XX
          +XXX.XX
            B

     PRO
     KEY V46E

**ASSUMED PROGRAM CONFIGURATION**

     KEY V37E47E

                  6
```

P47

47

```
F 16 83 (DVX,DVY,DVZ)
        V32 KEYED FOLLOWING TLI
         CUTOFF
```

```
                                    **********************************
                                    ADDENDUM 2
                                    IMU ALIGN (OR REALIGN)          (P52)
                                    **********************************

          D
          I
          S
          P                                                          P
    P     L      C                                                  A
G   R     A      R                                                  N
E   O     Y      E                                                  E
T   G     S      W   PROCEDURES                                     L

                 **PROCEDURES FOR IMU REALIGN**

P00               LMP G/N PWR=AC1
                  LEB G/N PWR OPTICS=ON
                      OPT ZERO=ZERO (15 SEC)
                      OPT ZERO=OFF
                      OPT MODE=MAN
                      COND LAMPS=ON
                      RETICLE BRT TW=ADJUST
                  CDR ATT DB=MIN
                      RATE=LOW
                      LIMIT CYCLE=OFF
                      RMAG MODE(3)=ATT1/RATE2
                      MAN ATT(3)=RATE CMD
                      SC CONT=SCS

P52               LEB KEY V37E52E
              F 04 06 (ALIGN OPTION CODE)
                      LOAD 00001 IN R2 FOR ALIGN TO
                       UPLINKED PREFERRED REFSMMAT
                       AND GO TO F 06 22 DISPLAY
                       OR LOAD 00003 FOR REALIGN TO
```

```
          REFSMMAT AND GO TO
          F 50 25 DISPLAY
          PRO
F 06 22   (R,P,Y AT PROPOSED ALIGNMENT)
          VERIFY NO GMBL LOCK AT
           PROPOSED ALIGNMENT
          PRO/MONITOR COARSE ALIGN
F 50 25   (00015, PERFORM STAR ACQ)
          RHC=ARMED
          PRO
          IF TWO STARS NOT AVAILABLE,A
           F 05 09(CODE 405) ALARM
           WILL OCCUR. COR MANUALLY
           MANEUVER SC TO ACQUIRE BACKUP
           ALIGN NAV STARS IN SCT FOV,
           CMP KEY V32E,RETURN TO
           F 50 25(00015),DISPLAY AND PRO
          IF TWO STARS AVAILABLE AT
           THIS ATTITUDE
F 01 70   (STAR CODE)
          CHECK FIRST STAR CODE
           OR LOAD THIRD STAR CODE
            IF DOING ALIGN CHECK
          OPT MODE=CMC
          PRO
  06 92   (SHAFT,TRUN,BLANK)
          MONITOR OPTICS DRIVE TO
             STAR ONE
          (IF VERIFYING SXT DRIVE TO
           THIRD STAR,KEY V37E00E)
          IDENTIFY STAR ONE
          OPT MODE=MAN
F 51 BB   (PLEASE MARK)
          MARK ON STAR ONE WITH SXT
F 50 25   (00016, TERMINATE MARK SEQ)
          PRO
```



```
F 01 71   (MARKED STAR CODE)
          PRO
F 01 70   (STAR CODE)
          CHECK SECOND STAR CODE
          OPT MODE=CMC
          PRO
  06 92   (SHAFT,TRUN,BLANK)
          MONITOR OPTICS DRIVE TO
             STAR TWO
          IDENTIFY STAR TWO
          OPT MODE=MAN
F 51 BB   (PLEASE MARK)
          MARK ON STAR TWO WITH SXT
F 50 25   (00016, TERMINATE MARK SEQ)
          PRO
F 01 71   (MARKED STAR CODE)
          PRO
F 06 05   (ANGLE DIFF)
          IF GREATER THAN .05 DEG,KEY
           V32F,GO TO F 50 25(00014)
           AND REPEAT ALIGNMENT
          IF .05 DEG OR LESS,PRO
F 06 93   (GYRO TORQ ANGLES)
    LMP   RECORD GYRO TORQ ANGLES
          VOICE TO GND
    LEB   PRO IF GYRO TURQ ANGLES OK
F 50 25   (00014, PERFORM FINE ALIGN)
          IF REPEAT ALIGNMENT REQUIRED,
           PRO,RETURN TO F 50 25(00015),
           VERIFY STAR ID AND REPEAT
           MARK PROCESS ON TWO STARS
          IF ONLY ALIGN CHECK REQUIRED,
           PRO,RETURN TO F 50 25(00015),
           KEY ENTER,GO TO F 01 70,
           AND VERIFY SXT DRIVES TO
           THIRD STAR
```

```
P00             (CALLED AFTER THIRD STAR =MK)
                OPT MODE-MAN
                DRIVE TRUN TO LESS THAN 5 DEG
                OPT ZERO-ZERO
                RETICLE BRT TW-MIN BRTNES*
```

```
          ***********************************
          ADDENDUM 3
          GDC ALIGN TO IMU
          ***********************************

GET PROG DISPLAYS CREW PROCEDURES                 PANEL

          **PROCEDURES FOR GDC ALIGN TO IMU**

   P00       CDR ATT DB-MIN
                 RATE-LOW
                 BMAG MODE(3)-ATT1/RATE2
                 MAN ATT(3)-RATE CMD
                 SC CONT-SCS
                 FDAI SELECT-1
                 FDAI SOURCE-ATT SET
                 ATT SET-IMU
                 KEY V16N20E
           16 20 (CURRENT R,P,Y)
                 NULL ATT ERROR NEEDLES
                  ON FDAI 1 WITH
                  ATT SET THUMBWHEELS
                  (AVOID FALSE NULL BY
                  COMPARING ATT SET IND
                  WITH N20)
                 ATT SET-GDC
                 DEPRESS GDC ALIGN BUTTON
                 FDAI SELECT 1/2
                 ATT DB-MAX
```

```
                ************************************
                ADDENDUM 4
                STAR/EARTH(OR LUNAR) HOR        (P23)
                 (OR LMK SIGHTINGS)
                ************************************

          D
          I
          S
          P                                          P
    P     L     C                                    A
G   R     A     R                                    N
E   U     Y     E                                    E
T   G     S     W  PROCEDURES                        L

          ***PROCEDURES FOR CISLUNAR NAV***

P00            LMP G/N PWR-AC1
                   TLM INPUTS PCM-LOW
                   UP TLM CMD-RESET THEN NORM
                   TAPE RCDR PCM-PCM/ANLG
                   TAPE RCDR RCD-RCD
                   TAPE RCDR FWD-FWD
                   TAPE MOTION TB-BP
               LEB G/N PWR,OPTICS-ON(OPTICS PWR
                    MUST BE ON AT LEAST
                    30 MIN PRIOR TO TAKING MARKS)
                   OPT ZERO-ZERO(15SEC)
                   OPT TELTRUN-SLAVE TO SXT
                   COND LAMPS-ON
                   OPT MODE-MAN
                   RETCL BRT TW-ADJUST
               CDR SC CONT-CMC
                   CMC MODE-AUTO
                   BMAG MODE(3)-RATE2
                   MAN ATT(3)-RATE CMD
```

```
P23          KEY V37E23E
     F 05 70 (MEASUREMENT IDENTIFICATION)
             LOAD
                 000XX STAR ID
                 XXXXX LMK ID
                 00XX0 HOR ID
              FOR HOR MARKS,R2=00000
               AND LOAD HOR DATA IN R3
              FOR LMK MARKS,R3=00000
               AND LOAD LMK DATA IN R2
               (ASSUMED ALL KNOWN LMKS)
             PRO
     F 50 25 (00202,PERFORM AUTO MANEUVER)
             KEY ENTER
     F 59 88 (PERFORM CALIBRATION MARK)
             CALIBRATION OF OPTICS TRUNNION
              REQUIRED AT THE BEGINNING
              OF EACH SIGHTING PERIOD.
             IF OPTICS CALIBRATION ALREADY
              PERFORMED,
              OPT MODE=CMC
              OPT ZERO=OFF
              KEY ENTER AND GO TO
               06 92 DISPLAY
             IF OPTICS CALIBRATION REQUIRED
             OPT MODE=MAN
             RHC 2=ARMED
             MANEUVER SC TO ACQUIRE A STAR
              WITH THE SXT LMK LOS
          CDR CMC MODE=FREE
          LEB FIX STAR IN SXT LMK LOS FIELD
              OF VIEW WITH MIN IMP CONTROL
             OPT ZERO=OFF
             OPT COUPLING=RSLV
             OPT SPEED=LOW
```



```
             SUPERIMPOSE SXT STAR LOS
              ON SXT LMK LOS WITH THE
              OPTICS HAND CONTROLLER
             MARK WHEN THE TWO LINES OF
              SIGHT ARE SUPERIMPOSED
     F 06 87 (BLANK,TRUN ANGLE BIAS,BLANK)
             COPY TRUN ANGLE BIAS
             KEY V32E
     F 59 88 (PERFORM CALIBRATION MARK)
             SUPERIMPOSE SXT STAR LOS
              ON THE SXT LMK LOS
             MARK WHEN THE TWO LINES OF
              SIGHT ARE SUPERIMPOSED
     F 06 87 (BLANK,TRUN ANGLE BIAS,BLANK)
             COPY TRUN ANGLE BIAS
             IF THE TWO TRUN ANGLE BIAS
              MEASUREMENTS ARE NOT WITHIN
              .003 DEG,
              KEY V32E AND REPEAT THE
              CALIBRATION PROCESS
             IF ANY TWO TRUN ANGLE BIAS
              MEASUREMENTS ARE
              WITHIN .003 DEG,
              PRO(INCORPORATE TRUN BIAS)
     F 51 88 (PLEASE MARK)
             KEY V94E (PERFORM LMK(HOR)
              ACQUISITION)
     F 50 18 (COMMANDED R,P,Y ANGLES)
          CDR SC CONT=CMC
             CMC MODE=AUTO
          LEB PRO
       06 18 (COMMANDED R,P,Y ANGLES)
          CDR MONITOR AUTOMATIC MANEUVER
              FOR GIMBAL LOCK
          LEB MONITOR AUTO MANEUVER,VERIFY
              LMK/HOR IN SXT FIELD OF VIEW
```

```
F 50 18 (COMMANDED R,P,Y ANGLES)
        OPT MODE=CMC
        KEY ENTER
  06 92 (COMMANDED OPTICS ANGLES)
        MONITOR OPTICS DRIVE
         TO SELECTED STAR
        OPT MODE=MAN
F 51 88 (PLEASE MARK ON STAR=LMK/HOR)
    CDR CMC MODE=FREE
    LEB MANEUVER SC WITH MIN TMP
         CONTROLLER TO POSITION
         LMK(HOR) IN SXT AT
         SUBSTELLAR POINT
        FIX LMK(HOR) IN SXT
        OPT COUPLING=RSLV
        OPT SPEED=LO                          P00
        MANEUVER OPTICS TO SUPERIMPOSE
         STAR ON LMK/HOR
        MARK ON STAR=LMK/HOR
F 50 25 (00016,TERMINATE MARK SEQ)
        PRO
F 05 71 (MEASUREMENT IDENTIFICATION)
        VERIFY MARKED DATA
        PRO
F 06 49 (DR,DV,BLANK)
       **HOLD AT THIS DISPLAY FOR
         20 SECONDS**
        KEY V01N01E 362E
        COPY TRUN (OCTAL) IN R1
       **HOLD AT THIS DISPLAY FOR
         20 SECONDS**
        KEY RELEASE
F 06 49 (DR,DV,BLANK)
        PRO IF DR AND DV ACCEPTABLE
         OR IF NOT ACCEPTABLE,
         KEY V32E,RETURN TO F 05 70
```



```
         DISPLAY,AND REPEAT MARK
F 37 88
        TAKE 2 ADDITIONAL MARKS ON
         EACH STAR/LMK(HOR) SET
         KEY 23E,RETURN TO
         F 05 70 DISPLAY
         AND REPEAT MARK PROCESS
        WHEN SELECTING A NEW
         STAR/LMK(HOR) SET TO MARK ON,
         KEY 23E,RETURN TO THE
         F 05 70 DISPLAY PERFORM THE
         REQUIRED ATT MANEUVER,AND
         TAKE THREE MARKS ON THE SET
        WHEN TERMINATING THE NAV
         SIGHTING PERIOD
        KEY 00E
        OPT MODE=MAN
        DRIVE TRUN LESS THAN 5 DEG
        OPT ZERO=ZERO
        RETICLE BRT TN=MIN BRTNESS
    CDR CMC MODE=AUTO
    LMP IF TAPE RCDR OPERATING
         TAPE RCDR FWD=OFF(CTR)
         TAPE MOTION TB=GRAY
         (ASSUME GND PLAYBACK AT
          NEXT OPPORTUNITY)
```

```
                ************************************
                ADDENDUM 5
                GROUND TRACK DETERMINATION     (P21)
                ************************************

      D
      I
      S
      P                                          P
   P  L     C                                     A
G  R  A     R                                     N
E  O  Y     E                                     E
T  G  S     W  PROCEDURES                         L

P00
P21        CMP KEY V37E21E
      F 04 06 (00002,VEHICLE OPTION)
              LOAD 00001 IN R2
              PRO
      F 06 34 (T LAT AND LONG)
              LOAD NOMINAL TIME OF
               LOI1 RECEIVED FROM GND
              PRO
      F 06 43 (LAT,LONG,ALT)
              COPY LAT,LONG,AND ALT
              IF A 10MIN INCREMENT FROM THE
               LOADED TIME IS DESIRED,
               KEY V32E AND RETURN TO
               F 06 34 DISPLAY(TIME IS
               AUTOMATICALLY INCREMENTED)
              IF PROGRAM TERMINATION
               IS DESIRED,
               PRO
      F 37 BB
P00           KEY 00E
```



```
                ************************************
                ADDENDUM 6
                RETURN TO EARTH TARGETING      (P37)
                ************************************

                **PROCEDURES FOR RETURN TO
                  EARTH TARGETING *

P00
P37        CMP KEY V37E37E
      F 06 33 (TIG OF MIDCOURSE)
              LOAD TIG (GET) OF MIDCOURSE
              PRO
      F 06 60 (BLANK,VPRED,GAMMA EI)
              LOAD ZERO IN R2(VPRED) AND
              LOAD ZERO IN R3(GAMMA EI)
              PRO
              KEY V16N38E,MONITOR ITERATION
              KEY RELEASE WHEN KEY REL LT-ON
              IF F 06 09 ALARM 612,605,OR
               613 OCCUR,KEY V32E,GO TO
               F 06 33 DISPLAY,AND ADJUST
               INPUT PARAMETERS
      F 06 61 (IMPACT LAT,IMPACT LONG,BLANK)
              COPY LAT AND LONG AND IF NOT
               ACCEPTABLE,KEY V32E,GO TO
               F 06 33 DISPLAY,AND ADJUST
               INPUT PARAMETERS
              PRO IF ACCEPTABLE
      F 06 39 (DELTA T TRANSFER)
              COPY DELTA T TRANSFER (GET)
               AND IF NOT ACCEPTABLE,KEY
               V32E,GO TO F 06 33 DISPLAY,
               AND ADJUST INPUT PARAMETERS
              PRO IF ACCEPTABLE
      F 06 60 (BLANK,VPRED,GAMMA EI)
```

```
          COPY VPRED AND GAMMA EI AND
           IF NOT ACCEPTABLE,KEY V32E,
           GO TO F 06 33 DISPLAY,AND
           ADJUST INPUT PARAMETERS
          PRO IF ACCEPTABLE
F 06 81   (DELTA VX,VY,VZ-LOCAL VERT)
          COPY DVS
          PRO
          IF F 05 09 ALARM 605 OR 613
           OCCUR,KEY V32E,GO TO F 06 33
           DISPLAY,AND ADJUST
           INPUT PARAMETERS
F 06 61   (IMPACT LAT,IMPACT LONG,BLANK)
          COPY PRECISION IMPACT
           LAT AND LONG
          IF NOT ACCEPTABLE,KEY V32E,
           RETURN TO F 06 33 DISPLAY,
           AND ADJUST INPUT PARAMETERS
          PRO IF ACCEPTABLE
F 06 39   (DELTA T TRANSFER)
          COPY PRECISION DELTA T
           TRANSFER
          IF NOT ACCEPTABLE,KEY V32E,
           GO TO F 06 33 DISPLAY,AND
           ADJUST INPUT PARAMETERS
          PRO IF ACCEPTABLE
F 06 60   (BLANK,VPRED,GAMMA EI)
          COPY PRECISION VPRED
           AND GAMMA EI
          IF NOT ACCEPTABLE,KEY V32E,
           GO TO F 06 33 DISPLAY,AND
           ADJUST INPUT PARAMETERS
          PRO IF ACCEPTABLE
F 06 81   (DELTA VX,VY,VZ-LOCAL VERT)
          COPY PRECISION DELTA V
          PRO
```



```
F 04 06   (00007,00001,BLANK)
          VERIFY R2=00001 FOR SPS OR
           LOAD R2=00002 FOR RCS
          PRO
F 06 33   (TIG OF MIDCOURSE)
          COPY TIG OF MIDCOURSE
           ADJUSTED FOR FINITE
           BURN TIME
          PRO
F 16 45   (MKS,TFI,MGA)
          COPY MGA
          PRO
F 37 BB
P00       KEY 00E
```

```
          ********************************
          ADDENDUM 7
          GDC DRIFT CHECK
          ********************************

          D
          I
          S
          P                                   P
    P     L     C                             A
G   R     A     R                             N
E   O     Y     E                             E
T   G     S     W  PROCEDURES                 L

          **PROCEDURES FOR GDC DRIFT TEST**
P00        COR ATT DB=MIN
               RATE=LOW
               RMAG MODE(3)=ATT1/RATE2
               MAN ATT(3)=RATE CMD
               SC CONT=SCS
               KEY V06N20E
           06 20 (R,P,Y)
               FDAI SELECT=1
               FDAI SOURCE=ATT SET
               ATT SET=GDC
               NULL ATT ERROR NEEDLES
                ON FDAI 1 WITH
                ATT SET THUMBWHEELS
                (AVOID FALSE NULL BY
                COMPARING ATT SET IND
                WITH N20)
               KEY ENTER WHEN FDAI ERROR
                NEEDLES NULLED
               READ DSKY N20 AND ATT SET
                VALUES AND CONFIRM DRIFT
                LESS THAN 10 DEG PER HR
```



```
LMP RECORD DRIFT DATA AND
     VOICE TO GND
CDR ATT DB=MAX
    FDAI SEL=1/2
    ATT SET=IMU
```

```
********************************
ADDENDUM 8
GND UPLINK                 (P27)
********************************

         D
         I
         S
         P
      P  L   C                          P
  G   R  A   R                          A
  E   O  Y   E                          N
  T   G  S   W  PROCEDURES              E
                                        L

**PROCEDURES FOR GND UPLINK**

P00          CMP KEY V37E00E

             CDR UP TLM(CM)(MDC)-ACCEPT

P27          CMP MONITOR UPLINK ACT LT-ON
                 MONITOR GND UPLINK
P00              MONITOR UPLINK ACT LT-OFF
             LMP RECORD VOICE SV AND MANEUVER
                  PAD DATA

             CDR UP TLM(CM)(MDC)-BLOCK
```

25

```
********************************
ADDENDUM 9
EXTERNAL DV TARGETING      (P30)
********************************

         D
         I
         S
         P
      P  L   C                          P
  G   R  A   R                          A
  E   O  Y   E                          N
  T   G  S   W  PROCEDURES              E
                                        L

**PROCEDURES FOR EXT DV TARGETING**

P30           LEB KEY V37E30E
        F 06 33   (GETI OF BURN)
                  VERIFY GND GETI
                  PRO
        F 06 81   (VG - LV)
                  VERIFY GND DVX,DVY,DVZ
                  PRO
        F 06 42   (HA,HP,VG)
                  COPY VG/COMPARE WITH PAD DVT
                  PRO
        F 16 45   (MKS,TFI,MGA)
              CDR SET MDC ET COUNT DWN
                  CONFIRM MGA LESS THAN 45 DEG
              LEB PRO
        F 37 BB

P00               KEY 00E
```

26

```
********************************
ADDENDUM 10
SM RCS AND SPS PROPULSION CHECKS
********************************

      D
      I
      S
      P                                 P
   P  L   C                             A
 G R  A   R                             N
 E O  Y   E                             E
 T G  S   W  PROCEDURES                 L

**PROC FOR SM RCS MONITOR CHECK**
     SM RCS HE TB(8)-GRAY               2
     SM RCS PRIM PRPLNT TB(4)-GRAY      2
     SM RCS SEC PRPLNT TB(4)-GRAY       2
     RCS IND SEL-SM A,B,C,D             2
      CHECK QUADS A,B,C,D               2
       SM RCS PKG TEMP
        IND-105-195 DEG
       SM RCS HE PRESS IND-RECORD
       SM RCS IND SW-HE TK TEMP
       SM RCS HE TK TEMP
        IND-RECORD
       SM RCS IND SW-PRPLNT QTY
       SM RCS PRPLNT QTY
        IND-RECORD

       SM RCS MANF PRESS
        IND-178-192PSIA
     WHEN SM RCS MANF PRESS             2
        IND <150PSIA
        RCS SEC FUEL PRESS
        (A,B,C,D)-OPEN
```



```
**PROC FOR SPS MONITORING CHECK**

     SPS PRPLNT TK TEMP IND
      +53 TO +75 DEG
      IF<55DEG,SPS LINE HTRS-A
      IF>75DEG,SPS LINE HTRS-OFF
     SPS PRESS IND SW-HE,N2A,N2B    3
      SPS HE/N2 PRESS IND           3
       SPS HE PRESS-3900PSIA MAX
       SPS N2A PRESS-2900PSIA MAX
       SPS N2B PRESS-2900PSIA MAX
     SPS PRESS IND SW-HE            3
     SPS FUEL AND OXID PRESS        3
      INDS-170-195PSIA
      (FUEL/OXID MAX DELTAP=20PSIA)
     SPS ENG INJ VLV IND(4)-CLOSE   3
     RECORD                         3
      SPS OXID QTY IND
      SPS FUEL QTY IND
      SPS OXID UNBAL IND
     OXID FLOW VLV PRIM-PRIM        3
     SPS HE VLV(BOTH)-AUTO          3
     SPS HE VLV TB(BOTH)-BP         3
```

```
***********************************
ADDENDUM 11
SPS THRUST SETUP                (P40)
***********************************

        D
        I
        S
        P                          P
   P    L   C                      A
G  R    A   R                      N
E  O    Y   E                      E
T  G    S   W  PROCEDURES          L

**PROCEDURES FOR SPS THRUST**

P00      LEB KEY V37E00E
         CDR CONFIRM GND PIPA BIAS CHECK

**PROCEDURES FOR EMS TEST AND S/U**

         CDR CB,EMS(2)/CLOSED
             SC CONT-CMC
             CMC MODE-FREE
             EMS MODE-STBY
             EMS FUNCTION-OFF
             EMS FUNCTION-DV
             EMS MODE-AUTO
             VERIFY DV LESS THAN
              3.6FPS PER 100SEC
             CMC MODE-AUTO
             EMS FUNCTION-OFF
             EMS MODE-STBY
             EMS FUNCTION-DV SET
             EMS MODE-AUTO
             LOAD DV = 1586.8
```



```
             EMS FUNCTION-DV TEST
             MONITOR SPS LT-ON
             MONITOR DV COUNTDOWN
             MONITOR SPS LT-OFF
             CONFIRM DV = -20.8+/-20.7
             EMS MODE-STBY
             EMS FUNCTION-DV SET
             LOAD BURN VC
             EMS FUNCTION-DV

         LEB KEY V49E
F 06 22      (FINAL GMBL ANGLES)
             LOAD BURN R,P,Y GMBL ANGLES
             KEY V62E
         CDR BMAG MODE(3)-RATE2
             RHC-ARMED
         LEB PRO
F 50 18      (COMMANDED R,P,Y)
             PRO
  06 18      (COMMANDED R,P,Y)
         CDR MONITOR ATT MANEUVER
              FOR GMBL LOCK
F 50 18      (COMMANDED R,P,Y)
             VERIFY R,P,Y AGREE WITH BURN
              PAD R,P,Y WITHIN 5 DEG
         LEB KEY ENTER

        **PROC FOR SPS THRUST PROG**

P40      LEB KEY V37E40E
F 50 18      (COMMANDED R,P,Y)
             VERIFY R,P,Y AGREE WITH PAD
              VALUES WITHIN 5 DEG
         CDR ALIGN SC IN ROLL TO PAD VALUE
         LEB PRO
  06 18      (COMMANDED R,P,Y)
```

```
    CDR MONITOR BURN ATT TRIM
F 50 18 (COMMANDED R,P,Y)
    LEB G/N PWR OPTICS-ON
        OPT ZERO-ZERO(15SEC)
        OPT TEL TRUN-SLAVE TO SXT
        RETICLE BRT TW-ADJUST
        OPT ZERO-OFF
        OPT MODE-CMC
        KEY V41N91E
F 21 92 (BLANK,BLANK,BLANK)
        LOAD PAD SHAFT ANGLE(+XXX.XX)
         IN R1 AND PAD TRUNNION ANGLE
         (+XX.XXX) IN R2
  41 RB (SHAFT,TRUNNION,BLANK)
        MONITOR OPT DRIVE TO PAD
         VALUES
F 50 18 (COMMANDED R,P,Y)
        VERIFY PAD STAR IN SXT
        OPT MODE-MAN
        DRIVE TRUNN LESS THAN 5 DEG
        OPT ZERO-ZERO
        RETICLE BRT TW-MIN BRTNESS
        MOVE TO CENTER SEAT
    LMP MN BUS TIE(2)-ON
        PUG MODE-NORM(AUX FOR TEI)
        SPS HE VLV TB (BOTH)-RP
        SPS HE VLV (BOTH)-AUTO

    CDR RHC PWR DIRECT(BOTH)-OFF
        SC CONT-CMC
        CMC MODE-AUTO
        SCS TVC (BOTH)-RATE CMD
        TVC GMBL DRIVE (2)-AUTO
        PERFORM MTVC CHECKS
           TVC SERVO PWR 1-AC 1/MNA
           TVC SERVO PWR 2-AC 2/MNB
```



```
           TRANS CONTR PWR-ON (UP)
           RHC PWR NORM 2-AC
           GMBL MTRS PITCH 1-STRT-ON
           GMBL MTRS YAW 1-STRT-ON
           THC-CLOCKWISE
           RHC-VERIFY NO MTVC
           GMBL MTRS PITCH 2-STRT ON
           GMBL MTRS YAW 2-STRT ON
           SET GPI PTRIM TO PAD VALUE
                  YTRIM TO PAD VALUE
           RHC-VERIFY MTVC
           THC-NEUTRAL
           RHC PWR NORM 2-AC/DC
        ALIGN SC IN ROLL TO PAD VALUE
    CMP PRO
  06 18 (COMMANDED R,P,Y)
        MONITOR ATT TRIM
F 50 18 (COMMANDED R,P,Y)
        VERIFY R,P,Y AGREE WITH PAD
         VALUES WITHIN 5 DEG
        KEY ENTER
F 50 25 (00204, GMBL DRIVE TEST)
    CDR RHC PWR DIRECT(BOTH)-MNA/MNB
        MAN ATT (3)-RATE CMD
        ATT DB-MIN
        RATE-HIGH
        RMAG MODE (3)-ATT1/RATE 2
        AUTO RCS SEL(16)-MNA

   **ALIGN GDC TO IMU**
    CDR FDAI SELECT 1
        FDAI SOURCE-ATT SET
        ATT SET-IMU
    CMP KEY V16N20E
F 16 20 (R,P,Y)
    CDR NULL FDAI NEEDLES WITH
```

```
                ATT SET TW (AVOID FALSE
                NULL BY COMPARING ATT SET
                IND WITH N20)
               ATT SET=GDC
               DEPRESS GDC ALIGN PB
               FDAI SELECT=1/2
          CMP  KEY RELEASE
    F 50 25    (00204,GMBL DRIVE TEST)

          CMP  PRO
          CDR  MONITOR GMBL DRIVE
                SEQ AND TRIM
       06 40   (TFI,VG,DVM)
               VERIFY SPS GPI TRIM AGREE&
                WITH PAD WITHIN 0.5 DEG
-2MIN     LMP  NONESS BUS=MNA
               TAPE RCDR FWD=OFF(CTR)
               TLM INPUTS PCM=HIGH
               UP TLM CMD=RESET THEN NOR&
               TAPE RCDR PCM=PCM/ANLG
               TAPE RCDR RCD=RCD
               TAPE RCDR FWD=FWD
               TAPE MOTION TB=BP
               FLT RCDR=RECORD
                (FOR LOI1,LOI2,AND TEI)
          CDR  FDAI SCALE=5/5
               VERIFY SPS TH LT=OFF
               CB SPS P2=OPEN(TEI ONLY)
               CB SPS Y2=OPEN(TEI ONLY)
               DV THRUST(BOTH)=NORMAL
               THC=ARMED
               RHC=ARMED
-35SEC         DSKY BLANKS
-30       06 40 (TFI,VG,DVM)
          CDR  EMS MODE=AUTO
-25       CMP  CK DVM FOR HI PIPA BIAS
```



```
                (LESS THAN 2FPS PER 5 SEC)
-15       CDR  APPLY ULLAGE THRUST
                (IF REQUIRED)
-5     F 99 40 (REQUEST FOR ENGINE ENABLE)
          CMP  PRO
 0        06 40 (TFC,VG,DVM)
+1        CDR  MONITOR SPS LT=ON/START
                MDC ET COUNT UP
               TERMINATE ULLAGE 1 SEC
                AFTER SPS IGNITION
               CONFIRM FDAI 1 RATES LESS THAN
                10 DEG/SEC
               MONITOR PC GAUGE 95=105 PSIA
          CMP  VERIFY VG/DECR AND DVM/INCR
               MONITOR FDAI 2 RATES LESS THAN
                10 DEG/SEC
          LMP  MONITOR VALVES OPEN AND
                 SPS GAUGES
          CDR  MONITOR SPS ENGINE CUTOFF
               MONITOR SPS LT=OFF
       F 16 40 (TFC,VG,DVM) (COPY VG AND DVM)
CUTOFF+1SEC    DV THRUST(BOTH)=OFF
               MONITOR PC GAUGE ZERO
          LMP  MONITOR VALVES CLOSED
               SPS HE VLV TB(BOTH)=BP
               FLT RCDR=OFF(CTR)
          CDR  CB SPS P2=CLOSED
               CB SPS Y2=CLOSED
               SPS GMBL MTRS(4)=OFF
                (SEQUENTIALLY=P2,Y2,P1,Y1)
               TVC SERVO PWR(BOTH)=OFF
                (SEQUENTIALLY=2,1)
          CMP  PRO
       F 16 85 (VG=BODY)
          CDR  NULL VG RESIDUALS AS REQD
               THC=LOCKED
```

```
          RHC-LOCKED
      CMP PRO
  F 37 88

  **CALL IDLING PROGRAM**
P00       KEY 00E
          KEY V66E (TRANSFER POST BURN
           SV FROM CSM SLOTS
           TO LM SLOTS)
      LMP NONESS BUS-OFF
          TAPE RCDR FWD-OFF(CTR)
          TAPE MOTION TB-GRAY
           (ASSUME GND PLAYBACK AT
           NEXT OPPORTUNITY)
          MN BUS TIE(2)-OFF
          CHARGE BATTERIES
      CDR EMS MODE-STBY
          EMS FUNCTION-OFF
          FDAI SCALE-5/1
          ATT DB-MAX
          RATE-LOW
          TRANS CONT PWR-OFF
          RHC PWR DIRECT (BOTH)-OFF
          RMAG MODE (3)-RATE 2
```



```
****************************************
ADDENDUM 12
RCS THRUST SETUP                   (P41)
****************************************

GET   PROG   DISPLAYS   CREW PROCEDURES   PANEL

**PROCEDURES FOR RCS THRUST**

P00     LEB KEY V37E00E
        CDR CONFIRM GND PIPA BIAS CHECK

**PROCEDURES FOR EMS SETUP**

        CDR SC CONT-CMC
            CMC MODE-FREE
            EMS MODE-STBY
            EMS FUNCTION-DV
            EMS MODE-AUTO
            VERIFY DV LESS THAN
             3.2FPS PER 100SEC
            CMC MODE-AUTO
            EMS FUNCTION-OFF
            EMS MODE-STBY
            EMS FUNCTION-DV SET
            LOAD BURN VC
            EMS FUNCTION-DV

        LEB KEY V49E
```

```
F 06 22 (FINAL GMBL ANGLES)
        LOAD BURN R,P,Y GMBL ANGLES
        KEY V62E
   CDR BMAG MODE(3)-RATE2
        RHC-ARMED
   LEB PRO
F 50 18 (COMMANDED R,P,Y)
        PRO
  06 18 (COMMANDED R,P,Y)
   CDR MONITOR ATT MANEUVER
        FOR GMBL LOCK
F 50 18 (COMMANDED R,P,Y)
        VERIFY R,P,Y AGREE WITH
         PAD R,P,Y WITHIN 5 DEG
   LEB KEY ENTER

    **PROC FOR RCS THRUST PROG**

P41    LEB KEY V37E41E
F 50 18 (COMMANDED R,P,Y)
   CDR ALIGN SC IN ROLL TO PAD VALUE
   LEB PRO
  06 18 (COMMANDED R,P,Y)
   CDR MONITOR BURN ATT TRIM
F 50 18 (COMMANDED R,P,Y)
        VERIFY R,P,Y AGREE WITH PAD
         VALUES WITHIN 5 DEG
   LEB OPT MODE-MAN
        G/N PWR OPTICS-ON
        OPT ZERO-ZERO(15SEC)
        OPT TELTRUN-SLAVE TO SXT
        RETICLE BRT TW-ADJUST
        OPT ZERO-OFF
        OPT MODE-CMC
        KEY V41N91E
F 21 92 (BLANK,BLANK,BLANK)
```



```
        LOAD PAD SHAFT ANGLE(+XXX,XX)
         IN R1 AND PAD TRUNNION ANGLE
         (+XX,XXX) IN R2
  41 88 (SHAFT,TRUNNION,BLANK)

        MONITOR OPT DRIVE TO PAD
         VALUES
F 50 18 (COMMANDED R,P,Y)
        VERIFY PAD STAR IN SXT
        OPT MODE-MAN
        DRIVE TRUN LESS THAN 5 DEG
        OPT ZERO-ZERO
        RETICLE BRT TW-MIN BRTNESS
        MOVE TO CENTER SEAT
        KEY ENTER
  06 85 (VG-BODY)
   CDR ATT DB-MIN
        RATE-LOW
        BMAG MODE(3)-ATT1/RATE2
        AUTO RCS SEL(16)-MNA
        TRANS CONT PWR-ON(UP)

    **ALIGN GDC TO IMU**
   CDR FDAI SELECT 1
        FDAI SOURCE-ATT SET
        ATT SET-IMU
   CMP KEY V16N20E
  16 20 (R,P,Y)
   CDR NULL FDAI NEEDLES WITH
         ATT SET TW (AVOID FALSE
         NULL BY COMPARING ATT SET
         IND WITH N20)
        ATT SET-GDC
        DEPRESS GDC ALIGN PB
        FDAI SELECT-1/2
   CMP KEY RELEASE
```

```
-2MIN     LMP TLM INPUTS PCM-HIGH
               UP TLM CMD-RESET THEN NOR
               TAPE RCDR PCM-PCM/ANLG
               TAPE RCDR RCD-RCD
               TAPE RCDR FWD-FWD
               TAPE MOTION TB-BP
-35 SEC        DSKY BLANKS
-30       16 85 (VG-BODY)
               EMS MODE-AUTO
-25 SEC     CMP KEY N40E
          16 40 (TFI,VG,DVM)
               MONITOR DVM FOR HI PIPA BIAS
                (LESS THAN 2FPS PER 5SEC)
               KEY RELEASE
            CDR RHC-ARMED
               THC-ARMED
-0      F 16 85 (VG-BODY)
               SET MDC ET COUNTING UP AND
                NULL VG AS REQUIRED
               THC-LOCKED
               RHC-LOCKED
            CMP PRO
        F 37 BB

          **CALL IDLING PROGRAM**

P00            KEY OOF
               KEY V66E (TRANSFER POST BURN
                SV FROM CSM SLOTS
                TO LM SLOTS)
            LMP TAPE RCDR FWD-OFF(CTR)
               TAPE MOTION TB-GRAY
                (ASSUME GND PLAYBACK AT
                NEXT OPPORTUNITY)
            CDR EMS MODE-STBY
```



```
EMS FUNCTION-OFF
ATT DB-MAX
RMAG MODE(3)-RATE 2
TRANS CONT PWR-OFF
```

```
                    **********************************
                    ADDENDUM 13
                    ESTABLISH PTC
                    **********************************

      D
      I
      S
      P                                              P
   P  L     C                                        A
G  R  A     R                                        N
E  O  Y     E                                        E
T  G  S     W  PROCEDURES                            L

P00         CDR ATT DB-MIN
                RATE-LOW
                MAN ATT(3)-RATE CMD
                BMAG MODE(3)-RATE2
                SC CONT-CMC
                CMC MODE-AUTO
                FDAI SCALE-5/1
                FDAI SELECT-1/2

            CMP KEY V48E
          F 04 46 (DAP CONFIGURATION)
                LOAD OR VERIFY
                     11112
                     11111
                       8

                PRO
          F 06 47 (CSM AND LM WT)
                PRO
          F 06 48 (SPS GMBL TRIM)
                PRO
```



```
            LMP RECEIVE PTC R,P,Y FROM GND
                 OR USE PREVIOUS PTC ANGLES
                 IF STILL VALID,COORDINATE PTC
                 GMBL ANGLE UPDATES WITH GND

            CMP KEY V49E
          F 06 22 (FINAL GMBL ANGLES)
                LOAD PTC GMBL ANGLES
                KEY V62E
                RHC-ARMED
                PRO
          F 50 18 (COMMANDED R,P,Y)
                PRO
            06 18 (COMMANDED R,P,Y)
              CDR MONITOR ATT MANEUVER
                 FOR GMBL LOCK
          F 50 18 (COMMANDED R,P,Y)
                VERIFY R,P,Y AGREE WITH PTC
                 PAD R,P,Y WITHIN 5 DEG
                NULL FDAI NEEDLES WITH RHC
              CMP KEY ENTER

              CDR BMAG MODE(3)-ATT1/RATE2
                SC CONT-SCS
                AUTO RCS SEL ROLL(8)-MNA
                CONFIGURE AUTO RCS SEL FOR
                 SINGLE JET PITCH AND YAW
                 (PITCH-(+)A3,(-)C4)
                 (  YAW-(+)B3,(-)D4)
                LIMIT CYCLE-ON(UP)
                ATT DB-MAX
                RATE-HIGH
                BMAG MODE(R)-RATE2
                MAN ATT(P,Y)-RATE CMD
                MAN ATT(R)-ACC CMD
                MANEUVER SC IN ROLL ABOUT THE
```

BODY X AXIS TO SET UP A
.2 DEG/SEC BODY ROLL RATE
RHC-LOCKED
LMP RECORD PTC START GET IN LOG
CDR MAINTAIN PTC ATT TO +/- 20 DEG
MAINTAIN BODY ROLL RATE TO
.2 DEG/SEC +OR- .1 DEG/SEC
DURING PERIODS OF PTC

LMP RECORD PTC CORRECTIONS IN LOG

IF THE PTC ATTITUDE MUST BE
INTERRUPTED AND A NEW ATT
SELECTED,NULLING THE NEEDLES
WILL RETURN SC TO PTC ATT

PROG	DISPLAY	CREW	PROCEDURES	PANEL
P00				

****
ADDENDUM 14
TERMINATE PTC
****

CMP KEY V16N20E
16 20 (CURRENT R,P,Y)
CDR RHC-ARMED
LIMIT CYCLE-OFF
STOP PTC ROLL AT THE
PREFERRED ATTITUDE FOR NAV
SIGHTINGS OR AN IMU ALIGNMENT
BY SWITCHING
MAN ATT(3)-RATE CMD AT THE
APPROPRIATE GMBL ANGLES
BMAG MODE(3)-ATT1/RATE2
RATE-LOW
FDAI SELECT-1/2
FDAI SCALE-5/1
AUTO RCS SEL(16)-MNA
LMP RECORD PTC STOP GET IN LOG

```
********************************
ADDENDUM 15
ORBITAL NAVIGATION PROCEDURES (P22)
(PSEUDO LANDING SITE TRACKING)
********************************

    D
    I
    S
    P                                 P
  P L   C                             A
G R A   R                             N
E O Y   E                             E
T G S   W  PROCEDURES                 L

        LEB KEY V37E22E
P22
    F 06 45 (BLANK,BLANK,MAX MGA)
        LEB PRO
    F 05 70 (LANDMARK CODE)
            LOAD 10001 IN R2
        LEB OPT ZERO-OFF
            OPT MODE-MAN
            POSITION TRUNNION TO 35 DEG
            OPT MODE-CMC
        LEB PRO                        P00
      06 92 (SHAFT,TRUN,BLANK)
            MONITOR OPT DRIVE TO LANDING
                SITE
        LEB IDENTIFY IDENTIFICATION POINTS
                IF VISABLE
    LEB,CDR WHEN LANDING SITE IDENTIFIED.
                START 0.3 DEG/SEC
                PITCH RATE
        CDR ROLL TO AVOID SHAFT AXIS
                WITHIN 10 DEG OF LANDING
                SITE
        LEB OPT MODE-MAN
    F 51 88 (PLEASE MARK)
            MAKE 5 MARKS-20 SEC APART
            POSITION TRUNNION TO 5 DEG
            OPT ZERO-ZERO
        CDR STOP PITCH RATE
        LEB PRO
    F 05 71 (LANDING SITE DATA)
            VERIFY R2
        LEB PRO
    F 06 49 (DELTA R,DELTA V,BLANK)
            RECORD VALUES

          **HOLD AT THIS DISPLAY FOR
                ONE MINUTE**

        LEB PRO
    F 06 89 (LAT,LONG/2,ALT)
            RECORD VALUES

          **HOLD AT THIS DISPLAY FOR
                20 SECONDS**

        LEB KEY V37E00E
```

```
            ********************************
            ADDENDUM 16
            ORBITAL NAVIGATION PROCEDURES (P22)
            (LANDMARK TRACKING-NO AUTO OPTICS)
            ********************************

      D
      I
      S
      P                                    P
    P L   C                                A
  G R A   R                                N
  E O Y   E                                E
  T G S   W  PROCEDURES                    L

         LEB KEY V37E22E
22
      F 06 45 (BLANK,BLANK,MAX MGA)
         LEB PRO
      F 05 70 (LANDMARK CODE)
              LOAD 20000 IN R2
         LEB OPT ZERO-OFF
              OPT MODE-MAN
         LEB PRO
      F 51 88 (PLEASE MARK)
              PLACE OPTICS AT 10 DEG
                 TRUNNION ANGLE
              IDENTIFY IDENTIFICATION POINTS
                 AT THEIR RESPECTIVE
                 ACQUISITION TIMES
      LEB,CDR WHEN LANDMARK IDENTIFIED-
                 START 0.3 DEG/SEC
                 PITCH RATE
         CDR ROLL TO AVOID SHAFT AXIS
                 WITHIN 10 DEG OF LANDMARK
         LEB MAKE 5 MARKS-20 SEC APART

              POSITION TRUNNION TO 5 DEG
              OPT ZERO-ZERO
          CDR STOP PITCH RATE
              MAN ATT(P)-ACCEL CMD
              PITCH SC UP TO 5 DEG PITCH
               AND 0 DEG ROLL W.R.T.
               LOCAL HORIZONTAL
              MAN ATT(P)-MIN IMP
              INITIATE ORBITAL PITCH RATE
               FOR NEXT LANDMARK SIGHTING
          LEB PRO
      F 05 71 (LANDMARK DATA)
              VERIFY R2
          LEB PRO
      F 06 49 (DELTA R,DELTA V,BLANK)
              RECORD VALUES

            **HOLD AT THIS DISPLAY FOR
                 20 SECONDS**

          LEB PRO
      F 06 89 (LAT,LONG/2,ALT)
              RECORD VALUES

            **HOLD AT THIS DISPLAY FOR
                 20 SECONDS**

  P00     LEB KEY V37E00E
```

```
      **********************************
      ADDENDUM 17
      ORBITAL NAVIGATION PROCEDURES (P22)
      (LANDMARK TRACKING-WITH AUTO OPT)
      **********************************

      D
      I
      S
      P                                        P
   P  L     C                                  A
G  R  A     R                                  N
E  O  Y     F                                  E
T  G  S     W  PROCEDURES                      L

        LEB KEY V3722E
P22
      F 06 45 (BLANK,BLANK,MAX MGA)
          LEB PRO
      F 05 70 (LANDMARK CODE)
              LOAD 10000 IN R2
          LEB PRO
      F 06 89 (LAT,LONG/2,ALT)
              LOAD PREVIOUSLY COMPUTED
                 LANDMARK COORDINATES
          LEB OPT ZERO-OFF
              OPT MODE-MAN
              POSITION TRUNNION TO 35 DEG
              OPT MODE-CMC
              PRO
        06 92 (SHAFT,TRUN,BLANK)
              MONITOR OPT DRIVE TO LANDMARK
              IDENTIFY IDENTIFICATION POINTS
                 IF VISABLE
     LEB,CDR WHEN LANDMARK IDENTIFIED-
                 START 0.3 DEG/SEC
```



```
                 PITCH RATE
        CDR ROLL TO AVOID SHAFT AXIS
                 WITHIN 10 DEG OF LANDMARK
        LEB OPT MODE-MAN
    F 51 88 (PLEASE MARK)
            MAKE 5 MARKS-20 SEC APART
            POSITION TRUNNION TO 5 DEG
            OPT ZERO-ZERO
        CDR STOP PITCH RATE
            MAN ATT(P)-ACCEL CMD
            PITCH SC UP TO 5 DEG PITCH
             AND 0 DEG ROLL W.R.T.
             LOCAL HORIZONTAL
            MAN ATT(P)-MIN IMP
            INITIATE ORBITAL PITCH RATE
             FOR NEXT LANDMARK SIGHTING
        LEB PRO
    F 05 71 (LANDMARK DATA)
            VERIFY R2
        LEB PRO
    F 06 89 (LAT,LONG/2,ALT)
            VERIFY LANDMARK COORDINATES
        LEB PRO
    F 06 49 (DELTA R,DELTA V,BLANK)
            RECORD VALUES

          **HOLD AT THIS DISPLAY FOR
              20 SECONDS**

        LEB PRO
    F 06 89 (LAT,LONG/2,ALT)
            RECORD VALUES

          **HOLD AT THIS DISPLAY FOR
              20 SECONDS**
```

LEB KEY V37E00E

P00

****
ADDENDUM 18
ORDEAL INITIALIZATION/VERIFICATION
****

GET PROG DISPLAYS CREW PROCEDURES PANEL

PROCEDURES FOR ORDEAL SETUP

CDR SET ORDEAL ON FDAI 1
FDAI/GPI PWR=BOTH
LOGIC 2/3 PWR=ON
CMC ATT=IMU
FDAI SELECT=1/2
FDAI 1=ORB RATE
EARTH/LUNAR=LUNAR
MODE=HOLD/FAST
KEY V82E
F 04 06 (00002,00001)
PRO
F 16 44 (HA,HP,TFF)
ALT SET=SET ALT TO HA,HP AVG
PRO
KEY V83E
F 16 54 (R,RDOT,THETA)
VERIFY 0 DEG YAW
SLEW FDAI 1 TO THETA
MODE=OPR/SLOW
SLEW FDAI PRECISELY

PRO

```
**********************************
ADDENDUM 19
HIGH GAIN ANT ACQUISITION
**********************************

P00
     LMP HI GAIN ANT TRACK=MAN
         HI GAIN ANT BEAM=WIDE

     CMP KEY V64E
F 06 51 (RHO,GAMMA,BLANK)
     LMP RECORD HI GAIN ANT
          GMBL COORDINATES
     CMP PRO
     LMP HI GAIN ANT POSITION
            SET ANT PITCH TO RHO
            SET ANT YAW TO GAMMA
         S-BAND ANT OMNI-HI GAIN
         VERIFY HI GAIN S-BAND
          ANT IND GREATER THAN
          HALF SCALE
         HI GAIN ANT TRACK=
            AUTO OR REACQ AS REQUIRED
         HI GAIN ANT BEAM=AS REQUIRED
```

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