Apollo 11

Flight Plan

Final – July 1, 1969

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

APOLLO 11 - FLIGHT PLAN

315 pages

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FINAL

APOLLO 11 FLIGHT PLAN

AS-506/CSM-107/LM-5

JULY 1,1969

PREPARED BY
FLIGHT PLANNING BRANCH
FLIGHT CREW SUPPORT DIVISION

MANNED SPACECRAFT CENTER
HOUSTON,TEXAS

INDEXING DATA

DATE	OPR	#	T	PGM	SUBJECT	SIGNATOR	LOC

SECTION I
SECTION II
SECTION III
SECTION IV
SECTION V
SECTION VI

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Apollo 11
Flight Plan

Final – July 1, 1969

MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

APOLLO 11
APOLLO AS-506/CSM-107/LM-5
FINAL FLIGHT PLAN

JULY 1, 1969

Submitted by:

L. J. Riché
Flight Planning Branch

G. M. Colton
Flight Planning Branch

T. A. Guillory
Flight Planning Branch

Approved by:

W. J. North
Chief, Flight Crew Support Division

Donald K. Slayton
Director of Flight Crew Operations

Concurrence:

6-27

George M. Low
Manager, Apollo Spacecraft Program

Christopher C. Kraft, Jr.
Director of Flight Operations

Any comments or questions on this document should be forwarded to T. A. Guillory, Flight Planning Branch, mail code CF34, extension 4271.

ACKNOWLEDGMENT

Acknowledgment is made to Messrs. Richard Rogers, William Killian and Spencer Gardner for their technical support in the preparation of the Apollo 11 Flight Plan.

Views of the earth and the P52 stars shown in the Flight Plan were taken from the document, “Views from the CM and LM During the Flight of Apollo 11” (Mission G).

The CSM and LM attitude information was taken from the document, “Lunar Orbit Attitude Sequence for Mission G”.

TABLE OF CONTENTS

SECTION I - GENERAL

SECTION II - UPDATE FORMS

SECTION III - DETAILED TIMELINE

SECTION III CONT'D

SECTION IV DETAILED TEST OBJECTIVES

SECTION V - CONSUMABLES

SECTION VI - SUMMARY FLIGHT PLAN

ABBREVIATIONS

ACCEL	Accelerometer
ACN	Ascension
ACT	Activation
ACQ	Acquisition
AEA	Abort Electronics Assembly
AGS	Abort Guidance Subsystem
AH	Ampere Hours
ALSCC	Apollo Lunar Surface Close-up Camera
ALT	Altitude
AMP or amp	Ampere
ANG	Antigua
ANT	Antenna
AOH	Apollo Operations Handbook
AOS	Acquisition of Signal or Acquisition of Site
AOT	Alignment Optical Telescope
APS	Ascent Propulsion Subsystem
ARS	Atmosphere Revitalization System
ATT	Attitude
AUX	Auxiliary
AZ	Azimuth
BAT	Battery
BDA	Bermuda
Bio	Bio-Medical Data on Voice Downlink
BP	Barber Pole
BT	Burn Time
BU	Backup
BW	Black & White
BRKT	Bracket
CAP COM	Capsule Communicator
CAL	Calibration Angle
CAM	Camera
CB	Circuit Breaker
CDH	Constant Delta Altitüde
CDR	Commander
CDU	Coupling Data Unit
CEX	Color External
CIN	Color Internal
CIRC	Circularization
CK	Check
CM	Command Module
CMC	Command Module Computer
CMD	Command
CMP	Command Module Pilot
CNTL	Control
C/O	Check out
COAS	Crew Optical Alignment Sight
COMM	Communications
CONFIG	Configuration
CONT	Continue
CP	Control Point
CRO	Carnarvon, Australia
CRYO	Cryogenic
CSC	Contingency Sample Collection
CSI	Coelliptic Sequence Initiation
CSM	Command Service Module
C&WS	Caution and Warning System
CYI	Grand Canary Island
DAP	Digital Auto Pilot
DB	Deadband
DCA	Digital Command Assembly
DEDA	Data Entry and Display Assembly
DEGS	Degrees
DEPL	Depletion
DET	Digital Event Timer
DIFF	Difference

DOI	Descent Orbit Insertion
DPS	Descent Propulsion System
DS	Documented Sample
DSE	Data Storage Equipment
DSKY	Display and Keyboard
DTO	Detailed Test Objective
DUA	Digital Uplink Assembly
DWN	Down
E	Erasable or Enter
EASEP	Early Apollo Scientific Experiment Package
ECS	Environmental Control System
ED	Explosive Device
EDT	Eastern Daylight Time
EFH	Earth Far Horizon
EI	Earth (atmosphere) Interface
EL	Elevation or Electric
EMS	Entry Monitor System
EMU	Extravehicular Mobility Unit
ENH	Earth Near Horizon
EPO	Earth Parking Orbit
EPS	Electrical Power Subsystem
EQUIP	Equipment
EST	Eastern Standard Time
EVA	Extravehicular Activity
EVAP	Evaporator
EVT	Extravehicular Transfer
EXT	External
f	F Stop
FC	Fuel Cell
FDAI	Flight Director Attitude Indicator
FLT	Flight
FM	Frequency Modulated
FOV	Field of View
fps or FPS	Feet per second
FT or ft	Feet
FTO	Flight Test Objective
FTP	Full Throttle Position
GBI	Grand Bahama Islands
GBM	Grand Bahama (MSFN)
GDC	Gyro Display Coupler
GDS	Goldstone, California
GET	Ground Elapsed Time
GETI	Ground Elapsed Time of Ignition
GLY	Glycol
GMT	Greenwich Mean Time
G&N	Guidance and Navigation
GNCS	Guidance Navigation Control System
GWM	Guam
GYM	Guaymas, Mexico
H2	Hydrogen
HA	Apogee Altitude
HAW	Hawaii
HBR	High Bit Rate (TLM)
HD	Highly Desirable
HGA	High Gain Antenna
HI	High
Hp	Perigee Altitude
HSK	Honeysuckle (Canberra, Australia)
HTR	Heater
HTV	USNS Huntsville
ICDU	Inertial Coupling Data Unit
ID	Identification
IGA	Inner Gimbal Angle
IGN	Ignition
IMU	Inertial Measurement Unit

INIT	Initialization
INT	Intervalometer
IP	Initial Point
ISA	Interim Storage Assembly
IU	Instrumentation Unit
IVC	Intervehicular Communications
IVT	Intravehicular Transfer
JETT	Jettison
KM	Kilometer
kwh	Kilowatt Hour
LA	Launch Azimuth
LAT	Latitude
LBR	Low Bit Rate (TLM)
LBS or lbs	Pounds
LCG	Liquid Cooled Garment
LDG	Landing
LDMK	Landmark
LEB	Lower Equipment Bay
LEC	Lunar Equipment Conveyor
LFH	Lunar Far Horizon
LGC	LM Guidance Computer
LH	Left-hand
L/H	Local Horizontal
LHEB	Left-hand Equipment Bay
LHFEB	Left-hand Forward Equipment Bay
LHSSC	Left Hand Side Storage Container
LiOH	Lithium Hydroxide
LLM	Lunar Landing Mission
LLOS	Landmark Line of Sight
LM	Lunar Module
LMP	Lunar Module Pilot
LNH	Lunar Near Horizon
LOI	Lunar Orbit Insertion
LONG	Longitude
LOS	Loss of Signal or Loss of Site
LPO	Lunar Parking Orbit
LR	Landing Radar
LRRR or LR3	Laser Ranging Retro-Reflector
LS	Landing Site
LT	Light
LTG	Lighting
LV	Launch Vehicle
L/V	Local Vertical
LVPD	Launch Vehicle Pressure Display
M	Mandatory
MAD	Madrid, Spain
MAN	Manual
MAX	Maximum
MAX Q	Maximum Dynamic Pressure
MCC	Midcourse Correction
MCC-H	Mission Control Center - Houston
MCC	Mission Control Center
MDC	Main Display Console
MEAS	Measurement
MER	USNS Mercury
MESA	Modularized Equipment Stowage Assembly
MET	Mission Event Timer
MGA	Middle Gimbal Angle
M/I	Minimum Impulse
MIN	Minimum
MLA	Merrit Island, Florida
MNVR	Maneuver
MPS	Main Propulsion System
MSFN	Manned Space Flight Network
MTVC	Manual Thrust Vector Control

N2	Nitrogen
NAV	Navigation
NM	Nautical Miles
NOM	Nominal
NXX	Noun XX
O2	Oxygen
OBS	Observation
O/F	Oxidizer to Fuel Ratio
OGA	Outer Gimbal Angle
OMNI	Omnidirectional Antenna
OPS	Oxygen Purge System
ORB	Orbital
ORDEAL	Orbit Rate Display Earth and Lunar
ORIENT	Orientation
OVHD	Overhead
P	Pitch or Program
PAD	Voice Update
PCM	Pulse Code Modulation
PC	Plane Change
PDI	Powered Descent Initiation
PGA	Pressure Garment Assembly
PGNCS	Primary Guidance Navigation Control Section
PIPA	Pulse Integrating Pendulous Accelerometer
PLSS	Personal Life Support Systems
PM	Phase Modulated
POL	Polarity or Polarizing
PRE	Pretoria, South Africa
PREF	Preferred
PREP	Preparation
PRESS	Pressure
PRIM	Primary
PROP	Proportional
PSE	Passive Seismic Experiment
PT	Point
PU	Propellant Utilization
PUGS	Propellant Utilization and Gaging System
PTC	Passive Thermal Control
PWR	Power
PXX	Program XX
Qty	Quantity
R	Roll or Range
R&B	Red & Blue
RAD	Radiator
RCDR	Recorder
RCS	Reaction Control System
RCU	Remote Control Unit
RCV	Receiver
RED	USNS Redstone
REFSMMAT	Reference Stable Member Matrix
REG	Regulator
REQD	Required
RH	Right-hand
RING	Ringsite
RLS	Radius of Landing Site
RNDZ	Rendezvous
RR	Rendezvous Radar
RSI	Roll Stability Indicator
RT	Real Time
RTC	Real Time Command
RXX	Routine XX
SA	Shaft Angle
S/C	Spacecraft
SCE	Signal Conditioning Equipment
SCS	Stabilization Control System
SCT	Scanning Telescope

SEC	Secondary
SECO	S-IVB Engine Cut-off
SECS	Sequential Events Control System
SEP	Separate
SEQ	Sequence
S-IVB	Saturn IV B(Third Stage)
SLA	Service Module LM Adapter
SLOS	Star Line-of-Sight
SM	Service Module
SPOT	Spot Meter
SPS	Service Propulsion System
SR	Sunrise
SRC	Sample Return Container
SRX	S-Band Receiver Mode No. X
SS	Sunset
STX	S-Band Transmit Mode No. X
S.V.	State Vector
SWC	Solar Wind Composition
Sw	Switch
SXT	Sextant
T EPHEM	Time of Ephemeris Update
TA	Trunnion Angle
TAN	Tananarive, Madagascar
TB	Time Base
TCA	Time of Closest Approach
TD&E	Transposition Docking & LM Ejection
TEC	Trans Earth Coast
TEI	Transearth Insertion
TEMP	Temperature
TERM	Terminate
TEX	Corpus Christi, Texas
TGT	Target
TIG	Time of Ignition
TLC	Trans Lunar Coast
TLI	Translunar Insertion
TLM or TM	Telemetry
TPF	Terminal Phase Final
TPI	Terminal Phase Initiation
TPM	Terminal Phase Midcourse
T/R	Transmitter/Receiver
TRANS	Translation
TV	Television
TVC	Thrust Vector Control
TWR	Tower
US	United States
V	Velocity
VAN	USNS Vanguard
VHF	Very High Frequency
VLV	Valve
VI	Inertial Velocity
VOX	Voice Keying
VXX	Verb XX
W/O	Without
WRT	With Respect to
WTN	USNS Watertown
XFER	Transfer
XMIT	Transmit or Transmitter
XPONDER	Transponder
Y	Yaw

ΔV Velocity Change (Differential)
ΔVC Velocity Change at Engine Cutoff
ΔR Position Change (Differential)

8-balls Flight Director Attitude Indicator (FDAI)

CAMERA NOMENCLATURE

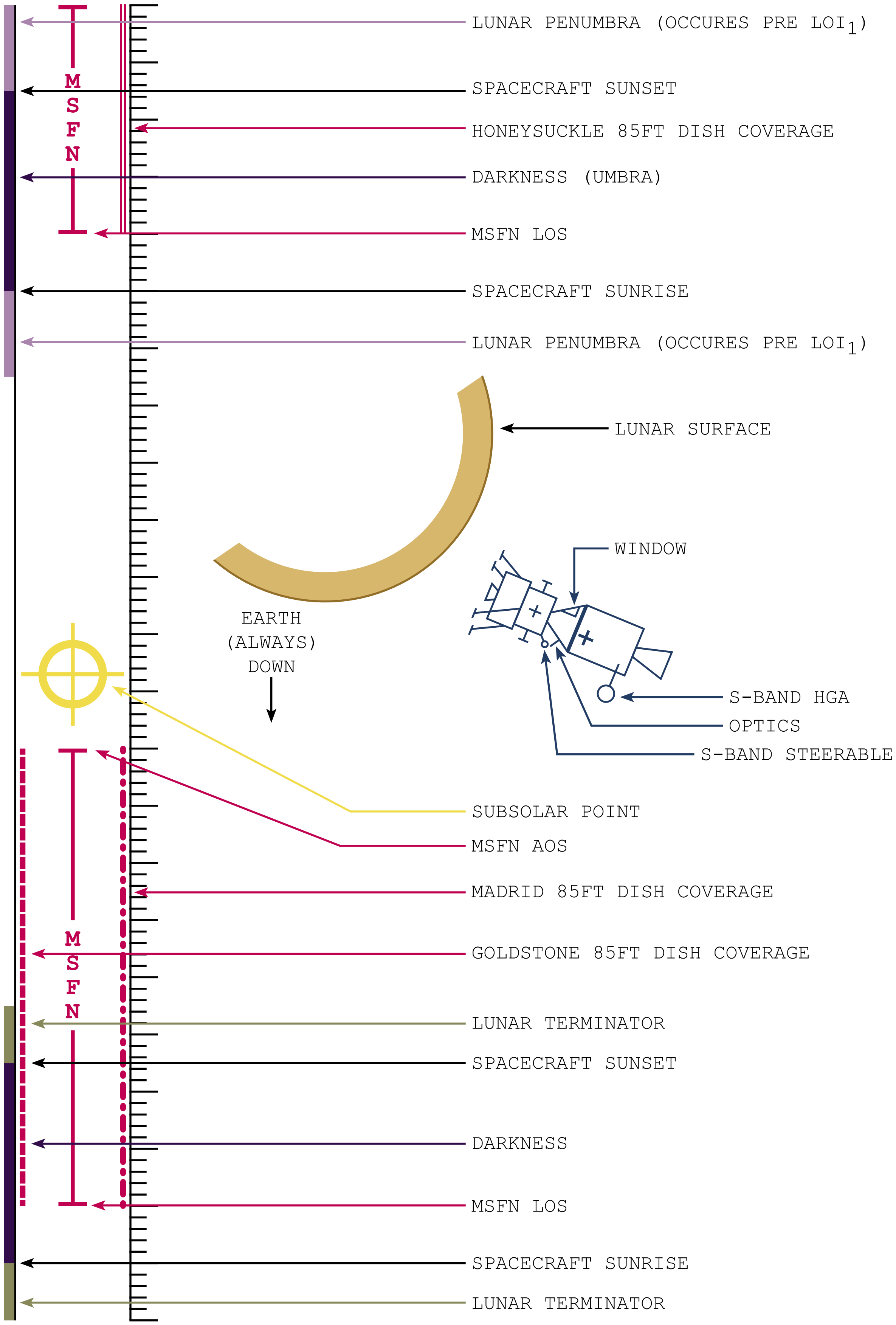
EL/250/BW-BRKT
Electric Hasselblad/250mm Lens/Black & White film-Camera Bracket

INT (f5.6,250,INF)
Intervalometer (f-stop 5.6, shutterspeed=1/250 sec, Infinity)

16mm/18/CEX-BRKT
16mm Camera/18mm Lens/Color Film External-Camera Bracket

MIR (f8,250,INF) 6fps
Mirror(f-stop 8, shutterspeed=1/250 sec,Infinity) 6 frames per sec

SYMBOL NOMENCLATURE



INTRODUCTION

This Flight Plan has been prepared by the Flight Planning Branch, Flight Crew Support Division, with technical support by TRW Systems.

This document schedules the AS-506/CSM-107/LM-5 operations and crew activities to fulfill, when possible, the test objectives defined in the Mission Requirements, G Type Mission Lunar Landing.

The trajectory parameters used in this Flight Plan are for July 16, 1969 launch, with a 72° launch azimuth and were supplied by Mission Planning and Analysis Division as defined by the Apollo Mission G Spacecraft Operational Trajectory.

The Apollo 11 Flight Plan is under the configuration control of the Crew Procedures Control Board (CPCB). All proposed changes to this document that fall in the following categories should be submitted to the CPCB via a Crew Procedures Change Request:

1. Items that impose additional crew training or impact crew procedures.
2. Items that impact the accomplishment of detailed test objectives.
3. Items that result in a significant RCS or EPS budget change.
4. Items that result in moving major activities to a different activity day in the Flight Plan.
5. Items that require a change to the flight data file.

The Chief, Flight Planning Branch (FCSD) will determine what proposed changes fall in the above categories.

Mr. T. A. Guillory will act as co-ordinator for all proposed changes to the Apollo 11 Flight Plan.

Any requests for additional copies or changes to the distribution lists of this document must be made in writing to Mr. W. J. North, Chief, Flight Crew Support Division, MSC, Houston, Texas.

SECTION I

GENERAL

MISSION DESCRIPTION

1. Launch and EPO (Duration 2:44) LIFT OFF - 2:44 GET
    (a) Nominal launch time is 9:32 EDT, July 16, 1969, with a launch window duration of 4 hrs. 24 min,
    (b) Earth orbit insertion into a 100 nm, circular orbit at 11 min. 43 sec. after lift-off
    (c) CSM systems C/0 in earth orbit
    (d) Optional IMU realign (P52) to the pad REFSMMAT during the first night period
    (e) TLI occurs at 2:44:26 GET over the Pacific Ocean during the second revolution. (See Table 1-1 for burn data).

2. Translunar Coast (Duration 73:10) 2:44 - 75:54 GET
    After TLI, which places the spacecraft in a free lunar return trajectory, the following major events occur prior to LOI:
    (a) Transposition, docking and LM ejection, including SIVB photography
    (b) Separation from SIVB and a CSM evasive maneuver
    (c) SIVB propulsive venting of propellants (slingshot)
    (d) Two series of P23 cislunar navigation sightings, star/earth horizon, consisting of five sets at 06:00 GET and five sets at 24:30 GET
    (e) Four midcourse corrections which take place at TLI +9, TLI +24, LOI -22 and LOI -5 hours with DV nominally zero (See Table 1-1).
    (f) Passive thermal control (PTC) will be conducted during all periods when other activities do not require different attitudes.
    (g) LM inspection and housekeeping
    (h) LOI_1, performed at 75:54:28 GET, ends the TLC phase.

3. Lunar Orbit (Duration 59:30) 75:54 - 135:24 GET

LOI Day (Duration 25:00) 69:00 - 94:00

(a) LOI_1

(b) Photos of targets of opportunity

(c) LOI2

(d) Post LOI2 LM entry and inspection. S-Band/UHF B Voice tests will be conducted.

(e) Post LOI2 Pseudo landmark tracking (one set of sightings) (See Table 1-4)

(f) Rest period of 9 hours

DOI and EVA Day (Duration 28:00) 94:00 - 122:00 GET

(a) Docked LM activation and checkout

(b) Docked landing site landmark sighting (one set of sightings) (See Table 1-3)

(c) Undocking and separation

(d) DOI thru landing (See Figure 1-3 Powered Descent)

(e) LM post touchdown and simulated liftoff

(f) Rest period (LM) of 4 hours

(g) CSM plane change

(h) Rest period (CSM) of 4 hours

(i) EVA prep

(j) EVA for 2 hours 40 minutes

(k) Post EVA

(l) Rest period (LM) 4 hours 40 minutes

(m) Rest period (CSM) 4 hours 50 minutes

Ascent and TEI Day (Duration 25:00) 122:00 - 147:00 GET

(a) LM Lift-Off and Insertion

(b) LM active rendezvous

CSI

PC

CDH

TPI

Braking

(c) Docking

(d) LM jettison

(e) TEI

(f) Rest Period

4. <u>Lunar Orbit Particulars</u> (Average Values for a 60 x 60 nm orbit)

(a) Revolutions start at 180° longitude

(b) Revolution duration - 1 hr. 58.2 min.

(c) S/C night period duration - 47 min.

(d) MSFN coverage per rev. - 72 min.

(e) Orbit inclination - 1.25° for July 16, 1969 launch

(f) S/C orbital rate - 3°/min. (.05°/sec)

(g) Lighting change at fixed ground point - 1°West/Rev.

(h) Horizon visibility ± 20° selenocentric angle on the lunar surface

(i) One lunar degree on lunar surface is 16.35 nm

(j) Site 2 will be visible (3° sun angle) at REV. 7

(k} S/C subvehicle point to horizon 327 nm.

5. <u>Transearth Coast and Entry</u> (Duration 59:39) 131:52 - 195:03 GET

Transearth coast begins with TEI at 135:24:34 GET and consists of the following major events:

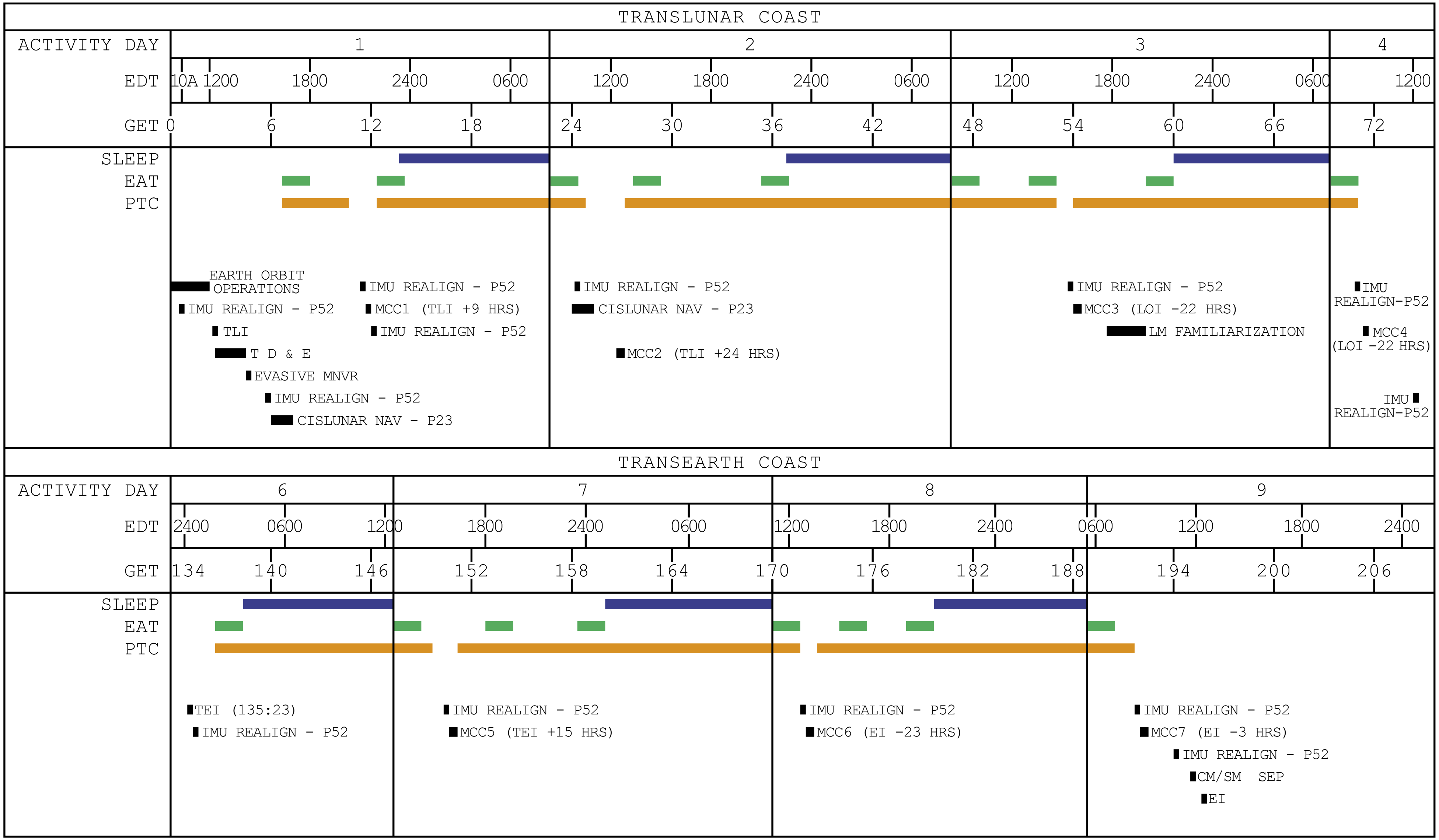
(a) Three midcourse corrections are scheduled at TEI +15, EI -23 and EI -3 hours with DV nominally zero.

(b) CM/SM separation takes place at 194:51 GET and Entry Interface occurs at 195:03 GET.

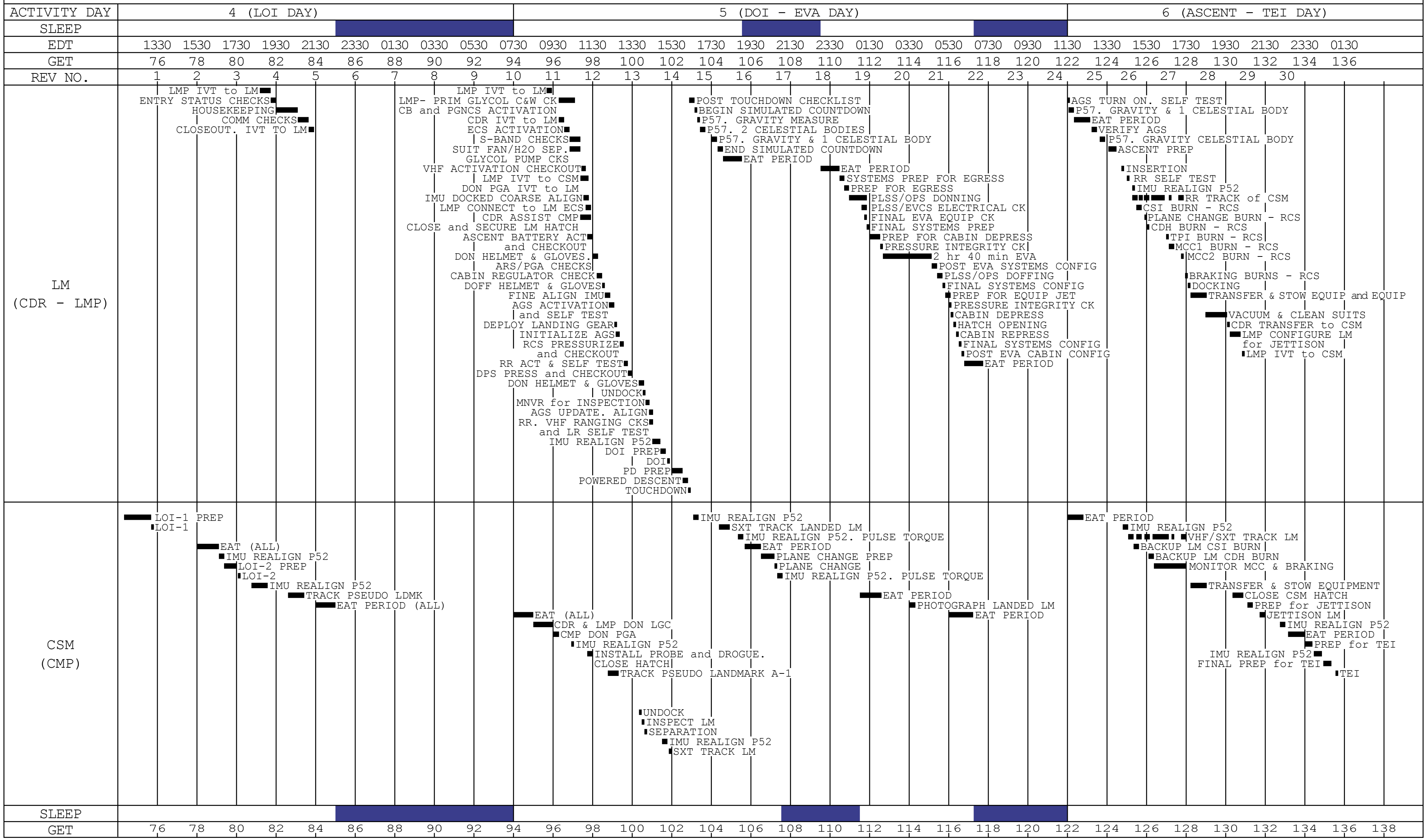
(c) Splashdown will occur in the Pacific Ocean at a longitude of about 172.4° West at 195:17 GET. This will occur approximately 25 minutes prior to sunrise local time.

FIGURE 1-1

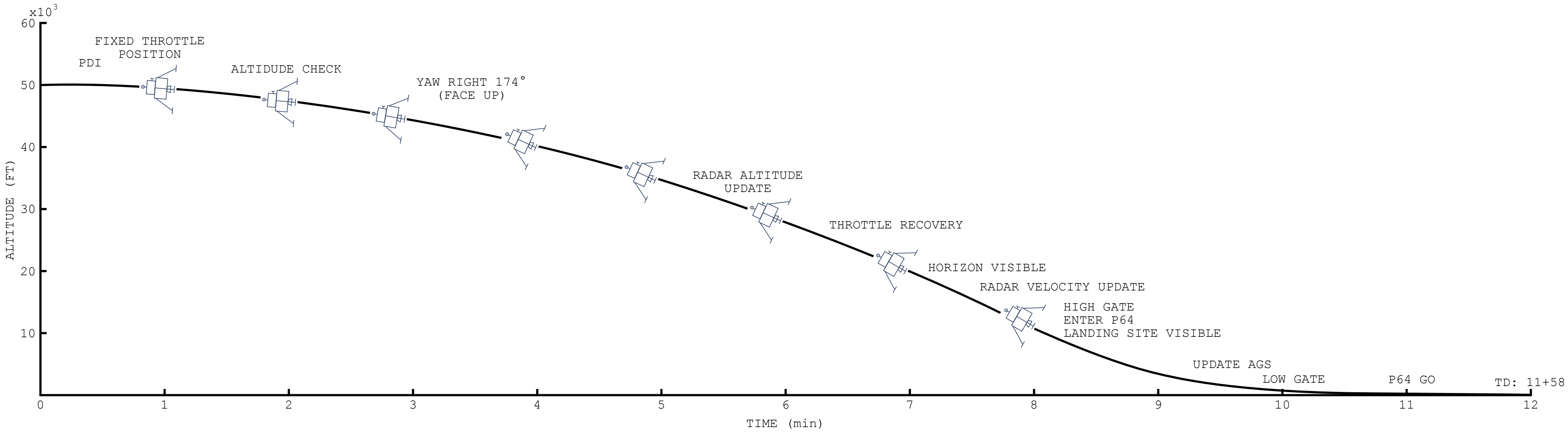
MISSION SUMMARY FLIGHT PLAN



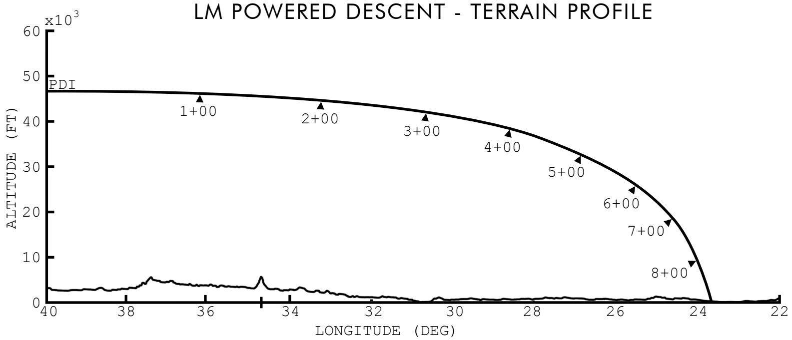
LUNAR ORBIT SUMMARY FLIGHT PLAN FIG 1 - 2



LM POWERED DESCENT



LM POWERED DESCENT - TERRAIN PROFILE



LM POWERED DESCENT - HIGH GATE TO TD

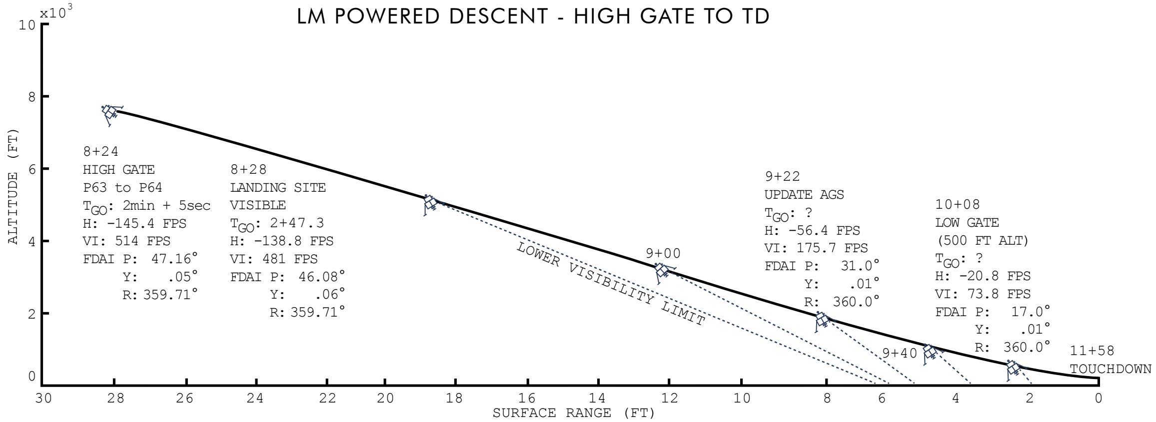


TABLE 1-1 CSM BURN SCHEDULE

BURN / MANEUVER	GETI BURN TIME ΔVC	ATTITUDE (DEG) LH/LV	 INERTIAL	LIGHTING	ΔV (FPS)	ULLAGE	TVC MODE	REFSMMAT	S/C WT. RESULTANT HA, HP	REMARKES
S-IVB TLI	02:44:26 5 MIN 20 SEC			BURNOUT AT SUNRISE	ΔVX: -- ΔVY: -- ΔVZ: -- ΔV REQ: 10,451.2	----	----	PAD	WT: -- HP: -- HA: --	S-IVB BURN
CSM/LM S-IVB EVASIVE MNVR	04:39:44.9 2.8 SEC 15.6 FPS			DAYLIGHT	ΔVX: 5.1 ΔVY: 0.0 ΔVZ: 19.0 ΔV REQ: 19.7	NOT REQUIRED	G&N AUTO	PAD	WT: 96662.3 HP: 123.8 HA: 281953.9	SPS BURN
MIDCOURSE CORRECTIONS MCC$_1$ TO MCC$_4$	11:45 26:45 53:55 70:55			----	ΔVX: NOMINALLY ΔVY: ZERO ΔVZ: ΔV REQ:	NOT REQUIRED	G&N AUTO	PAD PTC PTC LDG SITE	----	TLI +9 TLI +24 LOI -22 LOI -5
LOI$_1$	75:54:28.4 5 MIN 58.9 SEC 2914.8 FPS			DAYLIGHT (SS -1 HR 7 MIN)	ΔVX: -2891.8 ΔVY: -433.1 ΔVZ: 20.4 ΔV REQ: 2924.1	NOT REQUIRED	G&N AUTO	LDG SITE	WT: 95207.4 HP: 59.2 HA: 169.8	SPS BURN
LOI$_2$	80:09:29.7 16.4 SEC			DAYLIGHT (SR +9 MIN)	ΔVX: 138.3 ΔVY: 0.0 ΔVZ: 75.9 ΔV REQ: 157.8	2 JET 20 SEC	G&N AUTO	LDG SITE	WT: 71320.81bs HP: 53.6 HA: 65.6	SPS BURN
CSM/LM SEP	100:39:50.4 8 SEC			SUNLIGHT (SS -14 MIN)	ΔVX: 0.0 ΔVY: 0.0 ΔVZ: 2.5 ΔV REQ: 2.5	----	G&N AUTO	LDG SITE	WT: 36407.9 HP: 55.6 HA: 63.1	RCS BURN
*CSM PLANE CHANGE	107:05:33.4 0.8 SEC 5.7 FPS			DARKNESS (SS +17 MIN)	ΔVX: 0.0 ΔVY: 16.6 ΔVZ: 0.0 ΔV REQ: 16.6	2 JET 20 SEC	G&N AUTO	PLANE CHANGE	WT: 36325.4 HP: NO CHANGE HA: NO CHANGE	SPS BURN
LM JETTISON	131:53:04.7 3.1 SEC 0.8 FPS			DAYLIGHT (SR +36 MIN)	ΔVX: -1.0 ΔVY: -- ΔVZ: -- ΔV REQ: 1.0	----	G&N AUTO	LIFT OFF	WT: 36154.7 HP: 58.5 HA: 59.4	RCS BURN
TEI	135:24:33.8 2 MIN 29.4 SEC NOT AVAILABLE			DAYLIGHT (SR +10 MIN)	ΔVX: 3213.3 ΔVY: 705.0 ΔVZ: -138.8 ΔV REQ: 3292.7	2 JET 16 SEC	G&N AUTO	LIFT OFF	WT: 36111.4 HP: -- HA: --	SPS BURN
MIDCOURSE CORRECTIONS MCC$_5$ TO MCC$_7$	150:24 172:00 192:06			----	ΔVX: ΔVY: NOMINALLY ΔVZ: ZERO ΔV REQ:	----	G&N AUTO	PTC PTC ENTRY	----	TEI +15 EI -23 EI -3

TABLE 1-2 LM BURN SCHEDULE

BURN / MANEUVER	**GETI** **BURN TIME** **ΔVC**	**ATTITUDE (DEG)**		**LIGHTING**	**ΔV (FPS)**	**ULLAGE**	**TVC MODE**	**REFSMMAT**	**S/C WT.** **RESULTANT** **HA, HP**	**REMARKES**
		LH/LV	**INERTIAL**							
DOI	101:38:48 28:5 SEC			DARKNESS (SR -4 MIN)	ΔVX: 67.46 ΔVY: -28.68 ΔVZ: -12.51 ΔV REQ: 70	2 JET 7.5 SEC 1.3 FPS	PGNCS AUTO	LDG SITE	WT: 33,404 HP: 8.97 HA: 57.87 nM	DPS BURN
PDI	102:35:13 11 MIN 58 SEC			DAYLIGHT	ΔVX: - ΔVY: - ΔVZ: - ΔV REQ: 6766	2 JET 7.5 SEC 1.3 FPS	PGNCS AUTO	LDG SITE	WT: 16,569 HP: 0 HA: 0	DPS BURN
ASCENT	124:23:26 7 MIN 18 SEC			DAYLIGHT	ΔVX: - ΔVY: - ΔVZ: - ΔV REQ: 6060	----	PGNCS AUTO	LIFT OFF	WT: 5,894 AT INS HP: 60,000 ft HA: 45 nM	APS BURN
CSI	125:21:19.1 45:0 SEC			DARKNESS (SR -1 MIN)	ΔVX: 49.5 ΔVY: 0.0 ΔVZ: 0.0 ΔV REQ: 49.5	----	PGNCS AUTO	LIFT OFF	WT: 5875.0 HP: 44.9 HA: 45.0	RCS BURN
PLANE CHANGE	125:50:28 0			DAYLIGHT (SR +25 MIN)	ΔVX: 0.0 ΔVY: 0.0 ΔVZ: 0.0 ΔV REQ: 0.0	----	PGNCS AUTO	LIFT OFF	WT: - HP: - HA: -	RCS +Y 2 JET BURN NOMINALLY ZERO
CDH	126:19:37.0 1.9			DAYLIGHT (SS -19 MIN)	ΔVX: -1.1 ΔVY: 0.0 ΔVZ: 4.1 ΔV REQ: 4.3	----	PGNCS AUTO	LIFT OFF	WT: 5842.9 TIG HP: 43.8 HA: 45.3	RCS BURN
TPI	126:58:08.4 22.4 SEC			DARKNESS (SR -23 MIN)	ΔVX: 22.0 ΔVY: 0.0 ΔVZ: -11.1 ΔV REQ: 24.8	----	PGNCS AUTO	LIFT OFF	WT: 5840.1 HP: 43.3 HA: 61.7	RCS BURN
MCC_1	127:13:08 0			DARKNESS (SR -8 MIN)	ΔVX: 0.0 ΔVY: 0.0 ΔVZ: 0.0 ΔV REQ: 0.0	----	PGNCS AUTO	LIFT OFF	WT: - HP: - HA: -	RCS +Z 2 JET BURN NOMINALLY ZERO
MCC_2	127:28:08 0			DAYLIGHT (SR +7 MIN)	ΔVX: 0.0 ΔVY: 0.0 ΔVZ: 0.0 ΔV REQ: 0.0	----	PGNCS AUTO	LIFT OFF	WT: - HP: - HA: -	RCS +Z 2 JET BURN NOMINALLY ZERO
1st BRAKING MNVR	127:36:57 0			DAYLIGHT (SR +15 MIN)	ΔVX: 0.0 ΔVY: 0.0 ΔVZ: 0.0 ΔV REQ: 0.0	----		LIFT OFF	WT: - HP: - HA: -	RCS -Z 2 JET BURN NOMINALLY ZERO
2nd BRAKING MNVR	127:39:24.5 10.8 SEC			DAYLIGHT (SR +18 MIN)	ΔVX: - ΔVY: - ΔVZ: - ΔV REQ: 12.0	----	PGNCS AUTO	LIFT OFF	WT: 5824.1 HP: 49.0 HA: 60.7	RCS -Z 2 JET
3rd BRAKING MNVR	127:40:32.8 8.8 SEC			DAYLIGHT (SR +20 MIN)	ΔVX: - ΔVY: - ΔVZ: - ΔV REQ: 9.8	----	PGNCS AUTO	LIFT OFF	WT: 5816.4 HP: 53.7 HA: 60.3	RCS -Z 2 JET
4th BRAKING MNVR	127:42:16.1 4.3 SEC			DAYLIGHT (SR +21 MIN)	ΔVX: - ΔVY: - ΔVZ: - ΔV REQ: 4.6	----	PGNCS AUTO	LIFT OFF	WT: 5810.1 HP: 56.2 HA: 60.1	RCS -Z 2 JET
5th BRAKING MNVR	127:43:35.7 4.2 SEC			DAYLIGHT (SR +23 MIN)	ΔVX: - ΔVY: - ΔVZ: - ΔV REQ: 4.7	----	PGNCS AUTO	LIFT OFF	WT: 5807.0 HP: 69.9 HA: 58.9	RCS -Z 2 JET

TABLE 1-3 LUNAR LANDING SITE DATA

DAY	SITE DESIG	LATITUDE	LONGITUDE	[1]LAUNCH AZIMUTH/ SUN ELEVATION	[2]LAUNCH AZIMUTN/ SUN ELEVATION
JULY 16 0932 EDT	2(IIP6)	00°42'50"N 00.71388889°N (00.6914°N)	23°42'28"E 23.70777778°E (23.7169°E)[3]	72°/10.5°	108°/13.5°
JULY 18 1132 EDT	3(IIP8)	00°21'10"N 00.35277778°N	01°17'57"W 01.29916667°W	89.295°/11°	108°/13°
JULY 21 1209 EDT	5(IIP13)	01°40'41"N 01.67805556°N	41°53'57"W 41.89916667°W	94.6775°/9.7°	108°/11.7°

Data From TJ memo, Accuracy Estimates, Landing Site Landmarks, May 12, 1969, TJ-69-499.

[1]Sun Elevation Angles Are For Approximately 27 Hours After LOI, 1st Opportunity TLI.
[2]Includes 2nd Opportunity TLI.
[3]Data From MPAD memo, landing site coordinates for G, June 12, 1969, 69-FM41-181.

TABLE 1-4 LANDMARK TRACKING DATA
July 16 Launch

LANDMARK DESIG.	LATITUDE	LONGITUDE	DELTA ALTITUDE(nm)	SUN EL
Al(Pseudo)	2°N 2.000°N	65° 30'E 60.500°E	000.00	43°
IP(130)	1°53'N 1.885°N	28°42'E 28.726°E	000.00	--
130 (Prime LDG SITE 2)	01°15'56"N 01.26555556°N (01.24307°N)	23°40'44"E 23.67888889°E (23.6880°E)[1]	-001.68	8.5°
123(Alternate LDG SITE 2)	00°30'19"N 00.50527778°N	24°53'20"E 24.88888889°E	-001.71	--
129(Alternate LDG SITE 2)	01°17'06"N 01.28500000°N	23°44'37"E 23.74361111°E	-001.76	--
133(Alternate LDG SITE 2)	00°47'14'°N 00.78722222°N	23°30'55"E 23.51527778°E	-001.68	--

[1]Data from MPAD memo, landing site 2 position, June 20, 1969, 69-FM41-199.

TABLE 1-4 LANDMARK TRACKING DATA (CONT'D)
July 18 Launch

LANDMARK DESIG.	LATITUDE	LONGITUDE	DELTA ALTITUDE(nm)	SUN EL
IP(G1)	0°16'N 0.267°N	32°19'E 32.317°E	--	--
G1(129)	01°17'06"N 01.28500000°N	23°44'37"E 23.74361111°E	-001.97	26°
IP(143)	00°18'N 00.300°N	3°23'E 3.383°E	--	--
143(Prime LDG SITE 3)	00°36'51"N 00.61416667°N	01°04'39"W 01.07750000°W	-001.01	9°
150(Alternate LDG SITE 3)	00°16'59"N 00.28305556°N	01°25'43"W 01.42861111°W	-001.01	--
147(Alternate LDG SITE 3)	00°03'42"N 00.06166667°N	01°16'36"W 01.27666667°W	-000.99	--

TABLE 1-4 LANDMARK TRACKING DATA (CONT'D)
July 21 Launch

LANDMARK DESIG.	LATITUDE	LONGITUDE	DELTA ALTITUDE(nm)	SUN EL
IP(G1)	0°30'S 0.500°S	26°33'W 26.550°W	--	--
G1	1°42'N 1.696°N	32°10'W 32.162°W	-001.77	8°
IP(180)	0°36'N 0.608°N	36°34'W 36.567°W	--	--
180(PRIME LDG SITE 5)	01°30'37"N 01.51027778°N	41°49'05"W 41.81805556°W	-001.25	8.9°
171(Alternate LDG SITE 5)	01°20'04"N 01.33444444°N	40°47'34"W 40.79271778°W	-001.29	--
178(Alternate LDG SITE 5)	01°45'33"N 01.75916667°N	41°34'12"W 41.57000000°W	-001.22	--
184(Alternate LDG SITE 5)	02°03'10"N 02.05277778°N	42°13'41°'W 42.22805556°W	-001.23	--

FLIGHT PLAN NOTES

A. Crew

1. Crew designations are as follows:

Designation	Prime	Backup
Commander (CDR)	Armstrong	Lovell
Command Module Pilot (CMP)	Collins	Anders
Lunar Module Pilot (LMP)	Aldrin	Haise

2. Crew positions during the mission are as follows:

	CSM			LM	
	Left	Center	Right	Left	Right
Launch thru TLI	CDR	LMP	CMP		
T&D thru Entry	CMP	CDR	LMP		
Manned LM	CMP			CDR	LMP

3. The crew will eat and sleep simultaneously throughout the mission. Eat periods will be normally 1-hour duration, with additional activities held to a minimum during this time frame. Sleep periods will normally be 8 to 10 hour duration with two 4 to 5 hour sleep periods while the LM is on the lunar surface.

4.

Activity	PGA Configuration
Launch to insertion	PGA's with helmet & gloves (H&G)
Insertion to TLI	PGA's without H&G
TLI to evasive mnvr	PGA's with H&G
TLC & LOI 1&2	Constant wear garments
LM activation & checkout	PGA without H&G (CMP H&G donned for latch cocking & CDR/LMP H&G donned for pressure integrity check and cabin reg check)
Undocking through touchdown	PGA's with H&G except CMP without H&G after DOI
Touchdown through pre lift-off	PGA's without H&G except for CDR/LMP simulated count-down & EVA
Liftoff through LM jettison	PGA's with H&G (except H&G off after docking)
LM jettison through splashdown	Constant wear garmets

5. Two crew status reports via air-to-ground commmunications will be made by the flight crew during each activity day. The first report will be given after the first meal of the day and will concern the sleep obtained during the previous sleep period. The second report will be given following the final meal of the day and will concern the radiation dose received during the previous 24 hours and medication taken if any. The following information should be logged:
   a. Food Consumption
   b. Exercise
   c. Used fecal bags marked as to crewman and GET

6. Negative reporting will be used in reporting completion of each checklist.

7. Continuous CSM biomedical data are automatically transmitted to the ground.

8. LM biomedical switching is performed manually by the LMP from undocking to docking as scheduled in the timeline.

9. All onboard gage readings will be read directly from the gages. and will not be corrected by the appropriate calibration factors.

B. Photography

Photographic requirements were derived from the following:
a. Lunar Surface Operations Plan
b. Photographic Operations Plan

C. Procedures

1. CSM

Crew procedures called out in the flight plan may be found in the following documents:
a. Apollo Operations Handbook - CSM-107 (AOH), Volume 1/2
b. Crew Checklist
c. CSM Rendezvous Procedure
d. Abort Summary Document
e. Apollo Entry Summary Document
f. Photographic Operations Plan
g. Descent Procedures Document
h. Ascent Procedures Document
i. Lunar Landmark Tracking Attitude Studies
j. Lunar Orbit Attitude Sequence for Mission G
k. Data Priority Documents

2. LM

Crew procedures called out in the flight plan may be found in the following documents:
a. Apollo Operations Handbook LM-5 Volume 1/2
b. Crew Checklist
c. LM Rendezvous Procedures
d. LM Descent/Ascent Summary Document
e. Lunar Landing Phase Photographic Operations Plan
f. Data Priority Documents
g. EVA Procedures
h. Apollo Lunar Surface Operations Plan

D. Communications

1. General
a. CSM and LM HBR data transmissions in lunar orbit will normally require the use of the high gain or steerable antennas
b. During communications, the spacecraft will be referred to by name (Apollo 11) and MCC-H will be referred to as Houston.
c. The preferred S-Band communications are:
   (1) CSM
      (a) Uplink Mode 6 (Voice, PRN, and Updata)
      (b) Downlink Mode 2 (Voice, PRN, TLM-HBR)
   (2) LM
      (a) Uplink Mode 7 (Voice, Updata)
      (b) Downlink Mode 1 (Voice, TLM-HBR)
d. LM voice recorder has a maximum utilization of 10 hours. This recorder will be used during LM operations to record all LM voice data during undocked operations (27 hours 42 minutes). This recorder will be operated in the VOX mode.
e. A small portable voice recorder will be carried in the CM to be used at the discretion of the crew as a voice recorder backup. This recorder will not be transferred to the LM for use during undocked operations.
f. The S-band "squelch" will be on during the sleep periods in order to prevent MSFN fade-out noise from disturbing the crew.

2. DSE Operation
   a. The DSE will normally be operated via ground command except for special cases where the operation is time limited. In these cases the crew may be asked to rewind the tape.
   b. During the earth orbit period when the CSM is not over a MSFN station, CSM TLM-LBR data will be recorded on the DSE and will be dumped during the pass over the US and over CRO prior to TLI if possible.
   c. DSE will be used for CSM HBR and voice recording during all CSM engine burns.
   d. DSE data and voice recordings will be made in CSM LBR mode whenver possible in order to minimize the DSE dump time.
   e. During PTC using the HGA REACQ communications mode the DSE will be used to record LBR data when the HGA is not in the MSFN field of view.
   f. During lunar orbit LM operations, the DSE will be used to record LM-TLM-LBR data during all docked LM activites that occur on the lunar farside. For undocked LM activites only DOI will be recorded as VHF ranging is required.
   g. DSE will be used to record all HBR entry data during the blackout region.

3. Launch - Earth Orbit Phase
   a. OMNI B and VHF LEFT will be selected for lift off. OMNI D will be selected by the crew during boost phase if the launch azimuth is less than 96° or OMNI C if the launch azimuth is greater than 96°. OMNI D will probably be the best antenna for earth orbit.
   b. VHF Duplex B will be used for launch, and Simplex A for earth orbit operations.
   c. VHF Simplex A will be used for entry to be compatible with recovery forces communications.

4. Translunar and Transearth Coast Phase
   The translunar and transearth sleep communications mode will be as follows. The CSM x-axis will be placed normal to the ecliptic plane. The CSM will be rolled at a rate of approximately three revolution per hour. During the near earth sleep periods prior to 30 hours GET (range less than 120Knm) omni antennas B and D will be used. During the other sleep periods (beyond 120Knm) the high gain antenna may be required (in the REACQ mode). The REACQ configuration will provide approximately 210 degrees of HGA coverage per CSM/LM revolution or 35 minutes of MSFN coverage per hour. The REACQ configuration will also allow MCC-H to use real time control to select TLM HBR or LBR and to dump the DSE during each spacecraft revolution.

5. Lunar Exploration Phase
   a. Normal CSM communications between MSFN/LM will be by S-Band during the lunar exploration period.
   b. If additional communications capability is required the S-Band erectable antenna will be deployed by the EVA crewman and will be utilized for all LM/MSFN/CSM communications.
   c. During periods when both crewmen are EVA, the „AR" position (Relay Mode) will be the normal communication mode on each of the Extravehicular Communication System (EVCS). The CDR will relay the LMP VHF voice and data to the LM which in turn will relay to MCC-H via S-Band.

E. CSM Notes

1. Electrical Power System and Water Management
   a. Spacecraft lift-off switch positions are listed in the Apollo Operations Handbook (Volume 2) for CSM 107.
   b. The CSM will remain fully powered up throughout the mission (CMC, IMU and SCS in the „operate" configuration and optics power-up as required).
   c. Fuel cell H_2 and O_2 purging is scheduled as follows H_2 approximately every 48 hours and O_2 approximately every 12 hours.

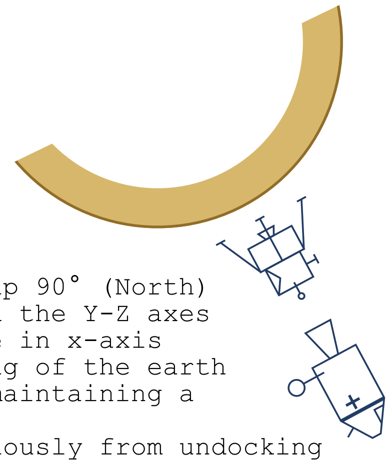
d. The hydrogen and oxygen VAC ION pumps will be inactive throughout the mission.
e. Potable water will be chlorinated once a day before each sleep period, starting with the First sleep period (GET 13:30). The POT H_2O inlet valve will be opened prelaunch.
f. FC purges and waste water dumps will not be scheduled within one hour prior to optical sightings.
g. Waste H2O dumping will be managed to allow:
   (1) Maximum QTY: 85-90%
   (2) Minimum QTY: 25%
   (3) At LOI: QTY = 75%
   (4) At CM-SM SEP: QTY = 90% to 100%
   (5) No dumping after MCC3 until after LOI
   (6) Dumps will be performed (if required) within 2 hours preceding MCC maneuvers
   (7) In lunar orbit if dumping is required, dumps will be performed immediately prior to sleep periods
   (8) The water dump will not be operated in the automatic mode at anytime during the mission
h. The cryogenic heaters will be in AUTO during the mission and the fans will be operated manually. The fans will be cycled for one minute before and after each sleep cycle.
i. The batteries will be charged according to the following schedule:

Time	Battery
5:20:00	B
12:20:00	A
48:10:00	B
80:25:00	A
103:30:00	B
148:00:00	A
154:00:00	B

2. Environmental Control System and Cabin Pressurization
   a. One CO_2 odor absorber filter (LiOH canister) is changed approximately every 12 hours or if CO_2 partial pressure is greater than 7.6mm Hg. There are 20 filters (2 in the canisters onboard and 18 stowed).
   b. A Pre TLI/LOI ECS redundant component check including the secondary evaporator operation, is performed prior to TLI and LOI. The secondary evaporator water control valves will be turned „OFF‟ after the check.
   c. The evaporator operation will be as follows:
      (1) Launch - primary loop operation
      (2) Earth Orbit - primary loop operation and secondary loop test plus redundant operation test prior to TLI.
      (3) Post TLI - deactivate both evaporators
      (4) Pre LOI-ECS pre TLI/LOI redundant component check and primary evaporator activation
      (5) Post TEI - deactivate primary evaporator
      (6) Entry interface minus 1 hour - activate primary and secondary evaporator.

3. Guidance and Navigation

a. During lunar orbit, the CSM and LM will utilize the same landing site REFSMMAT such that the gimbal angles would be 0,0,0 at landing with the LM sitting face forward on landing site number two and the CSM over the landing site pitched up 90° from local horizontal „heads up".



b. During PTC the CSM/LM x-axis is pitched up 90° (North) for TLC and down 90° (South) for TEC with the Y-Z axes in the plane of the ecliptic. This change in x-axis pointing is to enable simultaneous viewing of the earth and moon through the side windows while maintaining a favorable high gain antenna position.

c. The CSM tracking light will be on continuously from undocking to landing and from LM lift-off to docking.

4. Landmark Tracking

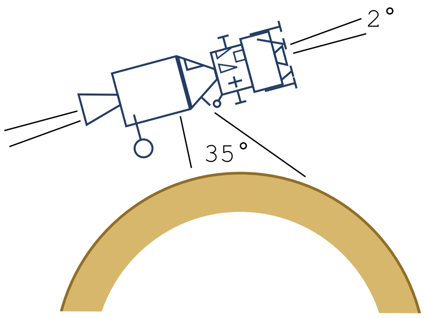
The following ground rules were used for landmark tracking.

a. IMU to be realigned on the dark side preceding each tracking period.

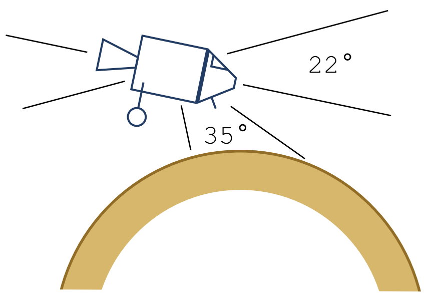
b. MSFN is reacquired after each tracking period. The tracking data will be acquired by MSFN after all the marks have been made and while N49 (ΔR,ΔV) is displayed. MSFN will give a GO when data acquisition has been verified.

c. The pseudo landmark tracking (A1) will be used to determine the altitude of an area in which the LM will be making altitude checks after DOI. The data will be processed during the sleep period after the trackings and relayed to the LM prior to undocking.

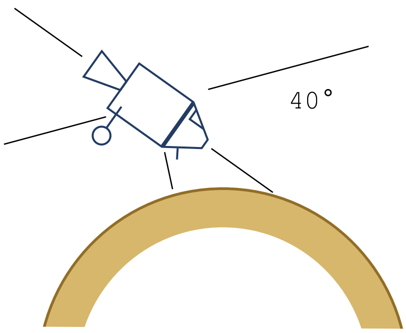
d. In the docked configuration the CSM/LM approaches the landmark in an inertial hold attitude. This inertial attitude places the spacecraft 2° below the local horizontal at the 35° elevation angle point. At 35° elevation angle a pitch down of 0.3°/sec is initiated. Five marks are then taken with the time between marks a minimum of 25 seconds. (See tracking profile)



e. In the undocked configuration the CSM approaches the landmark in ORB RATE and pitched down 22° from the local horizontal. At 35° elevation angle five marks are taken with the time between marks a minimum of 25 seconds. ORB RATE is continued throughout the marking period.



f. In the undocked COAS tracking the CSM will approach the LM in ORB RATE heads up and pitched down 40° from the local horizontal. When the LM is centered in the COAS the CSM will initiate a 40° variable pitch rate to keep the LM centered in the COAS.



5. CSM/LM and CSM attitude maneuvers will normally be at a rate of 0.2°/sec or 0.5°/sec. Unless other rates are required.
   NOTE: At 0.2°/sec, 15 minutes is required to maneuver 180°.
   At 0.5°/sec, 6 minutes is required to maneuver 180°.

6. Passive thermal control mode will be initiated after MCC1 or as soon as MCC1 is scrubbed and maintained throughout the mission (except in lunar orbit) until at least three hours before entry except for interruptions for midcourse corrections, communications orientation (maximum interruption of three hours). PTC will not be initiated before approximately 7:00 GET.

7. Service Propulsion System A11 SPS burns will be initiated on Bank A except LOI1 which will be initiated on Bank B.

F. LM Notes

1. Entries into the LM
   a. Three entries into the LM are scheduled in the timeline at 56:30, 81:30 and 95:52 GET respectively.
   b. *The first entry* (56:30 GET) will be for LM familiarization and will be performed by the CDR and LMP in the constant wear garments. During this period there will be approximately 5 minutes of VHF-B LBR data which will be recorded by the DSE in the CSM. The LM will remain on CSM power during the crew familiarization period.
   c. The second entry (81:30 GET) will be for LM housekeeping and will be performed by the LMP in constant wear garments. During this period the LM will go to internal power for the S-Band/VHF B voice activation.
   d. The third entry into the LM (95:52 GET) will be performed by the LMP in LCG's to prepare the LM for undocking and descent to the lunar surface. During this period the LMP and CDR initially transfer to the LM in LCG's then return to the CSM for PGA donning.

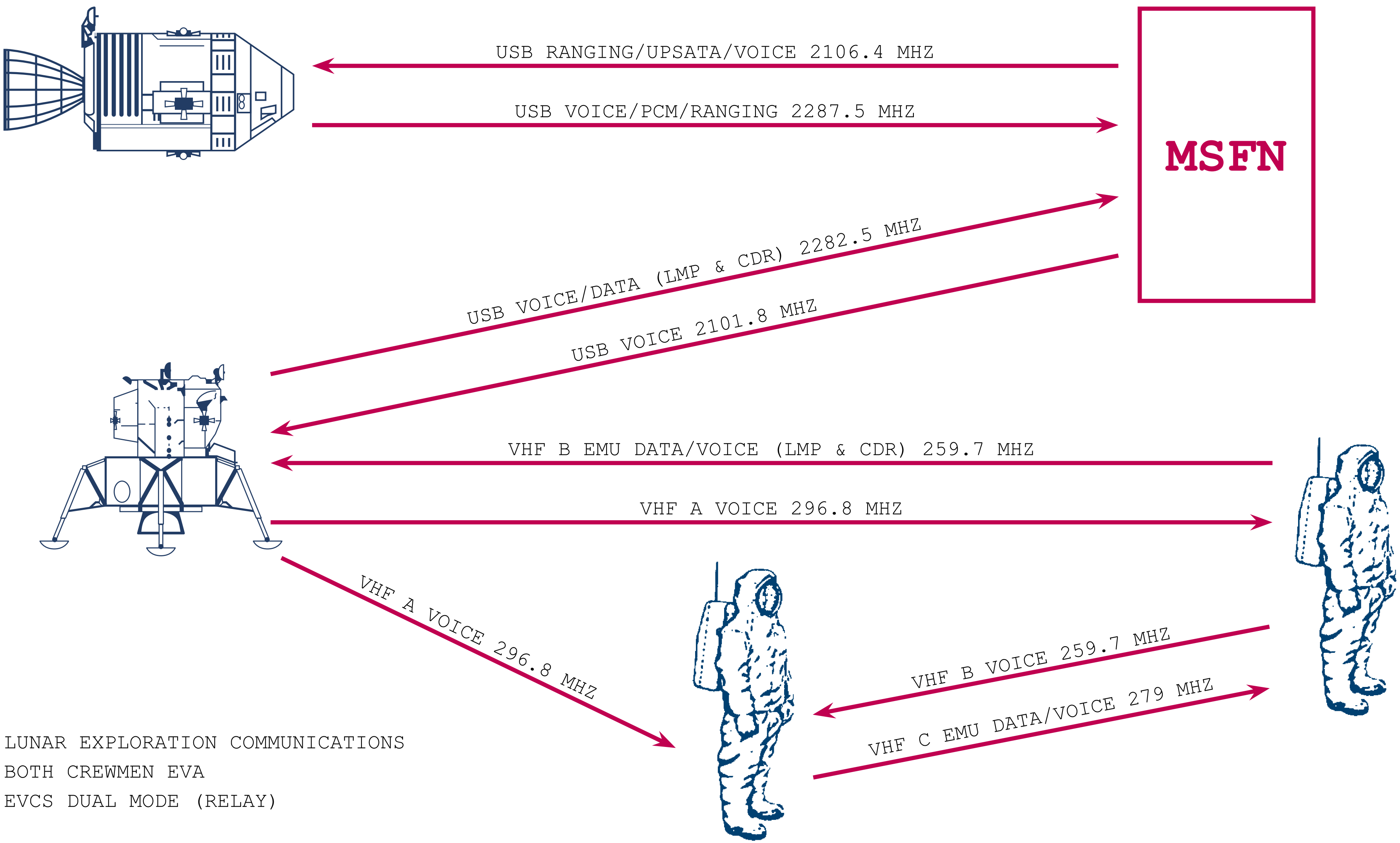
2. Environmental Control System and Cabin Pressurization
   a. The LM cabin will contain ambient air at lift off and will bleed down to zero pressure psi during the launch.
   b. The LM will be pressurized for transposition and docking after which it will be isolated and the pressure periodically monitored.
   c. The LM will be pressurized prior to the first entry (LM familiarization) after which it will be isolated again for the remainder of the TLC period.
   d. Prior to the second entry (LM housekeeping) it will be pressurized again and will remain pressurized.

3. Guidance and Navigation
   a. Two LGC erasable memory dumps and MCC-H verifications will be accomplished prior to DOI. If a significant number of errors are found, memory correction and re-verification will be performed before DOI.
   b. The LM IMU will be manually aligned to the CSM IMU during the DOI Day LM activation and checkout. P52/AOT alignments will be performed as close to DOI as possible.
   c. All translations during the undocked manned LM operations will be under PGNCS control.
   d. The capability for MCC-H to update the LGC via uplink will normally be blocked by the LMP UP-DATA LINK switch (panel 12).

4. RCS Operation and Interface Constraints
   a. During CSM/LM docked checkout operations, the LM steerable and/or RR antennas will not be powered down once they have been activated. The SM B3 and C4 thrusters will be deactivated before the LM steerable and/or RR antennas have been unstowed in order to prevent SM-RCS impingement on these antennas.

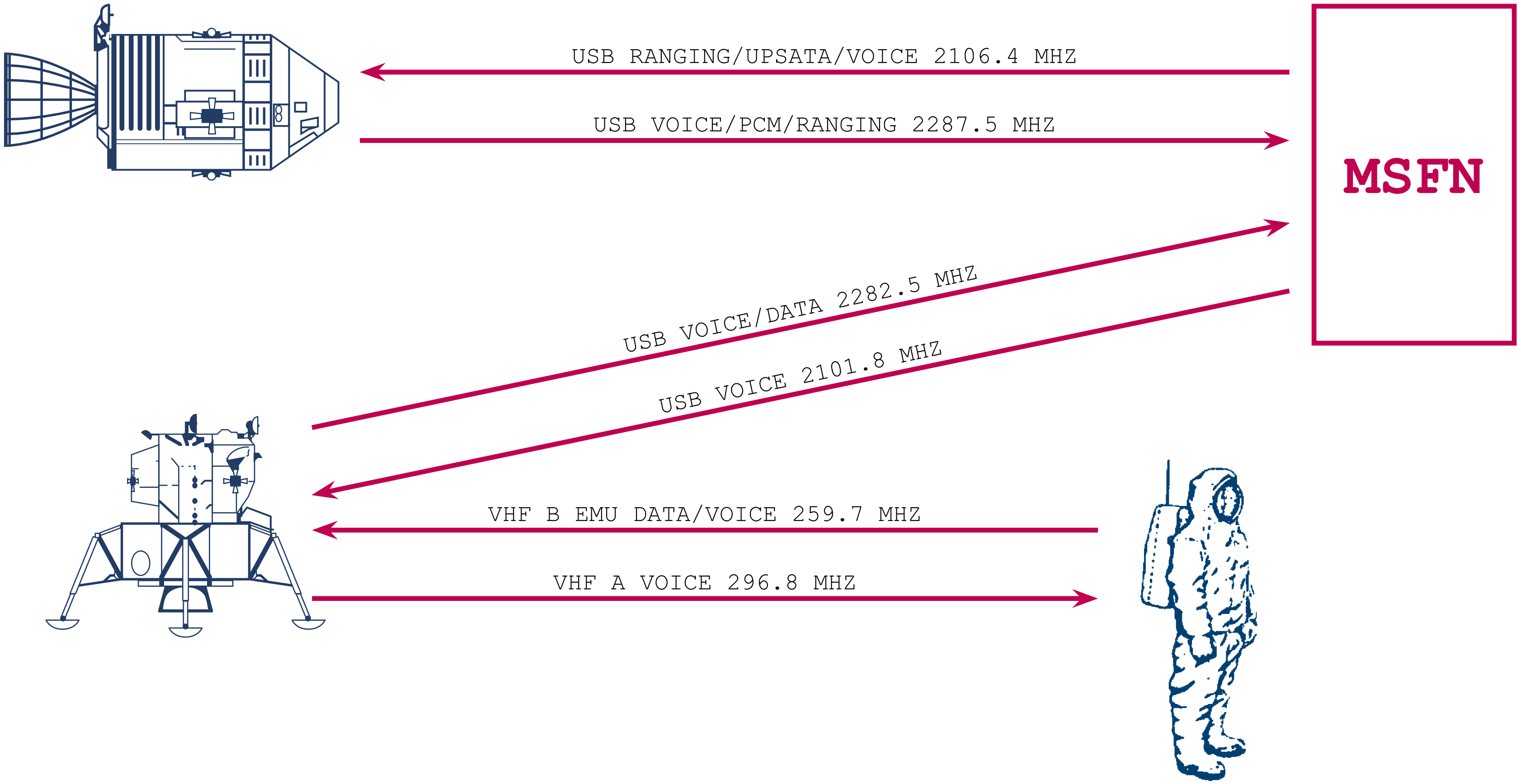
b. The CSM roll jets and LM yaw jets will be disabled when the probe is preloaded (docking latches are cocked) and the tunnel is pressurized prior to undocking. The jets will be activated after tunnel venting.
c. LM RCS two jet ullage (System B) will be used for unstaged ullage maneuvers in order to prevent asymetrical RCS thrust caused by impingement on the descent stage.
d. The RCS interconnect will be used during the APS lift-off and ascent, but will not be used during the rendezvous maneuvers.

5. Rendezvous
   a. The rendezvous radar will be pointed away from the sun and will be turned off when no functional use is required to prevent overheating of the antenna.
   b. The LM tracking light will be on continuously between separation and touchdown and between launch and docking except during PGNCS/AOT alignments. During PGNCS/AOT alignments (LM P52), the tracking light would interfere with the alignments. (dark adaption)



LUNAR EXPLORATION COMMUNICATIONS
BOTH CREWMEN EVA
EVCS DUAL MODE (RELAY)

FIGURE 1-4



LUNAR EXPLORATION COMMUNICATIONS
ONE CREWMEN EVA
PRIMARY MODE

FIGURE 1-5

SECTION II

UPDATE FORMS

UPDATE FORMS

This section contains the update pads which are in the Flight Data File onboard the spacecraft.

The CSM forms are as follows:

1. TLI Maneuver
2. P37 Block Data
3. P27 Update
4. P30 Maneuver (External ΔV)
5. P76
6. CSM Rendezvous Rescue
7. Lunar Entry
8. Earth Orbit Entry
9. Earth Orbit Block Data

The LM forms are:

1. P27 Update
2. AGS State Vector Update
3. Phasing P30 LM Maneuver
4. P30 LM Maneuver
5. DOI Data
6. PDI Data
7. Lunar Surface
8. LM Ascent
9. CSI Data
10. CDH Data
11. TPI Data

TLI

APRIL 1, 1969

TLI

X						X						TB6p	
X	X	X				X	X	X				R	TLI
X	X	X				X	X	X				P	
X	X	X				X	X	X				Y	
X	X	X				X	X	X				BT	
												ΔVC′	
												VI	
X	X	X				X	X	X				R	SEP
X	X	X				X	X	X				P	
X	X	X				X	X	X				Y	
X						X	X	X				R	EXTRACTION
X						X	X	X				P	
X						X	X	X				Y	

TLI PAD

TB 6p	X:XX:XX (HR:MIN:SEC)	PREDICTED TIME OF BEGINNING OF S-IVB RESTART PREPARATION FOR TLI (TB6 = TLI IGN -578.6 SEC)
R P Y	XXX (DEG) XXX (DEG) XXX (DEG)	PREDICTED SPACECRAFT IMU GIMBAL ANGLES AT TLI IGNITION
BT	X:XX (MIN:SEC)	DURATION OF TLI BURN
ΔVC	XXXX.X (FPS)	NOMINAL TLI ΔV SET INTO EMS ΔV COUNTER
VI	+XXXXX (FPS)	NOMINAL INERTIAL VELOCITY DISPLAYED ON DSKY AT TLI CUTOFF
R SEP P SEP Y SEP	XXX (DEG) XXX (DEG) XXX (DEG)	PREDICTED SPACECRAFT IMU GIMBAL ANGLES AT COMPLETION OF S-IVB MNVR TO CSM/S-IVB SEP ATTITUDE
R EXT P EXT Y EXT	XXX (DEG) XXX (DEG) XXX (DEG)	PREDICTED SPACECRAFT IMU GIMBAL ANGLES AT TIME OF CSM EXTRACTION OF LM FROM S-IVB

P37 BLOCK DATA

										GETI
X					X					ΔVT
X					X					LONG
										GET_{400K}
										GETI
X					X					ΔVT
X					X					LONG
										GET_{400K}
										GETI
X					X					ΔVT
X					X					LONG
										GET_{400K}
										GETI
X					X					ΔVT
X					X					LONG
										GET_{400K}
										GETI
X					X					ΔVT
X					X					LONG
										GET_{400K}
										GETI
X					X					ΔVT
X					X					LONG
										GET_{400K}
										GETI
X					X					ΔVT
X					X					LONG
										GET_{400K}

P37

APRIL 1, 1969

P37

P37 BLOCK DATA

GETI	XXX:XX (HR:MIN)	DESIRED TIME OF IGNITION
ΔVT	XXXX (FPS)	TOTAL VELOCITY OF MNVR
LONG	±XXX (DEG)	LONGITUDE OF THE LANDING POINT FOR ENTRY GUIDANCE
GET 400K	XXX:XX (HR:MIN)	TIME OF ENTRY INTERFACE

P27

APRIL 1, 1969

P27 UPDATE

PURP			V					V					V		
GET		:		:			:		:			:		:	
304 01	INDEX					INDEX					INDEX				
02															
03															
04															
05															
06															
07															
10															
11															
12															
13															
14															
15															
16															
17															
20															
21															
22															
23															
24															
N34 HRS				X	X	X				X	X	X			
MIN				X	X	X	X			X	X	X	X		
NAV CHECK SEC				X	X					X	X				
N43 LAT					0						0				
LONG															
ALT				+	0					+	0				

P27

P27 UPDATE - CSM

PURP	XXX	TYPE OF DATA TO BE RECEIVED (SUCH AS: CMC TIME)
V	XX (VERB)	TYPE OF COMMAND LOAD (70-71-72-73)
GET	XXX:XX:XX (HR:MIN:SEC)	TIME DATA RECORDED
304 01	XX (OCTAL)	INDEX NO. OF COMMAND WORDS IN LOAD
02-24	XX (OCTAL)	CORRECTION IDENTIFIERS
N34 NAV CHECK	XXX:XX:XX.XX (HR:MIN:SEC)	TIME FOR CONFIRMATION OF GROUNDTRACK
N43		
LAT	XX.XX (DEG)	LATITUDE FOR GROUND TRACK CONFIRMATION
LONG	XXX.XX (DEG)	LONGITUDE FOR GROUND TRACK CONFIRMATION
ALT	XXX.X (DEG)	ALTITUDE FOR GROUND TRACK CONFIRMATION

P30 MANEUVER

P30

SET STARS

^{R}ALIGN ____ ____ ____
^{P}ALIGN ____ ____ ____
^{Y}ALIGN ____ ____ ____

ULLAGE ____________

HORIZON/WINDOW ______

OTHER ____________

							PURPOSE
				/			PROP/GUID
	+						WT N47
	☐	0	0	.			P_{TRIM} N48
	☐	0	0	.			Y_{TRIM}
	+	0	0				HRS GETI
	+	0	0	0			MIN N33
	+	0		.			SEC
	☐				.		ΔV_X N81
	☐				.		ΔV_Y
	☐				.		ΔV_Z
	X	X	X				R
	X	X	X				P
	X	X	X				Y
	+				.		H_A N42
	☐				.		H_P
	+				.		ΔVT
	X	X	X	:			BT
	X				.		ΔVC
	X	X	X	X			SXTS
	+			.		0	SFT
	+		.		0	0	TRN
	X	X	X				BSS
	X	X	☐		.		SPA
	X	X	X	☐	.		SXP
	☐	0		.			LAT N61
	☐			.			LONG
	+				.		RTGO EMS
	+						VI0
			:		:		GET 0.05G

P30

APRIL 5, 1969

<u>P30 MANEUVER</u>

PURPOSE	XXXXX	TYPE OF MNVR TO BE PERFORMED
PROP/GUID	XXX/XXX	PROPULSION SYSTEM (SPS/RCS) GUIDANCE (SCS/G&N)
WT	+XXXXX (lbs)	PREMANEUVER VEHICLE WEIGHT
P TRIM	±X.XX (DEG)	SPS PITCH GIMBAL OFFSET TO PLACE THRUST THROUGH THE CG
Y TRIM	±X.XX (DEG)	SPS YAW GIMBAL OFFSET TO PLACE THRUST THROUGH THE CG
GETI	XX:XX:XX.XX (HRS:MIN:SEC)	TIME OF MNVR IGNITION
ΔVX ΔVY ΔVZ	±XXXX.X (FPS) ±XXXX.X (FPS) ±XXXX.X (FPS)	P30 VELOCITY TO BE GAINED COMPONENTS IN LOCAL VERTICAL COORDINATES
R P Y	XXX (DEG) XXX (DEG) XXX (DEG)	IMU GIMBAL ANGLES OF MANEUVER ATTITUDE
HA	XXXX.X (NM)	PREDICTED APOGEE ALTITUDE AFTER MANEUVER
HP	±XXXX.X (NM)	PREDICTED PERIGEE ALTITUDE AFTER MANEUVER
ΔVT	+XXXX.X (FPS)	TOTAL VELOCITY OF MANEUVER
BT	X:XX (MIN:SEC)	MANEUVER DURATION
ΔVC	XXXX.X (FPS)	PREMANEUVER ΔV SETTING IN EMS ΔV COUNTER
SXTS	XX (OCTAL)	SEXTANT STAR FOR MANEUVER ATTITUDE CK
SFT	+XXX.X (DEG)	SEXTANT SHAFT SETTING FOR MANEUVER ATTITUDE CK
TRN	+XX.X (DEG)	SEXTANT TRUNNION SETTING FOR MANEUVER ATTITUDE CK
BSS	XX (OCTAL)	BORESIGHT STAR FOR MANEUVER ATTITUDE CK USING THE COAS
SPA	±XX.X (DEG)	BSS PITCH ANGLE ON COAS FOR MANEUVER ATTITUDE CK

SXP	±X.X (DEG)	BSS X POSITION ON COAS FOR MANEUVER ATTITUDE CK
LAT LONG	±XX.XX (DEG) ±XXX.XX (DEG)	LATITUDE AND LONGITUDE OF THE LANDING POINT FOR ENTRY GUIDANCE
RTGO	+XXXX.X (NM)	RANGE TO GO FOR EMS INITIALIZATION
VI0	+XXXXX (FPS)	INERTIAL VELOCITY AT .05G FOR EMS INITIALIZATION
GET (.05G)	XXX:XX:XX.XX (HRS:MIN:SEC)	TIME OF .05G
SET STARS	XX (OCTAL) XX (OCTAL)	STARS FOR BACKUP GDC ALIGN
R, P, Y (ALIGN)	XXX (DEG) XXX (DEG) XXX (DEG)	ATTITUDE TO BE SET IN ATTITUDE SET TW FOR BACKUP GDC ALIGN
ULLAGE	X (JETS) XX.X (SEC)	NO. OF SM RCS JETS USED AND LENGTH OF TIME OF ULLAGE
HORIZON/WINDOW	XX.X (DEG)	WINDOW MARKING AT WHICH HORIZON IS PLACED AT A SPECIFIED TIG (ATT CK)
OTHER		ADDITIONAL REMARKS VOICED UP BY MCC-H

THIS PAGE INTENTONALLY LEFT BLANK.

P76

APRIL 5, 1969

P76 UPDATE PAD

												PURPOSE	
+	0	0				+	0	0				HR	N33
+	0	0	0			+	0	0	0			MIN	TIG
+	0					+	0					SEC	
												ΔVX	N84
												ΔVY	
												ΔVZ	
												PURPOSE	
+	0	0				+	0	0				HR	N33
+	0	0	0			+	0	0	0			MIN	TIG
+	0					+	0					SEC	
												ΔVX	N84
												ΔVY	
												ΔVZ	
												PURPOSE	
+	0	0				+	0	0				HR	N33
+	0	0	0			+	0	0	0			MIN	TIG
+	0					+	0					SEC	
												ΔVX	N84
												ΔVY	
												ΔVZ	
												PURPOSE	
+	0	0				+	0	0				HR	N33
+	0	0	0			+	0	0	0			MIN	TIG
+	0					+	0					SEC	
												ΔVX	N84
												ΔVY	
												ΔVZ	

P76

P76 UPDATE PAD

PURPOSE	XXXXX	PURPOSE OF MANEUVER
N33 TIG	XX:XX:XX.XX (HR:MIN:SEC)	TIME OF IGNITION
N84		
ΔVX	XXXX.X (FPS)	COMPONENTS OF ΔV APPLIED ALONG
ΔVY	XXXX.X (FPS)	LOCAL VERTICAL AXIS AT TIG (LM)
ΔVZ	XXXX.X (FPS)	

CSM RENDEVOUS RESCUE PADS

CSM SEP PAD

31	00 :	000 :	0 .
81	+ 0000.0	+ 0000.0	- 0002.5
22	XXX	XXX	XXX

DOI PAD

84	•	•	•
33	:	:	

PDI_1 +12 ABORT PAD

84	•	•	•
33	:	:	

„CSM RESCUE“ PAD

PHAS	33	00 :	000 :	0 .
TPI (PDI < 10)	37	00 :	000 :	0 .
TPI (PDI > 10)	37	00 :	000 :	0 .

„CSM RESCUE UPDATE“ PAD

PHAS	33	00 :	000 :	0 .
TPI (PDI < 14.5)	37	00 :	000 :	0 .
TPI (T_2)	37	00 :	000 :	0 .

RESCUE TWO PAD

47	+ .	+ 0000.0	X
48	.	.	X
33	00 :	000 :	0 .
81	.	.	.
22	XXX	XXX	XXX
ΔV_C	X .	X	X
11	00 :	000 :	0 .
37	00 :	000 :	0 .
N			

CSI ONE

11	:	000 :	0 .
81	.	.	.
N			

P22 PAD

T1	:	:	•	(HOR)
T2	:	:	•	(LMK)
	•	NM (N OR S)		
89	•	•	•	
	LAT	LONG/2	ALT	

NOMINAL LM IGNITION TIMES

CSI	11	00 :	000 :	0 .
PC	33	00 :	000 :	0 .
TPI	37	00 :	000 :	0 .

CSI TWO

11	00 :	000 :	0 .
81	.	.	.
N			

CSI THREE

11	00 :	000 :	0 .
81	.	.	.
N			

CSI FOUR

11	00 :	000 :	0 .
81	.	.	.
N			

CDH

13	00 :	000 :	0 .
81	.	.	.

TPI

13	00 :	000 :	0 .
81	.	.	.
59	.	.	.
LOS BT	XX :	XX :	XX :

CSM SEP PAD

33	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF CSM/LM SEPARATION BURN
81	DELTA VX DELTA VY DELTA VZ	+XXXX.X (FPS) +XXXX.X (FPS) +XXXX.X (FPS)	LOCAL VERTICAL VELOCITY COMPONENTS OF SEP BURN
22	R P Y	XXX (DEG) XXX (DEG) XXX (DEG)	SEPARATION BURN INERTIAL GIMBAL ANGLES

DOI PAD

84	DELTA VX DELTA VY DELTA VZ	XXXX.X (FPS) XXXX.X (FPS) XXXX.X (FPS)	LM LOCAL VERTICAL VELOCITY COMPONENTS FOR DOI BURN
33	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF DOI BURN

PDI +12 ABORT PAD

84	DELTA VX DELTA VY DELTA VZ	XXXX.X (FPS) XXXX.X (FPS) XXXX.X (FPS)	LM LOCAL VERTICAL VELOCITY COMPONENTS FOR FIRST OPPORTUNITY PDI PLUS 12 MIN ABORT
33	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF PDI +12 MIN ABORT BURN

„CSM RESCUE‟ PAD

PHAS	33	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF CSM ABORT PHASING BURN
TPI (PDI 10)	37	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF TPI FOR LM ABORTS BETWEEN PDI AND PDI +10 MIN
TPI (PDI 10)	37	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF TPI FOR LM ABORTS AFTER PDI +10 MIN

„CSM RESCUE UPDATE‟ PAD

PHAS	33	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF CSM ABORT PHASING BURN FOR 2ND OPPORTUNITY (1 REV DELAY)
TPI (PDI 14.5)	37	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF TPI FOR LM ABORTS BETWEEN PDI AND PDI +14.5 MIN FOR 2ND OPPORTUNITY
TPI (T2)	37	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF PREFERRED LM LIFTOFF TIME

RESCUE TWO PAD

47	WT	XXXX.X (lbs)	PREMANEUVER CSM WEIGHT
48	P TRIM Y TRIM	X.XX (DEG) X.XX (DEG)	SPS PITCH & YAW GIMBAL OFFSET TO PLACE THRUST THROUGH THE CG
33	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF RESCUE BURN
81	DELTA VX DELTA VY DELTA VZ	XXXX.X (FPS) XXXX.X (FPS) XXXX.X (FPS)	LOCAL VERTICAL VELOCITY COMPONENTS OF RESCUE BURN
22	R P Y	XXX (DEG) XXX (DEG) XXX (DEG)	RESCUE BURN GIMBAL ANGLES
ΔVc	ΔVc	XX.X (FPS)	VELOCITY TO BE SET IN EMS COUNTER FOR RESCUE BURN
11	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF CSI BURN BASED ON RESCUE BURN
37	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF TPI BURN BASED ON RESCUE BURN
N		X	THE FUTURE APSIDAL CROSSING (APOLUNE OR PERILUNE) OF THE ACTIVE VEHICLE AT WHICH CDH SHOULD OCCUR

CSI ONE

11	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF CSI ONE BURN
81	DELTA VX DELTA VY DELTA VZ	XXXX.X (FPS) XXXX.X (FPS) XXXX.X (FPS)	LOCAL VERTICAL VELOCITY COMPONENTS OF CSI ONE BURN
N		X	THE FUTURE APSIDAL CROSSING (APOLUNE OR PERILUNE) OF THE ACTIVE VEHICLE AT WHICH CDH SHOULD OCCUR

CSI TWO, THREE, FOUR

SAME AS ABOVE EXCEPT CSI TWO, THREE, FOUR

CDH

13	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF CDH BURN
81	DELTA VX DELTA VY DELTA VZ	XXXX.X (FPS) XXXX.X (FPS) XXXX.X (FPS)	LOCAL VERTICAL VELOCITY COMPONENTS OF CDH BURN

TPI

37	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF LM TPI BURN
81	DELTA VX DELTA VY DELTA VZ	XXXX (FPS) XXXX (FPS) XXXX (FPS)	LOCAL VERTICAL VELOCITY COMPONENTS OF TPI BURN
59	ΔV (LOS)	XXXX (FPS)	VELOCITY COMPONENTS ALONG THE LINE OF SIGHT TO TARGET
LOS BT		X:XX MIN:SEC	BURN DURATION ALONG THE LINE OF SIGHT

P22 PAD

T1		XXX:XX:XX.XX (HRS:MIN:SEC)	GET AT WHICH LANDMARK APPEARS ON HORIZON
T2		XXX:XX:XX.XX (HRS:MIN:SEC)	GET AT WHICH LANDMARK LOS IS 35° ABOVE LOCAL HORIZONTAL
NM (N OR S)		XX.X (NM)	DISTANCE OF LANDMARK NORTH OR SOUTH OF ORBITAL TRACK
89	LAT	±XX.X (DEG)	LATITUDE OF LANDMARK
	LONG	±XX (DEG)	LONGITUDE OF LANDMARK
	ALT		ALTITUDE OF LANDMARK ABOVE OR BELOW MEAN LUNAR RADIUS

NOMINAL LM IGNITION TIMES

CSI 11	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	NOMINAL GET OF LM CSI BURN
PC 33	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	NOMINAL GET OF LM PLANE CHANGE BURN
TPI 37	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	NOMINAL GET OF LM TPI BURN

THIS PAGE INTENTONALLY LEFT BLANK.

LUNAR ENTRY

												AREA
X	X	X				X	X	X				R 0.05G
X	X	X				X	X	X				P 0.05G
X	X	X				X	X	X				Y 0.05G
												GET HOR CK
X	X	X				X	X	X				P
	0						0					LAT N61
												LONG
X	X	X				X	X	X				MAX G
+						+						V_{400K} N60
-	0	0				-	0	0				γ 400K
+						+						RTGO EMS
+						+						VI0
												RRT
X	X					X	X					RET 0.05G
+	0	0				+	0	0				D_L MAX N69
+	0	0				+	0	0				D_L MIN
+						+						V_L MAX
+						+						V_L MIN
X	X	X				X	X	X				D_O
X	X					X	X					RET V_{CIRC}
X	X					X	X					RETBBO
X	X					X	X					RETEBO
X	X					X	X					RETDRO
X	X	X	X			X	X	X	X			SXTS
+					0	+					0	SFT
+				0	0	+				0	0	TRN
X	X	X				X	X	X				BSS
X	X					X	X					SPA
X	X	X				X	X	X				SXP
X	X	X	X			X	X	X	X			LIFT VECTOR

LUNAR ENTRY

APRIL 5, 1969

LUNAR ENTRY

LUNAR ENTRY PAD

AREA	XXXXX	SPLASHDOWN AREA DEFINED BY TARGET LINE
R .05G P .05G Y .05G	XXX (DEG) XXX (DEG) XXX (DEG)	SPACECRAFT IMU GIMBAL ANGLES REQUIRED FOR AERODYNAMIC TRIM AT .05G
GET (HOR CK)	XXX:XX:XX (HRS:MIN:SEC)	TIME OF ENTRY ATTITUDE HORIZ CHECK AT EI -17 MIN.
P (HOR CK)	XXX (DEG)	PITCH ATTITUDE FOR HORIZON CHECK AT EI -17 MIN.
LAT	±XX.XX (DEG)	LATITUDE OF TARGET POINT
LONG	±XXX.XX (DEG)	LONGITUDE OF TARGET POINT
MAX G	XX.X (G's)	PREDICTED MAXIMUM REENTRY ACCELERATION
V400K	+XXXXX (FPS)	INERTIAL VELOCITY AT ENTRY INTERFACE
γ400K	-X.XX (DEG)	INERTIAL FLIGHT PATH ANGLE AT ENTRY INTERFACE
RTGO	+XXXX.X (NM)	RANGE TO GO FROM .05G TO TARGET FOR EMS INITIALIZATION
VI0	+XXXXX (fps)	INERTIAL VELOCITY AT .05G FOR EMS INITIALIZATION
RRT	XXX:XX:XX (HRS:MIN:SEC)	REENTRY REFERENCE TIME BASED ON GET OF PREDICTED 400K (GET START)
RET .05G	XX:XX (MIN:SEC)	TIME OF .05G FROM 400K (RRT)
DL MAX	+X.XX (G's)	MAXIMUM ACCEPTABLE VALUE OF PREDICTED DRAG LEVEL (FROM CMC)
DL MIN	+X.XX (G's)	MINIMUM ACCEPTABLE VALUE OF PREDICTED DRAG LEVEL (FROM CMC)
VL MAX	+XXXXX (FPS)	MAXIMUM ACCEPTABLE VALUE OF EXIT VELOCITY (FROM CMC)
VL MIN	+XXXXX (FPS)	MINIMUM ACCEPTABLE VALUE OF EXIT VELOCITY (FROM CMC)
DO	X.XX (G's)	PLANNED DRAG LEVEL DURING CONSTANT G
RET VCIRC	XX:XX (MIN:SEC)	TIME FROM EI THAT S/C VELOCITY BECOMES CIRCULAR
RETBBO	XX:XX (MIN:SEC)	TIME FROM EI TO THE BEGINNING OF BLACKOUT
RETEBO	XX:XX (MIN:SEC)	TIME FROM EI TO THE END OF BLACKOUT

RETDRO	XX:XX (MIN:SEC)	TIME FROM EI TO DROGUE DEPLOY
SXTS	XX (OCTAL)	SEXTANT STAR FOR ENTRY ATTITUDE CHECK
SFT	+XXX. X (DEG)	SEXTANT SHAFT SETTING FOR ENTRY ATTITUDE CHECK
TRN	+XX. X (DEG)	SEXTANT TRUNNION SETTING FOR ENTRY ATTITUDE CHECK
BSS	XXX (OCTAL)	BORESIGHT STAR FOR ENTRY ATTITUDE CHECK USING THE COAS
SPA	±XX.X (DEG)	BSS PITCH ANGLE ON COAS FOR ENTRY ATTITUDE CHECK
SXP	±X.X (DEG)	BSS X POSITION ON COAS FOR ENTRY ATTITUDE CHECK
LIFT VECTOR	XX (UP/DN)	LIFT VECTOR DESIRED AT .05G's BASED ON ENTRY CORRIDOR

THIS PAGE INTENTONALLY LEFT BLANK.

APRIL 16, 1969

												EARTH ORBIT ENTRY UPDATE
X			-			X			-			AREA
X	X	-				X	X	-				ΔV TO
X	X	X				X	X	X				R 0.05G EMS
X	X	X				X	X	X				P 0.05G
X	X	X				X	X	X				Y 0.05G
+						+						RTGO EMS
+						+						VI0
X	X					X	X					RET 0.05G
	0						0					LAT N61
												LONG
X	X					X	X					RET 0.2G
												DRE (55°) N66
R	R		/			R	R		/			BANK AN
X	X					X	X					RET RB
X	X					X	X					RETBBO
X	X					X	X					RETEBO
X	X					X	X					RETDROG
X	X	X				X	X	X				(90°/fps) CHART
X	X					X	X					DRE (90°) UPDATE
												POST BURN
X	X	X				X	X	X				P 0.05G
+						+						RTGO EMS
+						+						VI0
X	X					X	X					RET 0.05G
X	X					X	X					RET 0.2G
												DRE ±100 nm N66
R	R		/			R	R		/			BANK AN
X	X					X	X					RETRB
X	X					X	X					RETBBO
X	X					X	X					RETEBO
X	X					X	X					RETDROG TO MAIN

E. O. ENTRY

E. O. ENTRY

EARTH ORBIT ENTRY UPDATE

AREA	XXX-X	RECOVERY AREA - FIRST 3 DIGITS DENOTES REV IN WHICH LANDING OCCURS. LAST DIGIT DENOTES RECOVERY AREA AND SUPPORT CAPABILITIES.
ΔV TO	XX.X (FPS)	ΔV DUE TO ENGINE TAILOFF
EMS		
R 0.05G P 0.05G Y 0.05G	XXX (DEG) XXX (DEG) XXX (DEG)	SPACECRAFT IMU GIMBAL ANGLES REQUIRED FOR AERODYNAMIC TRIM AT 0.05G.
EMS		
RTGO	XXXX.X (NM)	RANGE TO GO FROM .05G TO TARGET
VI0	XXXXX (FPS)	INERTIALVELOCITY AT .05G FOR EMS INITIALIZATION
RET 0.05G	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO .05G
N61		
LAT	±XX.XX (DEG)	LATITUDE OF IMPACT LANDING POINT
LONG	±XXX.XX (DEG)	LONGITUDE OF IMPACT LANDING POINT
N66		
RET .2G	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO .2G
DRE (55°)	±XXXX.X (NM)	DOWNRANGE ERROR AT .2G
BANK AN	XX/XX (DEG/DEG)	BACKUP BANK ANGLE FOR SCS ENTRY: ROLL RIGHT/ROLL LEFT
RETRB	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO REVERSE BACKUP BANK ANGLE
RETBBO	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO BEGINNING OF COMMUNICATIONS BLACKOUT
RETEBO	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO END OF COMMUNICATIONS BLACKOUT
RETDROG	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO DROGUE CHUTE DEPLOYMENT
CHART UPDATE		
90°/FPS DRE (90°)	±XX ±XXX	VALUES USED TO RE-PLOT BACKUP ENTRY CHART - ΔV AND DOWNRANGE ERROR (DRE) @ 90° BANK ANGLE

POST BURN

P 0.05G	XXX (DEG)	PITCH ANGLE @ ENTRY INTERFACE
EMS		
RTGO	+XXXX.X (NM)	RANGE TO GO FROM 0.05G TO TARGET FOR EMS COUNTER
VI0	+XXXXX (FPS)	INERTIAL VELOCITY @ 0.05G
RET 0.05G	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO 0.05G
RET 0.2G	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO 0.2G
DRE	±XXXX.X (NM)	DOWN RANGE ERROR
BANK AN	XX/XX (DEG/DEG)	BACKUP BANK ANGLE FOR SCS ENTRY: ROLL RIGHT/ROLL LEFT
RETRB	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO REVERSE BACKUP BANK ANGLE
RETBBO	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO BEGINNING OF COMMUNICATIONS BLACKOUT
RETEBO	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO END OF COMMUNICATIONS BLACKOUT
RETDROG	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO DROGUE CHUTE DEPLOYMENT

APRIL 1, 1969

E. O. BLOCK

EARTH ORBIT BLOCK DATA

X	X				-		X	X				-		AREA
X	X	X					X	X	X					LAT
X	X						X	X						LONG
														GETI
X	X	X					X	X	X					ΔV_C
X	X				-		X	X				-		AREA
X	X	X					X	X	X					LAT
X	X						X	X						LONG
														GETI
X	X	X					X	X	X					ΔV_C
X	X				-		X	X				-		AREA
X	X	X					X	X	X					LAT
X	X						X	X						LONG
														GETI
X	X	X					X	X	X					ΔV_C
X	X				-		X	X				-		AREA
X	X	X					X	X	X					LAT
X	X						X	X						LONG
														GETI
X	X	X					X	X	X					ΔV_C
X	X				-		X	X				-		AREA
X	X	X					X	X	X					LAT
X	X						X	X						LONG
														GETI
X	X	X					X	X	X					ΔV_C

REMARKS:

E. O. BLOCK

EARTH ORBIT BLOCK DATA

AREA	XXX-X	RECOVERY AREA FIRST 3 DIGITS - LANDING REVOLUTION LAST DIGIT - RECOVERY AREA AND SUPPORT CAPABILITIES
LAT LONG	±XX.XX (DEG) ±XXX.XX (DEG)	COORDINATES OF THE DESIRED LANDING AREA
GETI	XXX:XX:XX.XX (HR:MIN:SEC)	DEORBIT IGNITION TIME FOR THE DESIRED LANDING AREA
ΔVC	XXX. X (FPS)	DEORBIT MANEUVER ΔV TO BE LOADED INTO THE EMS COUNTER.

P27

LM P27 UPDATE

PURP			V					V					V		
GET		:		:			:		:			:		:	
1174 01	INDEX					INDEX					INDEX				
02															
03															
04															
05															
06															
07															
10															
11															
12															
13															
14															
15															
16															
17															
20															
21															
22															
23															
24															
N34 HRS				X	X	X					X	X	X		
MIN				X	X	X	X				X	X	X	X	
NAV CHECK SEC				X	X			.			X	X		.	
N43 LAT				☐	0			.			☐	0		.	
LONG				☐				.			☐			.	
ALT				+	0				.		+	0			.

APRIL 16, 1969

P27

P27 UPDATE-LM

PURP	XXX	TYPE OF DATA TO BE RECEIVED (SUCH AS: LDG TIME)
V	XX (VERB)	TYPE OF COMMAND LOAD (70-71-72-73)
GET	XXX:XX:XX (HR:MIN:SEC)	TIME DATA RECORDED
1174 01	XX (OCTAL)	INDEX NO. OF COMMAND WORDS IN LOAD
02-24	XX (OCTAL)	CORRECTION WORD IDENTIFIERS
N34 NAV CHECK TIME	XXX:XX:XX.XX (HR:MIN:SEC)	TIME FOR CONFIRMATION OF GROUNDTRACK
N43		
LAT	XX.XX (DEG)	LATITUDE FOR GROUND TRACK CONFIRMATION
LONG	XXX.XX (DEG)	LONGITUDE FOR GROUND TRACK CONFIRMATION
ALT	XXX.X (NM)	ALTITUDE FOR GROUND TRACK CONFIRMATION

AGS STATE VECTOR UPDATE

												PURP	
												240	
												241	
												242	
												260	
												261	
												262	
+						+						254	
												244	
												245	
												246	
												264	
												265	
												266	
+						+						272	

REMARKS:

APRIL 5, 1969

AGS SV

AGS SV

AGS STATE VECTOR UPDATE

PURP		PURPOSE FOR AGS STATE VECTOR UPDATE
240	±XXXXX (100 FT)	LM STATE VECTOR-POSITION COMPONENTS
241	±XXXXX (100 FT)	
242	±XXXXX (100 FT)	
260	±XXXX.X (FPS)	LM STATE VECTOR-VELOCITY COMPONENTS
261	±XXXX.X (FPS)	
262	±XXXX.X (FPS)	
254	+XXXX.X (MIN)	LM TIME FOR WHICH THE STATE VECTOR IS ACCURATE
244	±XXXXX (100 FT)	CSM STATE VECTOR-POSITION COMPONENTS
245	±XXXXX (100 FT)	
246	±XXXXX (100 FT)	
264	±XXXX.X (FPS)	CSM STATE VECTOR-VELOCITY COMPONENTS
265	±XXXX.X (FPS)	
266	±XXXX.X (FPS)	
272	+XXXX.X (MIN)	CSM TIME FOR WHICH THE STATE VECTOR IS ACCURATE

		PHASING						P30 LM MANEUVER					
HR	N33	+	0	0				+	0	0			
MIN	TIG	+	0	0	0			+	0	0	0		
SEC		+	0					+	0				
ΔVX	N81												
ΔVY	LOCAL												
ΔVZ	VERT												
H_A	N42	+						+					
H_P													
ΔVR		+						+					
BT		X	X	X				X	X	X			
R	FDAI	X	X	X				X	X	X			
P	INER	X	X	X				X	X	X			
ΔVX	AGS N86												
ΔVY	AGS												
ΔVZ	AGS												
BSS		X	X	X				X	X	X			
SPA		X	X					X	X				
SXP		X	X	X				X	X	X			

PHASING

N33 PHASING TIG	XXX:XX:XX.XX (HR:MIN:SEC)	IGNITION TIME OF LM MANEUVER
N81 LOCAL VERTICAL ΔV		
ΔVX	±XXXX.X (FPS)	LOCAL VERTICAL ΔV COMPONENTS
ΔVY	±XXXX.X (FPS)	OF THE MANEUVER
ΔVZ	±XXXX.X (FPS)	
N42 ORBITAL PARAMETERS		
HA	+XXXX.X (NM)	PREDICTED APOGEE RESULTING FROM MANEUVER
HP	±XXXX.X (NM)	PREDICTED PERIGEE RESULTING FROM MANEUVER
ΔVR	+XXXX.X (FPS)	TOTAL ΔV REQUIRED FOR THE MANEUVER
BT	X:XX (MIN:SEC)	DURATION OF THE MANEUVER
FDAI		
R	XXX (DEG)	INERTIAL FDAI ANGLES AT THE
P	XXX (DEG)	BURN ATTITUDE
AGS ΔV		
ΔVX AGS	±XXXX.X (FPS)	LOCAL VERTICAL ΔV COMPONENTS OF
ΔVY AGS	±XXXX.X (FPS)	THE MANEUVER TO TARGET THE AGS
ΔVZ AGS	±XXXX.X (FPS)	
BSS	XX (OCTAL)	BSS STAR FOR MANEUVER ATTITUDE CHECK
SPA	±XX.X (DEG)	BSS PITCH ANGLE ON COAS, &
SXP	±XX.X (DEG)	BSS X POSITION ON COAS FOR MANEUVER ATTITUDE CHECK

P30

P30 LM Maneuver

												PURPOSE	
+	0	0				+	0	0				HR	N33
+	0	0	0			+	0	0	0			MIN	TIG
+	0					+	0					SEC	
												ΔVX	N81
												ΔVY	LOCAL
												ΔVZ	VERT
+						+						Ha	N42
												Hp	
+						+						ΔVR	
X	X	X				X	X	X				BT	
X	X	X				X	X	X				R	FDAI
X	X	X				X	X	X				P	INER
												ΔVX AGS	N86
												ΔVY AGS	
												ΔVZ AGS	
X	X	X				X	X	X				BSS	
X	X					X	X					SPA	
X	X	X				X	X	X				SXP	

REMARKS:

P30

P30 LM MANEUVER

PURPOSE	XXXXX	PURPOSE OF MANEUVER (SUCH AS DOI TARGETING)
N33 TIG OF MANEUVER	XXX:XX:XX.XX (HR:MIN:SEC)	IGNITION TIME FOR THE MANEUVER
N81 LOCAL VERTICAL ΔV		
ΔVX	±XXXX.X (FPS)	LOCAL VERTICAL ΔV COMPONENTS
ΔVY	±XXXX.X (FPS)	OF THE MANEUVER
ΔVZ	±XXXX.X (FPS)	
N42 ORBITAL PARAMETERS		
HA	+XXXX.X (NM)	PREDICTED APOGEE AND PERIGEE RESULTING FROM MANEUVER
HP	±XXXX.X (NM)	
ΔVR	+XXXX.X (FPS)	TOTAL ΔV REQUIRED FOR THE MANEUVER
BT	X:XX (MIN:SEC)	DURATION OF THE MANEUVER
FDAI		
R	XXX (DEG)	INERTIAL FDAI ANGLES AT THE
P	XXX (DEG)	BURN ATTITUDE
N86 AGS ΔV		
ΔVX AGS	±XXXX.X (FPS)	LOCAL VERTICAL ΔV COMPONENTS OF
ΔVY AGS	±XXXX.X (FPS)	THE MANEUVER USED TO TARGET
ΔVZ AGS	±XXXX.X (FPS)	THE AGS
BSS	XX (OCTAL)	BSS STAR FOR BURN ATTITUDE CHECK
SPA	±XX.X (DEG)	BSS PITCH ANGLE ON COAS, &
SXP	±XX.X (DEG)	BSS X POSITION ON COAS FOR MANEUVER ATTITUDE CHECK

DOI DATA CARD

P30													
HR	N33	+	0	0				+	0	0			
MIN	TIG	+	0	0	0			+	0	0	0		
SEC		+	0					+	0				
ΔVX	N81												
ΔVY	LOCAL												
ΔVZ	VERT												
H_A	N42	+						+					
H_P													
ΔVR		+						+					
BT		X	X	X				X	X	X			
R	FDAI	X	X	X				X	X	X			
P	INER	X	X	X				X	X	X			
ΔVX AGS	N86												
ΔVY AGS													
ΔVZ AGS													
BSS		X	X	X				X	X	X			
SPA		X	X					X	X				
SXP		X	X	X				X	X	X			

OR

MANUAL SHUT-DOWN

A. ΔVG NEGATIVE (PGNS)

B. VT: 2 SECONDS OVER BURN
- AND -
AGS VGX 2 FPS OVER

MANUAL TAKEOVER

ATT ±5° RATE ±5°/sec

LR SELF TEST

H TM (+7994±30) ________

$\dot{H}$ TM (−480±6) ________

N66 SLANTRNG (+08275.±5.0) ________

N67 VX (−00494. ±2.0) ________

VY (+01858. ±2.0) ________

VZ (+01329. ±2.0) ________

RR / TM / VHF

	R_1	R_2	$\dot{R}$
N73			
TM			
CMC			
VHF			

P52

STAR 1 ____ 2 ____ 3 ____

N05 (STAR ∡ DIFF) ________

N93 (TORQUING ∡) X ________

Y ________

GET ____ : ____ : ____ Z ________

RESIDUALS

		PGNS		AGS	
ΔVX	N85			500	
ΔVY				501	
ΔVZ				502	

DOI DATA CARD

N33 DOI TIG	XXX:XX:XX.XX (HR:MIN:SEC)	IGNITION TIME OF LM MANEUVER
N81 LOCAL VERTICAL ΔV		
ΔVX	±XXXX.X (FPS)	LOCAL VERTICAL ΔV COMPONENTS
ΔVY	±XXXX.X (FPS)	OF THE MANEUVER
ΔVZ	±XXXX.X (FPS)	
N42 ORBITAL PARAMETERS		
HA	+XXXX.X (NM)	PREDICTED APOGEE RESULTING FROM MANEUVER
HP	±XXXX.X (NM)	PREDICTED PERIGEE RESULTING FROM MANEUVER
ΔVR	+XXXX.X (FPS)	TOTAL ΔV REQUIRED FOR THE MANEUVER
BT	X:XX (MIN:SEC)	DURATION OF THE MANEUVER
FDAI		
R	XXX (DEG)	INERTIAL FDAI ANGLES AT THE
P	XXX (DEG)	BURN ATTITUDE
N86 AGS ΔV		
ΔVX AGS	±XXXX.X (FPS)	LOCAL VERTICAL ΔV COMPONENTS OF
ΔVY AGS	±XXXX.X (FPS)	THE MANEUVER TO TARGET THE AGS
ΔVZ AGS	±XXXX.X (FPS)	
BSS	XXX (OCTAL)	BSS STAR FOR MANEUVER ATTITUDE CHECK
SPA	±XX.X (DEG)	BSS PITCH ANGLE ON COAS,
SXP	±XX.X (DEG)	& BSS X POSITION ON COAS FOR MANEUVER ATTITUDE CHECK

June 18, 1969

PDI DATA CARD

PDI PAD

HRS	TIG	+	0	0				+	0	0			
MIN	PDI	+	0	0	0			+	0	0	0		
SEC		+	0					+	0				
TGO	N61	X	X					X	X				
CROSSRANGE													
R	FDAI	X	X	X				X	X	X			
P	AT TIG	X	X	X				X	X	X			
Y		X	X	X				X	X	X			
DEDA 231 IF RQD													

PDI ABORT <10 MIN

LOG INSERTION GET = __ __ __:__ __:__ __

\+ 5 0:0 0

CSI TIG = __ __ __:__ __:__ __

HRS	N37	+	0	0				+	0	0			
MIN	TPI	+	0	0	0			+	0	0	0		
SEC		+	0					+	0				

PDI ABORT >10 MIN

HRS		+	0	0				+	0	0			
MIN		+	0	0	0			+	0	0	0		
SEC	PHASING TIG	+	0					+	0				
HRS	N37	+	0	0				+	0	0			
MIN	TPI	+	0	0	0			+	0	0	0		
SEC		+	0					+	0				

NO PDI +12 ABORT

HR	N33	+	0	0				+	0	0			
MIN	TIG	+	0	0	0			+	0	0	0		
SEC		+	0					+	0				
ΔVX	N81												
ΔVY	LOCAL												
ΔVZ	VERT												
H_A	N42	+						+					
H_P													
ΔVR		+						+					
BT		X	X	X				X	X	X			
R	FDAI	X	X	X				X	X	X			
P	INER	X	X	X				X	X	X			
ΔVX AGS	N86												
ΔVY AGS													
ΔVZ AGS													
HRS	N11	+	0	0				+	0	0			
MIN	CSI	+	0	0	0			+	0	0	0		
SEC		+	0					+	0				
HRS	N37	+	0	0				+	0	0			
MIN	TPI	+	0	0	0			+	0	0	0		
SEC		+	0					+	0				

R2 SUN CHECK

N22 ________ N20 ________

____

____

PDI DATA CARD

PDI PAD

TIG PDI	XXX:XX:XX.XX (HR:MIN:SEC)	PDI IGNITION TIME
TGO	XX:XX (MIN:SEC)	TIME TO HIGH GATE
CROSSRANGE	±XXXX.X (NM)	OUT-OF-PLANE DISTANCE BETWEEN THE INITIAL LM ORBITAL PLANE AND THE LANDING SITE (POSITIVE INDICATES LANDING SITE IS NORTH OF ORBITAL PLANE)
FDAI AT TIG		
R	XXX (DEG)	INERTIAL FDAI ANGLES AT IGNITION
P	XXX (DEG)	
Y	XXX (DEG)	
DEDA 231 (IF REQ'D)	XXXXX (100 FT)	LUNAR RADIUS AT THE LANDING SITE

PDI ABORT <10 MIN

TPI TIG	XXX:XX:XX.XX (HR:MIN:SEC)	TPI IGNITION TIME

PDI ABORT >10 MIN

PHASING TIG	XXX:XX:XX.XX (HR:MIN:SEC)	TIME OF IGNITION OF LM PHASING MANEUVER
TPI TIG	XXX:XX:XX.XX (HR:MIN:SEC)	TPI IGNITION TIME

NO PDI +12 ABORT

N33 ABORT TIG	XXX:XX:XX.XX (HR:MIN:SEC)	IGNITION TIME OF FOR ABORT BURN
N81 LOCAL VERTICAL ΔV		
ΔVX	±XXXX.X (FPS)	LOCAL VERTICAL ΔV COMPONENTS OF THE PHASING MANEUVER
ΔVY	±XXXX.X (FPS)	
ΔVZ	±XXXX.X (FPS)	
N42 ORBITAL PARAMETERS		
HA	+XXXX.X (NM)	PREDICTED APOGEE RESULTING FROM MANEUVER
HP	±XXXX.X (NM)	PREDICTED PERIGEE RESULTING FROM MANEUVER
ΔVR	XXXX.X (FPS)	TOTAL ΔV REQUIRED FOR THE MANEUVER
BT	X:XX (MIN:SEC)	DURATION OF THE MANEUVER
FDAI		
R	XXX (DEG)	INERTIAL FDAI ANGLES AT THE BURN ATTITUDE
P	XXX (DEG)	
N86 AGS ΔV		
ΔVX AGS	±XXXX.X (FPS)	LOCAL VERTICAL ΔV COMPONENTS OF THE MANEUVER TO TARGET THE AGS
ΔVY AGS	±XXXX.X (FPS)	
ΔVZ AGS	±XXXX.X (FPS)	
N11 CSI TIG	XXX:XX:XX.XX (HR:MIN:SEC)	TIME OF IGNITION FOR CSI BURN
N37 TPI TIG	XXX:XX:XX.XX (HR:MIN:SEC)	TIME OF IGNITION FOR TPI BURN

THIS PAGE INTENTONALLY LEFT BLANK.

June 18, 1969

LUNAR SURFACE DATA CARD

T 2 ABORT													
HRS	T2	+	0	0				+	0	0			
MIN	TIG	+	0	0	0			+	0	0	0		
SEC		+	0		.			+	0		.		
HRS	N33	+	0	0				+	0	0			
MIN	PHASING	+	0	0	0			+	0	0	0		
SEC	TIG	+	0		.			+	0		.		
HRS	N11	+	0	0				+	0	0			
MIN	CSI_1	+	0	0	0			+	0	0	0		
SEC		+	0		.			+	0		.		
HRS	N37	+	0	0				+	0	0			
MIN	TPI	+	0	0	0			+	0	0	0		
SEC		+	0		.			+	0		.		

P68

N43 ______________.________ LAT

______________.________ LONG

__________________.____ ALT

P12

N76 __________________.____ V (HOR) (5515.2)

__________________.____ V (VERT) (19.6)

__________________.____ CROSSRANGE (0.0)

NOTE: IF CROSSRANGE >8 N.M., LOAD 8 N.M.

N74 __________________.____ YAW

__________________.____ PITCH

T 3 ABORT													
HRS	T3	+	0	0				+	0	0			
MIN	TIG	+	0	0	0			+	0	0	0		
SEC		+	0		.			+	0		.		
HRS	CSM	+	0	0				+	0	0			
MIN	PERIOD	+	0	0	0			+	0	0	0		
SEC		+	0		.			+	0		.		
HRS		+	0	0				+	0	0			
MIN	P+ΔT	+	0	0	0			+	0	0	0		
SEC		+	0		.			+	0		.		
HRS	N11	+	0	0				+	0	0			
MIN	CSI TIG	+	0	0	0			+	0	0	0		
SEC		+	0		.			+	0		.		
HRS	N37	+	0	0				+	0	0			
MIN	TPI	+	0	0	0			+	0	0	0		
SEC		+	0		.			+	0		.		

P12

N76 __________________.____ V (HOR) (5535.6)

__________________.____ V (VERT) (32.0)

__________________.____ CROSSRANGE (0.0)

NOTE: IF CROSSRANGE >8 N.M., LOAD 8 N.M.

N74 __________________.____ YAW

__________________.____ PITCH

LUNAR SURFACE DATA CARD

T2 ABORT

T2 TIG	XXX:XX:XX.XX (HR:MIN:SEC)	LIFTOFF TIME - SECOND PREFERRED TIME AFTER TOUCHDOWN (~T.D. +12 MIN.)
N33 PHASING TIG	XXX:XX:XX.XX (HR:MIN:SEC)	TIME OF IGNITION FOR PHASING BURN
N11 CSI TIG	XXX:XX:XX.XX (HR:MIN:SEC)	TIME OF IGNITION FOR CSI BURN
N37 TPI TIG	XXX:XX:XX.XX (HR:MIN:SEC)	TIME OF IGNITION FOR TPI BURN

T3 ABORT

T3 TIG	XXX:XX:XX.XX (HR:MIN:SEC)	LIFT OFF TIME AFTER FIRST CSM REVOLUTION
CSM PERIOD	XXX:XX:XX.XX (HR:MIN:SEC)	CSM ORBITAL PERIOD
$P + \Delta T$	XXX:XX:XX.XX (HR:MIN:SEC)	CSM PERIOD PLUS THE TIME INTERVAL BETWEEN CLOSEST APPROACH AND LIFTOFF TIMES
N11 CSI TIG	XXX:XX:XX.XX (HR:MIN:SEC)	TIME OF IGNITION FOR CSI BURN
N37 TPI TIG	XXX:XX:XX.XX (HR:MIN:SEC)	TIME OF IGNITION FOR TPI BURN

LM ASCENT PAD

+	0	0				+	0	0				HR
+	0	0	0			+	0	0	0			MIN TIG
+	0					+	0					SEC
+						+						V (HOR)
+						+						V (VERT) N76
	0						0					*CROSSRANGE
												DEDA 047
												DEDA 053
												DEDA 225/226
												DEDA 231

*NOTE: LOAD 8 NM IF CROSSRANGE IS GREATER THAN 8 NM

COMMENTS:

LM ASCENT PAD

ASCENT TIG	XXX:XX:XX.XX (HR:MIN:SEC)	TIME OF APS IGNITION FOR LM ASCENT
N76 INSERTION TARGET		
V (HOR)	XXXX.X (FPS)	HORIZONTAL VELOCITY AT ORBIT INSERTION
V (VERT)	XXXX.X (FPS)	VERTICAL VELOCITY AT ORBIT INSERTION
CROSSRANGE	±XXX.X (NM)	CROSSRANGE DISTANCE AT ORBITAL INSERTION
DEDA 047	XXXXXX (OCTAL)	SINE OF LANDING AZIMUTH ANGLE
DEDA 053	XXXXXX (OCTAL)	COSINE OF LANDING AZIMUTH ANGLE
DEDA 225	XXXXXX (100 FT)	LOWER LIMIT OF $\alpha \measuredangle$ AT ORBIT INSERTION
DEDA 226	XXXXXX (100 FT)	UPPER LIMIT OF $\alpha \measuredangle$ AT ORBIT INSERTION
DEDA 231	XXXXXX (100 FT)	RADIAL DISTANCE OF LAUNCH SITE FROM CENTER OF MOON

CSI DATA CARD — June 19, 1969

HRS	TIG CSI N11	+	0	0				+	0	0			
MIN		+	0	0	0			+	0	0	0		
SEC		+	0					+	0				
N55	(+00001) (+02660) (+13000)												
HRS	TIG TPI N37	+	0	0				+	0	0			
MIN		+	0	0	0			+	0	0	0		
SEC		+	0					+	0				
ΔVX	N81	+	0					+	0				
ΔVY			0						0				
FDAI PITCH		+	X	X				+	X	X			
373	(+0321.3)	+						+					
275	(+0418.1)	+						+					
410+1, 605+00777, 416+1													
ΔVX AGS	N86		0	0					0	0			
ΔVY AGS			0	0					0	0			
ΔVZ AGS			0	0					0	0			

RESIDUALS

		PGNS		AGS	
ΔVX	N85			500	
ΔVY				501	
ΔVZ				502	

P52

STAR 1 ______ 2 ______ 3 ______

N05 (STAR ∡ DIFF) __________

N93 (TORQUING ∡) X __________

Y __________

Z __________

PGNCS

N75

ΔH (15.0)	CSI/CDH (57:58)	CDH/TPI (38:21)
.	:	:
.	:	:
.	:	:
.	:	:

N81

ΔVX CSI (+50.5)	YDOT N90 CSI (+0.0)
.	
.	(–) .
.	(–) .
.	(–) .

N82

ΔVX CDH (–0.4)	ΔVY CDH (+0.0)	ΔVZ CDH (+0.0)
.	.	.
.	.	.
.	.	.

AGS

402 ΔH	372 ΔT (CSI-CDH)	267 ΔVG (CSI)

CSM SOLUTION

ΔVX CSI ____.____ ΔVY CSI ____.____

N86 (AGS)

ΔVX	ΔVY	ΔVZ

371 ΔV CDH

____

____

____

CSI DATA CARD (P32 LM MANEUVER)

N11 CSI TIG	XXX:XX:XX.XX (HR:MIN:SEC)	CSI IGNITION TIME
N37 TPI TIG	XXX:XX:XX.XX (HR:MIN:SEC)	TPI IGNITION TIME
N81		
ΔVX	XXX.X (FPS)	LOCAL VERTICAL ΔV COMPONENTS OF
ΔVY	XXX.X (FPS)	THE CSI MANEUVER
FDAI PITCH	XXX (DEG)	FDAI INERTIAL PITCH ANGLE AT THE CSI BURN ATTITUDE
DEDA 373	XXXX.X (MIN)	AGS IGNITION TIME OF NEXT MANEUVER
DEDA 275	XXXX.X (MIN)	DESIRED TPI TIG (FOR CSI CALCULATION ONLY)
N86 AGS ΔV		
ΔVX AGS	XX.XX (FPS)	LOCAL VERTICAL ΔV COMPONENTS OF
ΔVY AGS	XX.XX (FPS)	CSI USED TO TARGET AGS EXT ΔV
ΔVZ AGS	XX.XX (FPS)	

CDH PAD

HRS	N13	+	0	0				+	0	0		
MIN	TIG	+	0	0	0			+	0	0	0	
SEC	CDH	+	0		.			+	0		.	
ΔVX			0			.			0			.
ΔVY	N81		0			.			0			.
ΔVZ			0			.			0			.
PLM	FDAI	X	X	X				X	X	X		
373 (+0379.6)		+				.		+				.
ΔVX	N86		0			.			0			.
ΔVY	AGS		0			.			0			.
ΔVZ			0			.			0			.

RESIDUALS

	PGNS		AGS	
ΔVX	N85	.	500	.
ΔVY		.	501	.
ΔVZ		.	502	.

PLANE CHANGE P30, V90, 410+5

TIG	CDH	___ ___ ___:___ ___:___ ___.___ ___
		: 3 0 : 0 0 . 0 0
TIG	PC	___ ___ ___:___ ___:___ ___.___ ___

YDOT

CSM N90	PGNS N90	AGS 263
(–)______.	(–)______.	(–)______.
(–)______.	(–)______.	(–)______.

RESIDUALS

	PGNS		AGS	
ΔVX	N85	.	500	.
ΔVY		.	501	.
ΔVZ		.	502	.

PGNCS

N75

ΔH (15.0)	ΔT TPI/CDH (37:31)	TPI SLIP (0:00)
______.	___:___:___	___:___:___
______.	___:___:___	___:___:___
______.	___:___:___	___:___:___
______.	___:___:___	___:___:___

N81

ΔVX (–1.1)	YDOT N90 CDH (+0.0)	ΔVZ (+4.1)
______.		______.
______.	(–)______.	______.
______.	(–)______.	______.
______.	(–)______.	______.

AGS

402 / ΔH	450 / ΔVX	452 / ΔVZ
______	______	______
______	______	______
______	______	______

CSM SOLUTION

ΔVX	ΔVY	ΔVZ
______.	______.	______.

N86 (AGS)

ΔVX	ΔVY	ΔVZ
______.	______.	______.

<u>CDH DATA CARD</u>

N13 CDH TIG	XXX:XX:XX.XX (HR:MIN:SEC)	IGNITION TIME FOR CDH MANEUVER
N81 LOCAL VERTICAL ΔV		
ΔVX	±XXX.X (FPS)	LOCAL VERTICAL ΔV COMPONENTS OF CDH MANEUVER
ΔVY	±XXX.X (FPS)	
ΔVZ	±XXX.X (FPS)	
PLM FDAI	XXX (DEG)	FDAI INERTIAL PITCH ANGLE AT CDH BURN ATTITUDE
DEDA 373	XXXX.X (MIN)	AGS IGNITION TIME OF NEXT MANEUVER
N86 AGS ΔV		
ΔVX AGS	±XXX.X (FPS)	LOCAL VERTICAL ΔV COMPONENTS OF CDH USED TO TARGET AGS EXT ΔV
ΔVY AGS	±XXX.X (FPS)	
ΔVZ AGS	±XXX.X (FPS)	

HRS	N37	+ 0 0	+ 0 0
MIN	TIG	+ 0 0 0	+ 0 0 0
SEC	TPI	+ 0	+ 0
N55	(BLANK)	(+026.60)	(+130.00)
ΔVX	N81	0	0
ΔVY		0	0
ΔVZ		0	0
ΔVR	N42	+ 0 0	+ 0 0
RLM		X X X	X X X
PLM		X X X	X X X
R TPI	N54	+ 0	+ 0
R TPI	TIG –5	0	0
F/A (+/–)	N59	0 0	0 0
R/L (+/–)	ΔV	0 0	0 0
D/U (+/–)	LOS	0 0	0 0
BT		X X	X X
307+043.00, 314+0			

		RESIDUALS		
	PGNS		AGS	
ΔVX	N85		500	
ΔVY			501	
ΔVZ			502	

PGNCS

N58			N81					
HP ( )	ΔV TPI ( )	ΔV TPF ( )	ΔVX ( )	ΔVY ( )	ΔVZ ( )	ΔV F/A- ( )	ΔV R/L- ( )	ΔV D/U- ( )
				N90				

AGS

			CSM SOLUTION		
267 ΔV TPI	371 ΔV TPI+TPF		ΔVX	ΔVY	ΔVZ
			N86 (AGS)		
			ΔVX	ΔVY	ΔVZ

TPI DATA CARD

N37 TPI TIG	XXX:XX:XX.XX (HR:MIN:SEC)	IGNITION TIME FOR THE TPI MANEUVER
N81 LOCAL VERTICAL ΔV		
ΔVX	±XX.X (FPS)	LOCAL VERTICAL ΔV COMPONENTS OF THE TPI MANEUVER
ΔVY	±XX.X (FPS)	
ΔVZ	±XX.X (FPS)	
N42 ΔVR	+XX.X (FPS)	TOTAL ΔV REQUIRED FOR THE MANEUVER
RLM	XXX (DEG)	ROLL AND PITCH FDAI ANGLES AT TPI BURN ATTITUDE
PLM	XXX (DEG)	
N54 TIG -5		
R TPI	XX.XX (FT)	RANGE AT TPI TIG -5 MIN
R TPI	±XXX.X (FPS)	RANGE RATE AT TPI TIG -5 MIN
N59 ΔV LOS		
F/A	±XX.X (FPS)	LINE-OF-SIGHT ΔV COMPONENTS OF THE TPI MANEUVER
R/L	±XX.X (FPS)	
D/U	±XX.X (FPS)	
BT	XX:XX (MIN:SEC)	DURATION OF THE MANEUVER

SECTION III

DETAILED TIMELINE

TIME	EVENT		REMARKS
-00:09	LCC:	REPORT IGNITION	FIRST OPPORTUNITY LIFT-OFF JULY 16, 0932 EDT, 72° LA, TARGETED FOR LANDING SITE 2. LIFT-OFF: 1332 GMT
00:00	LCC: CDR:	REPORT LIFT-OFF	
00:02	CDR:	REPORT YAW MNVR	
00:10	LCC:	REPORT CLEAR OF TOWER	
00:15	CDR:	REPORT ROLL AND PITCH PROGRAM INITIATE	
00:32	CDR:	REPORT ROLL COMPLETE	
00:42	MCC:	REPORT MARK MODE IB	PROP DUMP TO RCS CMD
00:51	LMP:	REPORT CABIN PRESS DECREASING	ALTITUDE 14,000 ft
01:21	MAX Q		
01:56	MCC:	REPORT MARK MODE IC	ALTITUDE 100,000 ft
02:00	MCC: CDR:	REPORT GO/NO GO FOR STAGING	
02:15	CDR:	REPORT INBOARD OUT	
02:41	CDR:	REPORT OUTBOARD OUT	
02:42	CDR:	REPORT STAGING / S-II IGNITION	
03:12	CDR:	S-II SEP LIGHT OUT	
03:17	CDR:	REPORT TWR JETT AND MODE II	
03:21	CDR:	REPORT GUIDANCE	

TIME	EVENT	REMARKS
04:00	MCC: REPORT TRAJECTORY AND GUIDANCE GO/NO GO	
04:00	CDR: REPORT S/C GO/NO GO	
05:00	CDR: REPORT S/C GO/NO GO	
05:25	MCC: REPORT S-IVB TO ORBIT CAPABILITY	
06:00	CDR: REPORT S/C GO/NO GO	
07:00	CDR: REPORT S/C GO/NO GO	
08:00	CDR: REPORT S/C GO/NO GO	
08:30	MCC: CDR: REPORT GO/NO GO FOR STAGING	
08:57	MCC: REPORT MODE IV	
	CDR: REPORT S/C GO/NO GO	
	MCC: REPORT TRAJECTORY AND GUIDANCE GO/NO GO	
09:11	CDR: REPORT S-II CUTOFF	
09:15	CDR: REPORT S-IVB IGNITION	
10:00	MCC: CDR: REPORT GO/NO GO FOR ORBIT	
	MCC: REPORT PREDICTED SECO	
11:40	CDR: REPORT SECO $TB_5 = 0$	IMU GIMBAL ANGELS @ INSERTION R 180° P 340° Y 0°
	S-IVB MAINTAINS COMMANDED CUTOFF INTERTIAL ATTITUDE	H pad 103.3 NM

MCC-H

0930 EDT

FLIGHT PLAN

NOTES

00:00 US :10 CYI :20 :30 TAN :40 :50 CRO 01:00

LIFTOFF

SECO-INSERTION CHECKLIST
LMP - SM RCS MON CK, CM RCS MON CK, C&W OPERATIONAL CK
REMOVE AND STOW HELMETS AND GLOVES
UNSTOW CAMERAS
CMP - TRANS TO LEB - O_2 MAIN REG CK
CMP/LMP - SEC RAD LEAK CK
CDR/CMP - ECS POST INSERTION CONFIG
LMP - FUEL CELL PURGE CK; EPS MON CK, FUEL CELL POWER PLANT CK,
DC VOLT - AMP CK, ECS MON CK, SPS MON CK
GDC ALIGN TO IMU - RECORD DRIFT
CDR - UNSTOW SEQ CAMERA BRACKET AND ORDEAL
INSTALL ORDEAL & COAS
MOUNT AND INITIALIZE ORDEAL
CMP - ECS REDUNDANT COMPONENT CHECK
JETTISON OPTICS COVER
(DIRECT, HIGH, SHAFT RIGHT)
RECORD ΔAZ CORRECTION

UPDATE
ΔAZ CORRECTION

SET UP CAMERA EQUIP(T&D)
16mm/18/CEX-BRKT-MIR
(f8, 250, 7) 6 FPS
1 MAG (FOR T&D)
EL/80/CEX
(f8, 250, INF)

IMU REALIGN - P52
(OPTION 3 - REFSMMAT)
(OPTIONAL)

S-BAND VOL - UP FOR HSK
TWO-WAY USB VOICE CK

LIFTOFF CREW POSITIONS
LEFT COUCH - CDR
CENTER COUCH - LMP
RIGHT COUCH - CMP
INSERTION IMU GIMBAL ANGLES
P 340 R 180 Y 0
AT SECO +20 SEC, SIV-B MNVRS
TO LH AND INITIALIZES ORB
RATE (HEADS DOWN)

COOLANT CONTROL ATTENUATION
PANEL NOT OPENED

REPORT
P52 - (PAD REFSMMAT)
N71: __ __, __ __
N05: __ __ __. __ __
N93:
X __ __. __ __ __
Y __ __. __ __ __
Z __ __. __ __ __
GET __ __ __: __ __: __

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	00:00 - 01:00	1 / 1	3-1

MCC-H

1030 EDT

FLIGHT PLAN

NOTES

01:00

H
S
K

P52 - CONT'D

GDC ALIGN TO IMU
STOW OPTICS

:10

:20

:30

UPLINK CMC
CSM STATE VECTOR

U
S

SCS ATT REF COMPARISON CK
EXTEND DOCKING PROBE

AS A GENERAL RULE MSFN WILL ALWAYS UPLINK THE STATE VECTOR TO THE CSM SLOT AND THE CREW WILL TRANSFER IT VIA V66 TO THE LM SLOT

UPDATE
PAD DATA

V66 - TRANS CSM STATE VECTOR TO LM SLOT
RECORD PAD DATA
(TLI, TLI +90 MIN ABORT, AND P37 - TLI +4 HR ABORT)
SM RCS HOT FIRE
(MIN IMPULSE - ALL JETS)

:40

:50

GO/NO GO

C
Y
I

GO/NO GO FOR PYRO ARM
BEGIN TLI PREPARATION (CHECKLIST PG L-2-19)
DON HELMETS & GLOVES - ALL

EMS ΔV TEST

02:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	01:00 - 02:00	1 / 1	3-2

TLI
BURN CHART

	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
TLI	10°/SEC SHUTDOWN	±45° SHUTDOWN	BT +6 SEC & VI = PAD VALUE	DO NOT TRIM

FLIGHT PLAN

MCC-H

NOTES

1130 EDT

02:00

:10 — TAN

GDC ALIGN TO IMU
PYRO LOGIC ARM
CMP - TRANS TO COUCH

REPORT
TLI BURN STATUS
VI ___ ___ ___ ___ ___
ΔVC ___ ___ ___ ___ ___

SET ORDEAL TO ORB RATE

:20

CRO

GO/NO GO

:30

GO/NO GO FOR TLI

TB-6 (02:34:48)

:40 — MER

THRUST MON - P47

AT SECO: SIV-B INERTIAL
AT SECO +20 SEC: SIV-B TO LOCAL HORIZONTAL ORB RATE,
GEADS DOWN

TLI

GETI = 02:44:26
BT = 5:20
ΔV_T = 10,451.2 FPS
POSIGRADE

:50 — MSFN

P00 - CMC IDLING
V66 - TRANS CSM SV TO LM SLOT
TLI BURN STATUS REPORT
CDR - TRANS TO CENTER COUCH, CMP - LEFT COUCH, LMP - RIGHT COUCH

03:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	02:00 - 03:00	1 / 2	3-3

1230 EDT

03:00

WASTE STOWAGE VENT VLV - CLOSED
PRESS CABIN TO 5.7 PSIA
GDC ALIGN TO IMU
VERIFY AND ACTIVATE RCS DAP
R1=11103, R2=01111

DAP LOAD FOR SEPARATION CSM, 0.5°DB, 2.0°/SEC, B/D ROLL, 4 JETS

:10

CSM SEP PREPARATION

LOAD DOCKING GIMBAL ANGLES

START 16mm CAMERA

CSM/SIV-B SEP

T&D MNVR
+X 0.8 FPS
AFTER 15 SEC, -X 0.3 FPS
AUTO MNVR TO DOCKING ATT
NULL TRANSLATION & RATES
+X TO CLOST AT .25 TO .5 FPS

EL PHOTOS AS CONVENIENT

GET = 03:15

:20

DOCKING PHOTOGRAPHY

DOCK GET = 03:25

STOP 16mm CAMERA

POST DOCKING
S-BAND HGA ANGLES = P____Y____

:30

M S F N

CMP - INITIATE CM/LM PRESS EQUALIZATION

CONFIGURE FOR EXTRACTION
CHECK LM PRESS STABILIZATION

:40

REMOVE AND TEMP STOW TUNNEL HATCH
CHECK DOCKING LATCHES
VENT DOCKING PROBE
CONNECT UMBILICALS - VERIFY PWR TO LM
REINSTALL HATCH

:50

LM/CM ΔP VALVE - LM/CM ΔP
VERIFY TUNNEL EQUALIZATION - CLOSED
WASTE STOWAGE VENT VALVE - OPEN (FOR 8 HOURS)

DECISION TO END CM CABIN PURGE WILL BE MADE REAL TIME BASED ON LM LEAK RATE

04:00

THIS PAGE INTENTIONALLY LEFT BLANK.

EVASIVE MANEUVER
BURN CHART

	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
EVASIVE MNVR	10°/SEC TAKEOVER	±10° TAKEOVER	BT +1 SEC	DO NOT TRIM

FLIGHT PLAN

MCC-H

UPDATE

EVASIVE MNVR
GO/NO-GO

TLI CUT OFF
+ 1 HR 50 MIN

1330 EDT

04:00

RECORD EVASIVE MNVR PAD
GO/NO-GO FOR PYRO ARM & LM EJECTION
DAP - R1 = 21101, R2 = 11111
PYRO LOGIC ARM
THRUST MONITOR - P47

DAP CONFIGURATION FOR
LM EJECTION: CSM & LM
0.5° DB, .5°/SEC, A/C
ROLL, 4 JETS

:10

LM EJECTION

GETI = 04:09:45
BT = 3 SEC
ΔV_T =

EXT ΔV = P30
DAP - R1 = 21111, R2 = 11111
DAP CONFIGURATION AFTER
LM EJECTION SAME AS ABOVE
EXCEPT CHANGE TO 5° DB

NOTE:
WITH RT TLM, ONLY
ITEMS NORMALLY
REQUIRED IN BURN
STATUS REPORT ARE
%VC, FUEL, OX, AND
UNBAL

:20

SPS THRUST - P40

PITCH DOWN 75° WRT LOCAL HORIZONTAL
ROLL TO VISUALLY ACQ SIV-B

:30

MSFN

SM RCS MON CK

GDC ALIGN TO IMU

:40

EVASIVE MNVR

GETI = 04:39:45
NO ULLAGE
BT = 2.8 SEC
ΔV_T = 19.7
IN PLANE

SM RCS MON CK
SPS MON CK
BURN STATUS REPORT
V66 - TRANS CSM STATE VECTOR TO LM SLOT
MANEUVER TO OBSERVE SLINGSHOT

:50

05:00

NOTES

FOR LM EJECTION
RELATIVE ΔV FROM
SPRINGS = 1 FPS

BURN STATUS REPORT

X X :	ΔTIG
X X :	BT
.	V_{gx}
TRIM	
X X X	R
X X X	P
X X X	Y
☐ .	V_{gx}
☐ .	V_{gy}
☐ .	V_{gz}
☐ .	ΔV_C
X X X	FUEL
X X X	OX
X X X	UNBAL

FIRST SPS BURN WILL ALWAYS
START ON BANK A AND
BANK B WILL BE ACTIVATED IF
THE BURN >5 SEC

MCC-H

FLIGHT PLAN

NOTES

1430 EDT

05:00

:10

:20

:30

:40

:50

06:00

MSFN

SIV-B SLINGSHOT

REPORT LM/CM ΔP

DOFF & STOW
HELMET, GLOVES
AND PGA'S

BATTERY CHARGE, BATTERY B

IMU REALIGN - P52
OPTION 3 - REFSMMAT

UPDATE
BLOCK DATA

GDC ALIGN TO IMU
RECORD BLOCK DATA
(P37 - TLI +11 HRS ABORT)

MNVR TO SIGHTING ATT

REPORT
P52 - (PAD REFSMMAT)
N71: __ __, __ __
N05: __ __ __.__ __
N93:
X __ __.__ __ __
Y __ __.__ __ __
Z __ __.__ __ __
GET __ __ __:__ __:__ __

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	05:00 - 06:00	1 / TLC	3-6

MCC-H

FLIGHT PLAN

NOTES

1530 EDT
06:00

CISLUNAR NAVIGATION - P23

OPTICS CALIBRATION

:10

1. STAR 02 ENH (R3=00110)

:20

2. STAR 40 ENH (R3=00120)

:30

3. STAR 44 ENH (R3=00110)

:40

4. STAR 44 ENH (R3=00110)

:50

5. STAR 45 ENH (R3=00110)

07:00

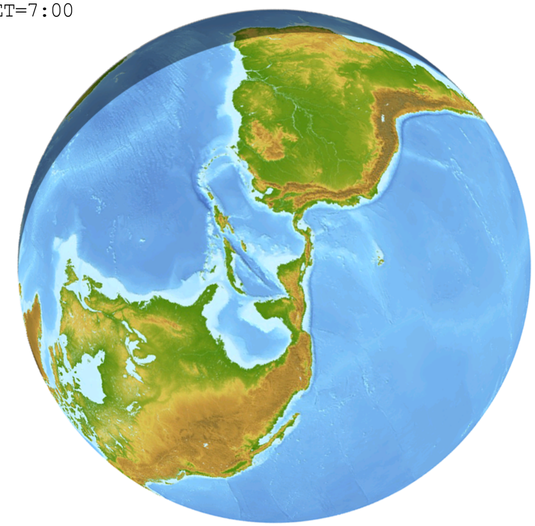
MSFN

3 MARKS ON EACH STAR

INCORPORATE P23 MARK DATA AND UPDATE ONBOARD STATE VECTOR

TRN BIAS CALIBRATION REPEATED UNTIL 2 CKS AGREE TO WITHIN 0.003°
REPEAT CKS EVERY 30 MIN DURING P23

FOV=12°
GET=7:00



MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	06:00 - 07:00	1 / TLC	3-7

MCC-H

FLIGHT PLAN

NOTES

1630 EDT

07:00

:10

:20

:30

:40

:50

08:00

:10

:20

:30

:40

:50

09:00

MSFN

EAT PERIOD - ALL

DEACTIVATE PRIMARY & SECONDARY EVAPORATORS
MNVR TO PTS ATT P 90 Y 0 (SEE NOTES)
SELECT NORMAL LUNAR COMM CONFIGURATION
EXCEPT: S-BD AUX TAPE - OFF (CTR)
TAPE RCDR FWD - OFF (CTR)
POWER DOWN VHF

PTC

PTC WILL BE INITIATED AFTER MCC1, OR AFTER MCC1 IS SCRUBBED

PHOTOS OF EARTH AS CONVENIENT
EL/250/CEX-RING
(f11, 250)

LUNAR
EL/250/CEX-RING
(f5.6, 250, INF)

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	07:00 - 09:00	1 / TLC	3-8

MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

FLIGHT PLAN

MCC-H

UPLINK CMC
EARTH HORIZON
BIAS (ΔH)
(IF REQUIRED)
CSM STATE VECTOR
MCC1 TGT LOAD

UPDATE
MCC1 MNVR PAD

1830 EDT
09:00
:10
:20
:30
:40
:50
10:00
:10
:20
:30
:40
:50
11:00

MSFN

CO_2 FILTER CHANGE NO.1
(3 INTO A, STORE 1 IN B5)

V66 - TRANS CSM STATE VECTOR TO LM SLOT

O2 FUEL CELL PURGE

RECORD MCC1 MNVR PAD

CONTINUE PTC IF MCC1 IS SCRUBBED

IMU REALIGN - P52
OPTION 3 - REFSMMAT
(OPTIONAL)

PTC

NOTES

THE EARTH HORIZON BIAS
(ΔH) WILL BE UPDATED
TO THE CMC IF
THE DIFFERENCE BETWEEN
THE SIGHTING ΔH & THE
E-MEMORY ΔH IS ≥8.3KM

REPORT

P52 - (PAD REFSMMAT)
N71: __ __, __ __
N05: __ __ __.__ __
N93:
X __ __.__ __ __
Y __ __.__ __ __
Z __ __.__ __ __
GET __ __ __:__ __:__ __

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	09:00 - 11:00	1 / TLC	3-9

MCC
BURN CHART

	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC1	10°/SEC TAKEOVER	±10° TAKEOVER	BT +1 SEC	TRIM X AXIS ONLY (UNLESS X > 2 FPS)

2030 EDT
11:00

:10

EXT ΔV

SPS/RCS THRUST - P40/41

MNVR TO BURN ATT

:20

SXT STAR CK

MSFN

EMS ΔV TEST

:30

SM RCS MON CK

GDC ALIGN TO IMU

:40

TLI
+9 HRS

MCC1 ΔV = NOMINALLY ZERO

:50

SM RCS MON CK
SPS MON CK
MCC1 BURN STATUS REPORT
V66 - TRANS CSM STATE VECTOR TO LM SLOT

UPLINK CMC
DESIRED ORIEN-
TATION (PTC)

UPDATE
BLOCK DATA

RECORD BLOCK DATA
(P37 - TLI +25, +35, +44, AND +53 HR ABORTS)

12:00

BURN STATUS REPORT

X X □ :	ΔTIG
X X :	BT
□ .	V_{gx}
TRIM	
X X X	R
X X X	P
X X X	Y
□ .	V_{gx}
□ .	V_{gy}
□ .	V_{gz}
□ .	ΔV_c
X X X	FUEL
X X X	OX
X X X	UNBAL

MCC1 WILL BE PERFORMED
IF ΔV WOULD EXCEED
25 FPS IF DELAYED TO
MCC3 (LOI -22 HRS)

MCC-H

2130 EDT

FLIGHT PLAN

NOTES

12:00

IMU REALIGN - P52
(OPTION 1 - PREFERRED)
& STAR CHECK
(IF MCC1 WAS PERFORMED)

WASTE STOWAGE VENT VLV - CLOSED

VENT BATTS UNTIL SYSTEM TEST
METER (4A) = 0

P52 - PULSE TORQUE
TO PTC REFSMMAT.
ALIGNMENT CHECKED
WITH OPTICS

PTC ESTABLISHED IN
G&N P, Y ±30°DB,
R RATE OF 0.3°/SEC

:10

:20

REPORT LM/CM ΔP
BATTERY CHARGE, BATTERY A

START PTC
P 90° Y 0°

:30

:40

ONBOARD READOUT

BAT C	
PYRO BAT A	
PYRO BAT B	
RCS A	
B	
C	
D	

DC IND SEL TO MNA OR MNB

:50

MSFN

13:00

EAT PERIOD - ALL

PRE SLEEP CHECKLIST

CREW STATUS REPORT (RADIATION, MEDICATION)
CYCLE O_2 & H_2 FANS
CHLORINATE POTABLE WATER
SELECT NORMAL LUNAR CONFIGURATION
EXCEPT:
- S-BD NORMAL MODE VOICE - OFF
- S-BD SQUELCH - ENABLE
- S-BD AUX TAPE - OFF
- S-BD ANT - OMNI
- S-BD ANT OMNI - B
- TAPE RCDR FWD - OFF

VERIFY:
- WASTE MNGT OVBD DRAIN - OFF
- WASTE STOW VENT VLV - CLOSED
- EMERG CABIN PRESS VLV - BOTH
- SURGE TK O_2 VLV - ON
- REPRESS PACK O_2 VLV - ON
- LM TUNNEL VENT VLV - LM/CM ΔP
- POT H_2O HTR - OFF

AUTO RCS JET SELECT (16) - OFF

:10

:20

:30

DURING REST PERIOD,
2 CREWMEN IN REST
STATION, 1 IN LEFT
COUCH

:40

REST PERIOD
(9 HOURS)

:50

14:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	12:00 - 14:00	1 / TLC	3-11

MCC-H

FLIGHT PLAN

NOTES

2330 EDT

14:00

:10

:20

:30

:40

:50

15:00

:10

:20

:30

:40

:50

16:00

M
S
F
N

REST PERIOD
(9 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	14:00 - 16:00	1 / TLC	3-12

MCC-H

FLIGHT PLAN

NOTES

0130 EDT

16:00
:10
:20
:30
:40
:50
17:00
:10
:20
:30
:40
:50
18:00

MSFN

REST PERIOD
(9 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	16:00 - 18:00	1 / TLC	3-13

MCC-H

FLIGHT PLAN

NOTES

0330 EDT

18:00
:10
:20
:30
:40
:50
19:00
:10
:20
:30
:40
:50
20:00

M S F N

REST PERIOD
(9 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	18:00 - 20:00	1 / TLC	3-14

MCC-H

FLIGHT PLAN

NOTES

0530 EDT

20:00

:10

:20

:30

:40

:50

21:00

:10

:20

:30

:40

:50

22:00

MSFN

REST PERIOD
(9 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	20:00 - 22:00	1 / TLC	3-15

MCC-H

FLIGHT PLAN

NOTES

0730 EDT

22:00

:10

:20

:30

:40

:50

23:00

:10

:20

:30

:40

:50

24:00

UPDATE

CONSUMABLES

MSFN

REST PERIOD
(9 HOURS)

CO_2 FILTER CHANGE NO.2
(4 INTO B, STORE 2 IN B5)

EAT PERIOD

POST SLEEP CHECKLIST

CREW STATUS REPORT (SLEEP)
CYCLE O_2 & H_2 FANS
GDC ALIGN TO IMU
REPORT LM/CM ΔP
CONSUMABLES UPDATE
SELECT NORMAL LUNAR CONFIGURATION
EXCEPT:
S-BD AUX TAPE - OFF
TAPE RCDR FWD - OFF
POT H_2O HTR - ON
AUTO RCS JET SELECT (16) - ON

PTC

CONSUMABLE UPDATE
(Δ FROM NOMINAL)

GET: ______

RCS TOT ______

A ______

B ______

C ______

D ______

H_2 TOT ______

O_2 TOT ______

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	22:00 - 24:00	2 / TLC	3-16

MCC-H

FLIGHT PLAN

NOTES

0930 EDT

24:00

O_2 FUEL CELL PURGE

PTC

:10

REPORT

P52 - (PAD REFSMMAT)

N71: __ __, __ __

N05: __ __ __. __ __

N93:

X __ __. __ __ __

Y __ __. __ __ __

Z __ __. __ __ __

GET __ __ __: __ __: __ __

IMU REALIGN - P52

OPTION 3 - REFSMMAT

:20

GDC ALIGN TO IMU

MSFN

MNVR TO SIGHTING ATT

CISLUNAR NAVIGATION P23

:30

OPTICS CALIBRATION

3 MARKS ON EACH STAR
INCORPORATE P23 MARK
DATA AND UPDATE
ONBOARD STATE VECTOR
TRN BIAS CALIBRATION
REPEATED UNTIL 2 CKS
AGREE TO WITHIN 0.003°
REPEAT CKS EVERY 30 MIN
DURING P23's

:40

1. STAR 01 ENH (R3=00110)

:50

2. STAR 02 ENH (R3=00110)

25:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	24:00 - 25:00	2 / TLC	3-17

FLIGHT PLAN

MCC-H

1030 EDT

25:00

3. STAR 44 EFH (R3=00120)

:10

4. STAR 44 EFH (R3=00120)

:20

5. STAR 45 EFH (R3=00120)

MSFN

:30

UPLINK CMC
CSM STATE VECTOR
MCC2 TGT LOAD

V66 - TRANS CSM STATE VECTOR TO LM SLOT

UPDATE
MCC2 PAD DATA

:40

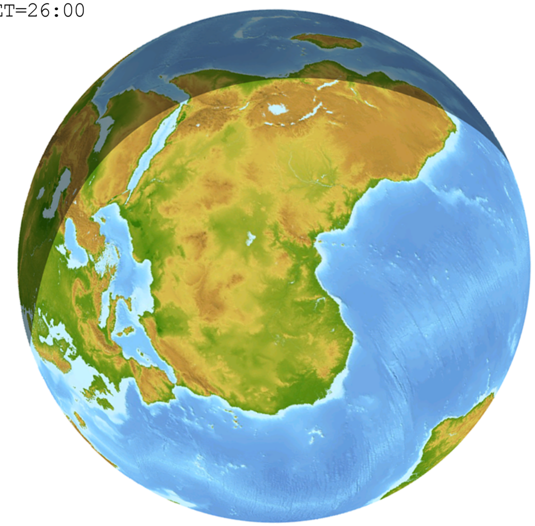
RECORD MCC2 MNVR PAD

:50

26:00

NOTES

FOV=4°
GET=26:00



MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	25:00 - 26:00	2 / TLC	3-18

MCC
BURN CHART

	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC2	10°/SEC TAKEOVER	±10° TAKEOVER	BT +1 SEC	TRIM X AXIS ONLY (UNLESS X > 2 FPS)

FLIGHT PLAN

1130 EDT
26:00

:10

EXT ΔV - P30

SPS/RCS THRUST - P40/41

:20

MNVR TO BURN ATT

MSFN

SXT STAR CK

26:30

EMS ΔV TEST

SM RCS MON CK

:40

GDC ALIGN TO IMU

TLI
+24 HRS

MCC2 ΔV=NOMINALLY ZERO

:50

SM RCS MON
SPS MON CK
MCC2 BURN STATUS REPORT

V66 - TRANS CSM STATE VECTOR TO LM SLOT

27:00

BURN STATUS REPORT

X X □ : :	ΔTIG
X X : :	BT
□ .	V_{gx}
TRIM	
X X X	R
X X X	P
X X X	Y
□ .	V_{gx}
□ .	V_{gy}
□ .	V_{gz}
□ .	ΔV_C
X X X	FUEL
X X X	OX
X X X	UNBAL

MCC2 WILL BE PERFORMED
IF 5V WOULD EXCEED
25 FPS IF DELAYED TO
MCC3 (LOI -22 HRS)

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	26:00 - 27:00	2 / TLC	3-19

FLIGHT PLAN

MCC-H

UPLINK

EARTH HORIZON
BIAS (ΔH)
(IF REQUIRED)

1230 EDT

27:00
:10
:20
:30
:40
:50
28:00
:10
:20
:30
:40
:50
29:00

MSFN

EAT PERIOD

START PTC
P 90° Y 0°

PTC

NOTES

THE EARTH HORIZON BIAS WILL BE UPDATED TO THE CMC IF THE DIFFERENCE BETWEEN THE SIGHTING ΔH IS $\geq$8.3 KM

PTC ESTABLISHED IN G&N P, Y ±30° DB, R RATE OF 0.3°/SEC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	27:00 - 29:00	2 / TLC	3-20

FLIGHT PLAN

MCC-H

NOTES

1430 EDT

29:00

:10

:20

:30

:40

:50

30:00

:10

:20

:30

:40

:50

31:00

MSFN

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	29:00 - 31:00	2 / TLC	3-21

MCC-H

FLIGHT PLAN

NOTES

1630 EDT

31:00
:10
:20
:30
:40
:50
32:00
:10
:20
:30
:40
:50
33:00

MSFN

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	31:00 - 33:00	2 / TLC	3-22

MCC-H

FLIGHT PLAN

NOTES

1830 EDT

33:00

:10

:20

:30

:40

:50

34:00

:10

:20

:30

:40

:50

35:00

MSFN

PTC

O_2 FUEL CELL PURGE

CO_2 FILTER CHANGE NO.3
(5 INTO A, STORE 3 IN B5)

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	33:00 - 35:00	2 / TLC	3-23

FLIGHT PLAN

MCC-H

UPDATE

BLOCK DATA

2030 EDT

35:00
:10
:20
:30
:40
:50
36:00
:10
:20
:30
:40
:50
37:00

MSFN

RECORD BLOCK DATA-
LOI -5 FLYBY TO
PRIME CLA

EAT PERIOD - ALL

REPORT LM/CM ΔP

REINITIATE CSM PURGE
(IF REQUIRED)

NOTE:
THE LENGTH OF THE SECOND CSM CABIN PURGE
WILL BE DETERMINED REAL TIME BASED ON THE
LM LEAK RATE ENSURING LM O_2 PURITY
REQUIREMENTS ON THE LUNAR SURFACE

PRE SLEEP CHECKLIST

CREW STATUS REPORT (RADIATION, MEDICATION)
CYCLES O_2 & H_2 FANS
CHLORINATE POTABLE WATER
SELECT NORMAL LUNAR CONFIGURATION
EXCEPT:
- S-BD NORMAL MODE VOICE - OFF
- S-BD AUX TAPE - OFF
- TAPE RCDR FWD - OFF
- GO TO HGA OR CONTINUE OMNI
- OPS PER MSFN

OMNI OPS
- S-BD ANT OMNI - OMNI
- S-BD ANT OMNI - B

HI GAIN OPS
- HI GAIN ANT BEAM - NARROW
- HI GAIN ANT TRACK - REACQ
- S-BD ANT - HI GAIN

VERIFY:
- WASTE MNGT OVBD DRAIN - OFF
- WASTE STOW VENT VLV - CLOSED
- EMERG CABIN PRESS VLV - BOTH
- SURGE TK O_2 VLV - ON
- REPRESS PACK O_2 VLV - ON
- LM TUNNEL VENT VLV - LM/CM ΔP
- POT H_2O HTR - OFF

AUTO RCS JET SELECT (16) - OFF

NOTES

ONBOARD READOUT

BAT C	________
PYRO BAT A	________
PYRO BAT B	________
RCS A	________
B	________
C	________
D	________

DC IND SEL TO MNA OR MNB

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	35:00 - 37:00	2 / TLC	3-24

MCC-H

FLIGHT PLAN

NOTES

2230 EDT

37:00

:10

:20

:30

:40

:50

38:00

:10

:20

:30

:40

:50

39:00

M
S
F
N

REST PERIOD
(10 HOURS)

PTC

DURING REST PERIOD 2 CREWMEN IN REST STATION, 1 IN LEFT COUCH

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	37:00 - 39:00	2 / TLC	3-25

MCC-H

FLIGHT PLAN

NOTES

0030 EDT

39:00

:10

:20

:30

:40

:50

40:00

:10

:20

:30

:40

:50

41:00

MSFN

REST PERIOD
(10 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	39:00 - 41:00	2 / TLC	3-26

MCC-H

FLIGHT PLAN

NOTES

0230 EDT

41:00
:10
:20
:30
:40
:50
42:00
:10
:20
:30
:40
:50
43:00

MSFN

REST PERIOD
(10 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	41:00 - 43:00	2 / TLC	3-27

MCC-H

FLIGHT PLAN

NOTES

0430 EDT

43:00

:10

:20

:30

:40

:50

44:00

:10

:20

:30

:40

:50

45:00

MSFN

REST PERIOD
(10 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	43:00 - 45:00	2 / TLC	3-28

MCC-H

FLIGHT PLAN

NOTES

0630 EDT

45:00

:10

:20

:30

:40

:50

46:00

:10

:20

:30

:40

:50

47:00

MSFN

REST PERIOD
(10 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	45:00 - 47:00	2 / TLC	3-29

FLIGHT PLAN

MCC-H

NOTES

0830 EDT

47:00

CO_2 FILTER CHANGE NO.4
(6 INTO B, STORE 4 IN B5)

:10

POST SLEEP CHECKLIST

CREW STATUS REPORT (SLEEP)
CYCLE O_2 & H_2 FANS
GDC ALIGN TO IMU
CONSUMABLES UPDATE
SELECT NORMAL LUNAR CONFIGURATION
EXCEPT:
S-BD AUX TAPE - OFF
TAPE RCDR FWD - OFF
POT H_2O HTR - ON
AUTO RCS JET SELECT (16) - ON

:20

:30

EAT PERIOD - ALL

:40

:50

MSFN

UPDATE
CONSUMABLES

48:00

PTC

CONSUMABLE UPDATE
(Δ FROM NOMINAL)

GET: __________

RCS TOT __________
A __________
B __________
C __________
D __________
H_2 TOT __________
O_2 TOT __________

:10

BATTERY CHARGE, BATTERY B

:20

:30

:40

:50

49:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	47:00 - 49:00	3 / TLC	3-30

MCC-H

FLIGHT PLAN

NOTES

1030 EDT

49:00

:10

:20

:30

:40

:50

50:00

:10

:20

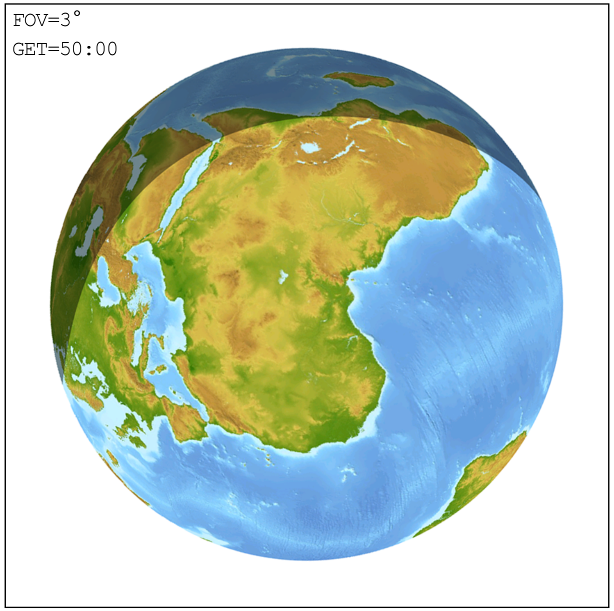
:30

:40

:50

51:00

MSFN



PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	49:00 - 51:00	3 / TLC	3-31

FLIGHT PLAN

MCC-H | **NOTES**

1230 EDT

51:00

:10

UPLINK
CSM STATE VECTOR
MCC3 TGT LOAD

:20 — V66 - TRANSFER CSM STATE VECTOR TO LM SLOT

UPDATE
MCC3 MNVR PAD

:30

RECORD MCC3 MNVR PAD
H_2 PURGE LINE HTRS-ON

:40

:50

O_2 & H_2 FUEL CELL PURGE

52:00

MSFN

PTC

:10

:20

:30 — EAT PERIOD - ALL

:40

:50

53:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	51:00 - 53:00	3 / TLC	3-32

THIS PAGE INTENTIONALLY LEFT BLANK.

MCC
BURN CHART

	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC3	10°/SEC TAKEOVER	±10° TAKEOVER	BT +1 SEC	TRIM X AXIS ONLY (UNLESS X > 2 FPS)

1430 EDT

53:00

IMU REALIGN - P52
OPTION 3 - REFSMMAT

:10

:20

EXT ΔV - P30

SPS/RCS THRUST - P40/41

53:30

MNVR TO BURN ATT

SXT STAR CK (STOW OPTICS)

:40

EMS ΔV TEST

SM RCS MON CK

:50

GDC ALIGN TO IMU

LOI -22 HRS

MCC3 ΔV=NOMINALLY ZERO

SM RCS MON
SPS MON CK

54:00

MSFN

BURN STATUS REPORT

X X ☐ :	ΔTIG
X X :	BT
☐ .	V_{gx}
TRIM	
X X X	R
X X X	P
X X X	Y
☐ .	V_{gx}
☐ .	V_{gy}
☐ .	V_{gz}
☐ .	ΔV_C
X X X	FUEL
X X X	OX
X X X	UNBAL

P52 - (PAD REFSMMAT)

N71: __ __, __ __

N05: __ __ __.__ __

N93:

X __ __.__ __ __

Y __ __.__ __ __

Z __ __.__ __ __

GET __ __ __:__ __:__ __

MCC3 WILL BE EXECUTED
IF ΔV >3 FPS
AND IF LOI1 CANNOT BE
TARGETED TO CORRECT
THE TLC DISPERSIONS

MCC-H

FLIGHT PLAN

NOTES

1530 EDT

54:00

MCC3 BURN STATUS REPORT

V66 - TRANS CSM STATE VECTOR TO LM SLOT

START PTC

P 90° Y 0°

:10

:20

:30

:40

:50

MSFN

55:00

PTC

PRESS CM TO 5.7 PSIA

:10

CM/LM PRESSURE EQUALIZATION VLV - OPEN

:20

:30

PRESSURIZE LM

:40

:50

56:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	54:00 - 56:00	3 / TLC	3-34

FLIGHT PLAN

CSM — **CMP**

1730 EDT

56:00

CLEAR TUNNEL OF CM HATCH
INSPECT TUNNEL &
DOCKING LATCHES
REMOVE PROBE & DROGUE

TEMPORARILY STOW PROBE
AND DROGUE

CONFIGURE DSE TO RECORD
LM DATA

:10

LM — **LMP**

OPEN LM HATCH
RECORD ROLL CAL ANGLE
IVT TO LM

ACT VHF B FOR DATA
XMIT FOR 5 MINUTES

:20

DUMP DSE (LM DATA)

LM — **CDR**

IVT TO LM

LM — **LMP**

ASSIST CDR

PTC

MSFN

56:30

MCC-H

VERIFY OPERATION
OF LM 16mm CAMERA

:40

LM — **CDR**

LM FAMILIARIZATION

LM — **LMP**

LM FAMILIARIZATION

:50

57:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	56:00 - 57:00	3 / TLC	3-35

FLIGHT PLAN

CSM **LM** **MCC-H**

CMP **CDR** **LMP**

1830 EDT

CMP	Time	CDR	LMP	MCC-H
PTC, MSFN	57:00			
	:10			
	:20	LM FAMILIARIZATION	LM FAMILIARIZATION	
	57:30			
	:40			
			IVT TO CSM	
	:50	IVT TO CSM		
		CLOSE LM HATCH		
	58:00			

MCC-H

FLIGHT PLAN

NOTES

1930 EDT

58:00

INSTALL PROBE AND DROGUE
INSTALL CM HATCH
LM TUNNEL VENT VALVE - LM/CM ΔP

180,000 NM from EARTH

:10

:20

:30

:40

:50

M S F N

CO_2 FILTER CHANGE NO.5
(7 INTO A, STORE 5 IN B6)

59:00

PTC

:10

ONBOARD READOUT

BAT C ______

PYRO BAT A ______

PYRO BAT B ______

RCS A ______

B ______

C ______

D ______

DC IND SEL TO MNA OR MNB

:20

EAT PERIOD - ALL

:30

:40

:50

60:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	58:00 - 60:00	3 / TLC	3-37

MCC-H

FLIGHT PLAN

NOTES

2130 EDT

60:00

:10

:20

:30

:40

:50

61:00

:10

:20

:30

:40

:50

62:00

MSFN

REST PERIOD
(9 HOURS)

PRE SLEEP CHECKLIST

CREW STATUS REPORT (RADIATION, MEDICATION)
CYCLES O_2 & H_2 FANS
CHLORINATE POTABLE WATER
SELECT NORMAL LUNAR CONFIGURATION
EXCEPT:
- S-BD NORMAL MODE VOICE - OFF
- S-BD SQUELCH - ENABLE
- S-BD AUX TAPE - OFF
- TAPE RCDR FWD - OFF
- GO TO HGA OR CONTINUE OMNI OPS PER MSFN

OMNI OPS
- S-BD ANT OMNI - OMNI
- S-BD ANT OMNI - B

HI GAIN OPS
- HI GAIN ANT BEAM - NARROW
- HI GAIN ANT TRACK - REACQ
- S-BD ANT - HI GAIN

VERIFY:
- WASTE MNGT OVBD DRAIN - OFF
- WASTE STOW VENT VLV - CLOSED
- EMERG CABIN PRESS VLV - ON
- REPRESS PACK O_2 VLV - ON
- LM TUNNEL VENT VLV - LM/CM ΔP
- POT H_2O HTR - OFF

AUTO RCS JET SELECT (16) - OFF

DURING REST PERIOD 2 CREWMEN IN REST STATION, 1 IN LEFT COUCH

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	60:00 - 62:00	3 / TLC	3-38

MCC-H

FLIGHT PLAN

NOTES

2330 EDT

62:00

:10

:20

:30

:40

:50

63:00

:10

:20

:30

:40

:50

64:00

M S F N

REST PERIOD
(9 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	62:00 - 64:00	3 / TLC	3-39

FLIGHT PLAN

0130 EDT

64:00

:10

:20

:30

:40

:50

65:00 MSFN REST PERIOD (9 HOURS) PTC

:10

:20

:30

:40

:50

66:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	64:00 - 66:00	3 / TLC	3-40

MCC-H

FLIGHT PLAN

NOTES

0330 EDT

66:00

:10

:20

:30

:40

:50

67:00

:10

:20

:30

:40

:50

68:00

MSFN

REST PERIOD
(9 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	66:00 - 68:00	3 / TLC	3-41

FLIGHT PLAN

MCC-H

0530 EDT

68:00

:10

:20

:30

:40

:50

69:00

:10

:20

:30

:40

:50

70:00

MSFN

REST PERIOD
(9 HOURS)

O_2 FUEL CELL PURGE

EAT PERIOD - ALL

PTC

UPLINK CMC
- CSM STATE VECTOR
- MCC4 TGT LOAD
- DESIRED ORIENTATION (LDG SITE)

UPDATE
- MCC4 MNVR PAD

POST SLEEP CHECKLIST
- CREW STATUS REPORT (SLEEP)
- CYCLE O_2 & H_2 FANS
- GDC ALIGN TO IMU
- CONSUMABLES UPDATE
- SELECT NORMAL LUNAR CONFIGURATION EXCEPT:
  - S-BD AUX TAPE - OFF
  - TAPE RCDR FWD - OFF
- POT H_2O HTR - ON
- AUTO RCS JET SELECT (16) - ON

V66 - TRANS CSM STATE VECTOR TO LM SLOT
RECORD MCC4 MNVR PAD

UNSTOW OPTICS

NOTES

CONSUMABLES REPORT
(Δ FROM NOMINAL)

GET: ______

RCS TOT ______

A ______

B ______

C ______

D ______

H_2 TOT ______

O_2 TOT ______

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	68:00 - 70:00	3 / TLC	3-42

THIS PAGE INTENTIONALLY LEFT BLANK.

MCC
BURN CHART

	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC4	10°/SEC TAKEOVER	±10° TAKEOVER	BT +1 SEC	TRIM X AXIS ONLY (UNLESS X > 2 FPS)

FLIGHT PLAN

MCC-H

UPDATE

BLOCK DATA

0730 EDT

70:00

:10

:20

70:30

:40

:50

LOI
-5 HRS
70:55

71:00

M S F N

IMU REALIGN - P52
OPTION 1 - PREFERRED

EXT ΔV - P30

SPS/RCS THRUST - P40/41

MNVR TO BURN ATT

SXT STAR CK

EMS ΔV TEST

SM RCS MON CK

GDC ALIGN TO IMU

MCC4 ΔV=NOMINALLY ZERO

SM RCS MON CK

RECORD BLOCK DATA-
PC +2 HRS FAST
RETURN TO ANY CLA

BURN STATUS REPORT

X	X	☐	:	ΔTIG
X	X		:	BT
☐			.	V_{gx}
TRIM				
X	X	X		R
X	X	X		P
X	X	X		Y
☐			.	V_{gx}
☐			.	V_{gy}
☐			.	V_{gz}
☐			.	ΔV_C
X	X	X		FUEL
X	X	X		OX
X	X	X		UNBAL

NOTES

REPORT

P52 - (LDG SITE REFSMMAT)

N71: __ __, __ __

N05: __ __ __.__ __

N93:

X __ __.__ __ __

Y __ __.__ __ __

Z __ __.__ __ __

GET __ __ __:__ __:__ __

MCC4 WILL BE EXECUTED ONLY IF LOI_1 CANNOT BE TARGETED TO CORRECT THE MCC3 DISPERSIONS

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	70:00 - 71:00	3 / TLC	3-43

MCC-H

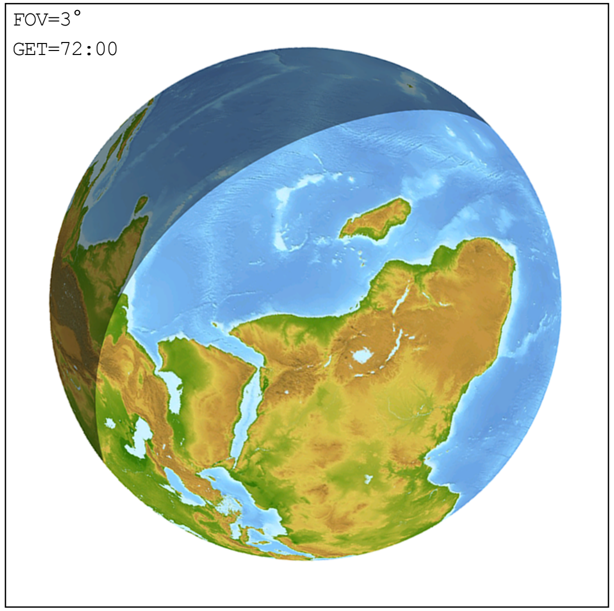
0830 EDT

FLIGHT PLAN

NOTES

Time	Activity
71:00	SPS MON CK
	MCC4 BURN STATUS REPORT
	V66 - TRANS CSM STATE VECTOR TO LM SLOT
:10	CO_2 FILTER CHANGE NO.6
	(8 INTO B, STORE 6 IN B6)
:20	PRE-LOI ECS REDUNDANT COMPONENT CK
	ACTIVATE PRIMARY EVAPORATOR
:30	
:40	
:50	
72:00	
:10	
:20	
:30	
:40	
:50	
73:00	

MSFN



MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	71:00 - 73:00	4 / TLC	3-44

FLIGHT PLAN

MCC-H

UPLINK CMC

CSM STATE VECTOR
LOI_1 TGT LOAD

UPDATE CSM

LOI_1 MNVR PAD

UPDATE CSM

BLOCK DATA

1030 EDT

73:00

V66 - TRANSFER CSM STATE VECTOR TO LM SLOT

COPY LOI_1 P30 MANEUVER PAD

M S F N

73:30

IMU REALIGN - P52
AND DRIFT CK
OPTION 3 - REFSMMAT

73:52

74:00

COPY BLOCK DATA (TEI_1 & TEI_4)

NOTES

TEI_1 BLOCK DATA ASSUM LOI_1 ACCOMPLISHED

TEI_4 ASSUMES LOI_1 ACCOMPLISHED BUT NO LOI_2

REPORT

P52 - (LDG SITE REFSMMAT)
N71: __ __, __ __
N05: __ __ __.__ __
N93:
X __ __.__ __ __
Y __ __.__ __ __
Z __ __.__ __ __
GET __ __ __:__ __:__ __

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	73:00 - 74:00	4 / TLC	3-45

1130 EDT

74:00

74:03

P30 EXTERNAL ΔV
EXT ΔV - P30
P00. V49
MANEUVER TO BURN ATTITUDE R 357.9, P 225.4, Y 346.2
SEXTANT STAR CHECK

ROLL TO ACQUIRE MSFN
SPS PRETHRUST - P40 (TVC TEST)
ROLL TO BURN ATTITUDE

S-BAND SQUELCH - OFF

PITCH UP 360° AT 0.2°/SEC
TO OBSERVE LUNAR SURFACE

74:30

MSFN

GO INERTIAL
V64 REACQUIRE MSFN

EMS ΔV TEST

75:00

THIS PAGE INTENTIONALLY LEFT BLANK.

LOI_1

BURN CHART

	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
LOI_1	10°/SEC TAKEOVER	±10° TAKEOVER	BT +10 SEC	DO NOT TRIM

LOI_1 V_{GO}	BT	TRAJECTORY	ABORT MODE
2924.0 - 2129.0	0 - 110	HYPERBOLIC	MODE I - COAST 2 HR - DPS - P37 (P37 BEYOND SPHERE FOR VGO >2279 AND BT <90)
2129.0 - 1589.0	110 - 180	UNSTABLE	MODE II - COAST 2 HR - 2 DPS BURNS FOR STABILIZATION AND WATER OR CLA LANDING
1589.0 - 0	180 - 365	LUNAR ORBIT	MODE III - DPS BURN AFTER ONE REV

FLIGHT PLAN

MCC-H | 1230 EDT | **NOTES**

75:00

CMP - PRE LOI_1 SYSTEMS CKS

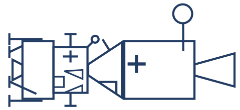
C&W CK
CM RCS CK
SM RCS CK
SPS PERIODIC MON
EPS PERIODIC MON
ECS PERIODIC MON

UPLINK CSM
LOS AND AOS
(WITH & WITHOUT
LOI1)

COPY UPDATE: LOS __ __:__ __:__ __
AOS WITH LOI_1 __ __:__ __:__ __
AOS W/O LOI_1 __ __:__ __:__ __

M S F N

EXT ΔV - P30 (RELOAD N81 WITH PAD VALUES)
SPS THRUST - P40
MNVR TO BURN ATTITUDE



75:30

R 357.9, P 225.4, Y 346.2

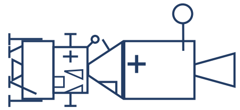
SEXTANT STAR CHECK

GO/NO GO

GO/NO GO FOR LOI_1
PCM-LO
S-BAND AUX-DOWN VOICE BACKUP

75:46

GDC ALIGN TO IMU



LOI_1

GETI: 75:54:28
NO ULLAGE
BT: 5 MIN 59.9 SEC
ΔV_T: 2924.1 FPS
ORBIT: 59.2 x 169.8
RETROGRADE
DO NOT TRIM

NOTE: INITIATE LOI_1
WITH BANK B BALL VALVES

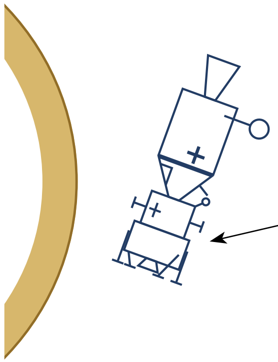
76:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	75:00 - 76:00	4 / 1	3-47

1330 EDT

76:00

REV 1



76:19

76:49

77:00

77:02

77:44

77:49

77:56

78:00

MSFN

V66 - TRANSFER CSM STATE VECTOR
TO LM SLOT

SM RCS AND SPS MON CK
ROLL 180°, PITCH DOWN 70°,
YAW LEFT 14°
V64 REACQUIRE MSFN
ORB RATE

LOI_1 BURN STATUS REPORT

R180, P315/295, Y0
HGA P-20, Y355
DUMP DSE

BURN STATUS REPORT

X X □ :	ΔTIG
X X :	BT
□ .	V_{gx}
TRIM	
X X X	R
X X X	P
X X X	Y
□ .	V_{gx}
□ .	V_{gy}
□ .	V_{gz}
□ .	ΔV_c
X X X	FUEL
X X X	OX
X X X	UNBAL

MCC-H

FLIGHT PLAN

NOTES

1530 EDT

78:00

REV 2

EAT PERIOD

78:27

MSFN

78:30

DUMP DSE

V64 REACQUIRE MSFN
HGA P -20, Y 359

UPLINK CMC
CSM STATE VECTOR
LOI_2 TARGET LOAD

V66 - TRANSFER CSM STATE VECTOR TO LM SLOT

UPDATE CSM
LOI_2 MNVR PAD
BLOCK DATA

RECORD LOI_2 MNVR PAD AND BLOCK DATA (TEI_5)

TEI_5 BLOCK DATA
ASSUMES LOI_1 & LOI_2
ACCOMPLISHED

78:58

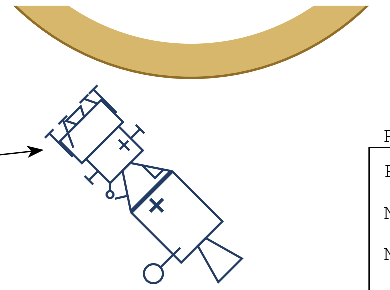
79:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	78:00 - 79:00	4 / 2	3-49

1630 EDT

79:00 CMP - PRE LOI$_2$ SYSTEMS MONITOR

79:10 GO INERTIAL



R 180, P 315/182, Y 0
HGA P -45, Y 180

IMU REALIGN - P52
OPTION 3 - REFSMMAT
DRIFT CHECK

REPORT

P52 - (LDG SITE REFSMMAT)
N71: __ __, __ __
N05: __ __ __.__ __
N93:
X __ __.__ __ __
Y __ __.__ __ __
Z __ __.__ __ __
GET __ __ __:__ __:__ __

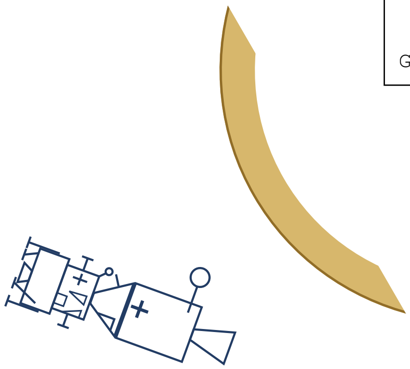
MSFN

79:30

PIPA BIAS CHECK

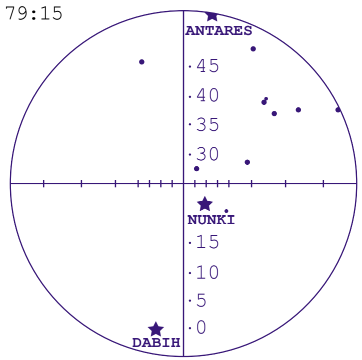
P30 EXTERNAL ΔV
MANEUVER TO LOI$_2$ BURN ATTITUDE

P40 SPS THRUST
GO INERTIAL



R 0, P 50.1/212.3, Y 359.6

79:15



SEXTANT STAR CHECK
EMS ΔV TEST
SM RCS CHECK
LOAD DAP FOR 2 JET ULLAGE
R1 = 20111
R2 = 11111

79:52

79:57

80:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	79:00 - 80:00	4 / 2	3-50

THIS PAGE INTENTIONALLY LEFT BLANK.

LOI$_2$
BURN CHART

	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
LOI$_2$	10°/SEC TAKEOVER	±10° TAKEOVER	BT +1 SEC	TRIM X AXIS TO 1 FPS

FLIGHT PLAN

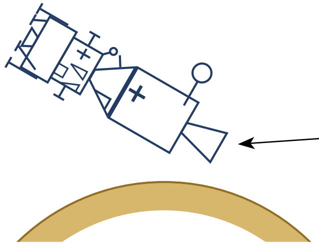
MCC-H

NOTES

1730 EDT

80:00 GDC ALIGN TO IMU

80:04



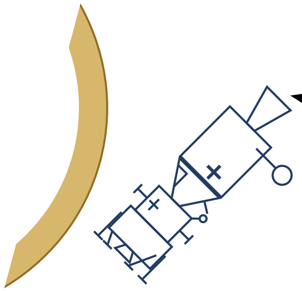
REV 3

LOI_2

GETI: 80:09:30
ULLAGE: 2 JET, 19 SEC
BT: 16.4 SEC
ΔV_T: 157.8 FPS
ORBIT: 53.6 x 65.6
RETROGRADE
DO NOT TRIM

R 0, P <u>151.5</u>/212.3, Y 359.6

SM RCS CHECK
SPS MONITOR CHECK
V66 - TRANSFER CSM STATE VECTOR TO LM SLOT
BATTERY CHARGE, BATTERY A



80:30 ROLL 180°, PITCH DOWN 81°, ORB RATE

OBSERVE LUNAR SURFACE

80:37 V64 ACQUIRE MSFN

MSFN

R 180, P <u>315</u>/293, Y 0
HGA P -34, Y 358

DUMP DSE

LOI_2 BURN STATUS REPORT

PRESSURIZE THE LM
CM/LM PRESSURE EQUALIZATION VALVE - OPEN

81:00

BURN STATUS REPORT

X X □ :	ΔTIG
X X :	BT
□ .	V_{gx}
TRIM	
X X X	R
X X X	P
X X X	Y
□ .	V_{gx}
□ .	V_{gy}
□ .	V_{gz}
□ .	ΔV_C
X X X	FUEL
X X X	OX
X X X	UNBAL

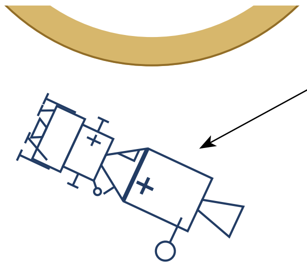
MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	80:00 - 81:00	4 / 3	3-51

FLIGHT PLAN

MCC-H

UPDATE CSM

P22 AUTO OPTICS
ALT LMK (A-1)
TRACKING
(SEE GET 82:35)



R 180, P 318/196, Y 0
HGA P -60, Y 182

1830 EDT

81:00

81:04 RECORD UPDATE (SEE GET 82:40)

GO INERTIAL

81:10

IMU REALIGN - P52
OPTION 3 - REFSMMAT

TUNNEL VENT VALVE - LM/CM ΔP
VERIFY LM/CM ΔP <0.2

MSFN

81:30 STOW OPTICS

PREPARE FOR LM INGRESS

CMP - CLEAR TUNNEL OF CM HATCH
INSPECT TUNNEL & DOCKING LATCHES
REMOVE PROBE & DROGUE
STOW CM HATCH, PROBE & DROGUE
LMP - OPEN LM HATCH
VERIFY DOCKING TUNNEL INDEX ANGLE
IVT TO LM

81:49

81:56 LMP - LM ENTRY STATUS CHECKS

82:00

NOTES

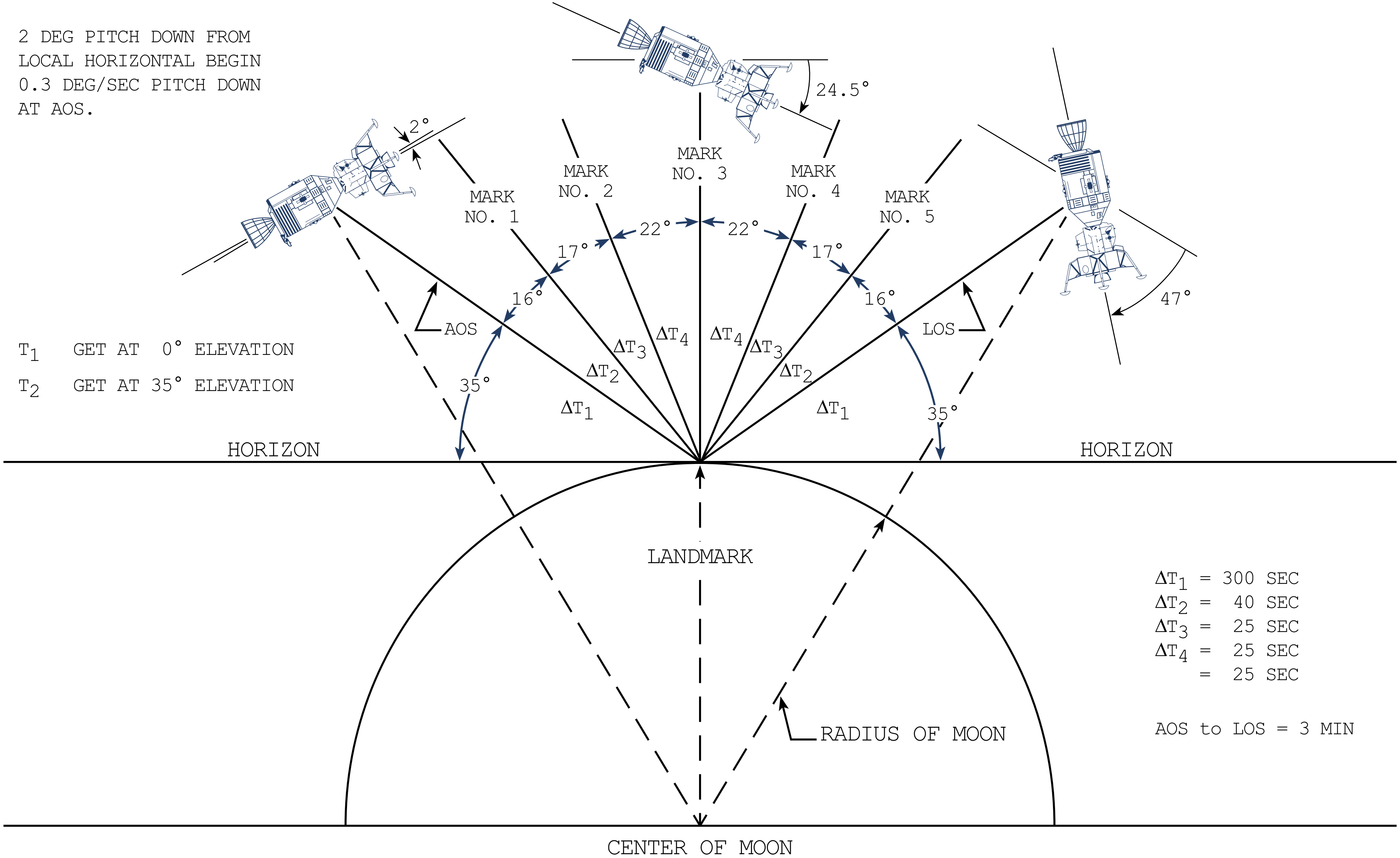
REPORT

P52 - (LDG SITE REFSMMAT)
N71: __ __, __ __
N05: __ __ __.__ __
N93:
X __ __.__ __ __
Y __ __.__ __ __
Z __ __.__ __ __
GET __ __ __:__ __:__ __

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	81:00 - 82:00	4 / 3	3-52

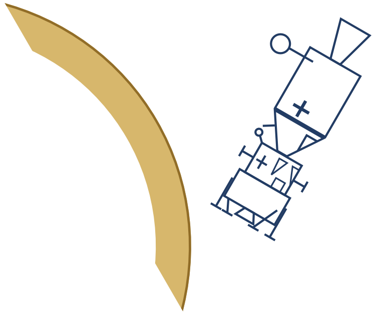
THIS PAGE INTENTIONALLY LEFT BLANK.

CSM/LM TYPICAL LANDMARK TRACKING PROFILE



FLIGHT PLAN

CSM **CMP** | 1930 EDT | **LM** **CDR** | **LMP** | **MCC-H**



82:00
82:02

REV 4

PERFORM HOUSEKEEPING CHORES
1 STOW HELMET STOWAGE BAGS
2 UNSTOW MIRROR, CHECKLIST AND DISPOSAL ASSEMBLY
3 STOW INTERIM STOWAGE ASSEMBLY
4 UNSTOW AND CONFIGURE FOR USE: 16mm/HCEX (f4, 500, INF) 6 fps

R 0, P 257/297, Y 0

MANEUVER TO LANDMARK TRACK ATTITUDE
GO INERTIAL
SELECT OMNI B

AID LMP AS REQUIRED

82:30

P22 ORBITAL NAVIGATION
UNSTOW OPTICS

82:35

MSFN

P22 AUTO OPTICS
LMK ID A-1
T_1 _ 8 2 : 4 1 : 0 6 (HOR)
T_2 _ 8 2 : 4 6 : 1 7 (35°)
1 4 NM N
N 89
LAT 0 2 . 0 0 0
LONG/2 3 2 . 7 5 0
ALTITUDE- 0 0 0 . 0 0 NM

TRACK LANDMARK ALT LMK (A-1)
(5 MARKS ON LMK)
PITCH DOWN 0.3°/SEC
DO NOT INCORPORATE MARKS

STOW OPTICS

83:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	82:00 - 83:00	4 / 4	3-53

FLIGHT PLAN

CSM

CMP

2030 EDT

83:00

CSM POWER TO LM - OFF
(AT LMP REQUEST)
STOP PITCH RATE, ROLL
TO SLEEP ATTITUDE
GO INERTIAL
V64 ACQUIRE MSFN

MSFN

83:02

83:08

RECORD BLOCK DATA
(TEI 2)
V66 - TRANSFER STATE VECTOR
TO LM SLOT
CSM POWER TO LM - ON
(AT LMP REQUEST)

83:30

INSTALL CM HATCH
TUNNEL VENT VALVE - LM PRESS

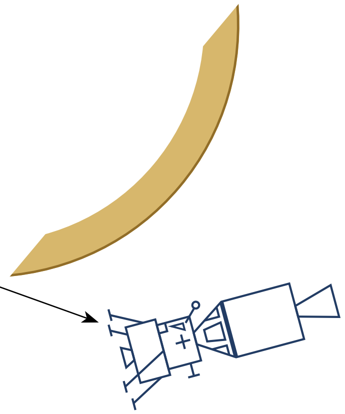
83:47

83:55

84:00

LM

CDR



R 82, P 350/229, Y 0
HGA P 8, Y 270

LMP

TRANSFER TO LM POWER

COMM ACTIVATION

S-BAND/VHF B
VOICE & TM TEST

REPORT OPS SOURCE
PRESSURE

COMM DEACTIVATION

TRANSFER TO CSM POWER

LMP IVT TO CSM
CLOSE LM HATCH

MCC-H

DUMP DSE

RECORD OPS
SOURCE PRESSURE

UPDATE CSM
BLOCK DATA

UPLINK CMC
CSM STATE VECTOR

MCC-H

FLIGHT PLAN

NOTES

2130 EDT

84:00

84:01

O_2 FUEL CELL PURGE

CSM PRESLEEP CHECKLIST

CREW STATUS REPORT (RADIATION, MEDICATION)
CYCLE O_2 & H_2 FANS
CHLORINATE POTABLE WATER
SELECT NORMAL LUNAR COMM CONFIGURATION
EXCEPT:
- S-BD SQUELCH - ENABLE
- HGA TRACK - REACQ
- HGA BEAM - NARROW

VERIFY:
- WASTE MNGT OVBD DRAIN - OFF
- WASTE STOW VENT VLV - CLOSED
- EMERGENCY CABIN PRESS VLV - BOTH
- SURGE TANK O_2 VLV - ON
- REPRESS PACK O_2 VALVE - OFF
- LM TUNNEL VENT VLV - LM PRESS
- POT H_2O HTR - OFF

REV 5

84:30

EAT PERIOD

84:33

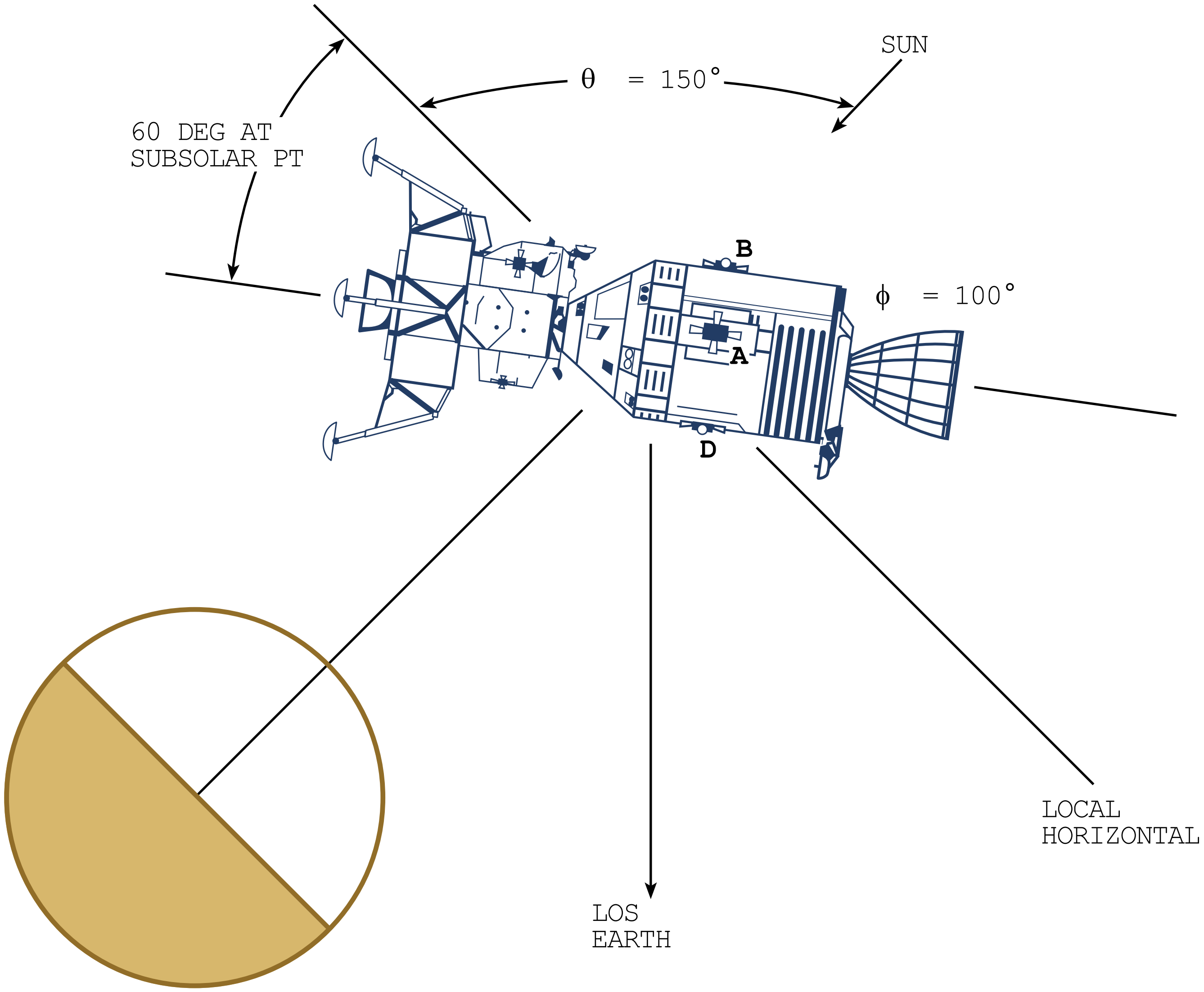
MSFN

CO_2 FILTER CHANGE NO. 7
(9 INTO A, STORE 7 IN B6)

85:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	84:00 - 85:00	4 / 5	3-55

LUNAR ORBIT REST PERIOD ATTITUDE



FLIGHT PLAN

MCC-H

DUMP DSE

2230 EDT

85:00

85:07

85:30

85:45

85:53

85:59
86:00

M
S
F
N

REST PERIOD
(9 HOURS)

NOTES

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	85:00 - 86:00	4 / 5	3-56

MCC-H

FLIGHT PLAN

NOTES

2330 EDT

86:00

REV 6

86:30
86:32

DUMP DSE

86:59
87:00

87:05

M
S
F
N

REST PERIOD
(9 HOURS)

87:30

87:43

87:52

87:58
88:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	86:00 - 88:00	4 / 6	3-57

FLIGHT PLAN

MCC-H

NOTES

0130 EDT

88:00

REV 7

DUMP DSE

88:30

MSFN

88:57
89:00
89:04

REST PERIOD
(9 HOURS)

89:30

89:42

89:50

89:55

90:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	88:00 - 90:00	4 / 7	3-58

MCC-H

FLIGHT PLAN

NOTES

0330 EDT

90:00

REV 8

DUMP DSE

90:28
90:30

90:56
91:00
91:02

M
S
F
N

REST PERIOD
(9 HOURS)

91:30

91:40

91:49

91:55

92:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	90:00 - 92:00	4 / 8	3-59

FLIGHT PLAN

MCC-H

NOTES

0530 EDT

92:00

REV 9

DUMP DSE

92:26

92:30

REST PERIOD
(9 HOURS)

92:55

M
S
F
N

93:00

93:01

93:30

93:37

93:47

93:54

94:00

REV 10

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	92:00 - 94:00	4 / 9-10	3-60

MCC-H

0730 EDT

FLIGHT PLAN

NOTES

DUMP DSE

94:00
94:24
94:30
94:53
94:59
95:00

M S F N

EAT PERIOD

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	94:00 - 95:00	5 / 10	3-61

FLIGHT PLAN

MCC-H

UPDATE

BLOCK DATA

UPDATE

BASELINE ALTITUDE
FOR DESCENT ALTITUDE
SIGHTINGS

0830 EDT

95:00

MSFN

SDR & LMP DON LCG'S
CMP - RECORD BLOCK DATA - TEI_{30}

LMP - COPY BASELINE ALTITUDE

POST SLEEP CHECKLIST

CREW STATUS REPORT (SLEEP)
CYCLE O_2 & H_2 FANS
GDC ALIGN TO IMU
CONSUMABLES UPDATE
SELECT NORMAL LUNAR CONFIGURATION

CO_2 FILTER CHANGE NO. 8
(10 INTO B, STORE 8 IN B6)

95:30

95:36

CMP: DON PGA W/O HELMET AND GLOVES
H2 - PURGE LINE HTRS - ON
LM TUNNEL VENT VALVE - LM/CM ΔP
VERIFY LM/CM ΔP <0.2
OPEN AND STOW CM HATCH
LMP: VERIFY DOCKING TUNNEL INDEX ANGLE
IVT TO LM

95:46

95:52

REV 11

96:00

NOTES

CONSUMABLE UPDATE
(Δ FROM NOMINAL)

GET: ____________

RCS TOT ____________

A ____________

B ____________

C ____________

D ____________

H_2 TOT ____________

O_2 TOT ____________

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	95:00 - 96:00	5 / 10-11	3-62

FLIGHT PLAN

CSM CMP	GET	LM CDR	LM LMP	MCC-H
UNDOCKING PHOTO 16mm/18/CEX-BRKT-MIR (f8, 250, 7) 6 fps O_2 & H_2 FUEL CELL PURGE	0930 EDT 96:00	DON PGA W/O HELMET AND GLOVES	LM FAMILIARIZATION	
V64 ACQUIRE MSFN CREW STATUS REPORT REPORT DOCKING TUNNEL INDEX ANGLE TO MSFN	96:22	CSM POWER TO LM - OFF (AT LMP REQUEST)	LM POWER - ON	DUMP DSE
DEACTIVATE B3 & C4 JETS CONFIGURE DAP 21112 WIDE DB 11001 (FOR LM STEERABLE ANTENNA ACTIVATION)	96:30 MSFN	DISCONNECT AND STOW LM POWER UMBILICAL	EPS ACTIVATION MISSION TIMER ACTIVATION PRIMARY GLYCOL LOOP ACT	UPLINK CMC CSM STATE VECTOR DESIRED ORIENT (LS REFSMMAT)
RECORD LMK 130 PAD DATA (SEE GET 98:35) AND CSM DAP DATA AND LOAD			CAUTION/WARNING CHECKOUT CB ACTIVATION TB VERIFICATION	UPDATE CSM LMK 130 PAD BLOCK DATA CSM DAP DATA
	96:51	IVT TO LM TRANSFER HELMET & GLOVES	PGNCS TURN - ON AND SELF TEST	
UNSTOW OPTICS P52 - IMU REALIGN OPTION 1 PREFERRED	96:58 97:00	ECS ACTIVATION AND C/O CONNECT TO LM ECS	BIO MED SWITCH - LEFT	

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	96:00 - 97:00	5 / 11	3-63

FLIGHT PLAN

CSM

CMP

REPORT

P52 - (LDG SITE REFSMMAT)
N71: __ __, __ __
N05: __ __ __. __ __
N93:
X __ __. __ __ __
Y __ __. __ __ __
Z __ __. __ __ __
GET __ __ __: __ __: __ __

VHF CHECKOUT
CSM TIME MARK TO LM
STOW OPTICS

V06N20E
(ON MARK FROM CDR)

RECORD LM PCM DATA

DON HELMET AND GLOVES
PGA PRESSURE INTEGRITY CHECK
INSTALL DROGUE & PROBE,
PRELOAD PROBE
INHIBIT ROLL COMMANDS UNTIL
LM/CM ΔP >3.5 PSIA
COCK LATCHES (12)
INSTALL HATCH
VENT TUNNEL
HATCH INTEGRITY CHECK
INSTALL AND ALIGN DOCKING
TARGET

MSFN

1030 EDT
97:00
97:30
97:34
97:44
97:49
REV 12
98:00

LM

CDR

SUIT FAN/H_2O SEP CHECK

GLYCOL PUMP CHECK

VHF-B ACTIVATION

E MEMORY DUMP

VHF CHECKOUT
(COMM CHECK WITH CSM)

LGC/CMC CLOCK SYNC
T EPHEM UPDATE

DOCKED IMU COARSE ALIGN
REPORT GIMBAL ANGLES AND TIME
TO MSFN

AFT OMNI - LBR
SLEW STEERABLE ANTENNA
P 187, Y 70

VERIFY DROGUE AND PROBE
INSTALLATION CLOSE AND
SECURE HATCH

LMP

SEC S-BAND T/R AND POWER
AMPLIFIER CHECK

S-BAND STEERABLE
ANTENNA ACTIVATION
P 152, Y -9

IVT TO CSM

DON PGA

IVT TO LM
TRANSFER HELMET & GLOVES

CONNECT TO LM ECS AND COMM

ASCENT BATTERY ACTIVATION
AND CHECKOUT
RECORD ED BAT VOLTS

MCC-H

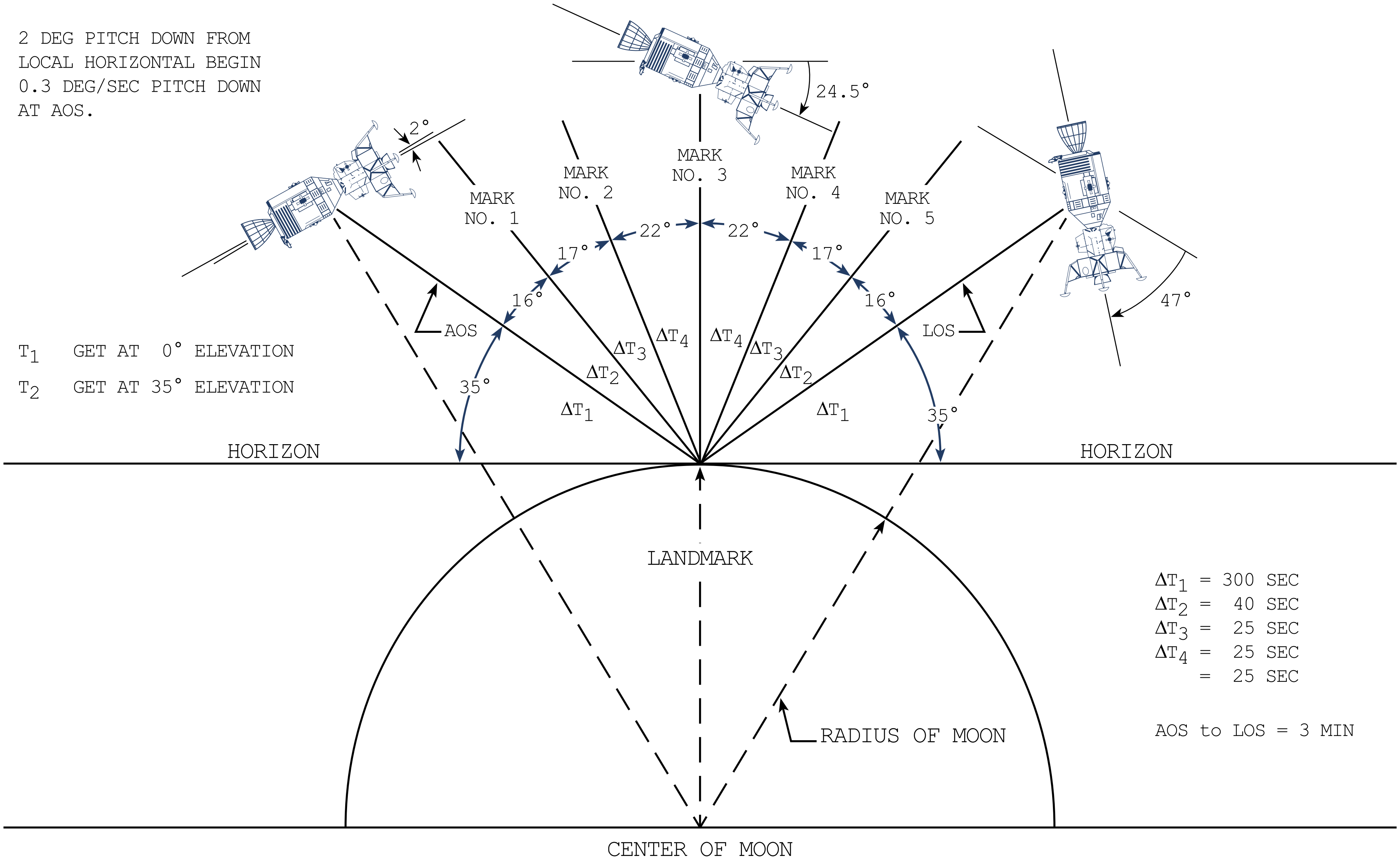
UPDATE LM
STEERABLE ANTENNA
ANGLES
(GET: 97:10)

UPDATE LM
STEERABLE ANTENNA
ANGLES P 187, Y 70
(GET: 98:55)

COPY GIMBAL ANGLES
AND TIME

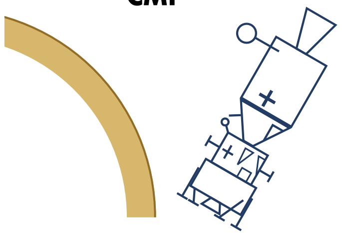
MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	97:00 - 98:00	5 / 11-12	3-64

CSM/LM TYPICAL LANDMARK TRACKING PROFILE



FLIGHT PLAN

CSM — CMP



MANEUVER TO TRACKING ATTITUDE
R 0, P 278/290, Y 0
DOFF HELMET & GLOVES

SELECT OMNI C

GO INERTIAL
UNSTOW OPTICS
P22 ORBITAL NAVIGATION

TRACK LDG SITE LANDMARK (5 MARKS ON LDMK 130) PITCH DOWN 0.3°/SEC AT T_2 DO NOT INCORPORATE MARKS

PITCH DOWN, 0.5°/SEC

STOP PITCH AND GO INERTIAL

V64 ACQUIRE MSFN

1130 EDT

98:00
98:21
98:30
M S F N
98:50
98:56
99:00

LM

CDR

DON HELMET & GLOVES

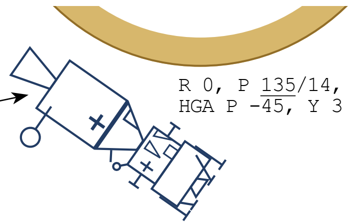
ARS/PGA PRESSURE
INTEGRITY CHECK

CABIN REGULATOR CHECK

DOFF HELMET & GLOVES

COPY DAP DATA
COPY GYRO TORQUE ANGLES AND
FINE ALIGN IMU
X ___, Y ___, Z ___

RATE GYRO CHECK



R 0, P 135/14, Y 0
HGA P -45, Y 3

LMP

DON HELMET & GLOVES

ARS/PGA PRESSURE
INTEGRITY CHECK

CABIN REGULATOR CHECK

DOFF HELMET & GLOVES

SELECT OMNI FWD
BIO MED SWITCH - RIGHT

AGS ACT & SELF TEST

V64 ACQUIRE MSFN
ANT P 187, Y 70

MCC-H

UPDATE LM
DAP DATA
GYRO TORQUE ANGLES

P22 AUTO OPTICS
LMK ID 130
T_1 _ 9 8 : 4 0 : 0 2 (HOR)
T_2 _ 9 8 : 4 5 : 0 8 (35°)
9 6 NM (N OR S)
N 89
LAT + 0 1 . 2 4 3
LONG/2 + 1 1 . 8 4 4
ALTITUDE- 0 0 1 . 4 6 NM

DUMP DSE

FLIGHT PLAN

CSM

CMP

1230 EDT

99:00

STOW FLIGHT PLAN
UNSTOW SOLO BOOK
COPY PADS

DON HELMET & GLOVES
SC CONT - SCS
MIN/MAX DB, LOW/HIGH RATE
(AT REQUEST OF CDR)
GO/NO-GO FOR UNDOCKING
DISABLE ROLL JETS FOR
RCS HOT FIRE
VERIFY TUNNEL VENT VALVE - OFF
RECORD LM PCM DATA

MSFN

99:30

99:32

MANEUVER TO
AGS CALIBRATION ATTITUDE

99:43

RATES <0.1°/SEC
DISABLE THRUSTERS FOR 32 SEC
(AT REQUEST OF LMP)
MANEUVER TO UNDOCKING ATTITUDE
R 0, P 320/14, Y 0

99:49

REV 13

100:00

LM

CDR

DRIFT CHECK - REPORT GIMBAL
ANGLES & TIME TO MSFN
DEPLOY LANDING GEAR

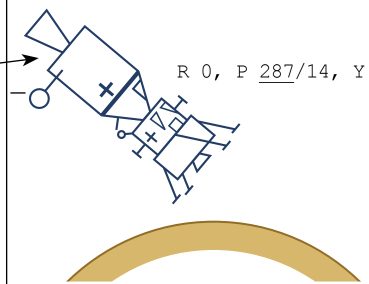
ORDEAL INITIALIZATION

LOAD DAP DATA - 32012
CSM WT ________
P TRIM ________
Y TRIM ________
DPS GIMBAL DRIVE AND
THROTTLE TEST

RCS PRESSURIZATION

RCS CHECKOUT

RR ACT & SELF TEST



R 0, P 287/14, Y 14

DPS PRESS & CHECKOUT

LMP

V47 INITIALIZE AGS

COPY AGS ABORT CONSTANT
AND K FACTOR

RCS PRESSURIZATION

GO/NO-GO FOR UNDOCKING
RCS CHECKOUT

AFT OMNI - LBR

SLEW STEERABLE ANTENNA
ANT P 123, Y -37

AGS ACCEL & GYRO CALIBRATION

MCC-H

UPLINK LGC
- LS REFSMMAT
- LM & CSM STATE VECTORS
- LGC/CMC CLOCK SYNC
- PIPA BIAS
- LGC ABORT CONSTANT

UPDATE LM
- AGS ABORT CONSTANT
- AGS K FACTOR

UPLINK CMC
- LM & CSM STATE VECTORS

UPDATE CSM
- P30 MNVR PAD (SEPATATION)
- GO/NO-GO

UPDATE LM
- STEERABLE ANTENNA ANGLES (GET: 100:25)

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	99:00 - 100:00	5 / 12-13	3-66

FLIGHT PLAN

CSM
CMP

RR TRANSPONDER ACT & SELF TEST
CONFIGURE DAP
FOR UNDOCKING, CSM ONLY
R1 = 11102
R2 = 11111
SC CONT - SCS
START 16mm CAMERA

UNDOCK

ENABLE B3 & C4 RCS JETS
V64 ACQUIRE MSFN
LM INSPECTION, CAMERA OFF

COPY PADS
SC CONT - CMC
P30 EXT ΔV
P41 RCS THRUST

CSM SEPARATION
GET: 100:39:50
BT: 8.0 SEC
ΔV_T: 2.5 FPS
-X THRUSTERS
ORBIT: 55.6 x 63.1

P20 AUTO MANEUVER
SXT & VHF RANGING

COPY PAD

1330 EDT

100:00
100:19
100:30
100:48
100:54
101:00

MSFN

MSFN

LM
CDR

DAP DATA LOAD

DON HELMETS AND GLOVES
PREPARE FOR UNDOCKING

UNDOCK

YAW LEFT 60°, PITCH UP 110°
SET ORDEAL
YAW 360°, LM INSPECTION

CSM: R 0, P 90/14, Y 0
HGA P -46, Y 3

SEPARATION

LR ACT AND SELF TEST

P30 EXT ΔV
RR MAN LOCK - ON

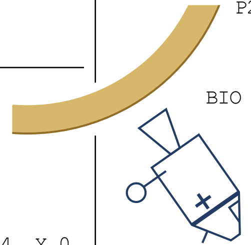
VHF RANGING
RR - OFF

LMP

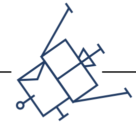
V47 AGS ALIGN
CSM: R 0, P 15/14, Y 0

ACQUIRE MSFN
ANT P 123, Y -37
P27 UPDATE

BIO MED SWITCH - LEFT



COPY PADS

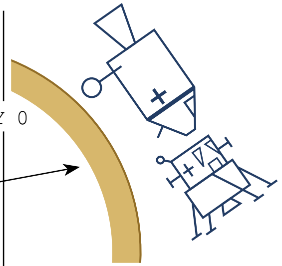


LM FDAI: R 0, P 304, Y 0

P27 UPDATE
V47 AGS UPDATE
AGS ALIGN

COPY PAD

MCC-H



LM FDAI: R 0, P 194, Y 60

UPLINK LGC
LM STATE VECTOR
(DOI -10)
DOI TARGET LOAD
DESCENT TARGET LOAD
PIPA BIAS

UPDATE LM
DOI MNVR PAD
PDI PAD
PDI ABORT <10 MIN
NO PDI +12 PAD
PDI ABORT >10 MIN

UPLINK LGC
CSM STATE VECTOR
(PDI +25)

UPDATE LM
LUNAR SURFACE PAD

UPDATE CSM
CSM RESCUE PAD

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	100:00 - 101:00	5 / 13	3-67

FLIGHT PLAN

CSM

CMP

P27 UPDATE
P52 IMU REALIGN
OPTION 3 REFSMMAT

REPORT

P52 - (LDG SITE REFSMMAT)
N71: __ __, __ __
N05: __ __ __.__ __
N93:
X __ __.__ __ __
Y __ __.__ __ __
Z __ __.__ __ __
GET __ __ __:__ __:__ __

GDC ALIGN TO IMU
VHF B - DATA
P20 AUTO MANEUVER TO SEXTANT
TRACK LM

CONFIRM DOI - VHF RANGING
INCORPORATE P76
P20 AUTO MANEUVER TO SEXTANT
TRACK LM
SEXTANT TRACK ONLY
DOFF HELMET & GLOVES

1430 EDT
101:00
MSFN
101:30
MSFN
101:41
101:47
REV 14
102:00

LM

CDR

REPORT

P52 - (LDG SITE REFSMMAT)
N71: __ __, __ __
N05: __ __ __.__ __
N93:
X __ __.__ __ __
Y __ __.__ __ __
Z __ __.__ __ __
GET __ __ __:__ __:__ __

P40 DPS THRUST
MNVR TO DOI ATTITUDE

DPS, DOI

TRIM V_X RESIDUALS
PITCH DOWN, P=195, RR - ON
P20 MAN LOCK - ON

RR - OFF

P30 EXT ΔV
LOAD PDI +12 ABORT
PITCH DOWN TO 125°
YAW LEFT 180°

LMP

SYSTEMS CHECKS

V47 AGS ALIGN

OMNI AFT, PCM LBR
VHF A-VOICE, B-DATA

SLEW STEERABLE ANTENNA
ANT P 220, Y 28

N20 AGS ALIGN
LOADS AGS EXT ΔV

GETI: 101:38:48
ULLAGE: 2 JET, 7.5 SEC
BT: 28.5 SEC
ΔV: 70 FPS
RETROGRADE
ORBIT 8.97 x 57.87

VHF A-VOICE/RNG

VHF B - XMTR - OFF
SET CAMERA
16mm/HCEX (4,5000, INF) 6 fps
COAS OVERHEAD

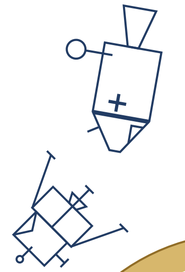
MCC-H

UPLINK CMC
CSM STATE VECTOR
(PDI +25)
LM STATE VECTOR
(DOI -10)
PIPA BIAS
DUMP DSE

GO/NO-GO FOR DOI

UPDATE LM
STEERABLE ANTENNA
ANGLES (GET: 102:19)

CSM: R 0, P 215/319, Y 0



LM FDAI: R 0, P 294.9, Y 0

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	101:00 - 102:00	5 / 13-14	3-68

FLIGHT PLAN

1530 EDT

CSM

CMP

SEXTANT AND VHF
TRACKING OF LM

TERMINATE P20 TRACK

P20 AUTO MANEUVER
TO SEXTANT TRACK LM

P00, MANUAL ATTITUDE
PITCH RATE DOWN 0.2°/SEC

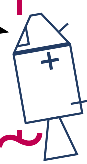
STOP PITCH AT
R 0, P 282/179, Y 0
GO INERTIAL
CONFIRM STAY/NO-STAY
V44 SET LS FLAG
CONFIRM STAY/NO-STAY

RR TRANSPONDER - OFF

102:00
102:17
102:19
102:30
102:46
102:53
103:00

MSFN

MSFN



LM

CDR

P52 PITCH ALIGNMENT CHECK

PITCH TO 285°

RR - ON
P20 MODE II LOCK - ON

P63

LPD ALTITUDE, ATTITUDE
POSITION CHECK
GO/NO-GO FOR PDI

LR - ON

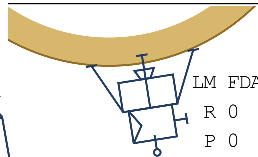
LPD ALTITUDE, ATTITUDE
POSITION CHECK,
ULLAGE 7.5 SEC

DPS, PDI

LPD ALT CK
YAW RIGHT 174° THEN 6°

EVALUATE MANUAL CONTROL
PITCH OVER AT P64
MANUAL ATTITUDE CONTROL

TOUCHDOWN 102:47:11



LM FDAI:
R 0
P 0
Y 0

INITIATE DPS VENTING
V76 RCS MIN IMPULSE

LMP

V06N20, ENTER ON MARK
RECORD PITCH CDU
N22, RECORD PITCH CDU

BATTERIES 5 & 6 ON

SYSTEMS CHECK
DPS, OPS, RCS, EPS, CWEA

ANT P 220, Y 28
ACQUIRE MSFN
DOI POST BURN REPORT

CSM: R 0, P 348/337, Y 0

N20 AGS ALIGN
CONFIGURE AGS

START 16mm CAMERA

GETI: 102:35:13
ULLAGE: 2 JET, 7.5 SEC
BT = 11 MIN 58 SEC
ΔV_T = 6766 FPS

SYSTEMS MONITOR

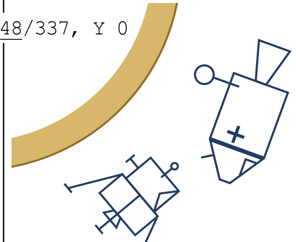
PERFORM LUNAR CONTACT CHECKLIST
STAY/NO-STAY

STAY/NO-STAY

STOP 16mm CAMERA
ASCENT BATTERIES OFF
REPORT 047, 053

MCC-H

COPY BURN REPORT
GO/NO-GO



LM FDAI: R 180, P 286.5, Y 0

STAY/NO-STAY

STAY/NO-STAY

ENABLE S-BAND RELAY

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	102:00 - 103:00	5 / 14	3-69

FLIGHT PLAN

CSM
CMP

REPORT

P52 - (LDG SITE REFSMMAT)
OPTION 3
N71: __ __, __ __
N05: __ __ __.__ __
N93:
X __ __.__ __ __
Y __ __.__ __ __
Z __ __.__ __ __
GET __ __ __:__ __:__ __

ALIGN GDC, VERIFY ORDEAL

COPY LM TRACKING PAD
(SEE GET - 104:35)

P22 AUTO MNVR TO
TRACKING ATTITUDE
ORB RATE

R 0, P 338/76, Y 0

1630 EDT
103:00
MSFN
103:29
103:30
103:39
103:45
REV 15
104:00
MSFN

LM
CDR

RR TO STANDBY
REPORT ESTIMATE OF
LANDED LOCATION
CLOSE SHADES, DOFF HELMET
AND GLOVES

BEGIN SIMULATED COUNTDOWN

80mm/BW/CHECKLIST
60mm/HCEX/CHECKLIST

6 FRAMES FAR FIELD (FOCUS 50')
6 FRAMES NEAR FIELD (FOCUS 20')
WITH EACH CAMERA
REMOVE MAGS AND STOW
INSTALL PROTECTIVE COVER AND
STOW CAMERAS

PHOTOGRAPH LUNAR SURFACE
DON HELMET AND GLOVES

LMP

AGS LUNAR SURFACE GYRO
CALIBRATION
LOAD AGS ASCENT TARGET
H=60,000 FT, H DOT=32 FPS
CLOSE SHADES, DOFF
HELMET AND GLOVES

P57 - IMU ALIGN (REFSMMAT)
GRAVITY MEASUREMENT
N04: __ __ __ __ __ __

AGS LUNAR ALIGNMENT

P57 - IMU ALIGN (REFSMMAT)
2 CELESTIAL BODIES
N04: __ __ __.__ __
N05: __ __ __.__ __
N71: __ __, __ __
N93:
X __ __.__ __ __
Y __ __.__ __ __
Z __ __.__ __ __
N89:
LAT __ __.__ __ __
LONG/2 __ __.__ __ __
ALT __ __.__ __ __
GET __ __ __:__ __:__ __

INITIALIZE AGS
COPY AND LOAD ASCENT PAD DATA
DON HELMET AND GLOVES

VERIFY AGS ASCENT PROGRAM

MCC-H

COPY AGS AZIMUTH

COPY LANDED LOCATION,
GRAVITY MEASURE

UPDATE CSM
LM TRACKING PAD

COPY P57 DATA

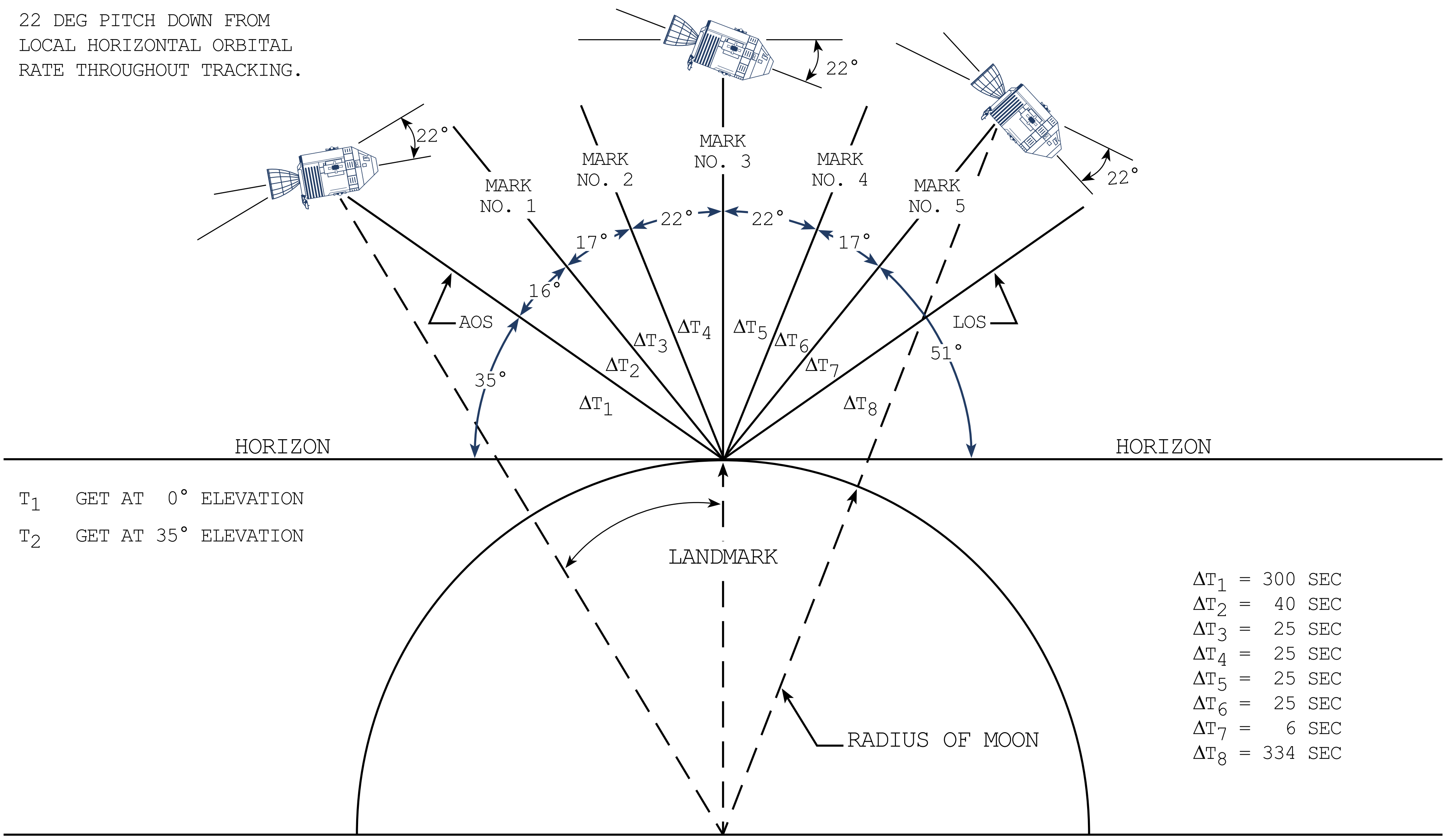
COPY AGS AZIMUTH

UPLINK LGC
RLS
CSM STATE VECTOR
(TD +1:40)

UPDATE LM
ASCENT PAD

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	103:00 - 104:00	5 / 14-15	3-70

CSM TYPICAL LANDMARK TRACKING PROFILE



FLIGHT PLAN

1730 EDT

104:00 — 104:15 — 104:30 — 104:45 — 104:51 — 105:00

MSFN

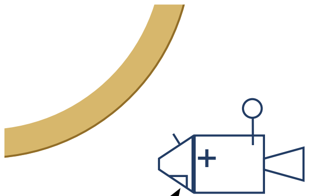
MSFN

CSM
CMP

P22 AUTO MANEUVER TO TRACKING ATTITUDE, ORB RATE

R 0, P 338/342, Y 0

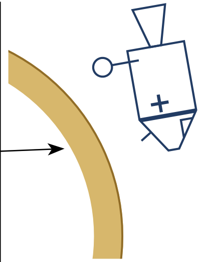
CONFIRM STAY/NO-STAY



LM TRACKING 5 MARKS ON LM ORB RATE

PITCH DOWN 0.05°/SEC
STOP ORB RATE
GO INERTIAL
ROLL 170° TO ACQ MSFN
V64 ACQUIRE MSFN

LM
CDR



STAY/NO-STAY FOR LUNAR SURFACE OPERATIONS

P12 - ASCENT PROGRAM
DAP LOAD 12012

END SIMULATED COUNTDOWN AT TIG -1 MINUTE

DOFF HELMET & GLOVES

EAT PERIOD (40 MIN)

REPORT: LMP

P57 - GRAVITY AND ONE CELESTIAL BODY (T-ALIGN)
N04: __ __ __.__ __
N71: __ __
N93:
X __ __.__ __ __
Y __ __.__ __ __
Z __ __.__ __ __
GET __ __ __:__ __:__ __

CONFIGURE COMM FOR LUNAR STAY
AGS LUNAR ALIGN

BIOMED SWITCH - RIGHT
COPY UPDATE

V47 - INITIALIZE AGS
AGS GUIDANCE STEERING

AGS POWER DOWN
(AGS STATUS SW - OFF)

DOFF HELMET & GLOVES

EAT PERIOD (40 MIN)

MCC-H

STAY/NO-STAY

UPDATE LM
T_4 THRU T_7
LIFT OFF TIMES

P22 AUTO OPTICS
LUNAR MODULE
T_1 104:34:31 (HOR)
T_2 104:39:32 (35°)
0.2 NM (N OR S)
N89
LAT +00.691
LONG/2 +11.858
ALTITUDE- 001.44 NM
(IF REQUIRED)

UPLINK CMC
DESIRED ORIENT
(PLANE CHANGE)

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	104:00 - 105:00	5 / 15	3-71

FLIGHT PLAN

CSM (CMP)	Time (1830 EDT)	LM: CDR	LM: LMP	MCC-H
P52 (OPT 1 - PREFERRED) GYRO TORQUE TO DESIRED ORIENTATION FOR PLANE CHANGE (IF PLANE CHANGE IS REQUIRED) GDC ALIGN TO IMU	105:00	EAT PERIOD (40 MIN)	EAT PERIOD (40 MIN)	DUMP DSE
MSFN	105:26			
EAT PERIOD (1 HOUR)	105:30	CREW STATUS REPORT (RADIATION, MEDICATION) CONFIGURE SLEEP STATION STOW PLSS IN DONNING STATION		
	105:38			
	105:44			
	REV 16	REST PERIOD (4 HOURS)	REST PERIOD (4 HOURS)	
	106:00			

MSFN

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	105:00 - 106:00	5 / 15-16	3-72

FLIGHT PLAN

CSM **LM** **MCC-H**

CMP — 1930 EDT — **CDR** — **LMP**

CSM CMP		1930 EDT		LM CDR	LM LMP	MCC-H
EAT PERIOD (1 HOUR)		106:00	MSFN	REST PERIOD (4 HOURS)	REST PERIOD (4 HOURS)	
	MSFN	106:13				
V64 REACQUIRE MSFN COPY PLANE CHANGE PAD						(IF PLANE CHANGE IS REQUIRED) UPDATE CSM MNVR PAD (PLANE CHANGE) UPLINK CMC CSM STATE VECTOR PLANE CHANGE TARGET LOAD DUMP DSE
		106:30				
(IF PLANE CHANGE IS REQUIRED) MANEUVER TO PLANE CHANGE BURN ATTITUDE R 1.1, P 166.3/2.9, Y 358.7		106:42				
SEXTANT STAR CHECK P30 EXTERNAL ΔV		106:50				
P40 SPS THRUST GDC ALIGN TO IMU		107:00				

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	106:00 - 107:00	5 / 16	3-73

FLIGHT PLAN

CSM **CMP**

2030 EDT
107:00

SPS, PLANE CHANGE
GETI = 107:05:33
ΔV=NOMINALLY ZERO

R 1.1, P 244.2/2.9, Y 358.7

BATTERY CHARGE, BATTERY B

P52 IMU REALIGN
OPTION 1 PREFERRED
PULSE TORQUE TO
LIFT OFF REFSMMAT

PRESLEEP CHECKLIST

MANEUVER TO SLEEP ATTITUDE

REST PERIOD
(4 HOURS)

R 82, P 128/218, Y 0
HGA P -10, Y 258

MSFN

107:25
107:30
107:36
107:43
REV 17
108:00

MSFN

LM

CDR

REST PERIOD
(4 HOURS)

LMP

REST PERIOD
(4 HOURS)

CSM
PRE SLEEP CHECKLIST
CREW STATUS REPORT (RADIATION, MEDICATION)
CYCLES O_2 & H_2 FANS
CHLORINATE POTABLE WATER
VERIFY:
WASTE MNGT OVBD DRAIN VLV - OFF
WASTE STOW VENT VLV - CLOSED
EMERG CABIN PRESS VLV - BOTH
SURGE TANK O_2 VLV - ON
REPRESS PACK O_2 VLV - OFF
POTABLE H_2O HTR - OFF
LM TUNNEL VENT VLV - OFF
SELECT COMM NORMAL LUNAR CONFIGURATION
EXCEPT:
S-BD SQUELCH - ENABLE
HGA TRACK - REACQ
HAG BEAM - NARROW
HGA P -10, Y 258

MCC-H

UPLINK CMC
DESIRED ORIENT
(LIFT OFF)

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	107:00 - 108:00	5 / 16-17	3-74

FLIGHT PLAN

CSM

CMP

2130 EDT

108:00

108:11

108:30

108:42

108:48

109:00

REST PERIOD
(4 HOURS)

M S F N

M S F N

LM

CDR

REST PERIOD
(4 HOURS)

LMP

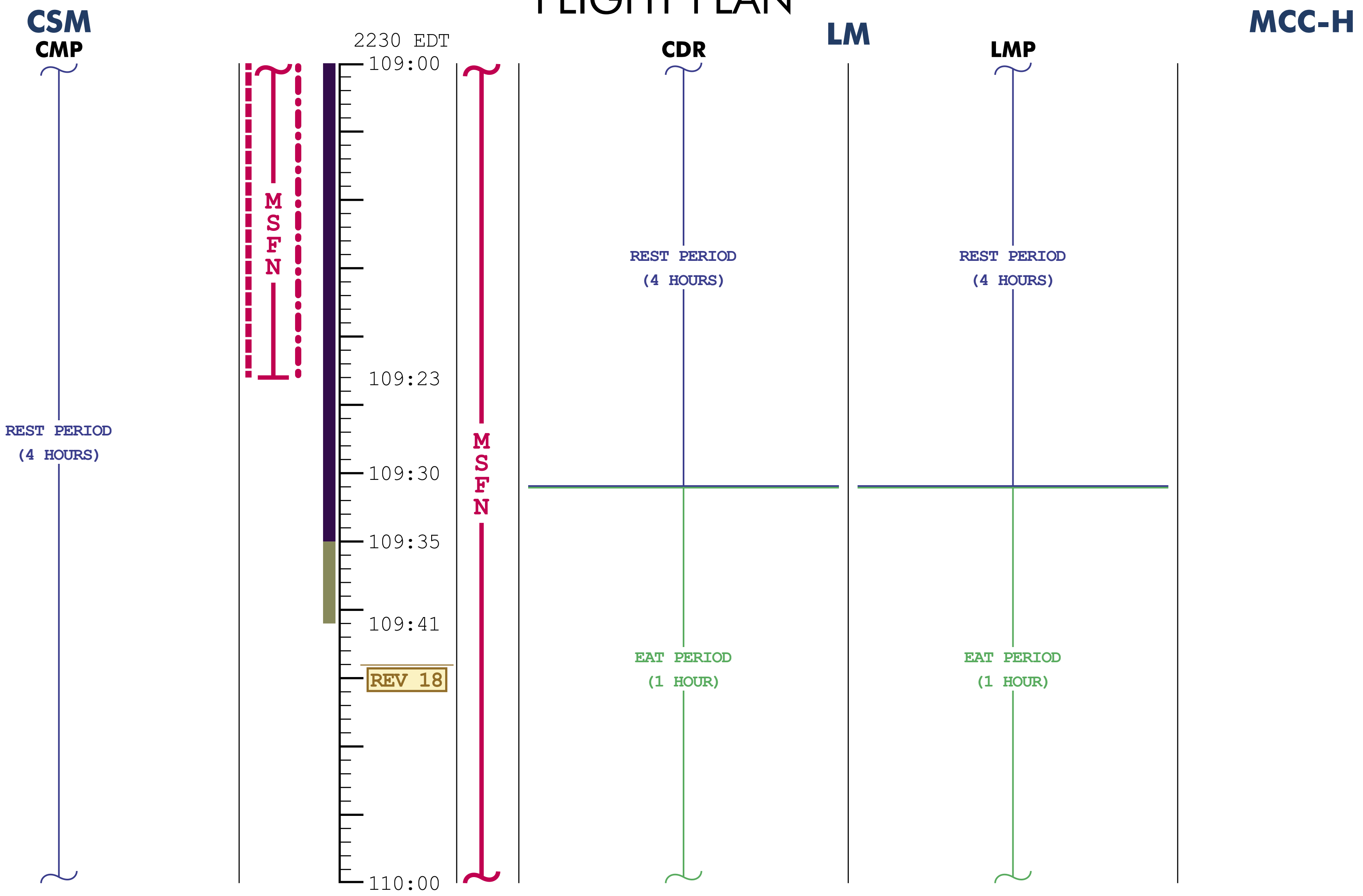
REST PERIOD
(4 HOURS)

MCC-H

DUMP DSE

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	108:00 - 109:00	5 / 17	3-75

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	109:00 - 110:00	5 / 17-18	3-76

FLIGHT PLAN

CSM
CMP

2330 EDT
110:00

LM
CDR
LMP

MCC-H

110:09

EAT PERIOD
(1 HOUR)

EAT PERIOD
(1 HOUR)

DUMP DSE

UPDATE LM
CAMERA EXPOSURE
UPDATED FOR LM AZIMUTH
AND T_7 THRU T_{10}

COPY UPDATE

CHANGE CO_2 FILTER

REST PERIOD
(4 HOURS)

STAY/NO-STAY FOR EVA PREP
CREW STATUS REPORT (SLEEP, RADIATION)

STAY/NO-STAY

110:30

MSFN

CREW STATUS

LM CONSUMABLES UPDATE
GET:___ ___ ___:___ ___
RCS A _______ B _______
DESC O_2 ___________
DESC A-H ___________
ASC A-H ___________

SYSTEMS PREPARATION FOR EGRESS
C&W LIGHT CK, ADJUST INTERIOR LIGHTING

110:40

PREPARATION FOR EGRESS
STOW LOOSE ITEMS AND ARMREST
PREPARE CAMERAS

16mm/HCEX/AS PER DECAL
60mm/FRESH HCEX/AS PER DECAL
80mm/HCEX/AS PER DECAL

MSFN

110:47

PLSS/OPS DONNING
UNSTOW PLSS AND OPS
CONFIGURE PLSS AND OPS FOR DONNING

111:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	110:00 - 111:00	5 / 18	3-77

FLIGHT PLAN

CSM CMP	0030 EDT	LM CDR / LMP	MCC-H
REST PERIOD (4 HOURS)	111:00 (MSFN)	LMP UNSTOW AND DON OVERSHOES ATTACH OPS TO PLSS CDR UNSTOW AND DON OVERSHOES ATTACH OPS TO PLSS LMP DON PLSS UNSTOW AND CONNECT RCU VERIFY PLSS SWITCH AND VALVE POSITIONS	
	111:21	PREPARE CDR PLSS FOR DONNING CDR DON PLSS UNSTOW AND CONNECT RCU VERIFY PLSS SWITCH AND VALVE POSITIONS	
	111:30		
CO_2 FILTER CHANGE NO. 9 (11 INTO A, STORE 9 IN A3)	111:33		
	111:39		
O_2 FUEL CELL PURGE	REV 19		
EAT PERIOD (1 HOUR)		<u>PLSS/EXTRA VEHICULAR COMM SYSTEM ELECTRICAL CHECKOUT</u> AUDIO SWITCHES CHECK ACTIVATE PLSS COMM SYSTEMS	
		<u>FINAL EVA EQUIPMENT PREP FOR EGRESS</u> UNSTOW AND CONNECT OPS O_2 HOSE AND ACTUATOR	
		<u>FINAL SYSTEMS PREP FOR EGRESS</u> CONFIRM „GO" FOR CABIN DEPRESS VERIFY C/B, VALVES AND O_2/H_2O QUANTITY	GO/NO-GO
	112:00		

FLIGHT PLAN

CSM CMP	0130 EDT	LM CDR	LM LMP	MCC-H
EAT PERIOD (1 HOUR)	112:00	PREP FOR CABIN DEPRESS CONNECT OPS O_2 HOSES LMP DON HELMET CDR DON HELMET CONNECT PLSS H_2O HOSES DON GLOVES		DUMP DSE
	112:08			
CREW STATUS REPORT (SLEEP) SELECT COMM NORMAL LUNAR CONFIGURATION		PRESSURE INTEGRITY CHECK PLSS O_2 ON	SET CHRONOMETER	START EVA
	112:30	FINAL PRE-EVA OPERATIONS DEPRESS CABIN FINAL SYSTEMS CHECKS PLSS H_2O ON	OPEN FWD HATCH	0+00
	112:39	INITIAL EVA EGRESS TO PLATFORM RELEASE MESA DESCEND LADDER REST/CHECK EMU SYSTEM	ASSIST AND MONITOR CDR TURN TV ON ACT 16mm CAMERA	0+10 UPDATE CSM LM ACQUISITION TIME
COPY PAD (SEE GET 114:20)	112:45			
		ENVIRONMENTAL FAMILIARIZATION CHECK STABIL, MOBIL, EMU	MONITOR CDR OPERATE 16mm CAMERA	0+20
		CONT SAMPLE COLLECTION COLLECT AND STOW SAMPLE		
	113:00			0+30

MSFN

MSFN

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	112:00 - 113:00	5 / 19	3-79

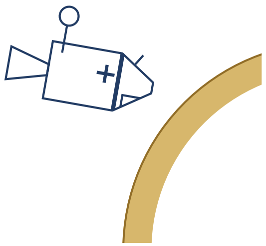
FLIGHT PLAN

CSM
CMP

SET UP CAMERA FOR TRACKING

EL/250/BW-BRKT
INT (f5.6, 250, INF)

PITCH DOWN 172° TO HEADS DOWN
FOR LUNAR SURFACE OBSERVATION,
ORB RATE



R 180, P 282/44, Y 0

0230 EDT
113:00
MSFN
113:19
113:30
113:32
113:38
REV 20
MSFN
114:00

LM
CDR

PRELIMINARY CHECKS
CK LM STATUS
CK LIGHTING VISIBILITY

REST
MONITOR AND PHOTOGRAPH
LMP EGRESS

TV DEPLOYMENT
CAMERA EQPT FROM MESA
CARRY TV TO SITE
MOUNT TRIPOD, PANORAMA,
POSITION FOR EVA
PHOTOGRAPH SWC
PHOTO BULK SAMPLE AREA

BULK SAMPLE COLLECTION
CAMERA ON MESA
PREPARE SRC
COLLECT ROCK FRAGMENTS AND
LOOSE MATERIAL
WEIGH SAMPLE
PACK AND SEAL SRC,
CONNECT TO LEC
REST

LM INSPECTION
INSPECT QUAD IV, +Y GEAR
EVAL TERRAIN, VISIBILITY
INSPECT QUAD III, -Z GEAR
PHOTO QUAD II, EASEP
OFF LOADING
INSPECT, PHOTO -Y GEAR
PHOTO PANORAMA
TAKE CLOSEUP PHOTOS

EASEP DEPLOYMENT

LMP

STILL-CAMERA TO SURFACE
FINAL LM CK
EVA GO

INITIAL EVA
EGRESS
DESCEND TO SURFACE

ENVIRONMENT FAMILIARIZATION
CK BALANCE, STABILITY, REACH,
WALKING, EMU

SWC DEPLOYMENT
DEPLOY SWC IN SUN

EVA AND ENIRON EVAL
EVAL EVA CAPABILITY AND
EFFECTS
EVAL LIGHTING/VISIBILITY
AND SURFACE CHARACTERISTICS
PHOTO PANORAMA

LM INSPECTION
PHOTO QUAD I, +Z GEAR
PHOTO BULK SAMPLE AREA
DEPLOY ALSCC
PHOTO QUAD IV, +Y GEAR
PHOTO PANORAMA
PHOTO QUAD III, -Z GEAR
CAMERA TO CDR

EASEP DEPLOYMENTS
REMOVE EXPERIMENTS

MCC-H

0+30
EVA GO
0+40
0+50
1+00
1+10
1+20
1+30

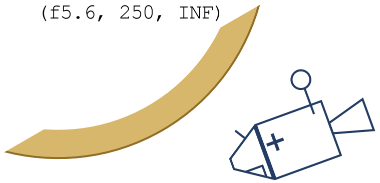
MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	113:00 - 114:00	5 / 19-20	3-80

FLIGHT PLAN

CSM
CMP

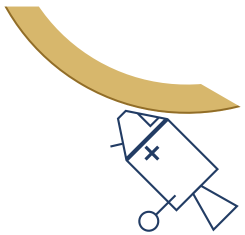
0330 EDT

EL/250/BW-BRKT, INT
(f5.6, 250, INF)



IF CONVENIENT CHANGE
  SHUTTER TO 1/125
PITCH UP 38°
ROLL 180° TO HEADS UP
R 0, P 320/260, Y 0
PITCH DOWN, PHOTOGRAPH LM
  WHILE TRACKING THROUGH COAS

STOP PITCH AND ROLL 180° TO
  HEADS DOWN ATTITUDE FOR
  SURFACE OBSERVATIONS
STOP CAMERA



R 180, P 282/185, Y 0
HGA P -7, Y 183

MSFN

114:00
114:06
114:30
114:37
114:43
115:00

MSFN

LM
CDR

SELECT DEPLOY SITE
CARRY CAMERAS
DEPLOY LR^3 EXPERIMENT
PHOTO EXPERIMENTS

DOCUMENTED SAMPLE COLLECTION
REST/PHOTO LMP
CLOSE-UP PHOTOS
TETHER SAMPLE BAG TO LMP
PHOTO SAMPLING
UNSTOW GNOMON
PHOTO DS AREA
PHOTO SAMPLE COLLECTION
STOW ALSCC FILM
COLLECT ENVIRONMENTAL SAMPLES
RETRIEVE AND STOW SWC
PACK SRC
CLOSE AND SEAL SRC
REST/PHOTO LMP

SRC TRANSFER
TRANSFER BULK SRC AND STILL
  CAMERA MAGAZINE
PHOTO LMP
REST
TRANSFER DS SRC

LMP

SELECT DEPLOY SITE
CARRY EXPERIMENTS
DEPLOY PSE
TAKE CLOSEUP PHOTOS

DOCUMENTED SAMPLE COLLECTION
MOVE BULK SRC TO STRUTS OR
  FOOT PAD
PREPARE DS SRC

COLLECT CORE TUBE SAMPLE
UNSTOW TOOLS
COLLECT SAMPLES
STOW ALSCC FILM
COLLECT ENVIRONMENTAL SAMPLES
COLLECT LOOSE MATERIAL
CORE TUBE SAMPLE

EVA TERMINATION
WIPE SUIT AND EMU
WIPE FEET ON LANDING PAD
  AND LADDER
ASCEND LADDER
INGRESS CABIN
CHECK LM
OPERATE SEQ CAMERA
RECEIVE AND STOW SRC
  AND MAGAZINE
RECEIVE AND STOW SRC

MCC-H

1+30

1+40

DUMP DSE

1+50

LM ACQUISITION GET:
__ __ __:__ __:__ __

2+00

2+10

2+20

2+30

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	114:00 - 115:00	5 / 20	3-81

FLIGHT PLAN

CSM — **CMP** | 0430 EDT | **LM** — **CDR** / **LMP** | **MCC-H**

CMP

PRE SLEEP CHECKLIST
CREW STATUS REPORT
(RADIATION, MEDICATION)
CYCLES O_2 & H_2 FANS
CHLORINATE WATER
VERIFY:
WASTE MNGMT OVBD DRAIN VLV - OFF
WASTE STOW VENT VLV - CLOSED
EMERG CABIN PRESS VLV - BOTH
SURGE TANK O_2 VLV - ON
REPRESS PACK O_2 VLV - OFF
POTABLE H_2O HTR - OFF
SELECT COMM NORMAL LUNAR
CONFIGURATION - EXCEPT:
S-BD SQUELCH - ENABLE
HGA TRACK - REACQ
HAG BEAM - NARROW
HGA P -59, Y 355

EAT PERIOD
(1 HOUR)

Timeline: 115:00 — 115:18 — 115:30 — 115:37 REV 21 — 116:00

MSFN

MSFN

LM — CDR

TERMINATE EVA
WIPE FEET ON LANDING PAD AND LADDER
ASCEND LADDER
CABIN REPRESS

LM — LMP

CLOSE FWD HATCH

LM (CDR / LMP)

PPOST EVA SYSTEMS CONFIGURATION
VERIFY CAUTION LIGHTS OFF
DISCONNECT RCU
DISCONNECT OPS O_2 HOSES
CONNECT LM O_2 HOSES
CONFIGURE VALVES AND CIRCUIT BREAKERS
DISCONNECT PLSS H_2O HOSES
SWITCH TO LM COMM SYSTEM

(TV-OFF)

PLSS/OPS DOFFING
REMOVE LMP RCU
OPS CHECK
STOW PLSS/OPS ON CABIN FLOOR
REMOVE CDR RCU
STOW PLSS/OPS ON CABIN FLOOR

80mm/HCEX/EVA CARD #1
3 FRAMES EACH, FAR & NEAR FIELD (FOCUS 50')
AND
80mm/BW/EVA CARD #1
3 FRAMES EACH, FAR & NEAR FIELD (FOCUS 20')

FINAL SYSTEMS CONFIGURATION

PREP FOR EQUIPMENT JETTISON
REPORT PLSS FEEDWATER
REMOVE OPS FROM PLSS

MCC-H

2+30

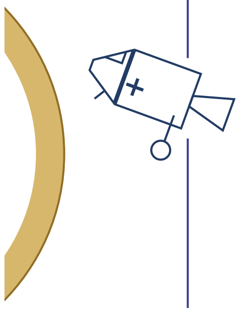
2+40
END EVA

COPY REPORT

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	115:00 - 116:00	5 / 20-21	3-82

FLIGHT PLAN

CSM CMP	0530 EDT	LM CDR	LM LMP	MCC-H
EAT PERIOD (1 HOUR)	116:00	STOW EQUIPMENT IN LHSSC		
	116:04	PRESSURE INTEGRITY CHECK CHECK VALVE POSITIONS VERIFY GAGE READINGS		DUMP DSE
MANEUVER TO SLEEP ATTITUDE R 82, P 256/218, Y 0 HGA P -59, Y 355		CABIN DEPRESS OPEN RELIEF AND DUMP VALVES		
		HATCH OPENING		
		EQUIPMENT JETTISON JETTISON 2 PLSS, LHSSC AND 1 ARMREST		
	116:30	CABIN REPRESS RELIEF AND DUMP VALVES - AUTO VERIFY MASTER ALRM AND WARN LIGHTS ON POST EVA SYSTEMS CONFIGURATION		
		FINAL SYSTEMS CONFIGURATION		
	116:36	POST EVA CABIN CONFIGURATION STOW EQUIPMENT RECONFIGURE CAMERAS		
REST PERIOD (4 HR 50 MIN)	116:42	EAT PERIOD (40 MIN)	EAT PERIOD (40 MIN)	UPDATE LM T_{10} THRU T_{13}
	117:00			

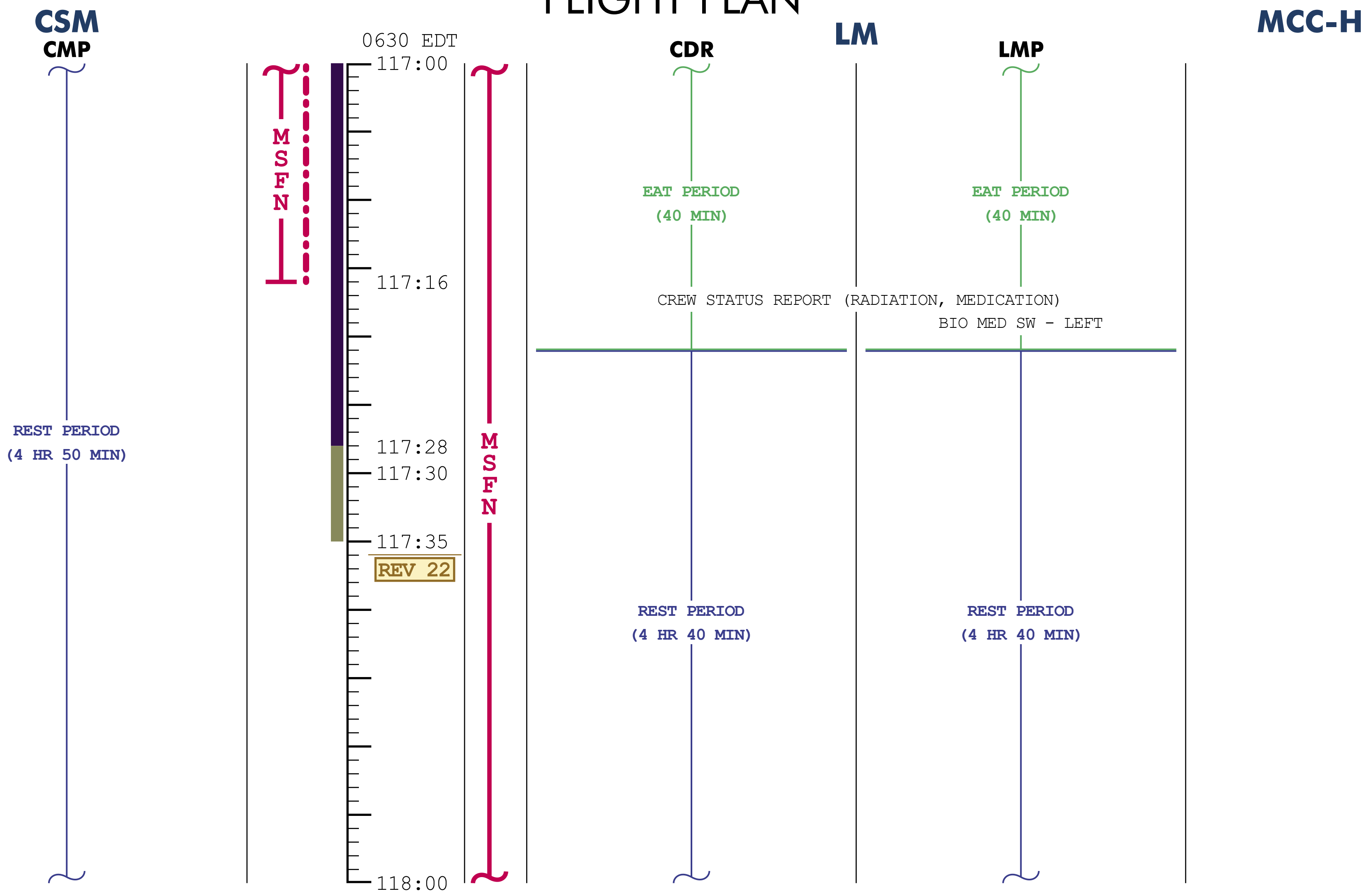


MSFN

MSFN

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	116:00 - 117:00	5 / 21	3-83

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	117:00 - 118:00	5 / 21-22	3-84

FLIGHT PLAN

CSM

CMP

REST PERIOD
(4 HR 50 MIN)

MSFN

0730 EDT
118:00
118:02
118:30
118:34
118:40
119:00

MSFN

LM

CDR

REST PERIOD
(4 HR 40 MIN)

LMP

REST PERIOD
(4 HR 40 MIN)

MCC-H

DUMP DSE

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	118:00 - 119:00	5 / 22	3-85

FLIGHT PLAN

CSM | **LM** | **MCC-H**

CMP

0830 EDT

119:00

119:14

119:27
119:30
119:33

REV 23

120:00

120:30
120:33

120:39

121:00

M S F N

M S F N

REST PERIOD
(4 HR 50 MIN)

CDR

REST PERIOD
(4 HR 40 MIN)

LMP

REST PERIOD
(4 HR 40 MIN)

DUMP DSE

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	119:00 - 121:00	5 / 22-23	3-86

FLIGHT PLAN

CSM

CMP

1030 EDT

121:00

MSFN

SET LEB TIMER TO NOMINAL
LIFT OFF TIME AND STOP

121:12

EAT PERIOD
(1 HOUR)

121:25

121:30

121:32

REV 24

MSFN

LM

CDR

REST PERIOD
(4 HR 40 MIN)

LMP

REST PERIOD
(4 HR 40 MIN)

MCC-H

121:58

122:00

DUMP DSE

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	121:00 - 122:00	5 / 23-24	3-87

FLIGHT PLAN

CSM

CMP

SELECT COMM: NORMAL LUNAR
CONFIGURATION
CREW STATUS REPORT (SLEEP)

V45 RESET LUNAR SURFACE FLAG

1130 EDT
122:00
122:30
122:31
122:37
123:00

MSFN

MSFN

LM

CDR

CREW STATUS REPORT (SLEEP)
RR - ON, SELF TEST

EAT PERIOD
(35 MIN)

LMP

AGS TURN ON, SELF TEST
AND SYSTEM TESTS
INITIALIZE AGS TIME
REPORT BIAS TO MCC-H

REPORT:

P57 - GRAVITY AND ONE
CELESTIAL BODY (REFSMMAT)
N04: ___ ___ ___.___ ___
N71: ___ ___
N93:
X ___ ___.___ ___ ___
Y ___ ___.___ ___ ___
Z ___ ___.___ ___ ___
GET ___ ___ ___:___ ___:___ ___

EAT PERIOD
(35 MIN)

MCC-H

COPY TIME BIAS

UPLINK LGC
CSM STATE VECTOR
(INSERTION +18 MIN)
PGNCS GYRO COMP
(IF REQUIRED)

UPLINK CMC
CSM STATE VECTOR
(INSERTION +18 MIN)
NOMINAL LM S. V.
(INSERTION +18 MIN)

FLIGHT PLAN

CSM

CMP

1230 EDT

123:00

COPY CONSUMABLES UPDATE

123:10

123:24

123:30

REV 25

O_2 FUEL CELL PURGE

SET UP CAMERA FOR DOCKING
16mm/18/CEX-BRKT
MIR (f8, 250, INF) 6 fps

123:56

RR TRANSPONDER - PWR

124:00

MSFN

LM

CDR

COPY CONSUMABLES UPDATE

RCS HOT FIRE

LMP

COPY ASCENT PAD
LOAD PAD DATA

VERIFY AGS:
AZIMUTH CORRECTION = 0
H = 60,000 FT
H DOT = 32 FPS
NO S-BAND YAW MNVR
ORBIT INSERTION MODE

SET CAMERA FOR ASCENT
16mm/HCEX/OVERHEAD
MIR (f4, 500, INF) 12 fps

REPORT:

P57 - GRAVITY AND ONE CELESTIAL BODY (T-ALIGN)
N04: ___ ___ ___.___ ___
N71: ___ ___
N93:
X ___ ___.___ ___ ___
Y ___ ___.___ ___ ___
Z ___ ___.___ ___ ___
GET ___ ___ ___:___ ___:___ ___

ENTER AGS LUNAR ALIGN

MCC-H

UPDATE LM
ASCENT PAD

CONSUMABLE UPDATE
(Δ FROM NOMINAL)

GET: ___ ___ ___:___ ___
RCS TOT ________
A ________
B ________
C ________
D ________
H_2 TOT ________
O_2 TOT ________

LM CONSUMABLES UPDATE

GET: ___ ___ ___:___ ___
RCS A ______ B ______
DESC O_2 ________
DESC A-H ________
ASC A-H ________

FLIGHT PLAN

CSM
CMP

V64 ACQUIRE MSFN

VHF RANGING
MNVR TO SUPPORT LIFT OFF
R 0, P 250/207, Y 0

PITCH DOWN, 0.2°/SEC

CONFIRM INSERTION

VHF RANGING

REPORT:

P52 - (LIFT OFF REFSMMAT)
OPTION 3
N71: __ __, __ __
N05: __ __ __. __ __
N93:
X __ __. __ __ __
Y __ __. __ __ __
Z __ __. __ __ __
GET __ __ __: __ __: __ __

1330 EDT

124:00

MSFN

124:30
124:31

124:36
124:37

125:00

MSFN

LM
CDR

LOAD DAP - 12012
DON HELMET AND GLOVES
P12 ASCENT PROGRAM
RR - ON

PRELAUNCH SWITCH CK
VERIFY RESTRAINTS

TIG -5 SEC, ABORT STAGE

APS, LIFT OFF

RR LOCK ON, MODE II

ORBIT INSERTION 124:30:44

RR - OFF
VERIFY INSERTION VEL

P52 - (LIFT OFF REFSMMAT)
OPTION 3
N71: __ __, __ __
N05: __ __ __. __ __
N93:
X __ __. __ __ __
Y __ __. __ __ __
Z __ __. __ __ __
GET __ __ __: __ __: __ __

RR - ON

LMP

DON HELMET AND GLOVES

GO/NO-GO FOR PGNCS
ASCENT GUIDANCE AND
LIFT OFF THIS REV
PRELAUNCH SWITCH CK
VERIFY RESTRAINTS

LIFT OFF COMM
START 16mm CAMERA
V47 INITIALIZE AGS
AGS GUIDANCE STEERING

TIG: 124:23:26
BT: 7 MIN 18 SEC
ΔV: 6060 FPS
ORBIT: 60 KFT x 45 NM

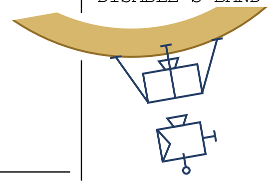
P00 - DOWNLINK LM S. V.
STOP 16mm CAMERA
ECS CHECK
V48 LOAD DAP N46, 12002
V56, V41 - RR - OFF
TURN ON TRACK LIGHT

V93 (BEFORE FIRST MARK)
V80, V47 INITIALIZE AGS
P32 CSI PRETHRUST

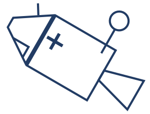
MCC-H

UPDATE LM
GO/NO-GO

LIFT OFF -6 MIN
DISABLE S-BAND RELAY

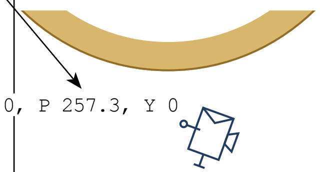


LM FDAI: R 0, P 0, Y 0

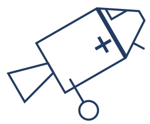


CSM: R 0, P 320/207, Y 0

UPLINK CMC
LM STATE VECTOR



LM FDAI: R 0, P 257.3, Y 0



CSM: R 0, P 235/119, Y 0

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	124:00 - 125:00	6 / 25	3-90

FLIGHT PLAN

CSM

CMP

VHF RANGING

P40
SPS CHECKLIST

CSI, BACKUP
P76 TARGET ΔV

P20 AUTO MANEUVER
TO SEXTANT TRACK

VHF RANGING

P76 TARGET ΔV
(LM PC BURN DATA)

SEXTANT TRACKING
VHF RANGING

1430 EDT

125:00
125:08
125:10
125:22
125:26
125:29
125:30
REV 26
125:32
125:54
125:57
126:00

MSFN

LM

CDR

P20 RENDEZVOUS NAVIGATION
ACQUIRE AND TRACK CSM
MAINTAIN RR
TRACKING ATTITUDE
SLEW STEERABLE ANT
ANT P 58, Y -38

V83 SET ORDEAL

P41 RCS THRUSTING

RCS, CSI

VERIFY RESIDUALS

Z AXIS BORESIGHT

MAINTAIN RR AND
VHF TRACKING ATTITUDE

P41 RCS THRUSTING

RCS, PLANE CHANGE

LMP

V32 - MARKS = 5

V32 - MARKS = 10
RCS TEMP/PRESS/QTY CK
AFT OMNI, PCM LBR

FINAL CSI COMPUTATION
V90 OUT OF PLANE
V47 INITIALIZE AGS (PCM-HI)

CSI DATA TO CSM (PCM-LO)
LOAD AGS ΔV

TIG: 125:21:19
BT: 45 SEC
ΔV: 49.5 FPS

V76, V67, VHF RANGING
P33 CDH PRETHRUST
V93 MARKS = 4
V32 MARKS = 3
V90 OUT OF PLANE

V32 MARKS = 10

P30 EXTERNAL ΔV
V90 OUT OF PLANE

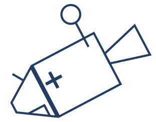
LOAD AGS ΔV

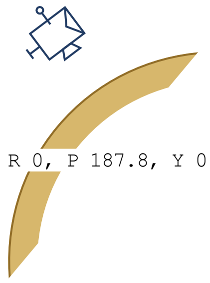
TIG: 125:50:28
ΔV=NOMINALLY ZERO

V76, P33 CDH PRETHRUST

MCC-H

CSM: R 0, P 180/271, Y 0

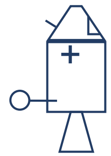
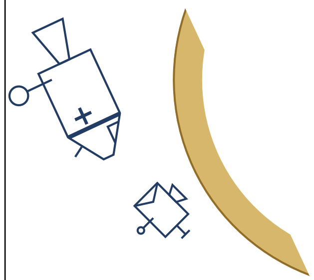




LM FDAI: R 0, P 187.8, Y 0

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	125:00 - 126:00	6 / 25-26	3-91

FLIGHT PLAN

CSM CMP	1530 EDT	LM CDR	LM LMP	MCC-H
	126:00 MSFN	MAINTAIN RR AND VHF TRACKING ATTITUDE	V93 MARKS = 4 ACQUIRE MSFN S-BAND STEERABLE ANTENNA P -58 Y -38	LM FDAI: R 0, P 352.8, Y 0 
V90 YDOT TRANSMIT YDOT TO LM P33 FINAL COMPUTATION			V32 MARKS = 5 RCS TEMP/PRESS/QTY CK	
		V83 SET ORDEAL P41 RCS THRUSTING	ECS CHECK FINAL COMPUTATION	
P41 CDH BACKUP			V90 OUT OF PLANE COPY CSM YDOT, LOAD NEG V47 INITIALIZE AGS	LOAD ΔV
P76 TARGET ΔV		RCS, CDH	TIG: 126:19:37 BT: 1.9 SEC ΔV: 4.3 FPS	
P20 AUTO MANEUVER TO SEXTANT TRACK VHF RANGING			V76, P34 TPI PRETHRUST V93 MARKS = 4 V32 MARKS = 3	CSM: R 180, P 264/177, Y 0
	126:28 126:30 MSFN	MAINTAIN RR AND VHF TRACKING ATTITUDE	V32 MARKS = 10	
	126:34			
SEXTANT TRACKING VHF RANGING			RCS TEMP/PRESS/QTY CK ECS CHECK	CSM: R 0, P 208/9, Y 0 
P34 TPI			FINAL COMPUTATION COPY CSM YDOT, LOAD NEG V47 INITIALIZE AGS COPY CSM TPI SOLUTION LOAD AGS ΔV	
SET EVENT TIMER P40 ΔV THRUST SPS CHECKLIST		P41 RCS THRUSTING COUNTDOWN TO CSM		
P76 TARGET ΔV		RCS, TPI VERIFY RESIDUALS	TIG: 126:58:08 BT: 22.4 SEC ΔV: 24.8 FPS	LM FDAI: R 0, P 274.6, Y 0
	127:00			

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	126:00 - 127:00	6 / 26	3-92

FLIGHT PLAN

CSM **CMP** | 1630 EDT | **LM** **CDR** | **LMP** | **MCC-H**

127:00

P20 AUTO MNVR
P35 TPM PRETHRUST
SXT AND VHF TRACKING

127:06

CDR: ANT P   Y

LMP: V76, V93 (BEFORE FIRST MARK)
P35 TPM PRETHRUST
AFT OMNI, PCM LBR

CMP: P41
MCC1 BACKUP
P76 TARGET ΔV

CDR: P41 RCS THRUSTING

LMP: COMPUTE MCC1 (TPI +15)

RCS, MCC1 | TIG: 127:13:08

LMP: V76, V93 (BEFORE FIRST MARK)
P35 TPM PRETHRUST

CDR: MAINTAIN LOS CSM

CMP: SXT AND VHF TRACKING

127:21

CMP: P35 TPM PRETHRUST
P41
MCC2 BACKUP
P76 TARGET ΔV
V89 MANEUVER TO COAS
    TRACKING ATTITUDE
DON HELMET & GLOVES

127:27

LMP: COMPUTE MCC2 (TPI +30)

CDR: P41 RCS THRUSTING

RCS, MCC2 | TIG: 127:28:08

REV 27

127:30

CDR: V63 RR SELF TEST
P47 THRUST MONITOR

LMP: P00

RCS BRAKING

GET	ΔT FROM TPI	BT SEC	ΔV FT/SEC	RANGE NM	RANGE RATE FT/SEC
127:36:57	28:49	NOMINALLY NOT PERFORMED			
127:39:24	41:16	10.8	12.0	2724	-19.7
127:40:37	42:29	8.8	9.8	1370	-9.8
127:42:16	44:08	4.3	4.8	469	-4.8
127:43:35	45:27	4.2	4.7	89	-0.2

CMP: START 16mm CAMERA
DOCK CHECKLIST
LOAD DAP R1 = 61112
         R2 = 11111
FOR LM ASCENT STAGE DOCKING
CMC - AUTO

127:53

128:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	127:00 - 128:00	6 / 26-27	3-93

FLIGHT PLAN

CSM

CMP

1730 EDT

128:00

CONTACT: CMC - FREE NULL RATES

ROLL RIGHT 60°
PITCH UP 53°

GO INERTIAL
PRESS CSM TO 5.5 PSIA
DISABLE JETS B3 & C4
ADJUST O_2 FLOW TO .6 LBS/HR
PRESS TUNNEL TO 3 PSID FOR
LEAK CK,
THEN EQUALIZE CM/LM ΔP
INFORM LM WHEN PRESS EQUAL
REMOVE HATCH AND STOW
VERIFY LATCHES
PASS BAGS & BRUSH TO LM

MSFN

128:26

128:30

128:32

129:00

LM

CDR

DOCKING 128:00

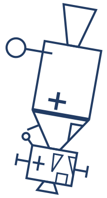
DOFF HELMET & GLOVES
AND TEMPORARILY STOW

OPEN LM HATCH
REMOVE AND STOW PROBE & DROGUE

RETRIEVE THE FOLLOWING ITEMS
FROM CSM:
HELMET STOWAGE BAGS (2)
SRC (ROCK BOX) BAGS (2)
CSC (GRAB SAMPLE) BAG (1)
70mm MAGAZINE BAG (1)
CLOSEUP MAGAZINE BAG (1)
VACUUM BRUSH & HOSE
GLOVE BAGS (2)

CONFIGURE CDR SUIT LOOP FOR
VACUUM CLEANING

LMP



LM FDAI: R 0, P 152, Y 0

DOFF HELMET & GLOVES
AND TEMPORARILY STOW

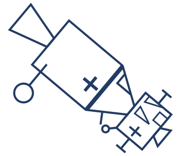
ASSIST CDR

TEMPORARILY STOW
BAGS AND BRUSH

ASSIST CDR

MCC-H

CSM: R 300, P 4/332, Y 0



CSM: R 0, P 102/25, Y 0
HGA: P -53, Y 3

LM FDAI: R 0, P 205, Y 60
ANT: P 173, Y 72

FLIGHT PLAN

CSM CMP	1830 EDT	LM CDR	LM LMP	MCC-H
	129:00			
V66 - TRANS CSM STATE VECTOR TO LM SLOT	129:05	VACUUM BRUSH FWD DUMP VALVE FILTER	UNSTOW AND HOLD SRC's FOR CLEANING	UPLINK CSM STATE VECTOR
		VACUUM SRC's	BAG SRC's AND TRANSFER TO CM	
RETRIEVE SRC's FROM LM AND STOW IN B5 AND B6	129:19	VACUUM: CSC		
		70mm MAGAZINE	HOLD EQUIPMENT FOR CLEANING	
	129:26	CLOSEUP MAGAZINE		
	REV 28			
	129:30	HELMETS	BAG ITEMS AND TRANSFER TO CSM (GLOVES IN HELMETS)	
RETRIEVE BAGGED ITEMS FROM LM AND STOW: CSC - A5; CLOSEUP MAGAZINE - A5; 70mm MAGAZINES - R13; HELMETS - FOOD CONTAINERS		GLOVES		
		VACUUM BRUSH LMP's PGA		
			VACUUM BRUSH CDR's PGA	
	129:51			
	130:00	VACUUM THE BRUSH AND STOW IN ISA		

FLIGHT PLAN

CSM — **CMP**

1930 EDT

130:00

REMOVE ISA CONTENTS AND
STOW. PLACE CM JETTISONABLE
ITEMS INTO ISA AND
TRANSFER ISA TO LM.

130:25

130:30

130:31

UNSTOW AND INSTALL CSM HATCH

HATCH INTEGRITY CHECK
DEPRESSURIZE TUNNEL

131:00

MSFN

LM — **CDR**

DISCONNECT FROM LM AND
TRANSFER TO CM WITH ISA

LMP

RETRIEVE ISA AND INSTALL ON
PANELS 1 & 2

CONFIGURE LM SYSTEMS
FOR JETTISON

DISCONNECT FROM LM HOSES
CLOSE LM HATCH

IVT TO CSM

MCC-H

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	130:00 - 131:00	6 / 28	3-96

MCC-H

FLIGHT PLAN

NOTES

2030 EDT

131:00

131:03

EQUIPMENT STOWAGE

131:18

VACUUM PGA's

131:25

REV 29

SET UP CAMERA FOR LM JETTISON
16mm/18/CEX-BRKT, MIR
(f8, 250, 7) 12 fps

131:30

DAP CONFIGURATION
FOR LM JETTISON
CSM, 0.5° DB, 0.5°/SEC
A/C ROLL, 4 JET

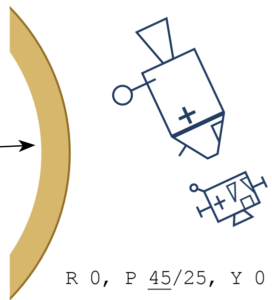
SM RCS CHECK
ENABLE JETS B-3 AND C-4
CONFIGURE DAP - R1=11102, R2=11111

GO/NO-GO FOR PYRO ARM
PYRO LOGIC ARM
THRUST MONITOR - P47
START CAMERA
LM JETTISON
SM RCS CHECK

GO/NO-GO

131:50

GETI = 131:53:05
BT = 3.1 SEC
ΔV = 1 FPS
RETROGRADE
ORBIT: 58.5 x 59.4



R 0, P 45/25, Y 0
HGA P -53, Y 3

132:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	131:00 - 132:00	5 / 29	3-97

FLIGHT PLAN

MCC-H

UPDATE

TEI$_{30}$ MNVR PAD

2130 EDT

132:00

MNVR TO TEI BURN ATTITUDE

V66 - TRANS CSM STATE VECTOR TO LM SLOT
BURN STATUS REPORT
RECORD PRELIMINARY TEI$_{30}$ MNVR PAD

GO INERTIAL

DOFF AND BAG PGA's, HELMETS AND GLOVES

132:23

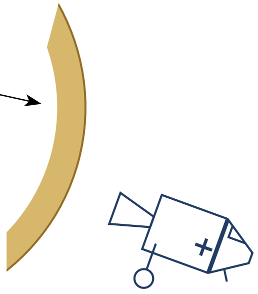
132:30

MSFN

EAT PERIOD

133:00

NOTES



R 1.1, P 93.2/52.6, Y 13.8
HGA P -79, Y 10

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	132:00 - 133:00	6 / 29	3-98

FLIGHT PLAN

2230 EDT

133:00

CO_2 FILTER CHANGE NO. 10
(12 INTO B, STORE 10 IN A3)

EAT PERIOD

133:16

133:23

REV 30

133:30

O_2 FUEL CELL PURGE

133:47

134:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	133:00 - 134:00	6 / 30	3-99

MCC-H

FLIGHT PLAN

NOTES

2330 EDT

134:00

PRI TEI SYSTEMS CKS:
- C&W CK
- CM RCS MON CK
- SM RCS MON CK
- EPS MONITOR CK
- ECS REDUNDANT COMPONENTS CK

UPDATE
- TEI_{30} MNVR PAD
- BLOCK DATA
- (TEI_{31})

134:22

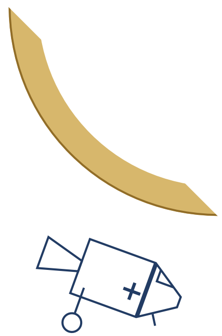
RECORD FINAL TEI_{30} MNVR PAD AND BLOCK DATA
GO/NO-GO FOR TEI_{31} THIS REV

UPLINK CMC
- CSM STATE VECTOR
- TEI TGT LOAD

134:29
134:30

MSFN

V66 - TRANS CSM STATE VECTOR TO LM SLOT



REPORT

P52 - (LIFT OFF REFSMMAT)

N71: __ __, __ __

N05: __ __ __. __ __

N93:

X __ __. __ __ __

Y __ __. __ __ __

Z __ __. __ __ __

GET __ __ __: __ __: __ __

IMU REALIGN - P52
OPTION 3 - REFSMMAT
AND DRIFT CHECK

R 1.1, P 201.4/52.6, Y 13.8
HGA P -78, Y 5

134:58

135:00

P30 EXTERNAL ΔV

THIS PAGE INTENTIONALLY LEFT BLANK.

TEI
BURN CHART

	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
TEI	10°/SEC TAKEOVER	±10° TAKEOVER	BT +2 SEC & ΔV_C = -40 FPS	TRIM X AND Z AXIS TO 0.2 FPS

LOI$_1$ V_{GO}	BT	TRAJECTORY	ABORT MODE
3292.7 - 1436.0	0 - 90	LUNAR ORBIT	MODE III - AFTER 1 REV
1436.0 - 1207.0	90 - 100	UNSTABLE	MODE II - 2 SPS BURNS FOR ORBIT STABILIZATION AND WATER OR CLA LANDING.
1207.0 - 0	100 - 149	UNSTABLE/ HYPERBOLIC	MODE I - 1 BURN AT TEI +2HRS P37 AT SPHERE OF INFLUENCE HYPERBOLIC (ΔV 580 TO 0, BT 125-149)

FLIGHT PLAN

MCC-H

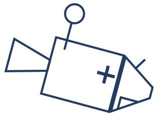
0030 EDT

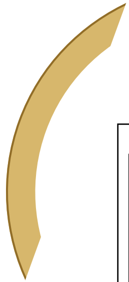
135:00

135:02

SPS THRUST - P40
ROLL TO BURN ATT

R 181.1, P 280.4/52.6, Y 13.8





SXT STAR CK

135:15

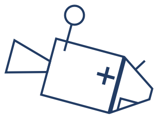
EMS ΔV TEST

DAP CONFIGURATION FOR TEI
CSM, 5° DB, 0.2°/SEC
A/C ROLL, 4 JET
DAP - R1=10111 R2=11111

REV 31

135:21

SM RCS CK

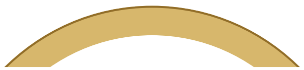


GDC ALIGN TO IMU

TEI

GET: 135:24:34
ULLAGE = 2 JET 16 SEC
ΔV = 3292.7 FPS
BT = 2 MIN 29 SEC

135:30



R 181.1, P 355/52.6, Y 13.8

V48 - DAP UPDATE (S/C WT)
SM RCS MON CK
SPS MON CK
V66 - TRANS CSM STATE VECTOR TO LM SLOT
PITCH DOWN TO ACQ MSFN AND VISUALLY ACQ MOON

MSFN

UPLINK
DESIRED ORIENTATION (PTC)

SET CAMERA FOR POST-TEI
EL/80/CEX (f5.6, 250, INF)
OR
EL/80/BW (f4, 250, INF)

IMU REALIGN - P52
OPTION 1 - PREFERRED
AND STAR CK

136:00

NOTES

BURN STATUS REPORT

X X ☐ :	ΔTIG
X X :	BT
☐ .	V_{gx}
TRIM	
X X X	R
X X X	P
X X X	Y
☐ .	V_{gx}
☐ .	V_{gy}
☐ .	V_{gz}
☐ .	ΔV_C
X X X	FUEL
X X X	OX
X X X	UNBAL

P52 - PULSE TORQUE
TO PTC REFSMMAT
PLATFORM ALIGN
CHECKED WITH OPTICS

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	135:00 - 136:00	6 / TEC	3-101

0130 EDT

136:00 | MSFN

WIPE EXCESSIVE MOISTURE
FROM TUNNEL HATCH AREA

START PTC
P 270° Y 0°

PTC ESTABLISHED IN G&N P,
Y ±30° DB, R RATE OF 0.3°/SEC

P23 - NO COMM, (5 SETS)
TEI +30 MIN (136:00)
MENKENT (30), LNH
MENKENT (30), LNH
ATRIA (34), LNH
NUNKI (37), LFH
NUNKI (37), LFH

:30 EAT PERIOD - ALL

PRE SLEEP CHECKLIST

CREW STATUS REPORT (RADIATION, MEDICATION)
CYCLES O_2 & H_2 FANS
CHLORINATE POTABLE WATER
SELECT NORMAL LUNAR CONFIGURATION
EXCEPT: (FOR COAST ASLEEP)
  S-BD NORMAL MODE VOICE - OFF
  S-BD AUX TAPE - OFF
  TAPE RCDR FWD - OFF
  GO TO HGA OR CONTINUE OMNI
  OPS PER MSFN
OMNI OPS
  S-BD ANT OMNI - OMNI
  S-BD ANT OMNI - B
HI GAIN OPS
  HI GAIN ANT BEAM - NARROW
  HI GAIN ANT TRACK - REACQ
  S-BD ANT - HI GAIN
VERIFY:
  WASTE MNGT OVBD DRAIN - OFF
  WASTE STOW VENT VLV - CLOSED
  EMERG CABIN PRESS VLV - BOTH
  SURGE TK O_2 VLV - OFF
  LM TUNNEL VENT VLV - OFF
  POT H_2O HTR - OFF
AUTO RCS JET SELECT (16) - OFF

ONBOARD READOUT

BAT C ______
PYRO BAT A ______
PYRO BAT B ______
RCS A ______
B ______
C ______
D ______
DC IND SEL TO MNA OR MNB

137:00

:30 REST PERIOD
(10 HOURS)

138:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	136:00 - 138:00	6 / TEC	3-102

MCC-H

FLIGHT PLAN

NOTES

0330 EDT

138:00

:10

:20

:30

:40

:50

139:00

:10

:20

:30

:40

:50

140:00

M
S
F
N

REST PERIOD
(10 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	138:00 - 140:00	6 / TEC	3-103

MCC-H

FLIGHT PLAN

NOTES

0530 EDT

140:00

:10

:20

:30

:40

:50

141:00

:10

:20

:30

:40

:50

142:00

MSFN

REST PERIOD
(10 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	140:00 - 142:00	6 / TEC	3-104

MCC-H

FLIGHT PLAN

NOTES

0730 EDT

142:00

:10

:20

:30

:40

:50

143:00

:10

:20

:30

:40

:50

144:00

MSFN

REST PERIOD
(10 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	142:00 - 144:00	6 / TEC	3-105

MCC-H

FLIGHT PLAN

NOTES

0930 EDT

144:00

:10

:20

:30

:40

:50

145:00

:10

:20

:30

:40

:50

146:00

MSFN

REST PERIOD
(10 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	144:00 - 146:00	6 / TEC	3-106

FLIGHT PLAN

MCC-H

PHOTO AS CONVENIENT

EARTH:
EL/250/CEX-RING
(11, 250, INF)

MOON:
EL/250/BW-RING
(5.6, 250, INF)

1130 EDT

146:00 :10 :20 :30 :40 :50 147:00 :10 :20 :30 :40 :50 148:00

MSFN

REST PERIOD
(10 HOURS)

CO_2 FILTER CHANGE NO. 11
(13 INTO A, STORE 11 IN A3)

EAT PERIOD - ALL

H_2 PURGE LINE HTR - ON

O_2 & H_2 FUEL CELL PURGE

POST SLEEP CHECKLIST

CREW STATUS REPORT (SLEEP)
CYCLE O_2 & H_2 FANS
GDC ALIGN TO IMU
CONSUMABLES UPDATE
SELECT NORMAL LUNAR CONFIGURATION
EXCEPT:
S-BD AUX TAPE - OFF
TAPE RCDR FWD - OFF
POT H_2O HTR - ON

PTC

NOTES

P23 - NO COMM, (5 SETS)
TEI +11:30 (147:00)
SPICA (26), LNH
SPICA (26), LNH
MENKENT (30), LNH
NUNKI (37), LFH
NUNKI (37), LFH

CONSUMABLE UPDATE
(Δ FROM NOMINAL)

GET: ____________

RCS TOT ____________

A ____________

B ____________

C ____________

D ____________

H_2 TOT ____________

O_2 TOT ____________

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	146:00 - 148:00	7 / TEC	3-107

MCC-H

1330 EDT

FLIGHT PLAN

NOTES

148:00

:10 WIPE EXCESSIVE MOISTURE FROM TUNNEL HATCH AREA

P23 - NO COMM, (5 SETS)
TEI +13:00 (148:30)
ALPHERATZ (01), EFH
DIPHDA (02), EFH
MIRFAK (10), ENH
MIRFAK (10), ENH
ALDEBARAN (11), ENH

:20

:30

:40

PTC

UPLINK
CSM STATE VECTOR
MCC5 TGT LOAD

:50 V66 - TRANS CSM STATE VECTOR TO LM SLOT

MSFN

149:00

UPDATE
MCC5 MNVR PAD

:10 RECORD MCC5 MNVR PAD

P52 - (PTC REFSMMAT)
N71: __ __, __ __
N05: __ __ __. __ __
N93:
X __ __. __ __ __
Y __ __. __ __ __
Z __ __. __ __ __
GET __ __ __: __ __: __ __

:20

IMU REALIGN - P52
OPTION 3 - REFSMMAT

:30

:40

:50 EXT ΔV - P30

SPS/RCS THRUST - P40/41

150:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	148:00 - 150:00	7 / TEC	3-108

THIS PAGE INTENTIONALLY LEFT BLANK.

MCC
BURN CHART

	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC5	10°/SEC TAKEOVER	10° TAKEOVER	BT +1 SEC	TRIM X AXIS ONLY

1530 EDT

150:00 MNVR TO BURN ATT

PTC ESTABLISHED IN G&N P, Y ±30° DB, R RATE OF 0.3°/SEC

:10 SXT STAR CK

EMS ΔV TEST

SM RCS MON CK

:20

TEI + 15 HRS

GDC ALIGN TO IMU

MCC5 ΔV=NOMINALLY ZERO

MSFN

SM RCS MON CK

SPS MON CK

START PTC

P 270° Y 0°

150:30

V66 - TRANS CSM STATE VECTOR TO LM SLOT

BURN STATUS REPORT

:40

:50

151:00 BATTERY CHARGE, BATTERY A

BURN STATUS REPORT

X X ☐ :	ΔTIG
X X :	BT
☐ .	V_{gx}
TRIM	
X X X	R
X X X	P
X X X	Y
☐ .	V_{gx}
☐ .	V_{gy}
☐ .	V_{gz}
☐ .	ΔV_C
X X X	FUEL
X X X	OX
X X X	UNBAL

MCC-H

FLIGHT PLAN

NOTES

1630 EDT

151:00

:10

:20

:30

:40

:50

152:00

:10

:20

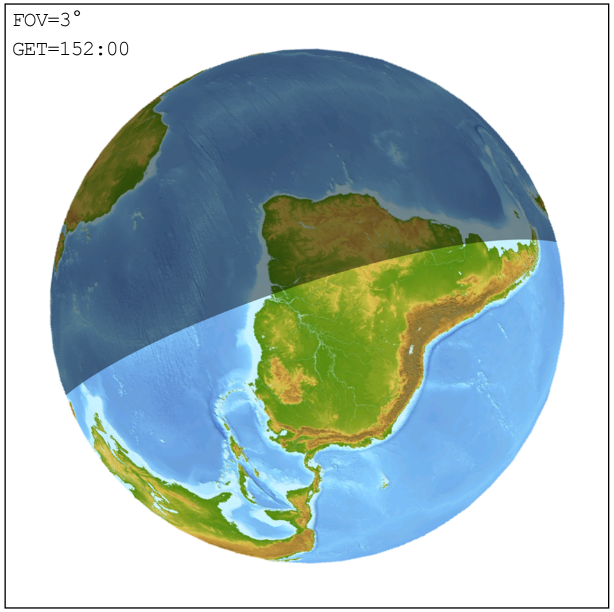
:30

:40

:50

153:00

MSFN



PTC

P23 - NO COMM, (5 SETS)
TEI +15:30 (152:00)
DIPHDA (02), EFH
DIPHDA (02), EFH
NAVI (03), ENH
MIRFAK (10), ENH
ALDEBARAN (11), ENH

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	151:00 - 153:00	7 / TEC	3-110

MCC-H

FLIGHT PLAN

NOTES

1830 EDT

153:00

:10

:20

:30

:40

:50

154:00

:10

:20

:30

:40

:50

155:00

M S F N

EAT PERIOD - ALL

PTC

P23 - NO COMM, (3 SETS)
TEI +19:00 (154:30)
SPICA (26), ENH
ANTARES (33), EFH
NUNKI (37), EFH

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	153:00 - 155:00	7 / TEC	3-111

MCC-H

2030 EDT

FLIGHT PLAN

NOTES

155:00
:10
:20
:30
:40
:50
156:00
:10
:20
:30
:40
:50
157:00

MSFN

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	155:00 - 157:00	7 / TEC	3-112

157:00
:10
:20
:30
:40
:50
158:00
:10
:20
:30
:40
:50
159:00

MSFN

PTC

WIPE EXCESSIVE MOISTURE FROM TUNNEL HATCH AREA

O_2 FUEL CELL PURGE

CO_2 FILTER CHANGE NO. 12
(14 INTO B, STORE 12 IN A3)

P23 - NO COMM, (5 SETS)
TEI +22:30 (158:00)
DIPHDA (02), EFH
DIPHDA (02), EFH
MENKAR (07), ENH
MIRFAK (10), ENH
ALDEBARAN (11), ENH

FLIGHT PLAN

MCC-H

NOTES

0030 EDT

159:00

:10

:20

:30

:40

:50

160:00

:10

:20

:30

:40

:50

161:00

MSFN

EAT PERIOD - ALL

UPDATE

PRELIMINARY MCC6
MNVR PAD & ENTRY PAD
(ASSUMES MCC6)

EMS CK
RECORD MCC6 &
PRELIMINARY ENTRY PADS

REST PERIOD
(10 HOURS)

PRE SLEEP CHECKLIST

CREW STATUS REPORT (RADIATION, MEDICATION)
CYCLES O_2 & H_2 FANS
CHLORINATE POTABLE WATER
SELECT NORMAL LUNAR CONFIGURATION
EXCEPT: (FOR COAST ASLEEP)
- S-BD NORMAL MODE VOICE - OFF
- S-BD AUX TAPE - OFF
- TAPE RCDR FWD - OFF
- GO TO HGA OR CONTINUE OMNI OPS PER MSFN

OMNI OPS
- S-BD ANT OMNI - OMNI
- S-BD ANT OMNI - B

HI GAIN OPS
- HI GAIN ANT BEAM - NARROW
- HI GAIN ANT TRACK - REACQ
- S-BD ANT - HI GAIN

VERIFY:
- WASTE MNGT OVBD DRAIN - OFF
- WASTE STOW VENT VLV - CLOSED
- EMERG CABIN PRESS VLV - BOTH
- SURGE TK O_2 VLV - OFF
- REPRESS PACK O_2 VLV - OFF
- LM TUNNEL VENT VLV - OFF
- POT H_2O HTR - OFF

AUTO RCS JET SELECT (16) - OFF

ONBOARD READOUT

BAT C ____________
PYRO BAT A ____________
PYRO BAT B ____________
RCS A ____________
B ____________
C ____________
D ____________

DC IND SEL TO MNA OR MNB

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	159:00 - 161:00	7 / TEC	3-114

MCC-H

FLIGHT PLAN

NOTES

0230 EDT

161:00

:10

:20

:30

:40

:50

162:00

:10

:20

:30

:40

:50

163:00

MSFN

REST PERIOD
(10 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	161:00 - 163:00	7 / TEC	3-115

MCC-H

FLIGHT PLAN

NOTES

0430 EDT

163:00
:10
:20
:30
:40
:50
164:00
:10
:20
:30
:40
:50
165:00

MSFN

REST PERIOD
(10 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	163:00 - 165:00	7 / TEC	3-116

MCC-H

FLIGHT PLAN

NOTES

0630 EDT

165:00

EI -30HRS

:20

:30

:40

:50

166:00

:10

:20

:30

:40

:50

167:00

MSFN

REST PERIOD
(10 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	165:00 - 167:00	7 / TEC	3-117

MCC-H

FLIGHT PLAN

NOTES

0830 EDT

167:00

:10

:20

:30

:40

:50

168:00

:10

:20

:30

:40

:50

169:00

MSFN

REST PERIOD
(10 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	167:00 - 169:00	7 / TEC	3-118

MCC-H

FLIGHT PLAN

NOTES

1030 EDT

169:00

:10

:20

:30

:40

:50

170:00

:10

:20

:30

:40

:50

171:00

MSFN

REST PERIOD
(10 HOURS)

P23 - NO COMM, (5 SETS)
TEI +35:00 (170:30)
DIPHDA (02), EFH
DIPHDA (02), EFH
NAVI (03), ENH
MIRFAK (10), ENH
ALDEBARAN (11), ENH

POST SLEEP CHECKLIST
CREW STATUS REPORT (SLEEP)
CYCLE O_2 & H_2 FANS
GDC ALIGN TO IMU
CONSUMABLES UPDATE
SELECT NORMAL LUNAR CONFIGURATION
EXCEPT:
S-BD AUX TAPE - OFF
TAPE RCDR FWD - OFF
POT H_2O HTR - ON
AUTO RCS JET SELECT (16) - ON

CO_2 FILTER CHANGE NO. 13
(15 INTO A, STORE 13 IN A4)

REPORT CM RCS EJECTOR VLV TEMP

CONSUMABLE UPDATE
(Δ FROM NOMINAL)

GET: ______

RCS TOT ______

A ______

B ______

C ______

D ______

H_2 TOT ______

O_2 TOT ______

EAT PERIOD - ALL

PTC

UPLINK CMC
CSM STATE VECTOR
MCC6 TGT LOAD

O_2 FUEL CELL PURGE
V66 - TRANSFER CSM STATE VECTOR TO LM SLOT

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	169:00 - 171:00	8 / TEC	3-119

MCC
BURN CHART

	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC6	10°/SEC TAKEOVER	10° TAKEOVER	BT +1 SEC	TRIM X AXIS ONLY

MCC-H

FLIGHT PLAN

NOTES

1230 EDT

171:00

UPDATE

MCC6 PAD DATA
ENTRY PAD
(ASSUMES MCC6)

WIPE EXCESSIVE MOISTURE FROM TUNNEL HATCH AREA

RECORD MCC6 AND PRELIMINARY ENTRY PAD DATA

P52 - (PTC REFSMMAT)

N71: __ __, __ __

N05: __ __ __.__ __

N93:

X __ __.__ __ __

Y __ __.__ __ __

Z __ __.__ __ __

GET __ __ __:__ __:__ __

:10

IMU REALIGN - P52
(OPTION 3 - REFSMMAT)

BURN STATUS REPORT

X X ☐ :		ΔTIG
X X :		BT
☐ .		V_{gx}
TRIM		
X X X		R
X X X		P
X X X		Y
☐ .		V_{gx}
☐ .		V_{gy}
☐ .		V_{gz}
☐ .		ΔV_C
X X X		FUEL
X X X		OX
X X X		UNBAL

:20

M S F N

EXT ΔV - P30

171:30

SPS/RCS THRUST - P40/41

MNVR TO BURN ATT

:40

SXT STAR CK

EMS ΔV TEST

:50

SM RCS MON CK

GDC ALIGN TO IMU

EI
-23 HRS

172:00

MCC6 ΔV=NOMINALLY ZERO

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	171:00 - 172:00	8 / TEC	3-120

MCC-H

FLIGHT PLAN

NOTES

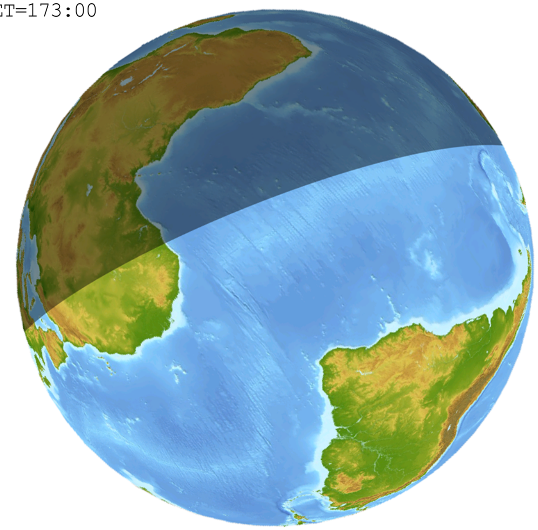
1330 EDT

172:00
:10
:20
:30
:40
:50
173:00
:10
:20
:30
:40
:50
174:00

MSFN

SM RCS MON CK
SPS MON CK
V66 - TRANS CSM STATE VECTOR TO LM SLOT
BURN STATUS REPORT
BATTERY CHARGE, BATTERY B

FOV=4°
GET=173:00



START PTC
P 270° Y 0°

PTC ESTABLISHED IN G&N P,
Y ±30° DB, R RATE OF 0.3°/SEC

P23 - NO COMM, (3 SETS)
TEI +37:00 (172:30)
SPICA (26), LNH
ANTARES (33), LFH
NUNKI (37), LFH

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	172:00 - 174:00	8 / TEC	3-121

MCC-H

FLIGHT PLAN

NOTES

1530 EDT

174:00

:10

:20

:30

:40

:50

175:00

:10

:20

:30

:40

:50

176:00

MSFN

EAT PERIOD - ALL

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	174:00 - 176:00	8 / TEC	3-122

MCC-H

1730 EDT

FLIGHT PLAN

NOTES

176:00
:10
:20
:30
:40
:50
177:00
:10
:20
:30
:40
:50
178:00

MSFN

PTC

P23 - NO COMM, (5 SETS)
TEI +41:00 (176:30)
DIPHDA (02), EFH
MIRFAK (10), ENH
ALDEBARAN (11), ENH
CAPELLA (13), ENH
CAPELLA (13), ENH

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	176:00 - 178:00	8 / TEC	3-123

MCC-H

FLIGHT PLAN

NOTES

1930 EDT

178:00

:10

:20

:30

:40

:50

179:00

:10

:20

:30

:40

:50

180:00

MSFN

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	178:00 - 180:00	8 / TEC	3-124

MCC-H

2130 EDT

FLIGHT PLAN

NOTES

180:00

:10

:20

:30

:40

:50

181:00

:10

:20

:30

:40

:50

182:00

MSFN

WIPE EXCESSIVE MOISTURE FROM TUNNEL HATCH AREA

O_2 FUEL CELL PURGE

CO_2 FILTER CHANGE NO. 14
(16 INTO B, STORE 14 IN A4)

EAT PERIOD - ALL

PTC

P23 - NO COMM, (5 SETS)
TEI +44:30 (180:00)
DIPHDA (02), EFH
DIPHDA (02), EFH
MIRFAK (10), ENH
CAPELLA (13), ENH
CAPELLA (13), ENH

ONBOARD READOUT
BAT C ______
PYRO BAT A ______
PYRO BAT B ______
RCS A ______
B ______
C ______
D ______
DC IND SEL TO MNA OR MNB

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	180:00 - 182:00	8 / TEC	3-125

MCC-H

FLIGHT PLAN

NOTES

2330 EDT

182:00
:10
:20
:30
:40
:50
183:00
:10
:20
:30
:40
:50
184:00

MSFN

REST PERIOD
(7 HOURS)

PRE SLEEP CHECKLIST

CREW STATUS REPORT (RADIATION, MEDICATION)
CYCLE O_2 & H_2 FANS
CHLORINATE POTABLE WATER
SELECT COMM NORMAL CONFIGURATION
EXCEPT:
- S-BD NORMAL MODE VOICE SW - OFF
- S-BD SQUELCH - ENABLE
- S-BD AUX TAPE - OFF
- S-BD ANT - OMNI
- S-BD ANT OMNI - B
- TAPE RCDR FWD - OFF

VERIFY:
- WASTE MNGT OVBD DRAIN - OFF
- WASTE STOW VENT VLV - CLOSED
- EMERG CABIN PRESS VLV - BOTH
- SURGE TK O_2 VLV - ON
- REPRESS PACK O_2 VLV - OFF
- POT H_2O HTR - OFF

AUTO RCS JET SELECT (16) - OFF

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	182:00 - 184:00	8 / TEC	3-126

MCC-H

FLIGHT PLAN

NOTES

0130 EDT

184:00
:10
:20
:30
:40
:50
185:00
:10
:20
:30
:40
:50
186:00

MSFN

REST PERIOD
(7 HOURS)

PTC

P23 - NO COMM, (5 SETS)
TEI +50:00 (185:30)
ALPHERATZ (01), EFH
MIRFAK (10), ENH
ALDEBARAN (11), ENH
CAPELLA (13), ENH
CAPELLA (13), ENH

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	184:00 - 186:00	8 / TEC	3-127

MCC-H

FLIGHT PLAN

NOTES

0330 EDT

186:00

:10

:20

:30

:40

:50

187:00

:10

:20

:30

:40

:50

188:00

MSFN

REST PERIOD
(7 HOURS)

PTC

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	186:00 - 188:00	8 / TEC	3-128

MCC-H

FLIGHT PLAN

NOTES

0530 EDT

188:00
EI -7HRS

:10

:20

:30

:40

:50

189:00

:10

:20

:30

:40

:50

190:00

MSFN

REST PERIOD (7 HOURS)

POST SLEEP CHECKLIST

CREW STATUS REPORT (SLEEP)
CYCLE O_2 & H_2 FANS
GDC ALIGN TO IMU
CONSUMABLES UPDATE
SELECT COMM NORMAL LUNAR
CONFIGURATION EXCEPT:
  S-BD AUX TAPE - OFF
  TAPE RCDR FWD - OFF
POT H_2O HTR - ON
AUTO RCS JET SELECT (16) - ON

PTC

CONSUMABLE UPDATE
(Δ FROM NOMINAL)

GET: ______

RCS TOT ______

A ______

B ______

C ______

D ______

H_2 TOT ______

O_2 TOT ______

GO/NO-GO

GO/NO-GO FOR MCC7
REPORT CM RCS INJECTOR VALVE TEMPERATURE

EAT PERIOD - ALL

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	188:00 - 190:00	8 / TEC	3-129

FLIGHT PLAN

MCC-H

UPLINK CMC
- CSM STATE VECTOR
- MCC7 TGT LOAD
- DESIRED ORIENT (ENTRY)
- ENTRY LAT & LONG

UPDATE
- MCC7 MNVR PAD
- ENTRY PAD

0730 EDT

Time	Activity
190:00 EI -5HRS	DON MAE WEST & FOOT RESTRAINTS
:10	V66 - TRANS CSM STATE VECTOR TO LM SLOT
:20	
190:30	RECORD MCC7 MNVR PAD & ENTRY PAD
:40	EPS CHECK
	SPS CHECK
	CM RCS MON CK
:50	SM RCS MON CK
	C&W SYS CK
	CMC SELF TEST
191:00	DSKY COND LT TEST

MSFN

PTC

NOTES

P23 - NO COMM, (5 SETS)
TEI +54:30 (190:00)
ALPHERATZ (01), EFH
MIRFAK (10), ENH
ALDEBARAN (11), ENH
CAPELLA (13), ENH
CAPELLA (13), ENH

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	190:00 - 191:00	9 / TEC	3-130

FLIGHT PLAN

NOTES

0830 EDT
191:00
EI -4HRS
:10
:20
191:30
:40
:50
192:00

MSFN

IMU REALIGN - P52
OPTION 1 - PREFERRED

EXT ΔV - P30

SPS/RCS THRUST - P40/41

MNVR TO BURN ATT

SXT STAR CK

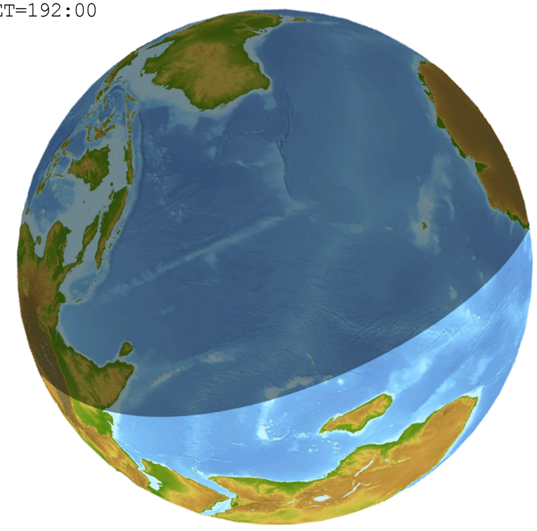
EMS ΔV TEST

SM RCS MON CK

GDC ALIGN TO IMU

P52 - (ENTRY REFSMMAT)
N71: __ __, __ __
N05: __ __ __. __ __
N93:
X __ __. __ __ __
Y __ __. __ __ __
Z __ __. __ __ __
GET __ __ __: __ __: __ __

FOV=15°
GET=192:00



MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	191:00 - 192:00	9 / TEC	3-131

THIS PAGE INTENTIONALLY LEFT BLANK.

MCC
BURN CHART

	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC7	10°/SEC TAKEOVER	10° TAKEOVER	BT +1 SEC	TRIM X AXIS ONLY

MCC-H

FLIGHT PLAN

NOTES

0930 EDT
192:00
EI -3HRS

MSFN

MCC7 ΔV=NOMINALLY ZERO

SM RCS MON CK
SPS MON CK
BURN STATUS REPORT
V66 - TRANS CSM STATE VECTOR TO LM SLOT

:10

:20

P23 - NO COMM, (5 SETS)
TEI +57:00 (192:30)
MENKAR (07), ENH
CAPELLA (13), ENH
CAPELLA (13), ENH

192:30

:40

:50

GO/NO-GO

GO/NO-GO FOR PYRO ARM SEQUENCE
VHF ACTIVATION

193:00

BURN STATUS REPORT

X X □ :	ΔTIG
X X :	BT
□ .	V_{gx}
TRIM	
X X X	R
X X X	P
X X X	Y
□ .	V_{gx}
□ .	V_{gy}
□ .	V_{gz}
□ .	ΔV_C
X X X	FUEL
X X X	OX
X X X	UNBAL

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	192:00 - 193:00	9 / TEC	3-132

FLIGHT PLAN

MCC-H 1030 EDT **NOTES**

193:00
EI -2HRS

LOGIC SEQUENCE CHECK

:10

MNVR TO ENTRY ATTITUDE

COAS STAR CHECK

:20

SXT STAR CHECK

193:30

MSFN

:40

IMU REALIGN - P52
(OPTION 3 - REFSMMAT)

P52 - (ENTRY REFSMMAT)
N71: __ __, __ __
N05: __ __ __.__ __
N93:
X __ __.__ __ __
Y __ __.__ __ __
Z __ __.__ __ __
GET __ __ __:__ __:__ __

:50

GDC ALIGN TO IMU
CM RCS PREHEAT

194:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	193:00 - 194:00	9 / TEC	3-133

FLIGHT PLAN

MCC-H

1130 EDT

194:00
EI -1HRS

:10

UPDATE
ENTRY PAD
RCVY PAD

:20

UPLINK
CSM STATE VECTOR

194:30
(EI -30)

GO FOR PYRO ARM

:40

:50

195:00

MSFN

PRIMARY EVAPORATOR ACTIVATION

FINAL GDC DRIFT CHECK
TERM CM RCS PREHEAT

SECONDARY EVAPORATOR ACTIVATION
PYRO BATTERY CHECK
RECORD ENTRY PAD AND RECOVERY DATA

P27 UPDATE - V66 - TRANS CSM STATE VECTOR TO LM SLOT

SET DET TO RRT
EMS INITIALIZATION
RSI ALIGN TO GDC

CM RCS CK
ENTRY BATTS - ON

SEPARATION CHECKLIST
GO FOR PYRO ARM

P61 ENTRY PREP
MNVR TO CM/SM SEP ATT

CM/SM SEP

P62 - ENTRY ATTITUDE
MNVR TO ENTRY ATT

NOTES

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	194:00 - 195:00	9 / TEC	3-134

1230 EDT

195:00

P63 - ENTRY INITIATE

EI - GET = 195:03:27

P64 - ENTRY POST .05G

:10

TRAJECTORY EVENT	TIME FROM ENTRY INTERFACE MIN:SEC
400,000 FEET (GET 195:03:27)	00:00
ENTER S-BAND BLACKOUT	00:18
0.05G	00:28
KA - INITIATE CONSTANT DRAG	00:52
RDOT = -700 FPS	01:18
PEAK G (6.6)	01:22
SUBCIRCULAR VELOCITY	02:08
P64 TO P67	02:08
EXIT S-BAND BLACKOUT	03:24
GUIDANCE TERMINATION	07:14
DROGUE DEPLOYMENT	08:12
MAIN DEPLOYMENT	09:00
SPLASHDOWN	13:55

$\gamma = -6.52°$, L/D = 0.295, V = 36,309 & R = 1285

:20

195:30

:40

:50

196:00

SECTION IV

DETAILED TEST OBJECTIVES

SECTION IV

SECTION 4

DETAILED OBJECTIVE ACTIVITIES

This section contains the activity summaries which reflect the test objectives for Mission G as described in „Mission Requirements G Type Mission", SPD9-R-038, Change A dated May 1, 1969. These activity summaries are presented in the approximate sequence in which they are planned to occur during the mission.

Each activity summary provides the following information:

A. TEST OBJECTIVES. This is the listing of the Functional Test Objectives (complete or partial) which relate to the particular activity;

B. TEST REQUIREMENTS. Here the special test prerequisites (and mission phase if necessary) are presented in addition to brief statements of the requirements for performing the activity;

C. TEST PROCEDURES/CHECKLISTS. These are the procedural references for the performance of the activity as far as the test objectives are concerned; and

D. DATA REQUIREMENTS. This part of the summary identifies the gross data which are needed for evaluation of test results in terms of flight crew and ground support requirements.

Cross references for relating Detailed and Functional Test Objectives with the activity summaries and relating activities to Functional Test Objectives, are provided as the initial part of this section.

The following ground rules are to be used in implementing data requirements:

A. The collection of highly desirable (HD) data should not constrain the timeline of the crew procedures.

B. Post-flight debriefing requirements which are fulfilled by real time transmission of data per the DATA REQUIREMENTS sections may be deleted from the post-flight debriefing.

All of the Test Requirements have not been totally implemented into the mission timeline. These items are identified in this section as „Not Implemented" or with the conditions by which they will be implemented.

TABLE 4-1
MISSION ACTIVITY AND
TEST OBJECTIVE CROSS REFERENCE

ACTIVITY	FTO
LM Descent	D-1, G-1, G-3, H-1, M-1
Lunar Surface Navigation	G-1, G-2, G-3, L-4, M-2
EVA Preparation and Egress	B-1, B-2, C-1, C-2, C-3, L-1
Surface Sample Collection	A-1, E-1, F-1, F-2, I-3, J-2, J-3, J-4, M-3
External LM Observations and Photography	D-1, D-2, D-3, D-4, L-2, M-3
Lunar Surface Observations and Photography	E-1, E-2, E-3, H-2, J-5, L-3, L-4, M-3
Experiment Deployment/Conduct	S-031, S-078, S-080
Post EVA Operations	B-1, C-1, C-2
Contamination Prevention	I-1, I-2

TABLE 4-2
TEST OBJECTIVE/MISSION ACTIVITY
CROSS REFERENCE

DTO/FTO NUMBER	TEST OBJECTIVE	MISSION ACTIVITY	SECTION PAGE NO.
A	Contingency Sample Collection		
A-1	Provide a Contingency Lunar Surface Sample	Surface Sample Collection	4 - 13
B	Lunar Surface EVA Operations		
B-1	Demonstrate Egress-To/Ingress-From the Lunar Surface	EVA Preparation and Egress	4 - 10
		Post EVA Operations	4 - 21
B-2	Evaluate Crew Lunar Surface EVA Capability	EVA Preparation and Egress	4 - 10
C	EMU Lunar Surface Operations		
C-1	EMU Capability to Provide a Habitable Environment	EVA Preparation and Egress	4 - 10
C-2	EMU Effects on Crew Mobility, Dexterity & Comfort	EVA Preparation and Egress	4 - 10
C-3	Demonstrate EVA Data/Voice Communications	EVA Preparation and Egress	4 - 10
D	Landing Effects on LM		
D-1	LM Landing Gear Performance Under Landing Conditions	LM Descent	4 - 6
		External LM Observ/Photo	4 - 15
D-2	Effects of Landing on LM Structure and Components	External LM Observ/Photo	4 - 15
D-3	Descent Engine Skirt Damage/Clearance After Landing	External LM Observ/Photo	4 - 15
D-4	Effects of RCS Plume Impingement on LM Structure & Components	External LM Observ/Photo	4 - 15
E	Lunar Surface Characteristics		
E-1	Data on Behavior/Characteristics of the Lunar Surface	Surface Sample Collection	4 - 13
		Lunar Surface Observ/Photo	4 - 17
E-2	Lunar Soil Erosion from DPS Plume Impingement	Lunar Surface Observ/Photo	4 - 17
E-3	Effect of DPS Venting on the Lunar Surface	Lunar Surface Observ/Photo	4 - 17
F	Bulk Sample Collection		
F-1	Collect Rock Samples and Fine Grained Material	Surface Sample Collection	4 - 13
F-2	Photograph Collection Area of Samples	Surface Sample Collection	4 - 13

TABLE 4-2
TEST OBJECTIVE/MISSION ACTIVITY
CROSS REFERENCE

DTO/FTO NUMBER	TEST OBJECTIVE	MISSION ACTIVITY	SECTION PAGE NO.
G	Landed LM Location		
G-1	Determine Location of Landed LM from LM Data	LM Descent	4 - 6
		Lunar Surface Navigation	4 - 8
G-2	Determine Location of Landed LM from CSM Data	Lunar Surface Navigation	4 - 8
G-3	Capability of Locating Landed LM in Real Time	LM Descent	4 - 6
		Lunar Surface Navigation	4 - 8
H	Lunar Environment Visibility		
H-1	Data on Landing Aids & Final Approach Visibility	LM Descent	4 - 6
H-2	Crew Performance of Visual Tasks on Lunar Surface	Lunar Surface Observ/Photo	4 - 17
I	Assessment of Contamination by Lunar Material		
I-1	Prevent Earth Contamination by Lunar Exposed Materials	Contamination Prevention	4 - 22
I-2	Minimize Crew/CM Contamination by Lunar Exposed Materials	Contamination Prevention	4 - 22
I-3	Lunar Sample for Quarantine Testing	Surface Sample Collection	4 - 13
J	Documented Sample Collection		
J-1	Obtain an Asceptic Sample of the Lunar Surface	Deleted	
J-2	Obtain a Core Sample of the Lunar Surface	Surface Sample Collection	4 - 13
J-3	Collect Lunar Geologic Samples	Surface Sample Collection	4 - 13
J-4	Collect a Lunar Environment Sample	Surface Sample Collection	4 - 13
J-5	Study and Describe Lunar Topography Features	Lunar Surface Observ/Photo	4 - 17
K	Lunar Surface Structure Photograph (Objective Deleted)	Deleted	

TABLE 4-2
TEST OBJECTIVE/MISSION ACTIVITY
CROSS REFERENCE

DTO/FTO NUMBER	TEST OBJECTIVE	MISSION ACTIVITY	SECTION PAGE NO.
L	Television Coverage		
L-1	TV Coverage of Astronaut Descending to the Lunar Surface	EVA Preparation and Egress	4 - 10
L-2	TV Coverage of External Landed LM	External LM Observ/Photo	4 - 15
L-3	TV Coverage of Lunar Surface Near LM	Lunar Surface Observ/Photo	4 - 17
L-4	TV Panoramic Coverage of Distant Terrain Features	Lunar Surface Navigation	4 - 8
		Lunar Surface Observ/Photo	4 - 17
L-5	TV Coverage of Astronaut Activities on the Lunar Surface	Lunar Surface Observ/Photo	4 - 17
M	Photographic Coverage		
M-1	Photograph Lunar Surface During LM Descent	LM Descent	4 - 6
M-2	Photograph Lunar Surface Post Touchdown/Pre EVA	Lunar Surface Navigation	4 - 8
M-3	Obtain Photographs During EVA	Surface Sample Collections	4 - 13
		External LM Observ/Photo	4 - 15
		Lunar Surface Observ/Photo	4 - 17
S-031	Lunar Passive Seismology	Experiment Deployment/Conduct	4 - 20
S-078	Laser Ranging Retro-Reflector	Experiment Deployment/Conduct	4 - 20
S-080	Solar Wind Composition	Experiment Deployment/Conduct	4 - 20

LM DESCENT

A. Test Objective

D-1 LM Landing Gear Performance Under Landing Conditions
G-1 Location of the Landed LM from LM Data
G-3 Capability of Locating the Landed LM in Real Time from LM/CSM/MSFN Data
H-1 Data on Landing Aids and Final Approach Visibility
M-1 Photograph Lunar Surface During LM Descent

B. Test Requirements

1. Determine landing site visibility, extent of washout and visibility of landing site landmarks. [H]

2. Photograph the landing site during the approach through the LM pilot's window with the data acquisition camera. [G, H, M]

3. Evaluate landing aids, i.e., Landing Point Designator, maps, photographs. [G, H]

4. Assess visual phenomena during LM landing which are significantly different from expected. [H]

5. Voice anotate location and identity of features during final descent. [G]

6. Determine landing location in real time by description of terrain features during descent. [G]

7. Assess LM landing conditions on the lunar surface. [D]

C. Procedures/Checklist

1. Photographic and Television Operations Plan.

2. Descent Procedures Document.

D. Data Requirements

1. Flight Crew Reports/Logs/Photographs

   a. LM crew comments on landing site visibility during final approach and landing phases and on effectiveness of the Landing Point Designator and landing site recognition aids. [H] (M)

   b. GET at start of data acquisition camera photographs during LM final approach. [H] (M)

   c. Voice track regarding observations of surface features during the descent phase. [G] (M)

   d. Photographs of the landing site and surrounding lunar surface features taken through a LM window during descent. [G, M] (M)

   e. Data Acquisition Camera photographs of the landing site from high gate to touchdown. [H, M] (M)

   f. Photographs of the landing site and surrounding lunar surface features taken through a LM window during descent. [G, M] (N)

   g. Comments on any lunar dust observed during the final approach, the severity of the landing and vehicle stability after touchdown. [D] (M)

2. Ground Support

   a. LM TM HBR. [D, G, H] (M)

   b. LM TM LBR. [D, G] (M)

c. LM BET from DOI through touchdown. [G, H] (M)

d. MSFN tracking data of LM from acquisition of signal through touchdown. [G] (F4)

LUNAR SURFACE NAVIGATION

A. Test Objectives

G-1 Determine the Location of the Landed LM from LM Data
G-2 Determine the Location of the Landed LM from CSM Data
G-3 Determine Capability of Locating the Landed LM in Real Time from LM/CSM/MSFN Data
L-4 Panoramic Coverage of Distant Terrain Features
M-2 Photograph Lunar Surface Post Touchdown/Pre EVA

B. Test Requirements

1. Correlate lunar surface features surrounding the landing site with photomaps and mark the LM location. [G, L, M]

2. Photograph terrain features thru the LM window to correlate LM location. [G, M]

3. Obtain two sets of LM IMU alignments after landing [G]

4. Provide TV coverage of prominent terrain features. [G, L]

5. Track the landed LM from the CSM during two orbital passes. Mark on a landmark near the landed LM. [G] - (Only one pass is implemented.)

6. Track the CSM with LM RR during one pass. [G] - (Not Implemented.)

7. Obtain 70 MM photographs of the landed LM or its shadow and the surrounding lunar features. [G]

8. Assist MCCH in determining the landing LM location in real time. [G, L]

C. Procedures/Checklist

1. Photographic and Television Operations Plan.

2. LM AOH, „PGNCS Lunar Surface Align Program (P57)‟.

3. LM AOH, „Lunar Surface Navigation Program (P22)‟

4. CSM AOH, „Orbital Navigation (P22)‟.

D. Data Requirements

1. Flight Crew Reports/Logs/Photographs

   a. Estimate of the landed LM location on lunar photomaps. [G] (M)

   b. Comments by LM crew regarding any difficulties encountered in estimating the location of the LM with respect to lunar surface features. [G] (HD)

   c. Comments by LM crewman on location of landed LM with respect to prominent terrain features. [G] (M)

   d. Obtain high resolution photographs of the landing area from the CSM. [G] (M)

   e. Photographs of the landing site and surrounding lunar surface features taken through a LM window after landing. [G, M] (M)

   f. Provide TV coverage of the lunar surface as viewed from the LM. [G, L] (M)

2. Ground Support

   a. LM TLM HBR. [G] (M)

   b. LM TLM LBR. [G] (M)

c. BET of CSM during the lunar surface phase. [G] (M)

d. BET of LM from DOI through touchdown. [G] (M)

e. Photographs of the landing area obtained during previous lunar missions. [G] (M)

f. Post-scan conversion video tape of all TV coverage. [L] (M)

g. Estimate solar illumination established by mission geometry. [L] (M)

h. Reflectivity and geometry of surfaces contributing to indirect illumination. [L] (HD)

EVA PREPARATION AND EGRESS

A. Test Objectives

B-1 Demonstrate Egress-to/Ingress-from the Lunar Surface
B-2 Evaluate Crew Lunar Surface EVA Capability
C-1 EMU Capability to Provide a Habitable Environment
C-2 EMU Effects on Crew Mobility/Dexterity/Comfort
C-3 Data/Voice Communications Capability During EVA
L-1 TV Coverage of an Astronaut Descending to the Lunar Surface

B. Test Requirements

1. Perform EVA preparations. [C]

2. Release the MESA pallet with pre-mounted TV camera and turn camera power on prior to descent to the lunar surface. [L]

3. Egress to the lunar surface. [B, C]

4. Deploy and set the TV camera to provide TV coverage of the lunar surface EVA. [L]

5. During EVA, communicate with MSFN via the EVA-LM-MSFN two way voice relay. [C]

6. Two-way voice communications to be performed between two EVA crewmen. [C]

7. EMU and biomedical data from two EVA crewmen will be simultaneously transmitted to MSFN via EVA-LM-MSFN one-way relay. [C]

C. Procedures/Checklist

1. EVA Procedures Document.

2. Lunar Surface Operations Plan.

D. Data Requirements

1. Flight Crew Reports/Logs/Photographs

   a. Notify MSFN of the initial and final positions of the PLSS water diverter valve, primary oxygen shutoff valve and water shutoff/relief valve each time they are changed. [C] (M)

   b. Notify MSFN when PLSS; High O2 flowrate, low vent flow, low feed water pressure or PGA pressure low remote control unit status indicators and audible warning tone come on. [C] (M)

   c. Record EMU radiation dosimeter readings just prior to the EVA. [C] (M)

   d. Notify MSFN if noxious odors occur or any condensation on the visor assembly. [C] (HD)

   e. Comment on the adequacy of procedures and difficulties encountered during donning of EMU equipment. [C] (HD)

   f. Comment on time required and adequacy of the EMU checkout procedures. [C] (MD)

   g. Comment on the adequacy of EMU thermal environment when walking from a sunlit area to shadow and vice versa. [C] (M)

   h. Comment on estimated energy expenditure and comfort as compared to simulation experience. [C] (HD)

   i. Provide data on the adequacy of hardware and procedures, and the time required to perform the egress from the LM. [B] (M)

j. Comment on voice quality for EVA-EVA and EVA-LM-MSFN communications. [C] (M)

k. Provide sequence camera coverage and TV camera coverage of: [B, M] (M)

   1) A crew member descending to the lunar surface.

   2) A crew member walking on the lunar surface.

   3) A crew member performing lunar surface EVA operations.

2. Ground Support

   a. LM TM FM. [B, C] (M)

   b. Ground recorded TV signals. [B] (HD)

   c. LM TM LBR. [L] (HD)

   d. Post-scan conversion video tape of all TV coverage. [L] (M)

   e. Record of S-band signal strength during video transmission. [L] (HD)

   f. GET at beginning and end of TV transmission. [L]

   g. Time period, if any, when LBR TM (in lieu of HBR TM) transmitted simultaneously with TV data. [L] (M)

   h. Identity of ground station(s) used to record video transmission from LM. [L] (M)

   i. Time period, if any, when erectable antenna used to transmit TV data. [L] (M)

   j. Estimate of incident illumination. [L] (M)

   k. LM position on lunar surface. [H] (HD)

   l. MSFN recording of EVA-LM-MSFN voice. [C] (M)

SURFACE SAMPLE COLLECTION

A. Test Objectives

A-1 Provide a Contingency Lunar Surface Sample
E-1 Behavior and Characteristics of the Lunar Surface
F-1 Collect Rock Samples and Fine Grained Material
F-2 Photograph Collection Area of Samples
I-3 Obtain a Lunar Sample for Quarantine Testing
J-2 Obtain a Core Sample of the Lunar Surface
J-3 Collect Lunar Geologic Samples
J-4 Collect a Lunar Environment Sample
M-3 Obtain Photographs of Geologic Inspection & Sampling

B. Test Requirements

1. Contingency Sample - Obtain upon first descending to the lunar surface. [A]

2. Bulk Material - Obtain 30 pounds consisting of 1/3 fragmentary and 2/3 loose samples. [F]

3. Core Sample - Obtain with the drive tube. [I, J]

4. Geologic Samples - Obtain using tools stowed in the MESA. Photograph sample areas. [J, M]

5. Lunar Environment Sample - Seal in gas analysis container. [J]

C. Procedures/Checklist

1. Lunar Landing Mission Flight Plan.

2. Lunar Surface Operations Plan.

3. Photographic and Television Operations Plan.

D. Data Requirements

1. Flight Crew Reports/Logs/Photographs

   a. Record areas in relation to LM where samples were collected. [A, F, J] (M)

   b. Record unusual lunar surface observations. [A, F, J] (M)

   c. Comment on soil behavior during collection of Bulk Sample. [E] (M)

   d. Comment on soil behavior during collection of Documented Sample. [E] (HD)

   e. Estimates of volume of fine grained material collected in one bag of the Documented Sample. [E] (HD)

   f. Take photographs during sample collection. [A, F] (HD)

   g. Photograph the lunar surface sample areas and of the samples as defined in the Photographic Operations Plan. [J] (M)

2. Ground Support

   a. LM position on lunar surface. [J] (M)

   b. MSFN recordings of all MSFN/EVA voice conferences. [J] (M)

EXTERNAL LM OBSERVATIONS AND PHOTOGRAPHY

A. Test Objectives

D-1 Effects of Landing on LM Landing Gear
D-2 Effects of Landing on LM Structure and Components
D-3 Descent Engine Skirt Damage and Clearance After Landing
D-4 Effects of RCS Plume Impingement on LM Structure and Components
L-2 TV Coverage of External Landed LM
M-3 Obtain Photographs of Landed LM

B. Test Requirements

1. Operate the TV camera to provide an external view of the LM. [L]

2. Photograph any observed LM external structural damage. [D, M]

3. Determine descent engine skirt ground clearance. [D, M]

4. Photograph any effects of RCS plume impingement observed. [D, M]

5. Obtain photographs of any lunar material collected on the LM. [D, M]

C. Procedures/Checklist

1. Mission G Photographic and Television Operations Plan.

D. Data Requirements

1. Flight Crew Reports/Logs/Photographs

   a. Comment on any LM component damage to include any visible discoloration or lunar soil accumulation. [D] (M)

   b. Comments describing any descent engine skirt damage and estimate of any skirt ground clearance. [D] (M)

   c. If the landing gear strut assembly photographs cannot be obtained, estimate the amount of stroking of each primary and secondary strut assembly. [D] (M)

   d. Photograph the landing gear to show the stroking of the primary and secondary strut assemblies. [D, M] (M)

   e. Photograph the LM exterior showing any structural damage. [D, M] (M)

   f. Photograph each landing gear assembly along the Z axis and the Y axis. [D, M] (HD)

   g. Photograph the descent engine skirt. [D, M] (HD)

   h. Photograph the LM base heat shield. [D, M] (HD)

   i. Photograph the LM exterior, i.e., structure antenna, RCS jets, windows and foot pads. [D, M] (HD)

   j. Photograph soil accumulation on the LM. [D, M] (HD)

   k. Photographs by the close up stereo camera of lunar material adhering to LM surfaces. [M] (HD)

2. Ground Support

   a. LM TM HBR. [D] (M), [L] (HD)

   b. LM Mass, center of gravity and mass moment of inertia calculations. [E] (M)

   c. Video tape of all TV coverage. [L] (M)

d. Record of S-band signal strength during TV coverage. [L] (HD)

e. GET at beginning and end of TV operations.

f. Time period of simultaneous LBR TM and TV transmission. [L] (M)

g. Identification of ground station(s) used to record video transmission. [L] (M)

h. Time period when erectable antenna was used to transmit from lunar surface. [L] (M)

<u>LUNAR SURFACE OBSERVATIONS AND PHOTOGRAPHY</u>

A. Test Objectives

E-1 Behavior and Characteristics of the Lunar Surface
E-2 Erosion of Lunar Surface by DPS Plume Impingement
E-3 Effect of Any DPS Venting on the Lunar Surface
H-2 Crew Performance of Visual Tasks on the Lunar Surface
J-5 Study and Description of Lunar Topography Features
L-3 TV Coverage of Lunar Surface Near LM
L-4 TV Panoramic Coverage of Distant Terrain Features
L-5 Coverage of Astronaut Activities on the Lunar Surface
M-3 Obtain Photographs During EVA

B. Test Requirements

1. Provide TV coverage of the lunar surface in the vicinity of the LM and panoramic scenes of distant terrain features. [L]

2. Photograph the lunar terrain at various azimuths with respect to the sun including 9, 90 and 180 degrees. Comment on ability to see terrain features in these areas. [H, M]

3. Estimate the distance to prominent terrain features within the field of view of photographs taken. [H]

4. Observe lunar surface characteristics including texture, consistency, compressibility, cohesiveness, adhesiveness, density and color. [E]

5. Study and photograph the mechanical behavior of the lunar surface from interactions of astronauts boots and equipment with the lunar soil, erosion by DPS plume impingement and DPS venting. [E, M]

6. Describe and photograph field relationships such as shape, size, range, pattern of alignment or distribution of all accessible types of lunar topographic features. [J,M]

7. Photograph the structure of lunar surface material in its natural state. [M]

C. Procedures/Checklist

1. Mission G Photographic and Television Operations Plan.

D. Data Requirements

1. Flight Crew Report/Logs/Photographs

   a. Report condition of the temperature indicator viewing ports on the TV camera at the beginning and the end of the TV operations. [L] (M)

   b. Position of the TV camera scan rate switch at start of TV operation. [L] (M)

   c. Comments describing the interaction between astronaut boots and lunar surface while walking. [E] (M)

   d. Comments on slope and roughness characteristics of the landing terrain to include descriptions of craters, depressions, embankments or other obstacles. [E] (M)

   e. Comments on the color and texture of both undisturbed and mechanically disturbed areas of the lunar surface. [E] (M)

   f. Comments on lunar soil conditions adjacent to DPS vents to include any discoloration. [E] (M)

   g. Comments describing the lunar surface penetration by the Solar Wind Composition Staff and core sample tool under their own weight and the estimated force. [E] (Mandatory for either the staff or the core sample tool: highly desirable for the other.)

h. Comments on lunar soil erosion as caused by the DPS plume impingement during landing. [E] (M)

i. Record vent valves opened. [E] (M)

j. Photograph the lunar surface showing DPS plume impingement erosive effects. [E, M] (M)

k. Photograph the lunar surface adjacent to DPS vents if soil discoloration is observed. [E, M] (M)

l. Photograph an astronaut footprint showing interaction between astronaut boots and lunar surface. [E, M] (M)

m. Photograph the Solar Wind Composition Experiment Staff and core sampling tool after being inserted to their maximum depth as penetrometers. [E, M] (HD)

n. Photograph the natural slopes, crater walls and embankments in the vicinity of the landing site. [E,M] (M)

o. Photograph from the CSM of the lunar surface surrounding the LM. [E, M] (HD)

p. Comments on the visibility of the lunar terrain as a function of the sun/viewing angle and on their ability to perform visual tasks while on the lunar surface. [H] (M)

q. Comments on color/contrast perception. [H] (M)

r. Comments on and significant unexpected visual phenomena. [H] (M)

s. Estimate of distance to at least one prominent terrain feature within the field of view of the photographs in item »t« below. [H] (M)

t. Photograph the lunar terrain at various sun azimuths to include 0 degrees, 90 degrees and 180 degrees. [H, M] (M)

u. Photograph any unexpected visual phenomena. [H, M] (HD)

v. Photograph a representative depression caused by use of the scoop in collecting fine grained fragmental material. [E, M] (M)

w. Photograph one scoop of fine grained fragmental material placed in one of the pre-numbered bags. [E, M] (HD)

x. Photograph of each LM foot pad and surrounding lunar soil exhibiting evidence of LM foot pad - lunar soil interaction. [M] (HD)

2. Ground Support

a. LM TM HBR. [E, L] (HD)

b. Estimate of incident illumination. [D] (M)

c. Video tape of all TV coverage. [L] (M)

d. Record of S-band signal strength during TV transmission. [L] (M)

e. GET at beginning and end of TV transmission. [L] (M)

f. Time period when LBR TM was transmitted simultaneously with TV. [L] (M)

g. Identity of ground station(s) used to record LM video transmission. [L] (M)

h. Time period when erectable antenna was used to transmit from the lunar surface. [L] (M)

EXPERIMENT DEPLOYMENT/CONDUCT

A. Test Objectives

S-031	Deploy the Passive Seismic Experiment Package
S-078	Deploy the Laser Ranging Retro-Reflector Experiment
S-080	Conduct the Solar Wind Composition Experiment

B. Test Requirements

1. Emplace, level and orient the Passive Seismic Experiment Package (PSEP). Deploy the solar panels and aim the antenna at the earth. [S-031]

2. Photograph the deployed PSEP and deployment area. [S-031]

3. Remove the Laser Ranging Retro-Reflector (LRRR) from the descent stage and carry it to the deployment site. [S-078]

4. Emplace, level and orient the LRRR to the alignment marks corresponding to she landing site. [S-078]

5. Remove the Solar Wind Composition Experiment from the LM MESA and deploy it on the lunar surface. [S-080]

6. After one hour operation, disassemble the Solar Wind Composition Experiment, place the reel and foil in a teflon bag and store in a sample return container. [S-080]

C. Procedures/Checklist

None

D. Data Requirements

1. Flight Crew Reports/Logs/Photographs

   a. Comment on deployment of experiment. [S-031] (M)

   b. Photograph deployment area. [S-031, S-078, S-080] (HD)

   c. Comment on location of deployed experiment with respect to the LM, attitude of deployed foil with respect to the sun and total time foil was deployed. [S-080] (M)

   d. Retrieve reel and foil from the Solar Wind Composition Experiment. [S-080] (M)

   e. Comments on orientation and elevation setting used for deployment. [S-078] (HD)

2. Ground Support

   a. Experiment TLM Data [S-031] (M)

POST EVA OPERATIONS

A. Test Objectives

B-1 Demonstrate Egress-to/Ingress-from the Lunar Surface
C-1 EMU Capability to Provide a Habitable Environment
C-2 EMU Effects on Crew Mobility, Dexterity/Comfort

B. Test Requirements

1. Perform post EVA preparations and ingress. [B]

2. Perform PLSS shutdown. [C]

C. Procedures/Checklist

1. EVA Procedures Document.

D. Data Requirements

1. Flight Crew Reports/Logs/Photographs

   a. Notify MSFN of the initial and final positions of the PLSS water diverter valve, primary oxygen shutoff valve and water shutoff/ relief valve each time they are changed. [C] (M)

   b. Notify MSFN when PLSS; High O2 flowrate, low vent flow, low feed water pressure or PGA pressure low remote control unit status indicators and audible warning tone come on. [C] (M)

   c. Provide data on the adequacy of hardware and procedures, and the time required to perform the ingress to the LM. [B] (M)

   d. Comment on the adequacy of procedures and difficulties encountered during doffing of EMU equipment. [C] (HD)

   e. Record quantity of water drained from PLSS at end of EVA period. [C] (M)

   f. Record EMU radiation dosimeter readings after completion of the EVA. [C] (M)

   g. Provide sequence camera coverage and TV camera coverage of a crew member ascending the LM ladder. [B] (M)

CONTAMINATION PREVENTION

A. Test Objectives

I-1 Prevent Earth Contamination by Lunar Exposed Materials
I-2 Minimize Crew/CM Contamination by Lunar Exposed Materials

B. Test Requirements

1. All contamination related operations from the initial astronaut egress to the lunar surface until postflight crew/cm quarantine will be completed per procedures contained in the documents listed below. [I]

C. Procedures/Checklist

1. Lunar Surface Operations Plan

2. EVA Procedures Document

3. Quarantine Procedures

D. Data Requirements

1. Flight Crew Reports/Logs/Photographs

   a. Crew comments on the adequacy of Biological Isolation Garment, sample return containers, Mobile Quarantine Facility and related equipment and procedures used to prevent back contamination. [I] (M)

   b. Photograph boots, clothing and equipment showing adhesion of particles. [I, M] (HD)

2. Ground Support

   a. Deliver samples, CM and Mobile Quarantine Facility to the Lunar Receiving Laboratory. [I] (M)

   b. Comment on ground procedures and hardware used for retrieval, biological isolation and CM transfer to the Lunar Receiving Laboratory. [I] (M)

   c. Report on the existence of contamination of the crew on CM. [I] (M)

SECTION V

CONSUMABLES ANALYSIS

NOTE

Acknowledgement is made to the Consumables Analysis Section (CAS) of the Mission Planning and Analysis Division (MPAD) for their work in the preparation of the consumable analysis presented herein and to the Crew Systems Division for the PLSS Consumables.

CSM-107/LM5 PROPELLANT BUDGET

The results of the Propellant Budget Analysis are summarized in the following Tables and Figures:

SM-RCS BUDGET
GROUND RULES and ASSUMPTIONS

1. The transposition and docking phase of the mission includes an SPS evasive maneuver.

2. The first and third midcourse corrections (translunar) are executed as SPS burns with the third MCC followed by an RCS trim.

3. No SM RCS propellant is required during PTC or lunar orbit coast.

4. The sixth midcourse correction (transearth) is executed as an RCS burn of 5 fps.

5. The individual quad plots are included for reference only as quad management is determined by the flight controllers during the mission.

TABLE 5-1
SM RCS PROPELLANT LOADING AND USAGE SUMMARY

Nominal loaded		1342.4 lb
Initial outage due to loaded mixture ratio		15.6
Total trapped		26.4
Gauging inaccuracy		80.4
Deliverable SM-RCS propellant		1220.0
Nominal usage		590
Translunar phase (through LOI-2)	204	
Lunar orbit phase	311	
Transearth phase (includes TEI)	75	
Nominal remaining		630 lb

TABLE 5-2

TIME (HR)	SM-RCS PROPELLANT BUDGET EVENT	(a) S/C WT (LBS)	S/C RCS USED (LBS)	(b) S/C RCS LEFT (LBS)	(b) S/C RCS LEFT (%)
.0	MISSION G	63457.	.0	1220.0	100.
.0	INITIALIZE PROP LOADING	63457.	.0	1220.0	100.
1.7	SM RCS CHECKOUT	63451.	5.8	1214.2	100.
3.2	TRANSPOSITION AND DOCKING +X 0.8 FPS	63445.	6.1	1208.1	99.
3.2	-X 0.3 FPS	63443.	2.4	1205.7	99.
3.2	PITCH TO ACQUIRE S-IVB PITCH 180 DEG AT 1.5 DEG/SEC	63440.	2.3	1203.4	99.
3.2	ROLL CSM 60 DEG 2 DEG/SEC	63439.	1.3	1202.1	99.
3.2	NULL RELATIVE DEL V 0.5 FPS	63435.	4.0	1198.1	98.
3.5	INDEX AND DOCK	63409.	26.0	1172.1	96.
4.2	LM EJECTION -X 5 SEC 4 JET	96717.	7.4	1164.6	95.
4.5	SPS BURN TO EVADE S-IVB ORIENT AT 0.2 DEG/SEC	96712.	4.4	1160.2	95.
4.5	ATTITUDE HOLD 0.5 DEG DB PGNCS	96712.	.8	1159.4	95.
4.5	START TRANSIENT CONTROL	96710.	1.3	1158.1	95.
4.5	SPS BURN BUILD UP	96707.	.0	1158.1	95.
4.5	STEADY STATE BURN	96508.	.3	1157.8	95.
4.5	TAILOFF	96467.	.7	1157.2	95.
4.5	DAMP SHUTDOWN TRANSIENT	96466.	1.1	1156.1	95.
5.5	P52 IMU ALIGN	96466.	.2	1155.9	95.
5.9	NAVIGATION SIGHTINGS ORIENT AT 0.2 DEG/SEC	96461.	4.4	1151.5	94.

(a) Spacecraft weights are approximate and are included for reference only.
(b) Note: These refer to usable SM RCS propellant.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	S/C RCS USED (LBS)	S/C RCS LEFT (LBS)	S/C RCS LEFT (%)
6.1	NAVIGATION SIGHTINGS ORIENT AT 0.2 DEG/SEC	96457.	4.4	1147.1	94.
7.0	ORIENT FOR PTC 3-AXIS 0.2 DEG/SEC	96453.	4.1	1143.0	94.
7.0	ATTITUDE HOLD 0.5 DEG DB PGNCS	96452.	.8	1142.2	94.
7.0	ROLL 0.3 DEG/SEC	96451.	.4	1141.8	94.
10.6	TERMINATE PTC DAMP RATES	96447.	4.4	1137.4	93.
10.7	P52 IMU ALIGN	96447.	.2	1137.1	93.
11.5	MIDCOURSE CORRECTION NO 1 3-AXIS ORIENT PGNCS	96442.	4.4	1132.7	93.
11.5	ATTITUDE HOLD 0.5 DEG DB PGNCS	96442.	.8	1131.9	93.
11.5	START TRANSIENT CONTROL	96440.	1.3	1130.6	93.
11.5	SPS BURN BUILD UP	96437.	.0	1130.6	93.
11.5	STEADY STATE BURN 3 FPS PGNCS	96402.	.1	1130.5	93.
11.5	TAILOFF	96361.	.8	1129.7	93.
11.5	DAMP SHUTDOWN TRANSIENT	96359.	1.1	1128.6	93.
12.0	P52 IMU ALIGN	96359.	.2	1128.4	92.
12.5	ORIENT FOR PTC 3-AXIS 0.2 DEG/SEC	96355.	4.1	1124.3	92.
12.5	ATTITUDE HOLD 0.5 DEG DB PGNCS	96354.	.8	1123.5	92.
12.5	ROLL 0.3 DEG/SEC	96354.	.4	1123.1	92.
24.2	TERMINATE PTC DAMP RATES	96349.	4.4	1118.7	92.
24.3	P52 IMU ALIGN	96349.	.2	1118.5	92.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	S/C RCS USED (LBS)	S/C RCS LEFT (LBS)	S/C RCS LEFT (%)
24.5	CISLUNAR NAVIGATION STAR/EARTH HORIZON ORIENT	96345.	4.4	1114.2	91.
24.7	NAVIGATION SIGHTINGS ORIENT AT 0.2 DEG/SEC	96341.	4.4	1109.8	91.
26.6	MIDCOURSE CORRECTION NO 2 MNVR TO BURN ATT	96336.	4.4	1105.4	91.
26.6	ATTITUDE HOLD 0.5 DEG DB PGNCS	96335.	.8	1104.7	91.
26.7	DELTA VEL = NOMINALLY ZERO	96335.	.0	1104.7	91.
27.0	ORIENT FOR PTC 3-AXIS 0.2 DEG/SEC	96331.	4.2	1100.5	90.
27.0	ATTITUDE HOLD 0.5 DEG DB PGNCS	96330.	.8	1099.7	90.
27.0	ROLL 0.3 DEG/SEC	96330.	.4	1099.3	90.
52.8	TERMINATE PTC DAMP RATES	96326.	4.4	1094.9	90.
53.0	P52 IMU ALIGN	96325.	.2	1094.7	90.
53.6	MIDCOURSE CORRECTION NO 3 MNVR TO BURN ATT	96321.	4.4	1090.3	89.
53.6	ATTITUDE HOLD 0.5 DEG DB PGNCS	96320.	.8	1089.5	89.
53.6	START TRANSIENT CONTROL	96319.	1.3	1088.2	89.
53.6	SPS BURN BUILD UP	96318.	.0	1088.2	89.
53.6	STEADY STATE BURN 3 FPS	96281.	.1	1088.1	89.
53.6	TAILOFF	96239.	.8	1087.3	89.
53.6	DAMP SHUTDOWN TRANSIENT	96238.	1.1	1086.2	89.
53.6	RCS TRIM 1 FPS	96227.	11.2	1075.0	88.
54.0	ORIENT FOR PTC 3-AXIS 0.2 DEG/SEC	96223.	4.1	1070.9	88.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	S/C RCS USED (LBS)	S/C RCS LEFT (LBS)	S/C RCS LEFT (%)
54.0	ATTITUDE HOLD 0.5 DEG DB PGNCS	96222.	.8	1070.1	88.
54.0	ROLL 0.3 DEG/SEC	96222.	.4	1069.8	88.
69.5	TERMINATE PTC DAMP RATES	96217.	4.4	1065.3	87.
70.0	P52 IMU ALIGN	96217.	.2	1065.1	87.
70.5	MIDCOURSE CORRECTION NO 4 MNVR TO BURN ATT	96213.	4.4	1060.7	87.
70.5	ATTITUDE HOLD 0.5 DEG DB PGNCS	96212.	.8	1059.9	87.
70.5	DELTA VEL = NOMINALLY ZERO	96212.	.0	1059.9	87.
72.7	P52 IMU ALIGN	96212.	.2	1059.7	87.
74.0	ORIENT AND SXT STAR CHECK	96207.	4.4	1055.2	86.
74.5	ORIENT AND OBSERVE LUNAR SURFACE	96203.	4.4	1050.8	86.
75.5	LUNAR ORBIT INSERTION BURN 1 3-AXIS ORIENT PGNCS	96198.	4.4	1046.5	86.
75.5	ATTITUDE HOLD 0.5 DEG DB PGNCS	96198.	.8	1045.7	86.
75.5	START TRANSIENT CONTROL	96196.	1.3	1044.4	86.
75.9	LOI BURN BUILD UP	96193.	.0	1044.4	86.
75.9	STEADY STATE BURN	72357.	.5	1043.9	86.
75.9	TAILOFF	72316.	.0	1043.9	86.
75.9	DAMP SHUTDOWN TRANSIENT	72315.	1.1	1042.8	85.
76.2	REV 1 ATTITUDE HOLD WIDE DEADBAND	72312.	3.0	1039.8	85.
77.5	P52 IMU ALIGN	72312.	.1	1039.6	85.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	S/C RCS USED (LBS)	S/C RCS LEFT (LBS)	S/C RCS LEFT (%)
78.2	REV 2 ATTITUDE HOLD	72309.	3.0	1036.6	85.
79.2	P52 IMU ALIGN	72309.	.1	1036.5	85.
80.0	LOI 2 LPO CIRC MNVR TO BURN ATT	72306.	3.5	1033.0	85.
80.0	ATTITUDE HOLD 0.5 DEG DB PGNCS	72305.	.8	1032.2	85.
80.0	B-D ULLAGE	72290.	15.1	1017.1	83.
80.1	SPS BURN BUILD UP	72287.	.0	1017.1	83.
80.1	STEADY STATE BURN	71316.	.2	1017.0	83.
80.1	TAILOFF	71276.	.0	1017.0	83.
80.1	DAMP SHUTDOWN TRANSIENT	71275.	1.1	1015.9	83.
80.2	REV 3 ATTITUDE HOLD	71272.	3.0	1012.9	83.
80.4	REACQUIRE MSFN ROLL 0.2 DEG/SEC	71272.	.1	1012.8	83.
82.2	REV 4 ATTITUDE HOLD	71269.	3.0	1009.8	83.
82.3	MNVR TO LDG SITE OBS ATT	71265.	3.5	1006.3	82.
82.3	LDG SITE OBSERVATION	71265.	.4	1005.8	82.
82.3	REORIENT	71261.	3.5	1002.3	82.
82.3	REACQUIRE MSFN	71261.	.2	1002.1	82.
84.2	MANEUVER TO SLEEP ATTITUDE 3 AXIS 0.2 DEG/SEC	71258.	3.5	998.6	82.
94.4	DAMP RATES	71254.	3.5	995.0	82.
94.5	REACQUIRE MSFN	71254.	.1	994.9	82.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	S/C RCS USED (LBS)	S/C RCS LEFT (LBS)	S/C RCS LEFT (%)
95.1	MNVR TO ALIGN ATT	71250.	3.5	991.4	81.
96.2	REV 11 ATTITUDE HOLD	71247.	3.0	988.4	81.
98.2	REV 12 ATTITUDE HOLD	71244.	3.0	985.4	81.
98.5	MNVR TO LDG SITE OBS ATT	71241.	3.5	981.8	80.
98.5	LDG SITE OBSERVATION	71240.	.4	981.4	80.
98.9	REACQUIRE MSFN ROLL 0.2 DEG/SEC	71240.	.2	981.3	80.
99.8	MANEUVER TO AGS CAL ATTITUDE	71237.	3.5	977.7	80.
100.0	PRE UNDOCKING ALLOCATION	71213.	24.0	953.7	78.
100.0	ORIENT TO UNDOCKING ATTITUDE ROLL 0.2 DEG/SEC	71212.	.2	953.6	78.
100.2	CSM ACTIVE UNDOCK SEP AND NULL VEL 0.5 FPS	37893.	4.5	949.0	78.
100.2	FORMATION FLYING	37883.	10.0	939.0	77.
100.2	REACQUIRE MSFN	37883.	.1	938.9	77.
100.6	ORIENT FOR SEP BURN	37880.	3.1	935.8	77.
100.7	RCS SEPATATION BURN 2.5 FPS	37868.	11.2	924.6	76.
100.7	REV 13 ATTITUDE HOLD	37865.	3.0	921.6	76.
101.5	MANEUVER TO SXT TRACKING	37862.	3.1	918.6	75.
102.6	MANEUVER TO SXT TRACKING	37859.	3.1	915.5	75.
104.4	REACQUIRE MSFN ROLL 0.5 DEG/SEC	37859.	.3	915.5	75.
104.5	MANEUVER TO SXT TRACKING	37856.	3.1	912.2	75.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	S/C RCS USED (LBS)	S/C RCS LEFT (LBS)	S/C RCS LEFT (%)
104.6	REV 14 ATTITUDE HOLD	37853.	3.0	909.2	75.
104.6	MNVR TO LDG SITE OBS ATT	37850.	3.1	906.1	74.
104.6	SDG SITE OBS	37850.	.4	905.7	74.
104.7	TRACK LM	37846.	3.1	902.6	74.
104.9	REACQUIRE MSFN ROLL 0.5 DEG/SEC	37846.	.3	902.3	74.
105.0	REV 15 ATTITUDE HOLD	37843.	3.0	899.3	74.
105.0	REACQUIRE MSFN ROLL 0.5 DEG/SEC	37843.	.3	899.1	74.
107.0	PLANE CHANGE MNVR TO BURN ATT	37840.	3.1	896.0	73.
107.0	ATTITUDE HOLD 0.5 DEG DB PGNCS	37839.	.8	895.2	73.
107.0	ULLAGE	37825.	14.3	880.9	72.
107.0	SPS BURN BUILD UP	37822.	.0	880.9	72.
107.0	STEADY STATE	37754.	.1	880.8	72.
107.0	TAILOFF	37713.	1.0	879.8	72.
107.0	DAMP SHUTDOWN TRANSIENT	37712.	1.1	878.7	72.
107.2	P52 IMU ALIGN	37712.	.1	878.6	72.
107.2	MANEUVER TO SLEEP ATTITUDE	37710.	1.7	876.9	72.
111.5	DAMP RATES	37707.	3.1	873.9	72.
112.2	REV 19 ATTITUDE HOLD	37704.	3.0	870.9	71.
114.2	REV 20 ATTITUDE HOLD	37701.	3.0	867.9	71.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	S/C RCS USED (LBS)	S/C RCS LEFT (LBS)	S/C RCS LEFT (%)
114.3	ORIENT FOR SEXTANT TRACKING	37698.	3.1	864.8	71.
115.0	MANEUVER TO SLEEP ATT	37697.	.7	864.1	71.
120.0	DAMP RATES	37697.	.7	863.5	71.
120.0	SEXTANT TRACKING	37695.	1.3	862.2	71.
120.0	REACQUIRE MSFN	37695.	.1	862.1	71.
120.2	REV 23 ATTITUDE HOLD	37692.	3.0	859.1	70.
122.2	REV 24 ATTITUDE HOLD NARROW DEADBAND	37687.	5.2	853.9	70.
124.5	SUPPORT LM LIFT OFF	37669.	18.0	835.9	69.
124.6	MANEUVER TO TRACK LM POST LIFTOFF	37666.	3.1	832.8	68.
125.5	MANEUVER TO SUPPORT LM CSI BURN	37663.	3.1	829.7	68.
125.6	MANEUVER TO TRACK LM POLST CSI	37660.	3.1	826.6	68.
125.6	REV 25 ATTITUDE HOLD NARROW DEADBAND	37654.	5.2	821.4	67.
126.5	MANEUVER TO SUPPORT LM CDH BURN	37651.	3.0	818.4	67.
126.6	MANEUVER TO TRACK LM POST CDH	37648.	3.1	815.3	67.
126.6	RNDZ NAV	37645.	3.1	812.2	67.
126.6	REINITIATE RNDZ NAV	37642.	3.1	809.1	66.
127.0	MANEUVER TO SUPPORT LM TPI BURN	37639.	3.1	806.1	66.
127.1	MANEUVER TO TRACK LM POST TPI	37636.	3.1	803.0	66.
127.1	MANEUVER TO COAS TRACK	37633.	3.1	799.9	66.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	S/C RCS USED (LBS)	S/C RCS LEFT (LBS)	S/C RCS LEFT (%)
127.1	MANEUVER TO SXT TRACKING	37630.	3.1	796.9	65.
127.2	MANEUVER TO SUPPORT LM MCC1 BURN	37627.	3.1	793.8	65.
127.2	MANEUVER TO SXT TRACKING	37624.	3.1	790.8	65.
127.5	MANEUVER TO SUPPORT LM MCC2 BURN	37621.	3.1	787.7	65.
127.5	MANEUVER TO SUPPORT LM TPF BURN	37618.	3.0	784.7	64.
127.5	MANEUVER TO SXT TRACKING	37615.	3.1	781.6	64.
127.8	ORIENT TO DOCKING ATTITUDE	37612.	3.1	778.5	64.
127.8	ALLOCATION FOR TERMINAL RDZ USAGE FROM POSTFLIGHT	37577.	35.0	743.5	61.
127.9	MAINTAIN BORESIGHT	37574.	3.1	740.5	61.
128.0	DOCKING	43212.	26.0	714.5	59.
131.5	MNVR TO JETTISON ATT	43210.	1.1	713.3	58.
132.0	JETTISON LM 1 FPS	37542.	4.7	708.6	58.
132.0	ORIENT TO TRACKING ATT	37540.	1.6	707.0	58.
132.0	TRACK LM	37540.	.4	706.6	58.
132.6	HOLD INERTIAL ATT	37539.	.4	706.1	58.
132.6	P52 IMU ALIGN	37539.	.7	705.5	58.
134.5	P52 IMU ALIGN	37538.	.7	704.8	58.
134.5	SXT STAR CHECK	37537.	.4	704.4	58.
135.0	TRANS-EARTH INJECTION MNVR TO BURN ATT	37536.	1.6	702.7	58.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	S/C RCS USED (LBS)	S/C RCS LEFT (LBS)	S/C RCS LEFT (%)
135.0	ATTITUDE HOLD 0.5 DEG DB PGNCS	37535.	.8	702.0	58.
135.0	ULLAGE	37521.	14.3	687.6	56.
135.5	SPS BURN BUILD UP	37518.	.0	687.6	56.
135.5	STEADY STATE SPS BURN	27478.	.2	687.4	56.
135.5	TAILOFF	27437.	.0	687.4	56.
135.5	DAMP SHUTDOWN TRANSIENT	27436.	1.1	686.3	56.
136.0	P52 IMU ALIGN	27436.	.6	685.7	56.
136.0	ORIENT FOR PTC	27435.	1.1	684.6	56.
136.0	ATTITUDE HOLD 0.5 DEG DB PGNCS	27434.	.8	683.8	56.
136.0	ROLL 0.3 DEG/SEC	27434.	.1	683.7	56.
147.5	TERMINATE PTC DAMP RATES	27432.	1.3	682.3	56.
147.6	P52 IMU ALIGN	27432.	.6	681.8	56.
150.0	MIDCOURSE CORRECTION NO 5 MANVR TO BURN ATT	27430.	1.3	680.5	56.
150.0	ATTITUDE HOLD 0.5 DEG DB PGNCS	27430.	.8	679.7	56.
150.0	DEL VEL = NOM ZERO	27430.	.0	679.7	56.
150.5	ORIENT FOR PTC	27428.	1.1	678.5	56.
150.5	ATTITUDE HOLD 0.5 DEG DB PGNCS	27428.	.8	677.8	56.
150.5	ROLL 0.3 DEG/SEC	27428.	.1	677.6	56.
171.0	TERMINATE PTC	27426.	1.3	676.3	55.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	S/C RCS USED (LBS)	S/C RCS LEFT (LBS)	S/C RCS LEFT (%)
172.0	P52 IMU ALIGN	27426.	.6	675.8	55.
172.5	MIDCOURSE CORRECTION NO & MANVR TO BURN ATT	27424.	1.3	674.5	55.
172.5	ATTITUDE HOLD 0.5 DEG DB PGNCS	27424.	.8	673.7	55.
172.5	RCS -X TRANS 5 FPS	27408.	15.9	657.8	54.
173.0	ORIENT FOR PTC	27407.	1.1	656.6	54.
173.0	ATTITUDE HOLD 0.5 DEG DB PGNCS	27406.	.8	655.8	54.
173.0	ROLL 0.3 DEG/SEC	27406.	.1	655.7	54.
190.0	TERMINATE PTC	27404.	1.3	654.4	54.
191.2	P52 IMU ALIGN	27404.	.6	653.8	54.
192.0	MIDCOURSE CORRECTION NO 7 MNVR TO BURN ATT	27402.	1.3	652.5	53.
192.0	ATTITUDE HOLD 0.5 DEG DB PGNCS	27402.	.8	651.7	53.
192.0	DEL VEL = NOM ZERO	27402.	.0	651.7	53.
192.0	STAR CHECK MIN IMPULSE	27401.	.4	651.3	53.
193.0	MANEUVER TO REENTRY ATTITUDE	27399.	2.6	648.7	53.
193.0	ATTITUDE HOLD 0.5 DEG DB PGNCS	27390.	8.6	640.1	52.
194.8	MANEUVER TO SEP ATTITUDE	27387.	2.6	637.4	52.
194.8	CM/SM SEPARATION DELTA VEL = 3 FPS	15001.	7.9	629.6	52.

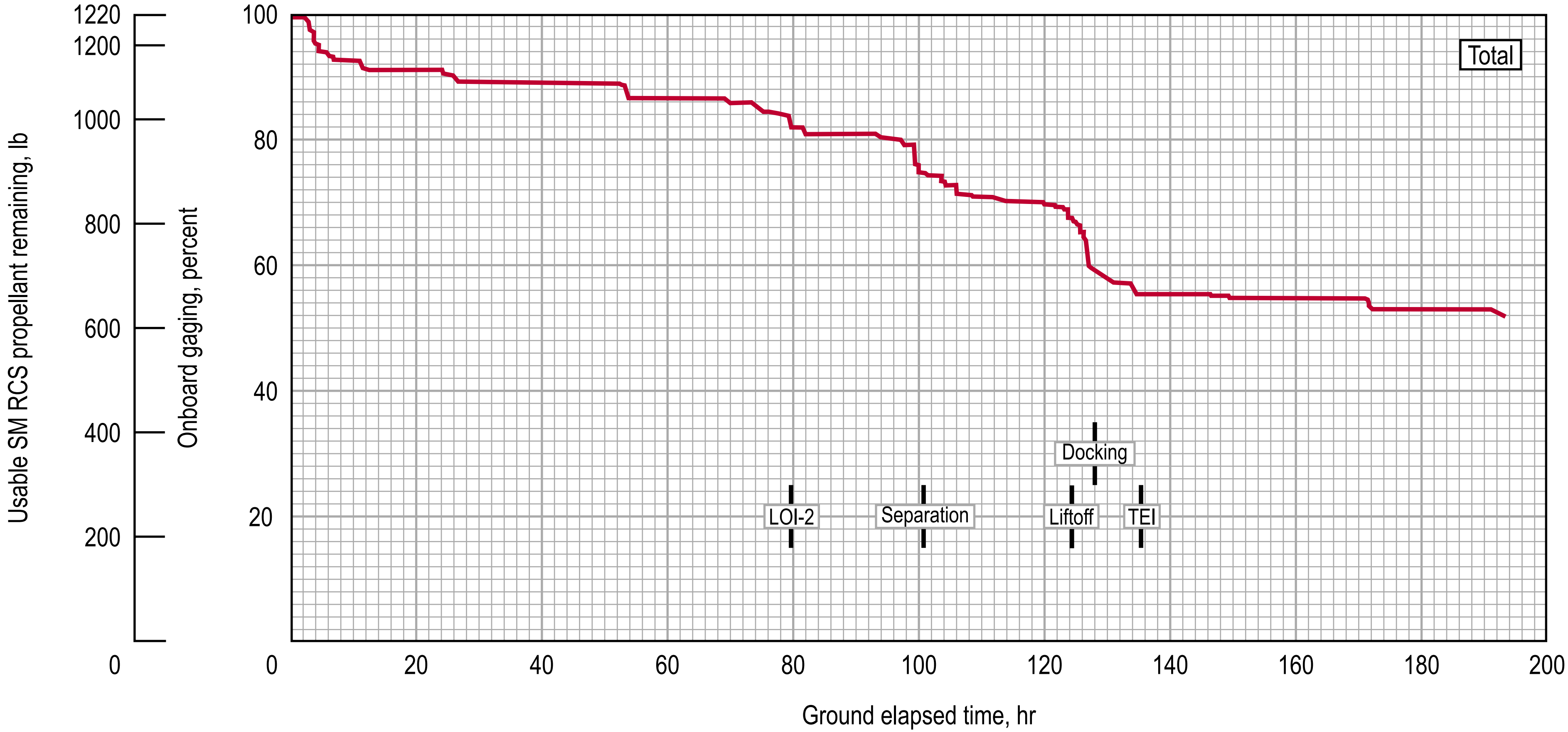


Figure 5-1
SM RCS propellant profile - total

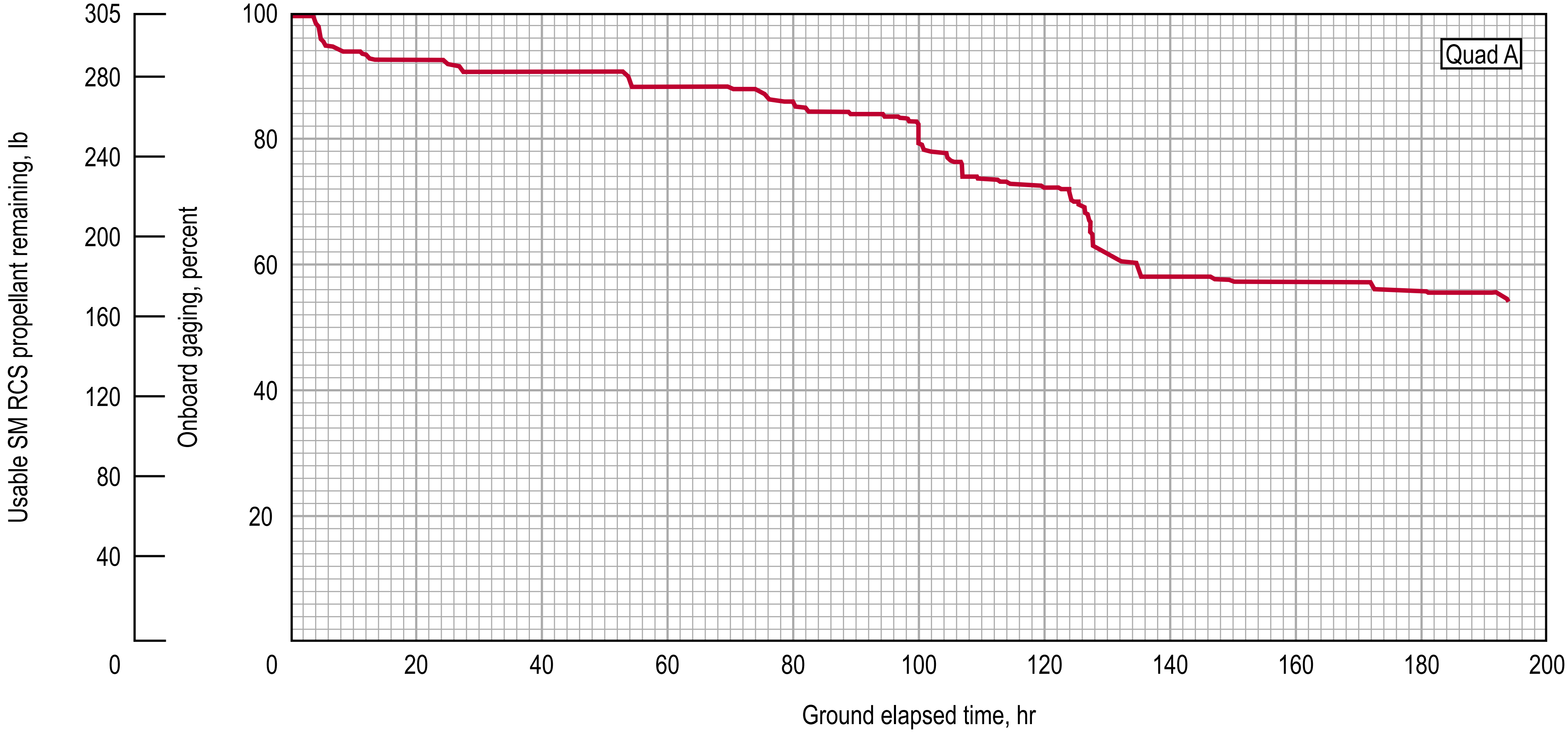


Figure 5-2
SM RCS propellant profile - quad A

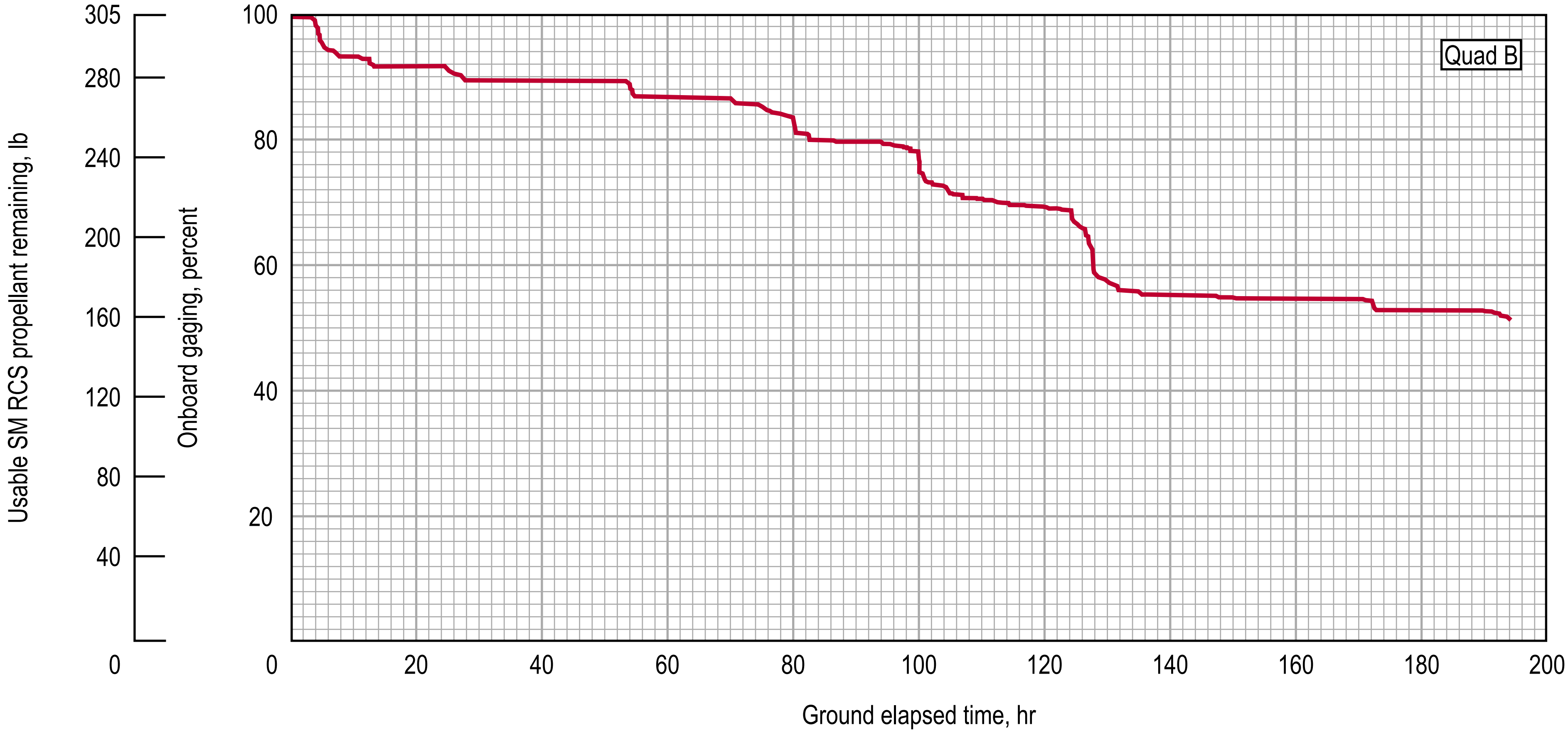


Figure 5-3
SM RCS propellant profile - quad B

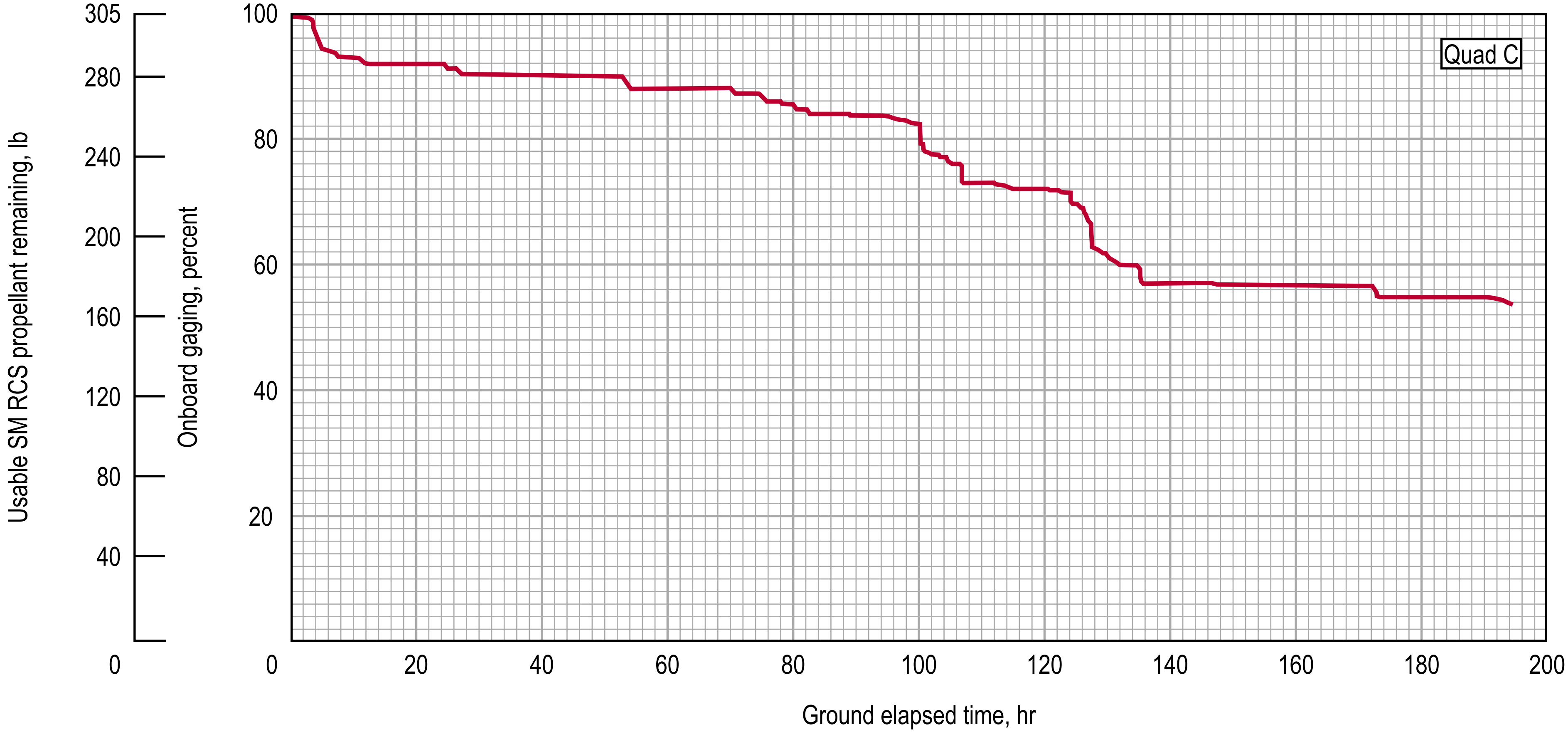


Figure 5-4
SM RCS propellant profile - quad C

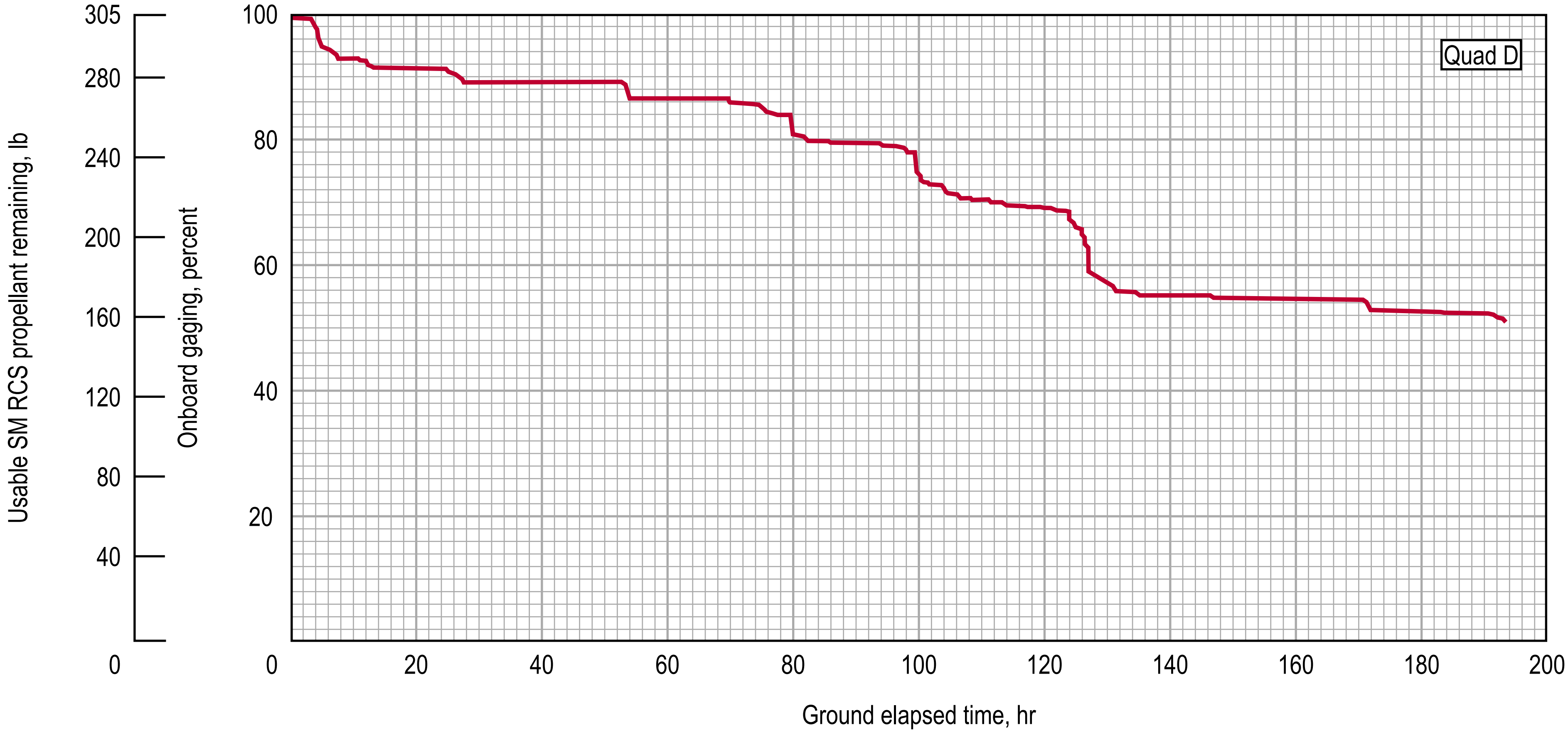


Figure 5-5
SM RCS propellant profile - quad D

TABLE 5-3

CM RCS Propellant Summary

Item	Propellant required, lb.	Propellant remaining, lb.
Loaded	--	245.0
Trapped	36.4	208.6
Available for mission planning	--	208.6
Nominal usage	39.3	169.3
Nominal remaining	--	169.3

SERVICE PROPULSION SYSTEM (SPS). – The budget presented in table 5-4 is for a July 16 launch, 72 degree launch azimuth, first opportunity injection, 59.5 hour lunar parking orbit, and fast earth return. The assumptions used in preparing this budget are presented in table 5-5. ΔV requirements were coordinated with LMAB in MPAD.

It should be noted that the mission flexibility allowance of 900 fps has been used in addition to the fast return. In real time however, it is highly likely that a slower earth return would be performed in the mission flexibiblity ΔV had already been used (e.g., for LM rescue). Table 5-4 shows 3906 lbs of propellant remaining nominally and a total propellant margin (accounting both for the flexibility ΔV and the fast return) of 1268 lb.

Table 5-4 – APOLLO 11 SPS PROPELLANT SUMMARY

ITEM	PROPELLANT REQUIRED, LB	PROPELLANT REMAINING, LB
Loaded [a]	--	40803.0
Trapped and unavailable	441.4	40361.6
Outage	59.5	40302.1
Unbalance meter	100.0	40202.1
Available for ΔV	--	40202.1
Required for ΔV		
TLMC (120 fps)[b]	1166.4	39035.7
LOI-1 (2924 fps, 5 min. 59 sec.)	23862.4	15173.3
LOI-2 (157.8 fps, 16.4 sec.)	1115.4	14057.9
LOPC (16.6 fps, .9 sec.)	73.8	13984.1
TEI (3292.7 fps, 149 sec.)	10077.8	3906.3
Nominal remaining	--	3906.3
Mission flexibility (900 fps)	2212.4	1693.9
Dispersions (-3 σ)	426.0	1267.9
Propellant margin	--	1267.9

[a] 15712.0 lb of fuel and 25091.0 lb of oxidizer; this is loaded on CSM-107.
[b] Includes 19.7 fps for evasive maneuver.

TABLE 5-5 – ASSUMPTIONS FOR THE APOLLO 11 SPS PROPELLANT BUDGET

1. There is a non-propulsive propellant loss of 14.4 lb for each engine start. LM rescue assumed three engine starts.

2. A mission flexibility ?V of 900 fps has been included in the SPS budget to provide the capability to perform a worst case LM rescue, or to handle several other contingencies (such as loss of PGNCS), or to perform a quicker earth return.

3. Spacecraft weight:

CM	12 280.0 lb
SM	10 551.3 lb
SLA Ring	98.0 lb
Tanked SPS	40 600.7 lb
LM (unmanned)	33 278.3 lb
Total	96 808.3 lb

4. Lunar Orbit Activity
   Total weight transfer (CSM to LM) = 436.7 lb
   Total weight transfer (LM to CSM) = 284.0 lb

5. SM RCS, EPS and ECS weight losses:

Mission Period	Incremental Weight Loss, lb
EL to TLMC	151.8
TLMC to LOI-1	327.1
LOI-1 to LOI-2	32.0
LOI-2 to LOPC	146.5
LOPC to TEI	216.1

6. SM RCS usage (above nominal rendezvous requirement) for LM rescue was 216 lb.

LM RCS BUDGET

Ground Rules and Assumptions

1. Data for the LM RCS engine performance and propellant requirements were obtained from the Spacecraft Operational Data Book and postflight analysis from Apollo 9 and Apollo 10.

2. All orientation maneuvers were assumed to be made at 2.0°/sec.

3. All orientation maneuvers were assumed to be three-axis maneuvers.

TABLE 5-6

LM RCS Propellant Loading and Usage Summary

Loaded	633.0
Trapped	40.6
Nominal deliverable	592.4
Gaging inaccuracy and loading tolerance	39.5
Mixture ratio uncertainty	17.0
Usable	535.9
Nominal mission requirement	252.7
Nominal remaining	283.2

TABLE 5-7

LM-RCS PROPELLANT BUDGET		(a)		(b)	(b)
TIME (HR)	EVENT	S/C WT (LBS)	S/C RCS USED (LBS)	S/C RCS LEFT (LBS)	S/C RCS LEFT (%)
0 00	OUTPUT PROPELLANT LOADINGS	33714.	.0	633.0	100.
99 25	RCS HOT FIRE	33709.	5.0	628.0	99.2
100 15	UNDOCKING	33709.	.0	628.0	99.2
100 15	NULL UNDOCKING VELOCITY	33707.	1.9	626.1	98.9
100 20	LM MNVR FOR INSPECTION YAW	33705.	1.7	624.4	98.6
100 20	LM MNVR FOR INSPECTION PITCH	33703.	2.0	622.4	98.3
100 25	LM MNVR FOR INSPECTION YAW	33702.	.8	621.6	98.2
100 25	FORMATION FLYING	33690.	2.0	619.6	97.9
100 50	RR LOCK ON MNVR	33687.	3.6	616.0	97.3
101 00	IMU REALIGN STAR 1	33683.	3.6	612.4	96.7
101 00	IMU REALIGN STAR 2	33680.	3.6	608.8	96.2
101 00	IMU REALIGN STAR 3	33676.	3.6	605.2	95.6
101 32	MNVR TO DOI BURN ATTITUDE	33672.	3.6	601.6	95.0
101 32	ATTITUDE HOLD	33672.	.1	601.5	95.0
101 38	2 JET ULLAGE	33667.	5.9	595.6	94.1
101 38	DOI BURN	33419.	.0	595.6	94.1
101 38	MOMENT CONTROL DOI BURN	33414.	5.0	590.6	93.3
101 38	TRIM HORIZONTAL RESIDUAL	33407.	7.6	583.0	92.1
101 38	ATTITUDE HOLD	33407.	.3	582.8	92.1
101 38	PITCH DOWN	33406.	1.0	581.8	91.9
101 42	RR LOCK ON MNVR	33402.	3.6	578.2	91.3
101 55	PITCH DOWN	33401.	.6	577.6	91.3
101 55	YAW LEFT	33401.	.6	577.0	91.2
102 00	ALIGNMENT CHECK	33400.	1.2	575.8	91.0
102 10	RR LOCK ON MNVR	33396.	3.6	572.2	90.4
102 14	MNVR TO PDI ATTITUDE	33392.	3.6	568.6	89.8
102 14	MAINTAIN LOS	33391.	1.0	567.6	89.7
102 29	ATTITUDE HOLD	33391.	.1	567.5	89.7
102 35	2 JET ULLAGE	33385.	5.9	561.7	88.7
102 35	PDI BURN	16753.	.0	561.7	88.7
102 35	POWERED DESCENT	16710.	34.1	527.5	83.3
102 47	TOUCHDOWN	16710.	.0	527.5	83.3

[a] These weights were used for analysis only and do not reflect the actual weight after consumables loading.
[b] RCS propellant remaining of total loaded.

TABLE 5-7 (CONT'D)

LM-RCS PROPELLANT BUDGET		(a)		(b)	(b)
TIME (HR)	EVENT	S/C WT (LBS)	S/C RCS USED (LBS)	S/C RCS LEFT (LBS)	S/C RCS LEFT (%)
112 40	ADD LUNAR SAMPLES	16580.	.0	527.5	83.3
124 23	LUNAR LIFT OFF	10840.	.0	527.5	83.3
124 23	POWERED ASCENT PHASE WITH RCS/APS INTERCONNECT	6087.	.0	527.5	83.3
124 23	POWERED ASCENT PHASE WITHOUT RCS/APS INTERCONNECT	5969.	.9	526.7	83.2
124 25	RR LOCK ON MNVR	5969.	.4	526.2	83.1
124 30	INSERTION BURN CONTROL	5967.	1.8	524.4	82.8
124 30	TRIM OUT OF PLANE ERROR	5964.	3.3	521.2	82.3
124 30	ATTITUDE HOLD	5962.	1.3	519.9	82.1
124 37	IMU REALIHN STAR 1	5962.	.4	519.5	82.1
124 37	IMU REALIHN STAR 2	5961.	.4	519.0	82.0
124 37	IMU REALIHN STAR 3	5961.	.4	518.6	81.9
124 55	RR LOCK ON MNVR	5961.	.4	518.1	81.9
124 55	MAINTAIN LOS	5958.	2.7	515.5	81.4
125 15	ATTITUDE HOLD	5957.	1.3	514.2	81.2
125 21	CSI BURN RCS +2	5923.	33.6	480.6	75.9
125 26	MAINTAIN LOS	5920.	3.3	477.2	75.4
125 44	MNVR TO PLANE CHANGE ATTITUDE	5919.	.4	476.8	75.3
125 45	ATTITUDE HOLD	5918.	1.3	475.5	75.1
125 50	RCS PLANE CHANGE BURN	5914.	4.1	471.4	74.5
126 00	RR LOCK ON MNVR	5913.	.4	471.0	74.4
126 00	MAINTAIN LOS	5911.	2.0	469.0	74.1
126 15	ATTITUDE HOLD	5910.	1.3	467.7	73.9
126 19	CDH RCS BURN	5906.	4.0	463.7	73.3
126 19	MAINTAIN LOS	5902.	4.0	459.7	72.6
126 53	ATTITUDE HOLD	5901.	1.3	458.4	72.4
126 58	RCS TPI BURN	5884.	17.0	441.4	69.7
126 58	MAINTIN LOS	5883.	1.3	440.1	69.5
127 36	MCC AND BRAKING	5849.	33.9	406.3	64.2
127 36	ATTITUDE AND LOS CONTROL	5833.	16.0	390.3	61.7
128 00	LM CONTROL CSM ACTIVE DOCKING	5823.	10.0	380.3	60.1

[a] These weights were used for analysis only and do not reflect the actual weight after consumables loading.
[b] RCS propellant remaining of total loaded.

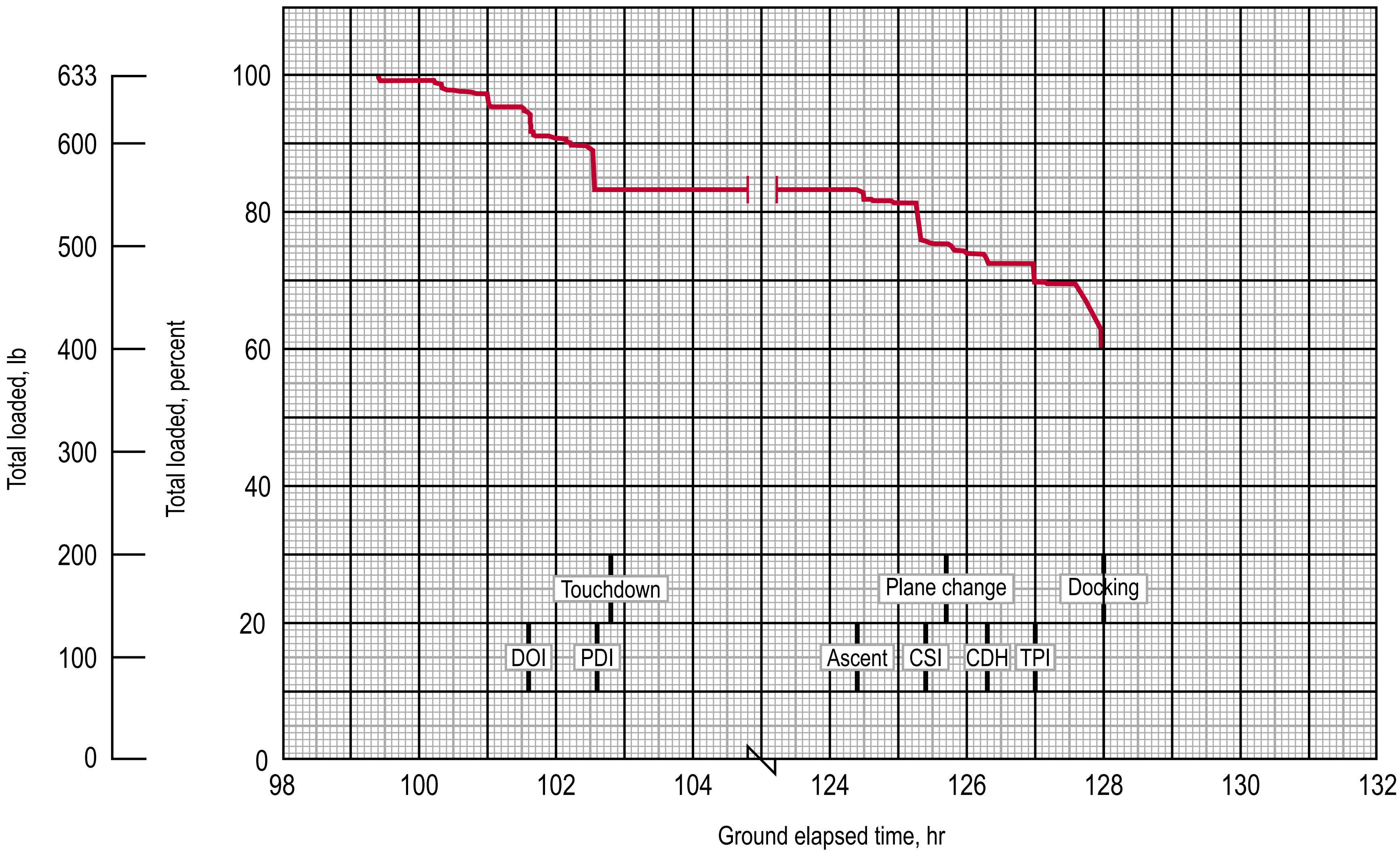


Figure 5-6
LM RCS propellant profile

DESCENT PROPULSION SYSTEM PROPELLANT BUDGET

DESCENT PROPULSION SUBSYSTEM (DPS) - The DPS budget is shown in table 5-8 and the ground rules and assumptions in table 5-9.

Previously, the uncertainty in the low-level sensor (68.7 lb) has been shown as a contingency allowance. This is now included as part of the unusables. Also, there has previously been a contingency allowance for manual hover to allow for 2 minutes of burn time from 500 feet to touchdown. The present budget shows a nominal ΔV which includes a manual allowance of 477 fps (90 sec) from 500 feet to touchdown. Any additional hover time will be used from the propellant margin (unassigned capability). The rate of use for hover is approximately 9.1 lb/sec.

Propellant loads are those actually loaded on LM-5, and trapped and residual propellants are from Volume III, SODB. Engine performance data and ΔV requirements have been coordinated with LAB in MPAD.

Three sigma dispersions represent total propellant cost due to 3 s uncertainties in propellant loading, trapped, I_{sp}, ΔV, separation weight, non-ΔV consumables weight, and mixture ratio. There is a total propellant margin of 669 lb or approximately 73 seconds of hover time.

Table 5-8 – APOLLO 11 DPS PROPELLANT SUMMARY

ITEM	PROPELLANT REQUIRED, LB	PROPELLANT REMAINING, LB
Loaded [a]	--	18184.2
Trapped and unavailable	223.5	17960.7
Outage	14.0	17946.7
Low-Level Sensor Uncertainty	68.7	17878.0
Available for ΔV	--	17878.0
Nominal Required for ?V of 6728.6 fps	16799.7	1078.3
Dispersions (-3 σ)	224.7	853.6
Contingencies		
Engine Valve-Pair Malfunction (ΔMR=±.016)	81.1	772.5
Redesignation (60 fps)	104.0	668.5
Margin (73 sec. hover)	--	668.5

[a] 6974.8 lb of fuel and 11209.4 lb of oxidizer; this is loaded on the LM-5 spacecraft.

Table 5-9 – ASSUMPTIONS FOR THE APOLLO 11 DPS PROPELLANT BUDGET

1. Integrated average I_{sp} = 301.9 ±3.54 seconds
2. LM separation weight = 33746. lb
3. Mixture ratio = 1.596 ±0.0108
4. Nominal ΔV = 6728.6 ±96 fps
5. Non-ΔV consumables of 47.4 lb from separation to DOI and 106.1 lb from DOI to touchdown.

ASCENT PROPULSION SYSTEM PROPELLANT BUDGET

ASCENT PROPULSION SUBSYSTEM (APS) – Tables 5-10 and 5-11 present the ascent propellant budget for the current mission. Propellant loads are those actually on LM-5. Mission ΔV was coordinated with LAB in MPAD. The budget shown in table 5-10 accounts for an engine valve-pair malfunction, a PGNCS to AGS switchover, and a touchdown abort. There is a total propellant margin of 68 lb or about 6 seconds of burn time.

Table 5-10 – APOLLO 11 APS PROPELLANT SUMMARY

ITEM	PROPELLANT REQUIRED, LB	PROPELLANT REMAINING, LB
Loaded [a]	--	5238.4
Trapped and unavailable	48.9	5189.5
Outage	17.5	5172.0
Available for ΔV	--	5172.0
Nominal Required for ΔV of 6072.5 fps	4965.8	206.2
Dispersions (-3 σ)	57.8	148.4
Contingencies		
Engine Valve-Pair Malfunction (ΔMR=±.016)	19.6	128.8
PGNCS to AGS Switchover (40 fps)	23.8	105.0
Touchdown Abort (ΔW=+99.9 lb, ΔΔV=-15fps)	36.8	68.2
Margin (6 seconds)	--	68.2

[a] Includes 2019.9 lb fuel and 3218.5 lb oxidizer; this is loaded on the LM-5 spacecraft.

Table 5-11 – ASSUMPTIONS FOR THE APOLLO 11 APS PROPELLANT BUDGET

1. I_{sp} = 308.97 ±3.553 seconds
2. Mixture ratio = 1.602 ±0.0225
3. Nominal ΔV = 6072.5 ±33.5 fps
4. Ascent stage lift-of weight = 10873.6 lb

CSM-107/LM5 CRYOGENIC/EPS AND ECS BUDGET

The results of the Cryogenic, EPS, and ECS analysis are summarized in the following tables and figures:

TABLE 5-11	CSM Cryogenic Loading And Usage Summary
TABLE 5-13	LM EPS Summary
TABLE 5-14	LM ECS Summary
FIGURE 5-7	CSM O2 PROFILE
FIGURE 5-8	CSM H2 PROFILE
FIGURE 5-9	CSM POWER PROFILE
FIGURE 5-10	CSM BUS VOLTAGE VS TIME
FIGURE 5-11	LM DESCENT POWER PROFILE
FIGURE 5-12	LM ASCENT POWER PROFILE
FIGURE 5-13	LM TOTAL CURRENT PROFILE
FIGURE 5-14	LM DESCENT O2 PROFILE
FIGURE 5-15	LM ASCENT O2 PROFILE
FIGURE 5-16	LM DESCENT H2O PROFILE
FIGURE 5-17	LM ASCENT H2O PROFILE

CSM EPS BUDGET

ASSUMPTIONS AND GROUND RULES

1. The system was assumed to operate with three fuel cells and two inverters.
2. Fuel cell purging is included in the EPS requirements.
3. 100% fill for both H_2 and O_2.
4. Three entry and postlanding batteries were considered available to supply the total spacecraft power required for entry, parachute descent, and postlanding time. Each battery was assumed to have a 40 A-h capacity until splashdown, at which time the capacity was uprated to 45 A-h.
5. Two batteries were considered to be in parallel with the fuel cells during ascent and for each SPS maneuver.
6. No cryogenic venting was assumed in flight.
7. The EPS hydrogen consumption rate (lb/hr) = 0.00257 x I_{fc}
8. The EPS oxygen consumption rate (lb/hr) = 7.936 x $\dot{H}_2$
9. Six battery charges were assumed: three on battery A and three on battery B.

TABLE 5-12

APOLLO 11 CRYOGENIC SUMMARY

	H_2, lb	O_2, lb
I. Planning Allowance		
A. Total Loaded	58.60	660.20
B. Less Residual	2.32	13.00
C. Less Instrumentation Error	1.50	17.50
Available for Mission Planning	54.78	629.70
II. Predicted Usages		
A. Prelaunch [1]		
1. Inline HTR + Pressure Relief (T-28 to T-3 (Incl 12.5 hr hold))	1.61	18.60
2. Power Production (plus ECS O_2) (T-3 to liftoff)	.57	6.96
Total Prelaunch requirements	2.18	25.50
B. Flight		
1. EPS Requirements (Incl FC Purge)	36.60	288.33
2. CM ECS (Incl Cabin Purge)	-	72.40
3. LM Pressurizations	-	10.35
Total Flight Requirements	36.60	371.08
III. Nominal Reserves (RSS)		
EPS Uncertainty (5 percent)	1.83	14.42
ECS Uncertainty (.08 lb/hr)	-	15.60
Tank Unbalance (AOH)	.80	12.90
Launch Window	.86	10.20
RSS Subtotal	2.17	26.87
IV. Operational Reserves		
A. Available for Mission Planning	54.78	629.70
B. Less Nominal Predicted Usage	38.78	396.58
C. Less Nominal Reserves	2.17	26.87
Operational Reserve	13.83	206.25

[1] KSC Supplied Data

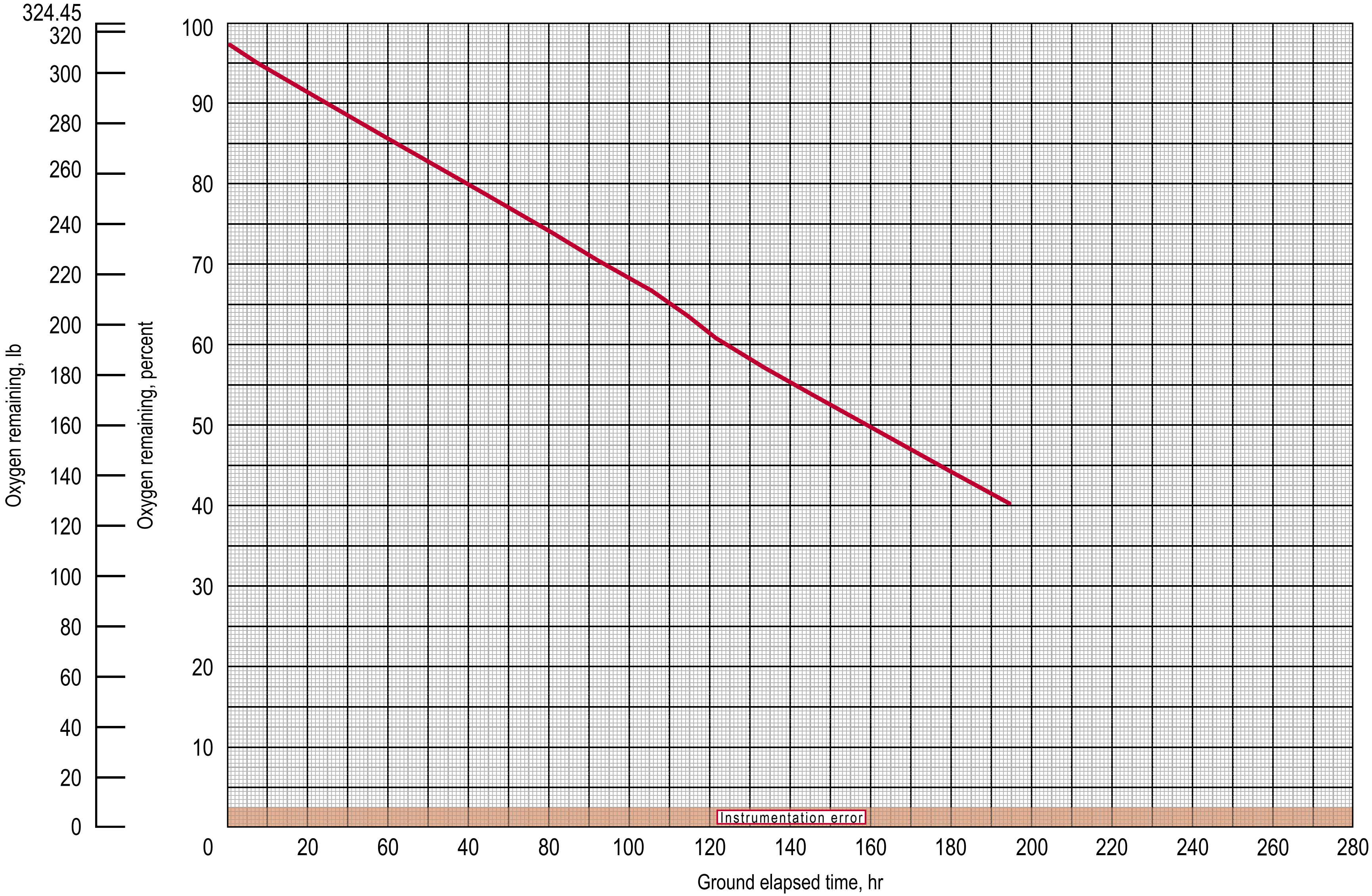


Figure 5-7
Oxygen remaining for mission for one tank versus time

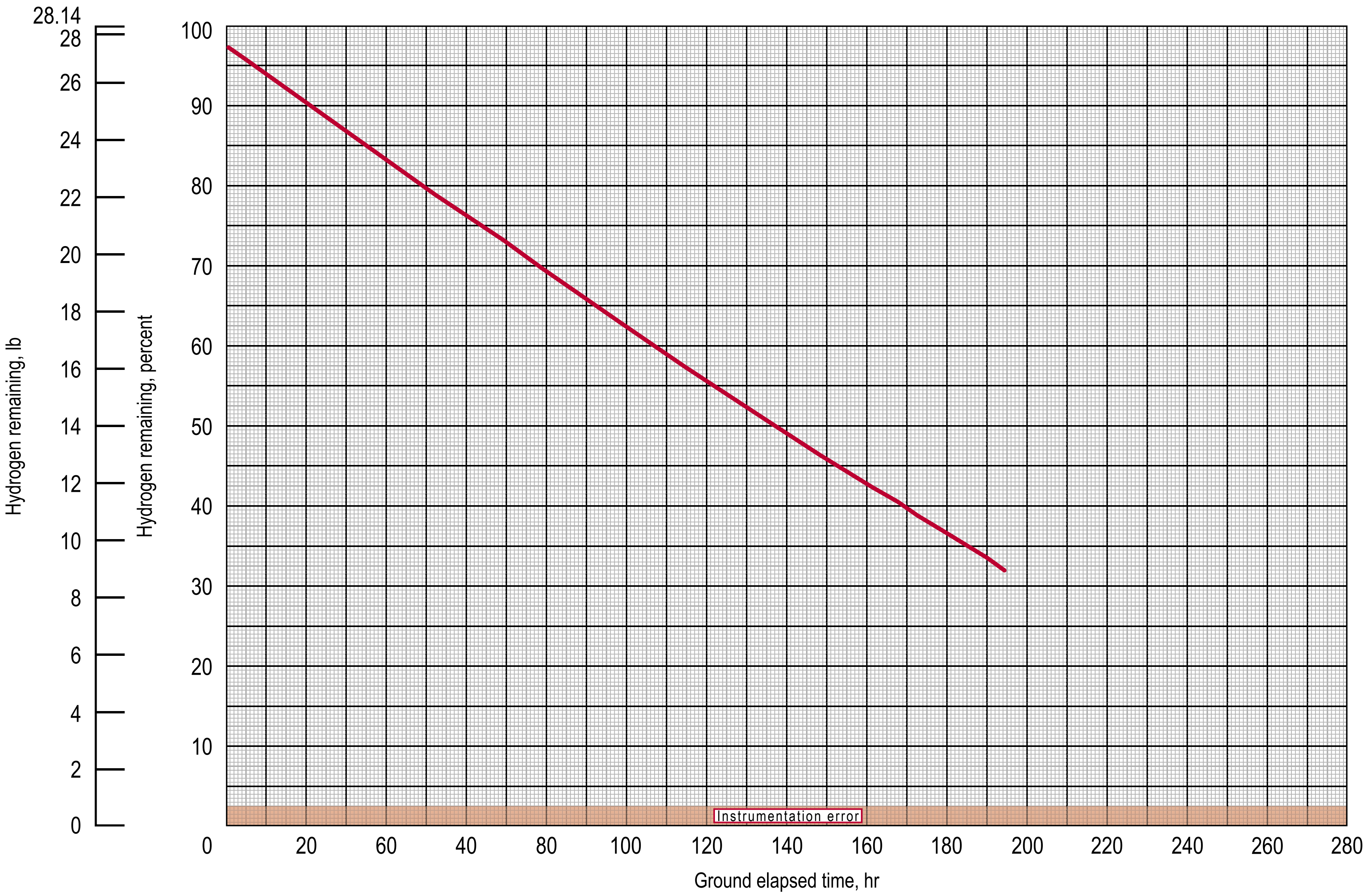


Figure 5-8
Hydrogen remaining for mission for one tank versus time

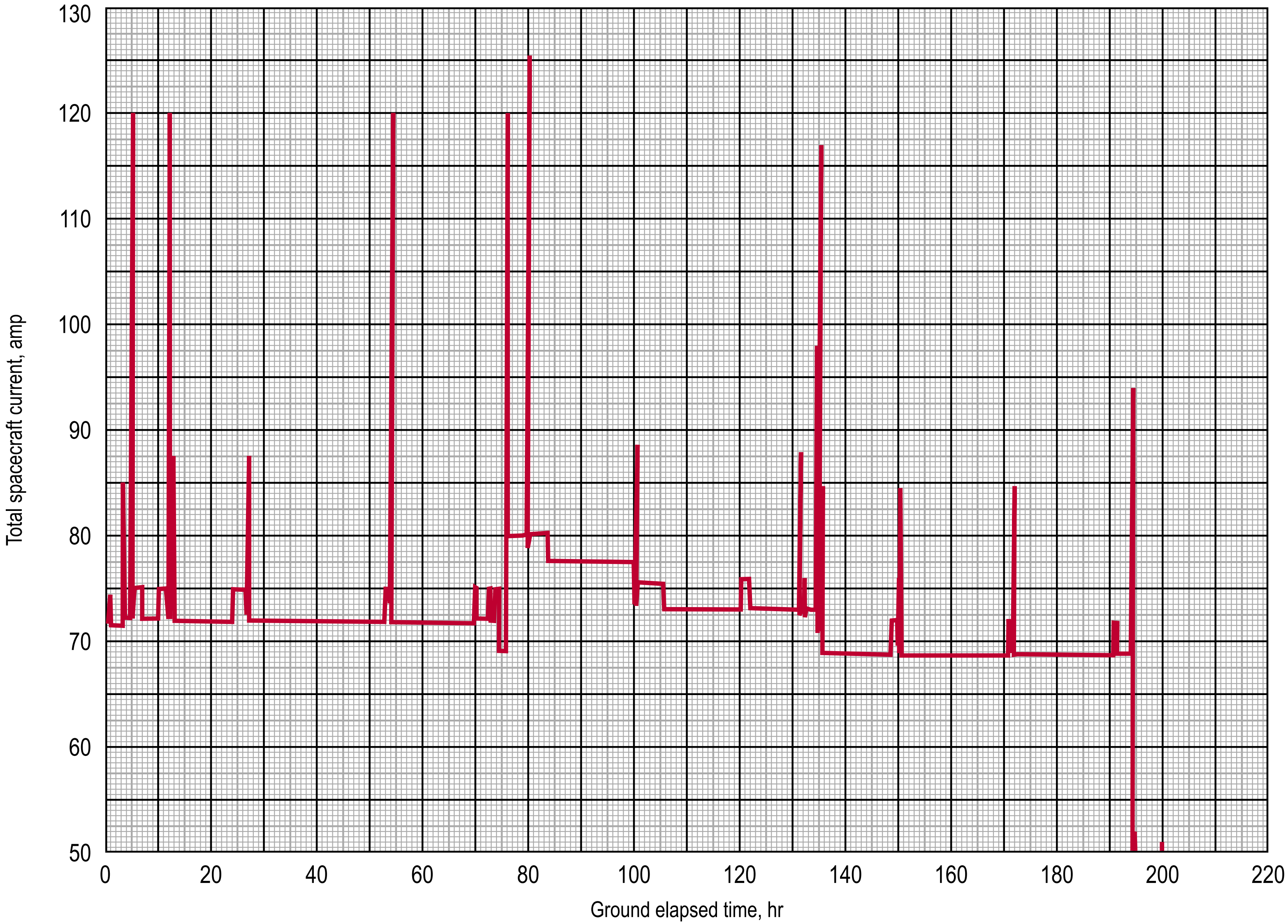


Figure 5-9
CSM total spacecraft current profile

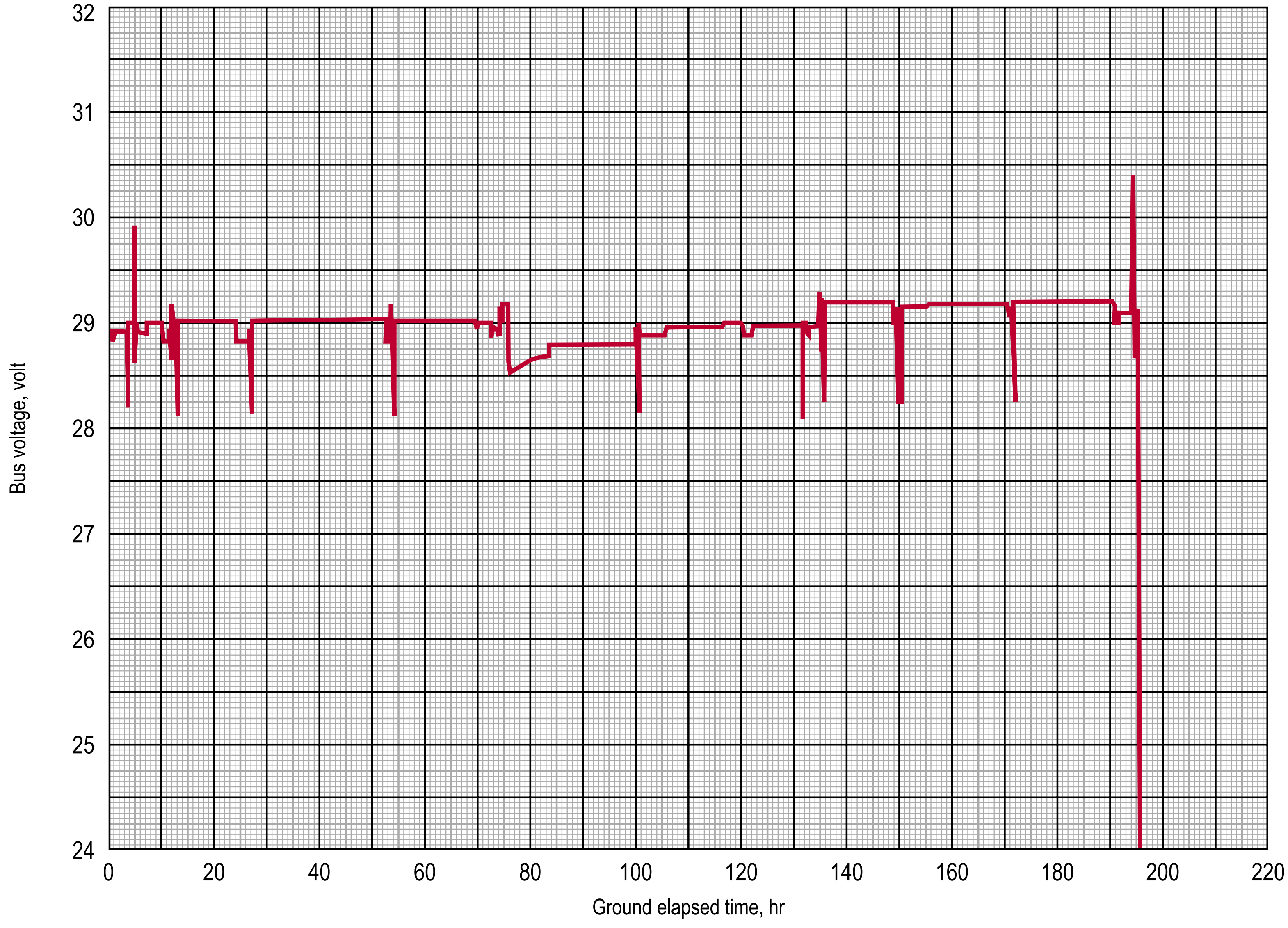


Figure 5-10
CSM bus voltage versus time

LM EPS ANALYSIS

GROUND RULES AND ASSUMPTIONS

1. The descent stage batteries go on the line 30 minutes prior to earth liftoff.
2. A 3.8 hour checkout was assumed for lunar orbit.
3. Ascent and descent batteries were paralleled for the powered descent burn and prior to liftoff from the lunar surface.
4. The S-band equipment was assumed on 100 percent from initial activation in lunar orbit until completion of the mission.
5. The rendezvous radar electronics was assumed to be operational for the period of time dictated by the current G Mission flight plan.
6. The primary navigation and guidance subsystem (PGNCS) was left in the operate mode for the entire lunar stay.
7. The forward window heaters were left off for the entire mission.

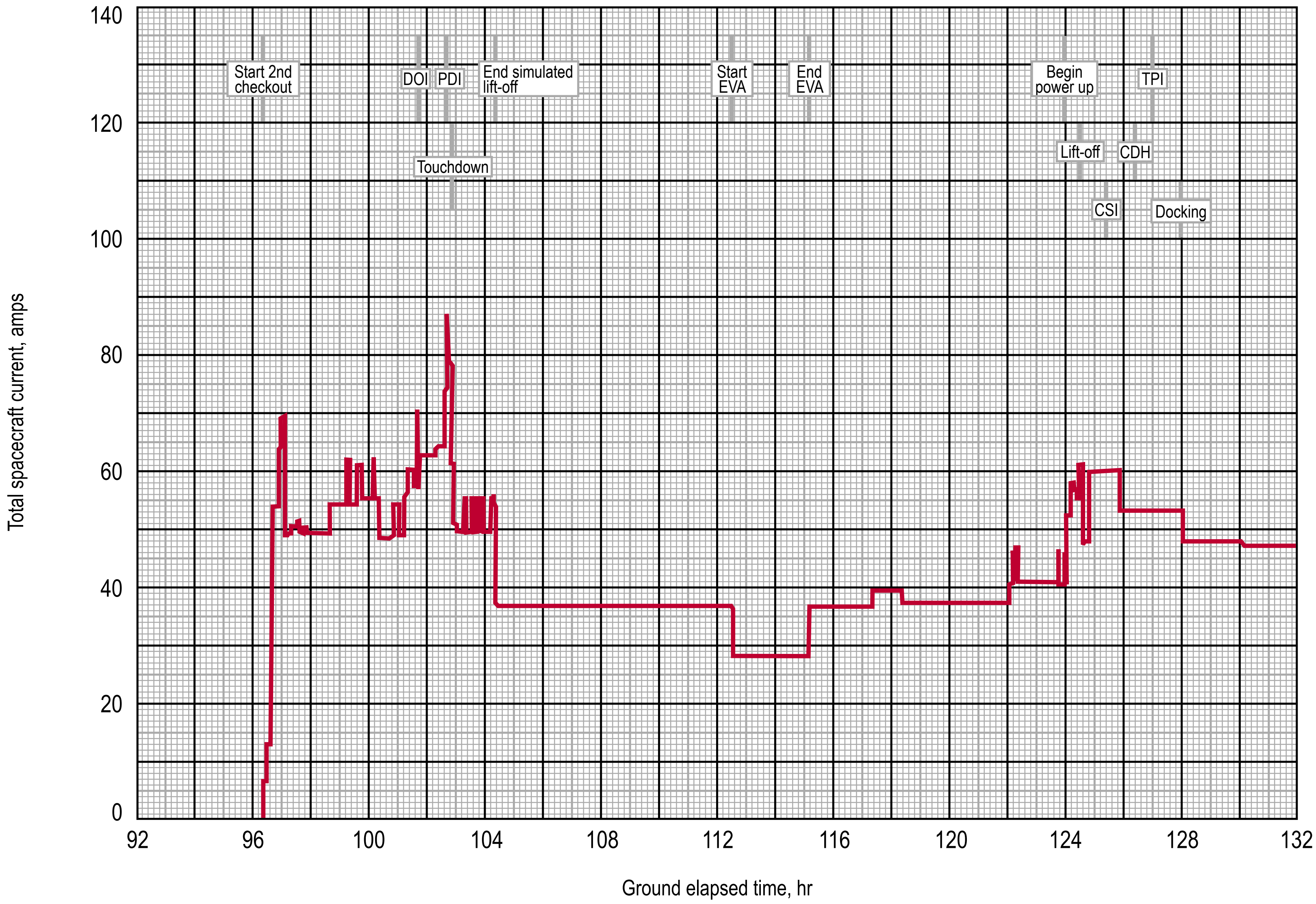


Figure 5-11
LM-5 total spacecraft current

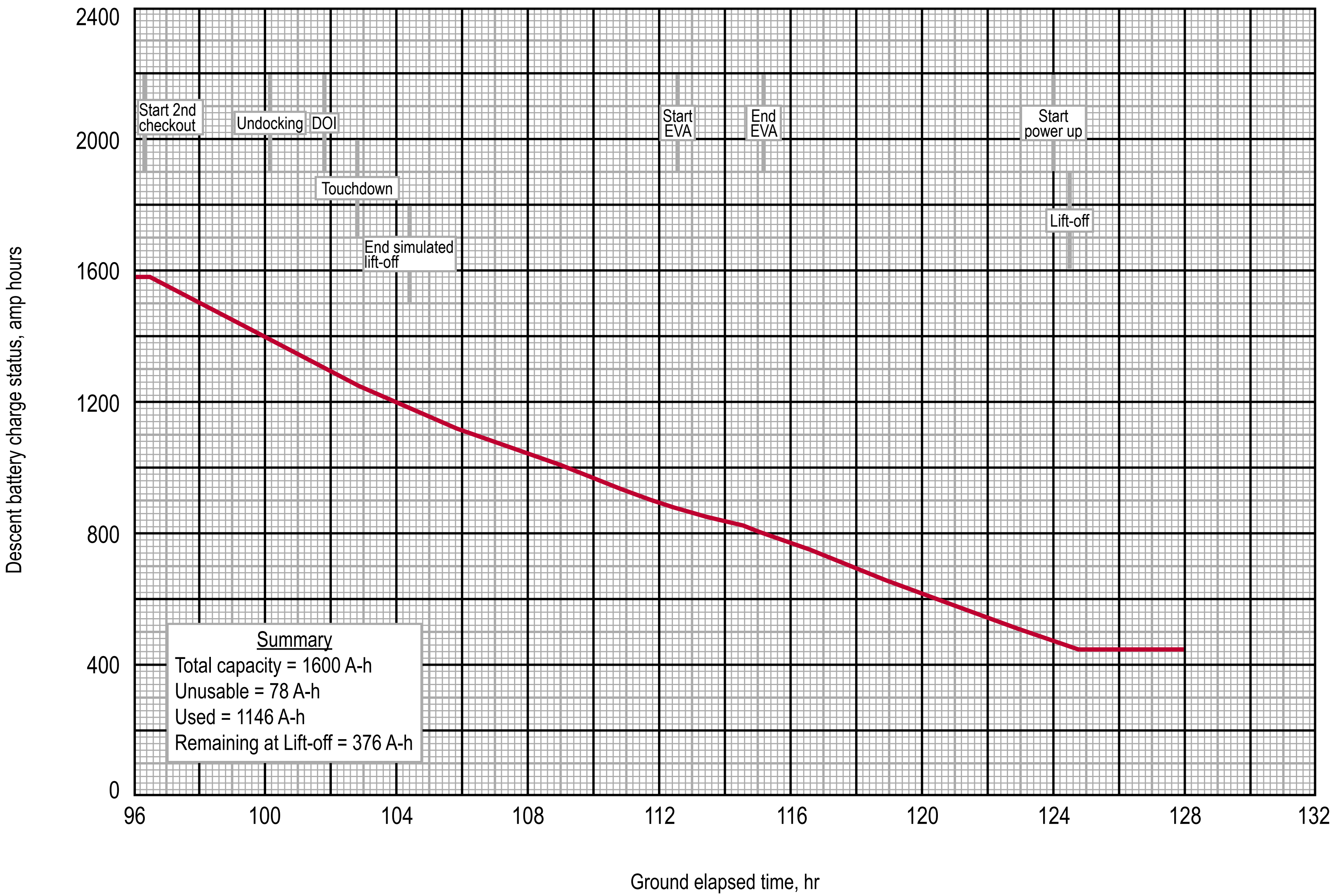


Figure 5-12
Descent stage amp hours remaining

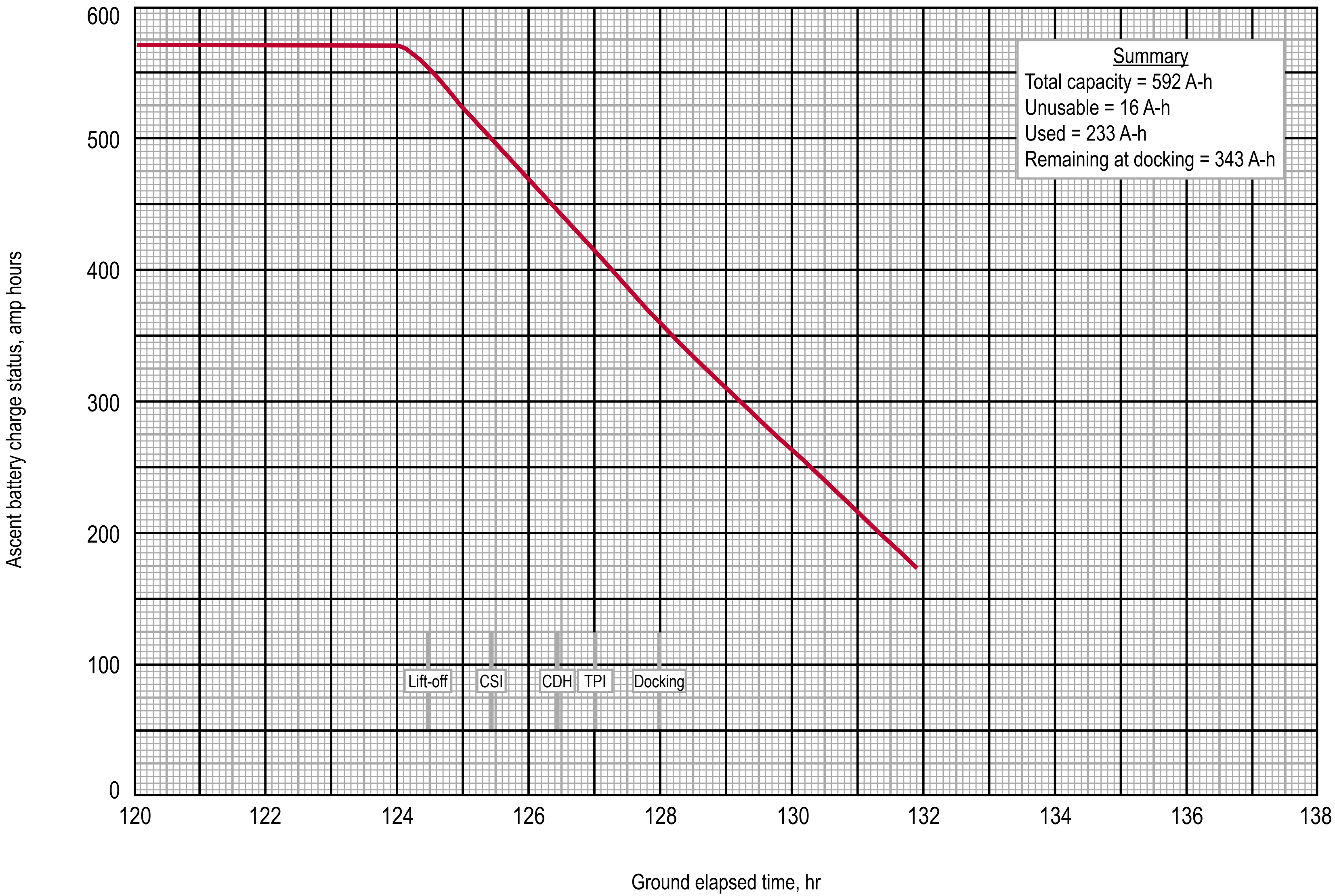


Figure 5-13
Ascent stage amp hours remaining

LM ECS BUDGET

GROUND RULES AND ASSUMPTIONS

1. Cabin O_2 leakage rate was 0.2 lb/hr while pressurized
2. Metabolic rates were varied according to Volume 2 of the Spacecraft Operational Data Book
3. Metabolic O_2 consumed was $(1.643 \times 10^{-4}) \times$ (metabolic rate)
4. LM pressurization requires 6.62 lb of O_2
5. Cabin pressure regulator check requires 2.65 lb of O_2
6. H_2O consumed because of sublimator cooling was total heat removed divided by 1040 (btu per lb) of H_2O
7. H_2O lost due to urination was 0.11 lb/hr per man
8. Cabin temperature control was set to 72° F
9. Average glycol flow rate was 250 lb/hr
10. Budget was performed on the operational trajectory and may change when the revision 1 is analyzed.

TABLE 5-13
LM ECS Summary

(a) Descent Stage

Description	O_2, lb	H_2O, lb
Loaded	48.00	210.6
Unusable	3.40	16.4
Available for mission	44.60	194.2
Required for mission	26.17	142.4
Usable remaining in tanks	18.43	51.8

(b) Ascent Stage

Description	O_2, lb	H_2O, lb
Loaded	4.86	85.00
Unusable	.74	4.20
Available for mission	4.12	80.80
Required for mission	1.95	45.48
Usable remaining in tanks	2.17	35.32

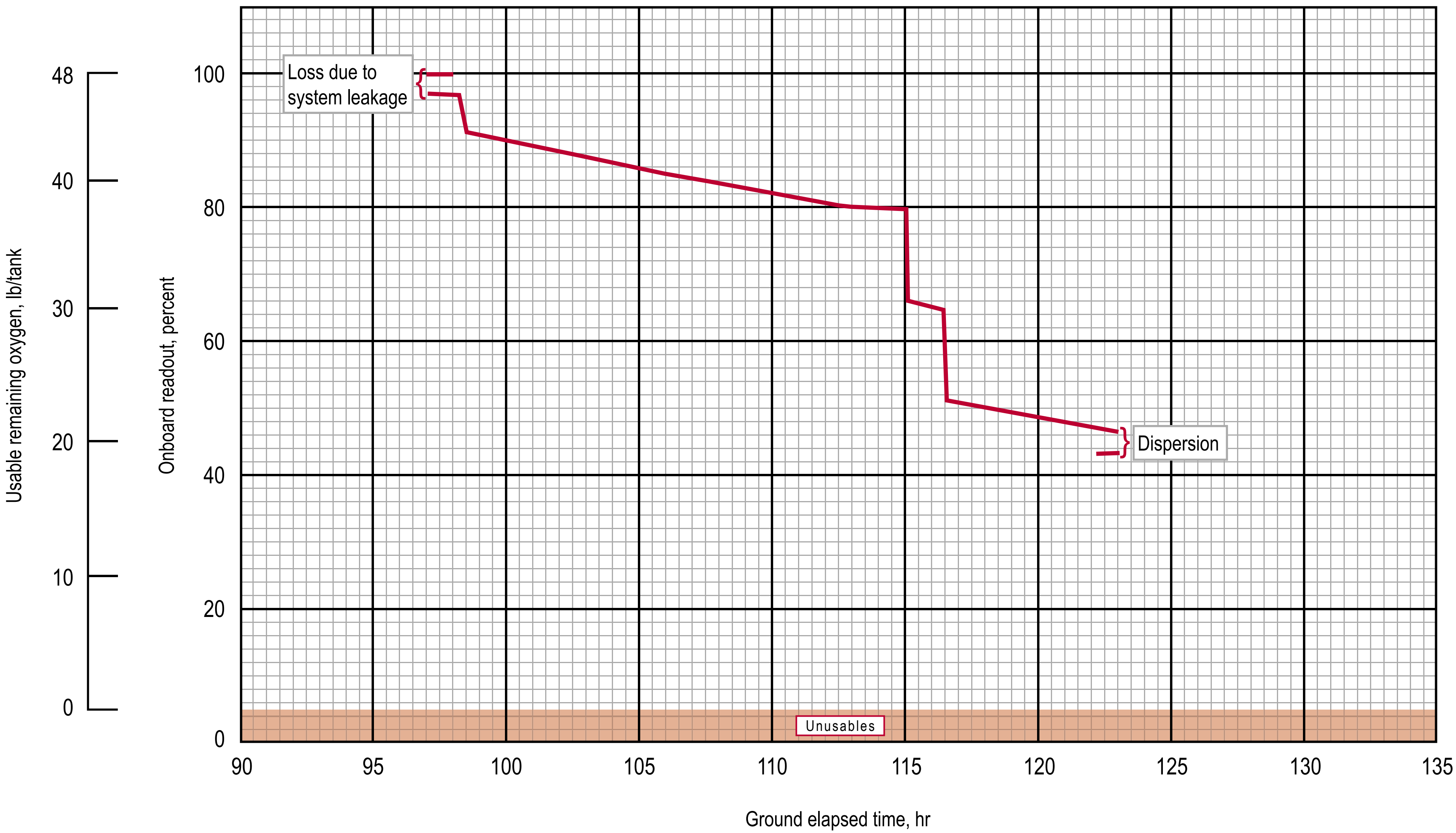


Figure 5-14
Descent oxygen tank quantities as a function of mission time

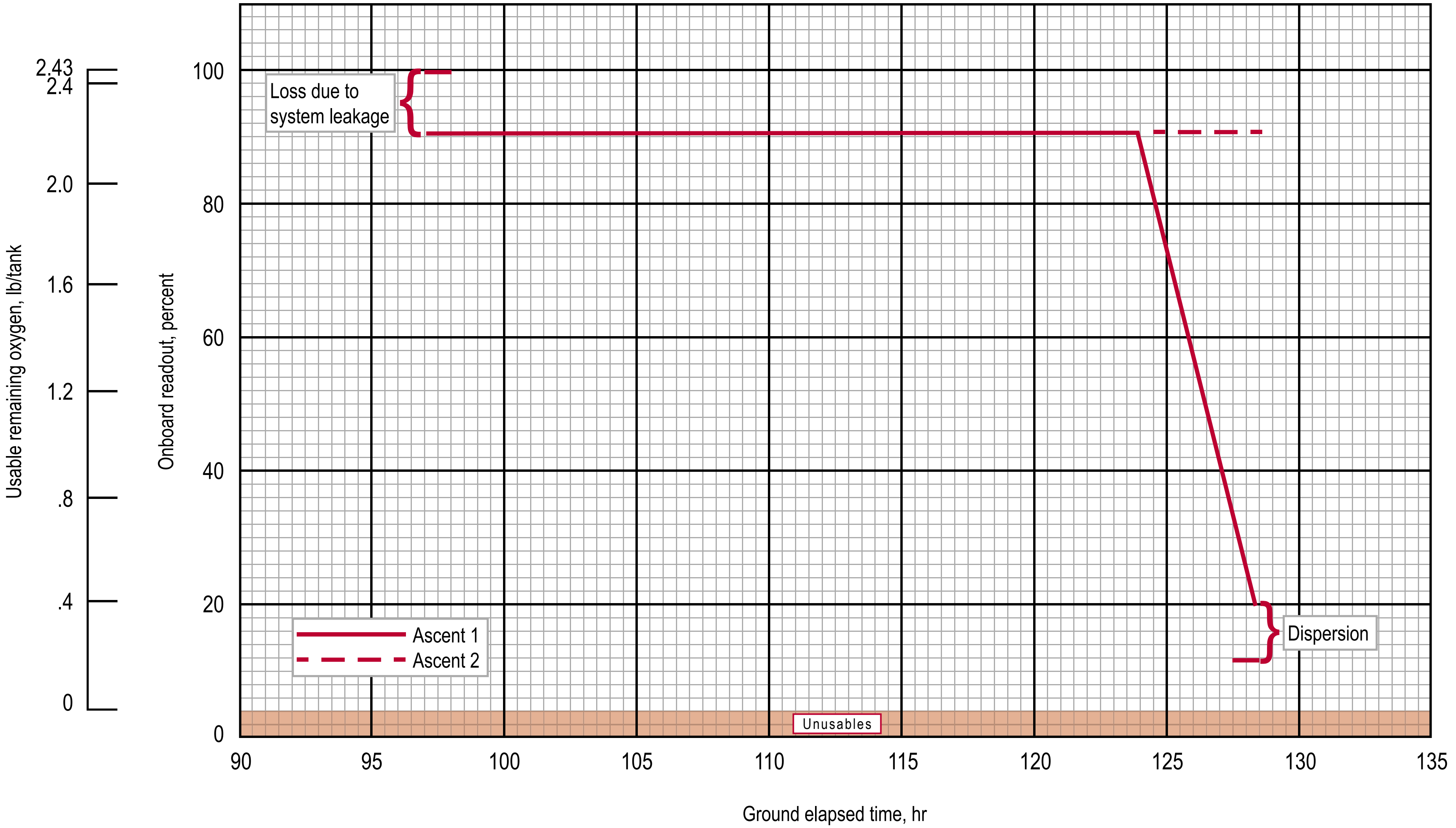


Figure 5-15
Ascent oxygen tank quantities as a function of mission time

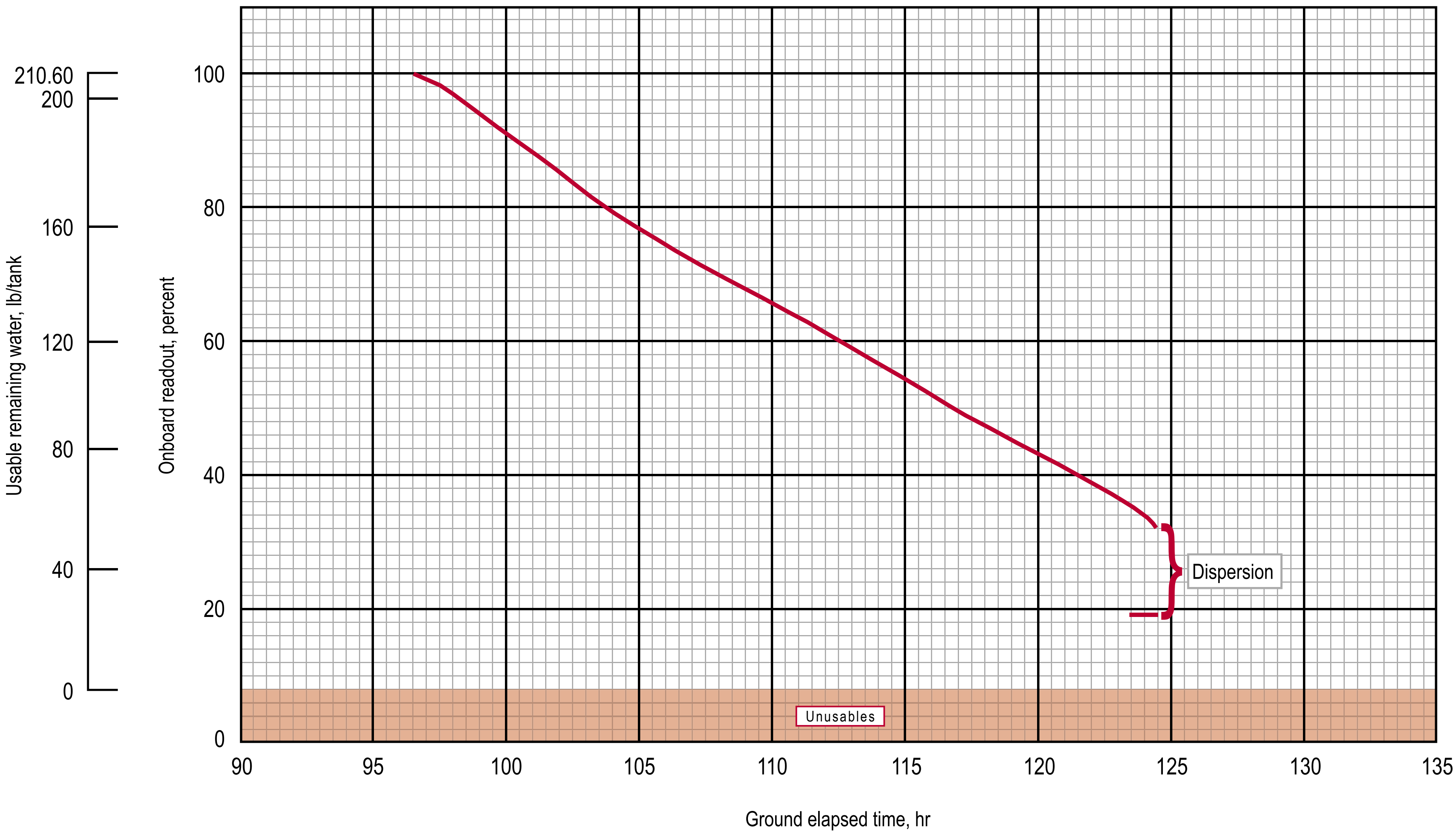


Figure 5-16
Descent water tank quantities as a function of mission time

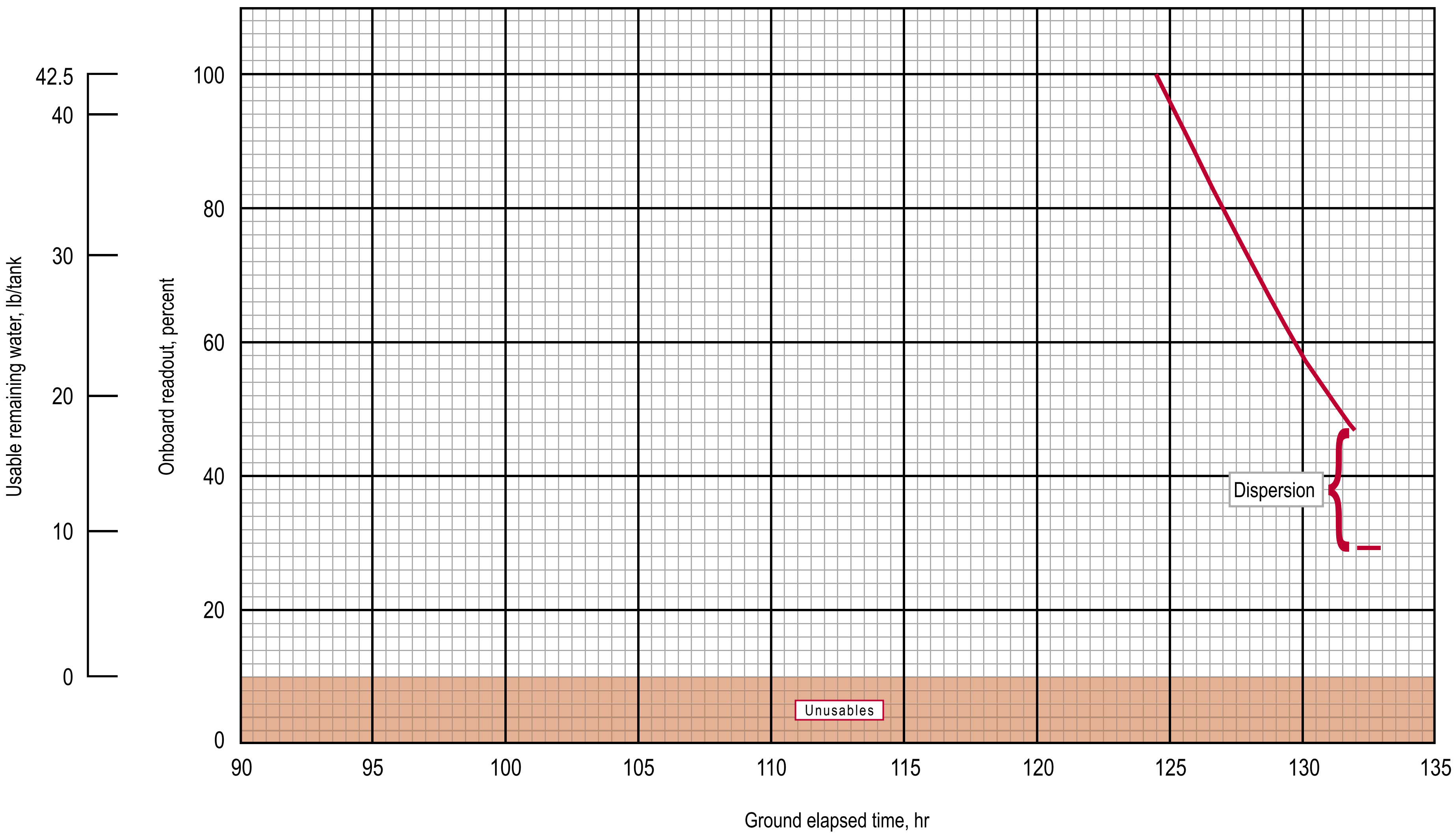


Figure 5-17
Ascent water tank quantities as a function of mission time

MISSION G PLSS CONSUMABLE ANALYSIS

THE RESULTS OF THE PLSS BATTERY, OXYGEN, WATER AND LiOH CONSUMABLE ANALYSIS ARE SUMMARIZED IN THE FOLLOWING FIGURES:

FIGURE5-18	LMP AND CDR PLSS BATTERY PROFILE
FIGURE5-19	CDR OXYGEN PROFILE
FIGURE5-20	LMP OXYGEN PROFILE
FIGURE5-21	CDR H2O PROFILE
FIGURE5-22	LMP H2O PROFILE
FIGURE5-23	LMP AND CDR LiOH CO2 PROFILE

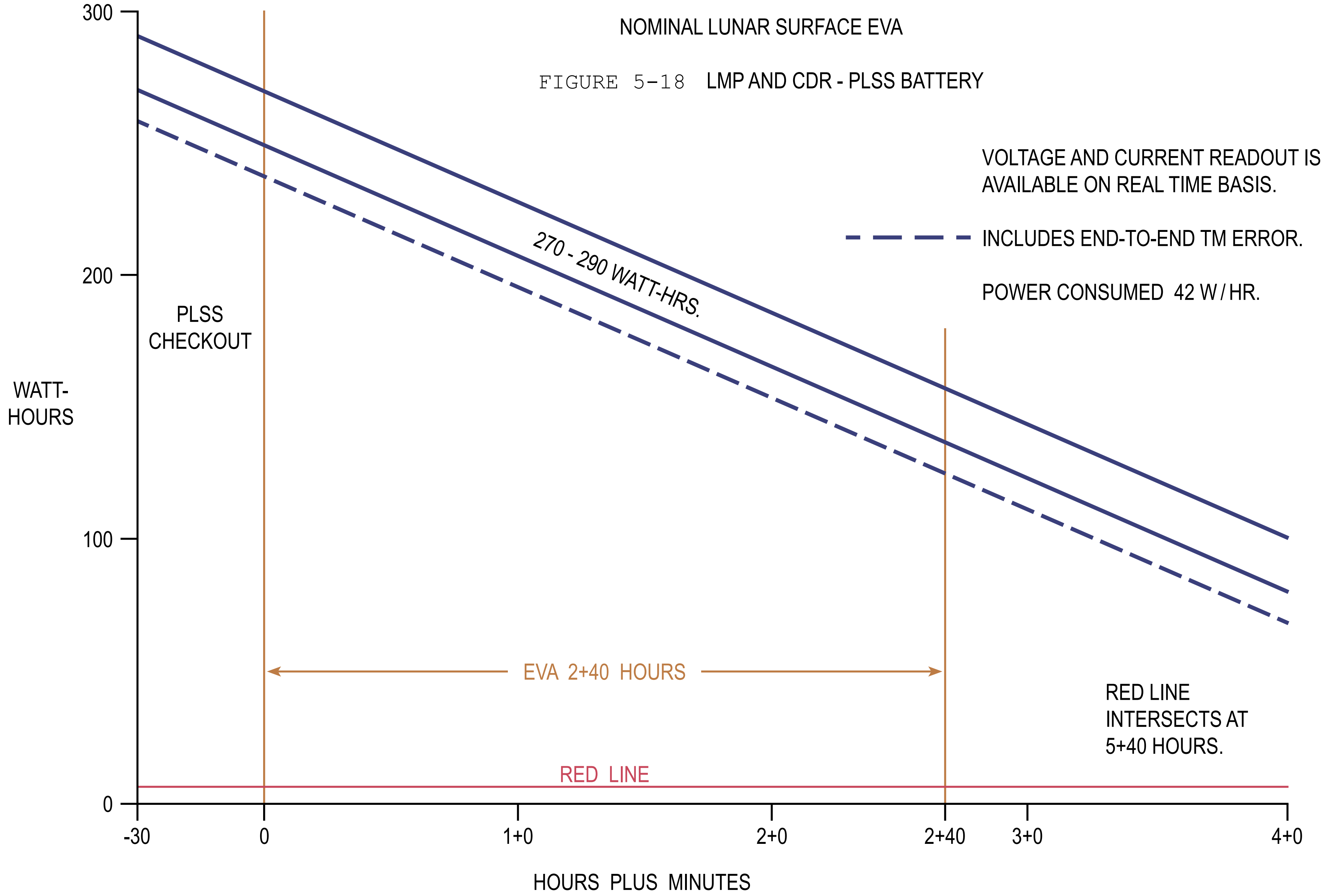
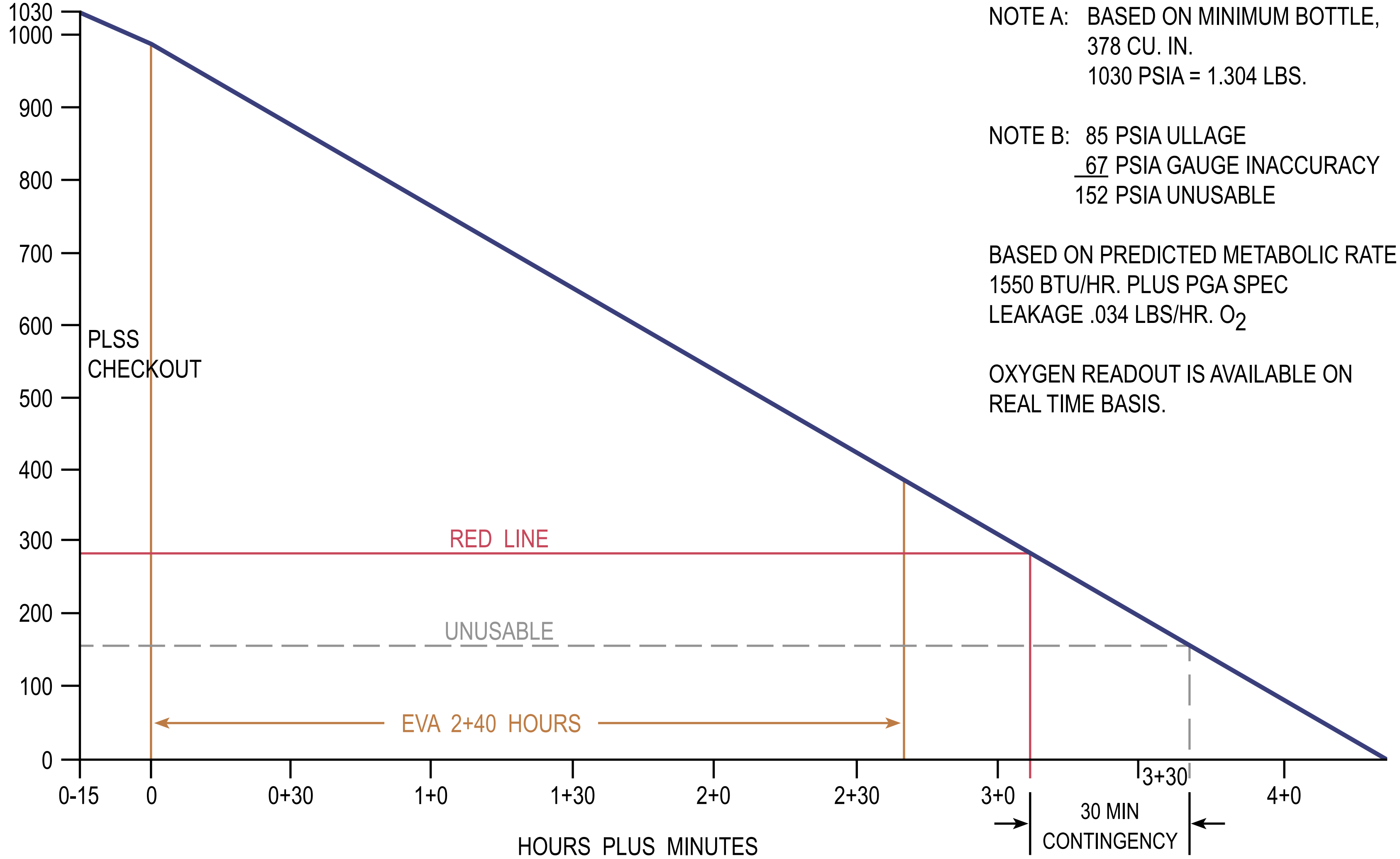


FIGURE 5-18 LMP AND CDR - PLSS BATTERY

NOMINAL LUNAR SURFACE EVA

FIGURE 5-19 CDR - OXYGEN



NOTE A: BASED ON MINIMUM BOTTLE,
378 CU. IN.
1030 PSIA = 1.304 LBS.

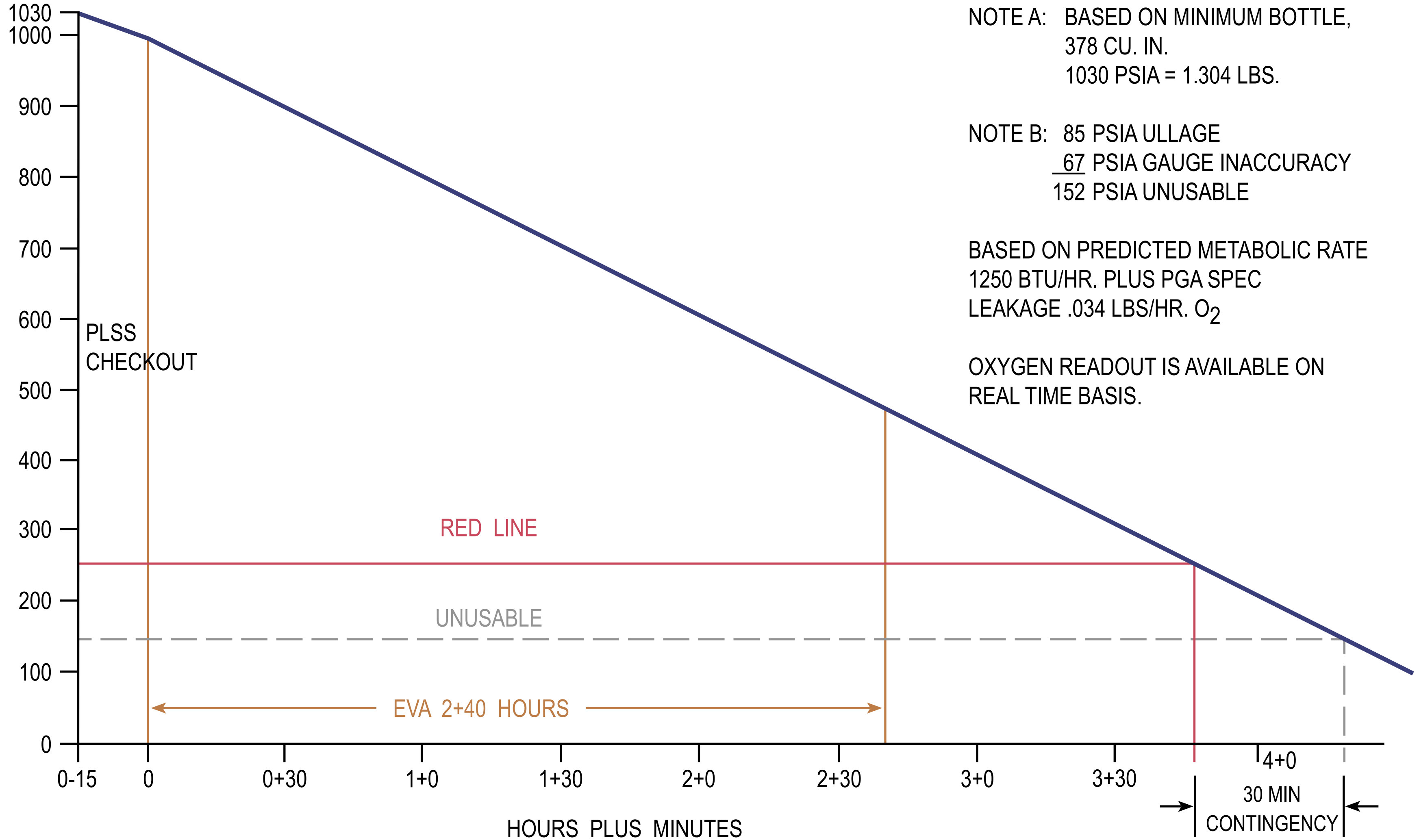
NOTE B: 85 PSIA ULLAGE
67 PSIA GAUGE INACCURACY
152 PSIA UNUSABLE

BASED ON PREDICTED METABOLIC RATE
1550 BTU/HR. PLUS PGA SPEC
LEAKAGE .034 LBS/HR. O_2

OXYGEN READOUT IS AVAILABLE ON
REAL TIME BASIS.

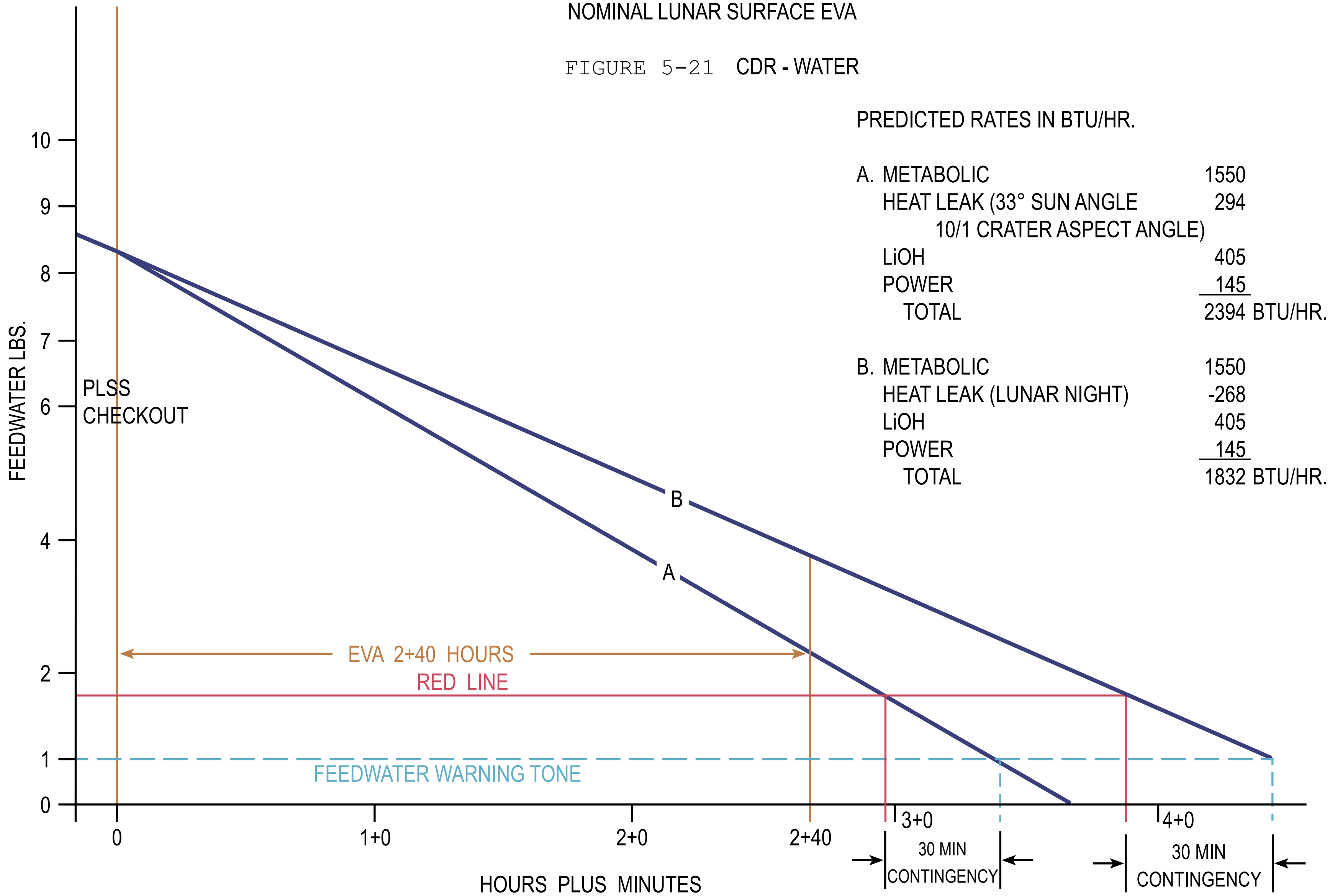
NOMINAL LUNAR SURFACE EVA

FIGURE 5-20 LMP - OXYGEN



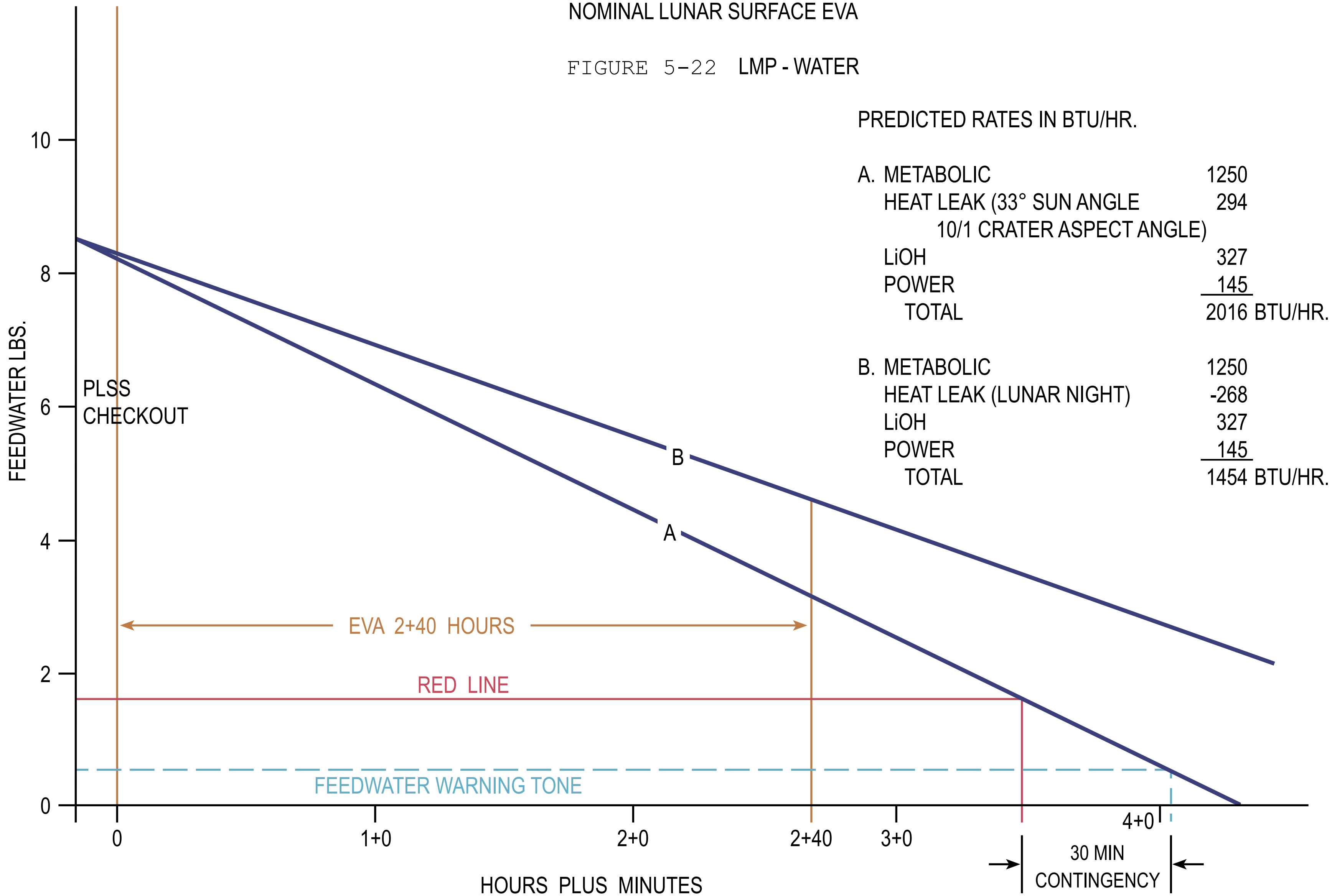
NOMINAL LUNAR SURFACE EVA

FIGURE 5-21 CDR - WATER



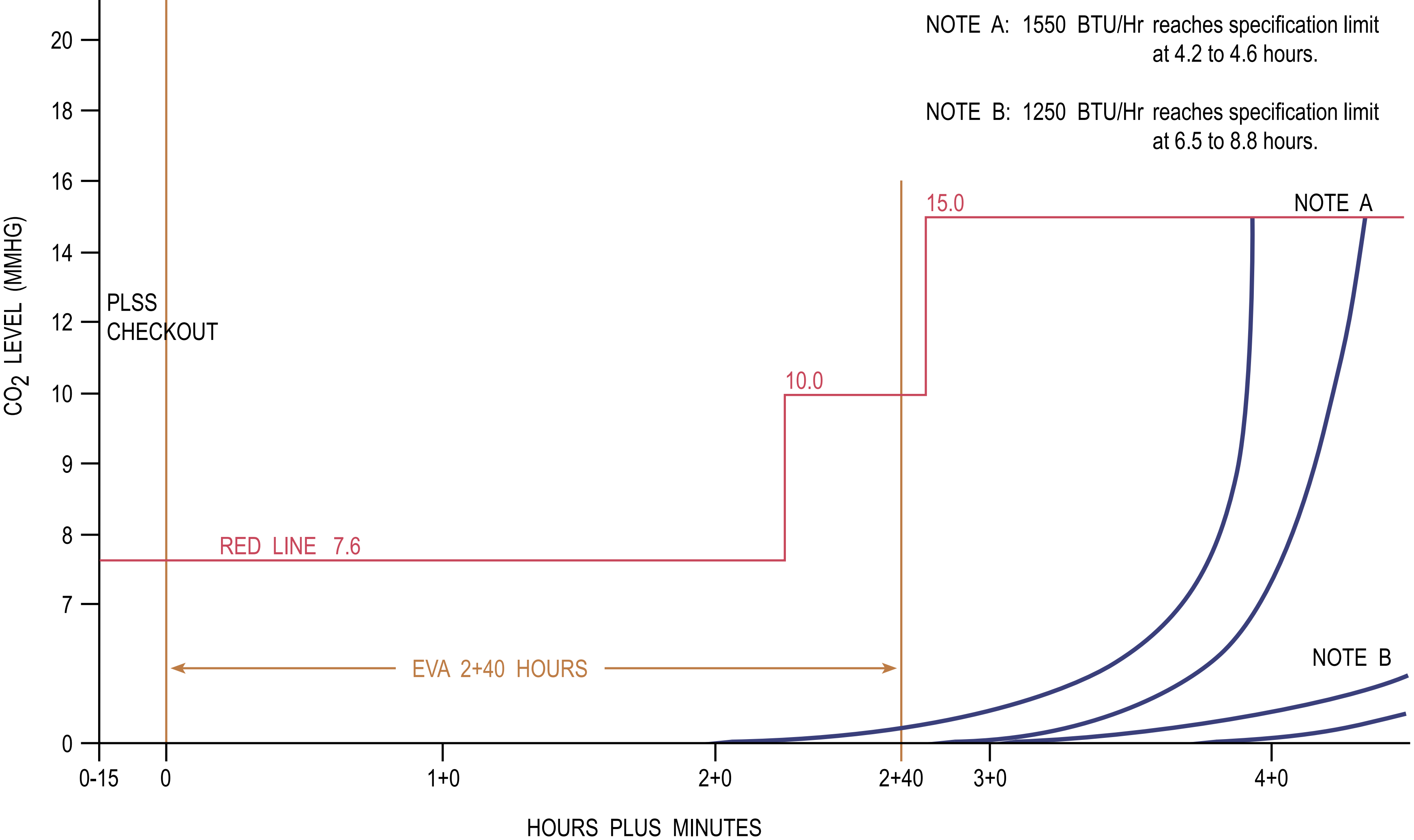
NOMINAL LUNAR SURFACE EVA

FIGURE 5-22 LMP - WATER



NOMINAL LUNAR SURFACE EVA

FIGURE 5-23 LMP & CDR LiOH



THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION VI

SUMMARY FLIGHT PLAN

FLIGHT PLAN

00:00 LIFT-OFF

SYSTEMS CK
P52 IMU REALIGN (OPTIONAL)

02:00

GO/NO-GO FOR TLI
TLI 02:44:26

CSM/SIV-B SEP
DOCKING
PRESS LM & CONNECT UMBILICAL
LM EJECTION

04:00

EVASIVE MNVR
DOFF PGA'S & STOW

P52 IMU REALIGN

MSFN

06:00

P23 STAR/EARTH/HORIZON SIGHTINGS

EAT PERIOD

08:00

PTC

(IF MCC1 IS SCRUBBED)

10:00

P52 IMU REALIGN

MCC1 TLI +9

12:00

12:00

P52 IMU REALIGN (PULSE TORQUE)

EAT PERIOD

14:00

16:00

MSFN

PTC

18:00

REST PERIOD
(9 HOURS)

20:00

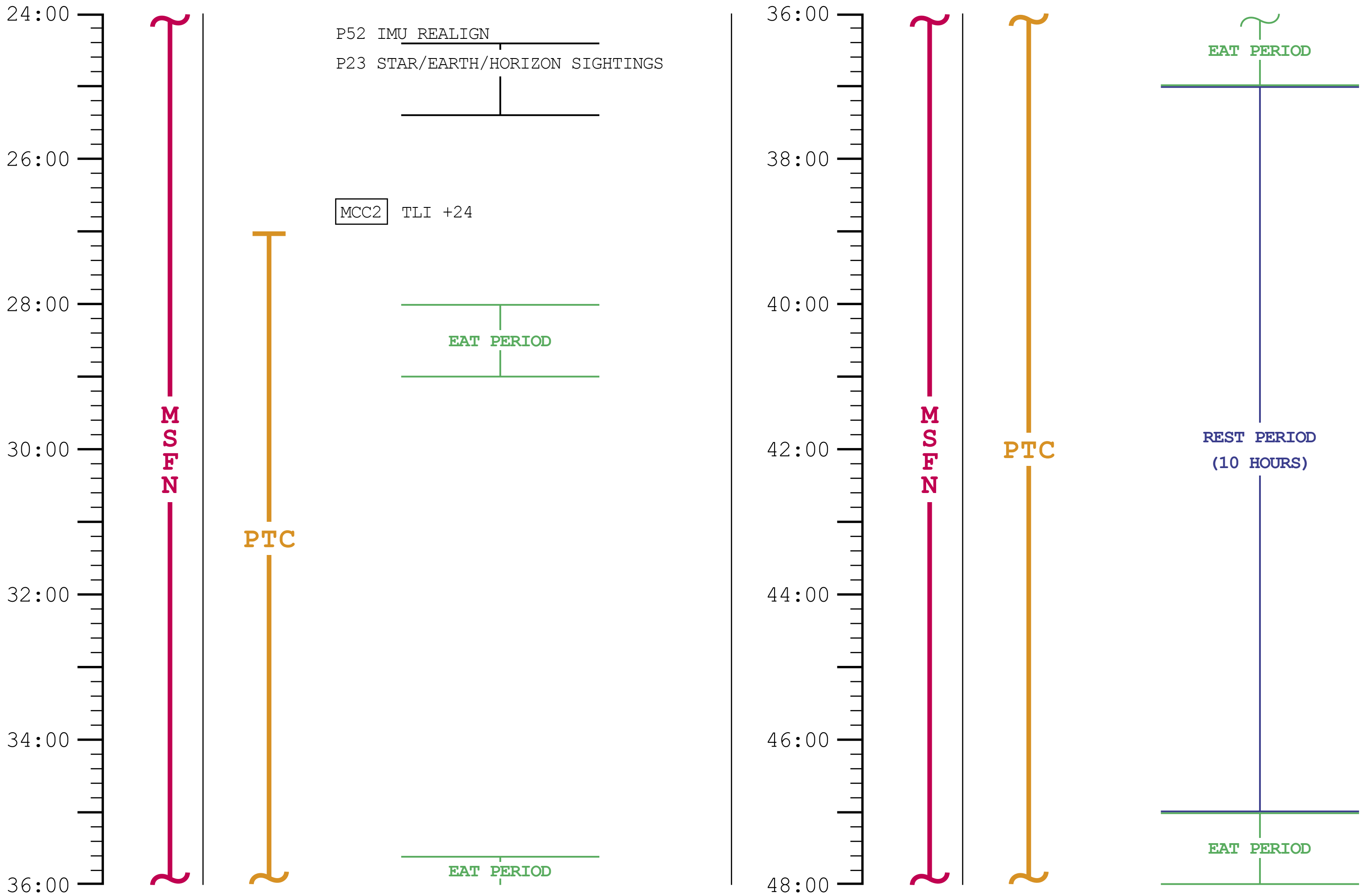
22:00

EAT PERIOD

24:00

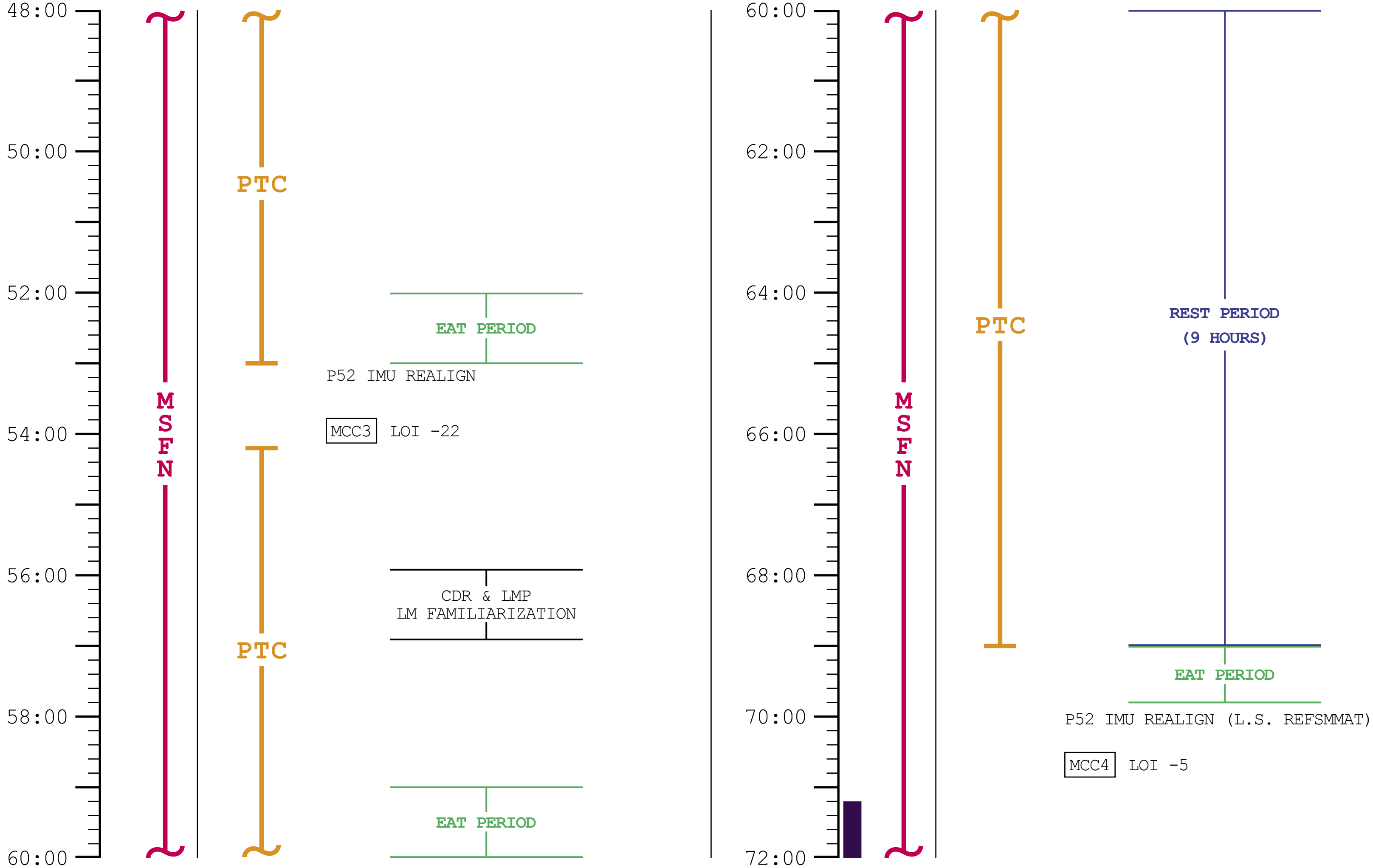
MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	00:00 - 24:00	1 / TLC	6-1

FLIGHT PLAN



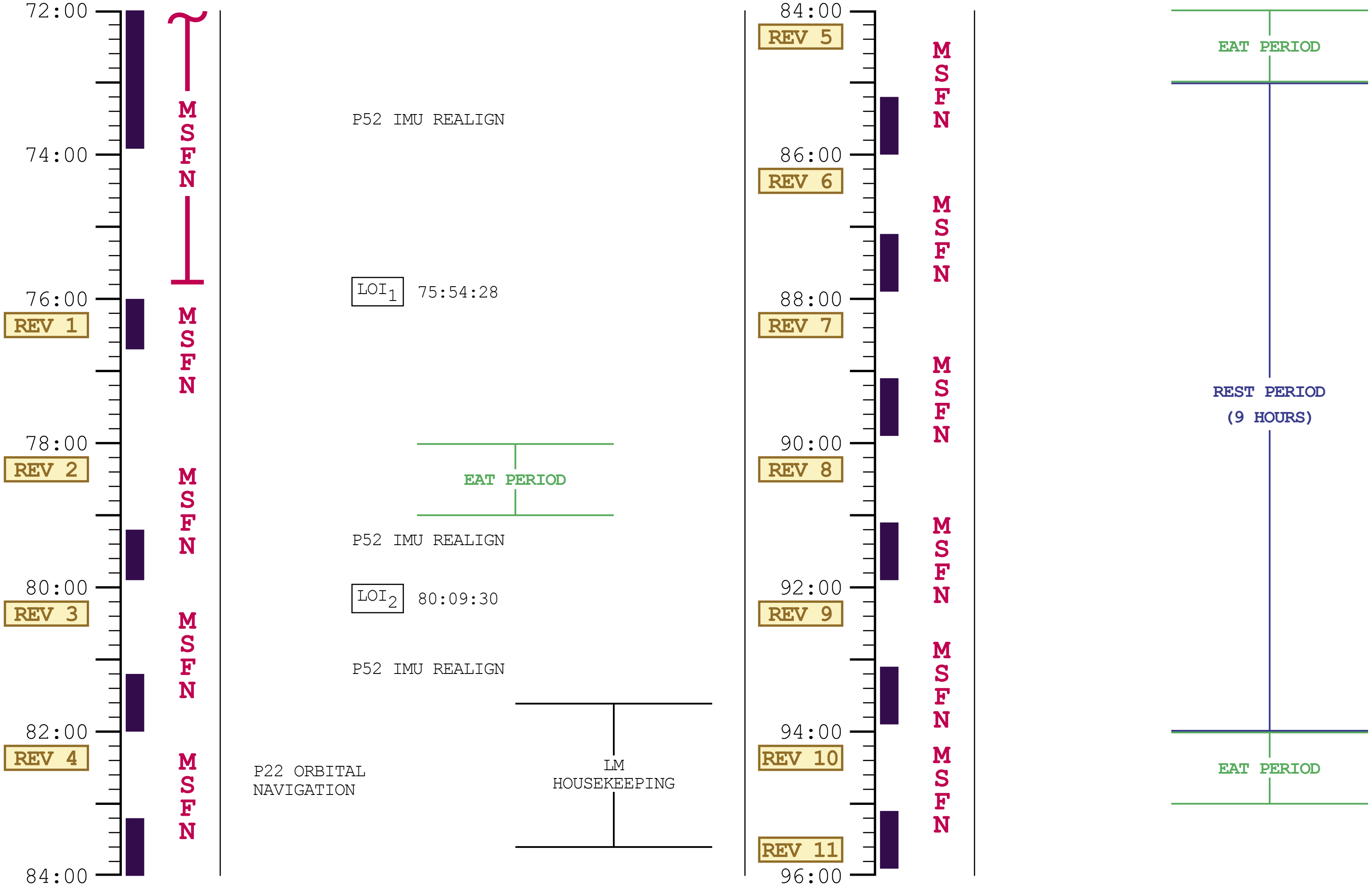
MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	24:00 - 48:00	2 / TLC	6-2

FLIGHT PLAN



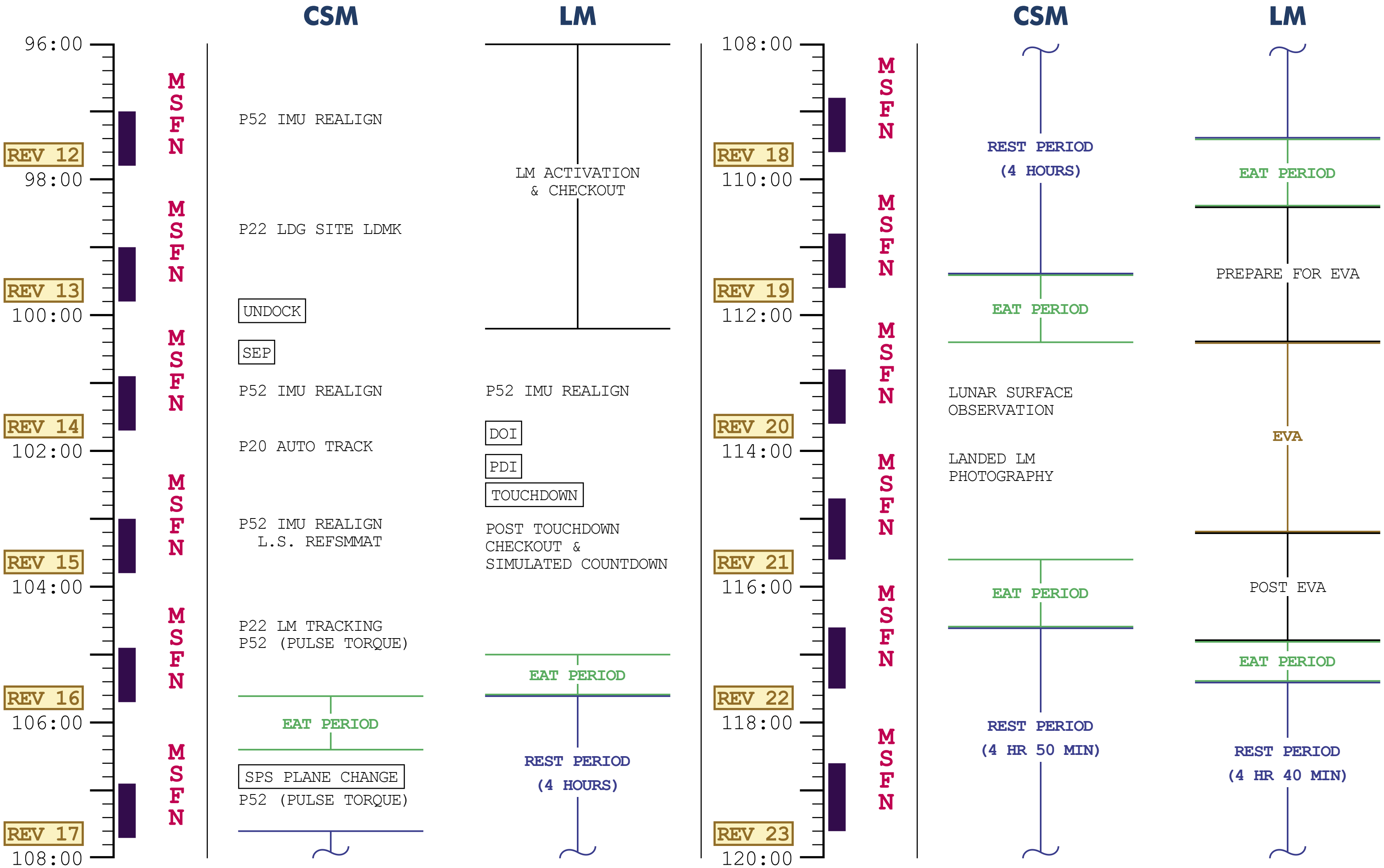
MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	48:00 - 72:00	3 / TLC	6-3

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	72:00 - 96:00	4 / 1 THRU 10	6-4

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	96:00 - 120:00	5 / LPO	6-5

FLIGHT PLAN

CSM | **LM**

120:00

MSFN

REV 24

122:00

MSFN

REV 25

124:00

MSFN

REV 26

126:00

MSFN

REV 27

128:00

MSFN

REV 28

130:00

MSFN

132:00

CSM

REST PERIOD
(4 HR 50 MIN)

EAT PERIOD

LM

REST PERIOD
(4 HR 40 MIN)

P57 IMU REALIGN

EAT PERIOD

P57 IMU REALIGN

LIFT-OFF 124:23:26
ORBIT INSERTION 124:30:44

R E N D E Z V O U S

P52 IMU REALIGN

CSI - 125:21:19

PLANE CHANGE - 125:50:28

CDH - 126:19:37

TPI - 126:58:08
MCC1 - 127:13:08
MCC2 - 127:28:08

DOCKING

BACK
DECONTAMINATION
PROCEDURES

CDR & LMP IVT TO CSM

LM JETTISON

132:00

MSFN

134:00

MSFN

136:00

138:00

MSFN

140:00

142:00

144:00

PTC

EAT PERIOD

P52 IMU REALIGN

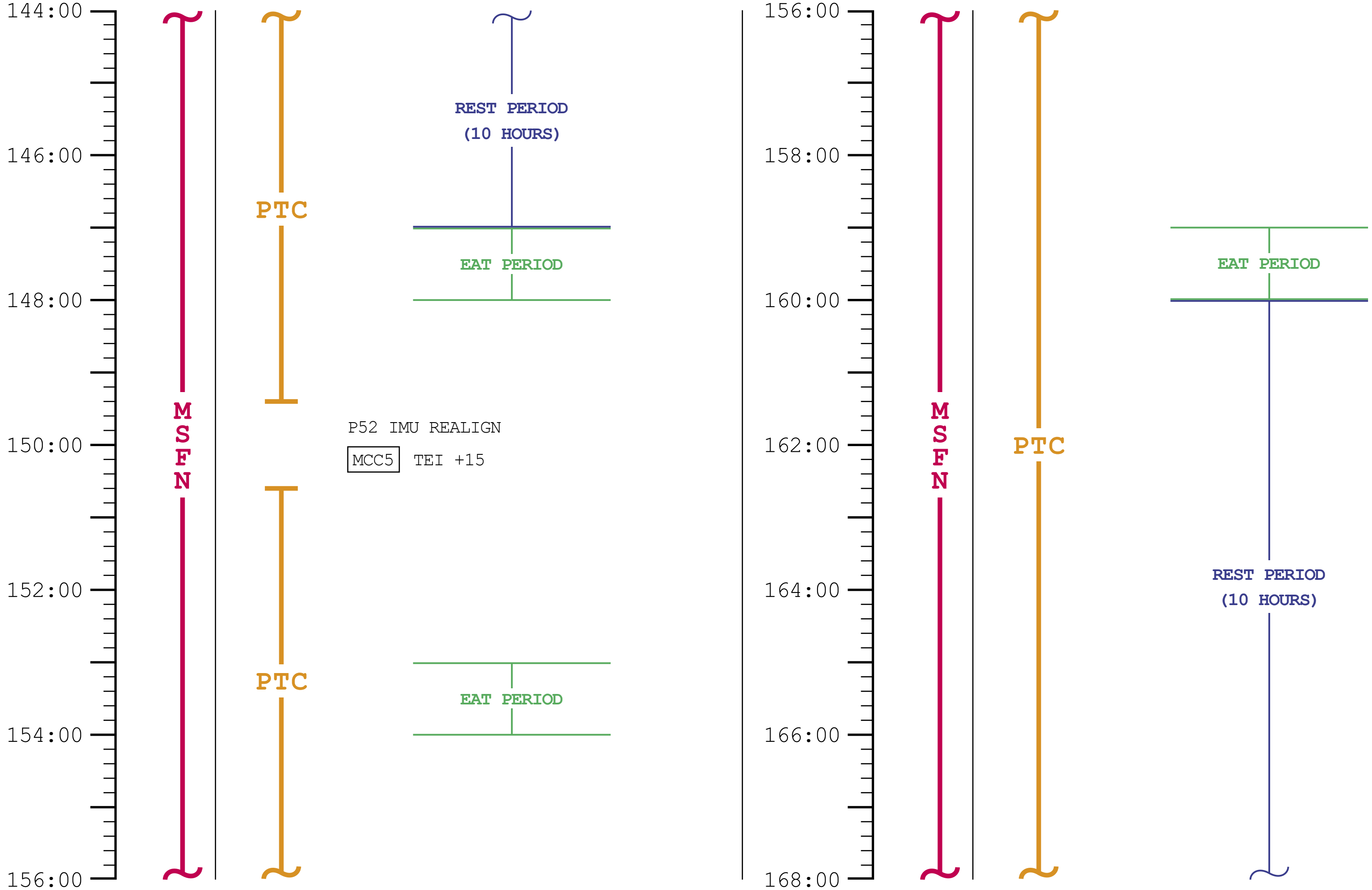
TEI 135:24:34
P52 IMU REALIGN (PULSE TORQUE)

EAT PERIOD

REST PERIOD
(10 HOURS)

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	120:00 - 144:00	6 / LPO	6-6

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	144:00 - 168:00	7 / TEC	6-7

FLIGHT PLAN

168:00

MSFN

PTC

REST PERIOD
(10 HOURS)

170:00

EAT PERIOD

P52 IMU REALIGN

172:00

$\boxed{\text{MCC6}}$ EI -23

PTC

174:00

EAT PERIOD

176:00

178:00

180:00

180:00

MSFN

PTC

EAT PERIOD

182:00

184:00

REST PERIOD
(7 HOURS)

186:00

188:00

EAT PERIOD

190:00

P52 IMU REALIGN

192:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	168:00 - 192:00	8 / TEC	6-8

FLIGHT PLAN

192:00

MSFN

MCC7 EI -3

P52 IMU REALIGN

194:00

CM/SM SEP

EI 195:03:27

LANDING

196:00

MISSION	EDITION	DATE	TIME	DAY / REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	192:00 - 196:00	9	6-9