

315 pages



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SECTION I

FINAL

SECTION II

# APOLLO 11 FLIGHT PLAN

SECTION III

AS-506/CSM-107/LM-5

SECTION IV

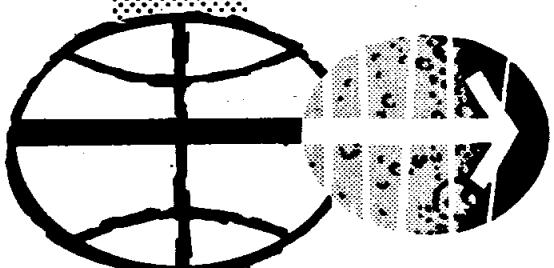
JULY 1, 1969

SECTION V

PREPARED BY  
FLIGHT PLANNING BRANCH  
FLIGHT CREW SUPPORT DIVISION

SECTION VI

MANNED SPACECRAFT CENTER  
HOUSTON, TEXAS



INDEXING DATA

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SUBJECT

SIGNATOR

LOC

SECTION VII

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

JULY 1, 1969

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#### ACKNOWLEDGMENTS

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.

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## 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 Altitude
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 or MCC	Mission Control Center - Houston
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

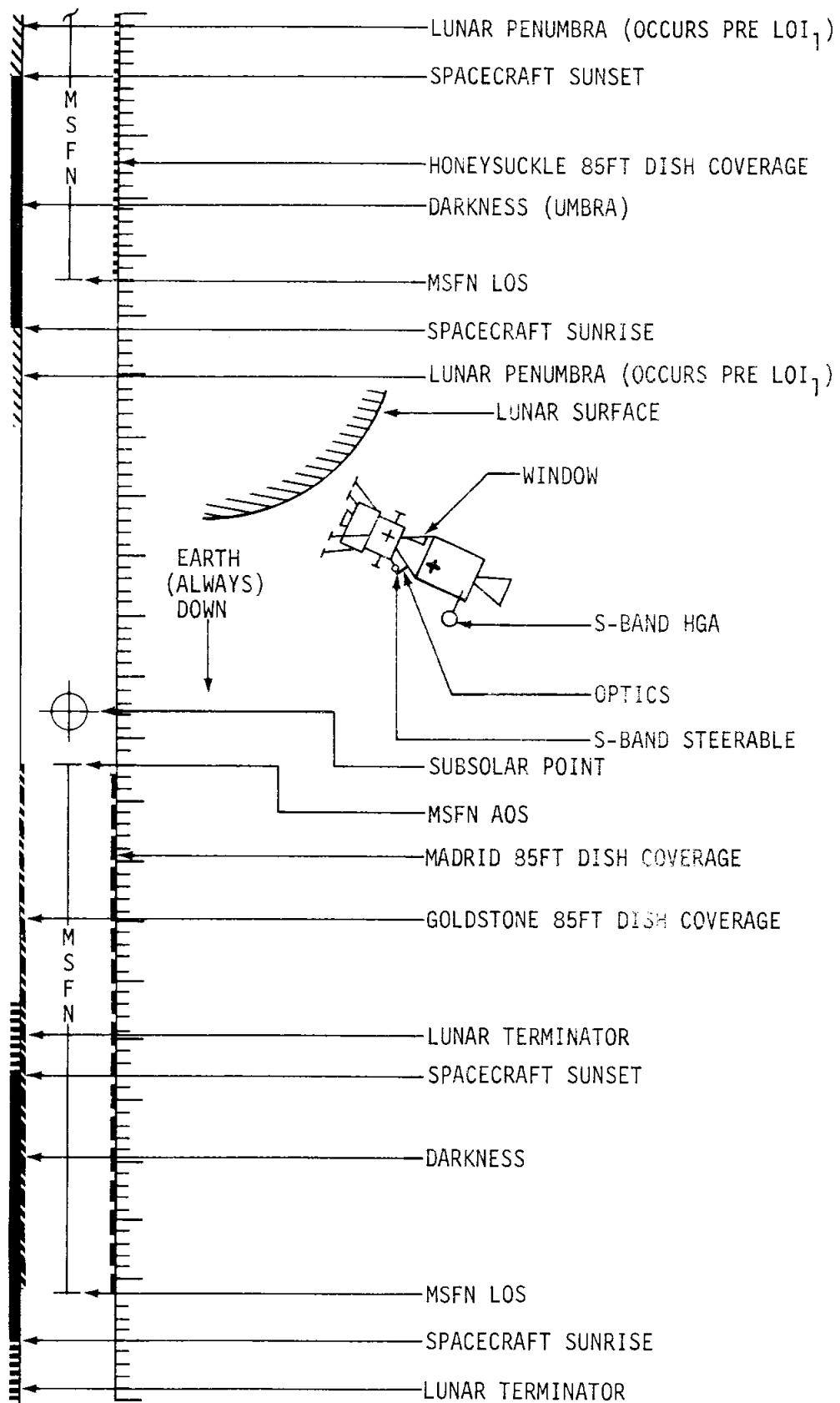
S.V.	State Vector
SWC	Solar Wind Composition
Sw	Switch
SXT	Sextant
T EPHEM	Time of Ephemeris Update
TA	Trunnion Angle
TAN	Tananarive, Madagascar
TB	Time Base
TCA	Time of Closest Approach
TD&E	Transposition Docking & LM Ejection
TEC	Trans Earth Coast
TEI	Transearth Insertion
TEMP	Temperature
TERM	Terminate
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

$\Delta V$	Velocity Change (Differential)
$\Delta VC$	Velocity Change at Engine Cutoff
$\Delta R$	Position Change (Differential)
8-balls	Flight Director Attitude Indicator (FDI)

#### CAMERA NOMENCLATURE

EL/250/BW-BRKT	Electric Hasselblad/250mm Lens/ Black & White film-Camera Bracket
INT (f5.6,250,INF)	Intervalometer $\frac{1}{250}$ (f-stop 5.6, shutterspeed= $\frac{1}{250}$ sec, Infinity)
16mm/18/CEX-BRKT MIR (f8,250,INF) 6fps	16mm Camera/18mm Lens/Color Film External-Camera Bracket Mirror (f-stop 8, shutterspeed = $\frac{1}{250}$ sec, Infinity) 6 frames per sec

## SYMBOL NOMENCLATURE



x1

## 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/O 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  $\Delta V$  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<sub>1</sub>, 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<sub>1</sub>
- (b) Photos of targets of opportunity
- (c) LOI<sub>2</sub>
- (d) Post LOI<sub>2</sub> LM entry and inspection. S-Band/VHF B Voice tests will be conducted.
- (e) Post LOI<sub>2</sub> 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. Lunar Orbit Particulars (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

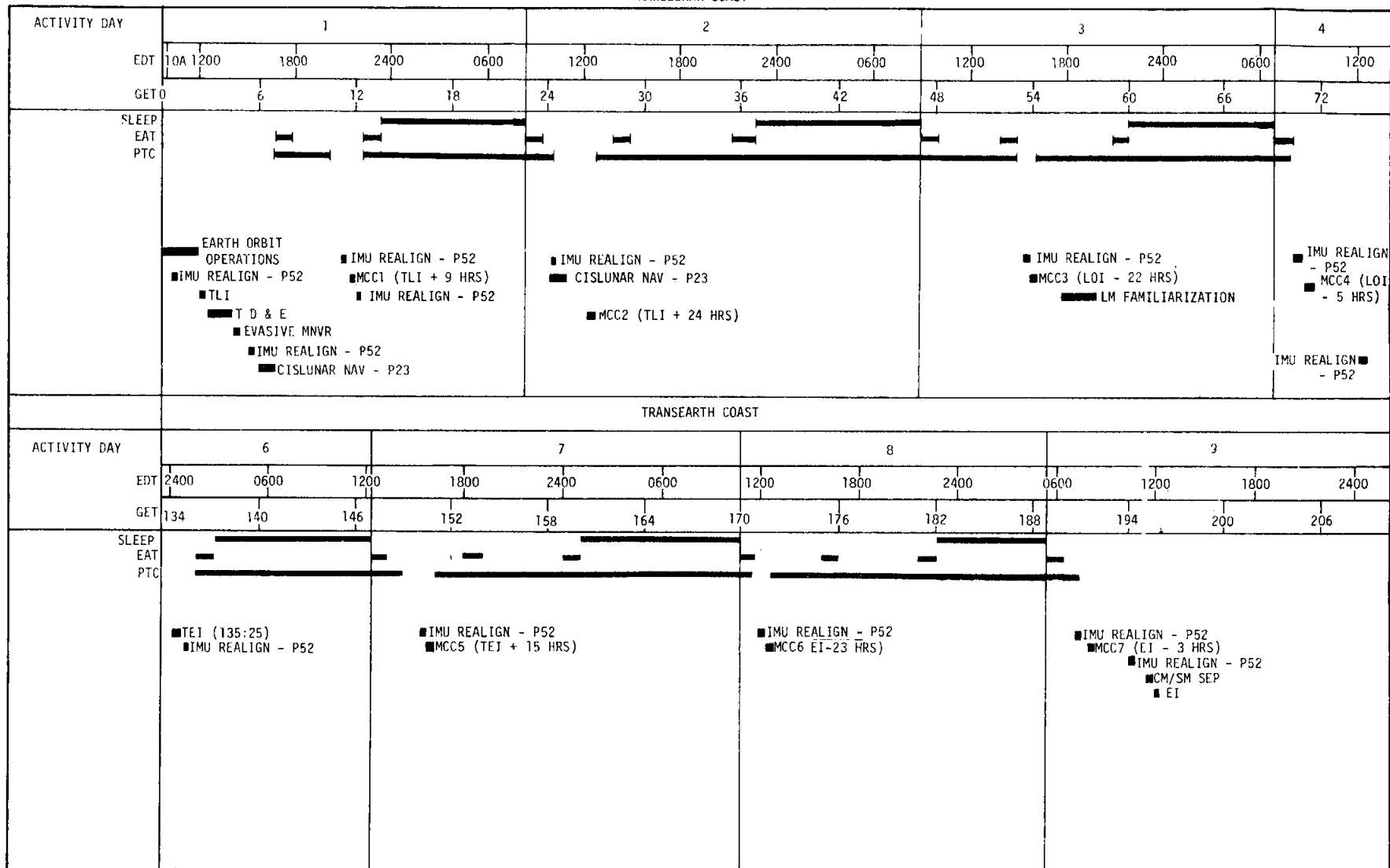
- (f) S/C orbital rate -  $3^\circ/\text{min}$ . ( $.05^\circ/\text{sec}$ )
- (g) Lighting change at fixed ground point -  $1^\circ\text{West}/\text{Rev}$ .
- (h) Horizon visibility  $\pm 20^\circ$  selenocentric angle on the lunar surface
- (i) One lunar degree on lunar surface is 16.35 nm
- (j) Site 2 will be visible ( $3^\circ$  sun angle) at REV. 7
- (k) S/C subvehicle point to horizon 327 nm.

5. Transearth Coast and Entry (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  $\Delta V$  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  $172.4^\circ$  West at 195:17 GET. This will occur approximately 25 minutes prior to sunrise local time.

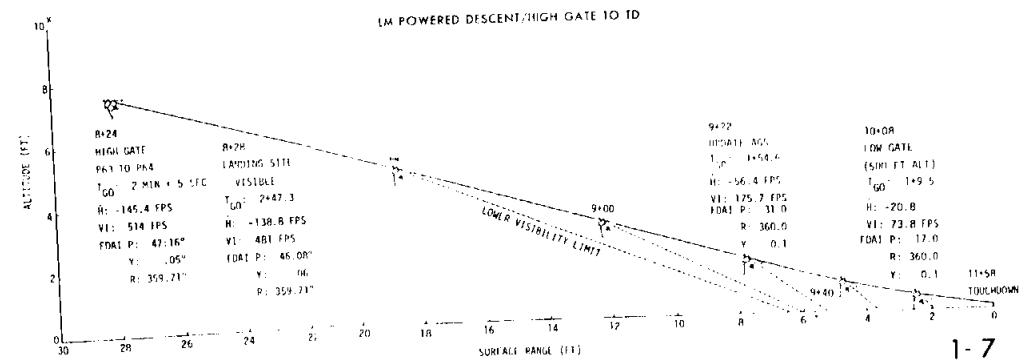
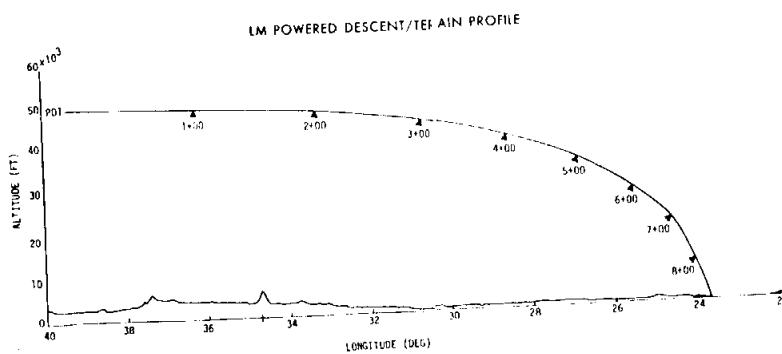
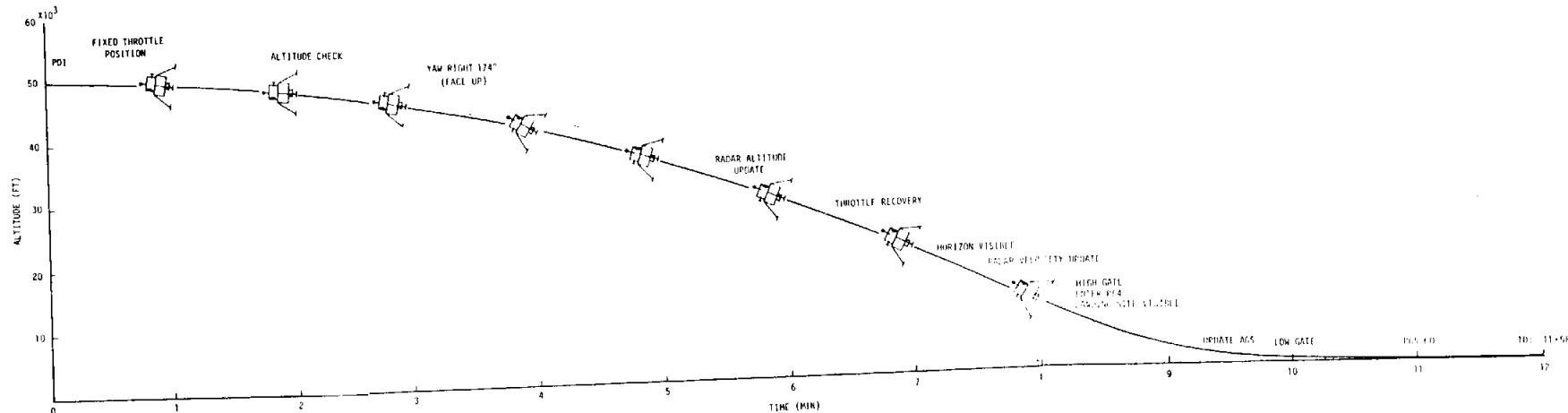
FIGURE 1-1  
MISSION SUMMARY FLIGHT PLAN  
TRANSLUNAR COAST



LUNAR ORBIT SUMMARY FLIGHT PLAN

FIG 1-2

# LM POWERED DESCENT



1-7

TABLE 1-1 CSM BURN SCHEDULE

BURN/MANEUVER	GETI BURN TIME $\Delta V_c$	ATTITUDE (DEG)		LIGHTING	$\Delta V$ (FPS)	ULLAGE	TVC MODE	REFSMMAT	S/C WT. RESULTANT HA, HP	REMARKS
		LH/LV	INERTIAL							
S-TVB TLI	2:44:26 5 MIN 20 SEC			BURNOUT AT SUNRISE	$\Delta V_x$ : — $\Delta V_y$ : — $\Delta V_z$ : — $\Delta V$ 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	$\Delta V_x$ : 5.1 $\Delta V_y$ : 0.0 $\Delta V_z$ : 19.0 $\Delta V$ REQ: 19.7	NOT REQUIRED	G&N AUTO	PAD	WT: 96662.3 HP: 123.8 HA: 281953.9	SPS BURN
MIDCOURSE CORRECTIONS MCC <sub>1</sub> to MCC <sub>4</sub>	11:45 26:45 53:55 70:55			—	$\Delta V_x$ : NOMINALLY $\Delta V_y$ : ZERO $\Delta V_z$ : — $\Delta V$ REQ:	NOT REQUIRED	G&N AUTO	PAD PTC PTC LDG SITE	—	TLI + 9 TLI + 24 LOI - 22 LOI - 5
LOI <sub>1</sub>	75:54:28.4 5 MIN 58.9 SEC 2914.8 FPS			DAYLIGHT (SS-THR 7 MIN)	$\Delta V_x$ : -2891.8 $\Delta V_y$ : -433.1 $\Delta V_z$ : 20.4 $\Delta V$ RLQ: 2924.1	NOT REQUIRED	G&N AUTO	LDG SITE	WT: 95207.4 HP: 59.2 HA: 169.8	SPS BURN
LOI <sub>2</sub>	80:09:29.7 16.4 SEC			DAYLIGHT (SR + 9 MIN)	$\Delta V_x$ : 138.3 $\Delta V_y$ : 0.0 $\Delta V_z$ : 75.9 $\Delta V$ REQ: 157.8	2 JET 20 SEC	G&N AUTO	LDG SITE	WT: 71320.81bs HP: 53.6 NM HA: 65.6 NM	SPS BURN
CSM/LM SEP	100:39:50.4 8 SEC			SUNLIGHT (SS-14 MIN)	$\Delta V_x$ : 0.0 $\Delta V_y$ : 0.0 $\Delta V_z$ : 2.5 $\Delta V$ 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 .8 SEC 5.7			DARKNESS (SS + 17 MIN)	$\Delta V_x$ : 0.0 $\Delta V_y$ : 16.6 $\Delta V_z$ : 0.0 $\Delta V$ 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)	$\Delta V_x$ : -1.0 $\Delta V_y$ : — $\Delta V_z$ : — $\Delta V$ 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)	$\Delta V_x$ : 3213.3 $\Delta V_y$ : 705.0 $\Delta V_z$ : -138.8 $\Delta V$ REQ: 3292.7	2 JET 16 SEC	G&N AUTO	LIFT OFF	WT: 36111.4 HP: — HA: —	SPS BURN
MIDCOURSE CORRECTIONS MCC <sub>5</sub> to MCC <sub>7</sub>	150:24 172:00 192:06			—	$\Delta V_x$ : $\Delta V_y$ : NOMINALLY $\Delta V_z$ : ZERO $\Delta V$ REQ:	—	G&N AUTO	PTC PTC ENTRY	—	TEI + 15 EI -23 ET -3

\* NEW DATA INDICATES THIS BURN MAY BE NOMINALLY ZERO

TABLE 1-2 LM BURN SCHEDULE

BURN/MANEUVER	G/T II BURN TIME	ATTITUDE (DEG)		LIGHTING	ΔV (FPS)	ULLAGE ΔV (FPS)	TVC MODE	REFSMMAT	S/C WI RESULTANT HA, HP	REMARKS
		LH	INERTIAL							
D01	101:38:48 28.5 SEC			DARKNESS (SR-4 MIN)	ΔVX: 67.46 ΔVY: -28.68 ΔVZ: -12.51 ΔV REQ: 70 FPS	2 JET 7.5 SEC 1.3 FPS	PGNCS AUTO	LDG SITE	WT: 33,404 HP: 8.97 HA: 57.87NM	DPS BURN
PDI	102:35:13 11MIN 58SEC			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 SEC			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 <sub>1</sub>	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 <sub>2</sub>	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	-	MANUAL	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: 4.8	-	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: 59.9 HA: 58.9	RCS - Z 2 JET

TABLE 1-3 LUNAR LANDING SITE DATA

DAY	SITE DESIG	LATITUDE	LONGITUDE	<sup>1</sup> LAUNCH AZIMUTH/ SUN ELEVATION	<sup>2</sup> LAUNCH AZIMUTH/ SUN ELEVATION
JULY 16 0932 EDT	2(IIP6)	00°42'50"N 00.71388889°N	23°42'28"E 23.70777778°E	72°/10.5° (00.6914°N) (23.7169°E) <sup>3</sup>	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 1409 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.

- <sup>1</sup> Sun Elevation Angles Are For Approximately 27 Hours After LOI, 1st Opportunity TLI.
- <sup>2</sup> Includes 2nd Opportunity TLI.
- <sup>3</sup> 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	SUN EL
			(nm)	
A1(Pseudo)	2°N 2.000°N	65° 30' 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	23°40'44" 23.67888889°E	-001.68	8.5°
	(01.24307°N)	(23.6880°E) <sup>1</sup>		
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	-

- <sup>1</sup> 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 SUN EL (nm)	
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	SUN EL (nm)
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 40.79277778°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:

<u>Designation</u>	<u>Prime</u>	<u>Backup</u>
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:

	<u>CSM</u>		<u>LM</u>	
<u>Left</u>	<u>Center</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
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 communications 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:

COLUME 1

- a. Apollo Operations Handbook - CSM-107 (AOH), Volume 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:

VOLUME I

- a. Apollo Operations Handbook LM-5 Volume 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 "squench" 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 whenever 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<sub>2</sub> and O<sub>2</sub> purging is scheduled as follows H<sub>2</sub> approximately every 48 hours and O<sub>2</sub> 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<sub>2</sub>O 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 H<sub>2</sub>O 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:

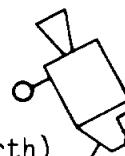
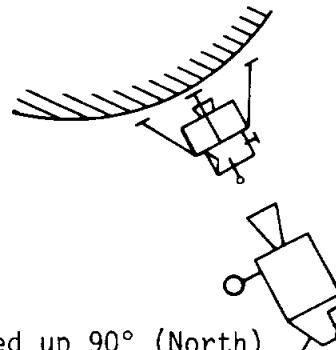
<u>Time</u>	<u>Battery</u>
5:20:00	B
12:20:00	A
48:10:00	B
80:25:00	A
103:30:00	B
148:00:00	A
154:00:00	B

2. Environmental Control System and Cabin Pressurization
  - a. One CO<sub>2</sub> odor absorber filter (LiOH canister) is changed approximately every 12 hours or if CO<sub>2</sub> 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.

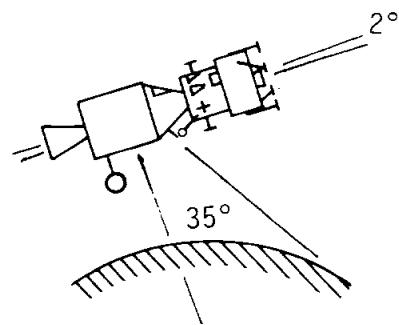


### 4. Landmark Tracking

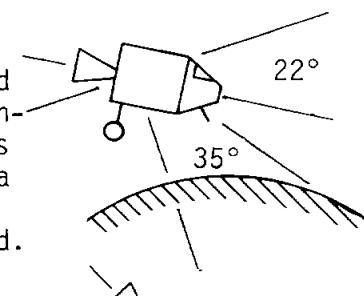
The following ground rules were used for landmark tracking.

- 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 ( $\Delta R, \Delta V$ ) 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.

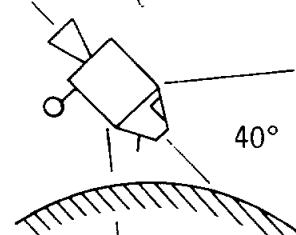
- d. In the docked configuration the CSM/LM approaches the landmark in an inertial hold attitude. This inertial attitude places the spacecraft 2° below the local horizontal at the 35° elevation angle point. At 35° elevation angle a pitch down of 0.3°/sec is initiated. Five marks are then taken with the 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 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 All SPS burns will be initiated on Bank A except LOI1 which will be initiated on Bank B.

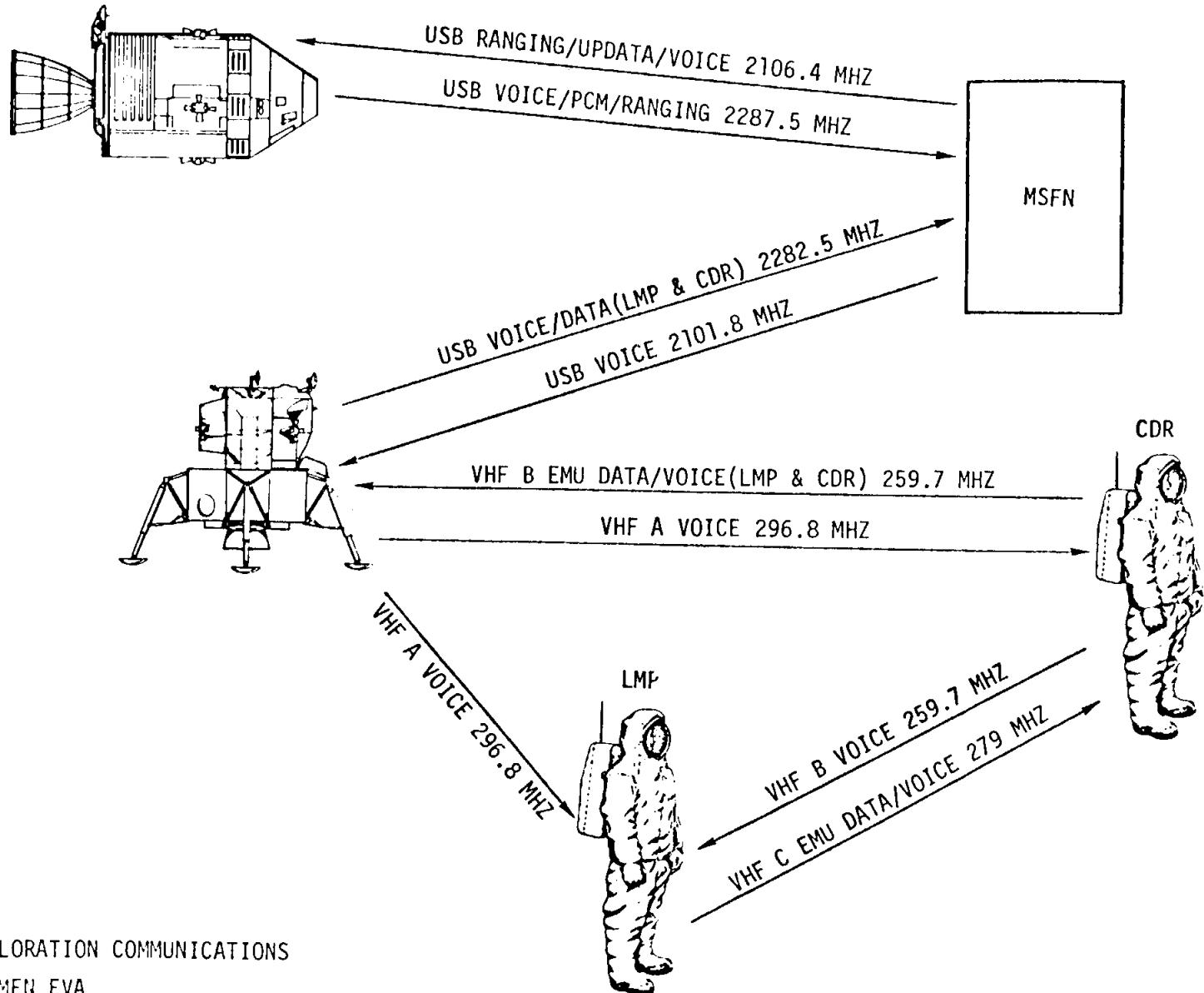
#### F. LM Notes

##### 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).

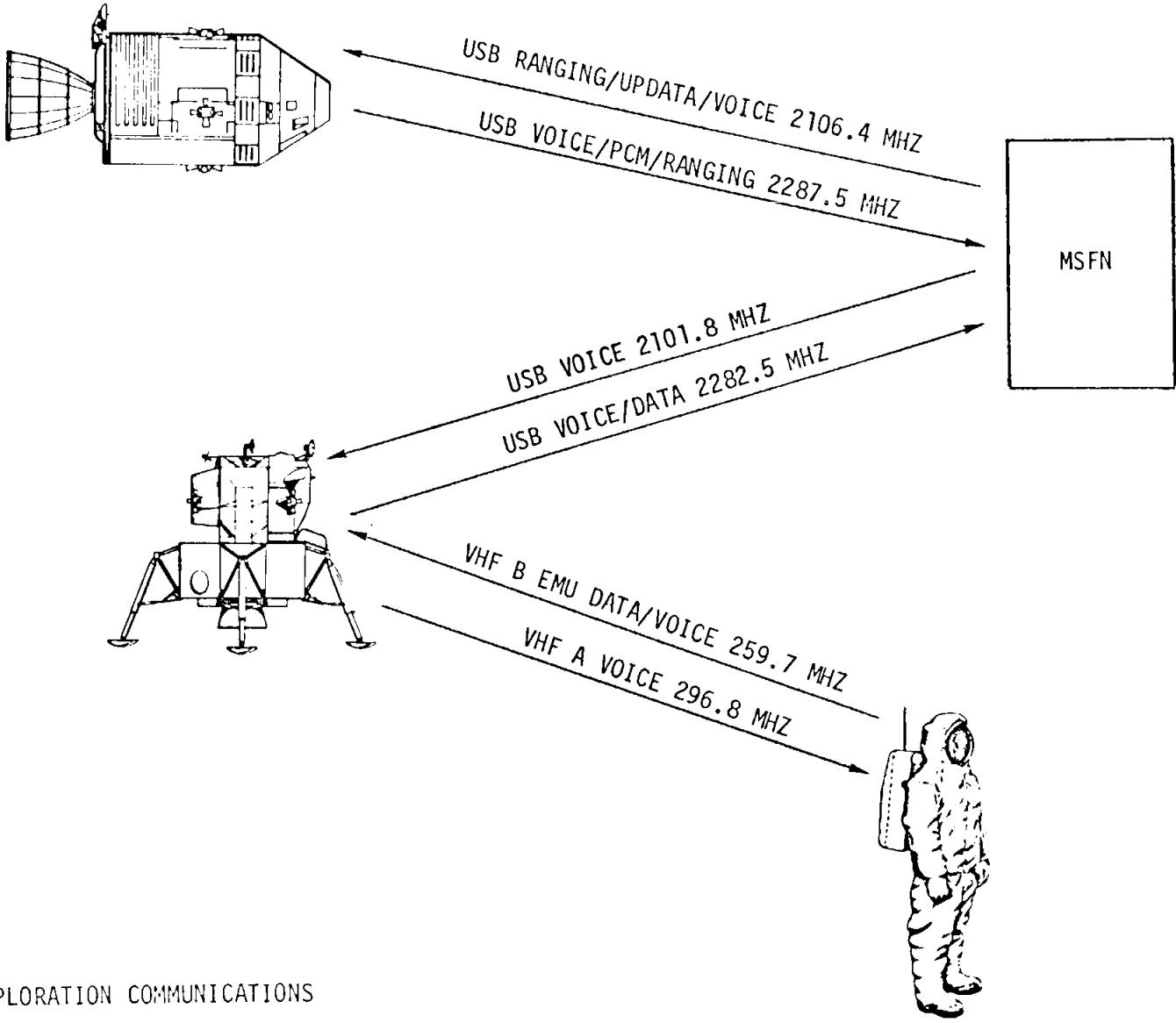
4. RCS Operation and Interface Constraints
  - a. During CSM/LM docked checkout operations, the LM steerable and/or RR antennas will not be powered down once they have been activated. The SM B3 and C4 thrusters will be deactivated before the LM steerable and/or RR antennas have been unstowed in order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

1-23



LUNAR EXPLORATION COMMUNICATIONS  
ONE CREWMAN EVA  
PRIMARY MODE

Figure 1-5

SECTION II

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  $\Delta V$ )
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		TLI										TLI	
X		TB6p										R	
X	X	X	P TLI										Y
X	X	X	BT										$\Delta VC'$
X	X	X	VI										R
+			P SEP										Y
X	X	X	R										
X	X	X	P EXTRACTION										Y
X													
APRIL 1, 1969													

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	XXX (DEG)	PREDICTED SPACECRAFT IMU GIMBAL ANGLES AT TLI IGNITION
P	XXX (DEG)	
Y	XXX (DEG)	
BT	X:XX (MIN:SEC)	DURATION OF TLI BURN
$\Delta V_C$	XXXX.X (FPS)	NOMINAL TLI $\Delta V$ SET INTO EMS $\Delta V$ COUNTER
VI	+XXXXXX (FPS)	NOMINAL INERTIAL VELOCITY DISPLAYED ON DSKY AT TLI CUTOFF
R SEP	XXX (DEG)	PREDICTED SPACECRAFT IMU GIMBAL ANGLES AT COMPLETION OF S-IVB MNVR TO CSM/S-IVB SEP ATTITUDE
P SEP	XXX (DEG)	
Y SEP	XXX (DEG)	
R EXT	XXX (DEG)	PREDICTED SPACECRAFT IMU GIMBAL ANGLES AT TIME OF CSM EXTRACTION OF LM FROM S-IVB
P EXT	XXX (DEG)	
Y EXT	XXX (DEG)	

## P37 BLOCK DATA

APRIL 1, 1969										P37										
										P37										
X	X	X	X	X	X	X	X	X	X	GETI										
X	X	X	X	X	X	X	X	X	X	ΔVT										
X	X	X	X	X	X	X	X	X	X	LONG										
X	X	X	X	X	X	X	X	X	X	GET 400K										
X	X	X	X	X	X	X	X	X	X	GETI										
X	X	X	X	X	X	X	X	X	X	ΔVT										
X	X	X	X	X	X	X	X	X	X	LONG										
X	X	X	X	X	X	X	X	X	X	GET 400K										
X	X	X	X	X	X	X	X	X	X	GETI										
X	X	X	X	X	X	X	X	X	X	ΔVT										
X	X	X	X	X	X	X	X	X	X	LONG										
X	X	X	X	X	X	X	X	X	X	GET 400K										
										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 UPDATE													
		PURP	V		V		V		V						
		GFT	:	:	:	:	:	:	:	:					
		304	01	INDEX		INDEX		INDEX							
		02													
		03													
		04													
		05													
		06													
		07													
		10													
		11													
		12													
		13													
		14													
		15													
		16													
		17													
		20													
		21													
		22													
		23													
		24													
APRIL 1, 1969		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 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 GROUND TRACK
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	PURPOSE	
		PROP/GUID	
R ALIGN	+ 0 0	WT N47	
	+ 0 0	P TRIM N48	
	+ 0 0	Y TRIM	
	+ 0 0 0	HRS GETI	
	+ 0	MIN N33	
		SEC	
		$\Delta V_X$ N81	
		$\Delta V_Y$	
		$\Delta V_Z$	
	X X X	R	
ULLAGE	X X X	P	
	X X X	Y	
	+ 0	$H_A$ N42	
		$H_P$	
	+ 0	$\Delta V_T$	
	X X X	BT	
	X	$\Delta V_C$	
	X X X X	SXTS	
	+ 0	SFT	
	+ 0 0	TRN	
HORIZON/WINDOW	X X X	BSS	
	X X	SPA	
	X X X	SXP	
	0	LAT N61	
		LONG	
	+ 0	RTGO EMS	
	+ 0	VIO	
		GET 0.05G	
APRIL 5, 1969			P30

P30 MANEUVER

PURPOSE	XXXXX	TYPE OF MNVR TO BE PERFORMED
PROP/GUID	XXX/XXX	PROPELLION SYSTEM (SPS/RCS)/ GUIDANCE (SCS/G&N)
WT	+XXXXX (1bs)	PREMANEUVER VEHICLE WEIGHT
P TRIM	<u>±</u> X.XX (DEG)	SPS PITCH GIMBAL OFFSET TO PLACE THRUST THROUGH THE CG
Y TRIM	<u>±</u> 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	+XXXX.X (FPS)	P30 VELOCITY TO BE GAINED COMPONENTS IN LOCAL VERTICAL
ΔVY	<u>±</u> XXXX.X (FPS)	COORDINATES
ΔVZ	<u>±</u> XXXX.X (FPS)	
R	XXX (DEG)	IMU GIMBAL ANGLES OF
P	XXX (DEG)	MANEUVER ATTITUDE
Y	XXX (DEG)	
HA	XXXX.X (NM)	PREDICTED APOGEE ALTITUDE AFTER MANEUVER
HP	<u>±</u> 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	<u>±XX.X (DEG)</u>	BSS PITCH ANGLE ON COAS FOR MANEUVER ATTITUDE CK
SXP	<u>±X.X (DEG)</u>	BSS X POSITION ON COAS FOR MANEUVER ATTITUDE CK
LAT LONG	<u>+XX.XX (DEG)</u> <u>+XXX.XX (DEG)</u>	LATITUDE AND LONGITUDE OF THE LANDING POINT FOR ENTRY GUIDANCE
RTGO	<u>+XXXX.X (NM)</u>	RANGE TO GO FOR EMS INITIALIZATION
VIO	<u>+XXXXX (FPS)</u>	INERTIAL VELOCITY AT .05G FOR EMS INITIALIZATION
GET (.05G)	<u>XXX:XX:XX.XX</u> (HRS:MIN:SEC)	TIME OF .05G
SET STARS	<u>XX (OCTAL)</u> <u>XX (OCTAL)</u>	STARS FOR BACKUP GDC ALIGN
R, P, Y (ALIGN)	<u>XXX (DEG)</u> <u>XXX (DEG)</u> <u>XXX (DEG)</u>	ATTITUDE TO BE SET IN ATTITUDE SET TW FOR BACKUP GDC ALIGN
ULLAGE	<u>X (JETS)</u> <u>XX.X (SEC)</u>	NO. OF SM RCS JETS USED AND LENGTH OF TIME OF ULLAGE
HORIZON/WINDOW	<u>XX.X (DEG)</u>	WINDOW MARKING AT WHICH HORIZON IS PLACED AT A SPECIFIED TIG (ATT CK)
OTHER		ADDITIONAL REMARKS VOICED UP BY MCC-H

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P76 UPDATE PAD										P76
P76						PURPOSE				P76
	+	0	0			+	0	0		
	+	0	0	0		+	0	0	0	
	+	0		.		+	0		.	
				.					.	
				.					.	
				.					.	
				.					.	
				.					.	
				.					.	
APRIL 5, 1969						PURPOSE				
	+	0	0			+	0	0		
	+	0	0	0		+	0	0	0	
	+	0		.		+	0		.	
				.					.	
				.					.	
				.					.	
				.					.	
				.					.	
				.					.	

P76 UPDATE PAD

PURPOSE	XXXXX	PURPOSE OF MANEUVER
N33 TIG	XX:XX:XX.XX (HR:MIN:SEC)	TIME OF IGNITION
N84		
$\Delta V_x$	XXXX.X (FPS)	COMPONENTS OF
$\Delta V_y$	XXXX.X (FPS)	$\Delta V$ APPLIED ALONG
$\Delta V_z$	XXXX.X (FPS)	LOCAL VERTICAL AXIS AT TIG (LM)

CSM RENDEZVOUS  
RESCUE PADS

CSM SEP PAD

33	00	000	0	.
81	+	0000.0	+	0000.0
22	XXX	XXX	XXX	

D01 PAD

84	•	•	•	•
33	•	•	•	•

PDI<sub>1</sub> +12 ABORT PAD

84	•	•	•	•
33	•	•	•	•

2-13

"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

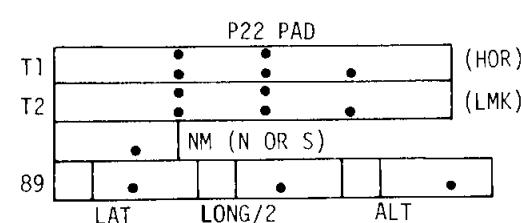
PHAS	33	00	000	0	.
TPI(PDI < 145)	37	00	000	0	.
TPI(T <sub>2</sub> )	37	00	000	0	.

RESCUE TWO PAD

47	+	.	+	00000.	X
48	.	.	.	.	X
33	00	000	0	.	
81	.	.	.	.	
22	XXX	XXX	XXX	.	
$\Delta V_C$	X	.	.	.	
11	00	000	0	.	
37	00	000	0	.	
N	.	.	.	.	

CSI ONE

11	•	000	0	.
81	.	.	.	.
N	.	.	.	.



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

37	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
<u>RESCUE TWO PAD</u>			
47	WT	XXXX.X (lbs)	PREMANEUVER CSM WEIGHT
48	P TRIM	X.XX (DEG)	SPS PITCH & YAW GIMBAL OFFSET TO
	Y TRIM	X.XX (DEG)	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
$\Delta V_c$	$\Delta V_c$	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.X (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.X (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		XXX:XX:XX.X (HRS:MIN:SEC)	GET OF LM TPI BURN
81	DELTA VX DELTA VY DELTA VZ	XXX (FPS) XXX (FPS) XXX (FPS)	LOCAL VERTICAL VELOCITY COMPONENTS OF TPI BURN
59	ΔV (LOS)	XXX (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 (HR: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 LONG ALT	+XX.X (DEG) +XX (DEG) LATITUDE OF LANDMARK LONGITUDE OF LANDMARK 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

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LUNAR ENTRY												AREA
ENTRY	LUNAR	X	X	X	X	X	X	X	X	X	X	
		X	X	X								R 0.05 G
		X	X	X								P 0.05G
		X	X	X								Y 0.05G
					•	•			•	•		GET HOR CK P
		X	X	X								LAT N61 LONG
			0			•			0			MAX G
		X	X	X								V 400K N60 Y 400K
		+							+			RTGO EMS VIO
		-	0	0					-	0	0	RRT
		+							+			RET 0.05G
		X	X						X	X		D <sub>L</sub> MAX <sub>N69</sub>
		+	0	0					+	0	0	D <sub>L</sub> MIN
		+	0	0					+			V <sub>L</sub> MAX
		+							+			V <sub>L</sub> MIN
		X	X	X					X	X	X	D <sub>O</sub> RET V <sub>CIRC</sub>
		X	X						X	X		RETBBO
		X	X						X	X		RETEBO
		X	X						X	X		RETDRO
		X	X	X	X				X	X	X	SXTS
		+							+			SFT
		+							+			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	LIFT VECTOR

APRIL 5, 1969

LUNAR ENTRY PAD

AREA	XXXXX	SPLASHDOWN AREA DEFINED BY TARGET LINE
R .05G	XXX (DEG)	SPACECRAFT IMU GIMBAL ANGLES REQUIRED FOR AERODYNAMIC TRIM AT .05G
P .05G	XXX (DEG)	
Y .05G	XXX (DEG)	
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	+XXXXXX (FPS)	INERTIAL VELOCITY AT ENTRY INTERFACE
400K	-X.XX (DEG)	INERTIAL FLIGHT PATH ANGLE AT ENTRY INTERFACE
RTGO	+XXXXX.X (NM)	RANGE TO GO FROM .05G TO TARGET FOR EMS INITIALIZATION
VIO	+XXXXXX (fps)	INERTIAL VELOCITY AT .05G FOR EMS INITIALIZATION
RRT	XXX:XX:XX (HRS:MIN:SEC)	REENTRY REFERENCE TIME BASED ON GET OF PREDICTED 400K (DET 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	+XXXXXX (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
RETBB0	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	<u>+XX.X (DEG)</u>	BSS PITCH ANGLE ON COAS FOR ENTRY ATTITUDE CHECK
SXP	<u>+X.X (DEG)</u>	BSS X POSITION ON COAS FOR ENTRY ATTITUDE CHECK
LIFT VECTOR	XX (UP/DN)	LIFT VECTOR DESIRED AT .05G's BASED ON ENTRY CORRIDOR

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EARTH ORBIT ENTRY UPDATE													
X		-	X		-	AREA							
X X	-		X X	-		$\Delta V$ 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							
+			+			VIO							
X X		•	X X		•	RET 0.05G							
0		•	0		•	LAT N61							
		•			•	LONG							
X X		•	X X		•	RET 0.2G							
		•			•	DRE ( $55^\circ$ ) 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		•	RET DROG							
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							
+			+			VIO							
X X		•	X X		•	RET 0.05G							
X X		•	X X		•	RET 0.2G							
		•			•	DRE $\pm 100$ nm N66							
R R	/		R R	/		BANK AN							
X X		•	X X		•	RETRB							
X X		•	X X		•	RETBBO							
X X		•	X X		•	RETEBO SEC							
X X		•	X X		•	RET DROG 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	XXX (DEG)	SPACECRAFT IMU
P 0.05G	XXX (DEG)	GIMBAL ANGLES REQUIRED
Y 0.05G	XXX (DEG)	FOR AERODYNAMIC TRIM AT 0.05G.
EMS		
RTGO	XXXX.X (NM)	RANGE TO GO FROM .05G TO TARGET
VIO	XXXXX (FPS)	INERTIAL VELOCITY AT .05G FOR EMS INITIALIZATION
RET 0.05G	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO .05G
N61		
LAT	<u>+XX.XX (DEG)</u>	LATITUDE OF IMPACT LANDING POINT
LONG	<u>+XXX.XX (DEG)</u>	LONGITUDE OF IMPACT LANDING POINT
N66		
RET .2G	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO .2G
DRE (55°)	<u>+XXXX.X (NM)</u>	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 <u>+XXX</u>	VALUES USED TO RE-PLOT BACKUP ENTRY CHART - ΔV AND DOWN RANGE ERROR (DRE) @ 90° BANK ANGLE
<u>POST BURN</u>		
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
VIO	+XXXXX (FPS)	INERTIAL VELOCITY @ 0.05G
RET 0.05G	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO 0.5G
RET 02G	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

EARTH ORBIT BLOCK DATA											
APRIL 1, 1969	E.O. BLOCK	-			X X			-			AREA
		X	X		X	X		X	X	X	LAT
		X	X	X							LONG
		X	X			X	X				GETI
											$\Delta V_C$
		X	X	X			X	X	X		AREA
		X	X			X	X				LAT
		X	X	X			X	X	X		LONG
											GETI
		X	X	X			X	X	X		$\Delta V_C$
		X	X			X	X				AREA
		X	X	X			X	X	X		LAT
		X	X			X	X				LONG
											GETI
		X	X	X			X	X	X		$\Delta V_C$
		X	X			X	X				AREA
		X	X	X			X	X	X		LAT
		X	X			X	X				LONG
											GETI
		X	X	X			X	X	X		$\Delta V_C$
		X	X			X	X				AREA
		X	X	X			X	X	X		LAT
		X	X			X	X				LONG
											GETI
		X	X	X			X	X	X		$\Delta V_C$
REMARKS:											

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.X (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.

		LM P27 UPDATE											
		PURP	V		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	HR	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

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 GROUND TRACK
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	<u>+XXXXX</u> (100 FT)	LM STATE VECTOR-POSITION COMPONENTS
241	<u>+XXXXX</u> (100 FT)	
242	<u>+XXXXX</u> (100 FT)	
260	<u>+XXXX.X</u> (FPS)	LM STATE VECTOR-VELOCITY COMPONENTS
261	<u>+XXXX.X</u> (FPS)	
262	<u>+XXXX.X</u> (FPS)	
254	<u>+XXXX.X</u> (MIN)	LM TIME FOR WHICH THE STATE VECTOR IS ACCURATE
244	<u>+XXXXX</u> (100 FT)	CSM STATE VECTOR-POSITION COMPONENTS
245	<u>+XXXXX</u> (100 FT)	
246	<u>+XXXXX</u> (100 FT)	
264	<u>+XXXX.X</u> (FPS)	CSM STATE VECTOR-VELOCITY COMPONENTS
265	<u>+XXXX.X</u> (FPS)	
266	<u>+XXXX.X</u> (FPS)	
272	<u>+XXXX.X</u> (MIN)	CSM TIME FOR WHICH THE STATE VECTOR IS ACCURATE

June 18, 1969

			PHASING				P30 LM MANEUVER				
HR	N33		+	0	0		+	0	0		
MIN	TIG		+	0	0	0		+	0	0	0
SEC			+	0				+	0		
$\Delta V_x$	N81										
$\Delta V_y$	LOCAL										
$\Delta V_z$	VERT										
H <sub>A</sub>	N42	+					+				
H <sub>P</sub>											
$\Delta V_R$		+					+				
BT		X	X	X		•	X	X	X	•	
R	FDAI	X	X	X			X	X	X		
P	INER	X	X	X			X	X	X		
$\Delta V_x$	AGS N86					•					
$\Delta V_y$	AGS					•					
$\Delta V_z$	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 $\Delta V$		
$\Delta V_x$	$\pm$ XXXX.X (FPS)	LOCAL VERTICAL $\Delta V$ COMPONENTS OF THE MANEUVER
$\Delta V_y$	$\pm$ XXXX.X (FPS)	
$\Delta V_z$	$\pm$ XXXX.X (FPS)	
N42 ORBITAL PARAMETERS		
HA	+XXXX.X (NM)	PREDICTED APOGEE RESULTING FROM MANEUVER
HP	$\pm$ XXXX.X (NM)	PREDICTED PERIGEE RESULTING FROM MANEUVER
$\Delta V_R$	+XXXX.X (FPS)	TOTAL $\Delta V$ 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)	
AGS $\Delta V$		
$\Delta V_x$ AGS	+XXXX.X (FPS)	LOCAL VERTICAL $\Delta V$
$\Delta V_y$ AGS	$\mp$ XXXX.X (FPS)	COMPONENTS OF THE
$\Delta V_z$ AGS	$\pm$ XXXX.X (FPS)	MANEUVER TO TARGET THE AGS
BSS	XX (OCTAL)	BSS STAR FOR MANEUVER ATTITUDE CHECK
SPA	+XX.X (DEG)	
SXP	$\mp$ XX.X (DEG)	BSS PITCH ANGLE ON COAS, & BSS X POSITION ON COAS FOR MANEUVER ATTITUDE CHECK

P30 LM MANEUVER												P30
PURPOSE												P30
+	0	0				+	0	0				HR N33
+	0	0	0			+	0	0	0			MIN TIG
+	0			•		+	0			•		SEC
												$\Delta V_X$ N81
				•						•		$\Delta V_Y$ LOCAL
				•						•		$\Delta V_Z$ VERT
+				•		+				•		Ha N42
				•						•		Hb
+				•		+				•		$\Delta V_R$
X	X	X		•		X	X	X		•		BT
X	X	X				X	X	X				R FDAI
X	X	X				X	X	X				P INER
				•						•		$\Delta V_X$ AGS N86
				•						•		$\Delta V_Y$ AGS
				•						•		$\Delta V_Z$ AGS
X	X	X				X	X	X				BSS
X	X			•		X	X			•		SPA
X	X	X		•		X	X	X		•		SXP
REMARKS:												

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	<u>+XXXX.X</u> (FPS)	LOCAL VERTICAL ΔV COMPONENTS OF THE MANEUVER
ΔVY	<u>+XXXX.X</u> (FPS)	
ΔVZ	<u>+XXXX.X</u> (FPS)	
N42 ORBITAL PARAMETERS		
HA	<u>+XXXX.X</u> (NM)	PREDICTED APOGEE AND PERIGEE RESULTING FROM THE MANEUVER
HP	<u>+XXXX.X</u> (NM)	
ΔVR	<u>+XXXX.X</u> (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	<u>+XXXX.X</u> (FPS)	LOCAL VERTICAL ΔV COMPONENTS OF THE MANEUVER USED TO TARGET THE AGS
ΔVY AGS	<u>+XXXX.X</u> (FPS)	
ΔVZ AGS	<u>+XXXX.X</u> (FPS)	
BSS	XX (OCTAL)	BSS STAR FOR BURN ATTITUDE CHECK
SPA	<u>+XX.X</u> (DEG)	BSS PITCH ANGLE ON COAS, & BSS X POSITION ON COAS FOR MANEUVER
SXP	<u>+XX.X</u> (DEG)	ATTITUDE CHECK

June 18, 1969

VVI DATA CARD

P30									
HR	N33	+	0	0	0	+	0	0	0
MIN	TIG	+	0	0	0	+	0	0	0
SEC		+	0			+	0		
$\Delta V_x$	N81								
$\Delta V_y$	LOCAL								
$\Delta V_z$	VERT								
$H_A$	N42	+							
$H_P$									
$\Delta V_R$		+				+			
BT		X	X	X	•	X	X	X	•
R	FDAI	X	X	X		X	X	X	
P	INER	X	X	X	I	X	X	X	
$\Delta V_x$ AGS	N86								
$\Delta V_y$ AGS									
$\Delta V_z$ AGS									
BSS		X	X	X		X	X	X	
SPA		X	X			X	X		
SXP		X	X	X		X	X	X	

MANUAL SHOT SEQUENCING	
A. AVG NEGATIVE POSITION	
CR	
B. V <sub>T</sub> = 2 SECONDS OVER BURN AND AGS, HGY, 3 FTS OVER	
MANUAL TAKEOVER ATT+5° RATE 15°/sec	

LR SELF TEST									
H TM (+7994) 30									
H TM (-480) 6									
N65 SLANTBNG (+68275, +5, 0)									
N67 VY (-66494, +2, 0)									
VY (+61858, +2, 0)									
VZ (+61329, +2, 0)									
RR/TM/VHF									
<input type="checkbox"/> R1	<input type="checkbox"/> R2	<input type="checkbox"/> R3							
N78									
TM									
CME									
VHF									
P52	<input type="checkbox"/>	<input type="checkbox"/> STAR	1		2		3		
N95 (STAR + DIFF)									
N93 (TORQUEING X)			X						
SET				X					
PFS INDICES									
AVX					PGNS			AGS	
AVY					N85			SG1	
AVZ								SG2	

DOI DATA CARD

N33 DOI TIG	XXX:XX:XX.XX (HR:MIN:SEC)	IGNITION TIME OF LM MANEUVER
N81 LOCAL VERTICAL ΔV		LOCAL VERTICAL ΔV COMPONENTS OF THE MANEUVER
ΔVX	+XXXX.X (FPS)	
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
ΔVY AGS	+XXXX.X (FPS)	MANEUVER TO TARGET
ΔVZ AGS	+XXXX.X (FPS)	THE AGS
BSS	XXX (OCTAL)	BSS STAR FOR MANEUVER ATTITUDE CHECK
SPA	+XX.X (DEG)	BSS PITCH ANGLE ON
SXP	+XX.X (DEG)	COAS, & BSS X POSITION ON COAS FOR MANEUVER ATTITUDE CHECK

## PDI DATA CARD

PDI PAD											
HRS	TIG	+ 0 0			+ 0 0						
MIN	PDI	+ 0 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											
TGO INSERTION GATE											
CSI TIG											
HRS	N37	+ 0 0			+ 0 0						
MIN	TPI	+ 0 0	0		+ 0 0	0	0				
SEC		+ 0		•	+ 0			•			

PDI ABORT > 10 MIN											
TGO PHASING GATE											
CSI TIG											
HRS		+ 0 0			+ 0 0						
MIN		+ 0 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	0				
SEC		+ 0		•	+ 0			•			

NO PDI + 12 ABORT											
HR	N33	+ 0 0			+ 0 0						
MIN	TIG	+ 0 0	0		+ 0 0	0	0				
SEC	+ 0			•							
ΔVX	N81							•			
ΔVY	LOCAL						•				
ΔVZ	VERT					•					
HA	N42	+ 0					•				
HP								□			
ΔVR		+ 0				•			+		
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	0				
SEC		+ 0		•					+		
HRS	N37	+ 0 0			+ 0 0						
MIN	TPI	+ 0 0	0		+ 0 0	0	0				
SEC		+ 0		•					+		

June 18, 1969

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
CROSS RANGE	+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 FOR ABORT BURN
N81 LOCAL VERTICAL $\Delta V$		
$\Delta V_X$	$\pm XXXX.X$ (FPS)	LOCAL VERTICAL $\Delta V$
$\Delta V_Y$	$\pm XXXX.X$ (FPS)	COMPONENTS OF THE
$\Delta V_Z$	$\pm XXXX.X$ (FPS)	PHASING MANEUVER
N42 ORBITAL PARAMETERS		
HA	+XXXX.X (NM)	PREDICTED APOGEE RESULTING FROM MANEUVER
HP	$\pm XXXX.X$ (NM)	PREDICTED PERIGEE RESULTING FROM MANEUVER
$\Delta V_R$	XXXX.X (FPS)	TOTAL $\Delta V$ REQUIRED FOR THE MANEUVER
BT	X:XX (MIN:SEC)	DURATION OF MANEUVER
FDAI		
R	XXX (DEG)	INERTIAL FDAI ANGLES
P	XXX (DEG)	AT THE BURN ATTITUDE
N86 AGS $\Delta V$		
$\Delta V_X$ AGS	$\pm XXXX.X$ (FPS)	LOCAL VERTICAL $\Delta V$
$\Delta V_Y$ AGS	$\pm XXXX.X$ (FPS)	COMPONENTS OF THE MANEUVER TO TARGET
$\Delta V_Z$ AGS	$\pm XXXX.X$ (FPS)	THE AGS
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

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## LUNAR SURFACE DATA CARD

June 18, 1969

T 2 ABORT			
HR	T2	+ 0 0	+ 0 0
MIN	TIG	+ 0 0 0	+ 0 0 0
SEC		+ 0	+ 0
		•	•
HR	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 <sub>1</sub>	+ 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
		•	•

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

2-40

P68

N43

LAT

P12

LONG

N43

ALT

P12

N76

V (HOR)

(5516.7)

P12

N76

V (VERT)

( -19.5 )

P12

N76

CROSSRANGE

( -0.9 )

NOTE: IF CROSSRANGE &gt; 0 N.M., LOAD 8 N.M.

N74

YAW

P12

N74

PITCH

P12

N76

Y (HOR) (5516.7)

P12

N76

Y (VERT) (-19.5)

P12

N76

CROSSRANGE (-0.9)

P12

N76

NOTE: IF CROSSRANGE &gt; 0 N.M., LOAD 8 N.M.

P12

N76

YAW

P12

N76

PITCH

LUNAR SURFACE DATA CARD

T2 ABORT

T2 TIG	XXX:XX:XX.XX (HR:MIN:SEC)	LIFTOFF TIME- SECOND PREFERRED TIME AFTER TOUCH- DOWN (~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 + ΔT	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

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	+XXXX.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 $\alpha_3$ AT ORBIT INSERTION
DEDA 226	XXXXXX (100 FT)	UPPER LIMIT OF $\alpha_3$ AT ORBIT INSERTION
DEDA 231	XXXXXX (100 FT)	RADIAL DISTANCE OF LAUNCH SITE FROM CENTER OF MOON

CSI DATA CARD												June 19, 1969			
HR	TIG	N11	+ 0 0	+ 0 0		RESIDUALS				P82					
MIN	CSI	+ 0 0 0	+ 0 0 0	+ 0											
SEC															
$\Delta V_x$	N81	+ 0 0	+ 0 0	+ 0											
$\Delta V_y$		+ 0	+ 0	+ 0											
FDAI PITCH		+ X X	+ X X	+ X X											
373 (+0321.3)		+ 0	+ 0	+ 0											
275 (+0418.1)		+ 0	+ 0	+ 0											
<hr/>															
$\Delta V_x$	AGS N86	0 0	0 0	0 0											
$\Delta V_y$	AGS	0 0	0 0	0 0											
$\Delta V_z$	AGS	0 0	0 0	0 0											
<hr/>															
P	CDH (+0.0)	CSI (+0.0)	CDH (+0.0)	CSI (+0.0)											
G															
N															
C															
S															
<hr/>															
A	AGS	CDH	CSI	CDH	CSI										
G															
S															
<hr/>															
P82															
STAR 1 2 3															
N86 (STAR + DIFF)															
N93 (TORQUING +)															
X Y Z															
N82															
AVX CDH SVY CZY CDH															
(-0.4) (+0.8) (+0.0)															
P G N C S A G S															
AVX CSI SVY CZY															
N86 (CSI)															
AVX SVY CZY															

CSI DATA CARD (P32 LM MANEUVER)

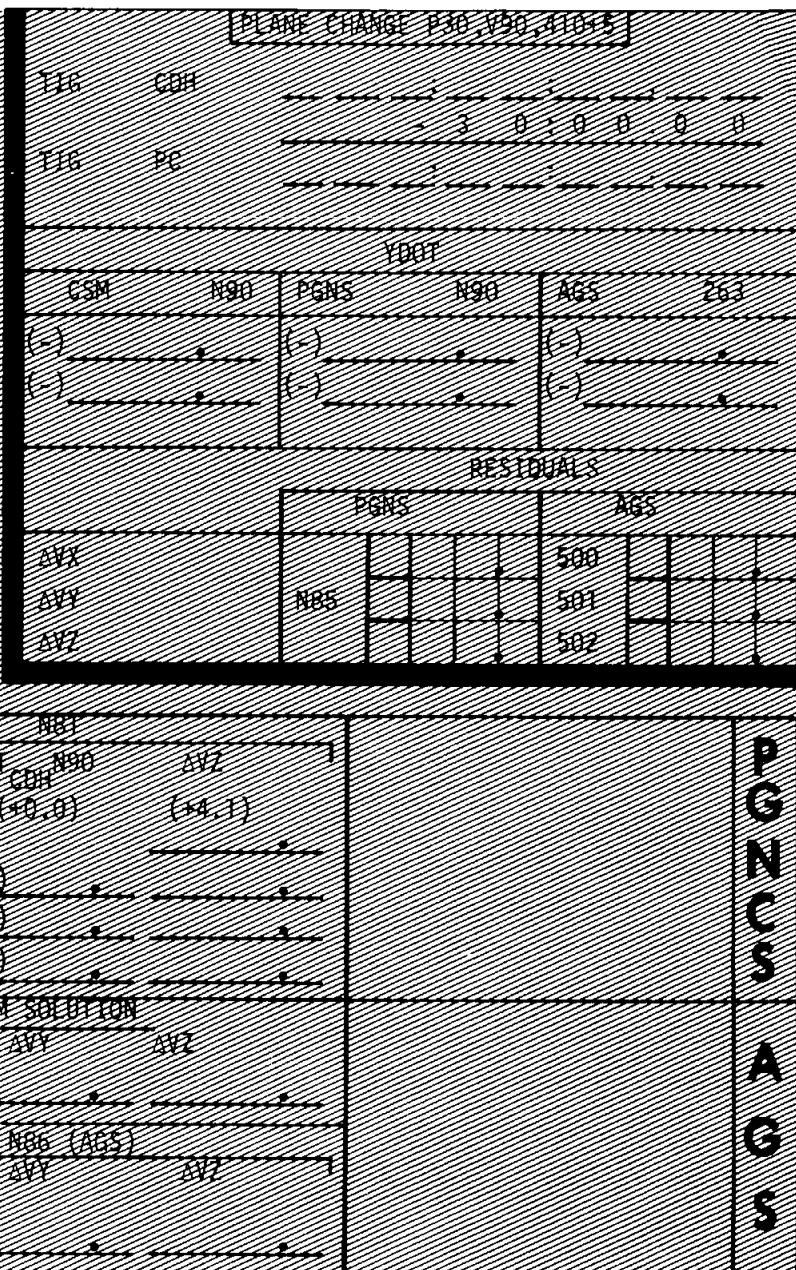
N11 CSI TIG	XXX:XX:XX.XX (HR:MIN:SEC)	CSI IGNITION TIME
N37 TPI TIG	XXX:XX:XX.XX (HR:MIN:SEC)	TPI IGNITION TIME
N81		
$\Delta V_x$	XXX.X (FPS)	LOCAL VERTICAL $\Delta V$ COMPONENTS OF THE CSI MANEUVER
$\Delta V_y$	XXX.X (FPS)	
FDAI PITCH	XXX (DEG)	FDAI INERTIAL PITCH ANGLE AT THE CSI BURN ATTITUDE
DEDA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

June 19, 1969

CDH PAD

HR	N13	+	0	0			+	0	0
MIN	TIG	+	0	0	0		+	0	0
SEC	CDH	+	0			.	+	0	
$\Delta Vx$			0			.		0	
$\Delta Vy$	N81		0			.		0	
$\Delta Vz$			0			.		0	
PLM	FDAI	X	X	X			X	X	X
373 (+0379.6)		+				.	+		
$\Delta Vx$	N86	0				.		0	
$\Delta Vy$	AGS	0				.		0	
$\Delta Vz$		0				.		0	

CDH DATA CARD



2-46

CDH DATA CARD

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
ΔVY	<u>+XXX.X (FPS)</u>	COMPONENTS OF CDH
ΔVZ	<u>-XXX.X (FPS)</u>	MANEUVER
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
ΔVY AGS	<u>+XXX.X (FPS)</u>	COMPONENTS OF CDH
ΔVZ AGS	<u>+XXX.X (FPS)</u>	USED TO TARGET AGS EXT ΔV

TPI DATA CARD

June 19, 1969

HR	N37	+	0	0				+	0	0	
MIN	TIG	+	0	0	0			+	0	0	0
SEC	TPI	+	0			•		+	0		•
<b>N55</b> <b>BLEWING</b> (+0.25, -0.01)      (+1.30, 0.01)											
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		•

2-48

P	N88				N89				N90				P	
G	HP	AV	TPF	AV	TPF	AV	AVY	AV	AVY	AV	AVY/A	AVY/C	AVY/U	G
N	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	N
S	-	-	-	-	-	-	-	-	-	-	-	-	-	S
A	267	371				CSM SOLUTION								A
G	AVYTF	AVYTRPFF				AV	AVY	AV						G
S	-	-	-	-	-	N86 (AGS)								S

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)  
ΔVY                    -XX.X (FPS)  
ΔVZ                    -XX.X (FPS)            LOCAL VERTICAL ΔV  
    COMPONENTS OF THE  
    TPI MANEUVER

N42 Δ VR              +XX.X (FPS)            TOTAL ΔV REQUIRED  
    FOR THE MANEUVER  
RLM                     XXX (DEG)                ROLL AND PITCH  
PLM                     XXX (DEG)                FDAI ANGLES AT TPI  
    BURN ATTITUDE

N54 TIG-5

R TPI                  XX.XX (FT)            RANGE AT TPI TIG - 5 MIN  
·                        +XXX.X (FPS)            RANGE RATE AT TPI TIG - 5 MIN

N59 Δ V LOS

F/A                    +XX.X (FPS)  
R/L                    -XX.X (FPS)  
D/U                    -XX.X (FPS)            LINE-OF-SIGHT ΔV  
    COMPONENTS OF THE  
    TPI MANEUVER

BT                     XX:XX (MIN:SEC)            DURATION OF THE MANEUVER

SECTION III

SECTION III - DETAILED TIMELINE

# FLIGHT PLAN

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

MISSION G

EDITION FINAL

DATE

JULY 1, 1969

PAGE 3-i

# FLIGHT PLAN

TIME	EVENT	REMARKS
04:00	MCC: <u>REPORT</u> TRAJECTORY AND GUIDANCE GO/NO GO	
04:00	CDR: <u>REPORT</u> S/C GO/NO GO	
05:00	CDR: <u>REPORT</u> S/C GO/NO GO	
05:25	MCC: <u>REPORT</u> S-IVB TO ORBIT CAPABILITY	
06:00	CDR: REPORT S/C GO/NO GO	
07:00	CDR: <u>REPORT</u> S/C GO/NO GO	
08:00	CDR: REPORT S/C GO/NO GO	
08:30	MCC: CDR: <u>REPORT</u> GO/NO GO FOR STAGING	
08:57	MCC: <u>REPORT</u> MODE IV	
	CDR: REPORT S/C GO/NO GO	
	MCC: <u>REPORT</u> TRAJECTORY AND GUIDANCE GO/NO GO	
09:11	CDR: <u>REPORT</u> S-II CUTOFF	
09:15	CDR: <u>REPORT</u> S-IVB IGNITION	
10:00	MCC: CDR: <u>REPORT</u> GO/NO GO FOR ORBIT	
	MCC: <u>REPORT</u> PREDICTED SECO	
11:40	CDR: <u>REPORT</u> SECO                            TB <sub>5</sub> = 0 S-IVB MAINTAINS COMMANDED CUTOFF INERTIAL ATTITUDE	IMU GIMBAL ANGLES @ INSERTION R 180° H pad 103.3 NM P 340° Y 0°

MISSION G

EDITION

FINAL

DATE

JULY 1, 1969

PAGE 3-ii

MCC-H

## FLIGHT PLAN

NOTES

	0930 EDT		
	00:00	LIFTOFF	
	:10	U S	SECO-INSERTION CHECKLIST LMP - SM RCS MON CK, CM RCS MON CK, C&W OPERATIONAL CK REMOVE AND STOW HELMETS AND GLOVES UNSTOW CAMERAS
	:20	T C Y I	CMP - TRANS TO LEB - 02 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
UPDATE  ΔAZ CORRECTION	:30	T A N	GDC ALIGN TO IMU - RECORD DRIFT CDR - UNSTOW SEQ CAMERA BRACKET AND ORDEAL INSTALL ORDEAL & COAS MOUNT AND INITIALIZE ORDEAL SET UP CAMERA EQUIP(T&D)
	:40	T C R O T I	CMP - ECS REDUNDANT COMPONENT CHECK JETTISON OPTICS COVER (DIRECT, HIGH, SHAFT RIGHT) RECORD ΔAZ CORRECTION
	:50		IMU REALIGN - P52 (OPTION 3 - REFSMMAT) (OPTIONAL)
	01:00		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 ATTEN-  
UATION PANEL NOT OPENED

## REPORT

P52 - (PAD REFSMMAT)

N71: \_\_\_\_\_

N05: \_\_\_\_\_

N93:

X \_\_\_\_\_

Y \_\_\_\_\_

Z \_\_\_\_\_

GET : : :

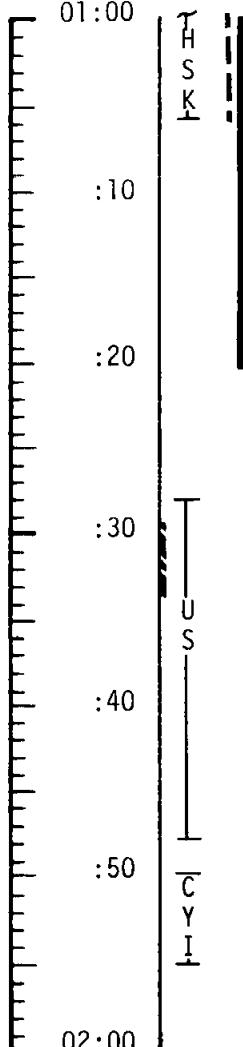
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	00:00 - 01:00	1/1	3-1

**MCC-H**1000 EDT  
01:00**FLIGHT PLAN****NOTES**

P52 - CONT'D

GDC ALIGN TO IMU  
STOW OPTICSUPLINK CMC  
CSM STATE VECTORUPDATE  
PAD DATA

GO/NO GO



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

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

THIS PAGE INTENTIONALLY LEFT BLANK.

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

3-2a

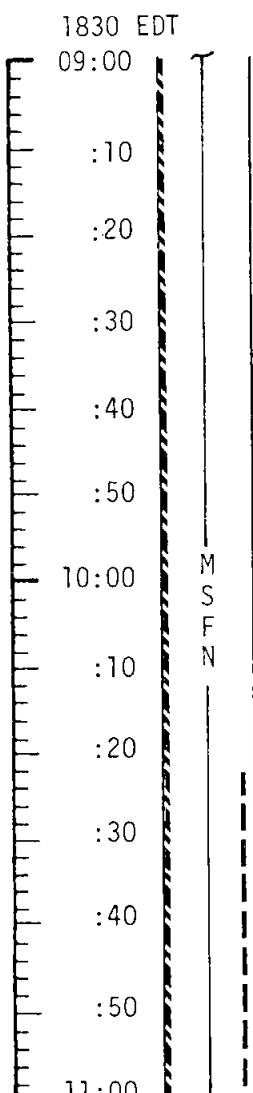
**MCC-H**

# FLIGHT PLAN

**NOTES**

UPLINK CMC  
 EARTH HORIZON  
 BIAS ( $\Delta H$ )  
 (IF REQUIRED)  
 CSM STATE VECTOR  
 MCC1 TGT LOAD

UPDATE  
 MCC1 MNVR PAD



CONTINUE PTC IF MCC1 IS SCRUBBED

IMU REALIGN - P52  
 OPTION 3 - REFSMMAT  
 (OPTIONAL)

PTC

THE EARTH HORIZON BIAS ( $\Delta H$ ) WILL BE UPDATED TO THE CMC IF THE DIFFERENCE BETWEEN THE SIGHTING  $\Delta H$  & THE E-MEMORY  $\Delta H$  IS  $\geq 8.3\text{KM}$

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)

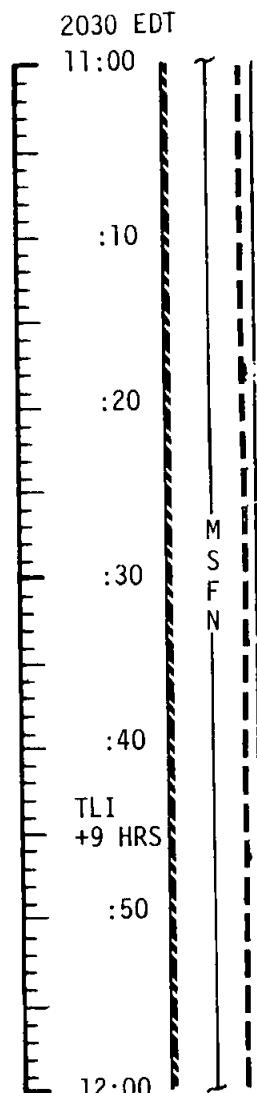
3-9a

MCC-H

## FLIGHT PLAN

NOTES

UPLINK CMC  
DESIRED ORIENTATION (PTC)  
UPDATE  
BLOCK DATA



## BURN STATUS REPORT

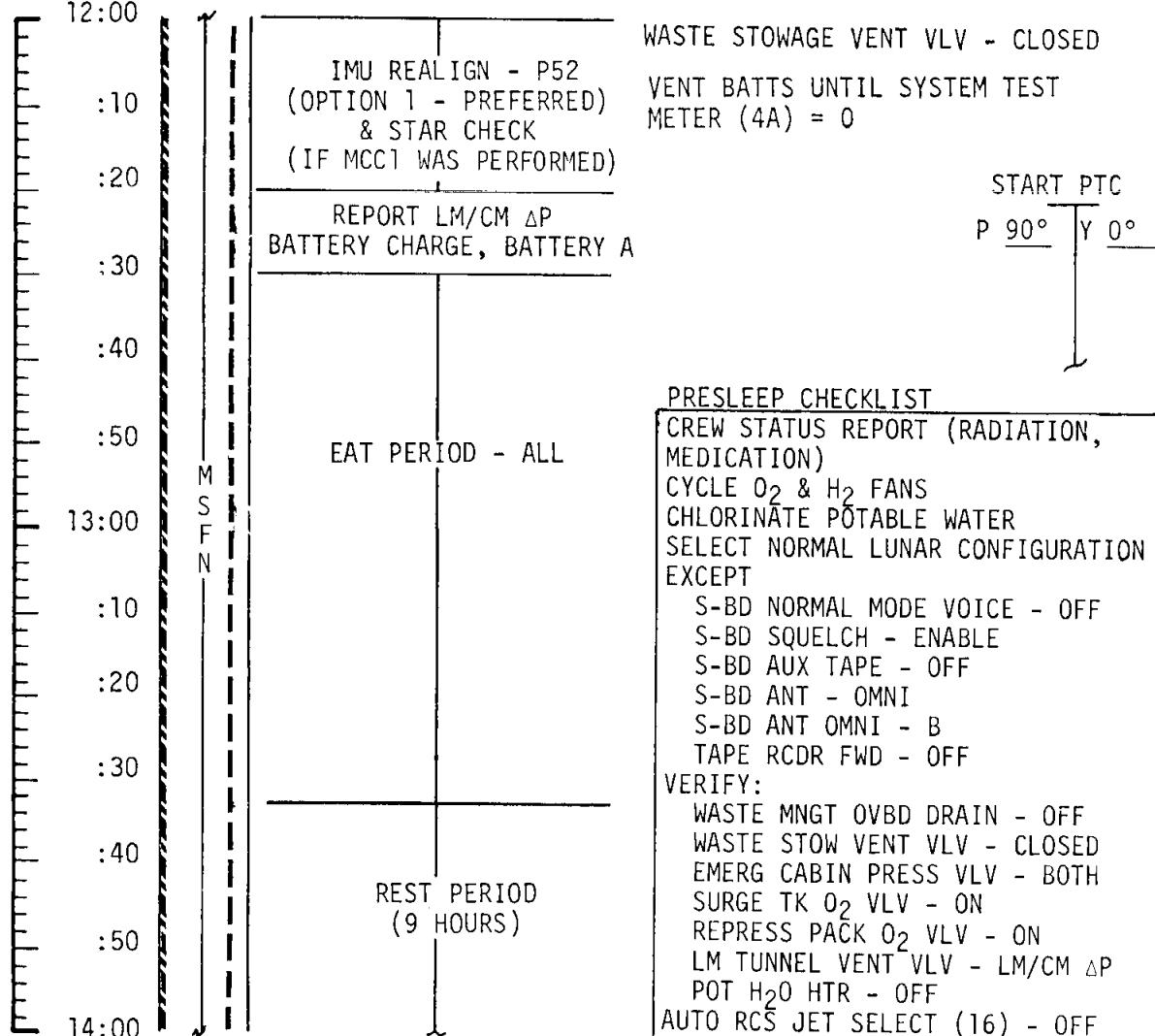
X X	□	•	ΔTIG
X X	•	•	BT
□	•	•	V <sub>gx</sub>
TRIM			
X X X			R
X X X			P
X X X			Y
□			V <sub>gy</sub>
□			V <sub>gz</sub>
□			ΔV <sub>c</sub>
X X X			FUEL
X X X			OX
X X X			UNBAL

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

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	11:00 - 12:00	1/TLC	3-10

2100 EDT

## FLIGHT PLAN



## NOTES

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

ON BOARD READOUT

BAT C \_\_\_\_\_

PYRO BAT A \_\_\_\_\_

PYRO BAT B \_\_\_\_\_

RCS A \_\_\_\_\_

B \_\_\_\_\_

C \_\_\_\_\_

D \_\_\_\_\_

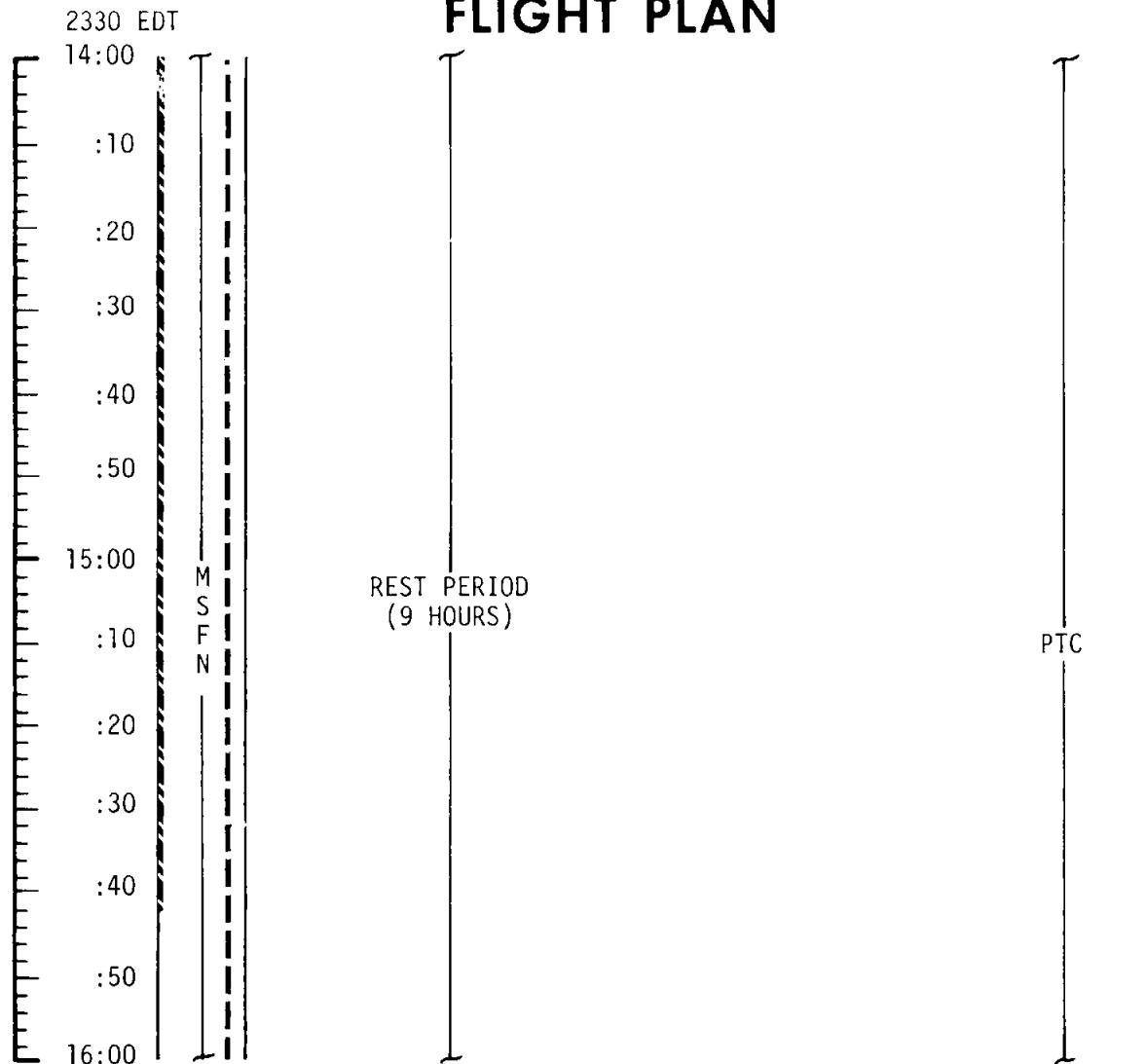
DC IND SEL TO MNA OR MNB

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	12:00 - 14:00	1/TLC	3-11

**MCC-H**

# FLIGHT PLAN

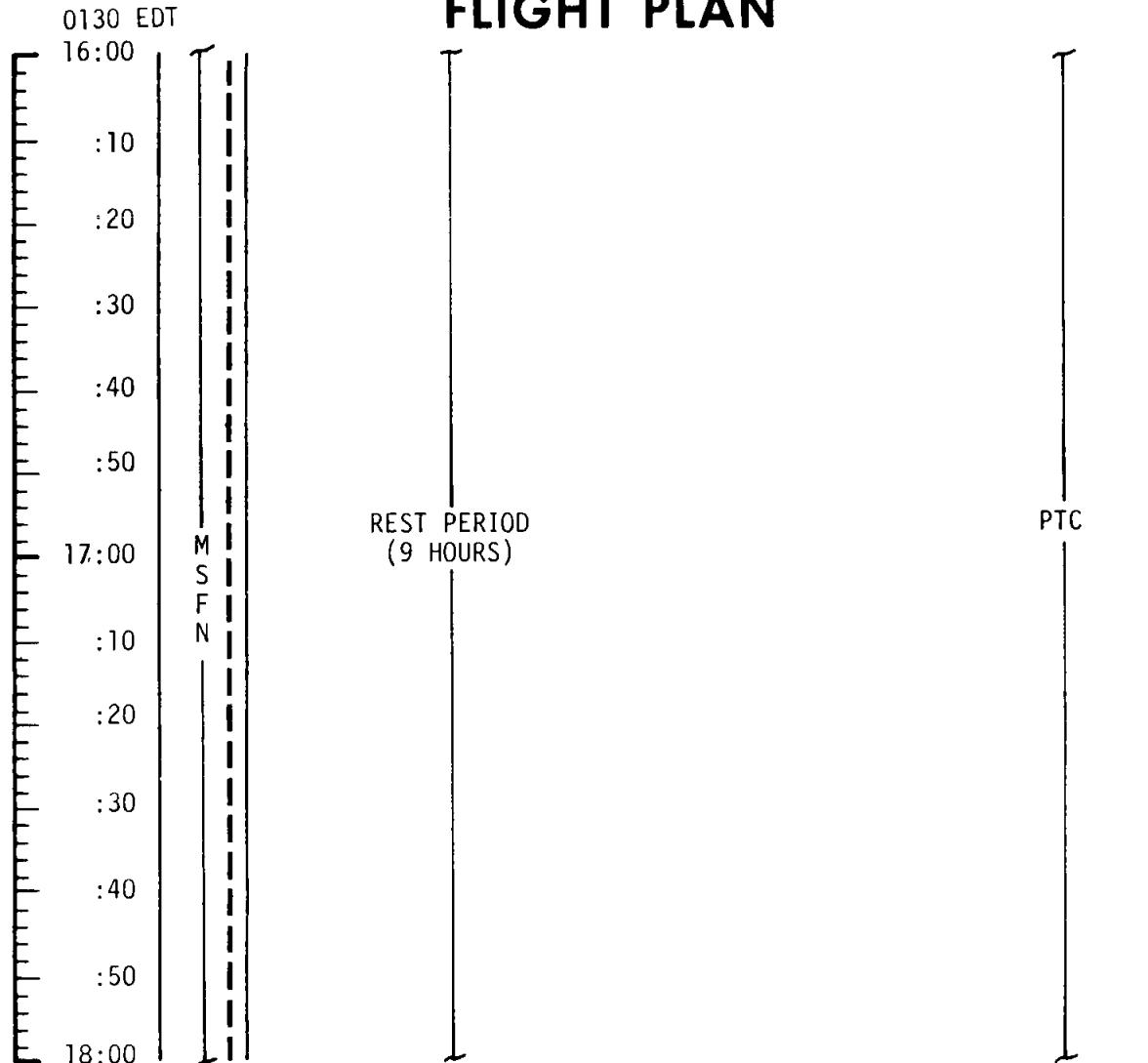
**NOTES**

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



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

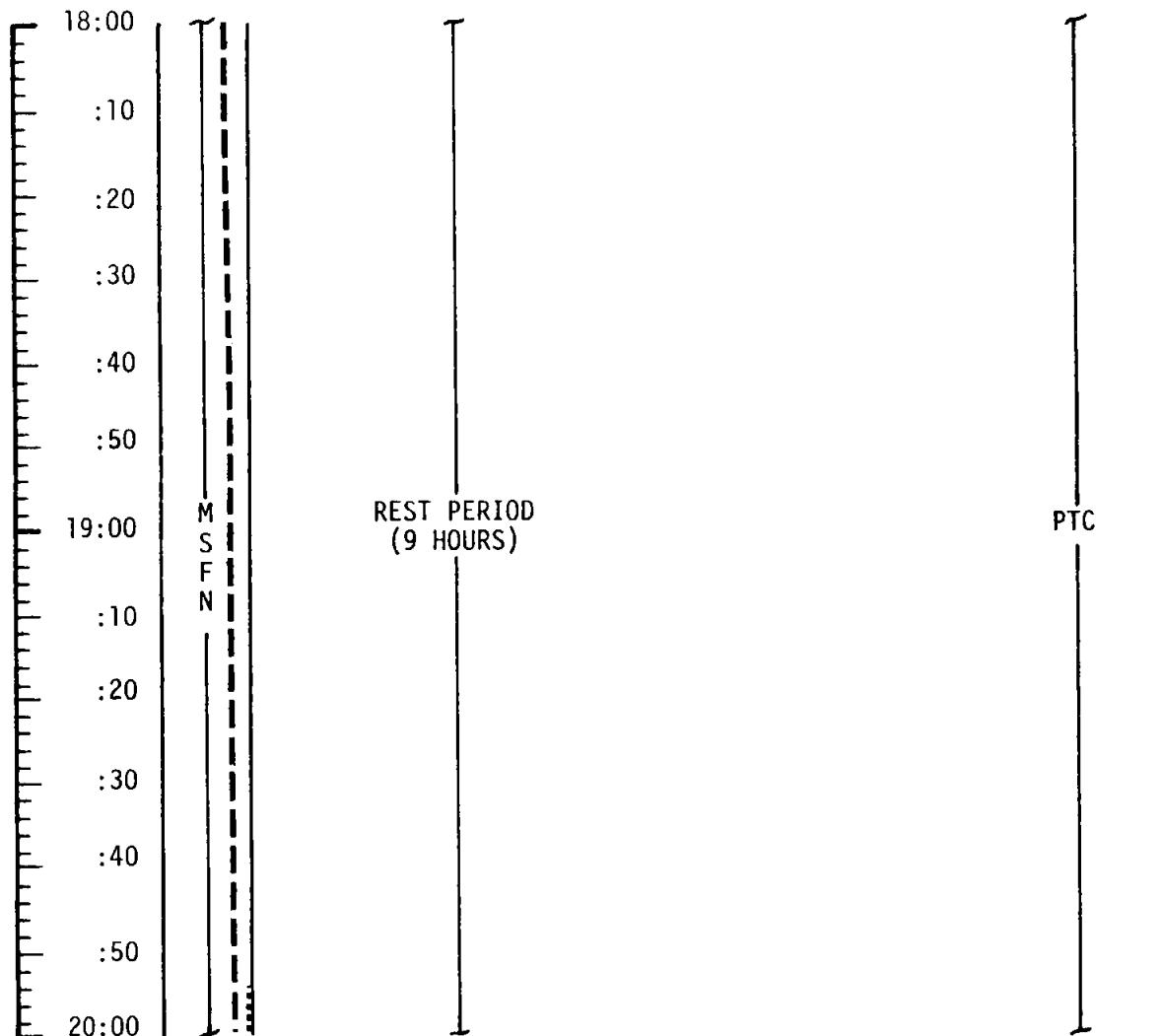
MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

**MCC-H**

0330 EDT

# FLIGHT PLAN

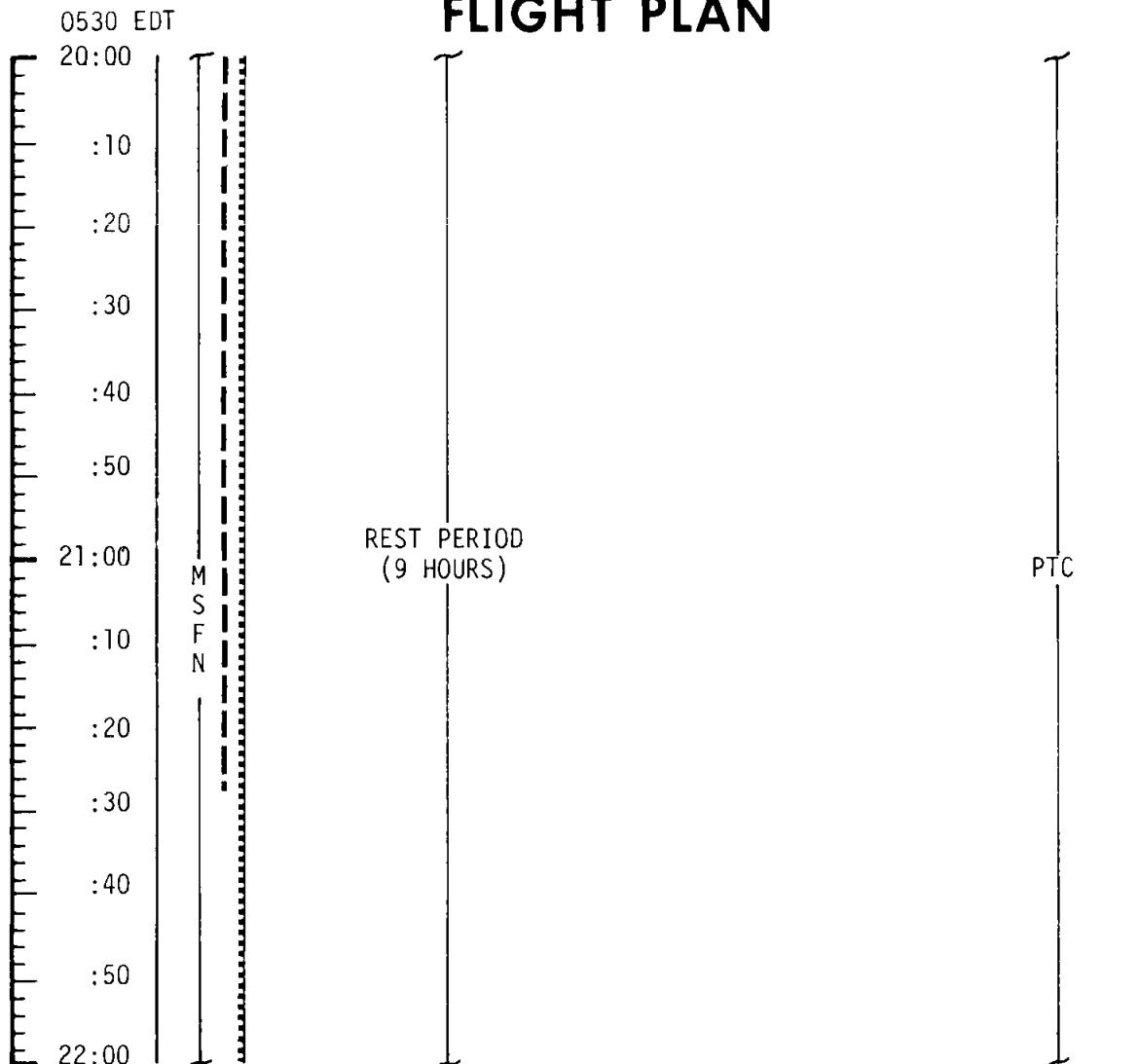
**NOTES**

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



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

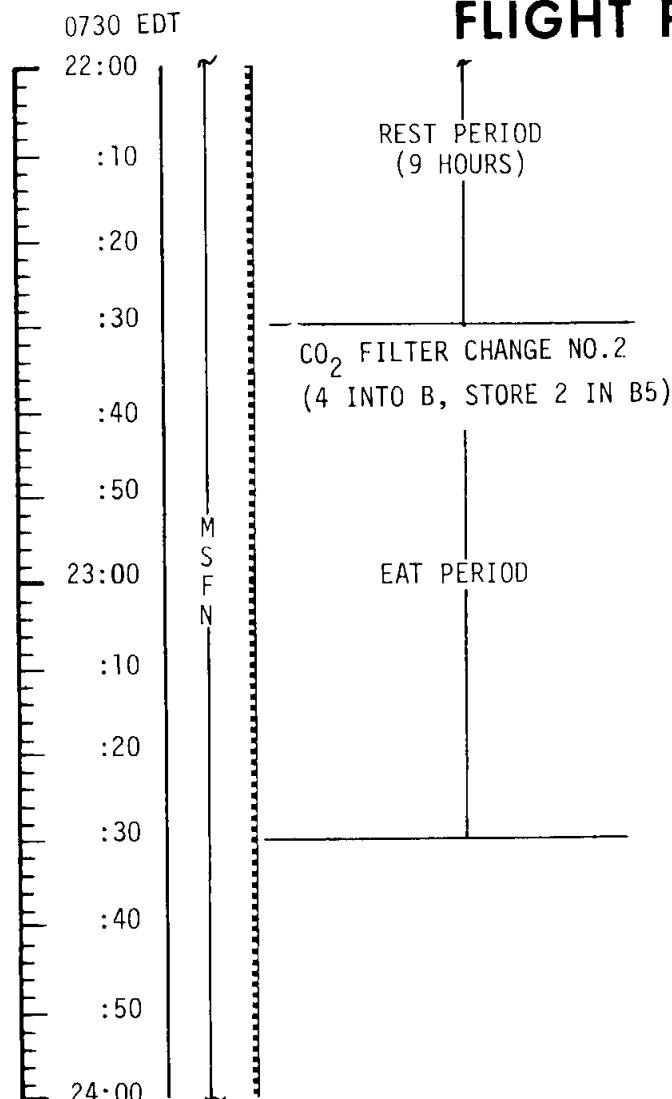
MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

MCC-H

## FLIGHT PLAN

NOTES

UPDATE  
CONSUMABLES

## POST SLEEP CHECKLIST

CREW STATUS REPORT (SLEEP)  
 CYCLE O<sub>2</sub> & H<sub>2</sub> 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<sub>2</sub>O HTR - ON  
 AUTO RCS JET SELECT (16) - ON

CONSUMABLE UPDATE  
(Δ FROM NOMINAL)

GET:

RCS TOT

A

B

C

D

H<sub>2</sub> TOTO<sub>2</sub> TOT

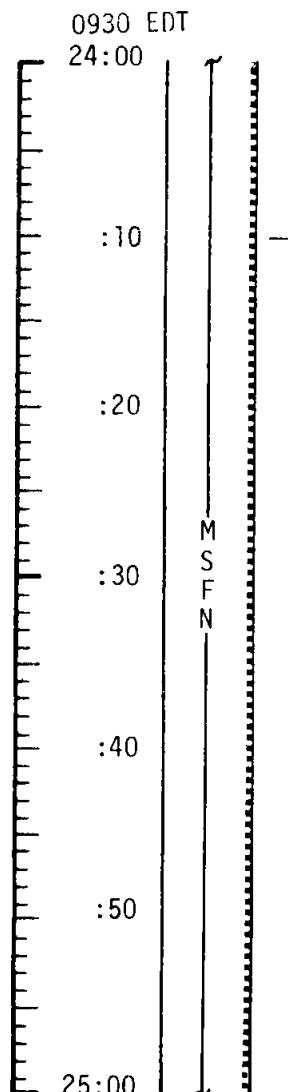
PTC

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



$O_2$  FUEL CELL PURGE

---

IMU REALIGN - P52  
OPTION 3 - REFSMMAT

GDC ALIGN TO IMU

MNVR TO SIGHTING ATT

**CISLUNAR NAVIGATION P23**

OPTICS CALIBRATION

1. STAR 01 ENH (R3=00110)

2. STAR 02 ENH (R3 00110)

PTC

REPORT:

P52 - PTC REFSMMAT

N71: \_\_\_\_ , \_\_\_\_

N05: \_\_\_\_ . \_\_\_\_

N93:

X \_\_\_\_ . \_\_\_\_

Y \_\_\_\_ . \_\_\_\_

Z \_\_\_\_ . \_\_\_\_

GET \_\_\_\_ : \_\_\_\_ :

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

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

MCC-H

1030 EDT  
25:00

## FLIGHT PLAN

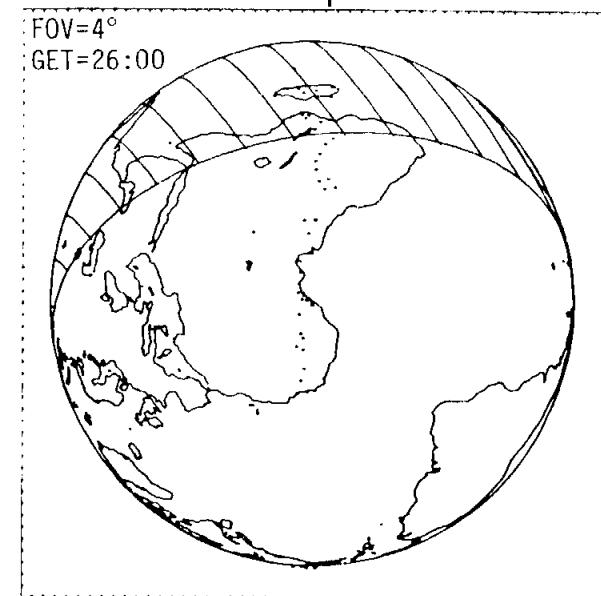
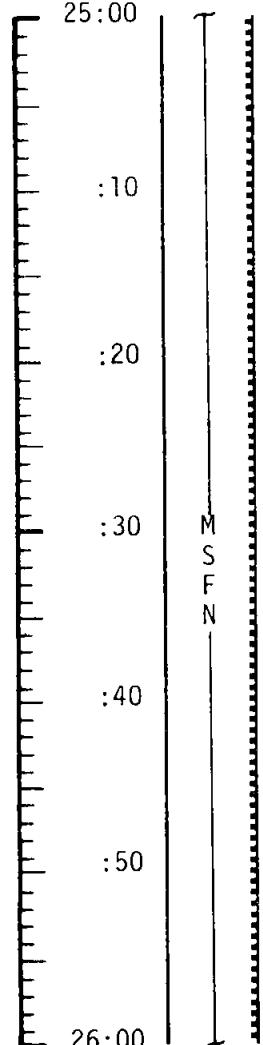
NOTES

3. STAR 44 EFH (R3=00120)

4. STAR 44 EFH (R3=00120)

5. STAR 45 EFH (R3=00120)

UPLINK CMC  
 CSM STATE VECTOR  
 MCC2 TGT LOAD  
UPDATE  
 MCC2 PAD DATA



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

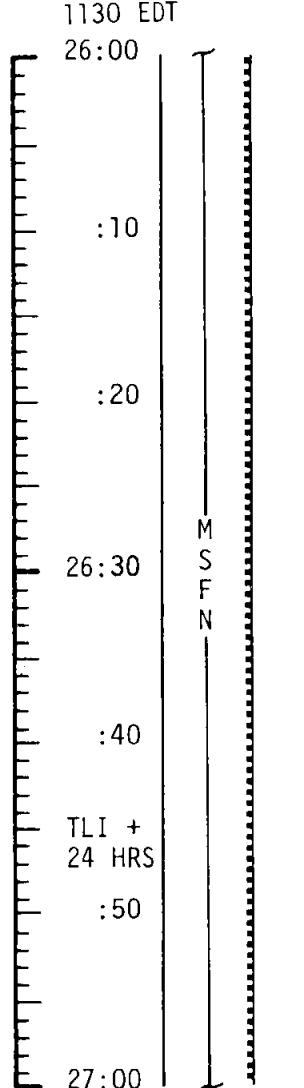
MCC  
BURN CHART

	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)

MCC-H

## FLIGHT PLAN

NOTES



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

**MCC2 ΔV=NOMINALLY ZERO**

SM RCS MON

SPS MON CK

MCC2 BURN STATUS REPORT

V66 - TRANS CSM STATE VECTOR TO LM SLOT

## BURN STATUS REPORT

X X	□	●	ΔTIG
X X	●	●	BT
□	●	●	$v_{gx}$
<b>TRIM</b>			
X X X			R
X X X			P
X X X			Y
□		●	$v_{gx}$
□		●	$v_{gy}$
□		●	$v_{gz}$
□		●	$\Delta V_c$
X X X			FUEL
X X X			OX
X X X			UNBAL

MCC2 WILL BE PERFORMED  
IF ΔV 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

MCC-H

## FLIGHT PLAN

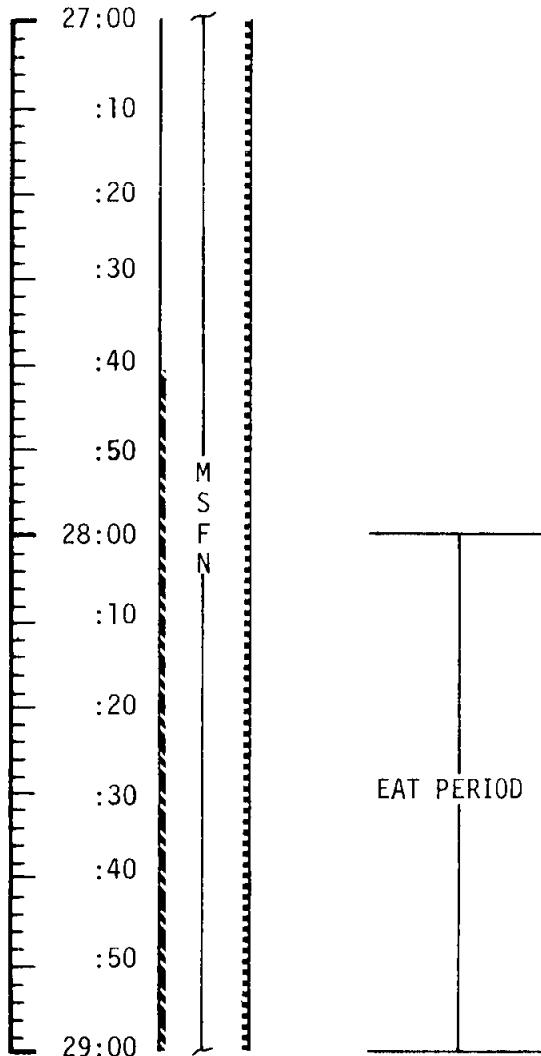
## NOTES

UPLINK

EARTH HORIZON  
BIAS ( $\Delta H$ )  
(IF REQUIRED)

1230 EDT

27:00



START PTC  
P 90 Y 0

PTC

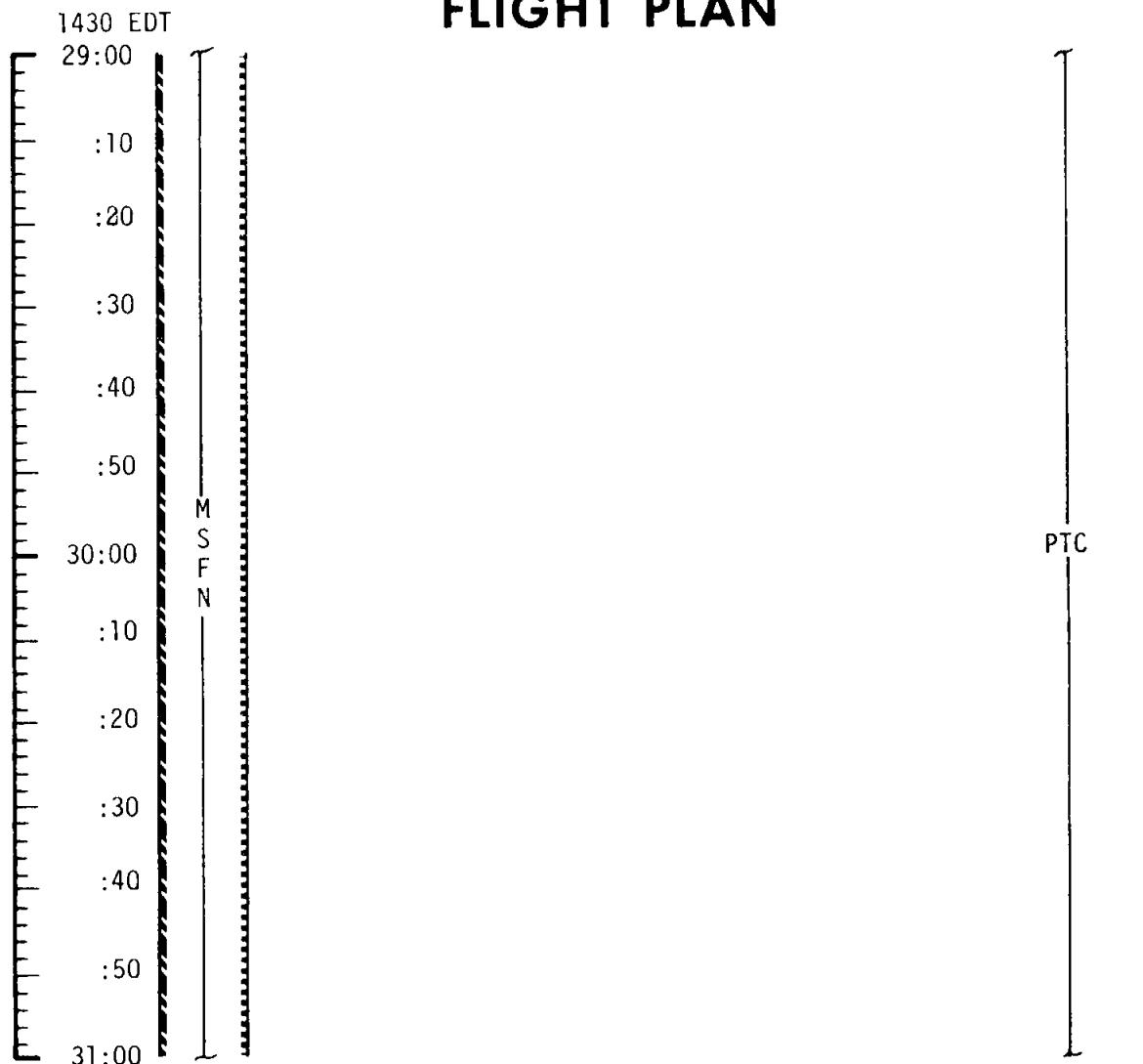
THE EARTH HORIZON  
BIAS WILL BE UP-  
DATED TO THE CMC  
IF THE DIFFERENCE  
BETWEEN THE SIGHT-  
ING  $\Delta H$  IS  $>8.3\text{KM}$

PTC ESTABLISHED  
IN G&N P, Y  
 $+30^\circ$  DB, R RATE  
OF  $0.3^\circ/\text{SEC}$

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

**MCC-H**

# FLIGHT PLAN

**NOTES**

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

M  
S  
F  
N

PTC

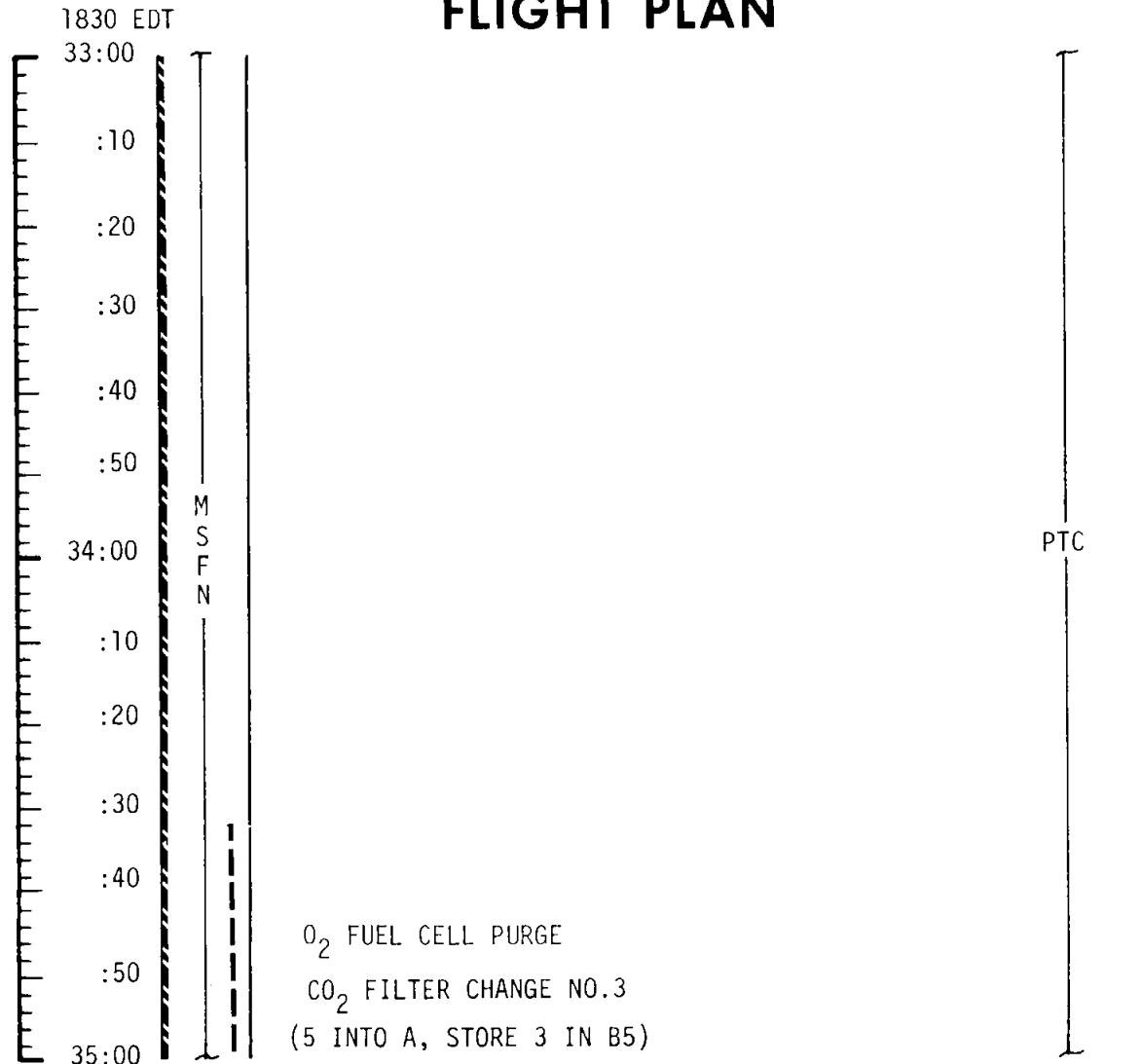
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	31:00 - 33:00	2/TLC	3-22

MSC Form 29 (May 69)

**FLIGHT PLANNING BRANCH**

**MCC-H**

# FLIGHT PLAN

**NOTES**

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

**MCC-H**UPDATE  
BLOCK DATA

(2030 EDT)

35:00

:10

:20

:30

:40

:50

36:00

:10

:20

:30

:40

:50

37:00

M  
S  
F  
NRECORD 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<sub>2</sub> PURITY REQUIRE-  
MENTS ON THE LUNAR SURFACE**FLIGHT PLANNING BRANCH**

# FLIGHT PLAN

**NOTES**

PRESLEEP CHECKLIST  
 CREW STATUS REPORT (RADIATION,  
 MEDICATION)  
 CYCLES O<sub>2</sub> & H<sub>2</sub> FANS  
 CHLORINATE POTABLE WATER  
 SELECT NORMAL LUNAR CONFIG  
 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<sub>2</sub> VLV-ON  
 REPRESS PACK O<sub>2</sub> VLV-OFF  
 LM TUNNEL VENT VLV-LM/CM ΔP  
 POT H<sub>2</sub>O HTR - OFF  
 AUTO RCS JET SELECT (16) - OFF

**ONBOARD READOUT**

BAT C \_\_\_\_\_

PYRO BAT A \_\_\_\_\_

PYRO BAT B \_\_\_\_\_

RCS A \_\_\_\_\_

B \_\_\_\_\_

C \_\_\_\_\_

D \_\_\_\_\_

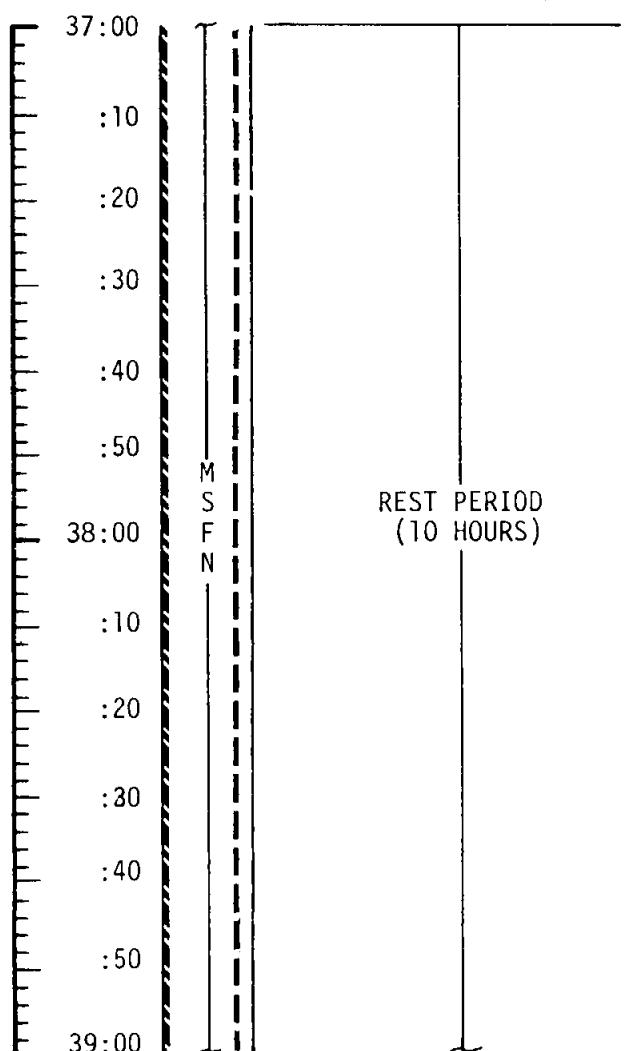
DC IND SEL TO MNA  
OR MNB

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

MCC-H

# FLIGHT PLAN

2230 EDT



## NOTES

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

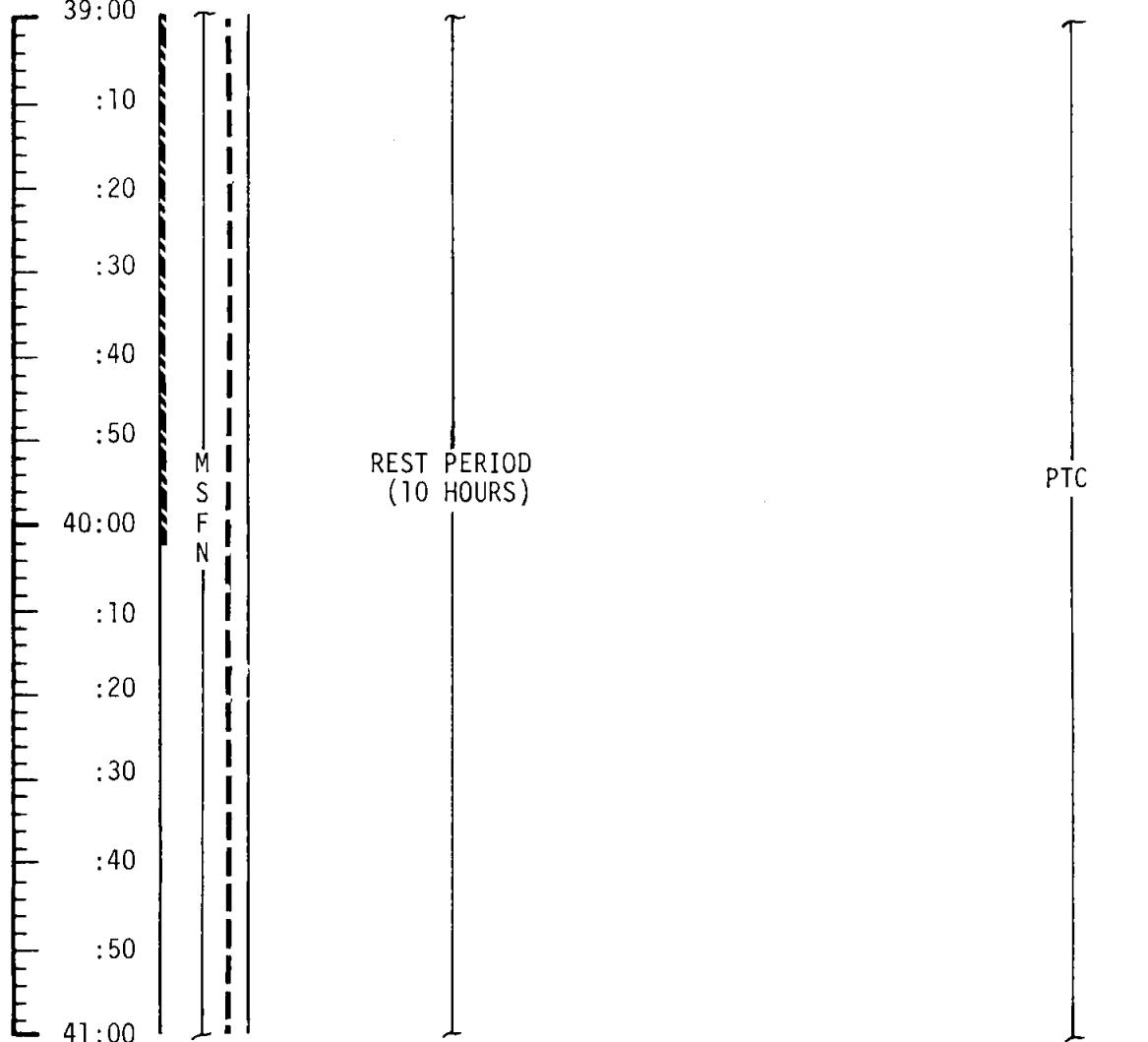
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	37:00 - 39:00	2/TLC	3-25

MCC-N

0030 EDT

## FLIGHT PLAN

NOTES



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

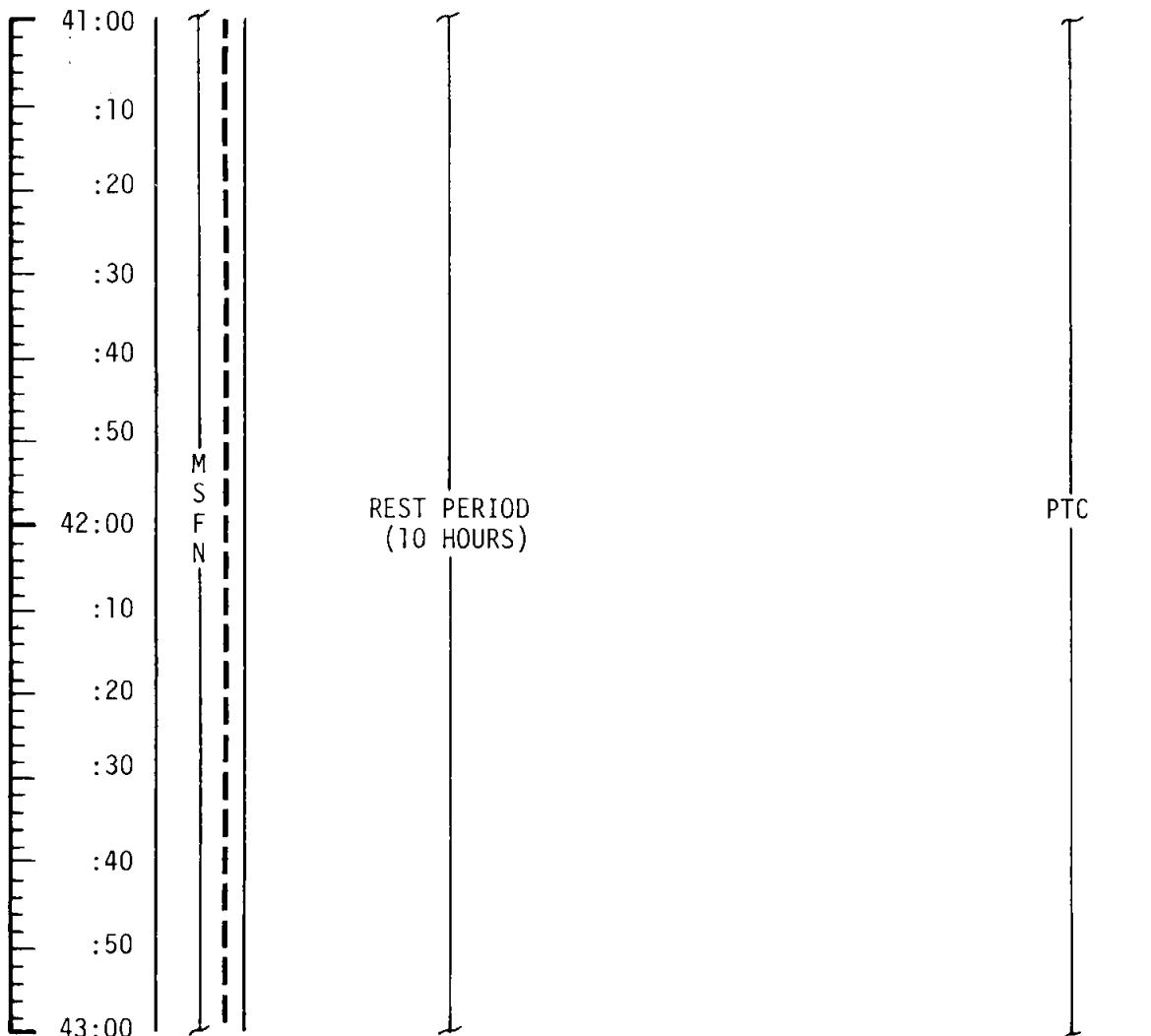
MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

**MCC-H**

0230 EDT

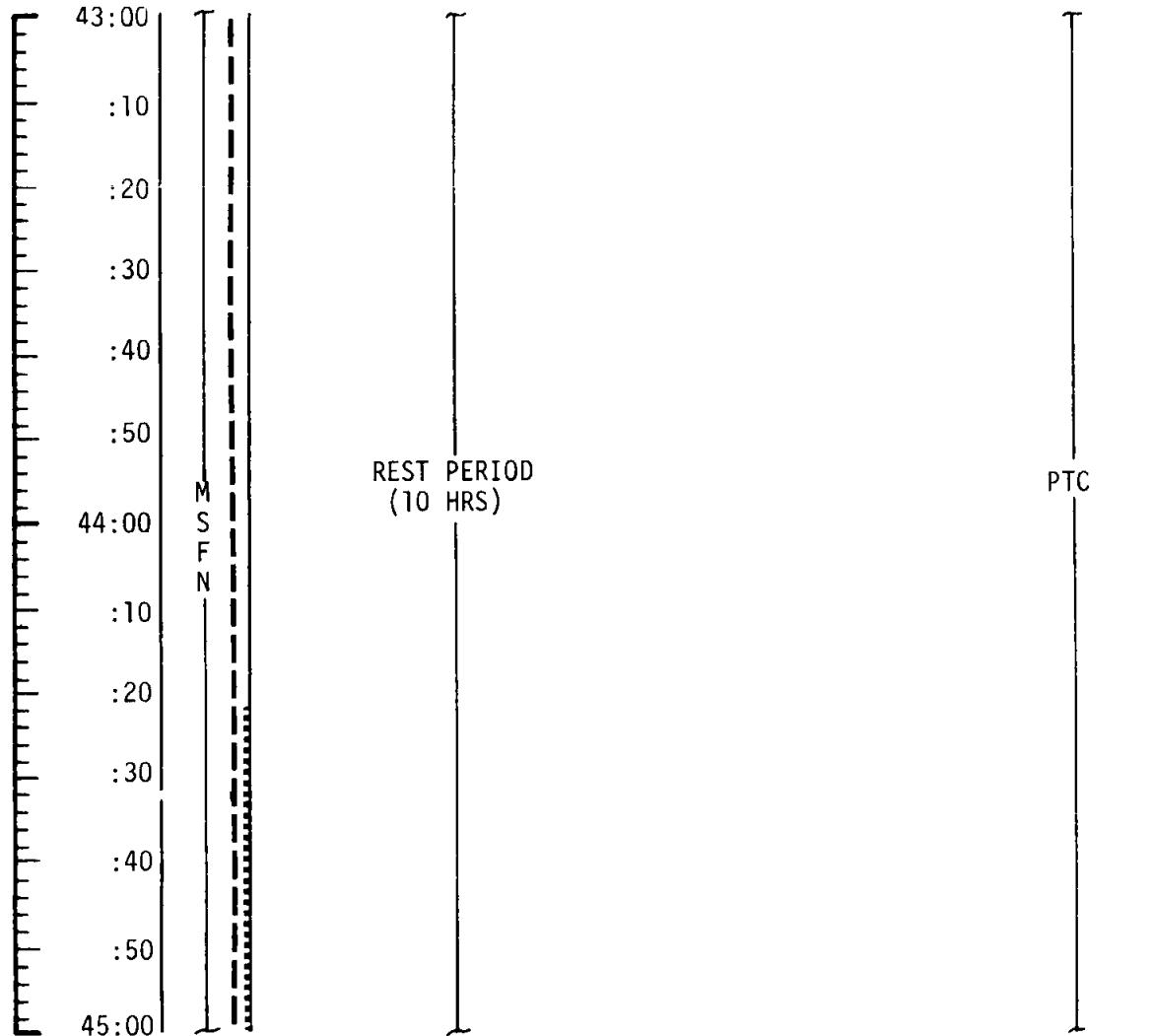
# FLIGHT PLAN

**NOTES**

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

**MCC-H**

0430 EDT

**FLIGHT PLAN****NOTES**

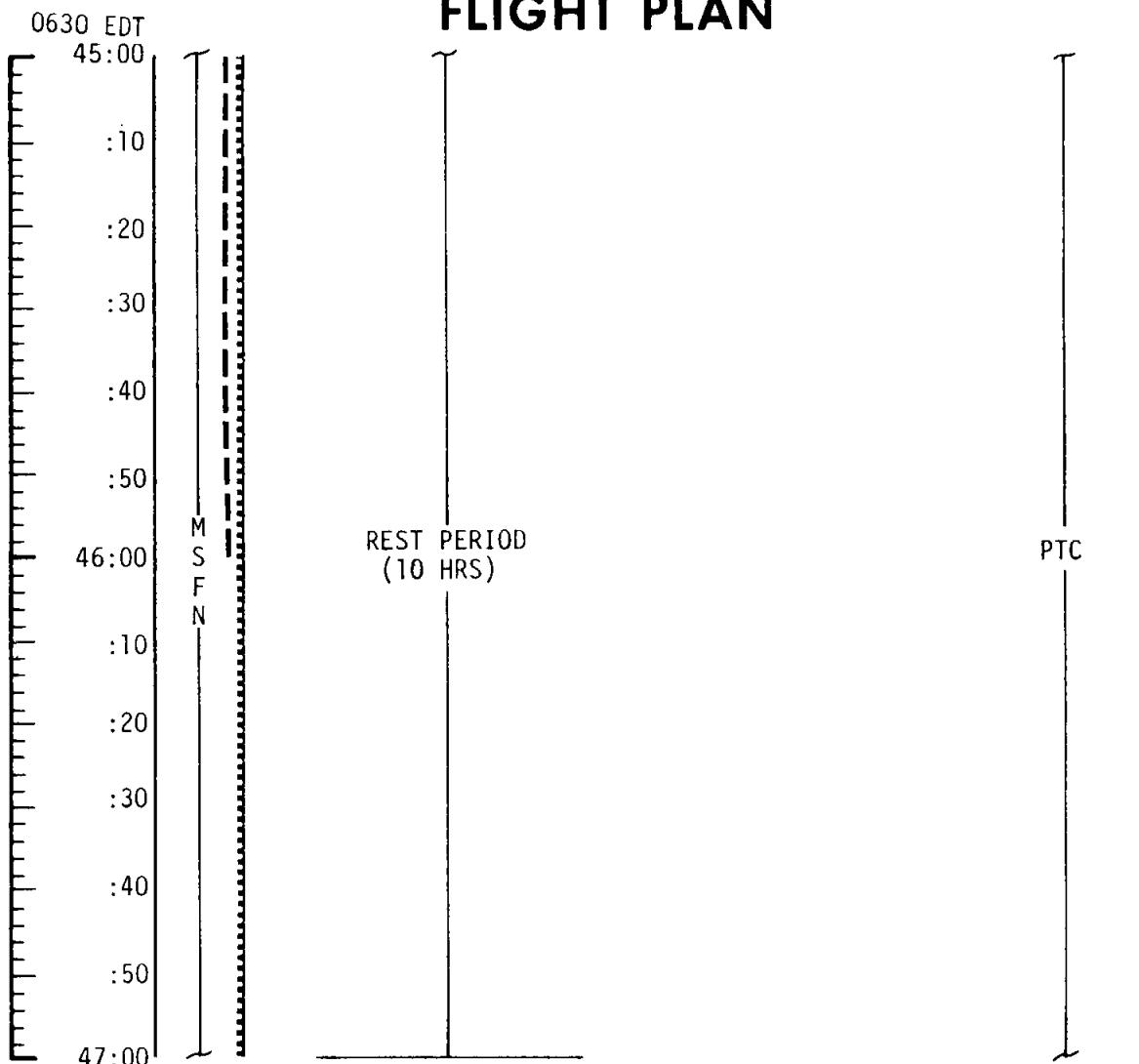
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	43:00 - 45:00	2/TLC	3-28

MSC Form 29 (May 69)

**FLIGHT PLANNING BRANCH**

**MCC-H**

# FLIGHT PLAN

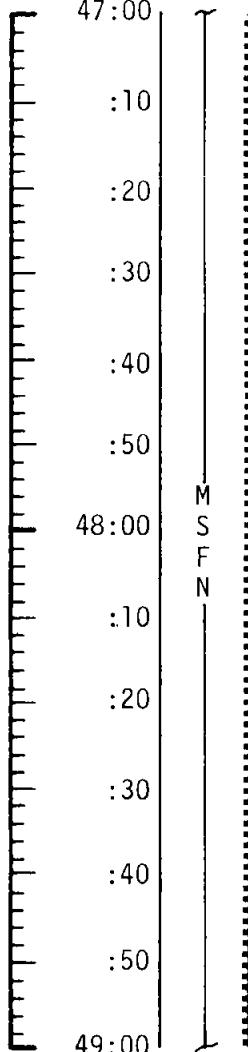
**NOTES**

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

MCC-H

## FLIGHT PLAN

NOTES

UPDATE  
CONSUMABLES0830 EDT  
47:00

EAT PERIOD-ALL

CO<sub>2</sub> FILTER CHANGE NO.4  
(6 INTO B, STORE 4 IN B5)  
POST SLEEP CHECKLIST

CREW STATUS REPORT(SLEEP)  
CYCLE O<sub>2</sub> & H<sub>2</sub> FANS  
GDC ALIGN TO IMU  
CONSUMABLES UPDATE  
SELECT NORMAL LUNAR  
CONFIGURATION EXCEPT:  
S-BD AUX TAPE - OFF  
TAPE RCDR FWD - OFF  
POT H<sub>2</sub>O HTR - ON  
AUTO RCS JET SELECT (16) - ON

PTC

BATTERY CHARGE, BATTERY B

CONSUMABLES UPDATE  
(Δ FROM NOMINAL)

GET: \_\_\_\_\_

RCS TOT \_\_\_\_\_

A \_\_\_\_\_

B \_\_\_\_\_

C \_\_\_\_\_

D \_\_\_\_\_

H<sub>2</sub> TOT \_\_\_\_\_O<sub>2</sub> TOT \_\_\_\_\_

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

MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

MCC-H

# FLIGHT PLAN

NOTES

1030 EDT

49:00

:10

:20

:30

:40

:50

50:00

:10

:20

:30

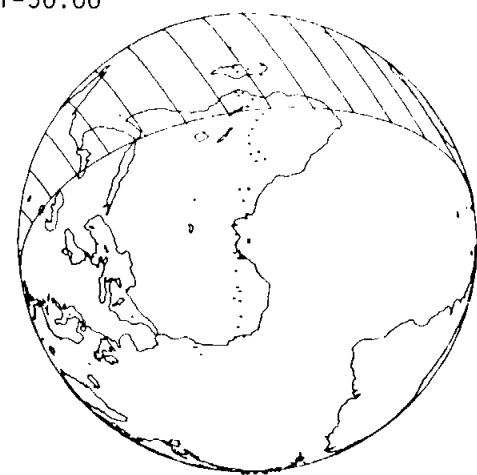
:40

:50

51:00

M  
S  
F  
N

FOV=3°  
GET=50:00



PTC

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

**MCC-H**

1230 EDT

# FLIGHT PLAN

**NOTES**

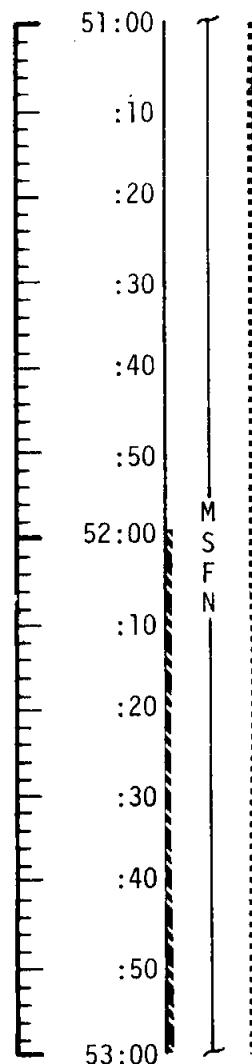
UPLINK

CSM STATE VECTOR

MCC 3 TGT LOAD

UPDATE

MCC 3 MNVR PAD



V66 TRANSFER CSM STATE VECTOR TO LM SLOT

RECORD MCC3 MNVR PAD  
H<sub>2</sub> PURGE LINE HTRS-ON

PTC

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

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FLIGHT PLANNING BRANCH

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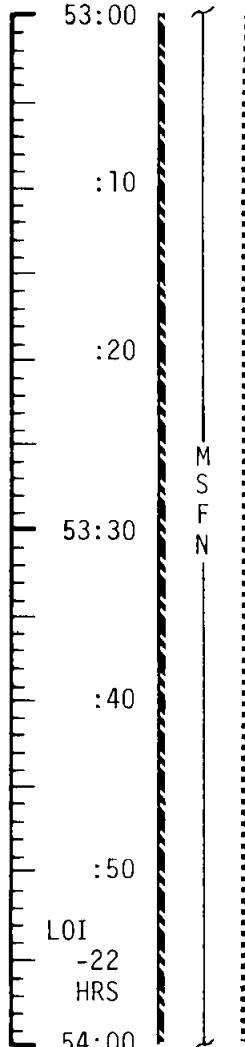
MCC  
BURN CHART

	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)

3-32a

MCC-H

1430 EDT



# FLIGHT PLAN

NOTES

## BURN STATUS REPORT

X X	<input type="checkbox"/>	•	ΔTIG
X X		•	BT
	<input type="checkbox"/>	•	V <sub>gx</sub>
		TRIM	
X X X			R
X X X			P
X X X			Y
	<input type="checkbox"/>	•	V <sub>gy</sub>
	<input type="checkbox"/>	•	V <sub>gz</sub>
	<input type="checkbox"/>	•	ΔV <sub>c</sub>
X X X			FUEL
X X X			OX
X X X			UNBAL

P52 (PTC REFSMMAT)

N71: \_\_\_\_\_

N05: \_\_\_\_\_

N93:

X \_\_\_\_\_

Y \_\_\_\_\_

Z \_\_\_\_\_

GET \_\_\_\_\_ : \_\_\_\_\_

MCC3 WILL BE EXECUTED  
IF  $\Delta V > 3$  FPS  
AND IF LOI1 CANNOT BE  
TARGETED TO CORRECT  
THE TLC DISPERSIONS.

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	53:00 - 54:00	3/TLC	3-33

MCC-M

# FLIGHT PLAN

NOTES

1530 EDT

54:00

:10

:20

:30

:40

:50

55:00

:10

:20

:30

:40

:50

56:00

:10

:20

:30

:40

:50

56:00

:10

:20

:30

:40

:50

56:00

M  
S  
F  
N

MCC 3 BURN STATUS REPORT  
 V66 - TRANS CSM STATE VECTOR  
 TO LM SLOT

PRESS CM TO 5.7 PSIA  
 CM/LM PRESSURE EQUALIZATION  
 VLV - OPEN  
 PRESSURIZE LM

START PTC  
 P 90 Y 0°

PTC

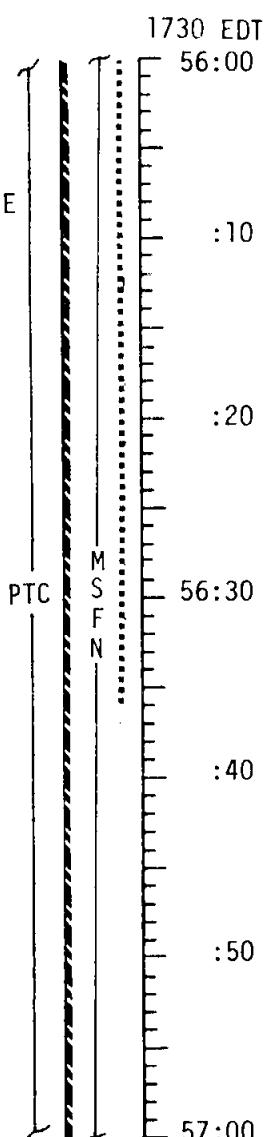
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	54:00 - 56:00	3/TLC	3-34

# FLIGH PLAN

**CSM**

**CMP**

CLEAR TUNNEL OF CM HATCH  
INSPECT TUNNEL & DOCKING LATCHES  
REMOVE PROBE & DROGUE  
TEMPORARILY STOW PROBE AND DROGUE  
CONFIGURE DSE TO RECORD LM DATA  
  
DUMP DSE (LM DATA)



**LM**

**CDR**

IVT TO LM

LM FAMILIARIZATION

**LMP**

OPEN LM HATCH  
RECORD ROLL CAL ANGLE  
IVT TO LM

ACT VHF B FOR DATA XMIT FOR 5 MINUTES

ASSIST CDR

LM FAMILIARIZATION

**MCC-H**

VERIFY OPERATION OF LM 16mm CAMERA

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

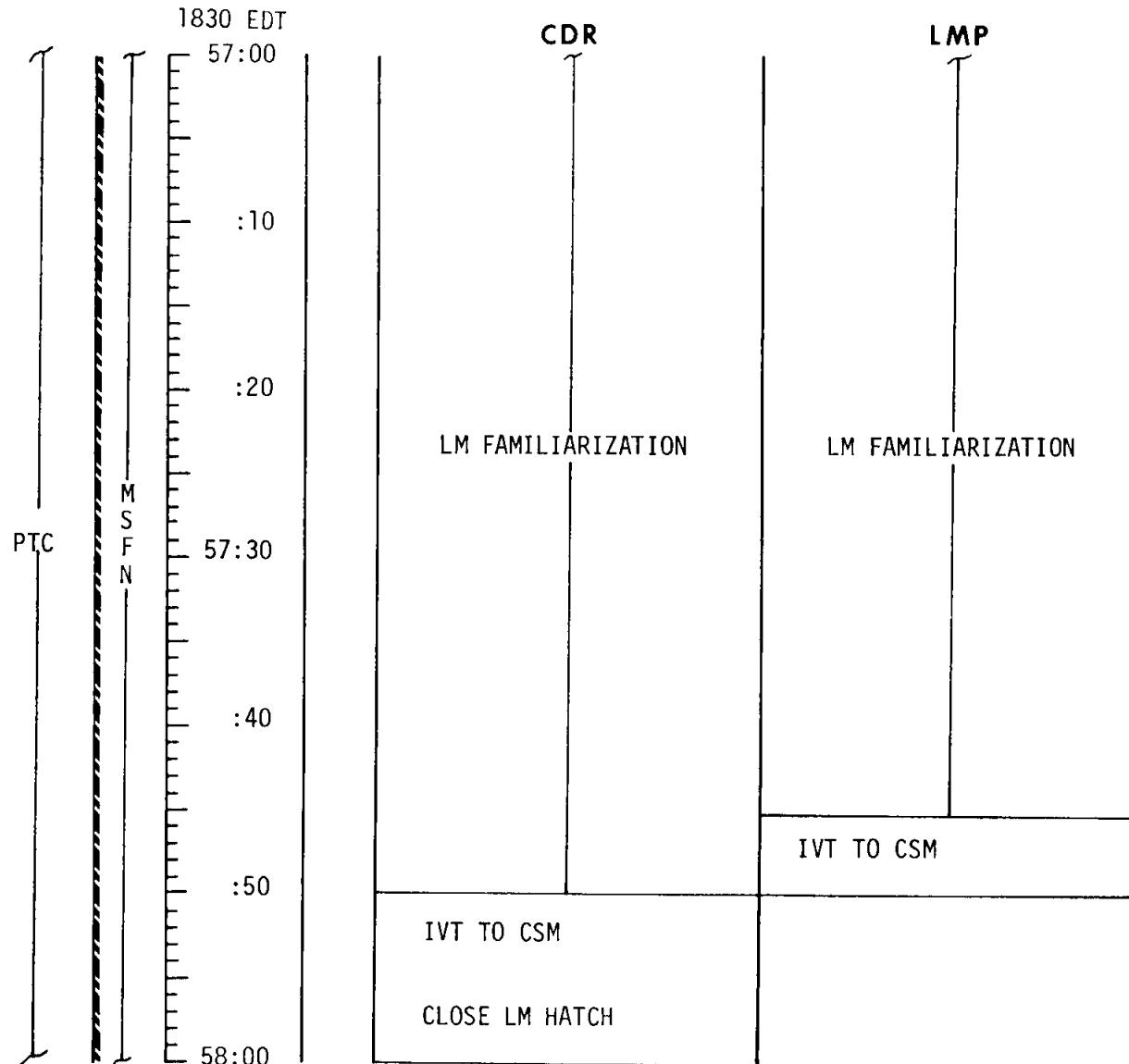
# FLIGHT PLAN

CSM

CMP

LM

MCC-H

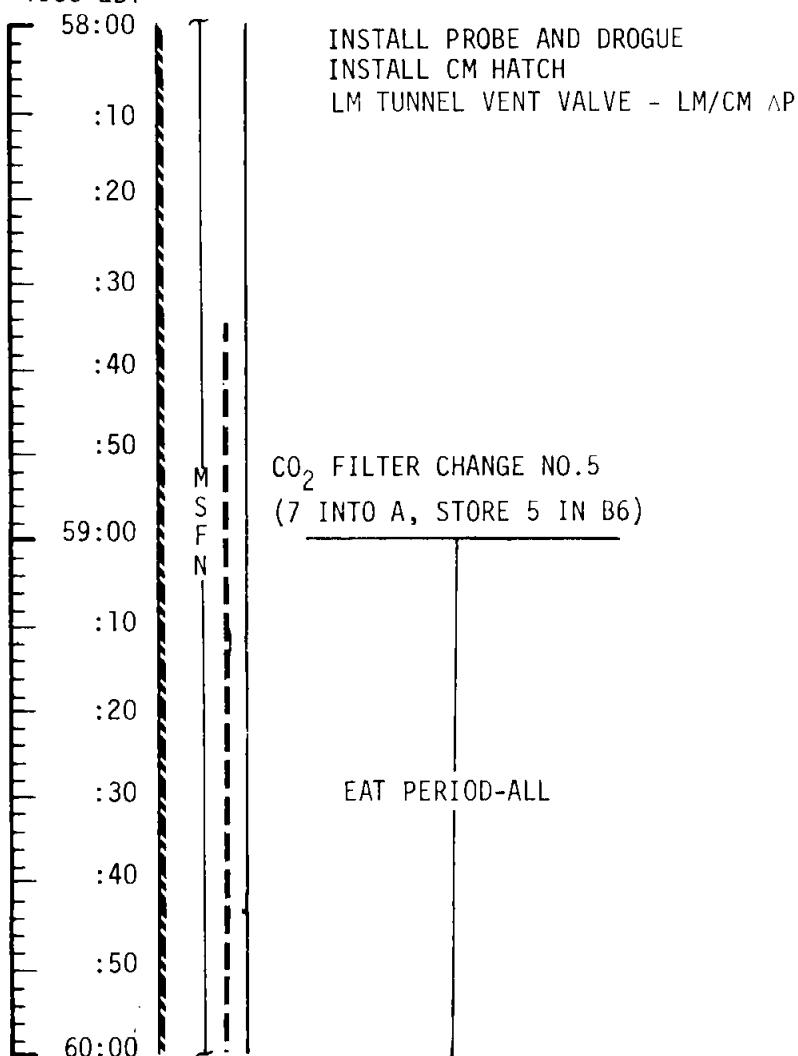


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	57:00 - 58:00	3/TLC	3-36

MCC-H

## FLIGHT PLAN

1930 EDT



## NOTES

180,000 NM from EARTH

PTC

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

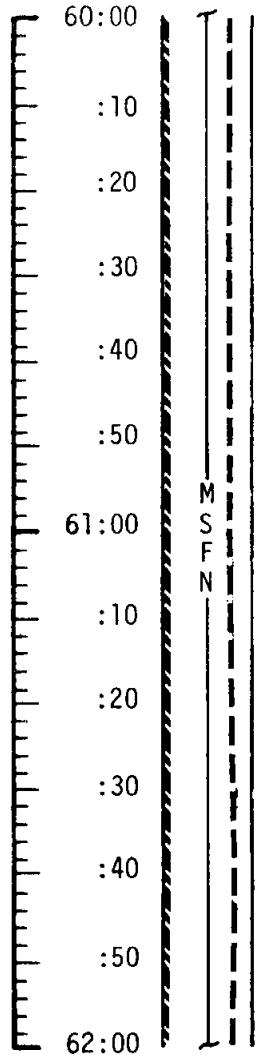
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	58:00 - 60:00	3/TLC	3-37

MCC-H

2130 EDT

## FLIGHT PLAN

NOTES



PRESLEEP CHECKLIST  
CREW STATUS REPORT (RADIATION & MEDICATION)  
CYCLE O<sub>2</sub> & H<sub>2</sub> 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 - REAQ  
  S-BD ANT - HI GAIN  
VERIFY:  
  WASTE MNGT OVBD DRAIN - OFF  
  WASTE STOW VENT VLV - CLOSED  
  EMERG CABIN PRESS VLV - ON  
  REPRESS PACK O<sub>2</sub>  
  VLV - OFF  
  LM TUNNEL VENT VLV - LM/CM ΔP  
  POT H<sub>2</sub>O HTR - OFF  
AUTO RCS JET SELECT (16) - OFF

DURING REST PERIOD  
2 CREWMAN IN REST STATIONS, 1 IN LEFT COUCH.

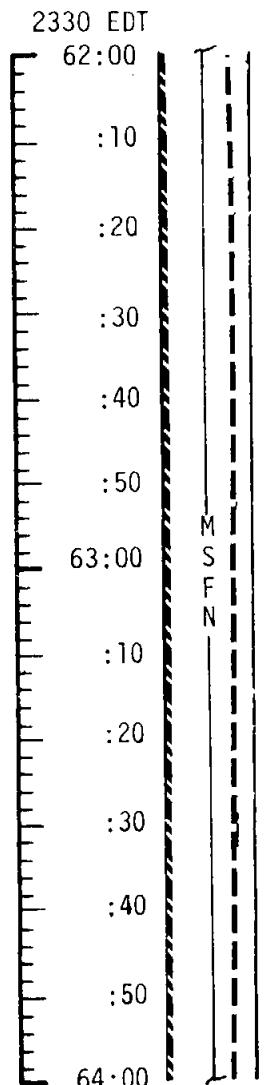
PTC

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



REST PERIOD  
(9 HOURS)

PTC

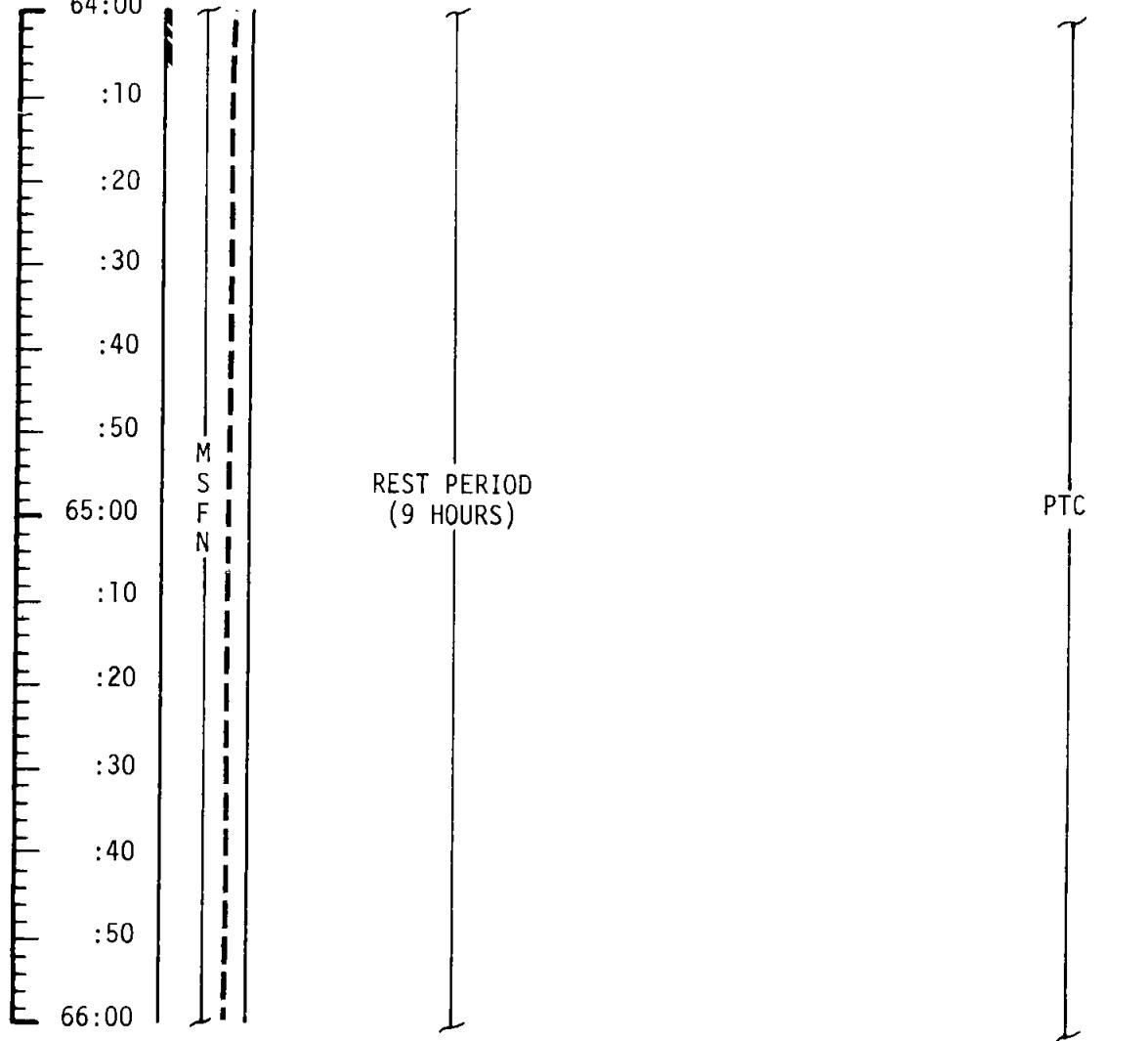
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	62:00 - 64:00	3/TLC	3-39

MCC-H

0130 EDT  
64:00

## FLIGHT PLAN

NOTES



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

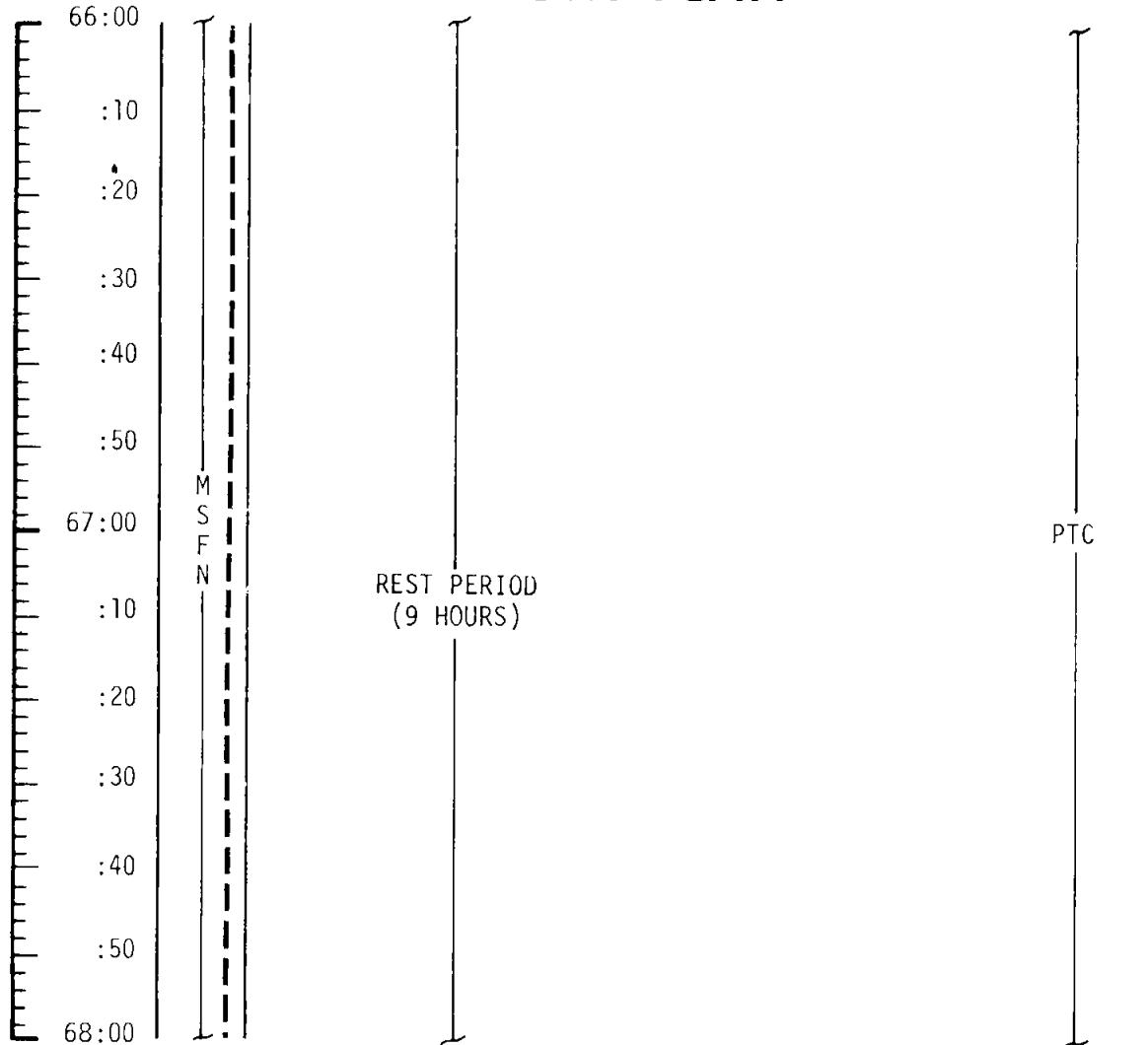
MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

**MCC-H**

0330 EDT

# FLIGHT PLAN

**NOTES**

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

MSC Form 29 (May 69)

**FLIGHT PLANNING BRANCH**

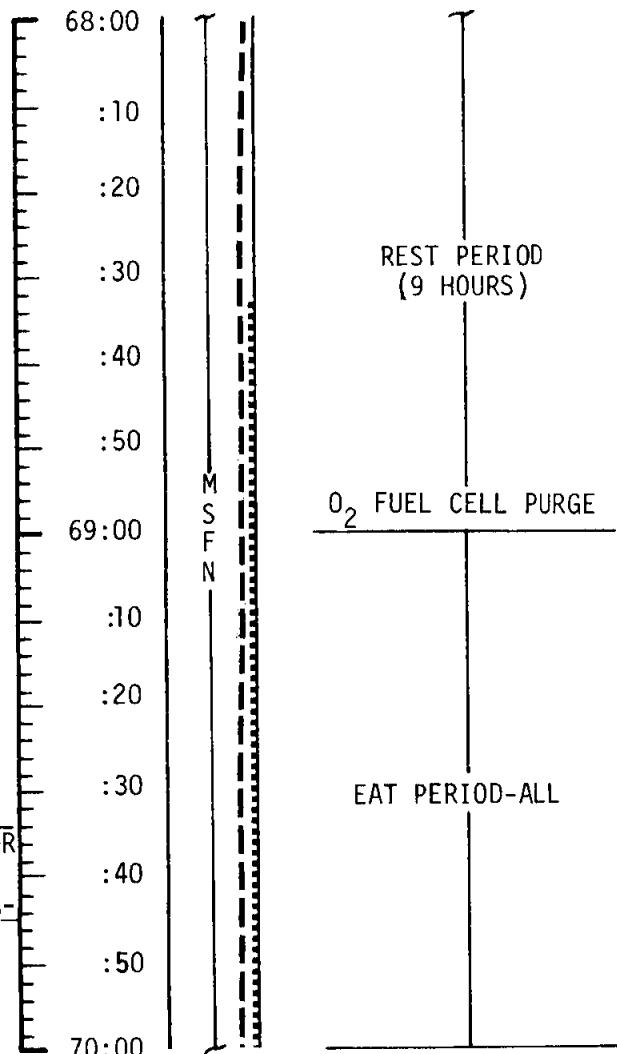
MCC-H

0530 EDT

## FLIGHT PLAN

NOTES

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<sub>2</sub> & H<sub>2</sub> FANS  
 GDC ALIGN TO IMU  
 CONSUMABLES UPDATE  
 SELECT NORMAL LUNAR  
 CONFIGURATION EXCEPT:  
 S-BD AUX TAPE - OFF  
 TAPE RCDR FWD - OFF  
 POT H<sub>2</sub>O HTR - ON  
 AUTO RCS JET SELECT (16) - ON  
 V66-TRANS CSM STATE  
 VECTOR TO LM SLOT  
 RECORD MCC4 MNVR PAD

UNSTOW OPTICS

CONSUMABLES REPORT  
(Δ FROM NOMINAL)

GET: \_\_\_\_\_  
 RCS TOT \_\_\_\_\_  
 A \_\_\_\_\_  
 B \_\_\_\_\_  
 C \_\_\_\_\_  
 D \_\_\_\_\_

H<sub>2</sub> TOT \_\_\_\_\_  
 O<sub>2</sub> TOT \_\_\_\_\_

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

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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

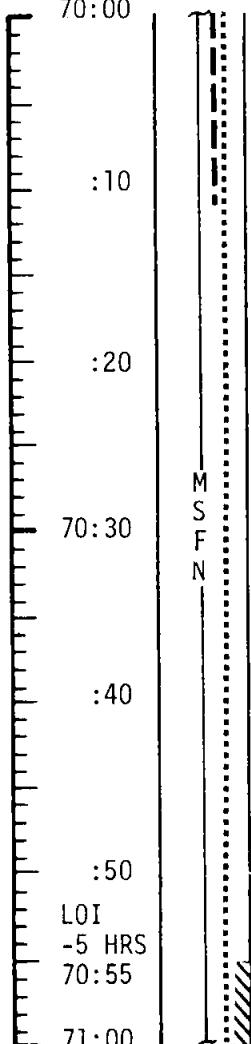
3-42a

MCC-H

UPDATE  
BLOCK DATA

0730 EDT  
70:00

# FLIGHT PLAN



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

BURN STATUS REPORT		
X X	ATIG	
X X	BT	
	V <sub>gx</sub>	
	TRIM	
X X X	R	
X X X	P	
X X X	Y	
	V <sub>gy</sub>	
	V <sub>gz</sub>	
	ΔV <sub>c</sub>	
X X X	FUEL	
X X X	OX	
X X X	UNBAL	

REPORT:  
NOTES

P52 (LDG SITE REFSMMAT)
N71: _____
N05: _____
N93: _____
X _____
Y _____
Z _____
GET _____ : _____

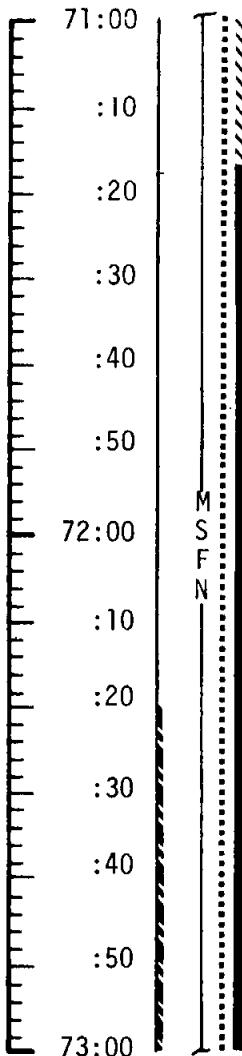
MCC 4 WILL BE  
EXECUTED ONLY IF  
LOI<sub>1</sub> CANNOT BE  
TARGETED TO CONNECT  
MCC 3 DISPERSIONS

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

**MCC-H**

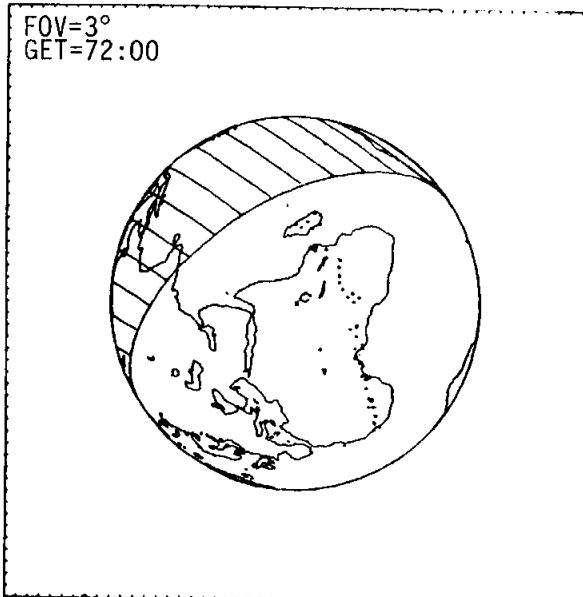
0830 EDT

# FLIGHT PLAN

**NOTES**

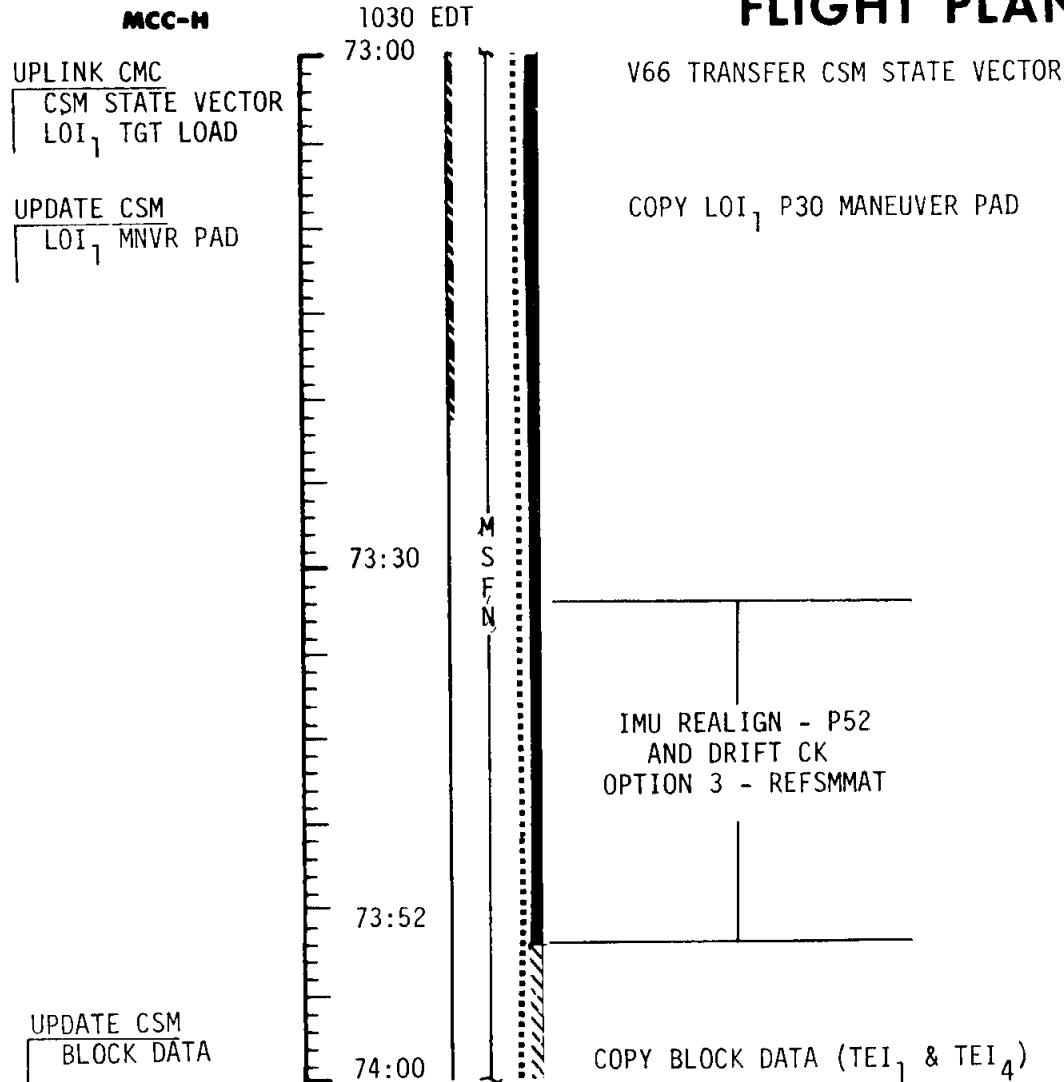
SPS MON CK  
MCC 4 BURN STATUS REPORT  
V66 - TRANS CSM STATE VECTOR TO LM SLOT

CO<sub>2</sub> FILTER CHANGE NO.6  
(8 INTO B, STORE 6 IN B6)  
PRE-LOI ECS REDUNDANT COMPONENT CK  
ACTIVATE PRIMARY EVAPORATOR



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

# FLIGHT PLAN



## NOTES

TEI<sub>1</sub> BLOCK DATA ASSUMED  
LOI<sub>1</sub> ACCOMPLISHED  
TEI<sub>4</sub> ASSUMES LOI<sub>1</sub> ACCOMPLISHED BUT NO LOI<sub>2</sub>

## REPORT:

P52 (LDG SITE REFSMMAT)
N71: _____
N05: _____
N93: _____
X: _____
Y: _____
Z: _____
GET: _____ : _____

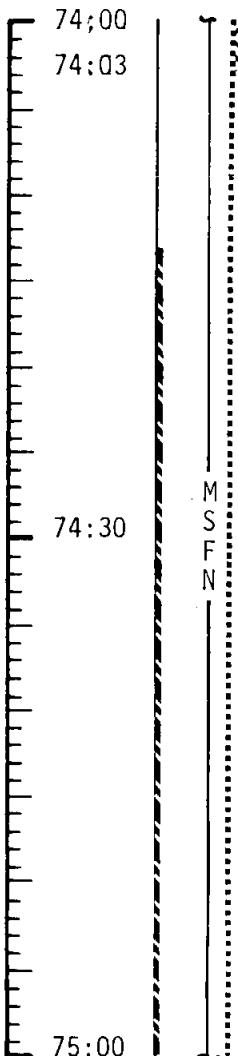
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	73:00 - 74:00	4/TLC	3-45

MCC-H

1130 EDT

74:00

74:03



# FLIGHT PLAN

NOTES

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

GO INERTIAL  
V64 REACQUIRE MSFN

EMS ΔV TEST

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	74:00 - 75:00	4/TLC	3-46

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LOI<sub>1</sub>  
BURN CHART

	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
LOI <sub>1</sub>	10°/SEC TAKEOVER	+10° TAKEOVER	BT + 10 SEC	DO NOT TRIM
LOI <sub>1</sub> ABORT MODES				
LOI <sub>1</sub> V <sub>GO</sub>	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 STABILIZA- TION AND WATER or CLA LANDING
1589.0 - 0	180 - 365	LUNAR ORBIT	MODE III	- DPS BURN AFTER ONE REV

MCC-H

1230 EDT

UPDATE CSM  
LOS AND AOS  
(WITH & WITHOUT  
LOI<sub>1</sub>)

75:00

M  
S  
F  
N

GO/NO GO

75:30

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

75:46

GDC ALIGN TO IMU

LOI<sub>1</sub>

GETI: 75:54:28  
NO ULLAGE  
BT: 5 MIN 59.9 SEC  
ΔV<sub>T</sub>: 2924.1 FPS  
ORBIT: 59.2 X 169.8  
RETROGRADE  
DO NOT TRIM

NOTE: INITIATE LOI<sub>1</sub>  
WITH BANK B BALL VALVES

76:00

FLIGHT PLANNING BRANCH

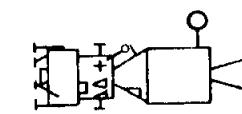
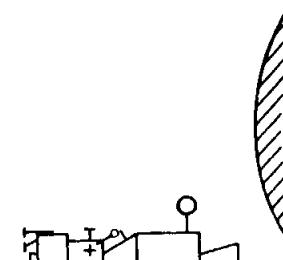
NOTES

## FLIGHT PLAN

CMP - PRE LOI<sub>1</sub> SYSTEMS CKS

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

COPY UPDATE: LOS \_\_\_\_\_:\_\_\_\_\_:  
AOS WITH LOI<sub>1</sub> \_\_\_\_\_:\_\_\_\_\_:  
AOS W/O LOI<sub>1</sub> \_\_\_\_\_:\_\_\_\_\_:



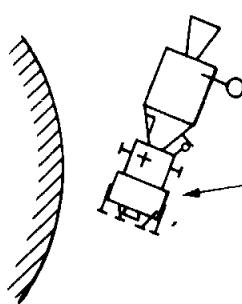
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	75:00 - 76:00	4/1	3-47

MCC-H

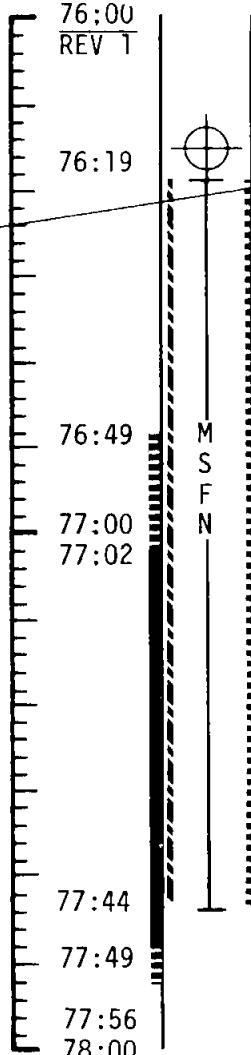
1330 EDT

## FLIGHT PLAN

NOTES



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



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, BURN STATUS REPORT

## BURN STATUS REPORT

X X		•	$\Delta T_{IG}$
X X		•	BT
		•	$v_{gx}$
	TRIM		
X X X			R
X X X			P
X X X			Y
		•	$v_{gy}$
		•	$v_{gz}$
		•	$\Delta v_c$
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	76:00 - 78:00	4/1	3-48

**MCC-H**1530 EDT  
78:00

REV 2

DUMP DSE

UPLINK CMC

CSM STATE VECTOR  
 LOI<sub>2</sub> TARGET LOAD

UPDATE CSM

LOI<sub>2</sub> MNVR PAD  
 BLOCK DATA

78:27  
78:3078:58  
79:00M  
S  
F  
N

# FLIGHT PLAN

**NOTES**

EAT PERIOD

V64 REACQUIRE MSFN  
HGA P-20, Y359

V66 TRANSFER CSM STATE VECTOR TO LM SLOT

RECORD LOI<sub>2</sub> MNVR PAD AND BLOCK DATA (TEI<sub>5</sub>)

TEI<sub>5</sub> BLOCK DATA  
 ASSUMES LOI<sub>1</sub> & LOI<sub>2</sub>  
 ACCOMPLISHED

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

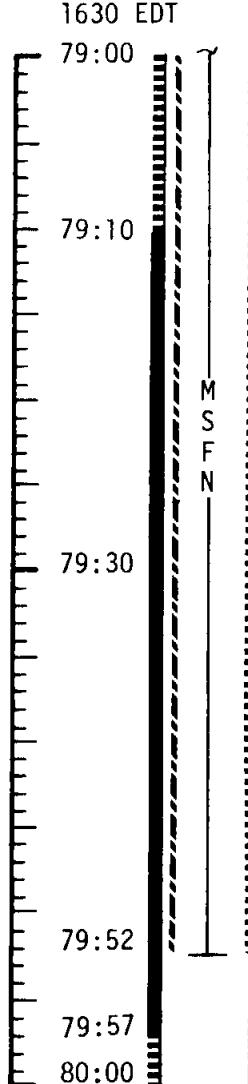
MCC-H

1630 EDT

# FLIGHT PLAN

NOTES

PIPA BIAS CHECK

CMP - PRE LOI<sub>2</sub> SYSTEMS MONITOR

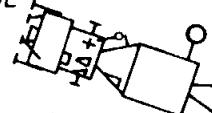
GO INERTIAL

IMU REALIGN - P52  
OPTION 3 - REFSMMAT  
DRIFT CHECK

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

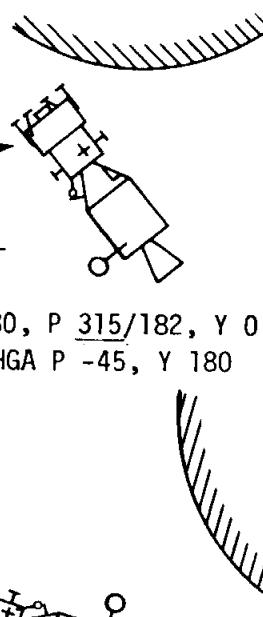
P30 EXTERNAL  $\Delta V$   
MANEUVER TO LOI<sub>2</sub> BURN ATTITUDE

P40 SPS THRUST  
GO INERTIAL

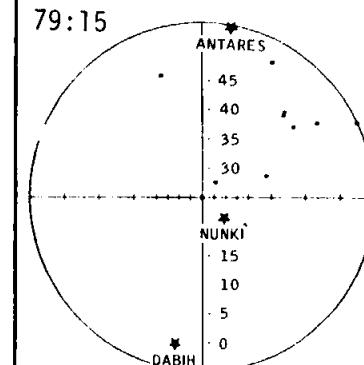


R 0, P 50.1/212.3, Y 359.6

SEXTANT STAR CHECK  
EMS  $\Delta V$  TEST  
SM RCS CHECK  
LOAD DAP FOR 2 JET ULLAGE  
R1 = 20111  
R2 = 11111



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	79:00 - 80:00	4/2	3-50

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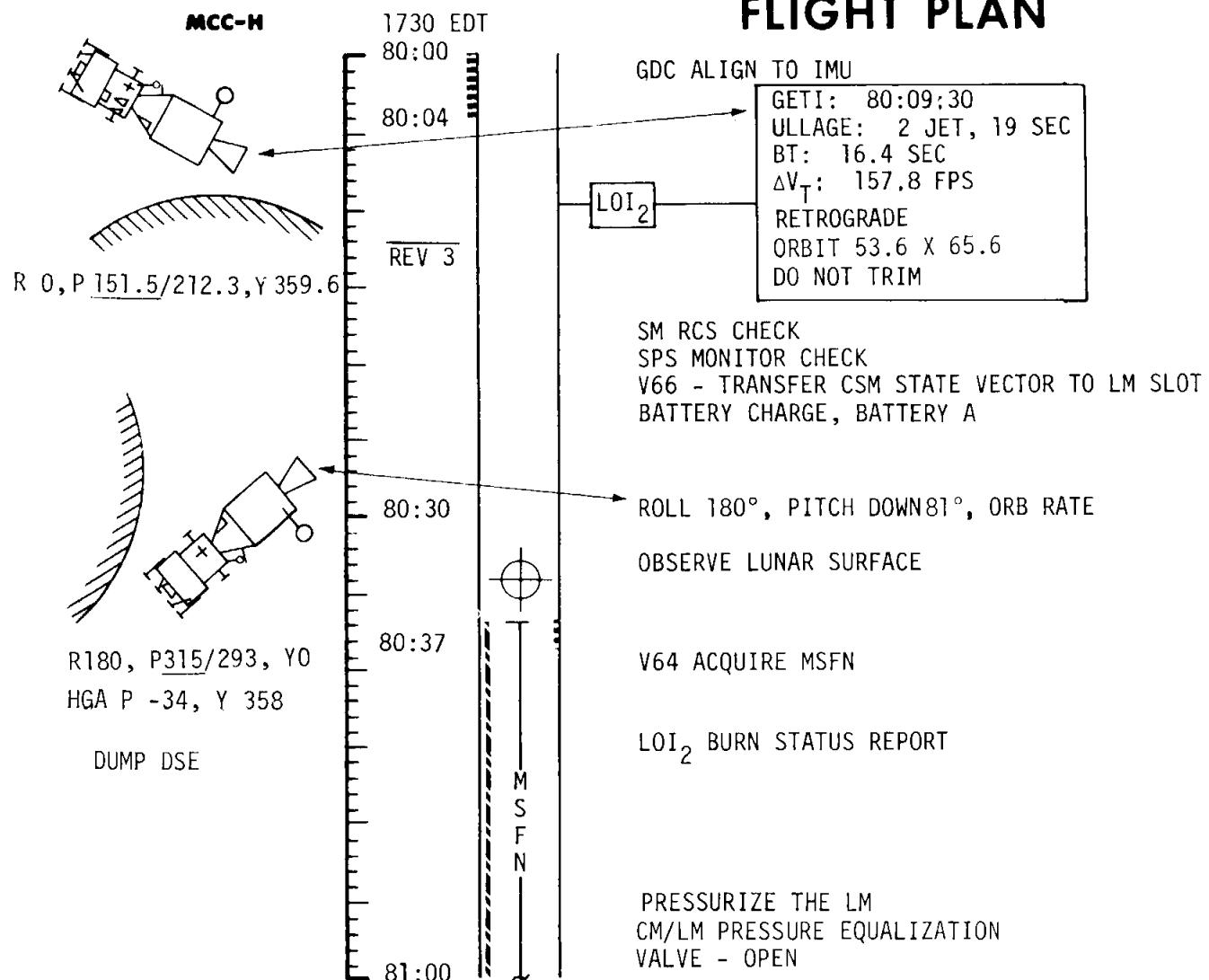
$\text{LOI}_2$   
BURN CHART

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

3-50a

# FLIGHT PLAN

NOTES



BURN STATUS REPORT	
X X	ATIG
X X	BT
	$V_{gx}$
	TRIM
X X X	R
X X X	P
X X X	Y
	$V_{gy}$
	$V_{gz}$
	$\Delta V_c$
X X X	FUEL
X X X	OX
X X X	UNBAL

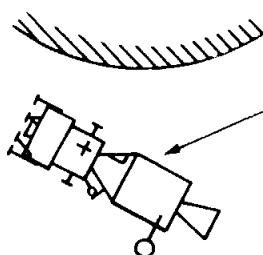
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	80:00 - 81:00	4/3	3-51

MCC-H

# FLIGHT PLAN

NOTES

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

81:10

81:30

81:49

81:56

82:00

M  
S  
F  
N

RECORD UPDATE (SEE GET 82:40)  
GO INERTIAL

IMU REALIGN - P52  
OPTION 3 REFSMMAT

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

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

LMP - LM ENTRY STATUS CHECKS

REPORT:

P52 (LDG SITE REFSMMAT)

N71: \_\_\_\_ , \_\_\_\_

N05: \_\_\_\_ . \_\_\_\_

N93:

X \_\_\_\_ . \_\_\_\_

Y \_\_\_\_ . \_\_\_\_

Z \_\_\_\_ . \_\_\_\_

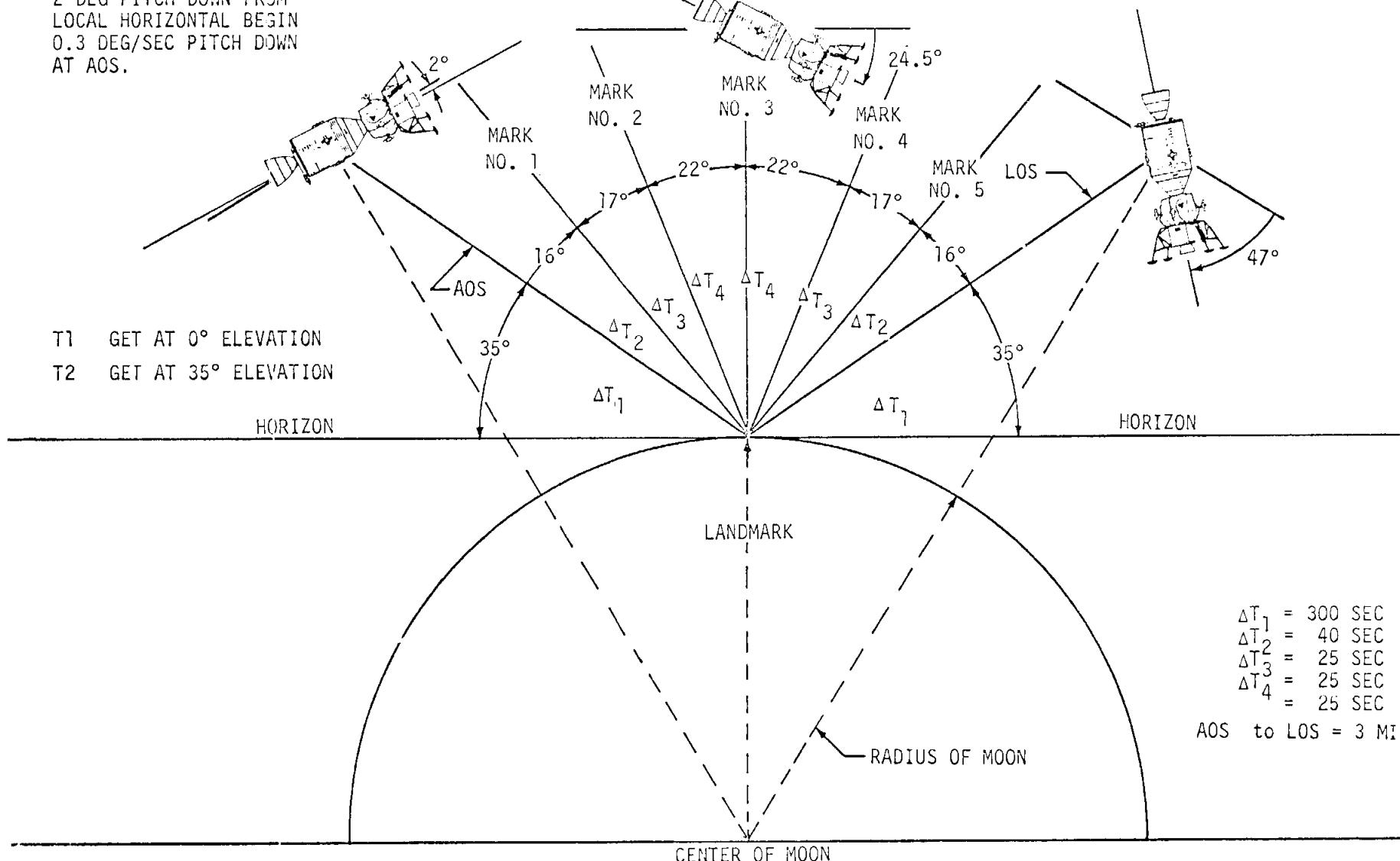
GET \_\_\_\_ : \_\_\_\_ :

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

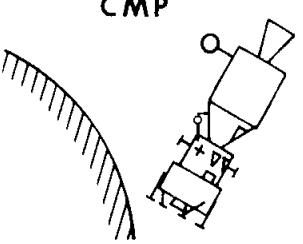
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CSM/LM TYPICAL LANDMARK TRACKING PROFILE

2 DEG PITCH DOWN FROM  
LOCAL HORIZONTAL BEGIN  
0.3 DEG/SEC PITCH DOWN  
AT AOS.



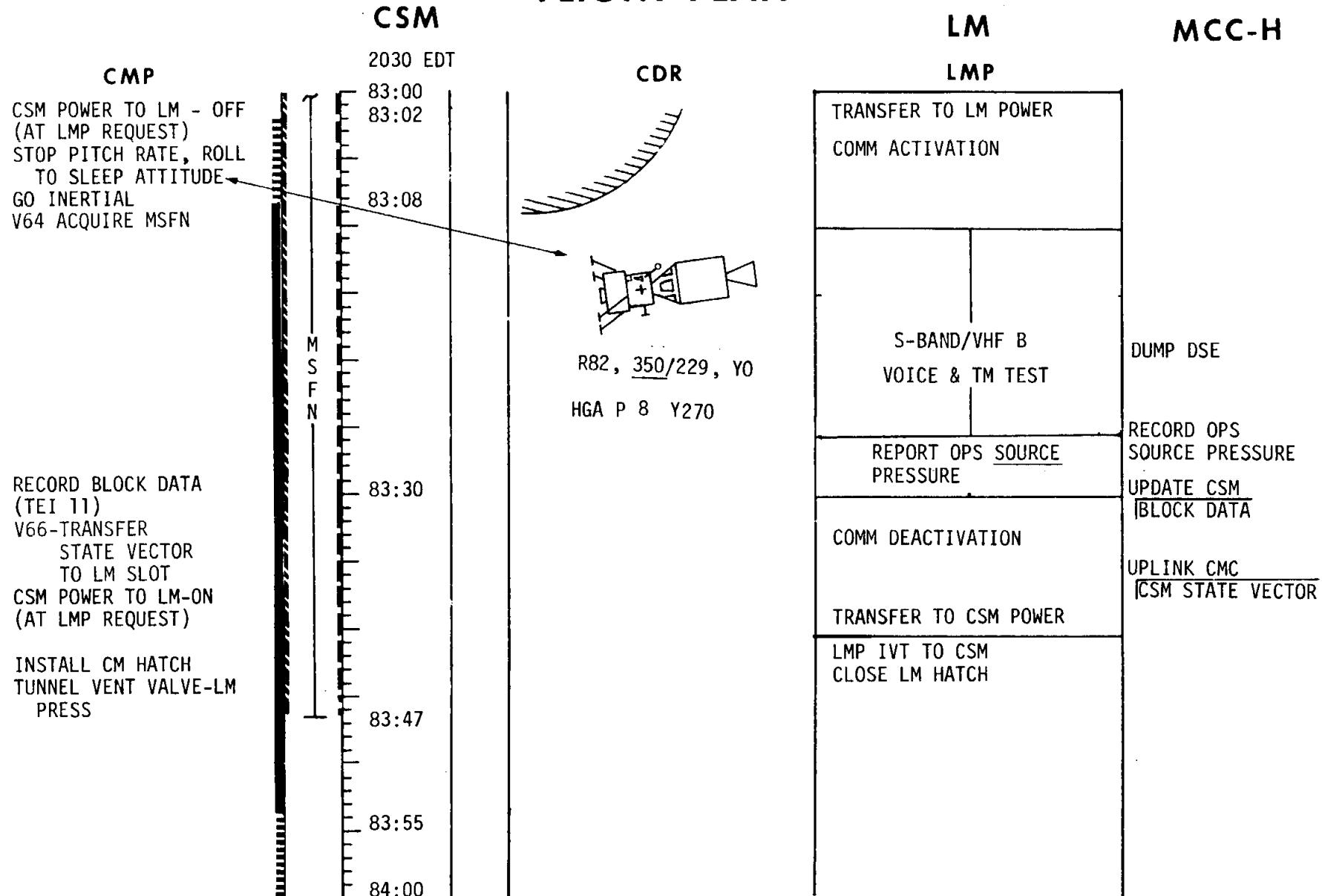
# FLIGHT PLAN

CSM	CDR	LM	MCC-H																																
 <p>CMP</p> <p>R 0, P 257/297, Y 0 MANEUVER TO LANDMARK TRACK ATTITUDE GO INERTIAL SELECT OMNI B</p> <p>P22 ORBITAL NAVIGATION UNSTOW OPTICS</p> <p>TRACK LANDMARK ALT LMK (A-1) (5 MARKS ON LMK) PITCH DOWN 0.3°/SEC DO NOT INCORPORATE MARKS</p> <p>STOW OPTICS</p> <p>1930 EDT 82:00 82:02 REV 4 82:30 82:35 M S F N 83:00</p>		<p>AID LMP AS REQUIRED</p>																																	
		<p>PERFORM HOUSEKEEPING CHORES</p> <ol style="list-style-type: none"> <li>1 STOW HELMET STOWAGE BAGS</li> <li>2 UNSTOW MIRROR, CHECKLIST AND DISPOSAL ASSEMBLY</li> <li>3 STOW INTERIM STOWAGE ASSEMBLY</li> <li>4 UNSTOW AND CONFIGURE FOR USE: 16mm/HCEX (f4,500,INF) 6 fps</li> </ol>																																	
			<table border="1"> <tr> <td colspan="2">P22 AUTO OPTICS</td> </tr> <tr> <td>LMK ID</td> <td>A-1</td> </tr> <tr> <td>T1</td> <td>8 2 : 4</td> <td>1 : 0</td> <td>6 (HOR)</td> </tr> <tr> <td>T2</td> <td>8 2 : 4</td> <td>6 : 1</td> <td>7 (35°)</td> </tr> <tr> <td>1</td> <td>4 NM</td> <td colspan="2">(N)</td> </tr> <tr> <td>N</td> <td>89</td> <td colspan="2"></td> </tr> <tr> <td>LAT</td> <td>0 2 . 0 0</td> <td>0</td> <td>0</td> </tr> <tr> <td>LONG/2</td> <td>3 2 . 7 5</td> <td>0</td> <td>0</td> </tr> <tr> <td>ALTITUDE-</td> <td>0 0 0 . 0 0</td> <td colspan="2">NM</td> </tr> </table>	P22 AUTO OPTICS		LMK ID	A-1	T1	8 2 : 4	1 : 0	6 (HOR)	T2	8 2 : 4	6 : 1	7 (35°)	1	4 NM	(N)		N	89			LAT	0 2 . 0 0	0	0	LONG/2	3 2 . 7 5	0	0	ALTITUDE-	0 0 0 . 0 0	NM	
P22 AUTO OPTICS																																			
LMK ID	A-1																																		
T1	8 2 : 4	1 : 0	6 (HOR)																																
T2	8 2 : 4	6 : 1	7 (35°)																																
1	4 NM	(N)																																	
N	89																																		
LAT	0 2 . 0 0	0	0																																
LONG/2	3 2 . 7 5	0	0																																
ALTITUDE-	0 0 0 . 0 0	NM																																	

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

FLIGHT PLANNING BRANCH

# FLIGHT PLAN



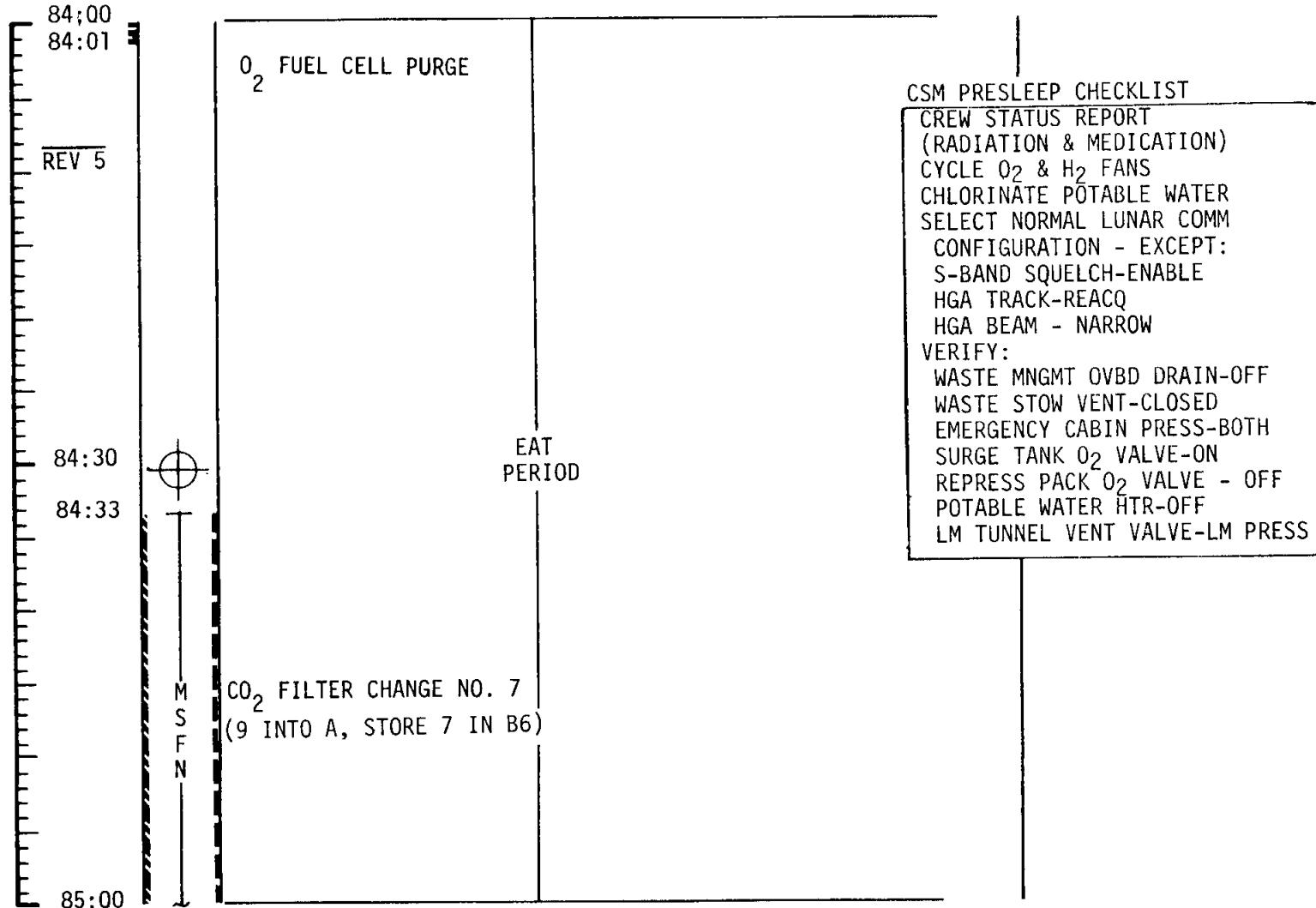
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	83:00 - 84:00	4/4	3-54

MCC-N

2130 EDT

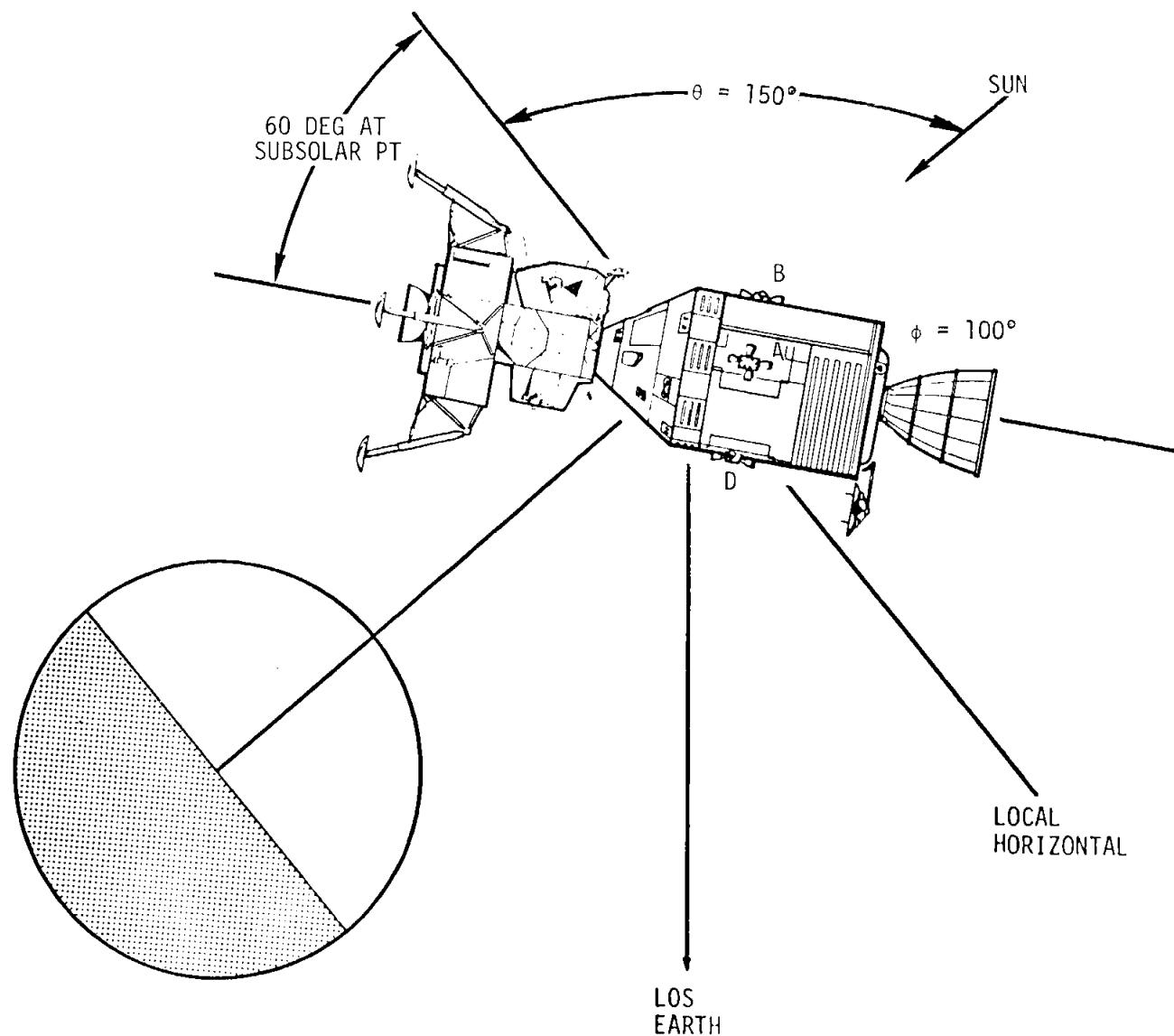
## FLIGHT PLAN

NOTES



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



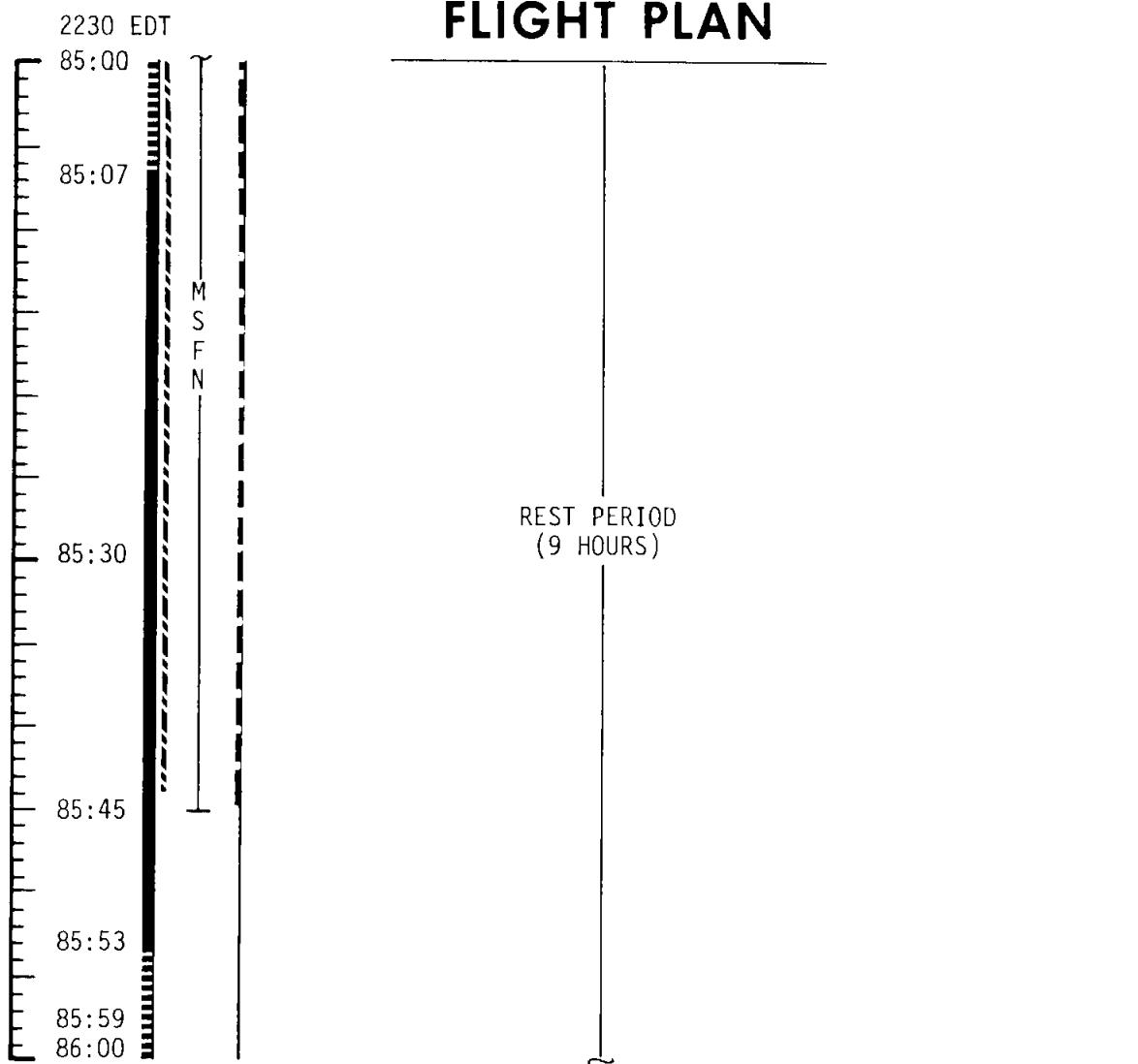
MCC-H

2230 EDT

# FLIGHT PLAN

DUMP DSE

NOTES



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

MSC Form 29 (May 69)

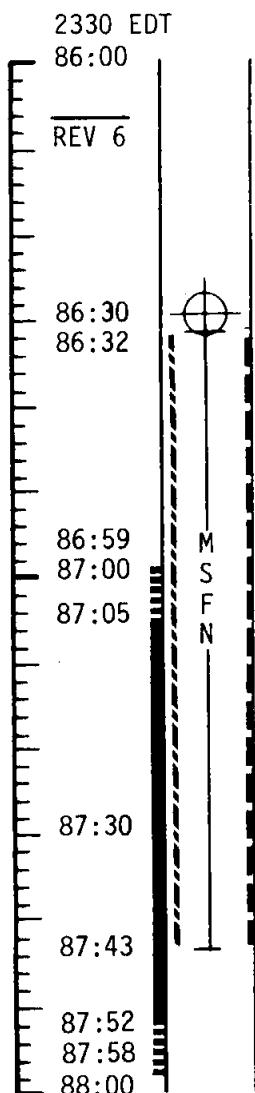
FLIGHT PLANNING BRANCH

MCC-H

# FLIGHT PLAN

NOTES

DUMP DSE



FLIGHT PLANNING BRANCH

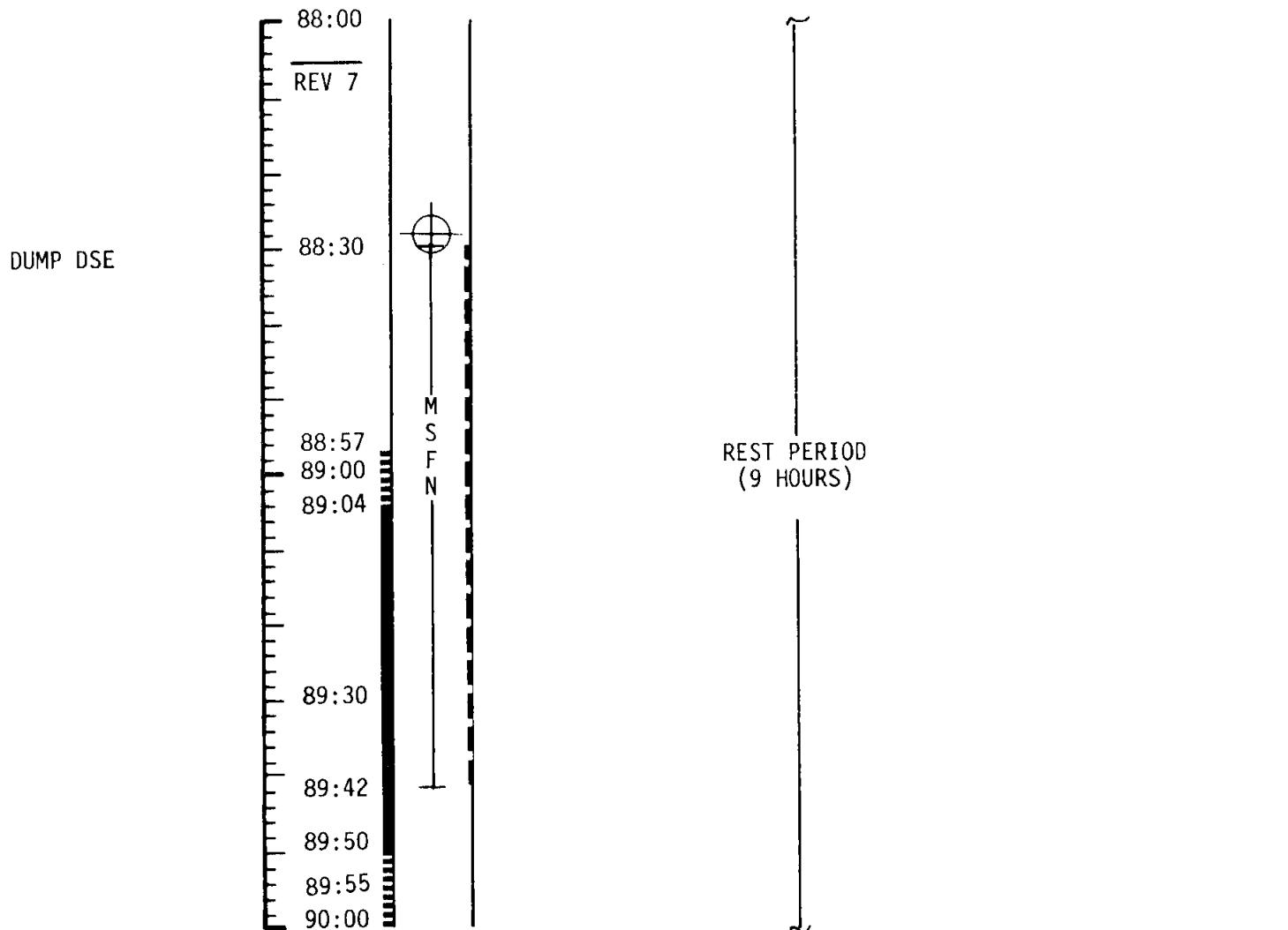
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	86:00 - 88:00	4/6	3-57

MSC Form 29 (May 69)

MCC-H

# FLIGHT PLAN

NOTES



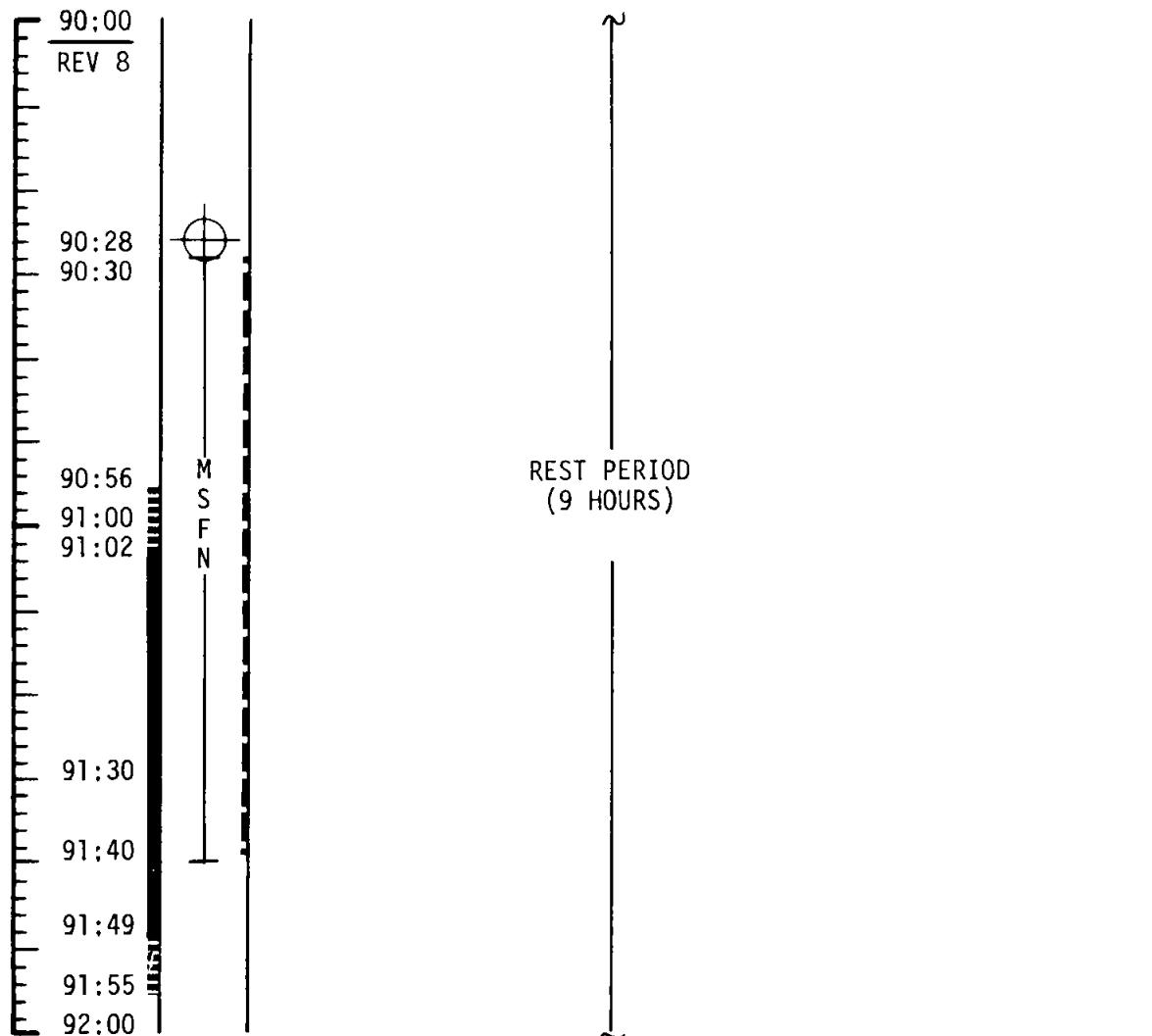
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	88:00 - 90:00	4/7	3-58

**MCC-H**

# FLIGHT PLAN

**NOTES**

DUMP DSE



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

MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

**MCC-H**

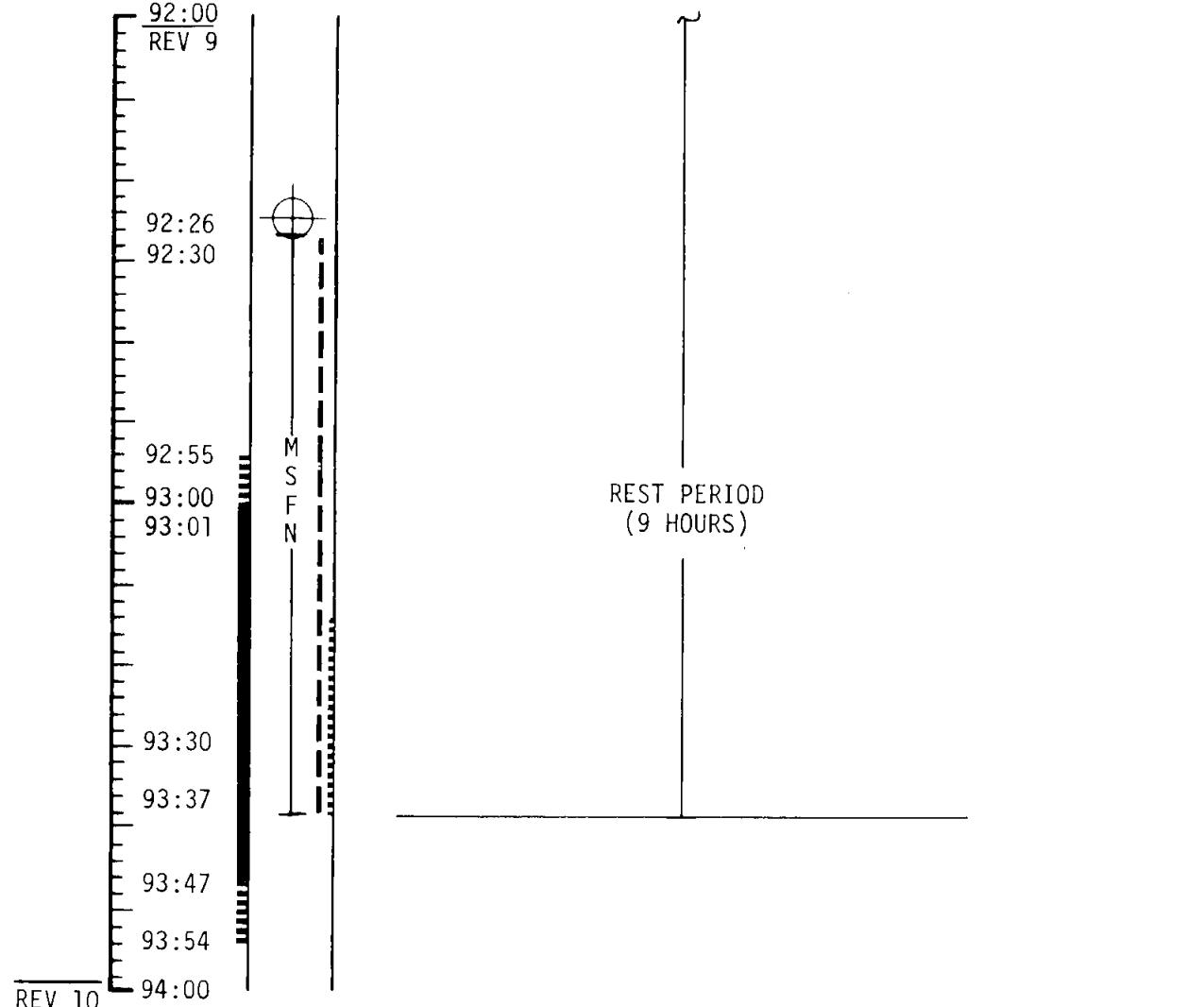
0530 EDT

92:00  
REV 9

# FLIGHT PLAN

**NOTES**

DUMP DSE



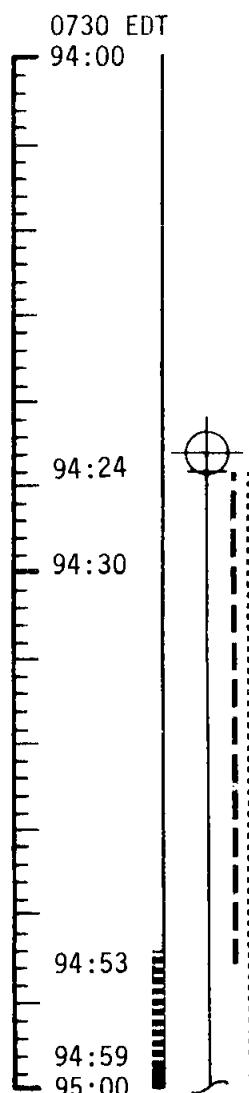
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	92:00 - 94:00	4/9 - 10	3-60

MSC Form 29 (May 69)

**FLIGHT PLANNING BRANCH**

**MCC-H****FLIGHT PLAN****NOTES**

DUMP DSE

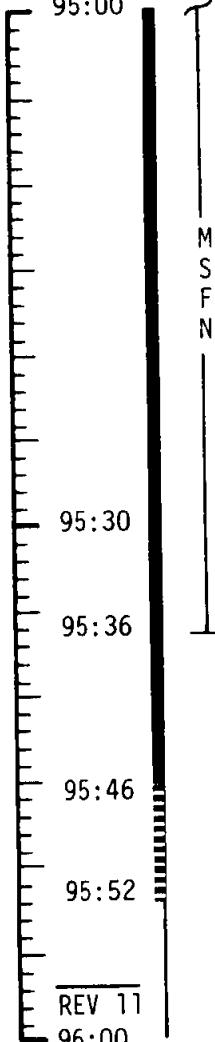


EAT PERIOD

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

MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

**MCC-H**0830 EDT  
95:00UPDATE  
BLOCK DATAUPDATE  
BASELINE  
ALTITUDE FOR  
DESCENT ALTITUDE  
SIGHTINGS

# FLIGHT PLAN

**NOTES**CDR & LMP DON LCG'S  
CMP-RECORD BLOCK DATA - TEI<sub>30</sub>

LMP-COPY BASELINE ALTITUDE

CO<sub>2</sub> FILTER CHANGE NO. 8  
(10 INTO B, STORE 8 IN B6)

POST SLEEP CHECKLIST

CREW STATUS REPORT (SLEEP)
CYCLE H <sub>2</sub> , O <sub>2</sub> FANS
GDC ALIGN TO IMU
CONSUMABLES UPDATE
SELECT COMM NORMAL
LUNAR CONFIGURATION

CONSUMABLES UPDATE  
( $\Delta$  FROM NOMINAL)

GET:  
RCS TOT  
A  
B  
C  
D

H<sub>2</sub> TOT  
O<sub>2</sub> TOT

CMP: DON PGA W/O HELMET  
AND GLOVES  
H<sub>2</sub> - PURGE LINE HTRS - ON  
LM TUNNEL VENT VALVE - LM/CM AP  
VERIFY LM/CM  $\Delta$ P < 0.2  
OPEN AND STOW CM HATCH  
LMP: VERIFY DOCKING TUNNEL INDEX ANGLE  
IVT TO LM

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**

UNDOCKING PHOTO  
16mm/18/CEX-BRKT-MIR  
(f8,250,7) 6 fps  
 $O_2$  &  $H_2$  FUEL CELL PURGE

**LM**

**MCC-H**

**CDR**

**LMP**

V64 ACQUIRE MSFN  
CREW STATUS REPORT  
REPORT DOCKING TUNNEL  
INDEX ANGLE TO MSFN  
DEACTIVATE B3 & C4 JETS  
CONFIGURE DAP 21112  
WIDE DB 11001  
(FOR LM STEERABLE  
ANTENNA ACTIVATION)

RECORD LMK 130 PAD  
DATA (SEE GET 98:35)  
AND CSM DAP DATA  
AND LOAD

UNSTOW OPTICS  
P52-IMU REALIGN  
OPTION 1 PREFERRED

0930 EDT  
96:00

96:22  
96:30  
M  
S  
F  
N  
96:51  
96:58  
97:00

DON PGA  
W/O HELMET AND  
GLOVES

CSM POWER TO LM-OFF  
( $\therefore$  T LMP REQUEST)

DISCONNECT AND STOW  
LM POWER UMBILICAL

IVT TO LM  
TRANSFER HELMET & GLOVES

ECS ACTIVATION AND C/O  
CONNECT TO LM ECS

LM FAMILIARIZATION

LM POWER-ON

EPS ACTIVATION  
MISSION TIMER ACTIVATION  
PRIMARY GLYCOL LOOP ACT

CAUTION/WARNING CHECKOUT  
CB ACTIVATION  
TB VERIFICATION

PGNCS TURN - ON AND  
SELF TEST

BIO MED SWITCH - LEFT

DUMP DSE

UPLINK CMC  
CSM STATE VECTOR  
DESIRED ORIENT  
(LS REFSMMAT)  
UPDATE CSM  
LMK 130 PAD  
BLOCK DATA  
CSM DAP DATA

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

# FLIGH. PLAN

**CSM**

**LM**

**MCC-H**

REPORT: **CMP**

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>3.5psia

COCK LATCHES (12)

INSTALL HATCH

VENT TUNNEL

HATCH INTEGRITY CHECK

INSTALL AND ALIGN DOCK-  
ING TARGET

1030 EDT

97:00

M  
S  
F  
N

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

**CDR**

**LMP**

SUIT FAN/H2O 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

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

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

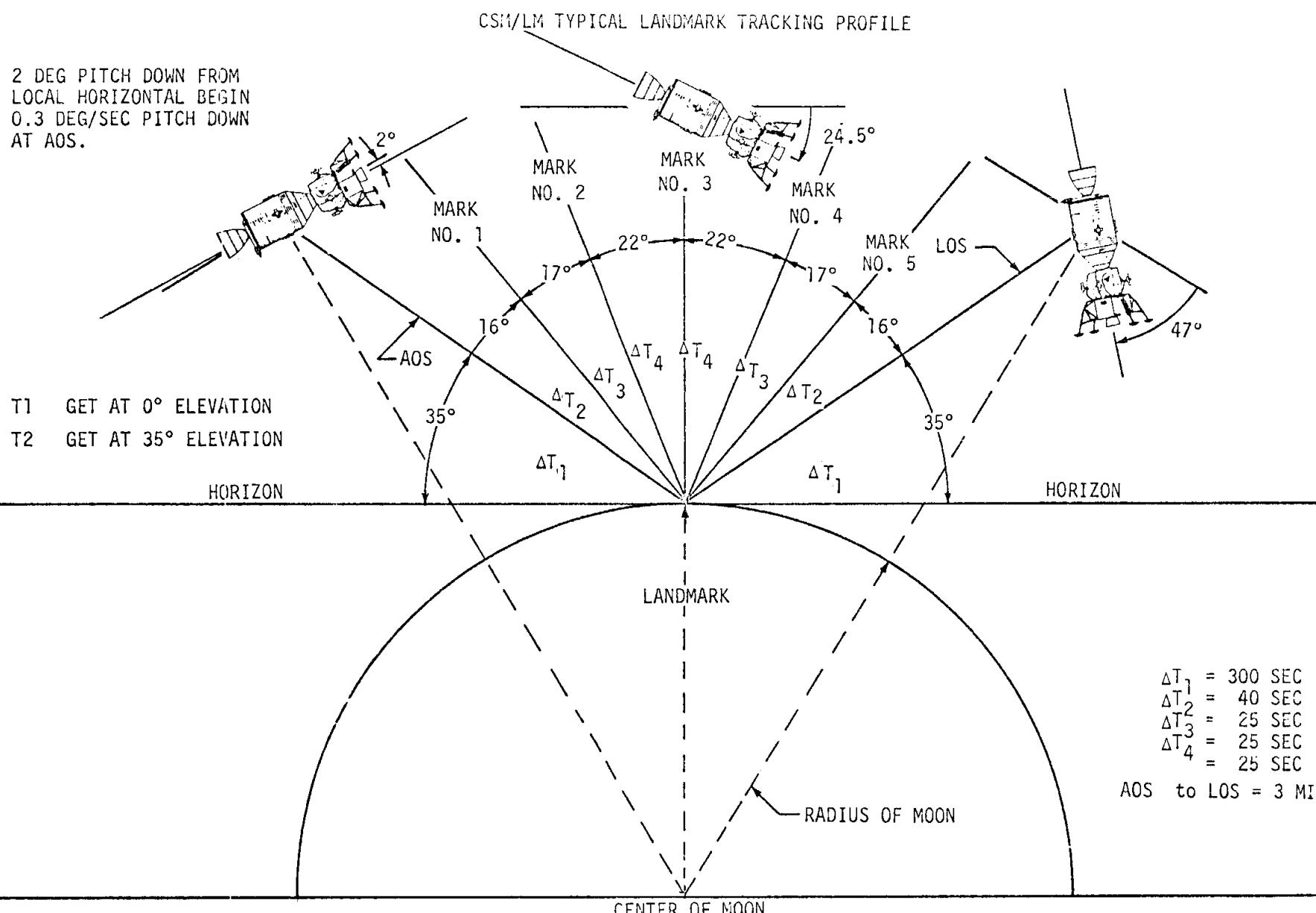
UPDATE LM  
STEERABLE ANTENNA  
ANGLES P 187, Y 70  
(GET: 98:55)

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

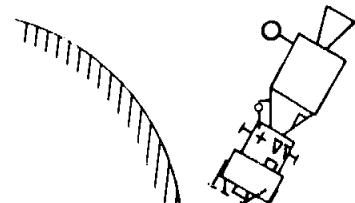
2 DEG PITCH DOWN FROM  
LOCAL HORIZONTAL BEGIN  
0.3 DEG/SEC PITCH DOWN  
AT AOS.



# 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

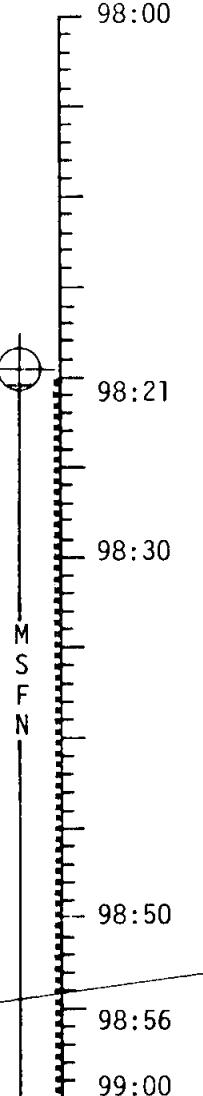
TRACK LDG SITE LANDMARK  
(5 MARKS ON LDMK 130)  
PITCH DOWN 0.3°/SEC AT T2  
DO NOT INCORPORATE MARKS

PITCH DOWN, 0.5°/SEC

STOP PITCH AND GO INERTIAL

V64 ACQUIRE MSFN

1130 EDT  
98:00



**LM**

**LMP**

**CDR**

DON HELMET & GLOVES	DON HELMET & GLOVES
ARS/PGA PRESSURE INTEGRITY CHECK	ARS/PGA PRESSURE INTEGRITY CHECK
CABIN REGULATOR CHECK	CABIN REGULATOR CHECK
DOFF HELMET & GLOVES COPY DAP DATA COPY GYRO TORQUE ANGLES AND FINE ALIGN IMU X __, Y __, Z __	DOFF HELMET & GLOVES SELECT OMNI FWD BIO MED SWITCH - RIGHT
RATE GYRO CHECK	AGS ACT & SELF TEST
R 0, P 135/14, Y 0 	V64 ACQUIRE MSFN ANT P 187, Y 70

**MCC-H**

UPDATE LM  
DAP DATA  
GYRO TORQUE  
ANGLES

P22 AUTO OPTICS				
LMK ID 130				
T1	9	8 : 4	0 : 0	2 (HOR)
T2	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	1 . 4	6	NM

DUMP DSE

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	98:00 - 99:00	5/12	3-65

# FLIGHT PLAN

**CSM**

**CMP**

STOW FLIGHT PLAN  
UNSTOW SOLO BOOK  
COPY PADS

	1230 EDT
	99:00
M S F N	
	99:30
	99:32
	99:43
	99:49
	REV 13
	100:00

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

MANEUVER TO AGS CALIBRATION ATTITUDE

RATES <0.1°/SEC  
DISABLE THRUSTERS FOR 32 SEC  
(AT REQUEST OF LMP)  
MANEUVER TO UNDOCKING ATTITUDE  
RO, P320/14, Y0

**CDR**

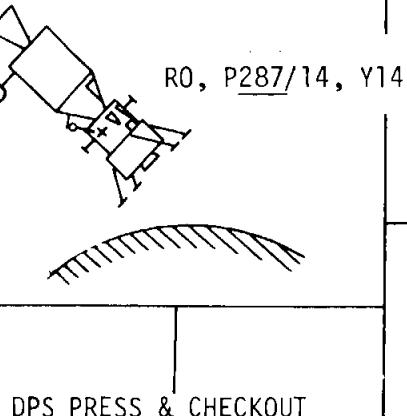
DRIFT CHECK-REPORT GIMBAL ANGLES & TIME TO MSFN  
DEPLOY LANDING GEAR  
ORDEAL INITIALIZATION

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

RCS PRESSURIZATION

RCS CHECKOUT

RR ACT & SELF TEST



**LM**

**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 (SEPARATION)  
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**

**LM**

**MCC-H**

**CMP**

**CDR**

**LMP**

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

RO P338/76, YO

1630 EDT  
103:00

M S F N

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

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

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

103:29  
103:30

M S F N

103:39

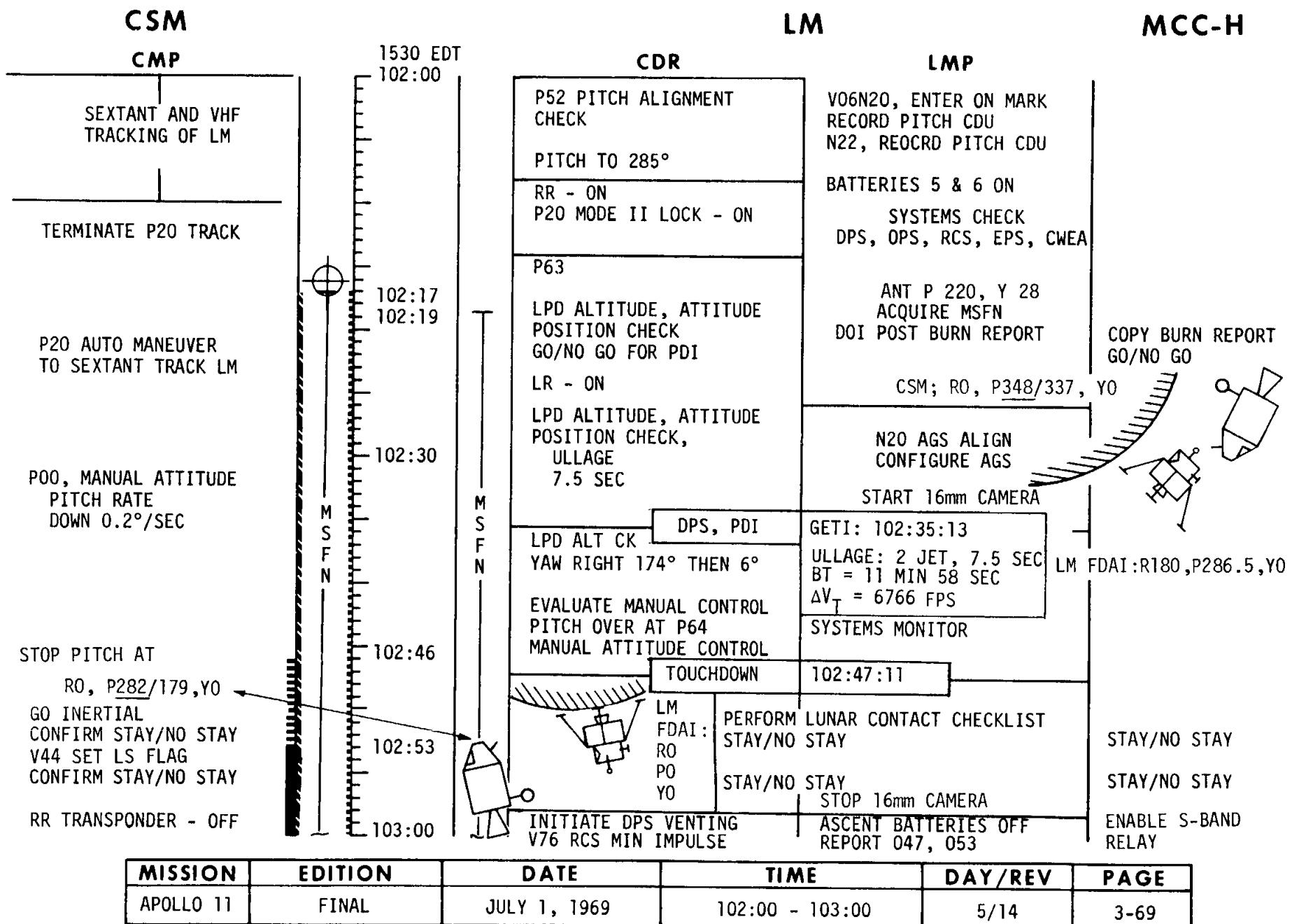
103:45

REV 15

104:00

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

# FLIGHT PLAN



# 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

M  
S  
F  
N

REPORT: CDR  
P52 (LDG SITE REFSMMAT)  
N71: \_\_\_\_ , \_\_\_\_  
N05: \_\_\_\_ . \_\_\_\_  
N93:  
X \_\_\_\_ . \_\_\_\_  
Y \_\_\_\_ . \_\_\_\_  
Z \_\_\_\_ . \_\_\_\_  
GET \_\_\_\_ : \_\_\_\_ :

P40 DPS THRUST  
MNVR TO DOI ATTITUDE

101:30

DPS,DOI  
TRIM V<sub>X</sub> RESIDUALS  
PITCH DOWN, P=195, RR-ON  
P20 MAN LOCK - ON

101:41

RR-OFF

101:47

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

REV 14

LM

LMP

SYSTEMS CHECKS

V47 AGS ALIGN

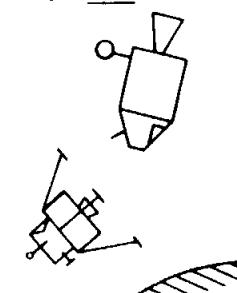
OMNI AFT, PCM LBR  
VHF A-VOICE, B-DATA

SLEW STEERABLE ANTENNA  
ANT P 220, Y 28

CSM: R0, P215/319, Y0

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

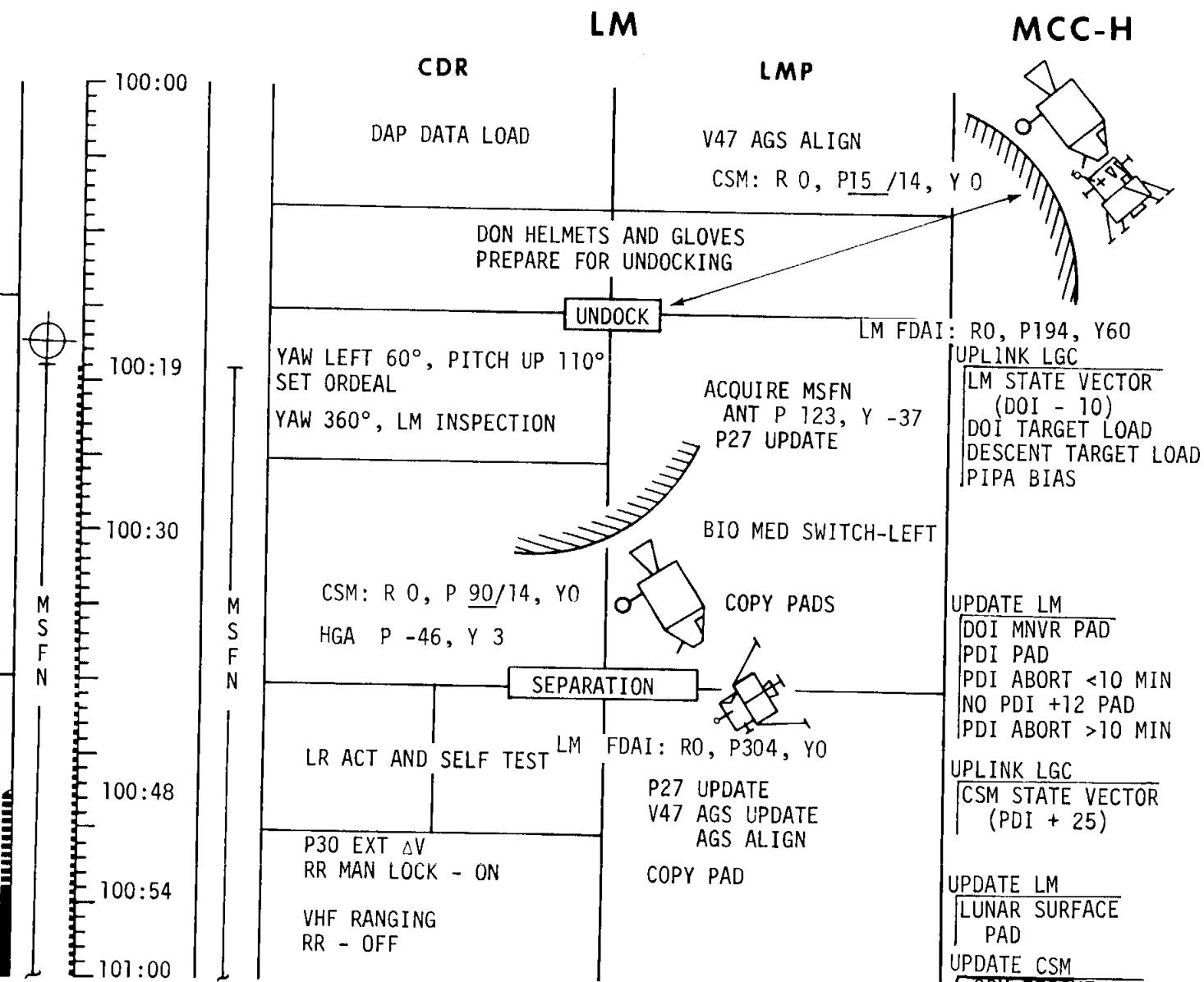
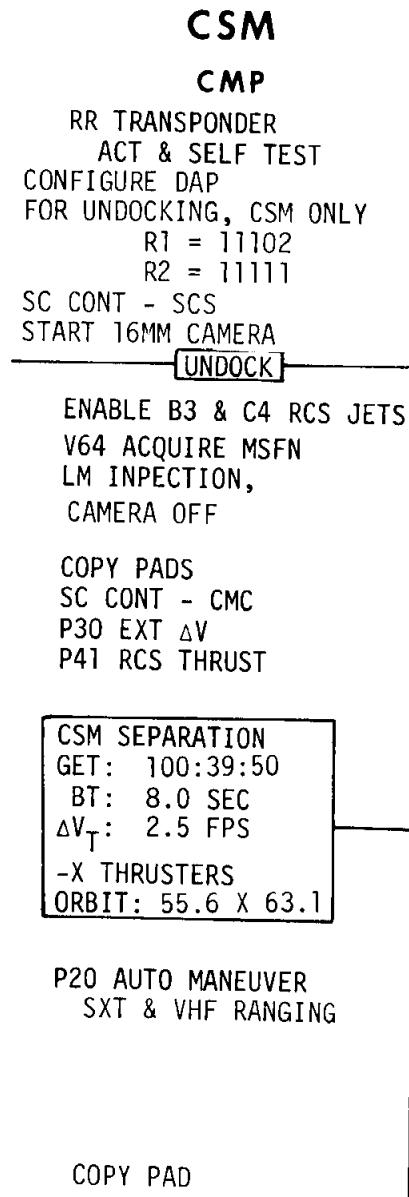


VHF A-VOICE/RNG LM FDAI: R0, P294.9, Y0

VHF B - XMTR - OFF  
SET CAMERA  
16mm/HCEX(4,500,INF) 6 fps  
COAS OVERHEAD

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

# FLIGHT PLAN

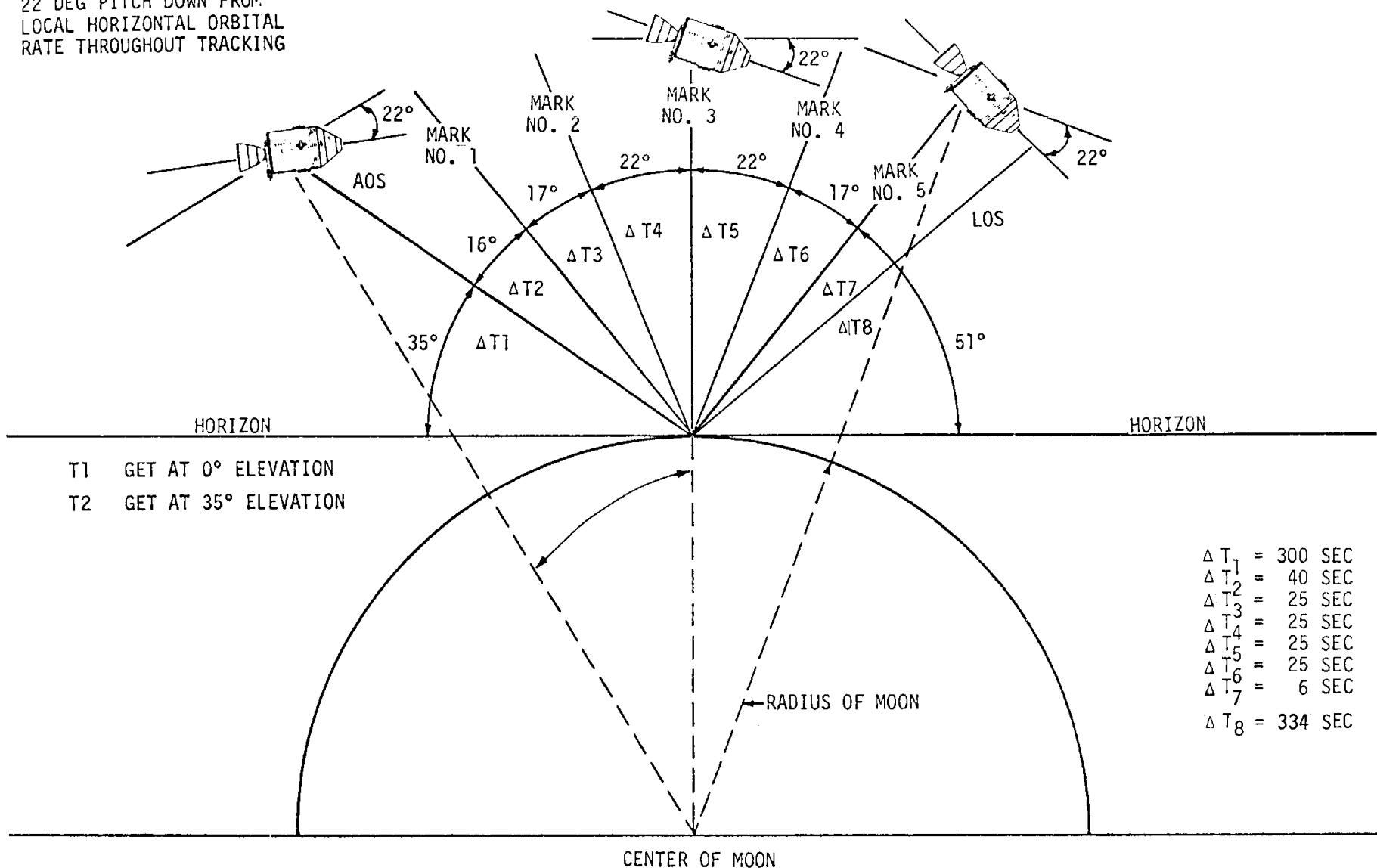


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	100:00 - 101:00	5/13	3-67

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CSM TYPICAL LANDMARK TRACKING PROFILE

22 DEG PITCH DOWN FROM  
LOCAL HORIZONTAL ORBITAL  
RATE THROUGHOUT TRACKING



# FLIGHT PLAN

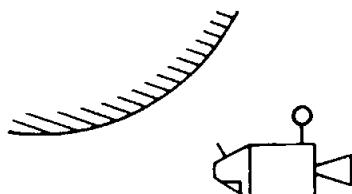
CSM

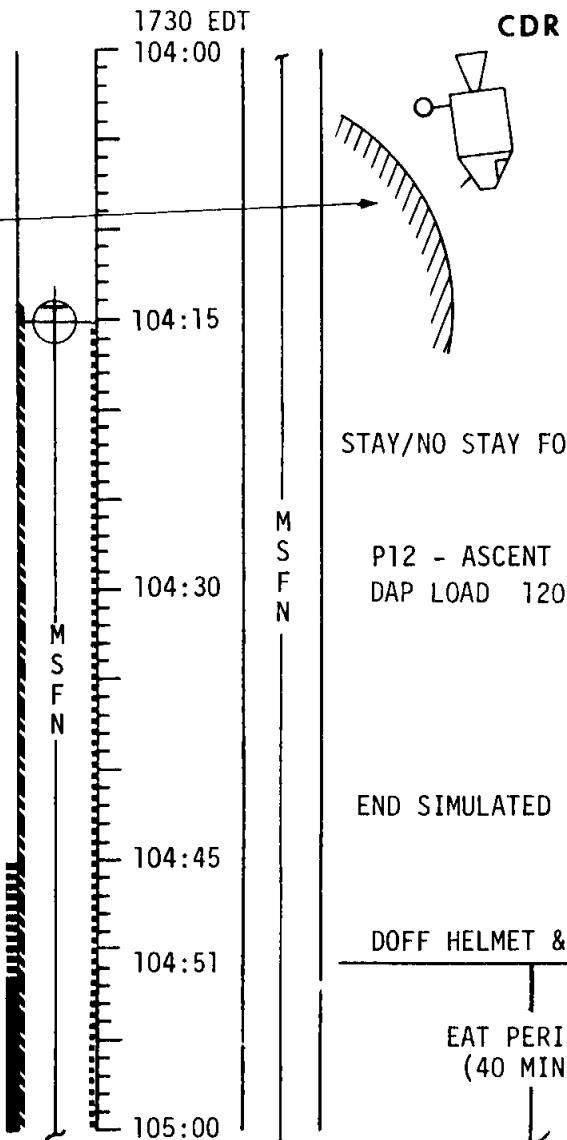
CMP

P22 AUTO MANEUVER TO  
TRACKING ATTITUDE,  
ORB RATE

R0, P338/342,Y0

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

REPORT: LMP

P57 - GRAVITY AND ONE  
CELESTIAL BODY (T-ALIGN)

N04: \_\_\_\_\_

N71: \_\_\_\_\_

N93: \_\_\_\_\_

X \_\_\_\_\_

Y \_\_\_\_\_

Z \_\_\_\_\_

GET \_\_\_\_\_ : \_\_\_\_\_ : \_\_\_\_\_

MCC-H

STAY/NO STAY

UPDATE LM  
T<sub>4</sub> THRU T<sub>7</sub>  
LIFT OFF TIMES  
P22 AUTO OPTICS  
LUNAR MODULE  
T1 104:34:31  
(HOR)  
T2 104:39:32  
(35°)  
0.2 NM (N OR S)  
N89  
LAT + 00.691°  
LONG/2 + 11.858°  
ALT - 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

P52 (OPT 1 - PREFERRED)
GYRO TORQUE TO DESIRED ORIENTATION FOR PLANE CHANGE (IF PLANE CHANGE IS REQUIRED)
GDC ALIGN TO IMU

1830 EDT  
105:00

M  
S  
F  
N

EAT PERIOD (1 HOUR)

105:26  
105:30

M  
S  
F  
N

105:38  
105:44

REV 16

106:00

**LM**

**CDR**

EAT PERIOD (40 MIN)

CREW STATUS REPORT (RADIATION, MEDICATION)

CONFIGURE SLEEP STATION  
STOW PLSS IN DONNING STATION

REST PERIOD (4 HOURS)

**LMP**

EAT PERIOD (40 MIN)

REST PERIOD (4 HOURS)

**MCC-H**

DUMP DSE

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

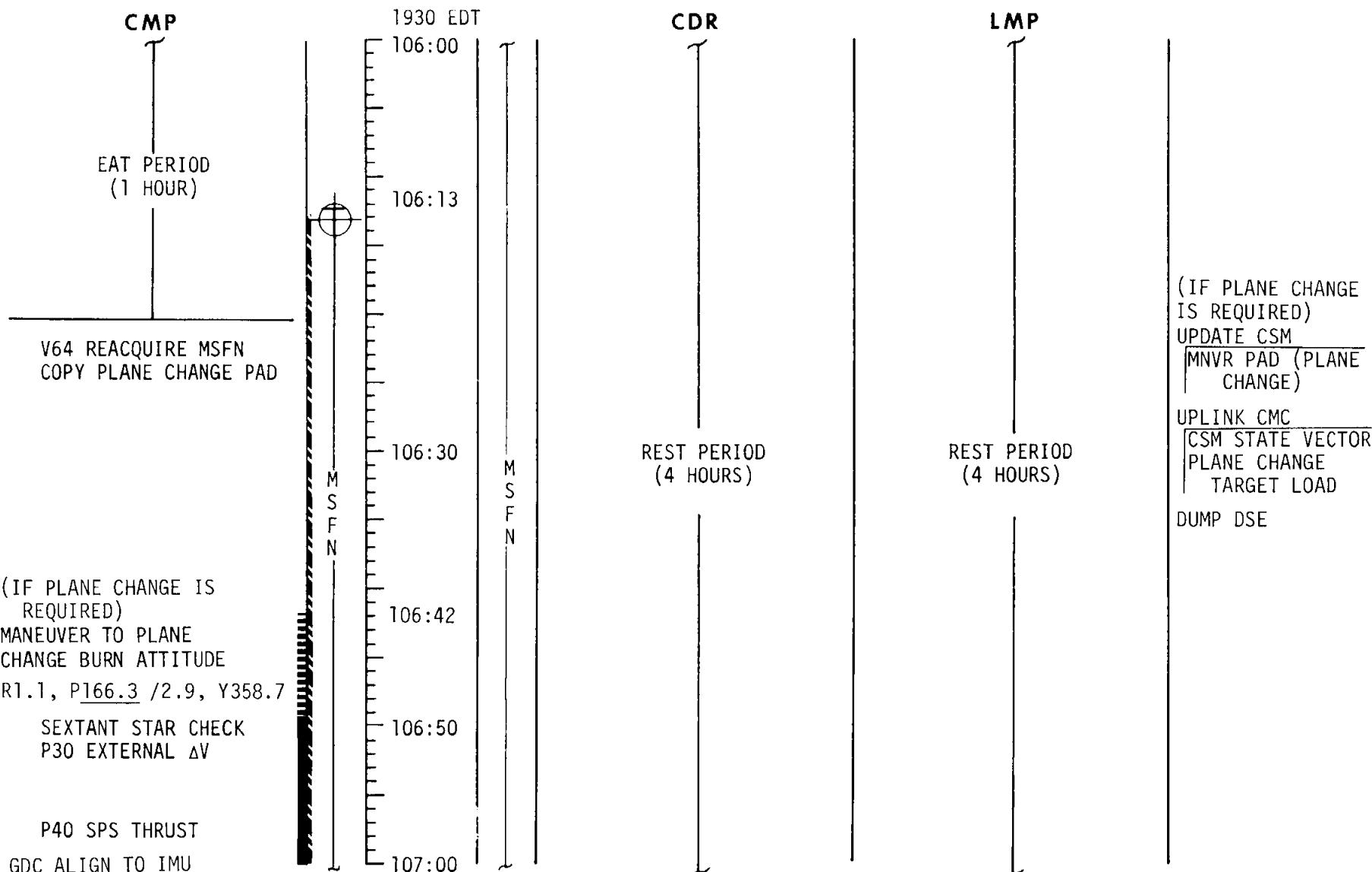
FLIGHT PLANNING BRANCH

# FLIGHT PLAN

**CSM**

**LM**

**MCC-H**



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**

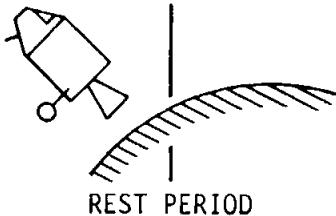
**SPS, PLANE CHANGE**  
 GETI = 107:05:33  
 $\Delta V$ =NOMINALLY ZERO

R1.1, P244.2/2.9, Y358.7

BATTERY CHARGE,  
BATTERY B

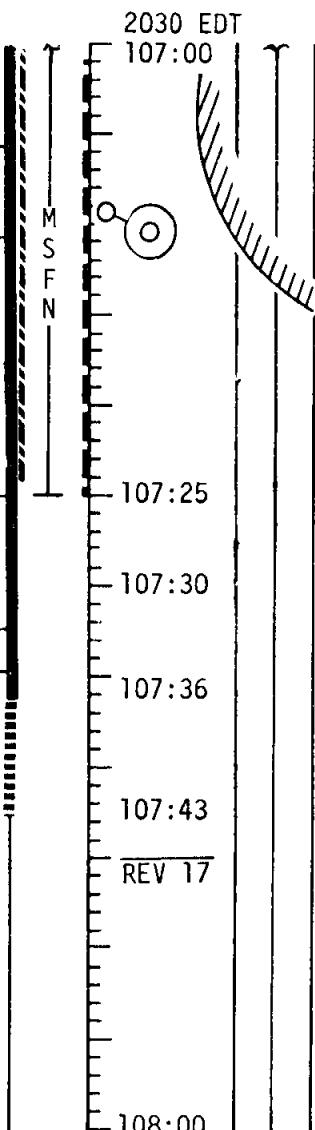
P52 IMU REALIGN  
 OPTION 1 PREFERRED  
 PULSE TORQUE TO  
 LIFT OFF REFSMMAT  
 PRESLEEP CHECKLIST

MANEUVER TO  
SLEEP ATTITUDE



REST PERIOD  
(4 HOURS)

R82, P128/218, Y0  
HGA P -10, Y 258



**LM**

**CDR**

REST PERIOD  
(4 HOURS)

**LMP**

REST PERIOD  
(4 HOURS)

**MCC-H**

UPLINK CMC  
 DESIRED ORIENT  
 (LIFT OFF)

**CSM**  
**PRESLEEP CHECKLIST**  
 CREW STATUS REPORT (RADIATION,  
 MEDICATION)  
 CYCLE O<sub>2</sub> & H<sub>2</sub> FANS  
 CHLORINATE POTABLE WATER  
 VERIFY:  
 WASTE MNGMT OVBD DRAIN VLV -  
 OFF  
 WASTE STOW VENT VLV - CLOSED  
 EMER CABIN PRESS VLV - BOTH  
 SURGE TANK O<sub>2</sub> VLV - ON  
 REPRESS PACK O<sub>2</sub> VLV - OFF  
 POTABLE H<sub>2</sub>O HTR - OFF  
 LM TUNNEL VENT VLV - OFF  
 SELECT COMM NORMAL LUNAR  
 CONFIGURATION - EXCEPT:  
 S-BAND SQUELCH - ENABLE  
 HGA TRACK - REACQ  
 HGA BEAM - NARROW  
 HGA P -10 , Y 258

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

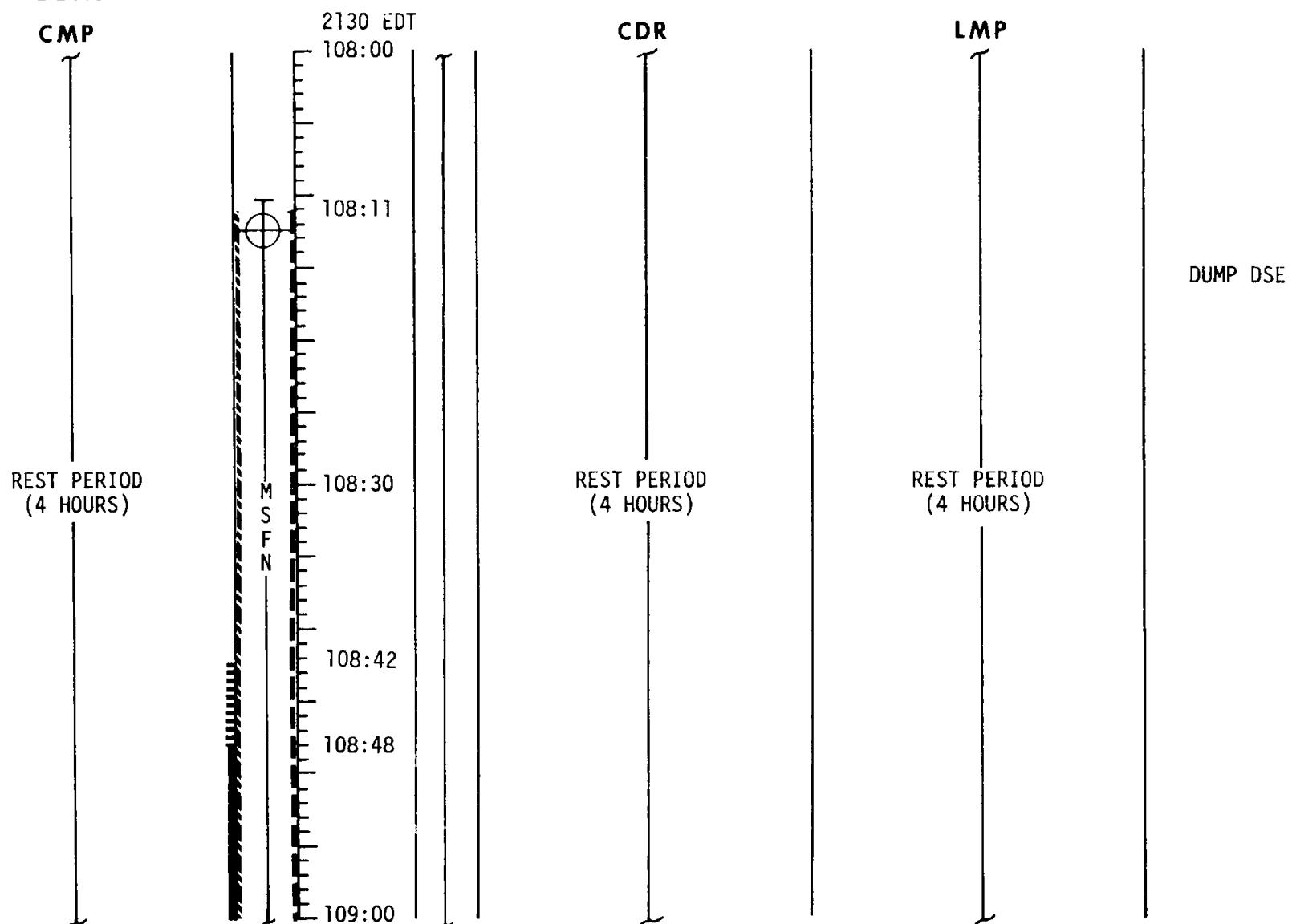
# FLIGHT PLAN

CSM

CMP

LM

MCC-H



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

# FLIGHT PLAN

CSM

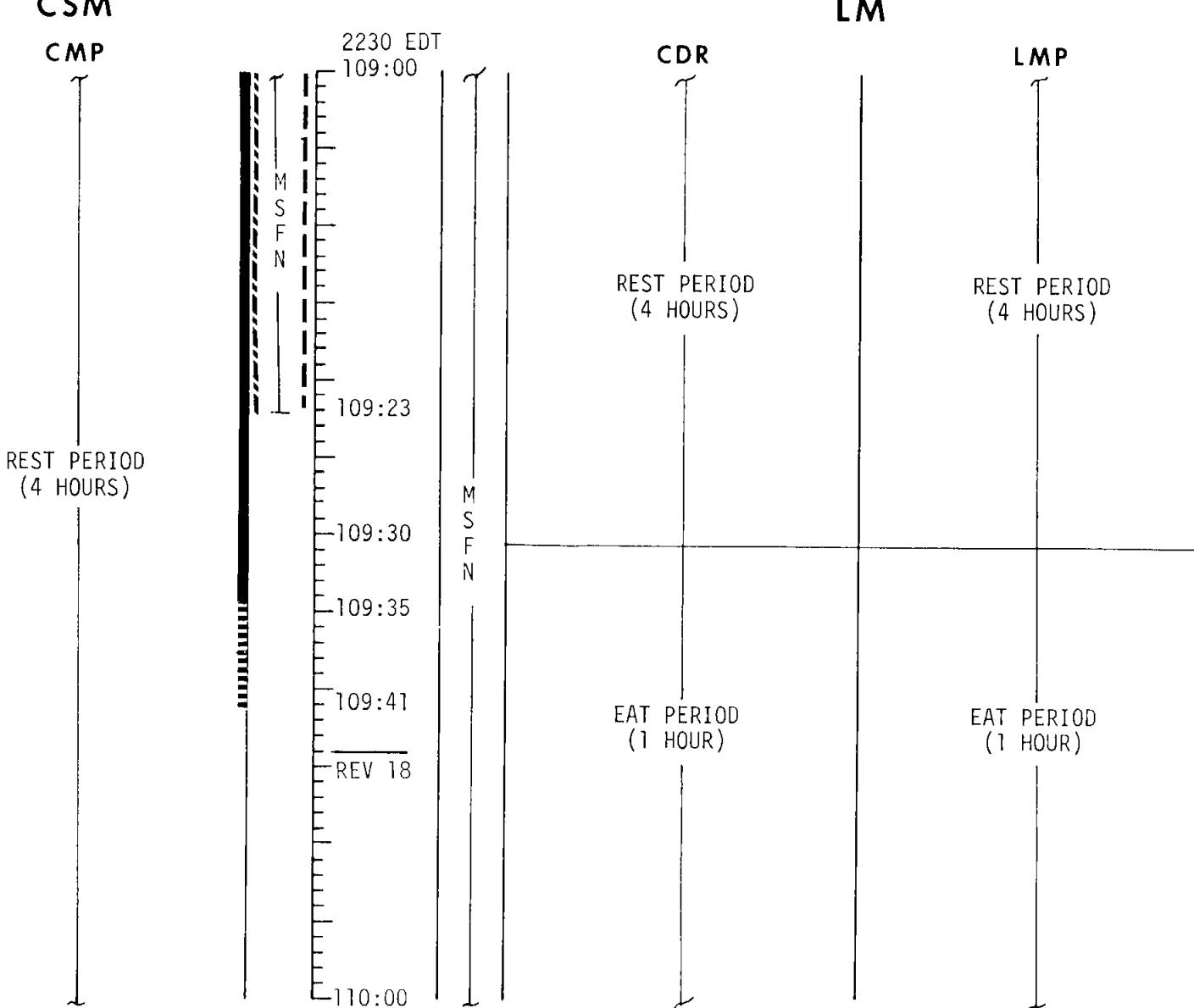
LM

MCC-H

CMP

CDR

LMP



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

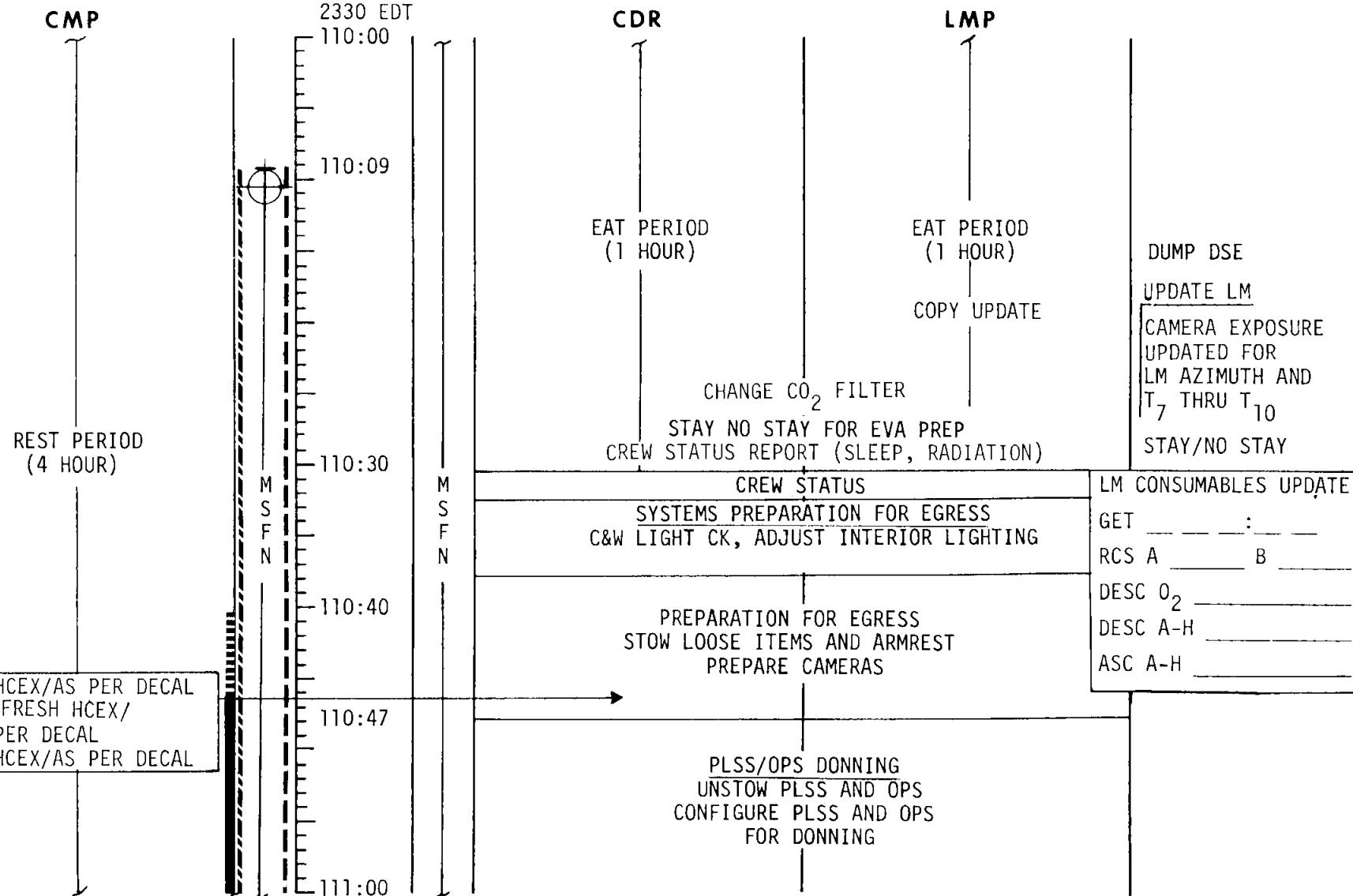
FLIGHT PLANNING BRANCH

# FLIGHT PLAN

CSM

LM

MCC-H



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

# FLIGHT PLAN

CSM

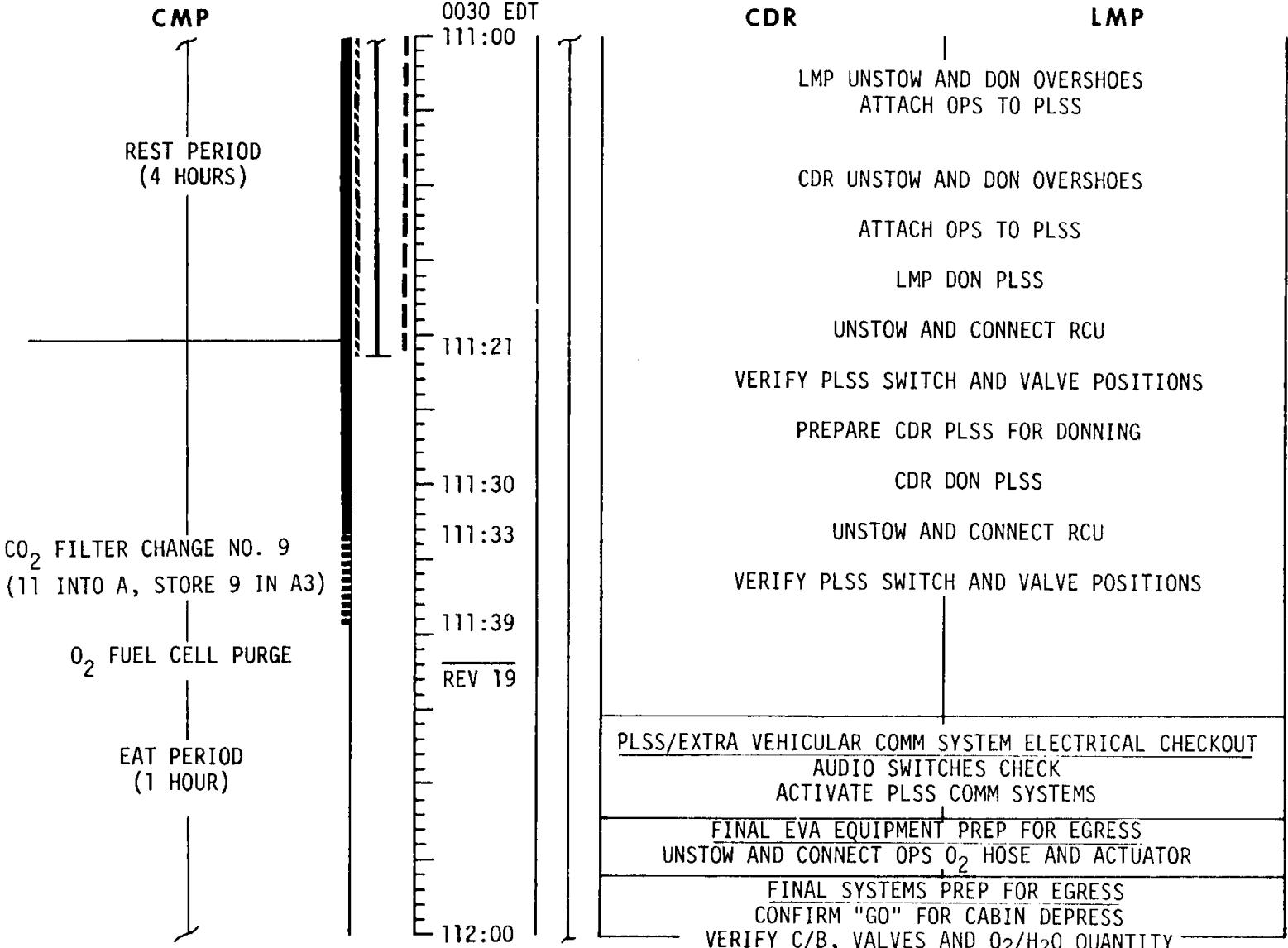
LM

MCC-H

CMP

CDR

LMP



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	111:00 - 112:00	5/18-19	3-78

# FLIGHT PLAN

**CSM**

**LM**

**MCC-H**

**CMP**

PRESLEEP CHECKLIST  
CREW STATUS REPORT RADIATION, MEDICATION)  
CYCLE O<sub>2</sub> & H<sub>2</sub> FANS  
CHLORINATE WATER  
VERIFY:

WASTE MNGMT OVBD DRAIN  
VLV - OFF  
WASTE STOW VENT VLV - CLOSED  
EMER CABIN PRESS VLV - BOTH  
SURGE TANK O<sub>2</sub> VLV - ON  
REPRESS PACK O<sub>2</sub> VLV - OFF  
POTABLE H<sub>2</sub>O HTR - OFF  
SELECT COMM NORMAL LUNAR  
CONFIGURATION - EXCEPT:  
S-BAND SQUELCH -  
ENABLE  
HGA TRACK - REACQ  
HGA BEAM - NARROW  
HGA P -59, Y 355

EAT PERIOD  
(1 HOUR)

0430 EDT  
115:00

115:18

115:30

115:37  
REV 21

116:00

**CDR**

**LMP**

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

CLOSE FWD HATCH

POST EVA SYSTEMS CONFIGURATION

VERIFY CAUTION LIGHTS OFF  
DISCONNECT RCU  
DISCONNECT OPS O<sub>2</sub> HOSES  
CONNECT LM O<sub>2</sub> HOSES (TV-OFF)  
CONFIGURE VALVES AND CIRCUIT BREAKERS  
DISCONNECT PLSS H<sub>2</sub>O HOSES  
SWITCH TO LM COMM SYSTEM

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

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**

**LM**

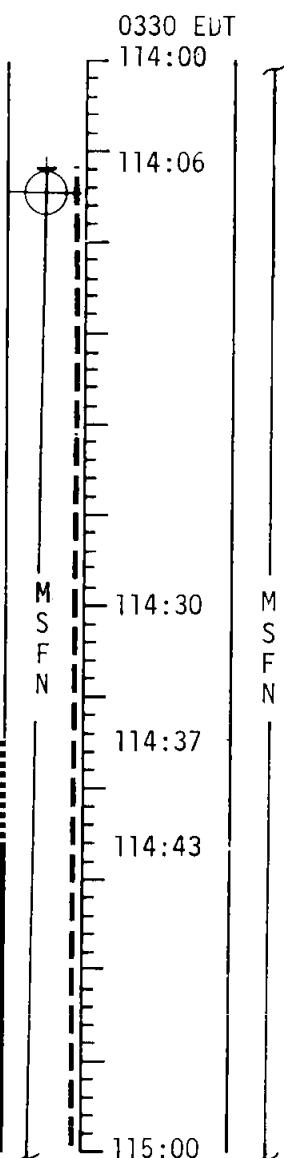
**MCC-H**

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

IF CONVENIENT CHANGE  
SHUTTER TO 1/125  
PITCH UP 38°  
ROLL 180° TO HEADS UP  
RO, P320/260,YO  
PITCH DOWN, PHOTOGRAPH  
LM WHILE TRACKING  
THROUGH COAS

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

R180, P282/185, YO  
HGA P -7, Y 183



**CDR**

SELECT DEPLOY SITE  
CARRY CAMERAS  
DEPLOY LR<sup>3</sup> 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 PHOTO LMP  
STILL CAMERA MAGAZINE  
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

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	5/21	3-81

# FLIGHT PLAN

**CSM**

**LM**

**MCC-H**

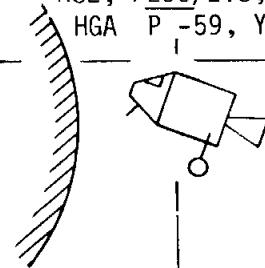
**CMP**

**CDR**

**LMP**

EAT PERIOD  
(1 HOUR)

MANEUVER TO  
SLEEP ATTITUDE  
R82, P256/218, Y0  
HGA P -59, Y 355



REST PERIOD  
(4 HR 50 MIN)

0530 EDT  
116:00

116:04

M  
S  
F  
N

116:30

116:36

M  
S  
F  
N

116:42

117:00

**CDR**

STOW EQUIPMENT IN LHSSC

PRESSURE INTEGRITY CHECK  
CHECK VALVE POSITIONS  
VERIFY GAGE READINGS

CABIN DEPRESS  
OPEN RELIEF AND DUMP VALVES

HATCH OPENING  
EQUIPMENT JETTISON

JETTISON 2 PLSS, LHSSC AND 1 ARMREST

CABIN REPRESS  
RELIEF AND DUMP VALVES - AUTO  
VERIFY MASTER ALRM AND WARN LIGHTS ON  
POST EVA SYSTEMS CONFIGURATION

FINAL SYSTEMS CONFIGURATION

POST EVA CABIN CONFIGURATION  
STOW EQUIPMENT  
RECONFIGURE CAMERAS

COPY UPDATE

EAT PERIOD  
(40 MIN)

EAT PERIOD  
(40 MIN)

DUMP DSE

UPDATE LM  
T<sub>10</sub> THRU T<sub>13</sub>

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

# FLIGHT PLAN

CSM

LM

MCC-H

CMP

CDR

LMP

REST PERIOD  
(4 HR 50 MIN)

0630  
117:00

LM

LMP

CDR

LMP

EAT PERIOD  
(40 MIN)

EAT PERIOD  
(40 MIN)

CREW STATUS REPORT (RADIATION, MEDICATION)  
BIO MED SW - LEFT

M  
S  
F  
N

117:16  
117:28

117:30

117:35

REV 22

118:00

REST PERIOD  
(4 HR 40 MIN)

REST PERIOD  
(4 HR 40 MIN)

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	117:00 - 118:00	5/20-21	3-84

# FLIGH. PLAN

CSM

LM

MCC-H

CMP

CDR

LMP

REST PERIOD  
(4 HR 50 MIN)

0730 EDT  
118:00  
118:02

REST PERIOD  
(4 HR 40 MIN)

REST PERIOD  
(4 HR 40 MIN)

DUMP DSE

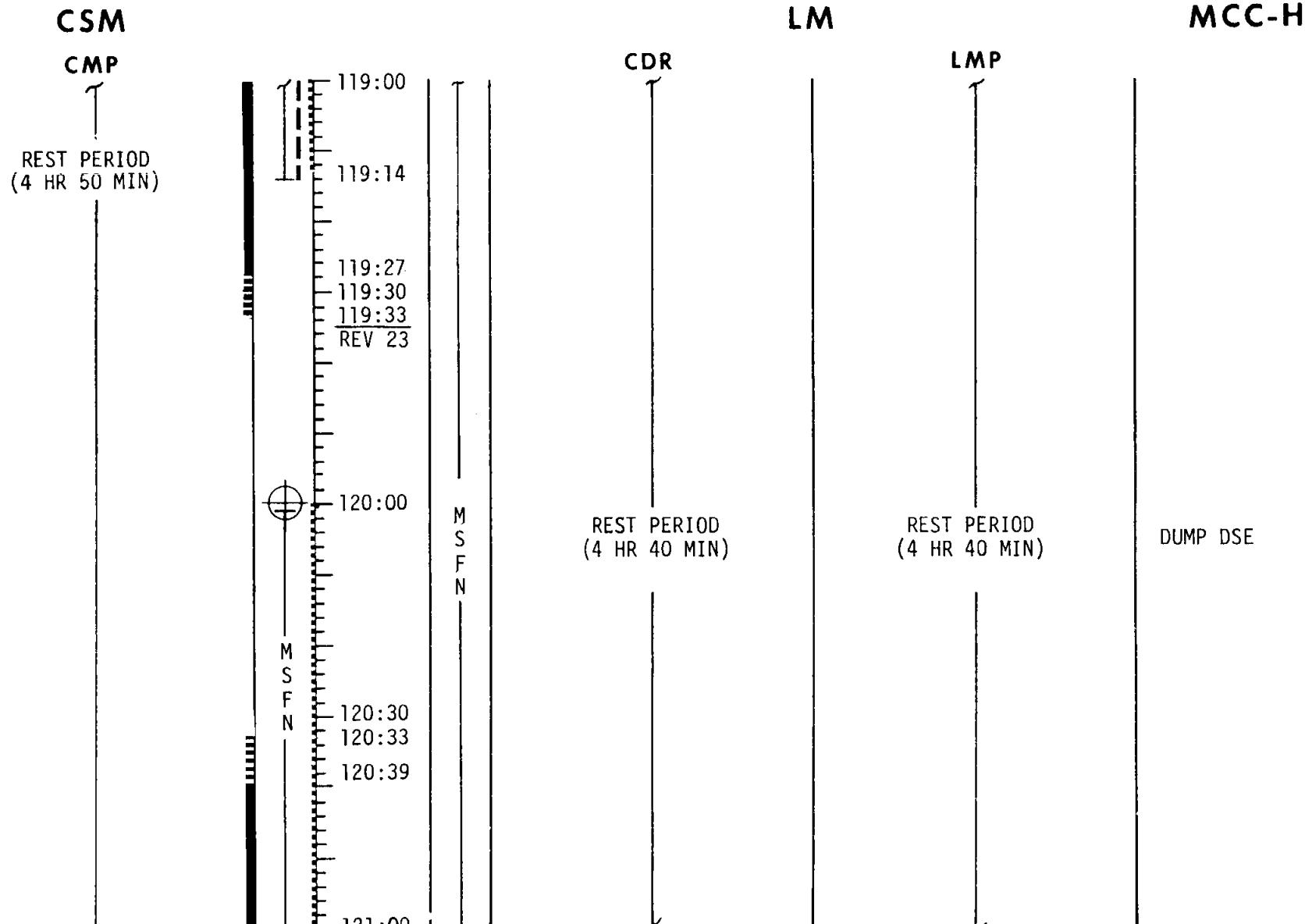
M 118:30  
S  
F  
N 118:34  
118:40

M  
S  
F  
N

119:00

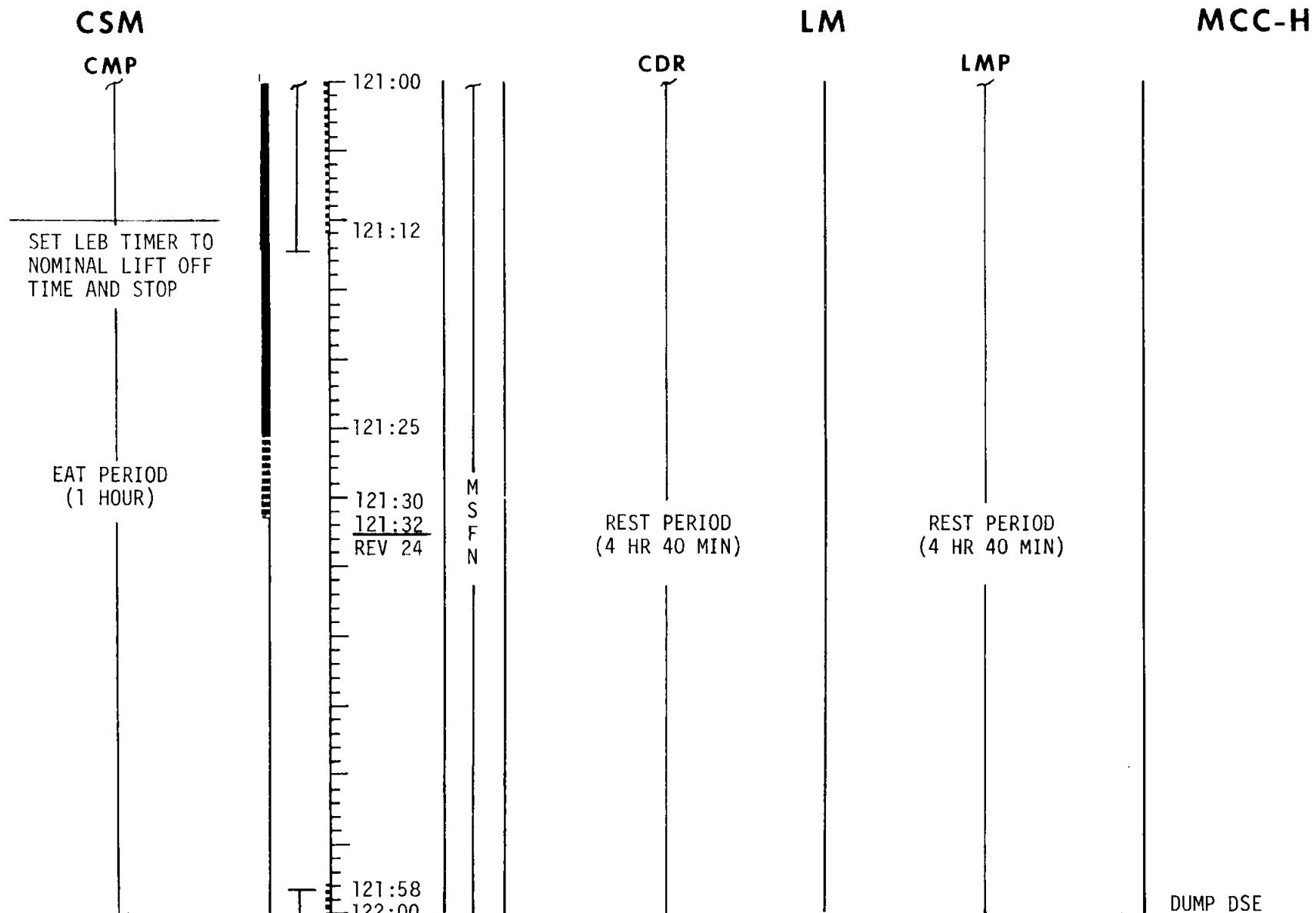
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
Apollo 11	FINAL	JULY 1, 1969	118:00 - 119:00	5/22-23	3-85

# FLIGHT PLAN



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

# FLIGHT PLAN



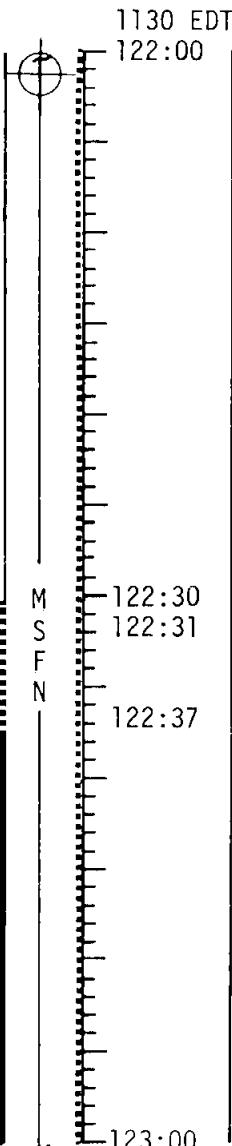
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	121:00 - 122:00	5/23-24	3-87

# FLIGHT PLAN

**CSM**

**CMP**

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



**CDR**

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

**LM**

**CDR**

**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 \_\_\_\_\_ : \_\_\_\_\_ : \_\_\_\_\_

**MCC-H**

COPY TIME BIAS

EAT PERIOD  
(35 MIN)

EAT PERIOD  
(35 MIN)

**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)

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	122:00 - 123:00	6/24	3-88

# FLIGHT PLAN

**CSM**

**CMP**

COPY CONSUMABLES UPDATE

1230 EDT  
123:00

**LM**

**LMP**

COPY ASCENT PAD  
LOAD PAD DATA

**MCC-H**

UPDATE LM  
ASCENT PAD

CONSUMABLES REPORT  
( $\Delta$  FROM NOMINAL)

GET: \_\_\_\_\_

RCS TOT \_\_\_\_\_

A \_\_\_\_\_

B \_\_\_\_\_

C \_\_\_\_\_

D \_\_\_\_\_

H<sub>2</sub> TOT \_\_\_\_\_

O<sub>2</sub> TOT \_\_\_\_\_

LM CONSUMABLES UPDATE

GET: \_\_\_\_\_ : \_\_\_\_\_

RCS A \_\_\_\_\_ B \_\_\_\_\_

DESC O<sub>2</sub> \_\_\_\_\_

DESC A-H \_\_\_\_\_

ASC A-H \_\_\_\_\_

O<sub>2</sub> FUEL CELL PURGE

123:30  
REV 25

M  
S  
F  
N

COPY CONSUMABLES UPDATE

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

123:56  
124:00

RCS HOT FIRE

RR TRANSPONDER - PWR

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	123:00-124:00	6/24-25	3-89

# FLIGHT PLAN

**CSM**

**CMP**

V64 ACQUIRE MSFN  
VHF RANGING  
MNVR TO SUPPORT  
LIFT OFF  
RO, P250/207, YO

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

M  
S  
F  
N  
124:30  
124:31

M  
S  
F  
N  
124:36  
124:37

125:00

**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

RR-OFF  
VERIFY INSERTION VEL

P52 (LIFT OFF REFSMMAT)  
OPTION 3  
N71: \_\_\_\_\_, \_\_\_\_\_

N05: \_\_\_\_\_, \_\_\_\_\_

N93:

X \_\_\_\_\_, \_\_\_\_\_

Y \_\_\_\_\_, \_\_\_\_\_

Z \_\_\_\_\_, \_\_\_\_\_

GET \_\_\_\_\_ : \_\_\_\_\_ : \_\_\_\_\_

RR - ON

**LM**

**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 45NM

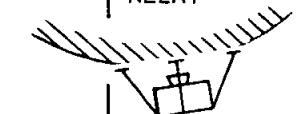
124:30:44  
POO - DOWNLINK LM S. V.  
STOP 16mm CAMERA  
ECS CHECK  
V48 LOAD DAP N46, 12002  
V56, V41 - RR-OFF  
TURN ON TRACK LIGHT

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

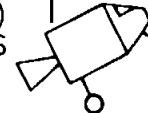


LM FDAI: RO, PO, YO

CSM:  
RO, P320/207, YO

UPLINK CMC  
LM STATE VECTOR

LM FDAI: RO, P257.3, YO



CSM: RO, P235/119, YO

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

# FLIGHT PLAN

**CSM**

**LM**

**MCC-H**

CMP  
VHF RANGING  
P40 SPS CHECKLIST

VHF RANGING

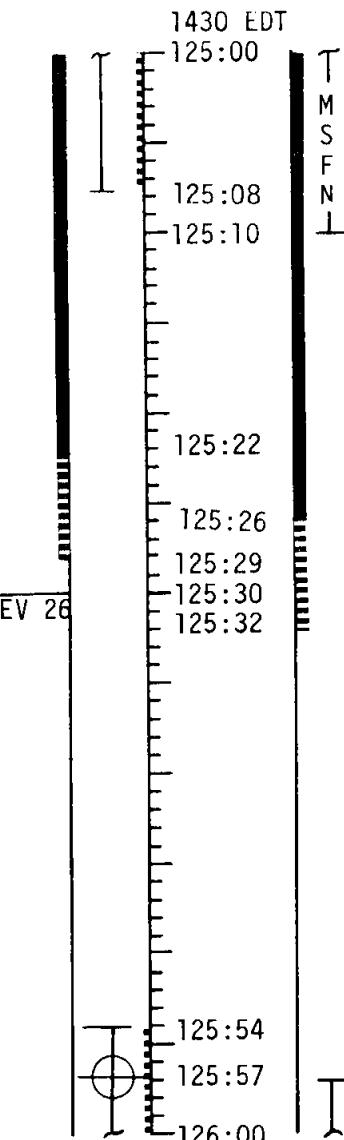
CSI, BACKUP  
P76 TARGET ΔV

P20 AUTO MANEUVER  
TO SEXTANT TRACK

VHF RANGING

P76 TARGET ΔV  
(LM PC BURN DATA)

SEXTANT TRACKING  
VHF RANGING



**CDR**

**LMP**

CSM: RO, P180/271, Y0

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

Z AXIS BORESIGHT

MAINTAIN RR AND  
VHF TRACKING ATTITUDE

P41 RCS THRUSTING

RCS, PLANE CHANGE

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

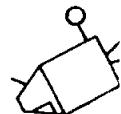
V32 MARKS=10

P30 EXTERNAL ΔV  
V90 OUT OF PLANE

LOAD AGS ΔV

TIG: 125:50:28  
ΔV=NOMINALLY ZERO

V76, P33 CDH PRETHRUST



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	125:00 - 126:00	2/25-26	3-91

# FLIGHT PLAN

**CSM**

**CMP**

**LM**

**MCC-H**

V90 YDOT  
TRANSMIT YDOT TO LM  
P33 FINAL COMPUTATION

P41  
CDH BACKUP

P76 TARGET  $\Delta V$

P20 AUTO MANEUVER  
TO SEXTANT TRACK  
VHF RANGING

SEXTANT TRACKING  
VHF RANGING

P34 TPI

SET EVENT TIMER  
P40  $\Delta V$  THRUST  
SPS CHECKLIST

P76 TARGET  $\Delta V$

1530 EDT  
126:00

**CDR**  
MAINTAIN RR  
AND VHF TRACKING  
ATTITUDE

V83 SET ORDEAL  
P41 RCS THRUSTING

RCS, CDH

MAINTAIN RR  
AND VHF TRACKING  
ATTITUDE

P41 RCS THRUSTING  
COUNTDOWN TO CSM

RCS, TPI  
VERIFY RESIDUALS

**LMP**  
V93, MARKS=4  
ACQUIRE MSFN-S BAND  
STEERABLE ANTENNA  
P -58 Y -38  
V32, MARKS=5

RCS TEMP/PRESS/QTY CK  
ECS CHECK  
FINAL COMPUTATION LM FDAI: RO, P352.8, Y0  
V90 OUT OF PLANE  
COPY CSM YDOT, LOAD NEG  
V47 INITIALIZE AGS

TIG: 126:19:37  
BT: 1.9 SEC  
 $\Delta V$ : 4.3 FPS

V76, P34 TPI PRETHRUST  
V93, MARKS=4  
V32, MARKS=3  
CSM: R180, P264/177, Y0  
V32, MARKS=10

RCS-TEMP/PRESS/QTY CK  
ECS CHECK

CSM: RO, P208/9, Y0

FINAL COMPUTATION  
COPY CSM YDOT, LOAD NEG  
V47 INITIALIZE AGS  
COPY CSM TPI SOLUTION  
LOAD AGS  $\Delta V$

TIG: 126:58:08  
BT: 22.4 SEC  
 $\Delta V$ : 24.8 FPS

LM FDAI: RO, P274.6, Y0

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**

P20 AUTO MNVR TO  
P35 TPM PRETHRUST  
SXT AND VHF TRACKING

P41  
MCC1 BACKUP  
P76 TARGET ΔV

SXT AND VHF TRACKING

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

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

**LM**

**CDR**

ANT P Y

P41 RCS THRUSTING

RCS, MCC1

MAINTAIN LOS CSM

P41 RCS THRUSTING

RCS, MCC2

V63 RR SELF TEST  
P47 THRUST MONITOR

**LMP**

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

COMPUTE MCC1 (TPI + 15)

TIG: 127:13:08

V76, V93(BEFORE FIRST MARK)  
P35 TPM PRETHRUST

COMPUTE MCC2 (TPI + 30)

TIG: 127:28:08

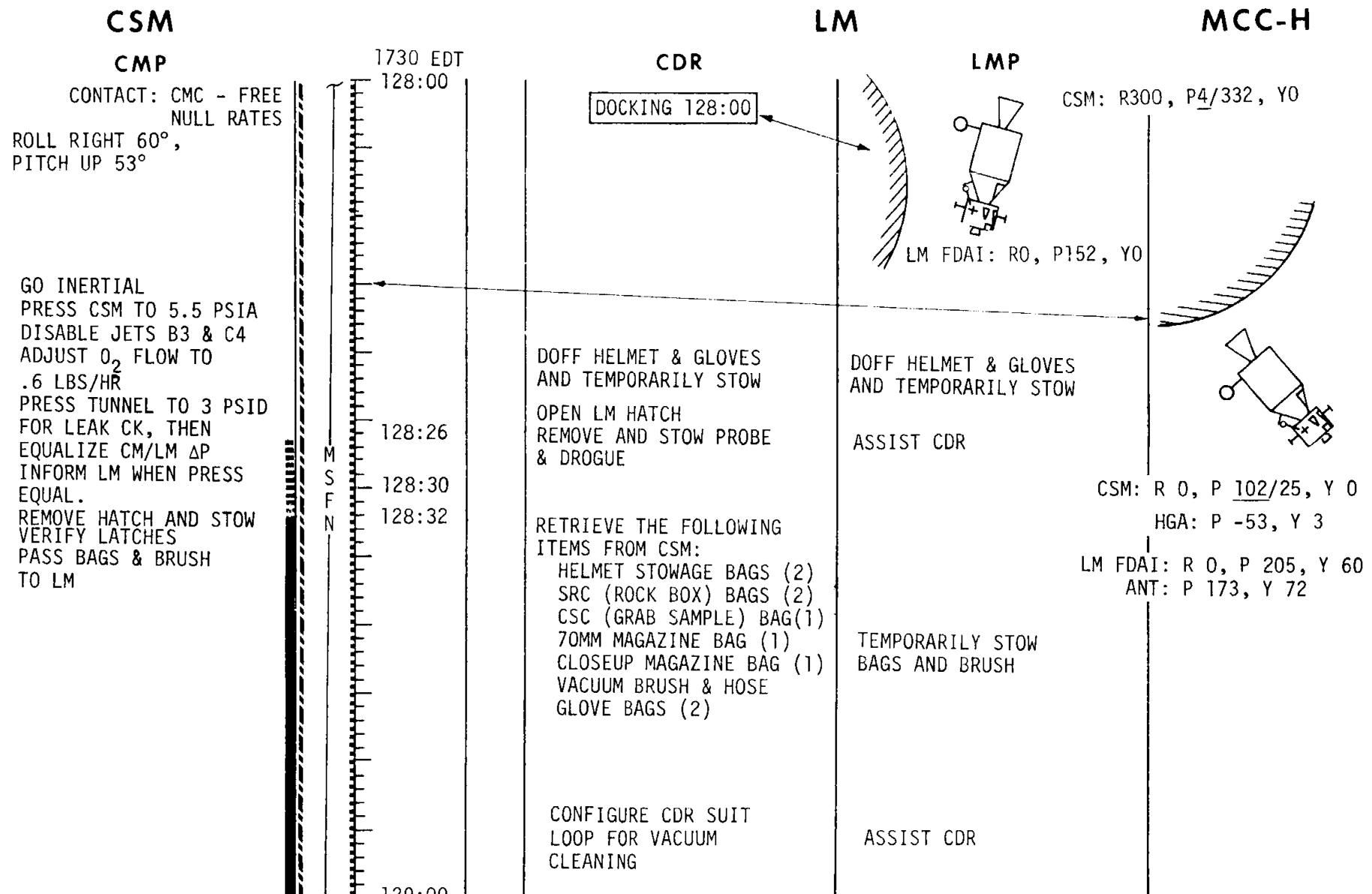
POO

RCS BRAKING

GET	ΔT FROM TPI	ΔV BT SEC	RANGE 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

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

# FLIGHT PLAN



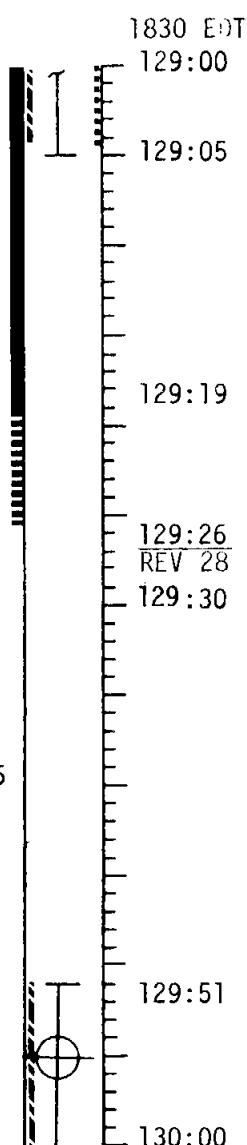
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	128:00 - 129:00	6/27	3-94

# FLIGHT PLAN

**CSM**

**CMP**

V66 - TRANS CSM STATE  
VECTOR TO LM SLOT



RETRIEVE SRC'S FROM  
LM AND STOW IN  
B5 AND B6

RETRIEVE BAGGED  
ITEMS FROM LM  
AND STOW:  
CSC - A5  
CLOSEUP MAGAZINE - A5  
70MM MAGAZINES - R13  
HELMETS-FOOD  
CONTAINERS

**CDR**

VACUUM BRUSH FWD  
DUMP VALVE FILTER

VACUUM SRC'S

VACUUM:

CSC

70MM MAGAZINE

CLOSEUP MAGAZINE

HELMETS

GLOVES

VACUUM BRUSH LMP'S PGA

VACUUM THE BRUSH  
AND STOW IN ISA

**LM**

**LMP**

UNSTOW AND HOLD  
SRC'S FOR CLEANING

BAG SRC'S AND  
TRANSFER TO CM

HOLD EQUIPMENT FOR  
CLEANING

BAG ITEMS AND  
TRANSFER TO CSM  
(GLOVES IN HELMETS)

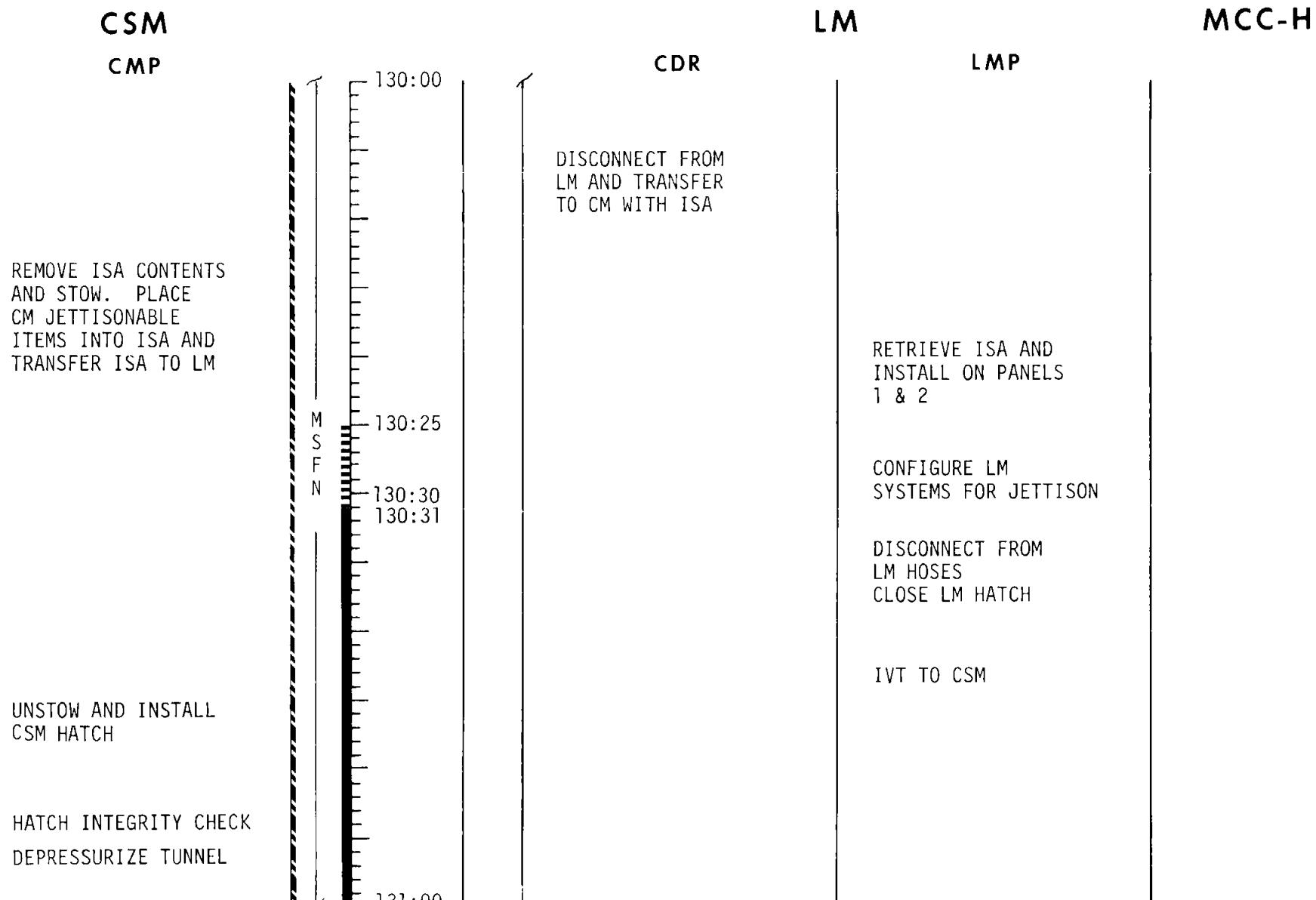
VACUUM BRUSH CDR'S PGA

**MCC-H**

UPLINK  
CSM STATE VECTOR

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	129:00 - 130:00	6/28	3-95

# FLIGHT PLAN



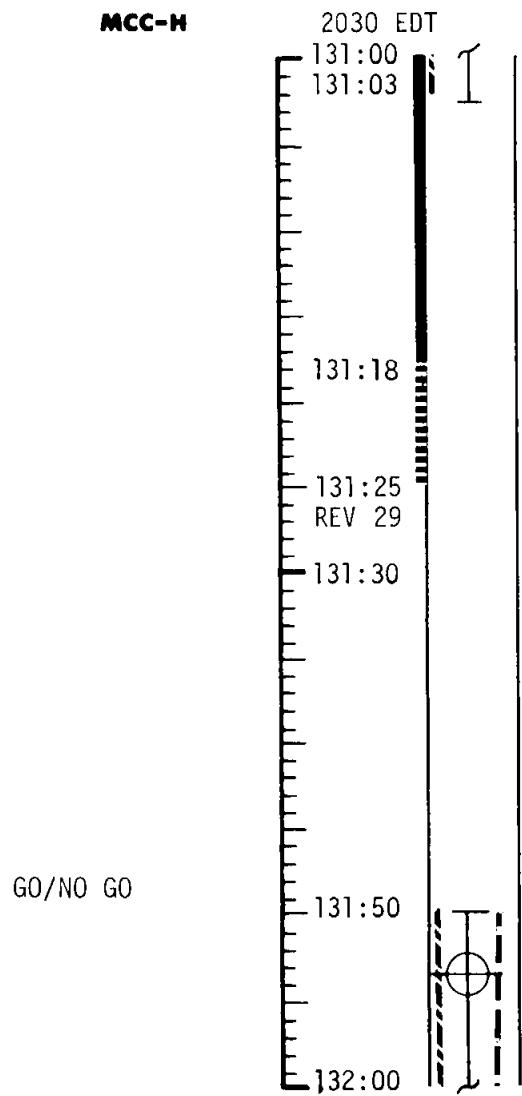
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	130:00 - 131:00	6/29	3-96

FLIGHT PLANNING BRANCH

MCC-H

# FLIGHT PLAN

NOTES



EQUIPMENT STOWAGE

VACUUM PGAS

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

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

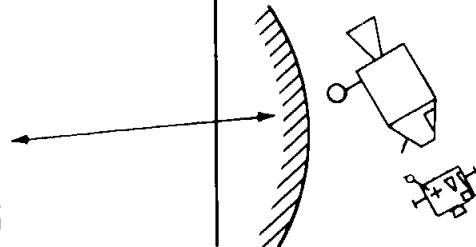
THRUST MONITOR - P47

START CAMERA

LM JETTISON

SM RCS CHECK

GETI = 131:53:05  
BT = 3.1 SEC  
 $\Delta V$  = 1 FPS  
RETROGRADE  
ORBIT: 58.5 X 59.4



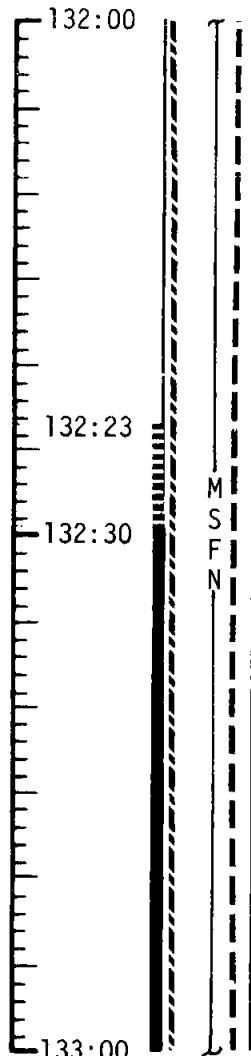
RO, P45/25, Y0  
HGA P-53, Y3

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	131:00 - 132:00	6/29	3-97

MCC-H

2130 EDT  
132:00

UPDATE  
TEI<sub>30</sub> MNVR PAD



## FLIGHT PLAN

MNVR TO TEI BURN ATTITUDE

V66 - TRANS CSM STATE VECTOR TO LM SLOT  
BURN STATUS REPORT  
RECORD PRELIMINARY TEI<sub>30</sub> MNVR PAD

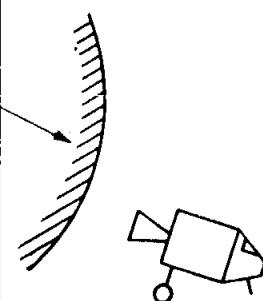
GO INERTIAL

DOFF AND BAG PGA'S HELMETS  
AND GLOVES

EAT PERIOD

NOTES

R1.1 P93.2/52.6 Y13.8  
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

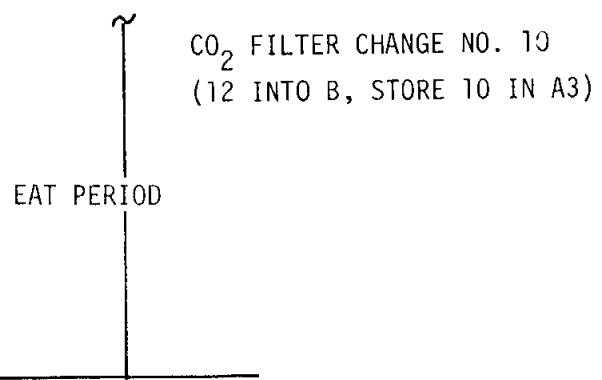
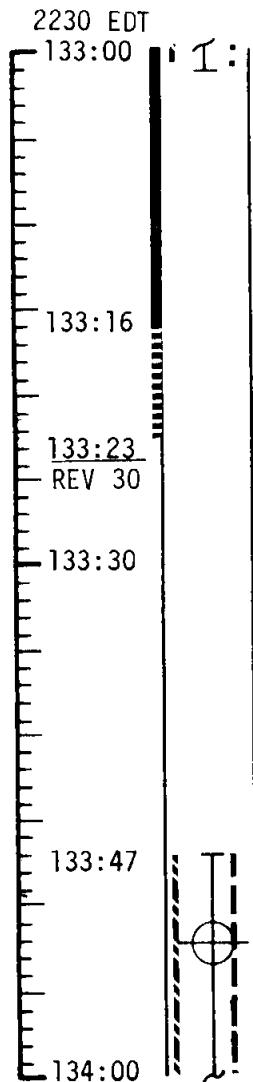
MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

MCC-N

# FLIGHT PLAN

NOTES



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

MCC-W

2330 EDT

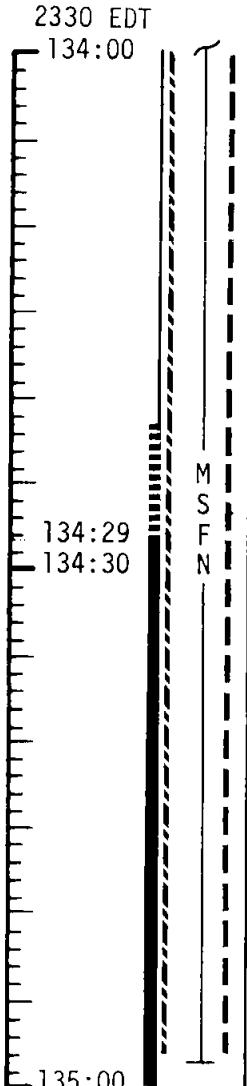
134:00

## FLIGHT PLAN

NOTES

UPDATE

TEI<sub>30</sub> MNVR PAD  
 BLOCK DATA  
 (TEI<sub>31</sub>)  
 GO/NO GO  
 UPLINK CMC  
 CSM STATE VECTOR  
 TEI TGT LOAD

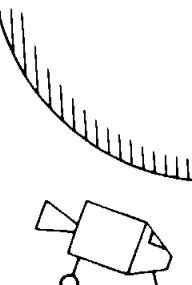


PRE TEI SYSTEMS CKS:  
 C&W CK  
 CM RCS MON CK  
 SM RCS MON CK  
 EPS MONITOR CK  
 ECS REDUNDANT COMPONENTS CK

RECORD FINAL TEI<sub>30</sub> MNVR PAD AND  
 BLOCK DATA  
 GO/NO GO FOR TEI<sub>31</sub>  
 THIS REV

V66 - TRANS CSM STATE VECTOR TO LM SLOT

IMU REALIGN - P52  
 OPTION 3 - REFSMMAT  
 AND DRIFT CHECK



R1.1 P201.4/52.6 Y13.8  
 HGA P -78, Y 5

P30 EXTERNAL ΔV

REPORT:	
P52 (LIFT OFF REFSMMAT)	
N71:	_____
N05:	_____
N93:	
X	_____
Y	_____
Z	_____
GET	_____ : _____

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	134:00 - 135:00	6/30	3-100

MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

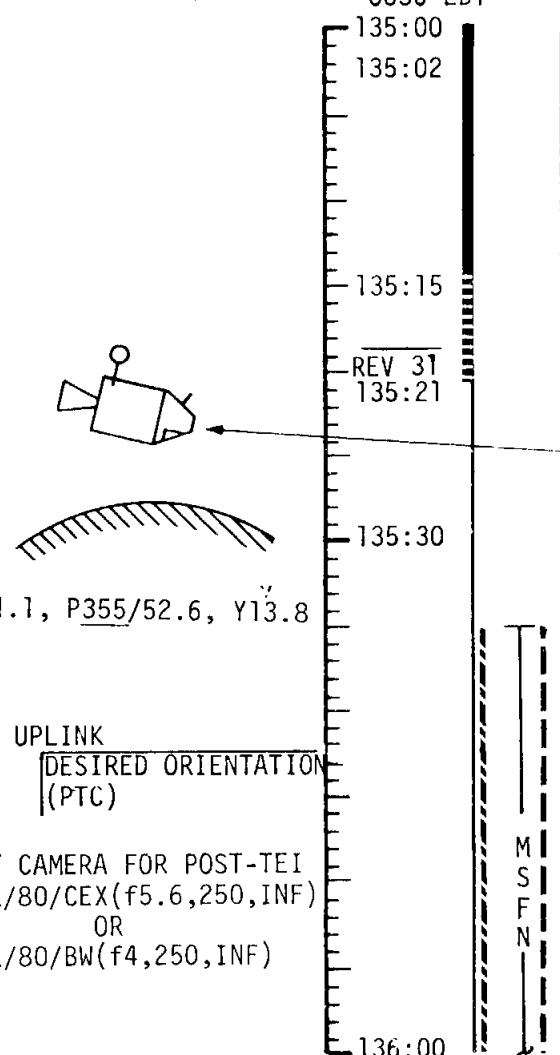
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TEI  
BURN CHART

	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
TEI	10°/SEC TAKEOVER	+10° TAKEOVER	BT + 2 SEC & $\Delta V_c = -40$ FPS	TRIM X AND Z AXIS TO 0.2 FPS
TEI ABORT MODES				
TEI $V_{G0}$	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 + 2 HRS P37 AT SPHERE OF INFLUENCE HYPERBOLIC ( $\Delta V$ 580 to 0, BT 125-149)	

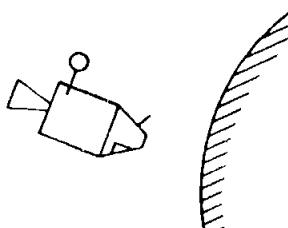
MCC-H

0030 EDT



## **FLIGHT PLAN**

SPS THRUST - P40  
ROLL TO BURN ATT  
R181.1, P280.4/52.6, Y13.8



SXT STAR CK

DAP CONFIGURATION FOR TEI  
CSM, 5°DB, 0.2°/SEC  
A/C ROLL, 4 JET

EMS AV TEST

SM RCS CK

GDC ALIGN TO IMU

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 ACO MOON

IMU REALIGN - P52  
OPTION 1 - PREFERRED  
AND STAR CK

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

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

EL/80/BW(f4,250,INF)

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

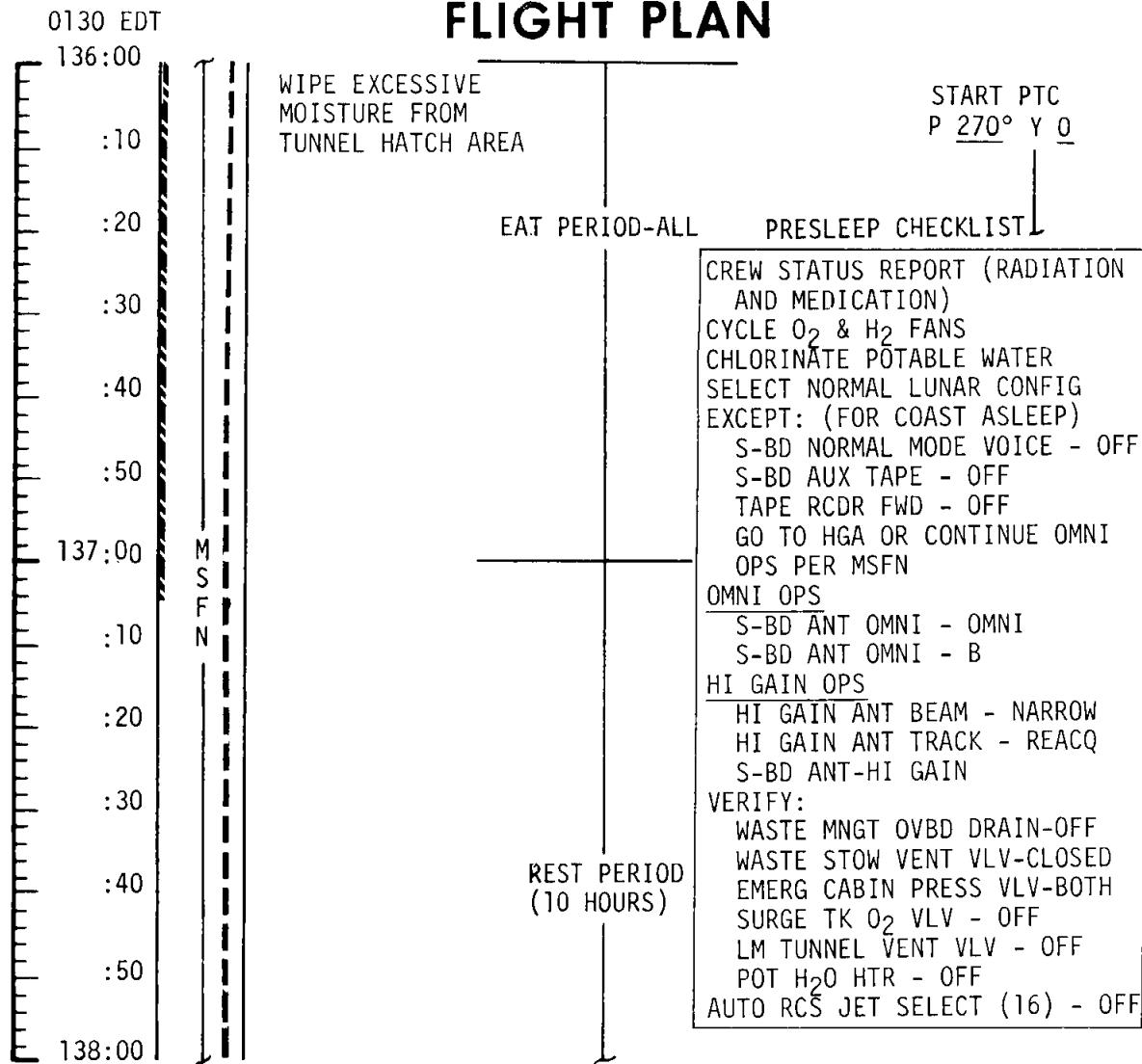
## **NOTES**

## BURN STATUS REPORT

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

MCC-H

## FLIGHT PLAN



## NOTES

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

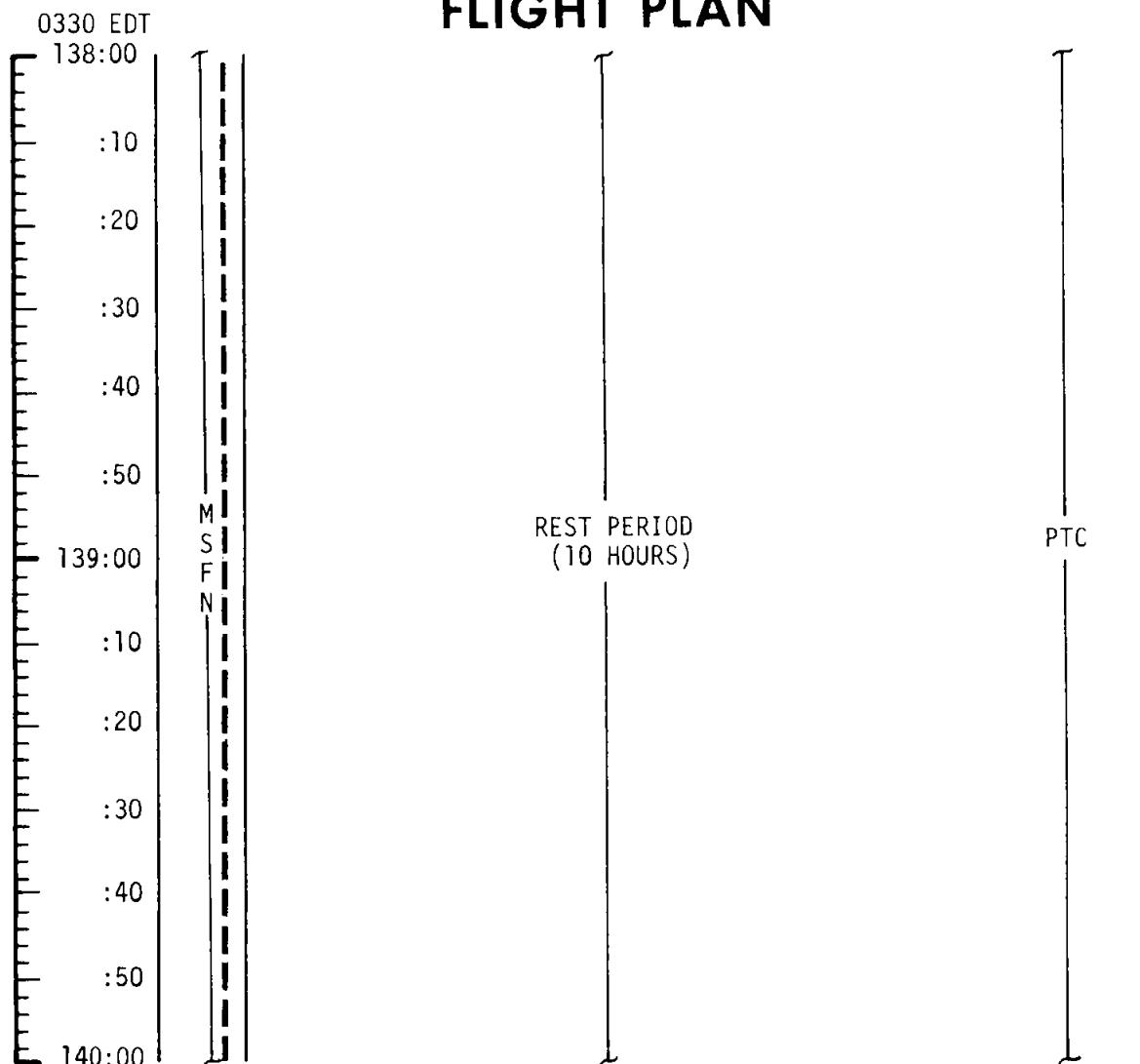
## ONBOARD READOUT

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	136:00 - 138:00	6/TEC	3-102

**MCC-H**

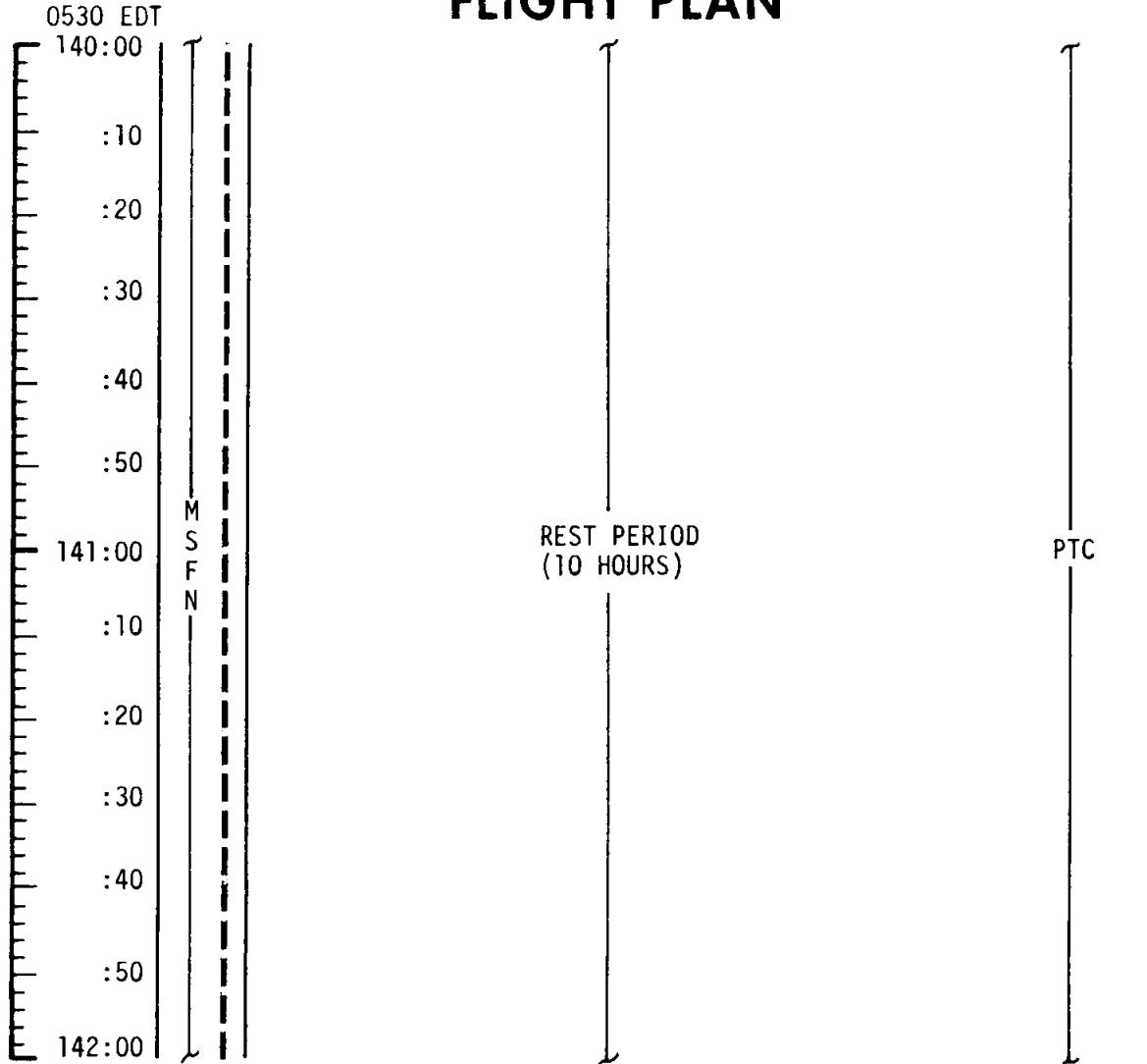
# FLIGHT PLAN

**NOTES**

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**

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

MSC Form 29 (May 69)

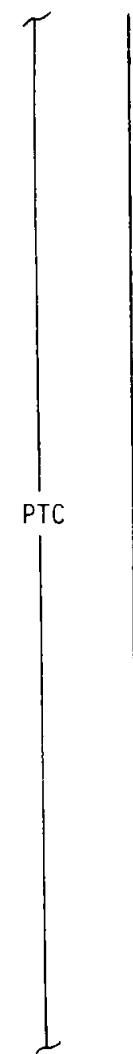
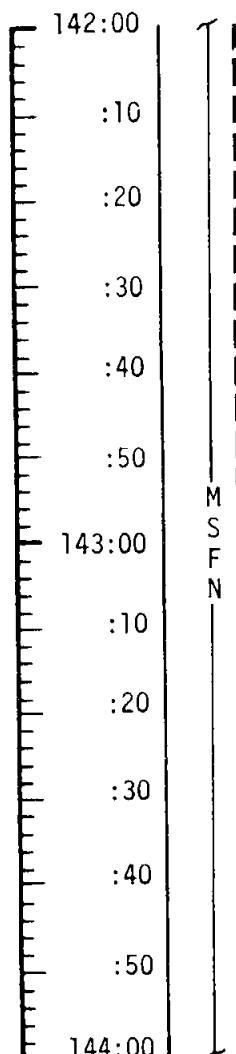
**FLIGHT PLANNING BRANCH**

MCC-H

# FLIGHT PLAN

NOTES

0730 EDT

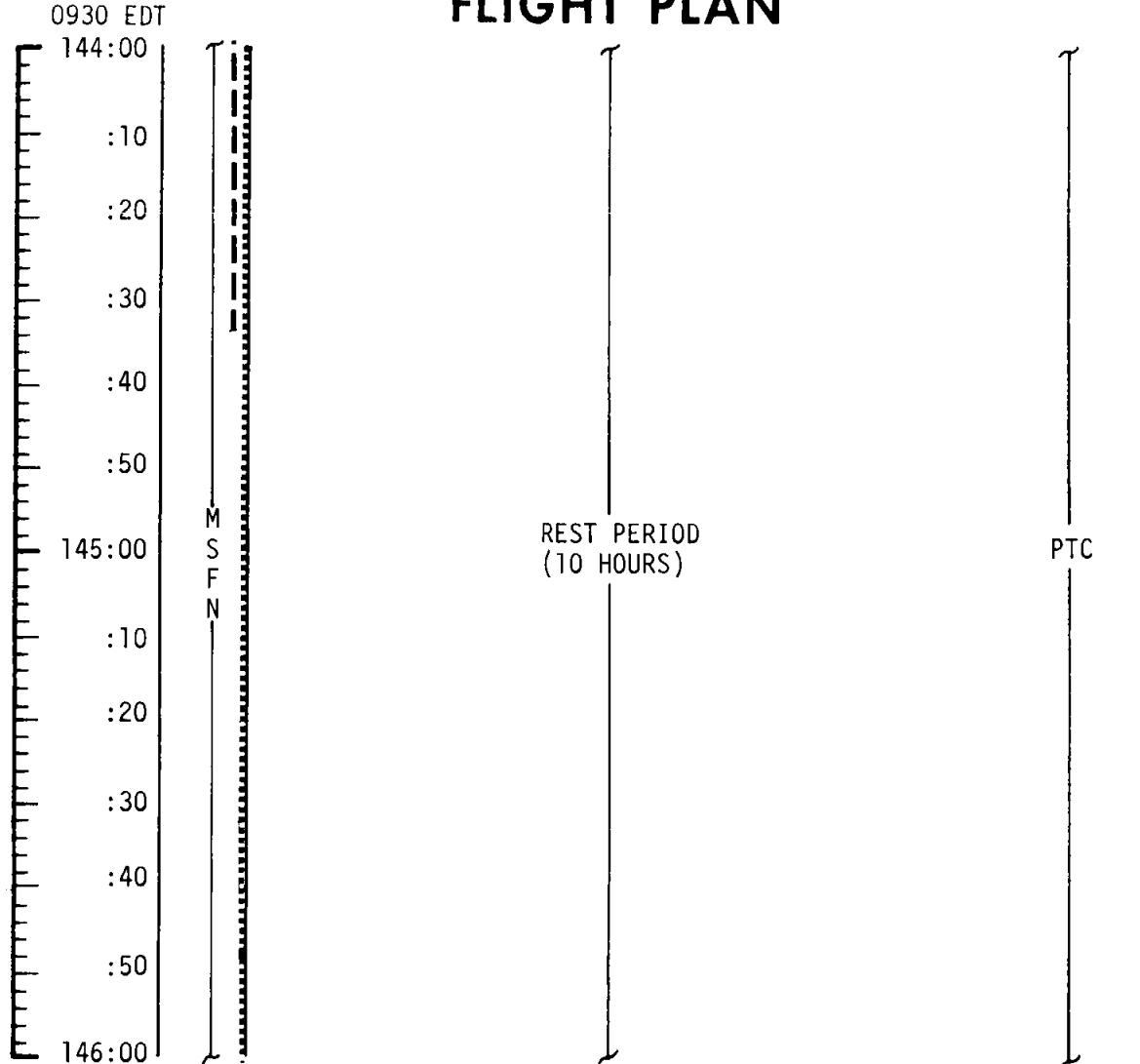


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	142:00 - 144:00	6/TEC	3-105

MCC-H

## FLIGHT PLAN

NOTES



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

MSC Form 29 (May 69)

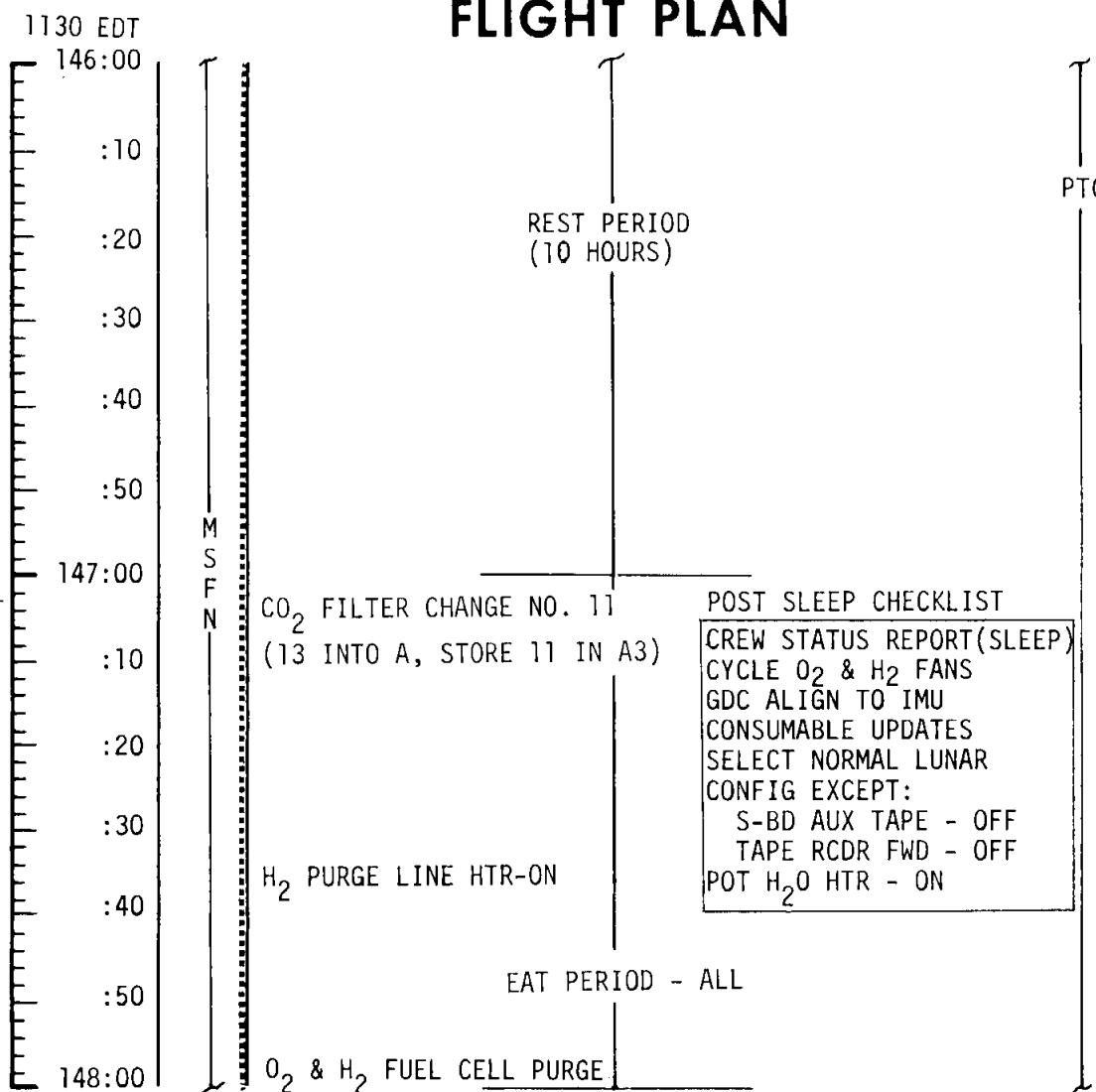
FLIGHT PLANNING BRANCH

MCC-H

## FLIGHT PLAN

## NOTES

PHOTO AS CONVENIENT

EARTH:  
EL/250/CEX-RING  
(11,250,INF)MOON:  
EL/250/BW-RING  
(5.6,250,INF)

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<sub>2</sub> TOT \_\_\_\_\_

O<sub>2</sub> TOT \_\_\_\_\_

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

**MCC-H**

# FLIGHT PLAN

**UPLINK**

CSM STATE VECTOR  
MCC5 TGT LOAD

1330 EDT

148:00

:10

:20

:30

:40

:50

149:00

:10

:20

:30

:40

:50

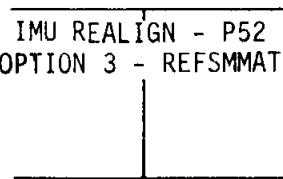
150:00

M S F N

WIPE EXCESSIVE MOISTURE  
FROM TUNNEL HATCH AREAV66 - TRANS CSM STATE VECTOR TO  
LM SLOT

RECORD MCC5 MNVR PAD

IMU REALIGN - P52  
OPTION 3 - REFSMMAT



EXT ΔV - P30

SPS/RCS THRUST - P40/41

**NOTES**

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

PTC

P52 (PTC REFSMMAT)

N71: \_\_\_\_\_

N05: \_\_\_\_\_

N93:

X \_\_\_\_\_

Y \_\_\_\_\_

Z \_\_\_\_\_

GET \_\_\_\_\_ : \_\_\_\_\_ :

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

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MCC  
BURN CHART

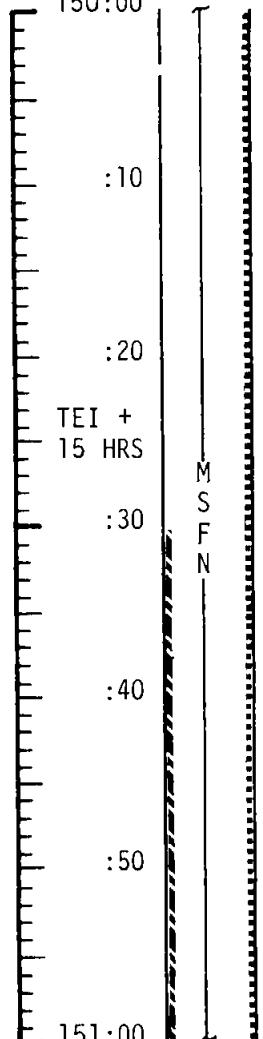
	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC5	10°/SEC TAKEOVER	10° TAKEOVER	BT + 1 SEC	TRIM X AXIS ONLY

3-108a

MCC-H

## FLIGHT PLAN

NOTES

1530 EDT  
150:00

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

## BURN STATUS REPORT

START PTC  
P 270° Y 0

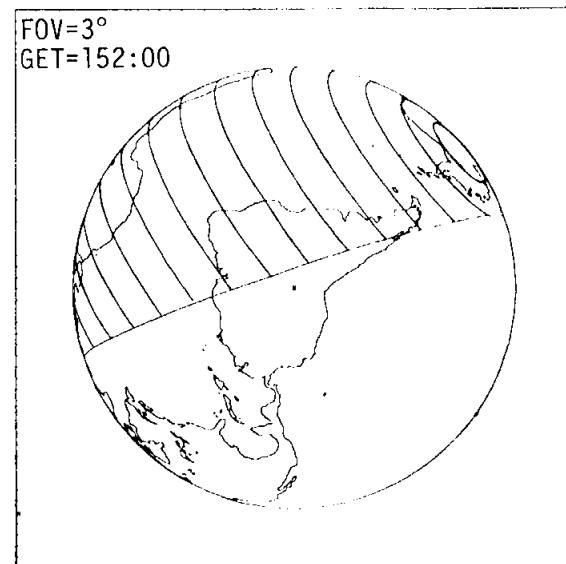
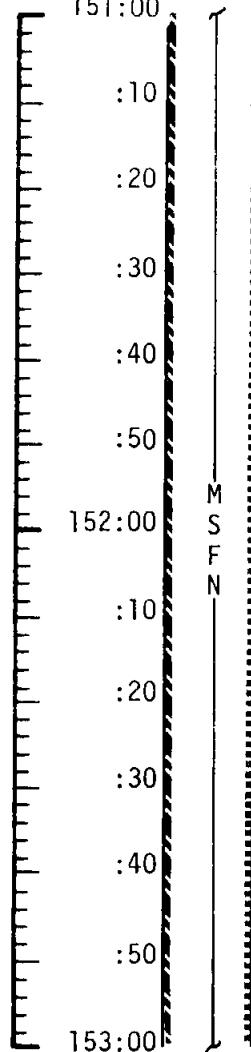
PTC

X X	□	•	ATIG
X X	•	•	BT
□	•	•	V <sub>gx</sub>
— TRIM —		•	R
X X X			P
X X X			Y
X X X			V <sub>gy</sub>
□		•	V <sub>gz</sub>
□		•	ΔV <sub>c</sub>
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	150:00 - 151:00	7/TEC	3-109

**MCC-H**1630 EDT  
151:00

# FLIGHT PLAN

**NOTES**

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

MSC Form 29 (May 69)

**FLIGHT PLANNING BRANCH**

**MCC-H**

# FLIGHT PLAN

**NOTES**

1830 EDT

153:00  
:10  
:20  
:30  
:40  
:50  
154:00  
:10  
:20  
:30  
:40  
:50  
155:00M  
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

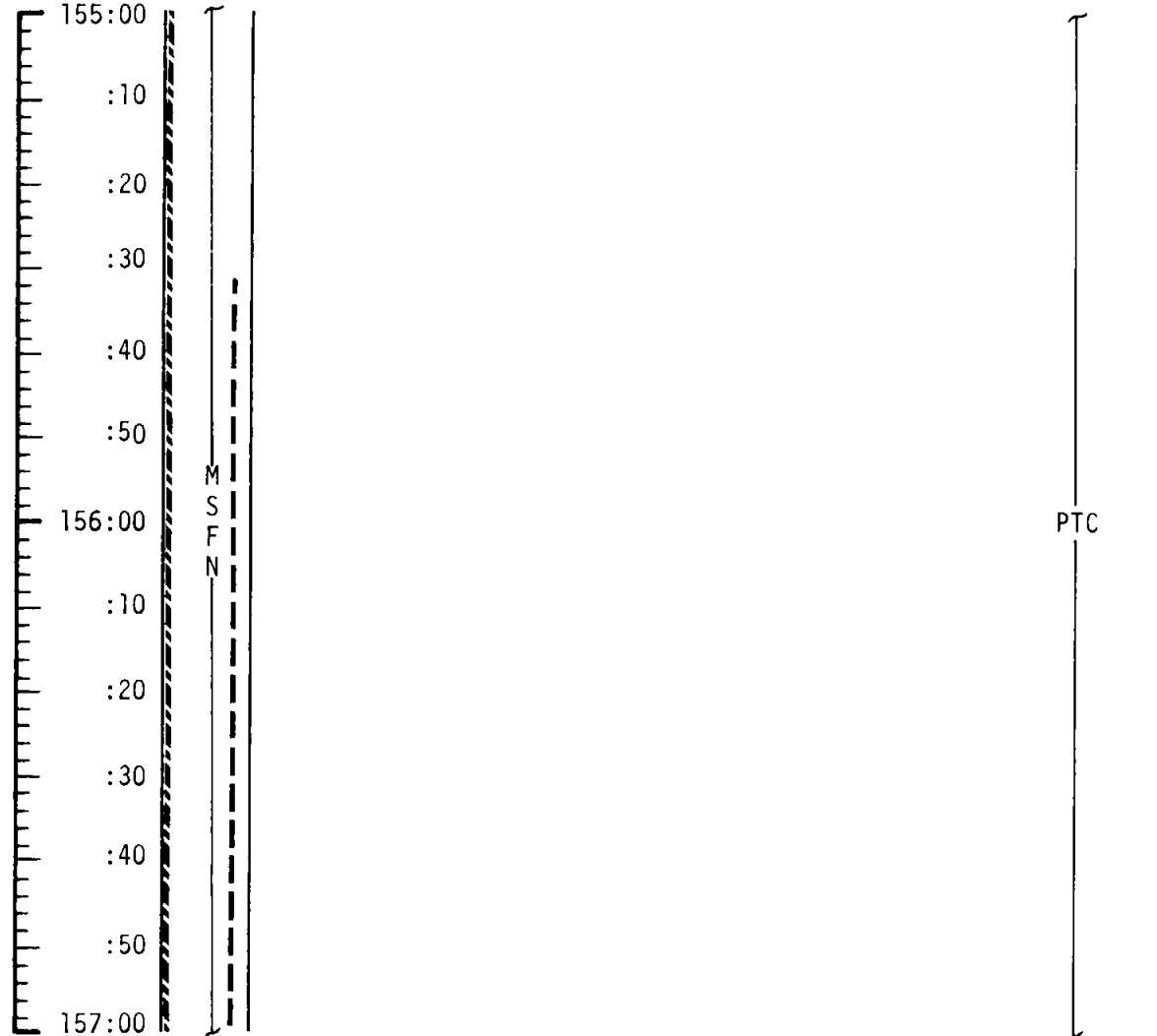
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	153:00 - 155:00	7/TEC	3-111

MCC-H

2030 EDT

## FLIGHT PLAN

NOTES



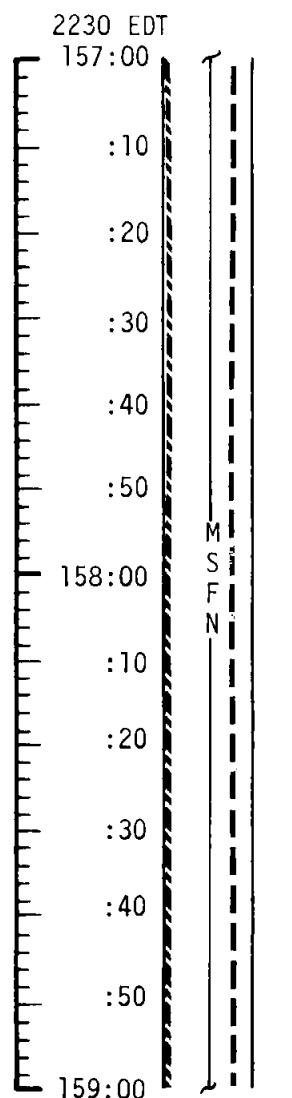
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	155:00 - 157:00	7/TEC	3-112

MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

**MCC-H**

# FLIGHT PLAN

**NOTES**

PTC

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

WIPE EXCESSIVE MOISTURE  
FROM TUNNEL HATCH AREA  
O<sub>2</sub> FUEL CELL PURGE  
  
CO<sub>2</sub> FILTER CHANGE NO. 12  
(14 INTO B, STORE 12 IN A3)

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	157:00 - 159:00	7/TEC	3-113

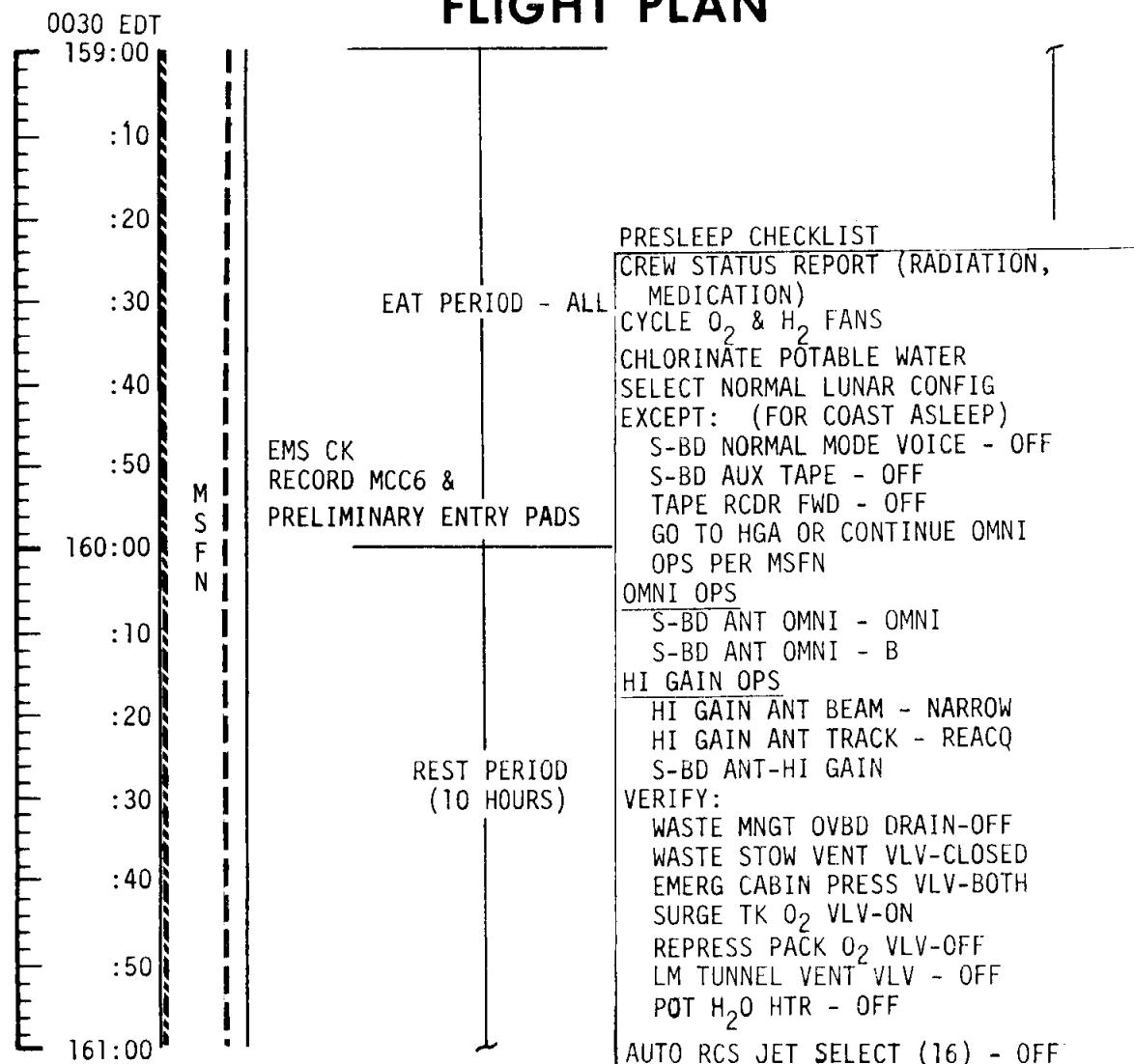
MCC-H

## FLIGHT PLAN

NOTES

UPDATE

PRELIMINARY MCC6  
MNVR PAD &  
ENTRY PAD  
(ASSUMES MCC6)

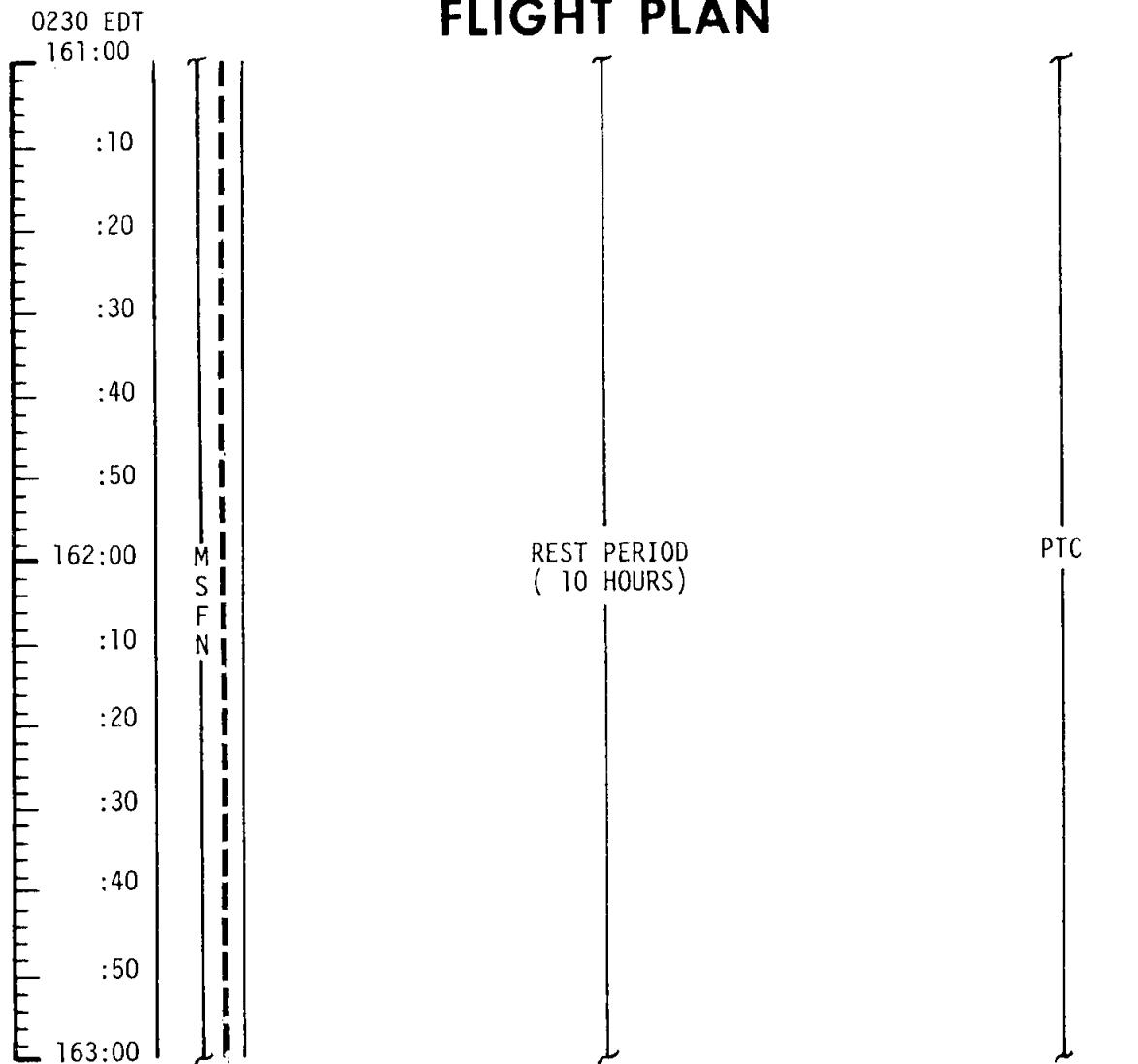


ON BOARD READOUT	
BAT C	
PYRO BAT A	
PYRO BAT B	
RCS A	
B	
C	
D	
DC IND SEL TO MNA OR MNB	

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

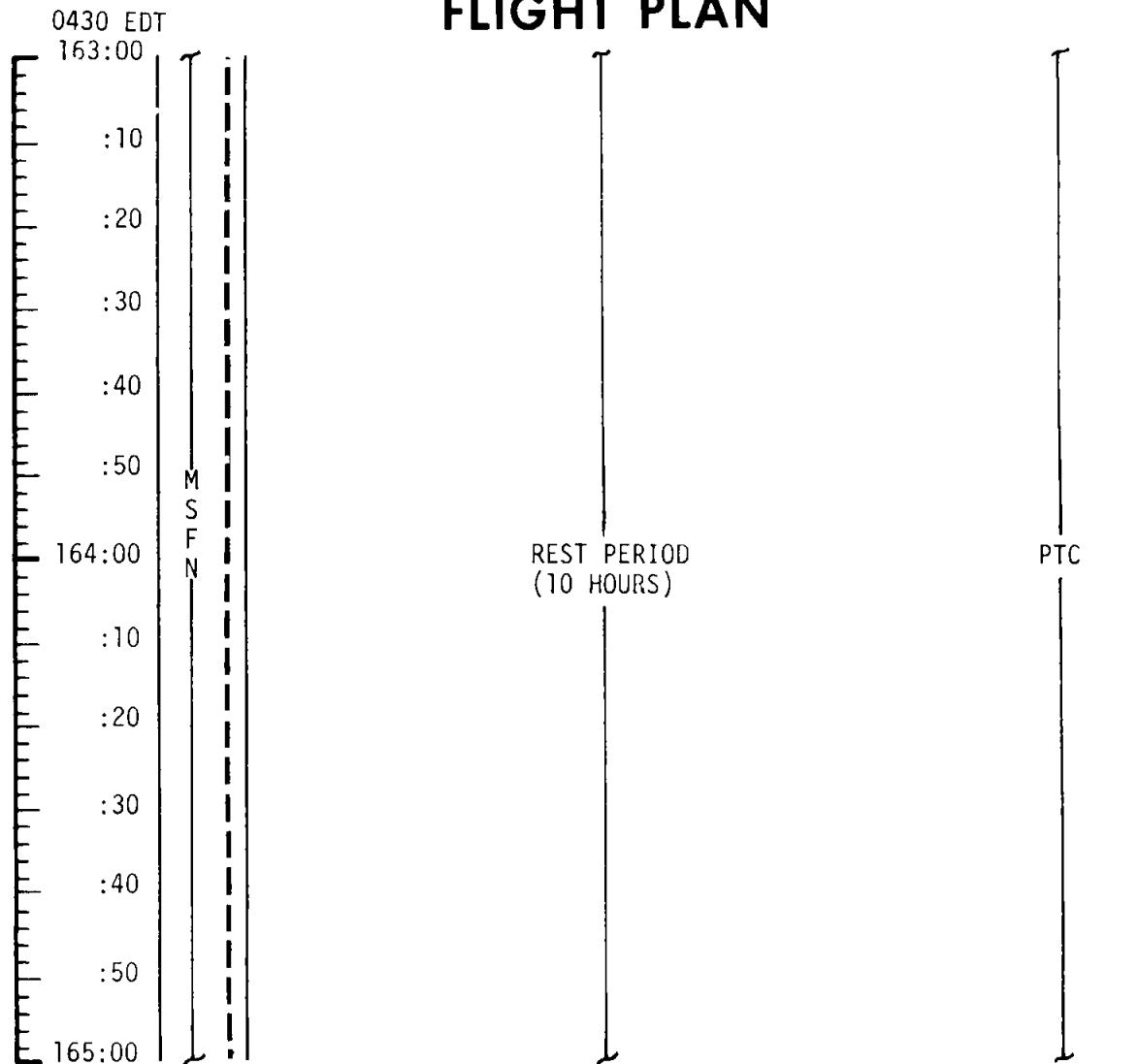
**NOTES**

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

MCC-M

## FLIGHT PLAN

NOTES



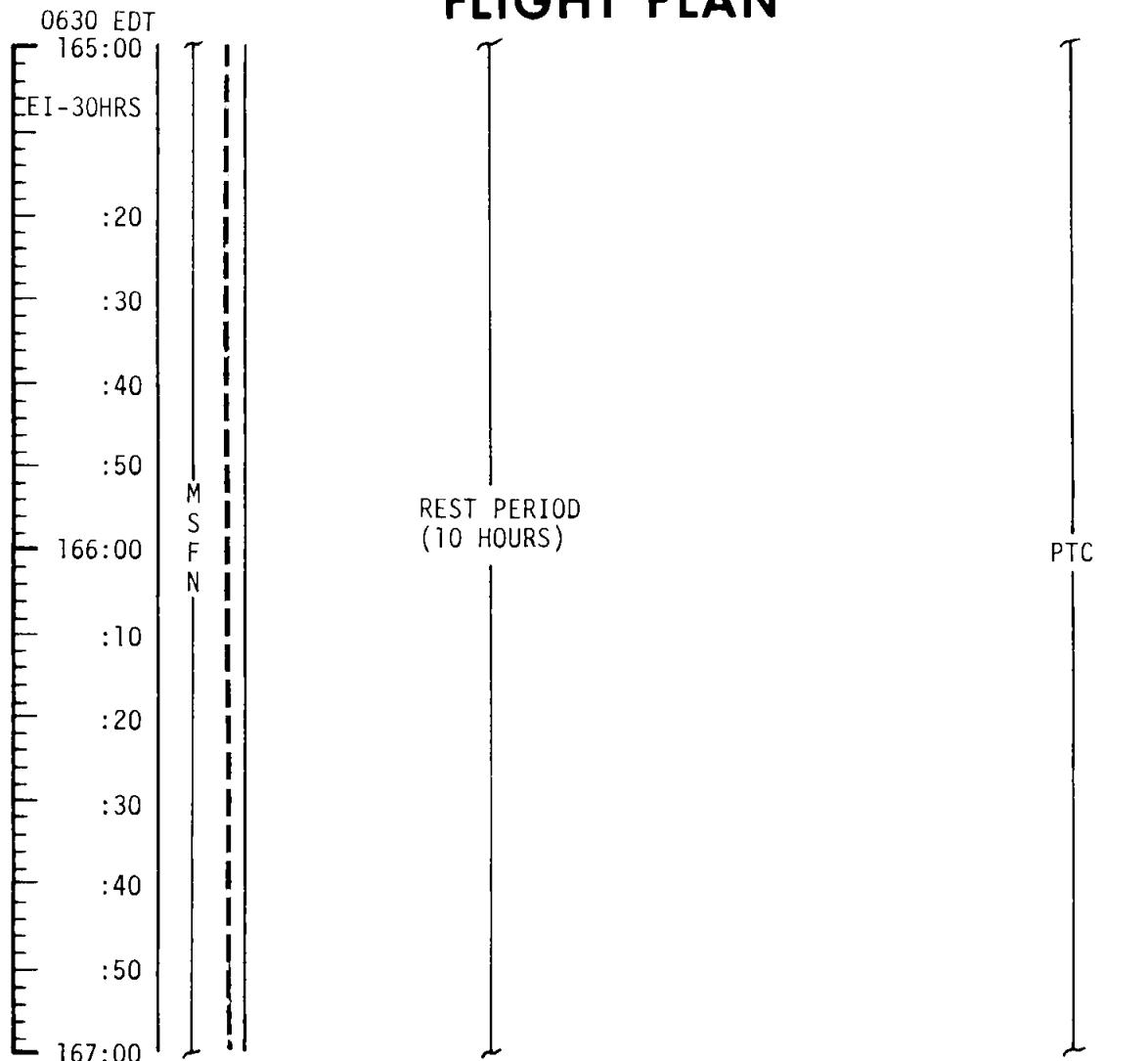
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	163:00 - 165:00	7/TEC	3-116

MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

**MCC-H**

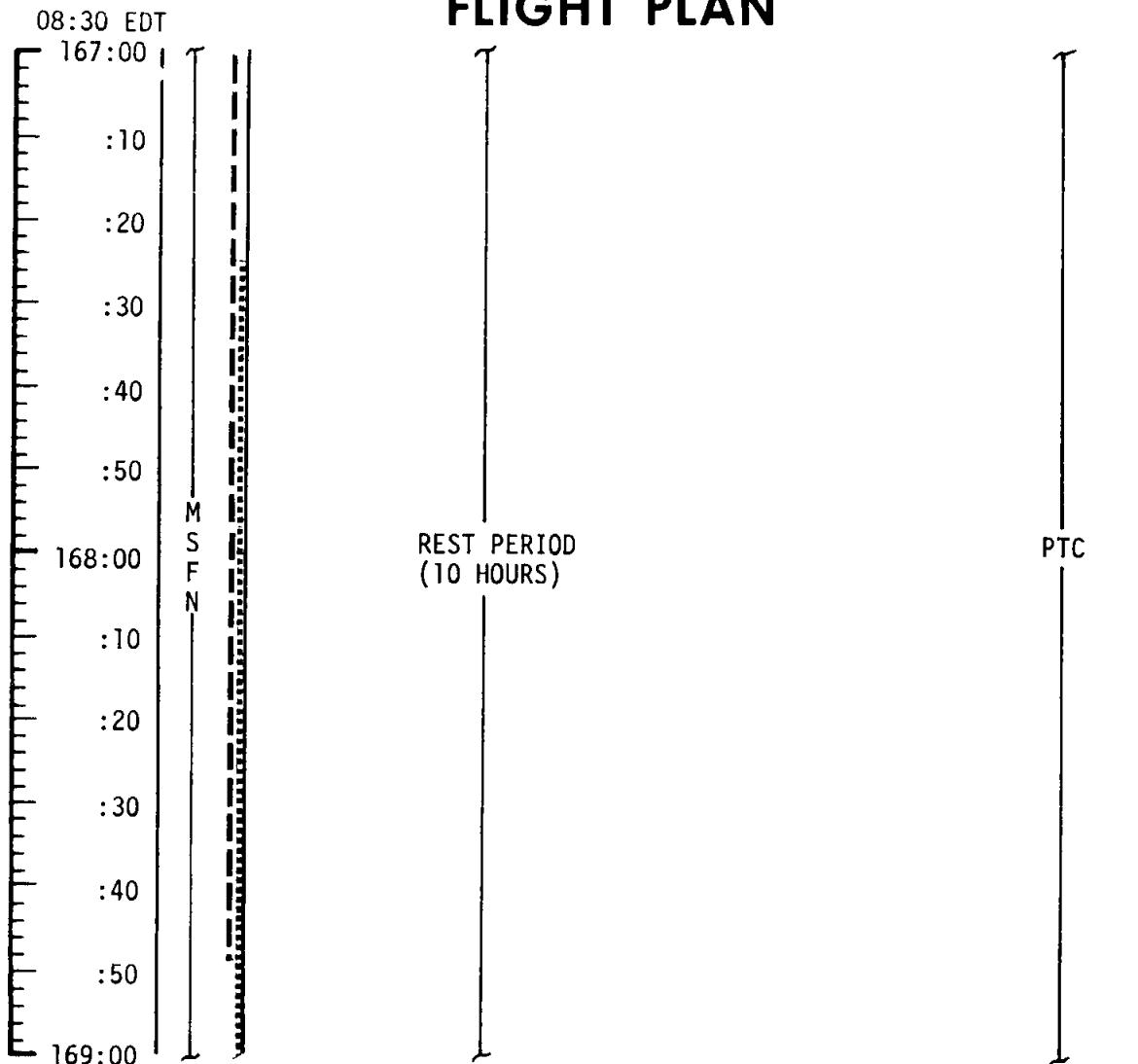
# FLIGHT PLAN

**NOTES**

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**

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

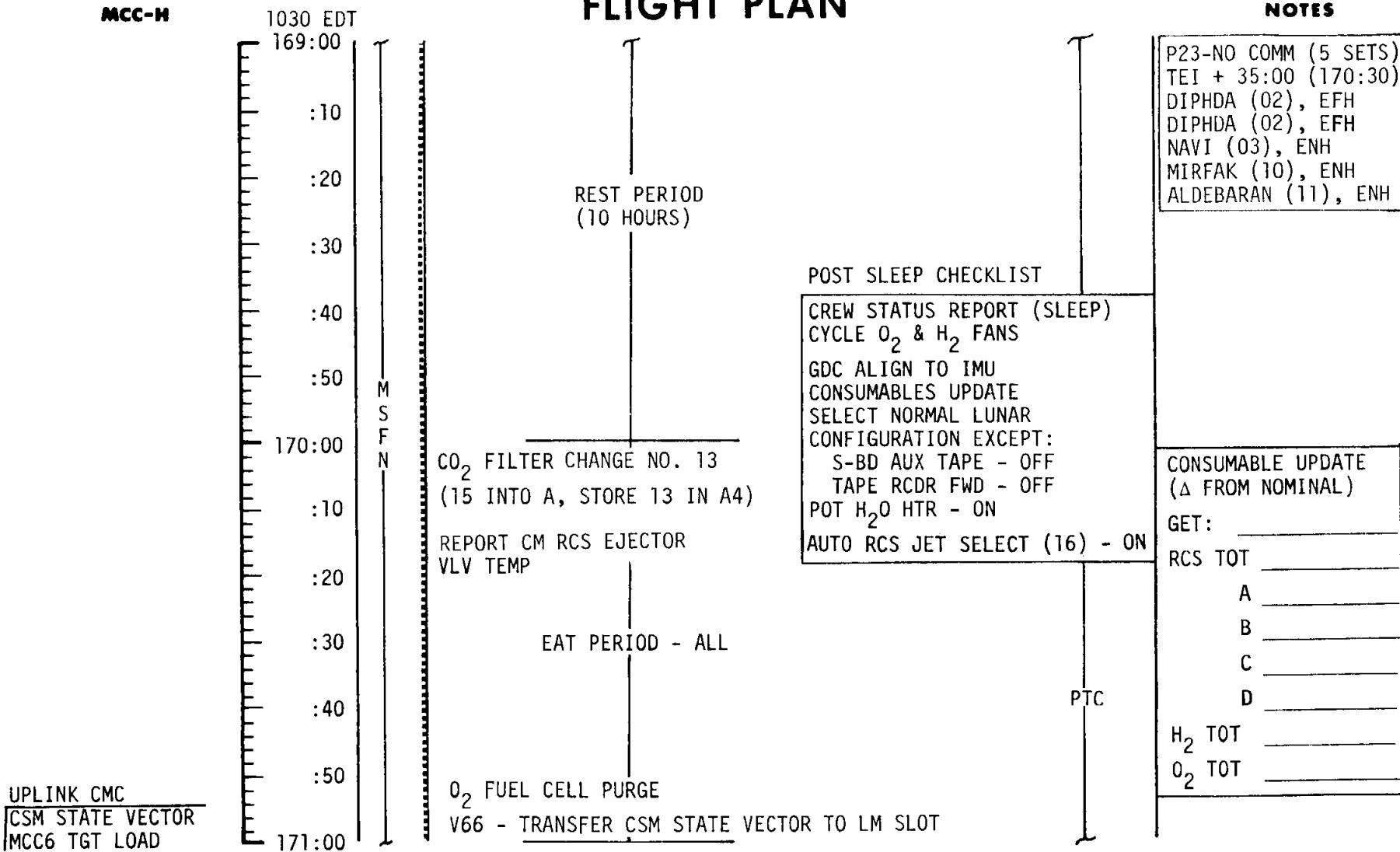
MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

MCC-H

## FLIGHT PLAN

NOTES



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

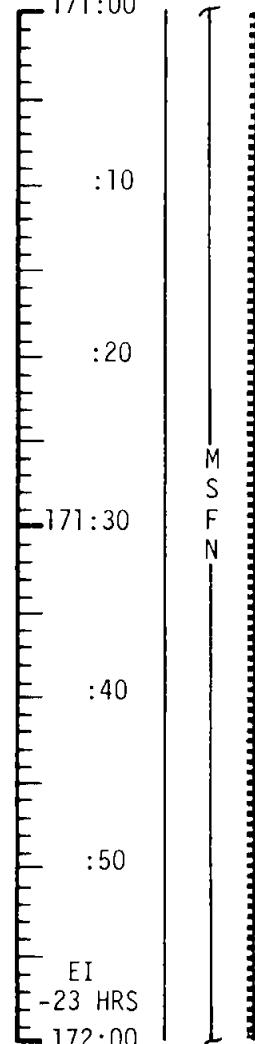
MCC  
BURN CHART

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

3-119a

**MCC-H**1230 EDT  
171:00

UPDATE  
**MCC6 PAD DATA**  
 ENTRY PAD  
 (ASSUMES  
 MCC6)

**FLIGHT PLAN****NOTES**

P52 - PTC REFSMMAT  
 N71: \_\_\_\_  
 N05: \_\_\_\_  
 N93:  
 X \_\_\_\_.  
 Y \_\_\_\_.  
 Z \_\_\_\_.  
 GET \_\_\_\_ : \_\_\_\_ :

**BURN STATUS REPORT**

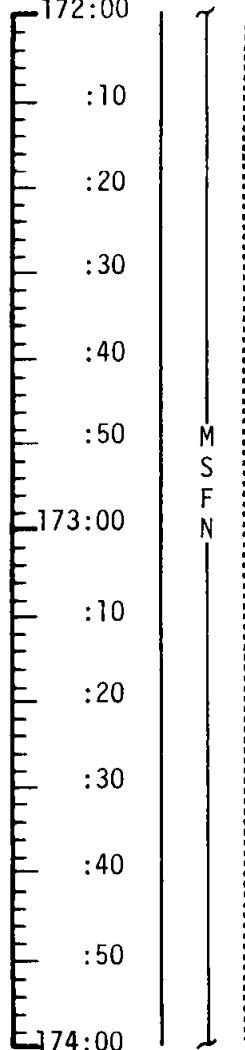
X X	□	•	$\Delta V_{TIG}$
X X	□	•	BT
□	•	•	$V_{gx}$
X X X	•	•	R
X X X	•	•	P
X X X	•	•	Y
□	•	•	$V_{gy}$
□	•	•	$V_{gz}$
□	•	•	$\Delta V_c$
X X X	•	•	FUEL
X X X	•	•	OX
X X X	•	•	UNBAL

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

MCC-H

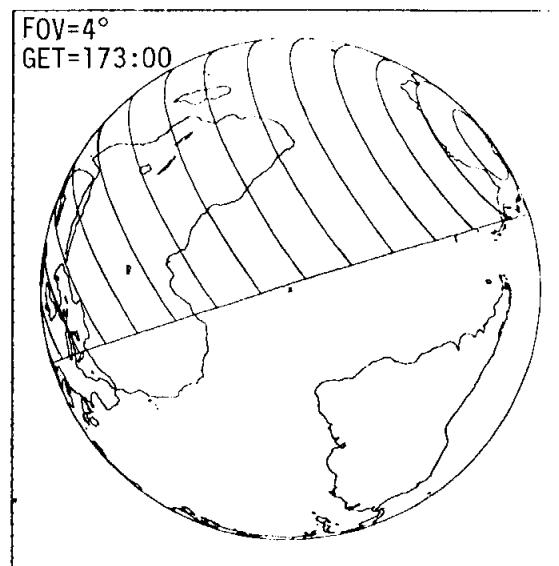
1330 EDT

172:00



# FLIGHT PLAN

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



START PTC  
 P 270° Y 0

PTC

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

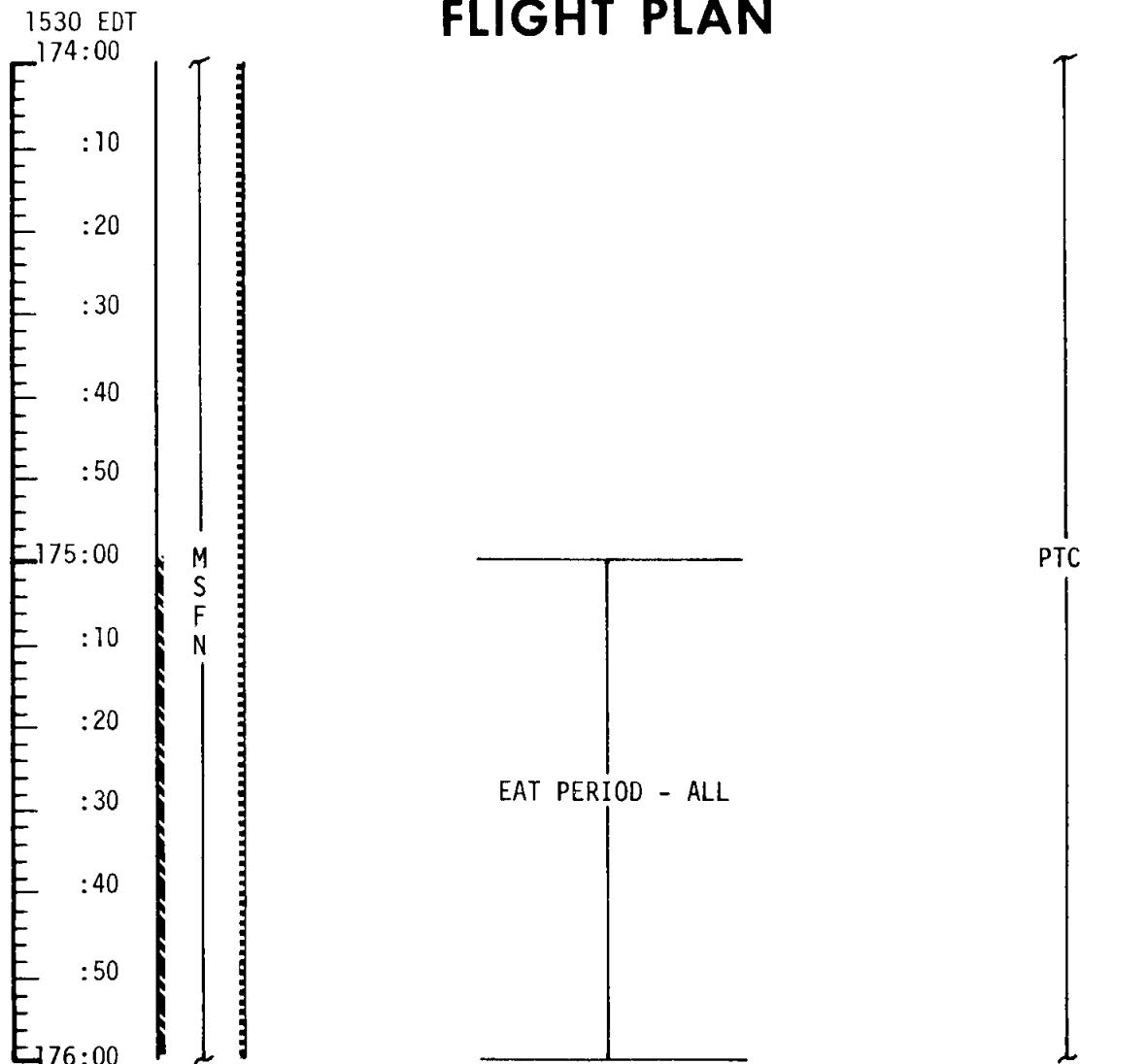
MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

MCC-H

# FLIGHT PLAN

NOTES



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

**MCC-H**

# FLIGHT PLAN

**NOTES**1730 EDT  
176:00:10  
:20  
:30  
:40  
:50  
  
177:00  
:10  
:20  
:30  
:40  
:50  
  
178:00M  
S  
F  
N

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

MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

**MCC-H**

# FLIGHT PLAN

**NOTES**

1930 EDT

178:00  
:10  
:20  
:30  
:40  
:50  
179:00  
:10  
:20  
:30  
:40  
:50  
180:00M  
S  
F  
N

PTC

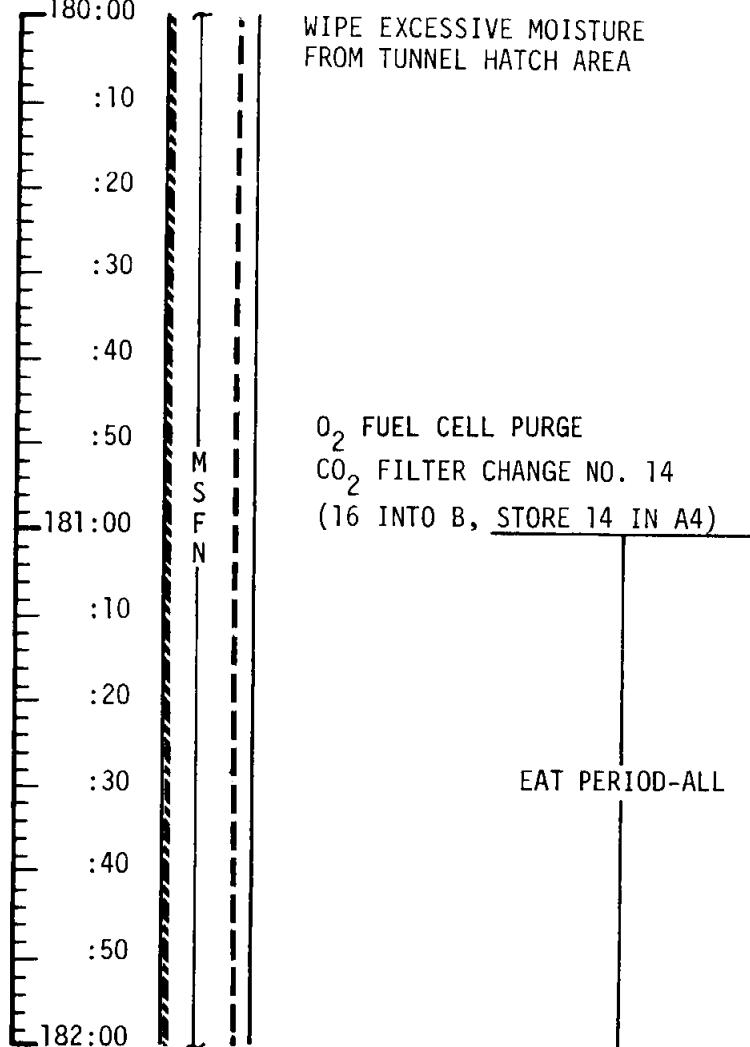
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	178:00 - 180:00	8/TEC	3-124

MCC-H

## FLIGHT PLAN

2130 EDT

180:00



## NOTES

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

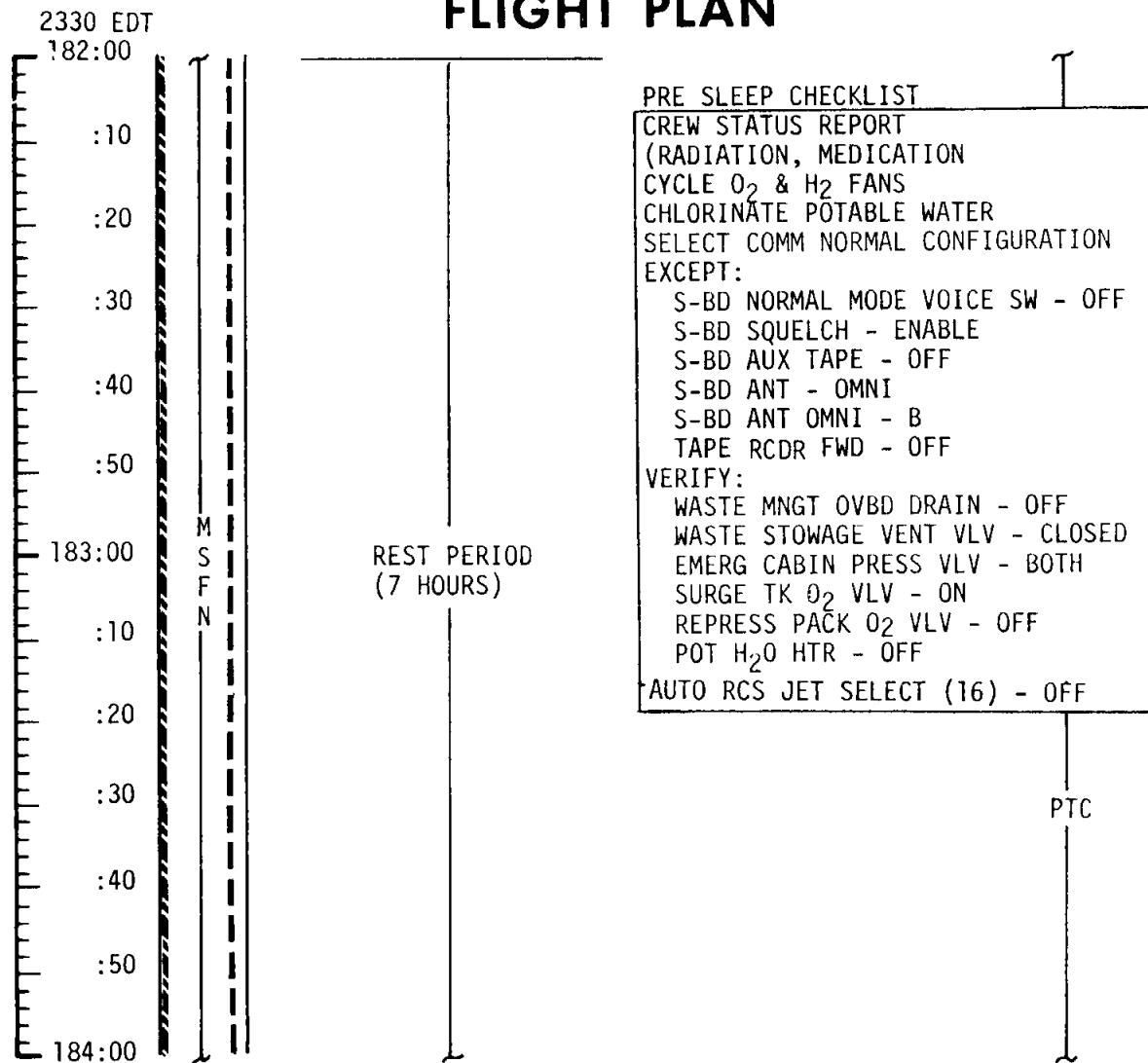
MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

MCC-H

## FLIGHT PLAN

NOTES



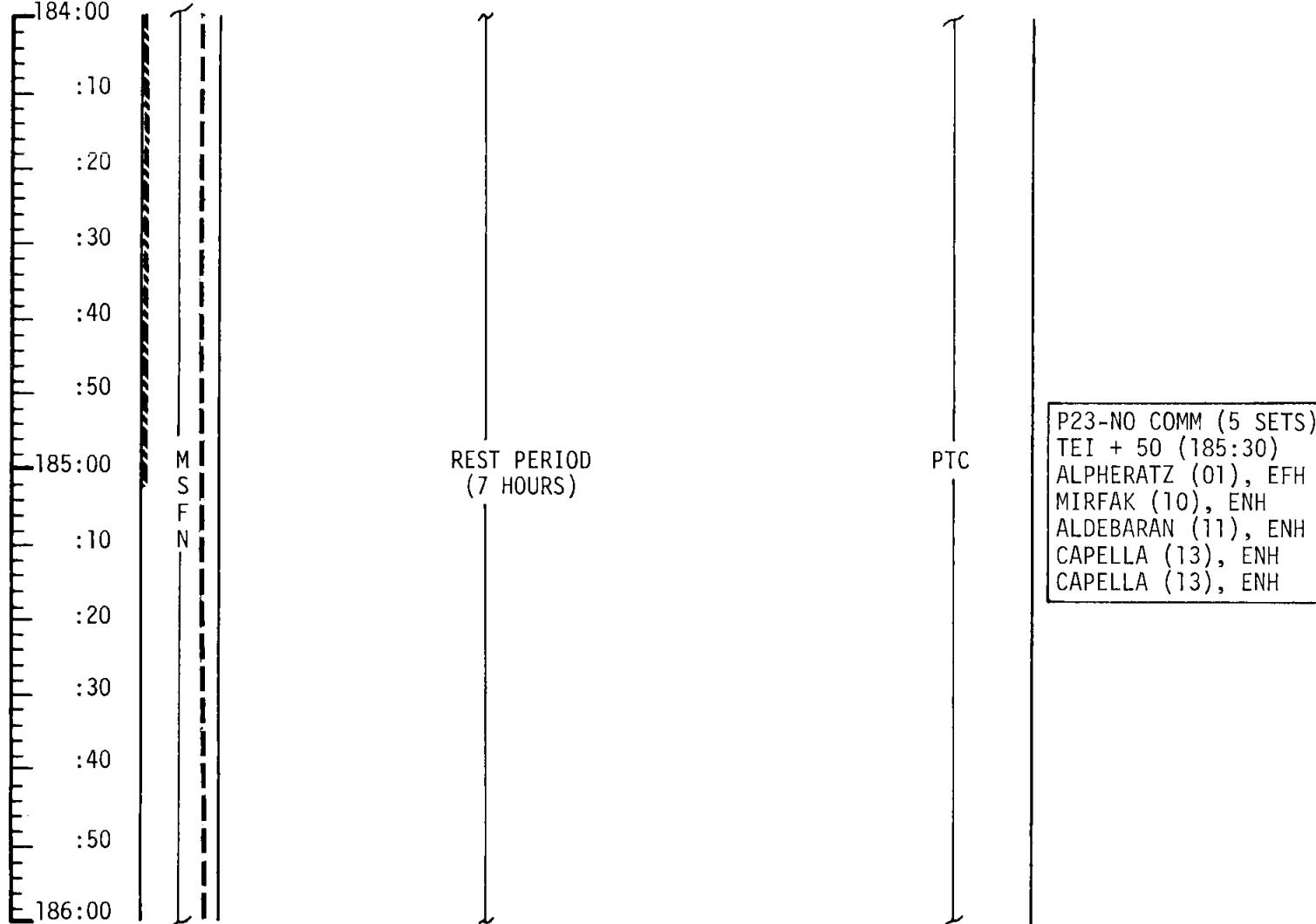
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	182:00 - 184:00	8/TEC	3-126

MCC-H

0130 EDT  
184:00

## FLIGHT PLAN

NOTES



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

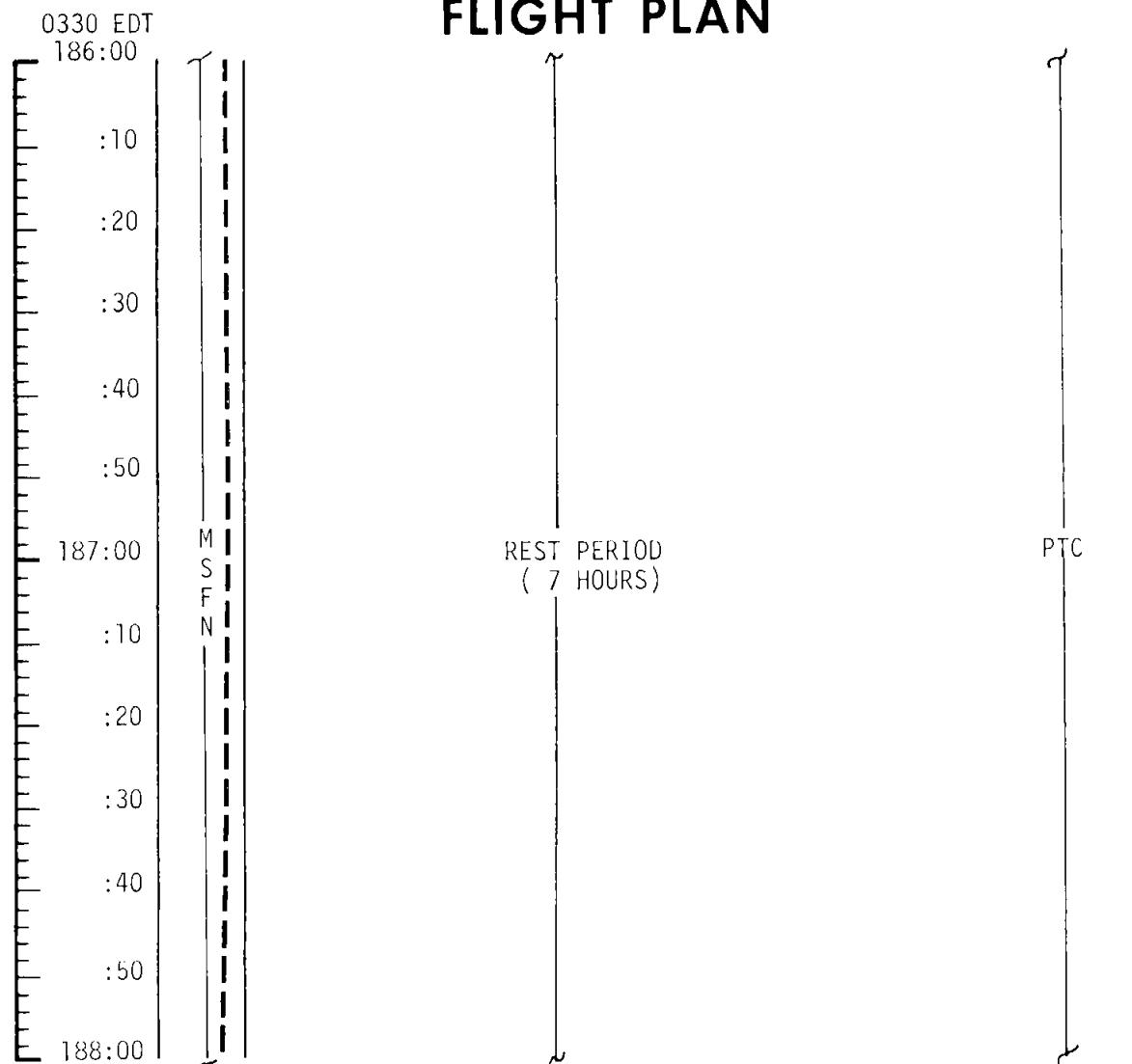
MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

MCC-H

# FLIGHT PLAN

NOTES



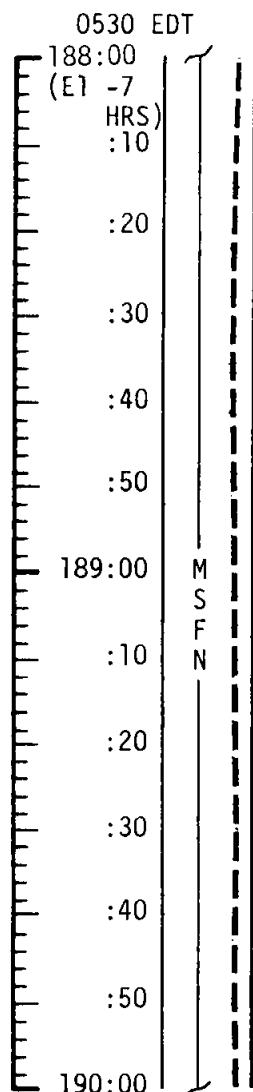
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	186:00 - 188:00	8/TEC	3-128

MCC-H

## FLIGHT PLAN

NOTES

GO/NO GO

REST PERIOD  
( 7 HOURS)

POST SLEEP CHECKLIST

CREW STATUS REPORT (SLEEP)  
CYCLE O<sub>2</sub> & H<sub>2</sub> FANS  
GDC ALIGN TO IMU  
CONSUMABLES UPDATE  
SELECT COM NORMAL LUNAR  
CONFIGURATION EXCEPT:  
S-BD AUX TAPE - OFF  
TAPE RCDR FWD - OFF  
POT H<sub>2</sub>O HTR - ON  
AUTO RCS JET SELECT (16) - ON

CONSUMABLE UPDATE (Δ FROM NOMINAL)
GET: _____
RCS TOT _____
A _____
B _____
C _____
D _____
H <sub>2</sub> TOT _____
O <sub>2</sub> TOT _____

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

PTC

EAT PERIOD-ALL

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

**MCC-H**

# FLIGHT PLAN

**NOTES**

UPLINK CMC

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

0730 EDT

190:00  
(EI -5  
HRS)

:10

:20

190:30

:40

:50

191:00

DON MAE WEST &amp; FOOT RESTRAINTS

V66 - TRANS CSM STATE VECTOR TO LM SLOT

UPLINK CMC

MCC7 MNVR PAD  
ENTRY PAD

M  
S  
F  
N

RECORD MCC7 MNVR PAD &amp; ENTRY PAD

PTC

EPS CHECK

SPS CHECK  
CM RCS MON CK

SM RCS MON CK

C &amp; W SYS CK

CMC SELF TEST

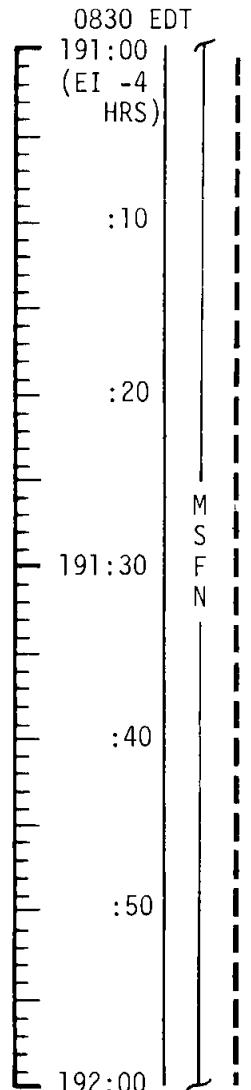
DSKY COND LT TEST

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

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

**MCC-H**

# FLIGHT PLAN



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

**NOTES**

P52 (ENTRY REFSMMAT)

N71: \_\_\_\_ , \_\_\_\_

N05: \_\_\_\_ . \_\_\_\_

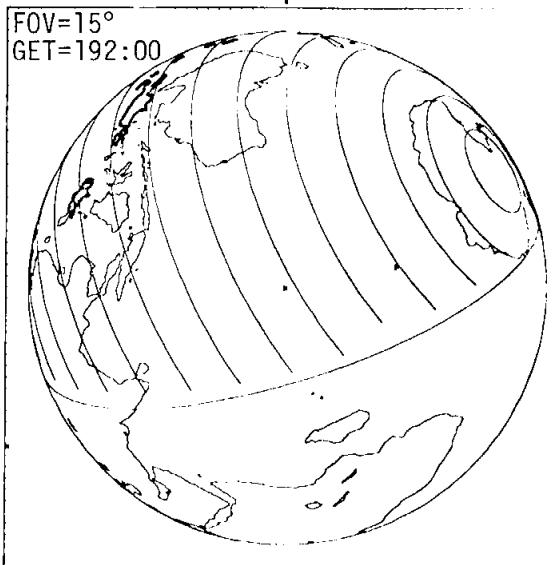
N93:

X \_\_\_\_ . \_\_\_\_

Y \_\_\_\_ . \_\_\_\_

Z \_\_\_\_ . \_\_\_\_

GET \_\_\_\_ : \_\_\_\_ :



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

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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

3-131a

**MCC-H**

0930 EDT

**FLIGHT PLAN****NOTES**192:00  
(EI -3  
HRS)

:10

MCC7  $\Delta V$ =NOMINALLY ZERO

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

:20

M  
S  
F  
N

192:30

:40

:50

GO/NO GO

193:00

GO/NO GO FOR PYRO ARM SEQUENCE  
VHF ACTIVATION**BURN STATUS REPORT**

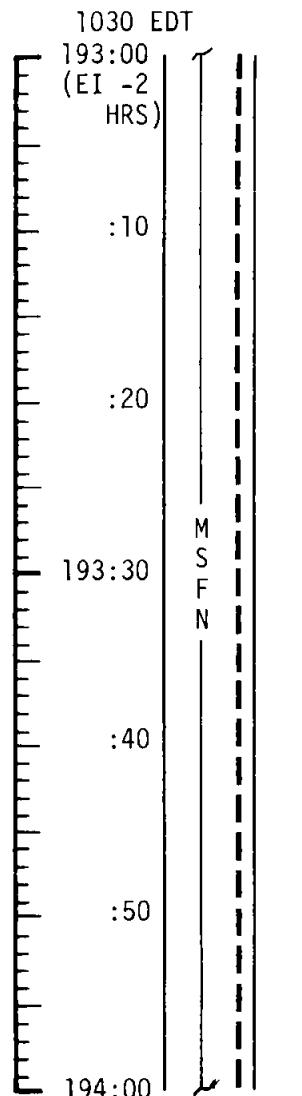
X X	□	•	$\Delta TIG$
X X	•	•	BT
□	•	•	$V_gx$
TRIM			
X X X			R
X X X			P
X X X			$Y$
□			$V_gx$
□			$V_gy$
□			$V_gz$
•			$\Delta V_c$
•			
X X			FUEL
X X X			OX
X X X			UNBAL

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

MCC-H

## FLIGHT PLAN

NOTES



LOGIC SEQUENCE CHECK

MNVR TO ENTRY ATTITUDE

COAS STAR CHECK

SXT STAR CHECK

IMU REALIGN - P52  
(OPTION 3 - REFSMMAT)GDC ALIGN TO IMU  
CM RCS PREHEAT

P52 (ENTRY REFSMMAT)

N71: \_\_\_\_ , \_\_\_\_

N05: \_\_\_\_ . \_\_\_\_

N93:

X \_\_\_\_ . \_\_\_\_

Y \_\_\_\_ . \_\_\_\_

Z \_\_\_\_ . \_\_\_\_

GET \_\_\_\_ : \_\_\_\_ : \_\_\_\_

I

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

**MCC-H**

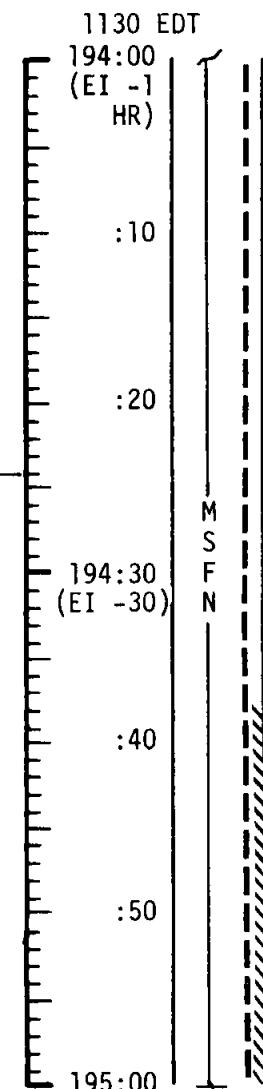
# FLIGHT PLAN

**NOTES**

UPDATE  
 ENTRY PAD  
 RCVY PAD

UPLINK  
 CSM STATE VECTOR

GO FOR PYRO ARM



PRIMARY EVAPORATOR ACTIVATION

FINAL GDC DRIFT CHECK  
TERM CM RCS PRFHEATSECONDARY EVAPORATOR ACTIVATION  
PYRO BATTERY CHECK  
RECORD ENTRY PAD AND RECOVERY DATA

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

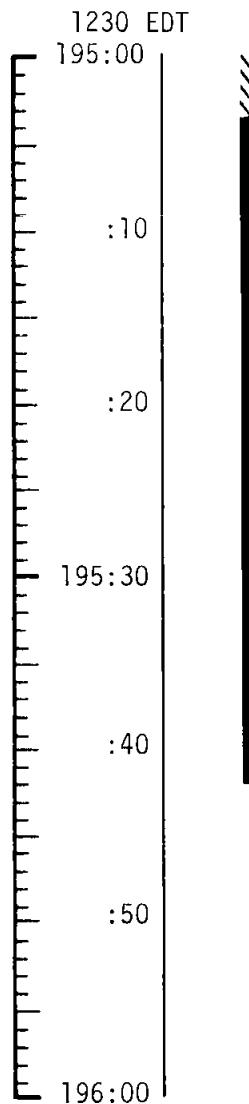
SET DET TO RRT  
EMS INITIALIZATION  
RSI ALIGN TO GDC  
CM RCS CK  
ENTRY BATT'S - ONSEPARATION CHECKLIST  
GO FOR PYRO ARMP61 ENTRY PREP  
MNVR TO CM/SM SEP ATT**CM/SM SEP**P62 - ENTRY ATTITUDE  
MNVR TO ENTRY ATT

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

MCC-H

## FLIGHT PLAN

NOTES



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	195:00 - 196:00	9/TEC	3-135

SECTION IV

SECTION IV - DETAILED TEST OBJECTIVES

## 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

<u>ACTIVITY</u>	<u>FTO</u>
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 A-1	Contingency Sample Collection Provide a Contingency Lunar Surface Sample	Surface Sample Collection	4-13
B B-1	Lunar Surface EVA Operations Demonstrate Egress-To/Ingress-From the Lunar Surface	EVA Preparation and Egress Post EVA Operations	4-10 4-21
B-2	Evaluate Crew Lunar Surface EVA Capability	EVA Preparation and Egress	4-10
C C-1 C-2 C-3	EMU Lunar Surface Operations EMU Capability to Provide a Habitable Environment EMU Effects on Crew Mobility, Dexterity & Comfort Demonstrate EVA Data/Voice Communications	EVA Preparation and Egress EVA Preparation and Egress EVA Preparation and Egress	4-10 4-10 4-10
D D-1	Landing Effects on LM LM Landing Gear Performance Under Landing Conditions	LM Descent External LM Observ/Photo	4-6 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 E-1	Lunar Surface Characteristics Data on Behavior/Characteristics of the Lunar Surface	Surface Sample Collection Lunar Surface Observ/Photo	4-13 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 F-1 F-2	Bulk Sample Collection Collect Rock Samples and Fine Grained Material Photograph Collection Area of Samples	Surface Sample Collection Surface Sample Collection	4-13 4-13

TABLE 4-2  
TEST OBJECTIVE/MISSION ACTIVITY  
CROSS REFERENCE

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

## 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 O<sub>2</sub> 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] (HD)
  - 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)

## LUNAR SURFACE OBSERVATIONS AND PHOTOGRAPHY

### 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 the 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 O<sub>2</sub> 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

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:

TABLE 5-1      SM RCS Propellant Loading And Usage Summary

TABLE 5-2      SM RCS Budget

TABLE 5-3      CM RCS Propellant Summary

TABLE 5-4      SPS Propellant Summary

TABLE 5-5      SPS Assumptions

TABLE 5-6      LM RCS Propellant Loading And Usage Summary

TABLE 5-7      LM RCS Budget

TABLE 5-8      DPS Propellant Summary

TABLE 5-9      DPS Assumptions

TABLE 5-10      APS Propellant Summary

TABLE 5-11      APS Assumptions

FIGURE 5-1      Total SM RCS Propellant Profile

FIGURE 5-2      Quad A SM RCS Propellant Profile

FIGURE 5-3      Quad B SM RCS Propellant Profile

FIGURE 5-4      Quad C SM RCS Propellant Profile

FIGURE 5-5      Quad D SM RCS Propellant Profile

FIGURE 5-6      Total LM RCS Propellant Profile

## 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 cutage due to loaded mixture ratio	15.6
Total trapped	26.4
Gauging inaccuracy	80.4
<hr/>	<hr/>
Deliverable SM-RCS propellant	1220.0
<hr/>	<hr/>
Nominal usage	590
Translunar phase (through LCI-2)	204
Lunar orbit phase	311
Transearth Phase (includes TEI)	75
<hr/>	<hr/>
Nominal remaining	630 lb

TABLE 5-2

TIME (HR)	EVENT	(a)		(b)	
		S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
0.0	MISSION G	63457.	.0	1220.0	100.
0.0	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 SIVB 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 SIVB 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.

(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)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
4.0	TAILOFF	96467.	.7	1157.2	95.
4.5	DAMP SHUTDOWN TRANSIENT	96466.	1.1	1156.1	95.
5.5	PSZ IMU ALIGN	96466.	.2	1155.9	95.
5.9	NAVIGATION SIGHTINGS ORIENT AT 0.2 DEG/SEC	96461.	4.4	1151.5	94.
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	PSZ 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.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
11.5	TAILOFF	96361.	.8	1129.7	93%
11.5	DAMP SHUT-DOWN TRANSIENT	96359.	1.1	1128.6	93%
12.0	PSZ IMU ALIGN	96359.	.2	1128.4	92%
12.5	ORIENT FOR PTC 3AXIS U+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 U+3 DEG/SEC	96354.	.4	1123.1	92%
24.2	TERMINATE PTC DAMP RATES	96349.	4.4	1118.7	92%
24.3	PSZ IMU ALIGN	96349.	.2	1118.5	92%
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 TU 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 = NUMINALLY ZERO	96335.	.0	1104.7	91%
27.0	ORIENT FOR PTC 3AXIS U+2 DEG/SEC	96331.	4.2	1100.5	90%
27.0	ATTITUDE HOLD 0.5 DEG DB PGNCS	96330.	.8	1099.7	90%

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
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	PSZ IMU ALIGN	96325.	.2	1094.7	90.
53.6	MICOURSE 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	96316.	.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 SHUT-DOWN TRANSIENT	96238.	1.1	1086.2	89.
53.6	RCS TRIM 1 FPS	96227.	11.2	1075.0	88.
54.0	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC	96223.	4.1	1070.9	88.
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.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM-RCS LEFT (%)
70.0	PSZ 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	DEL VEL = NUM ZERO	96212.	.0	1059.9	87.
72.7	PSZ 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 SHUT DOWN TRANSIENT	72315.	1.1	1042.8	85.
76.2	REV 1 ATTITUDE HOLD WIDE DEADBAND	72312.	3.0	1039.8	85.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
77.5	P5Z IMU ALIGN	72312.	.1	1039.6	85.
78.2	REV 2 ATTITUDE HOLD	72309.	3.0	1036.6	85.
79.2	P5Z IMU ALIGN	72309.	.1	1036.5	85.
80.0	L01 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.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (\$HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (\$)
82.3	REDIRECT	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.
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 LUG SITE OBS ATT	71241.	3.5	981.8	80.
98.5	LUG 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.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
400.2	FORMATION FLYING	37883.	10.0	939.0	77.
400.2	REACQUIRE MSFN	37883.	.1	938.9	77.
400.6	ORIENT FOR SEP BURN	37880.	3.1	935.8	77.
400.7	RCS SEPARATION BURN 2.5 FPS	37868.	11.2	924.6	76.
400.7	REV 13 ATTITUDE HOLD	37865.	3.0	921.6	76.
401.5	MANEUVER TO SXT TRACKING	37862.	3.1	918.0	75.
402.6	MANEUVER TO SX1 TRACKING	37859.	3.1	915.5	75.
404.4	REACQUIRE MSFN ROLL 0.5 DEG/SEC	37859.	.3	915.3	75.
404.5	MANEUVER TO SXT TRACKING	37856.	3.1	912.2	75.
404.6	REV 14 ATTITUDE HOLD	37853.	3.0	909.2	75.
404.6	MNVR TO LDG SITE OBS ATT	37850.	3.1	906.1	74.
404.6	LDG SITE OBS	37850.	.4	905.7	74.
404.7	TRACK LM	37846.	3.1	902.6	74.
404.9	REACQUIRE MSFN ROLL 0.5 DEG/SEC	37846.	.3	902.3	74.
405.0	REV 15 ATTITUDE HOLD	37843.	3.0	899.3	74.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
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	PS2 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.
114.3	ORIENT FOR SEXTANT TRACKING	37698.	3.1	864.8	71.
115.0	MANEUVER TO SLEEP ATT	37697.	.7	864.1	71.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET						
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)	
120.0	DAMP RATES	37697.	.7	863.5	71.	
120.0	SEXTANT TRACKING	37695.	1.3	862.4	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 CS1 BURN	37663.	3.1	829.7	68.	
125.6	MANEUVER TO TRACK LM POST CS1	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.	

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
127.1	MANEUVER TO TRACK LM POST TPI	37636.	3.1	803.0	66.
127.1	MANEUVER TO COAS TRACK	37633.	3.1	799.7	66.
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 BURESIGHT	37574.	3.1	740.5	61.
128.0	DOCKING	43212.	26.0	714.5	54.
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.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HRS)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
132.0	TRACK LM	37540.	.4	706.6	58.
132.6	HOLD INERTIAL ATT	37539.	.4	706.1	58.
132.6	PSZ IMU ALIGN	37539.	.7	705.5	58.
134.5	PSZ 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.
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	PSZ 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.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR.)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (#)
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	PS2 IMU ALIGN	27432.	.6	681.8	56.
150.0	MIDCOURSE CORRECTION NO 5 MNVR 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.
172.0	PS2 IMU ALIGN	27426.	.6	675.8	55.
172.5	MIDCOURSE CORRECTION NO 6 MNVR 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.

TABLE 5-2 (CONT'D)

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
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	PSZ 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 DS 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.

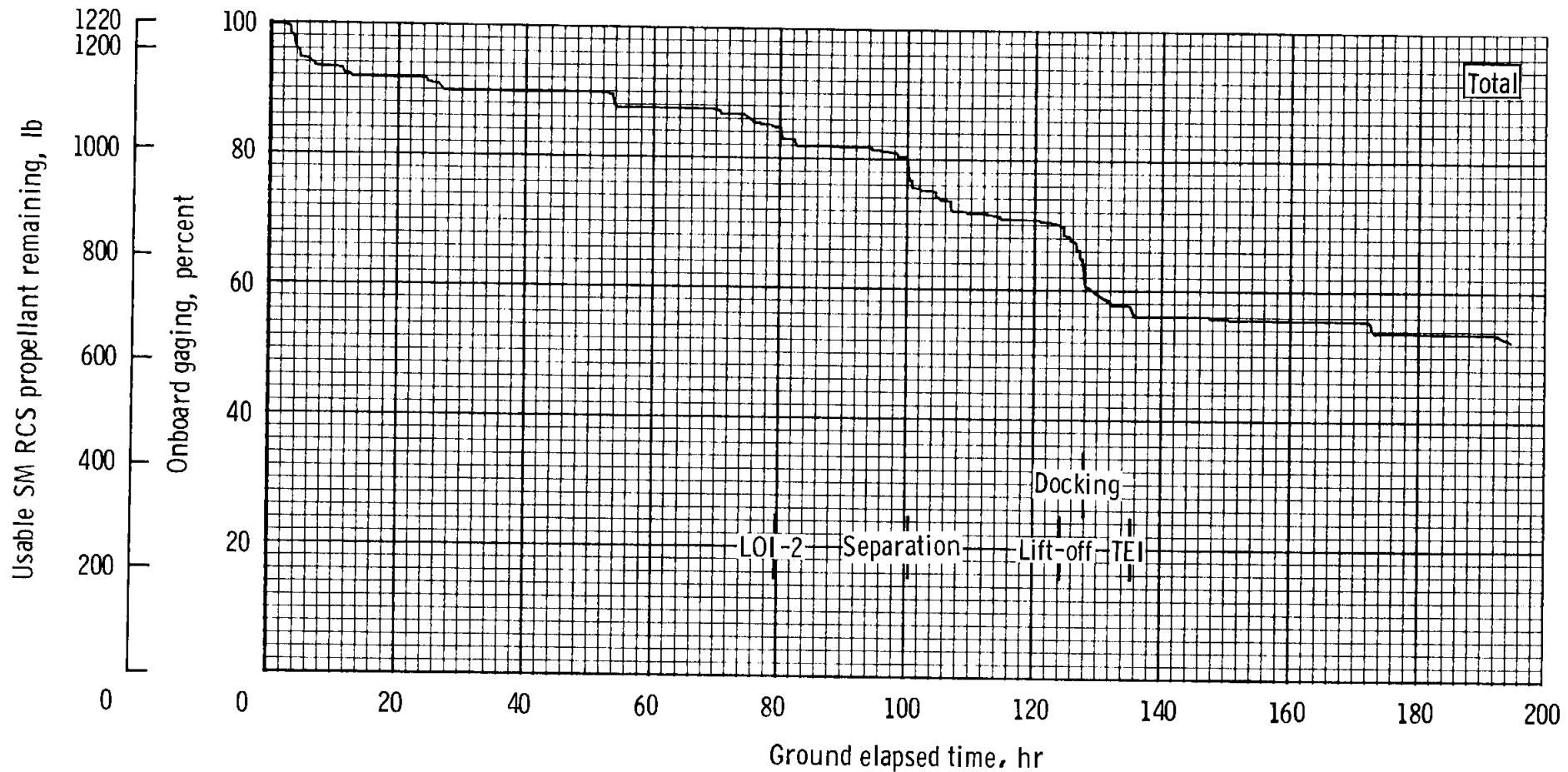


FIGURE 5-1  
SM RCS propellant profile - total.

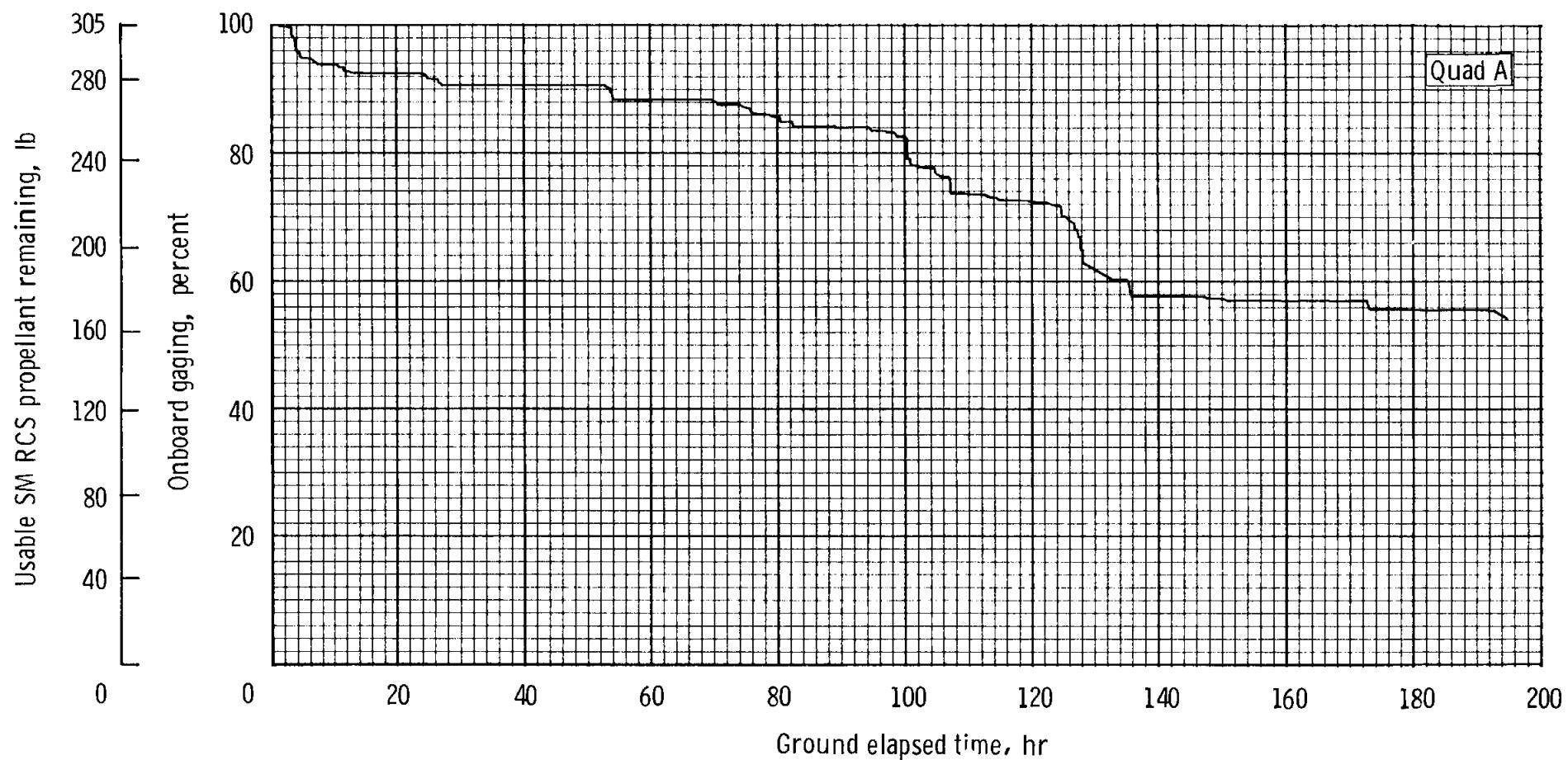


FIGURE 5-2  
SM RCS propellant profile - quad A.

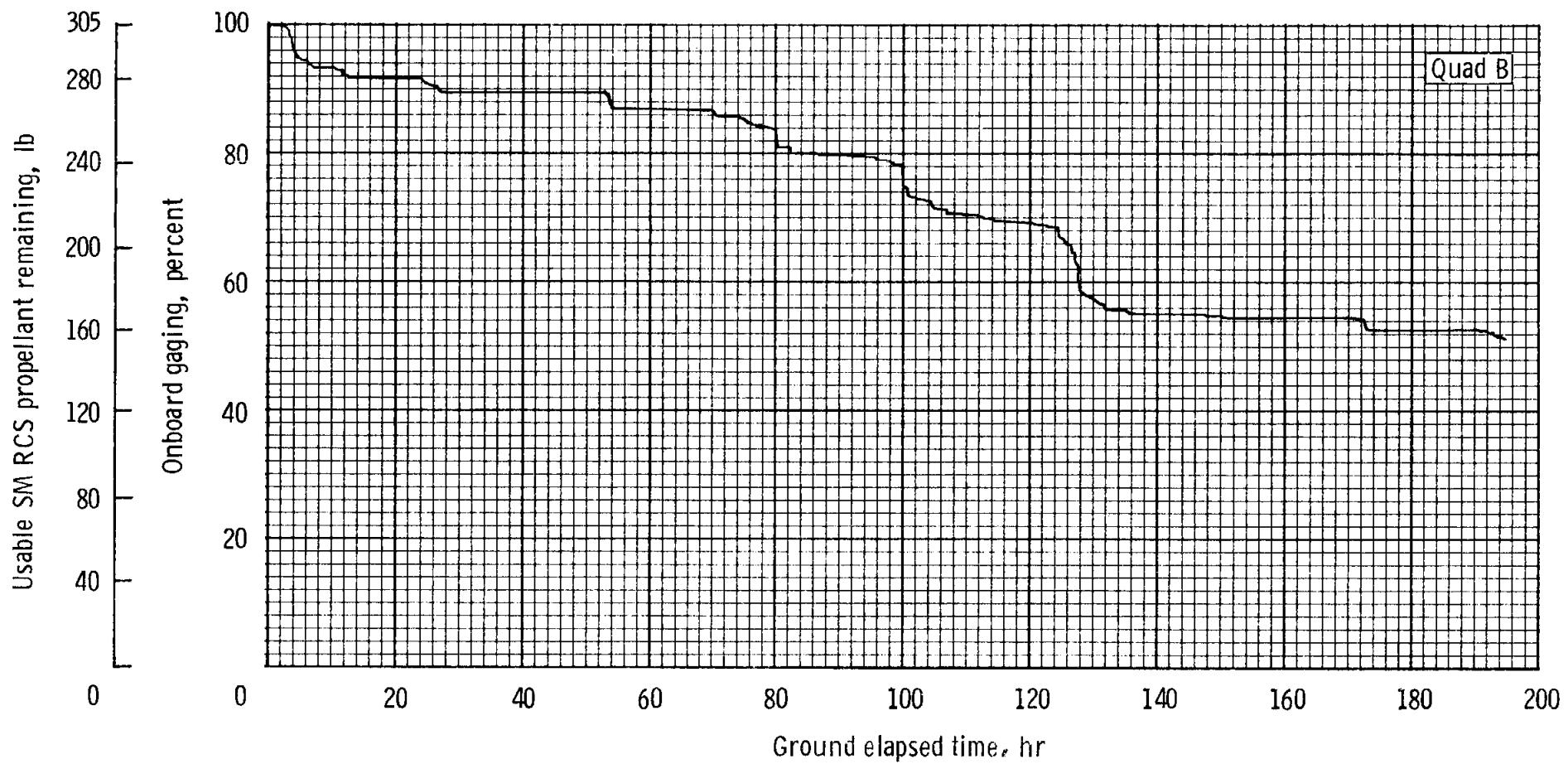


FIGURE 5-3  
SM RCS propellant profile - quad B.

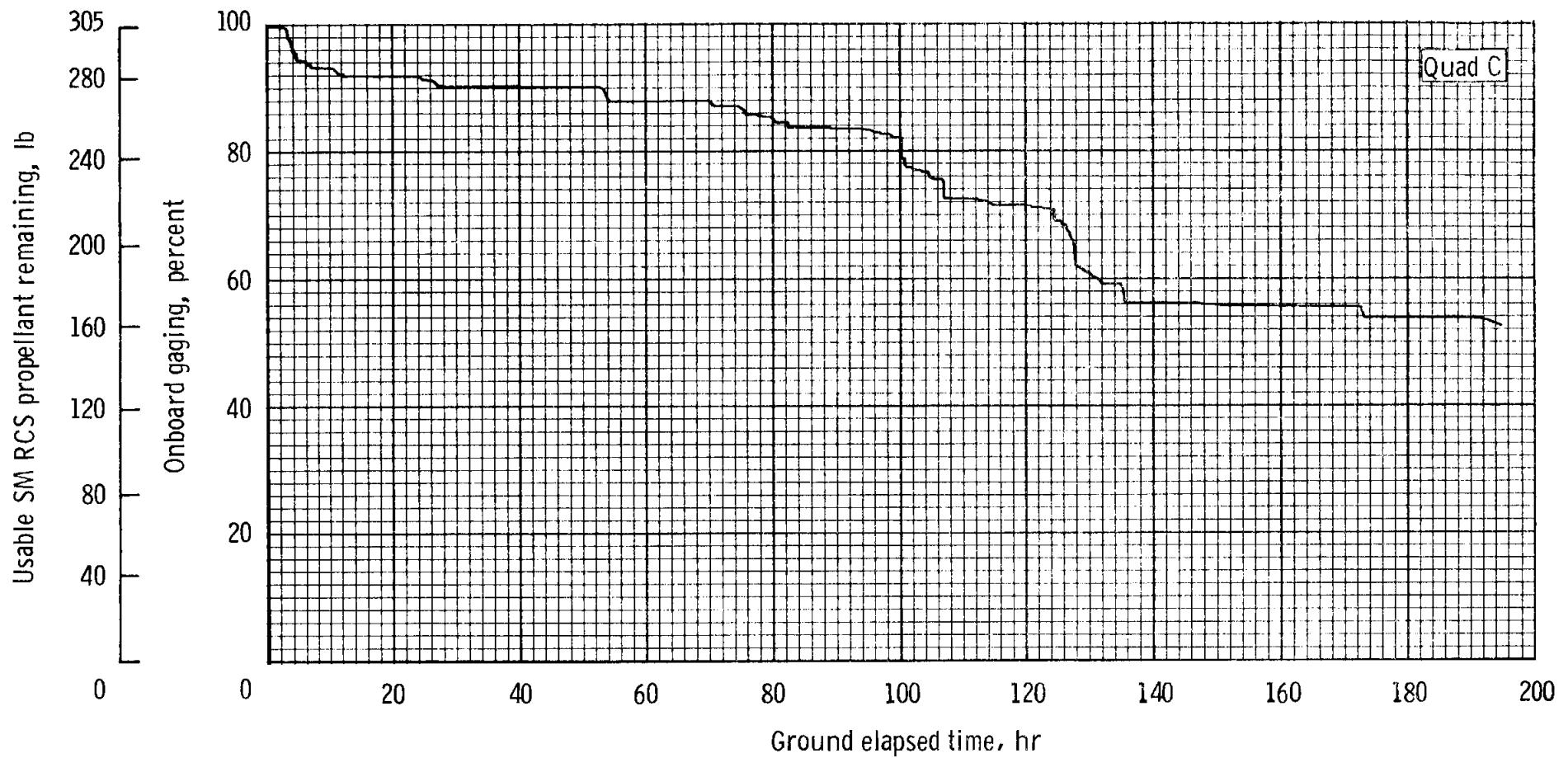


FIGURE 5-4  
SM RCS propellant profile - quad C.

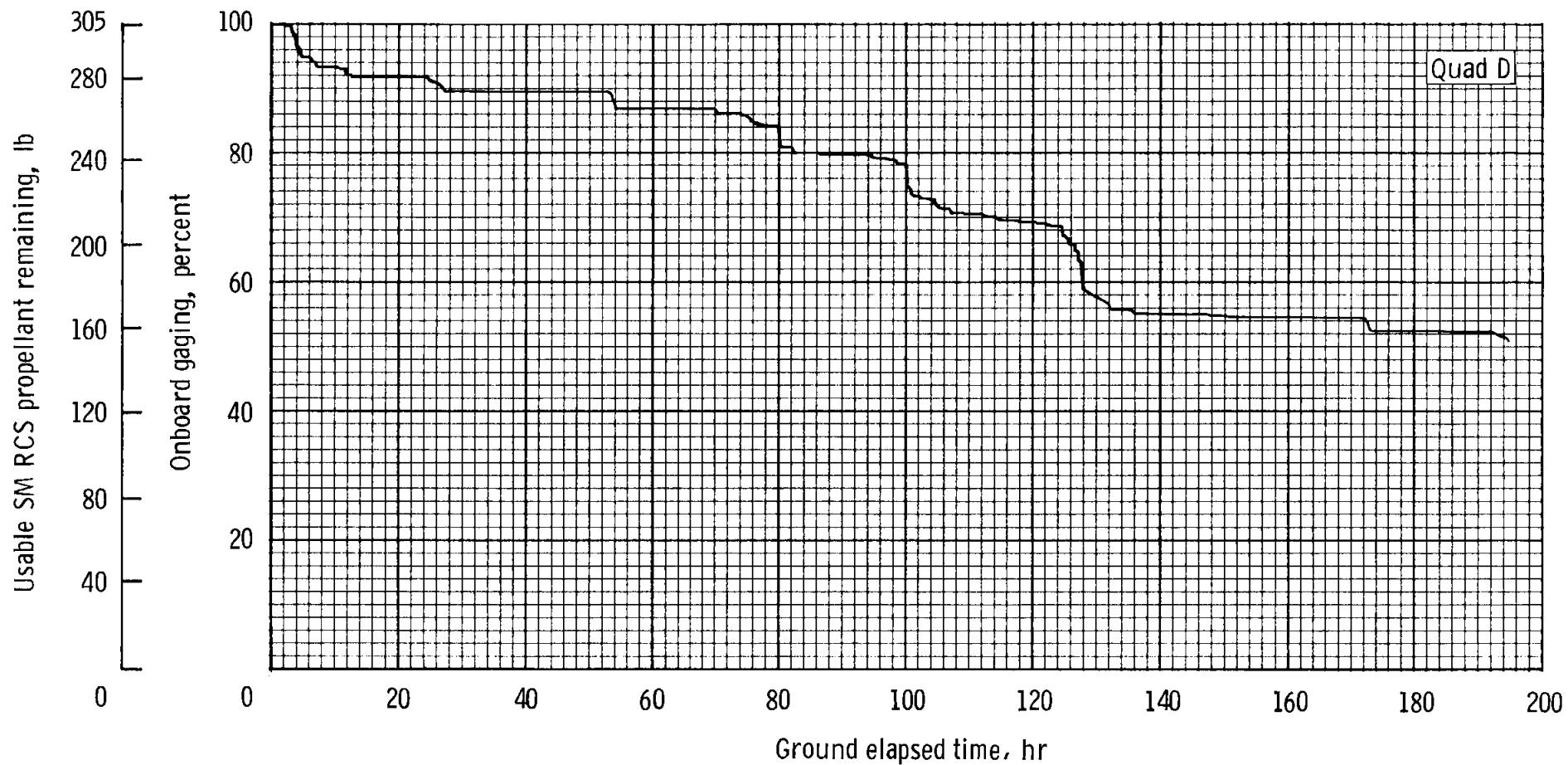


FIGURE 5-5  
SM RCS propellant profile - quad D.

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

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.  $\Delta V$  requirements were coordinated with LNAB 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 flexibility  $\Delta V$  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  $\Delta V$  and the fast return) of 1268 lb.

TABLE 5-4 - APOLLO 11 SPS PROPELLANT SUMMARY

ITEM	PROPELLANT REQUIRED, LB	PROPELLANT REMAINING, LB
Loaded <sup>a</sup>	--	40803.0
Trapped and unavailable	441.4	40361.6
Outage	59.5	40302.1
Unbalance meter	100.0	40202.1
Available for $\Delta V$	--	40202.1
Required for $\Delta V$		
TLMC (120 fps) <sup>b</sup>	1166.4	39035.7
LOI-1 (2924 fps, 5 min. 59 sec.)	23862.4	15173.3
LOI-2 (157.6 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 $\sigma$ )	426.0	1267.9
Propellant margin	--	1267.9

<sup>a</sup> 15712.0 lb of fuel and 25091.0 lb of oxidizer; this is loaded on CSM-107.

<sup>b</sup> 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  $\Delta V$  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	
			<hr/>	
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				PAGE	1
TIME HRS MIN	EVENT TITLE	<sup>a</sup> S/C WT (LBS)	LM RCS USED (LBS)	LM <sup>b</sup> RCS LEFT (LBS)	LM <sup>b</sup> RCS LEFT (%)
0 0	OUTPUT PROPELLANT LOADINGS	33714.	.0	633.0	100.0
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 0	IMU REALIGN STAR 1	33683.	3.6	612.4	96.7
101 0	IMU REALIGN STAR 2	33680.	3.6	608.8	96.2
101 0	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 0	ALIGNMENT CHECK	33400.	1.2	575.8	91.0
102 10	RR LOCK ON MNVR	33396.	3.6	572.2	90.4

<sup>a</sup> These weights were used for analysis only and do not reflect the actual weight after consumables loading.

<sup>b</sup> RCS propellant remaining of total loaded

TABLE 5-7 (CONT'D)

LM - RCS PROPELLANT BULGET				PAGE	2
TIME HRS M	EVENT TITLE	S/C WT <sup>a</sup> (LBS)	LM <sup>b</sup> RCS USED (LBS)	LM <sup>b</sup> RCS LEFT (LBS)	LM <sup>b</sup> RCS LEFT (%)
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
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 REALIGN STAR 1	5962.	.4	519.5	82.1
124 37	IMU REALIGN STAR2	5961.	.4	519.0	82.0
124 37	IMU REALIGN STAR3	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 +Z	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

<sup>a</sup> These weights were used for analysis only and do not reflect the actual weight after consumables loading.

<sup>b</sup> RCS propellant remaining of total loaded

TABLE 5-7 (CONT'D)

LM - RCS PROPELLANT BUDGET				PAGE	3
TIME HRS	EVENT TITLE	S/C WT <sup>a</sup> (LBS)	LW RCS USED	LM <sup>b</sup> RCS LEFT (LBS)	LM <sup>b</sup> RCS LEFT (%)
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 0	PR LOCK ON MNVR	5913.	.4	471.0	74.4
126 0	MAINTAIN LOS	5911.	2.0	469.0	74.1
126 15	ATTITUDE HOLD	5910.	1.3	467.7	73.9
126 19	CCB RCS BURN	5906.	4.0	463.7	73.3
126 23	MAINTAIN LOS	5902.	4.0	459.7	72.6
126 33	ATTITUDE HOLD	5901.	1.3	458.4	72.4
126 36	RCS TPI BURN	5884.	17.0	441.4	69.7
126 55	MAINTAIN LOS	5883.	1.3	440.1	69.5
127 36	FCC 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

<sup>a</sup> These weights were used for analysis only and do not reflect the actual weight after consumables loading.

<sup>b</sup> RCS propellant remaining of total loaded

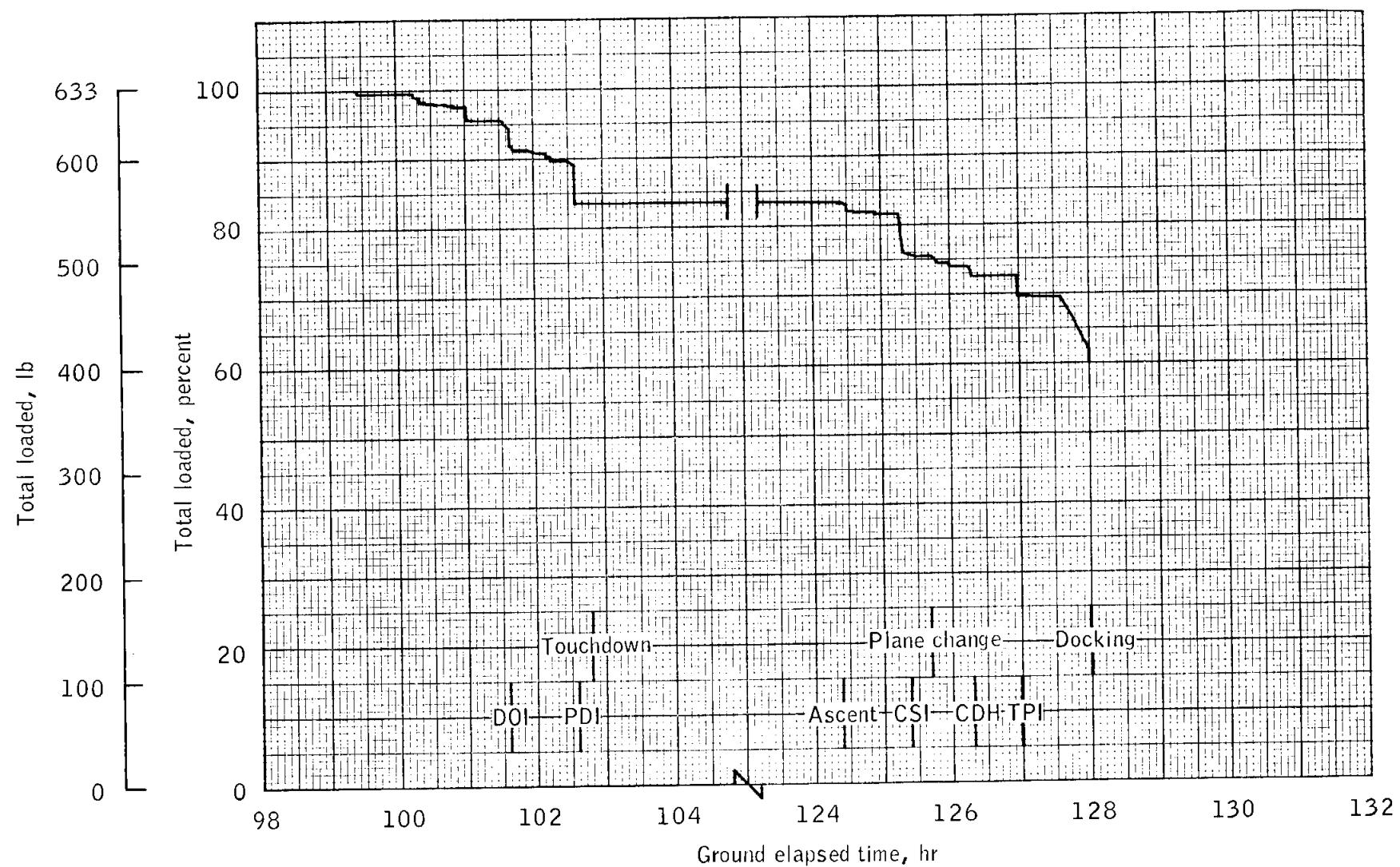


Figure 5-6.- LM RCS propellant profile.

### 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  $\Delta V$  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  $\Delta V$  requirements have been coordinated with LAB in MPAD.

Three sigma dispersions represent total propellant cost due to  $3\sigma$  uncertainties in propellant loading, trapped, ISP,  $\Delta V$ , separation weight, non- $\Delta V$  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 <sup>a</sup>	--	18184.2
Trapped and unavailable	223.5	17960.7
Outage	14.0	17946.7
Low-Level Sensor Uncertainty	68.7	17878.0
Available for $\Delta V$	--	17878.0
Nominal Required for $\Delta V$ of 6728.6 fps	16799.7	1078.3
Dispersions ( $-3\sigma$ )	224.7	853.6
Contingencies		
Engine Valve-Pair Malfunction ( $\Delta MR = \pm .016$ )	81.1	772.5
Redesignation (60 fps)	104.0	668.5
Margin (73 sec. hover)	--	668.5

<sup>a</sup> 6974.8 lb fuel and 11209.4 lb oxidizer; this is loaded on the LM-5 spacecraft.

TABLE 5-9 - ASSUMPTIONS FOR THE APOLLO 11 DPS PROPELLANT BUDGET

1. Integrated average  $I_{sp} = 301.9 \pm 3.54$  seconds
2. LM separation weight = 33746. lb
3. Mixture ratio =  $1.596 \pm 0.0108$
4. Nominal  $\Delta V = 6728.6 \pm 96$  fps
5. Non- $\Delta V$  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  $\Delta V$  was coordinated with LAB in MPAD. The budget shown in table 5-10 accounts for an engine valve-pair malfunction, a PGNCS to AGS switch-over, 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 <sup>a</sup>	--	5238.4
Trapped and Unavailable	48.9	5189.5
Outage	17.5	5172.0
Available for $\Delta V$	--	5172.0
Nominal Required for $\Delta V$ of 6072.5 fps	4965.8	206.2
Dispersions (-3 $\sigma$ )	57.8	148.4
Contingencies		
Engine Valve-pair Malfunction ( $\Delta V = \pm .016$ )	19.6	128.8
PGNCS to AGS Switchover (40 fps)	23.8	105.0
Touchdown Abort ( $\Delta V = +99.9$ lb, $\Delta \Delta V = -15$ fps)	36.8	68.2
Margin (6 seconds)	--	68.2

<sup>a</sup> 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.  $I_{sp} = 308.97 \pm 3.553$  seconds
- 2. Mixture ratio =  $1.602 \pm 0.0225$
- 3. Nominal  $\Delta V = 6072.5 \pm 33.5$  fps
- 4. Ascent stage lift-off 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 O<sub>2</sub> PROFILE

FIGURE 5-8      CSM H<sub>2</sub> 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 O<sub>2</sub> PROFILE

FIGURE 5-15      LM ASCENT O<sub>2</sub> PROFILE

FIGURE 5-16      LM DESCENT H<sub>2</sub>O PROFILE

FIGURE 5-17      LM ASCENT H<sub>2</sub>O 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<sub>2</sub> and O<sub>2</sub>.
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<sub>fc</sub>
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

I.	Planning Allowance	$H_2$ , lb	$O_2$ , lb
A.	Total Loaded	58.60	660.20
B.	Less Residual	2.32	13.00
C.	Less Instrumentation Error	<u>1.50</u>	<u>17.50</u>
	Available for Mission Planning	54.78	629.70
II.	Predicted Usages		
A.	Prelaunch <sup>1</sup>		
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)	<u>.57</u>	<u>6.96</u>
	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	<u>-</u>	<u>10.35</u>
	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	<u>.86</u>	<u>10.20</u>
	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	<u>2.17</u>	<u>26.87</u>
	Operational Reserve	13.83	206.25

<sup>1</sup> KSC Supplied Data

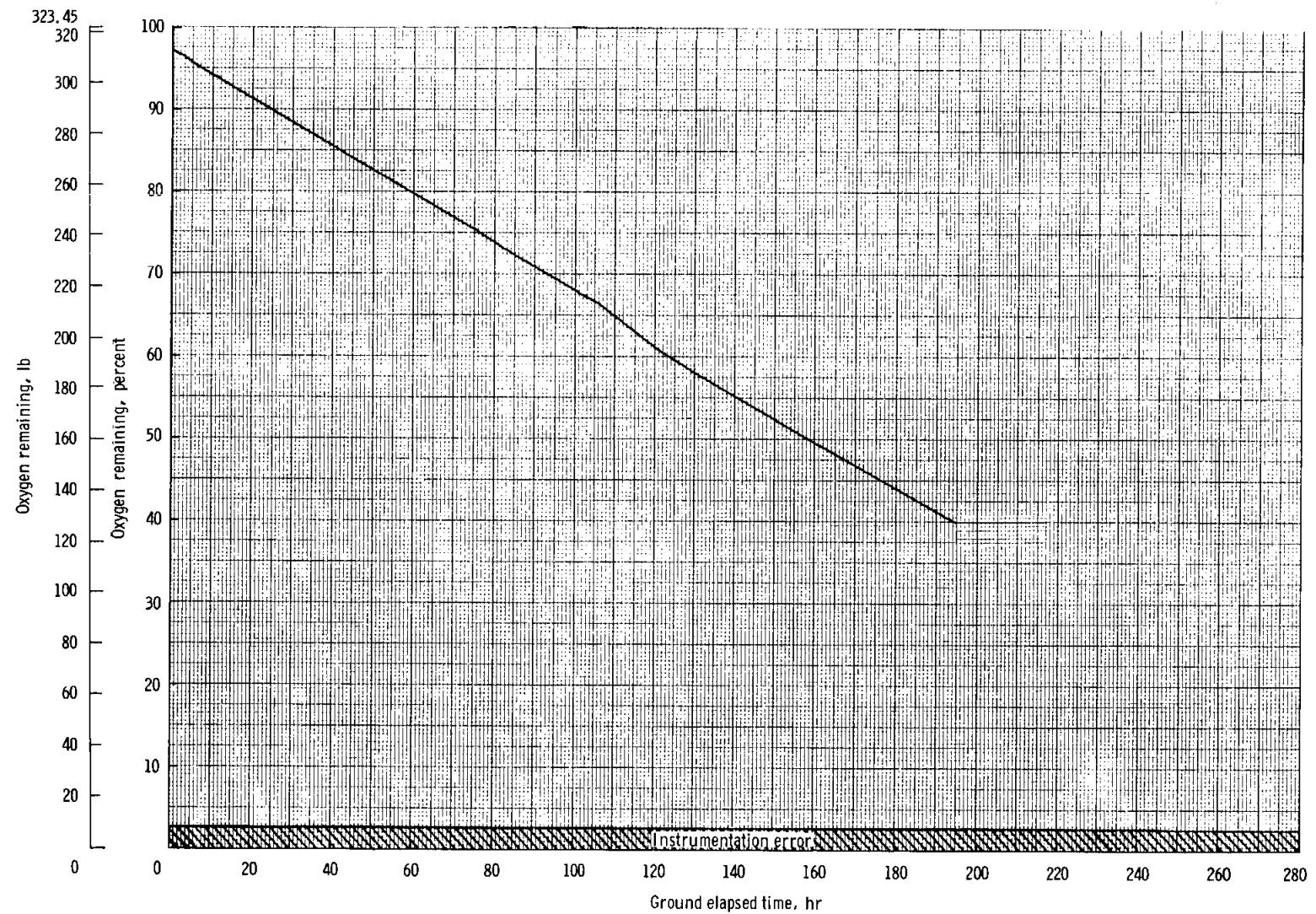


Figure 5-7. - Oxygen remaining for mission for one tank versus time.

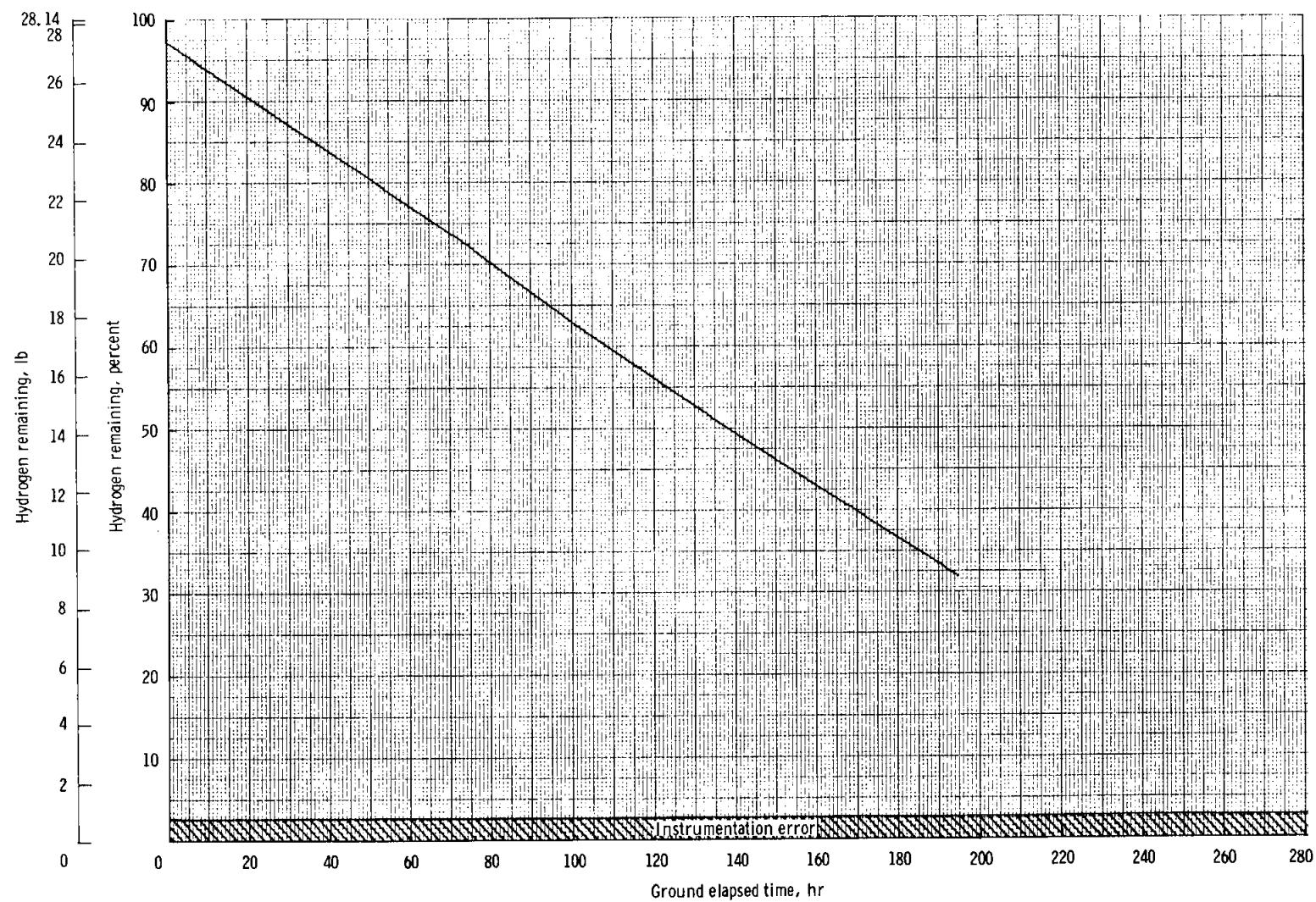


Figure 5-8.- Hydrogen remaining for mission for one tank versus time.

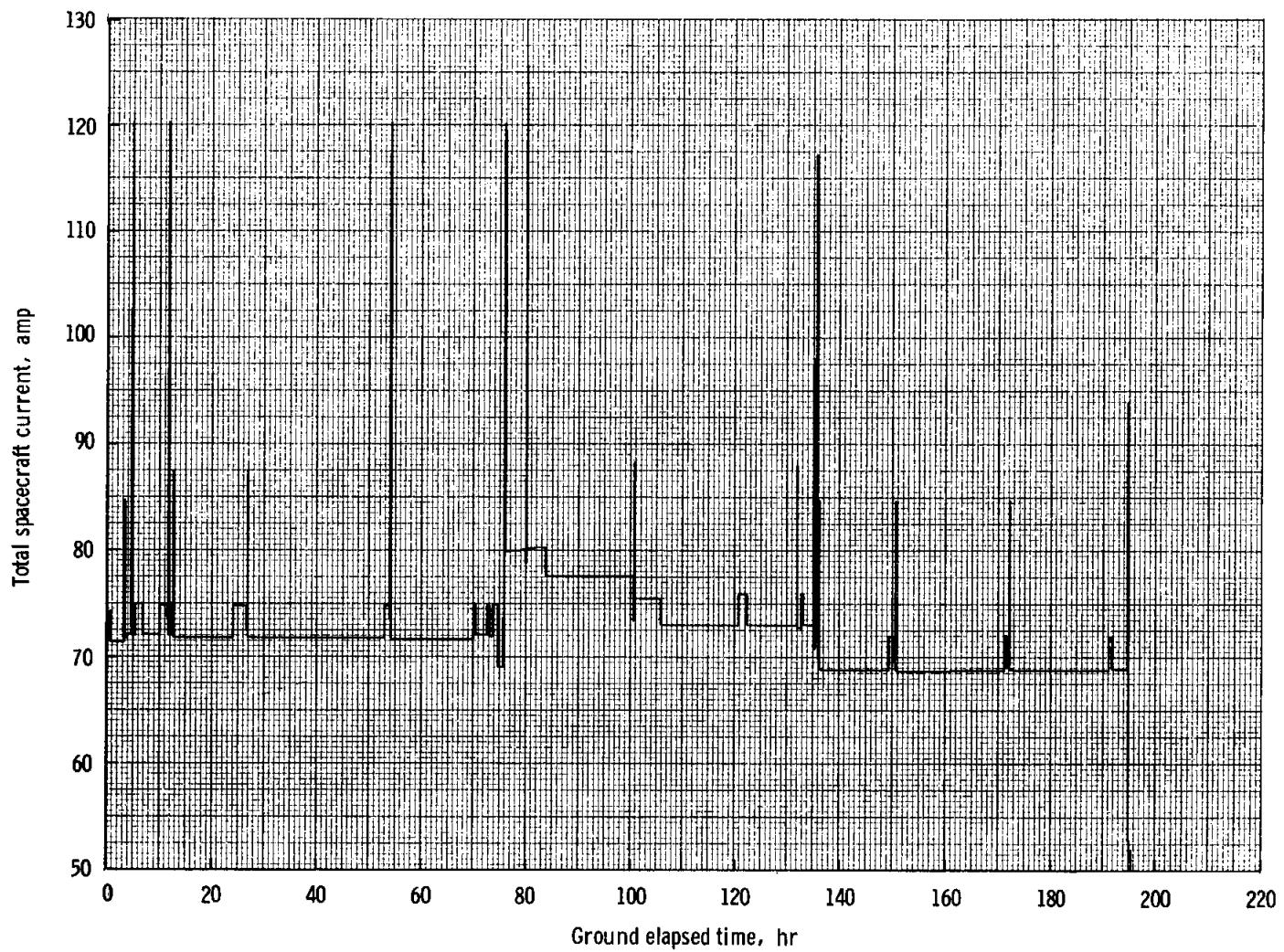


Figure 5-9 .- CSM total spacecraft current profile.

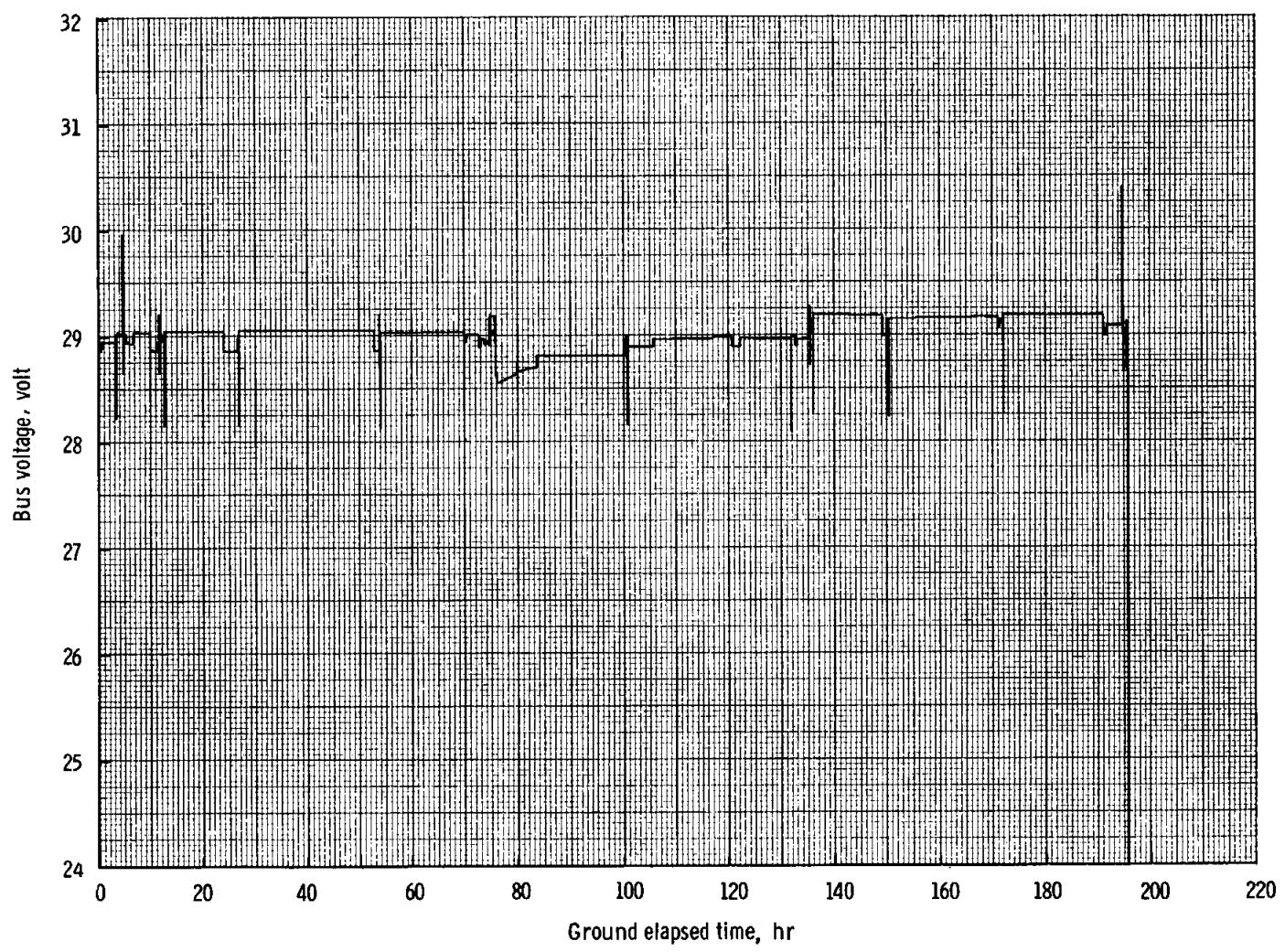


Figure 5-10.- CSM bus voltage versus time.

## 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.

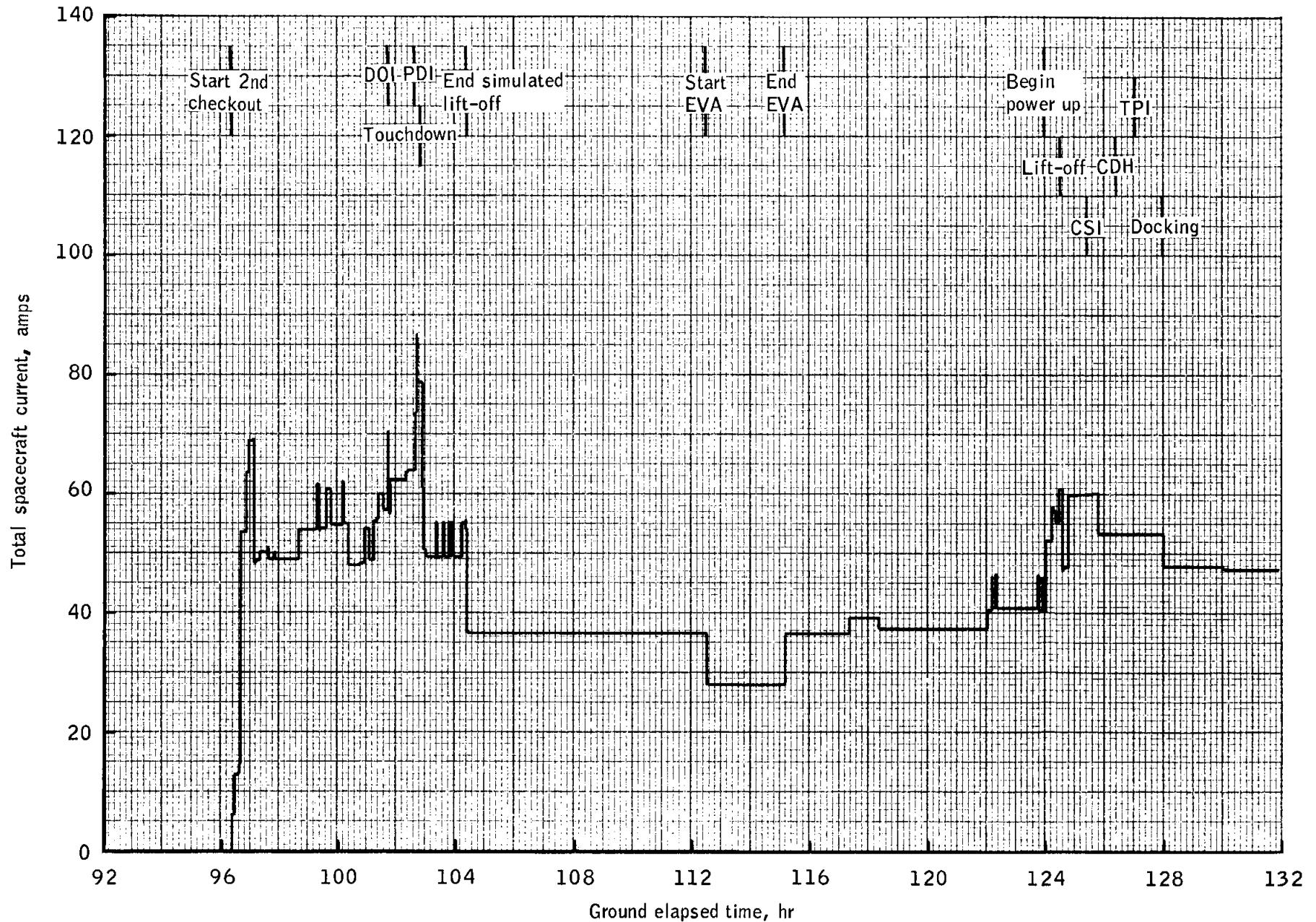


Figure 5-11.- LM-5 total spacecraft current.

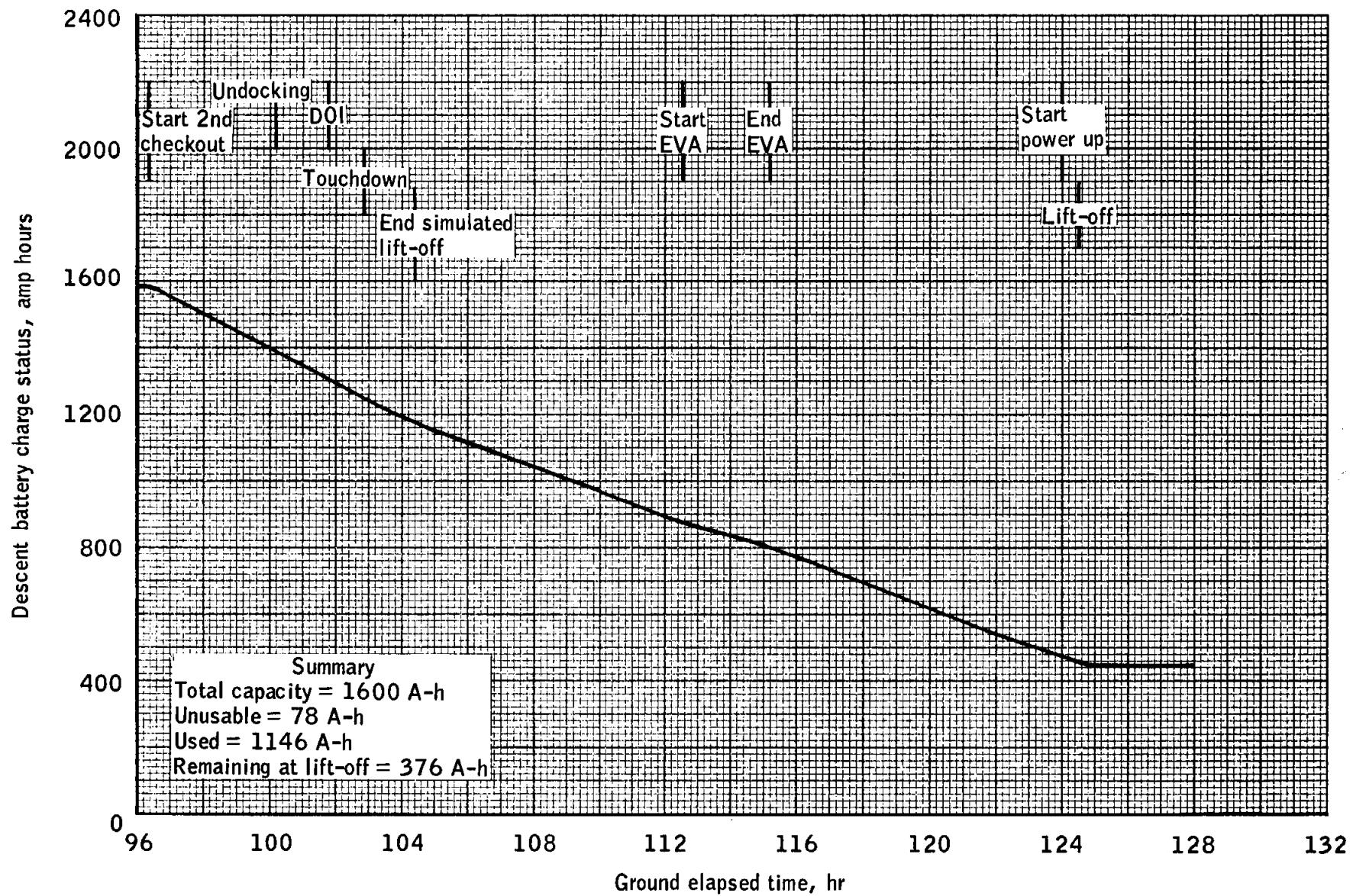


Figure 5-12.- Descent stage amp hours remaining.

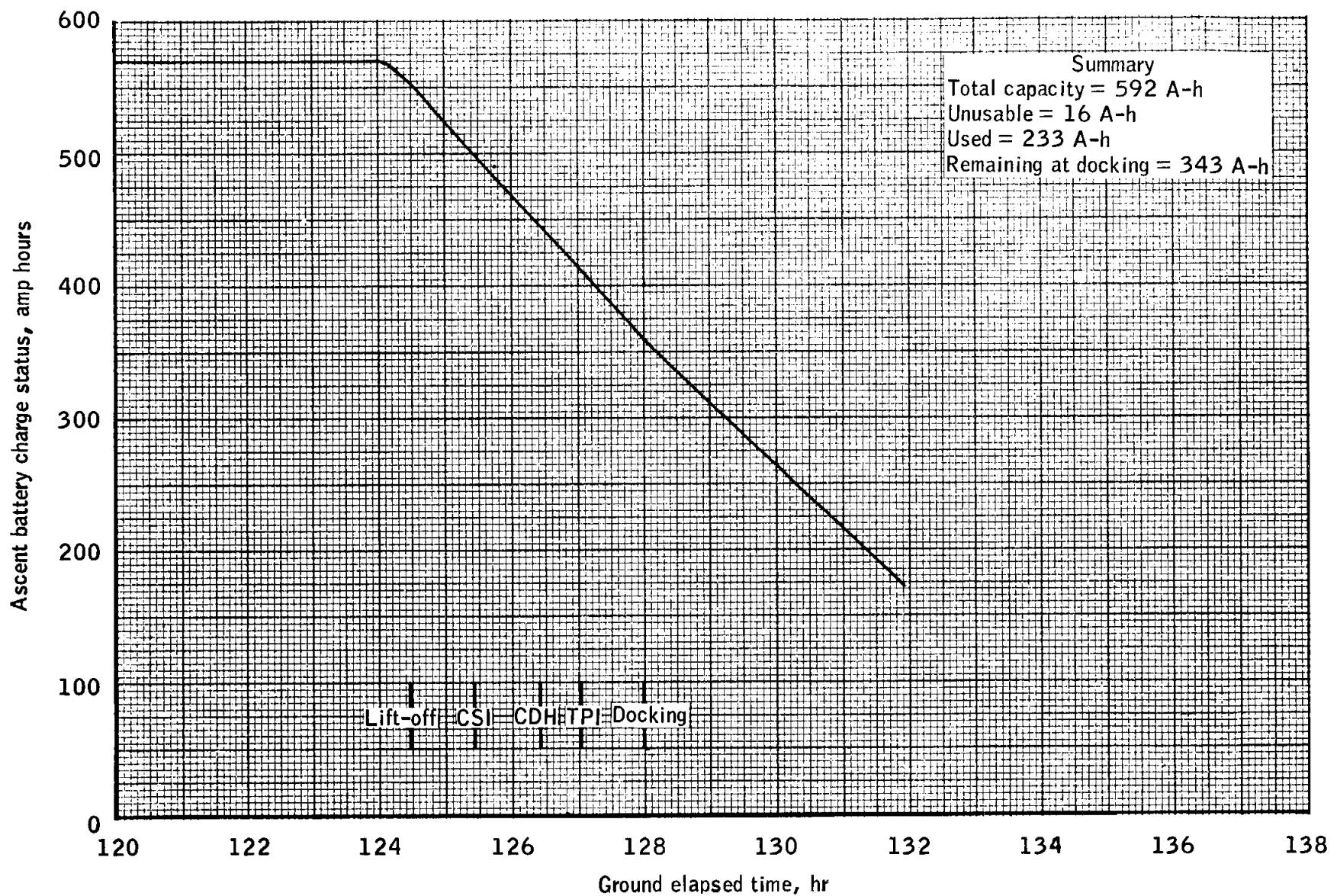


Figure 5-13 .- Ascent stage amp hours remaining.

## 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  $(1.643 \times 10^{-4}) \times (\text{metabolic rate})$
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  $10^{40}$  (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  $72^{\circ}\text{F}$
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

<u>Description</u>	<u><math>O_2</math>, lb</u>	<u><math>H_2O</math>, lb</u>
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

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

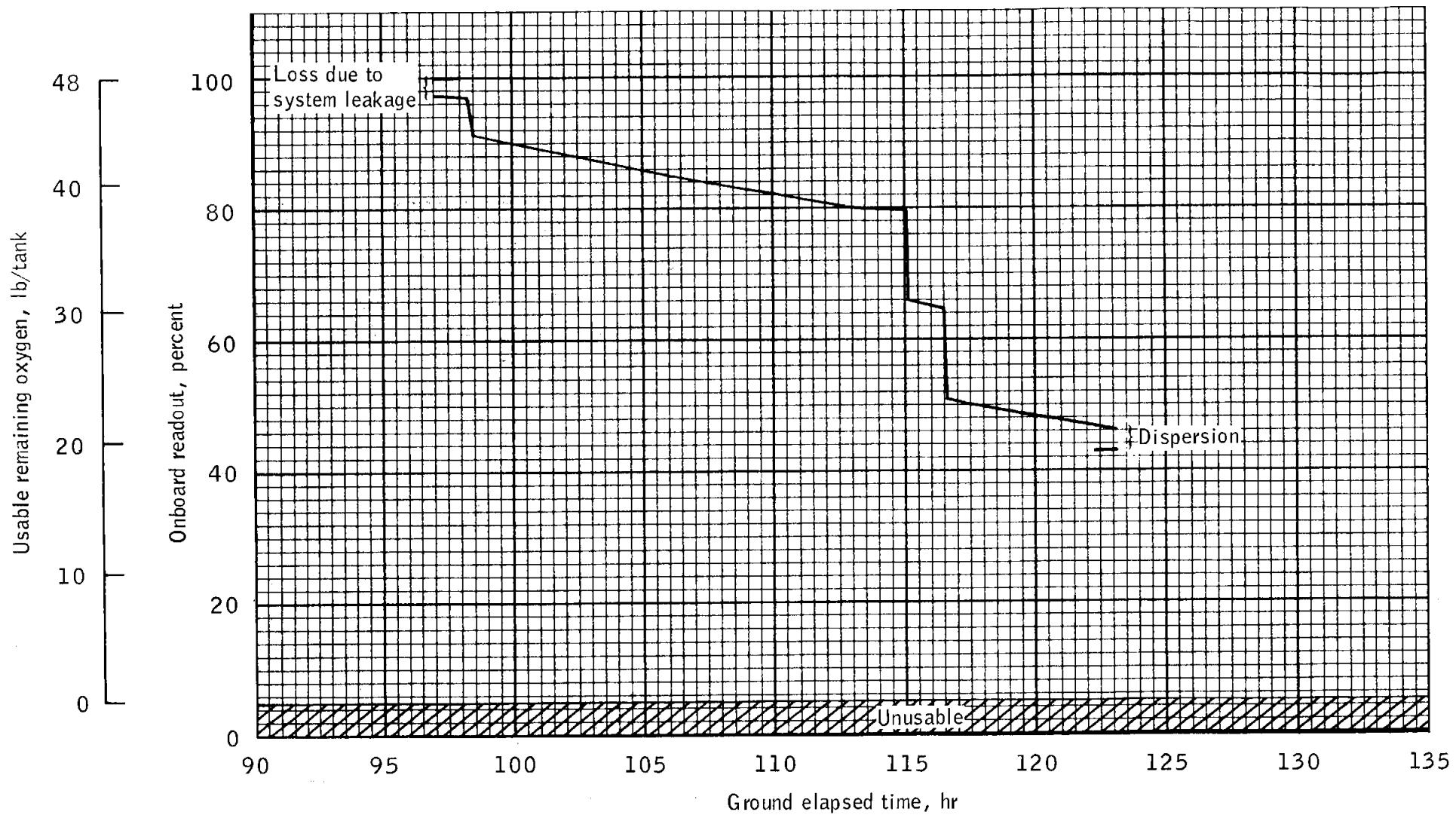


Figure 5-14 .- Descent oxygen tank quantities as a function of mission time.

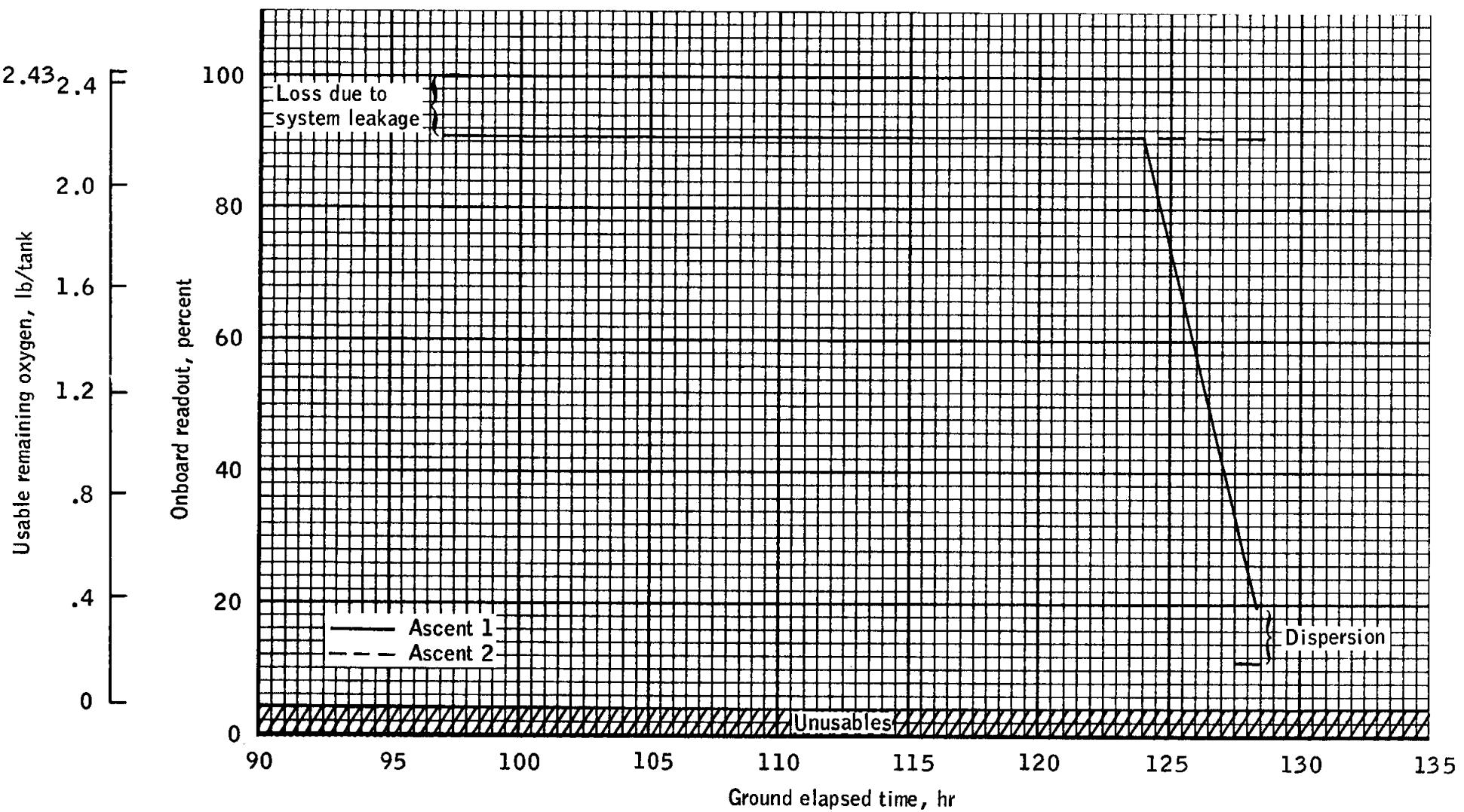


Figure 5-15 .- Ascent oxygen tank quantities as a function of mission time.

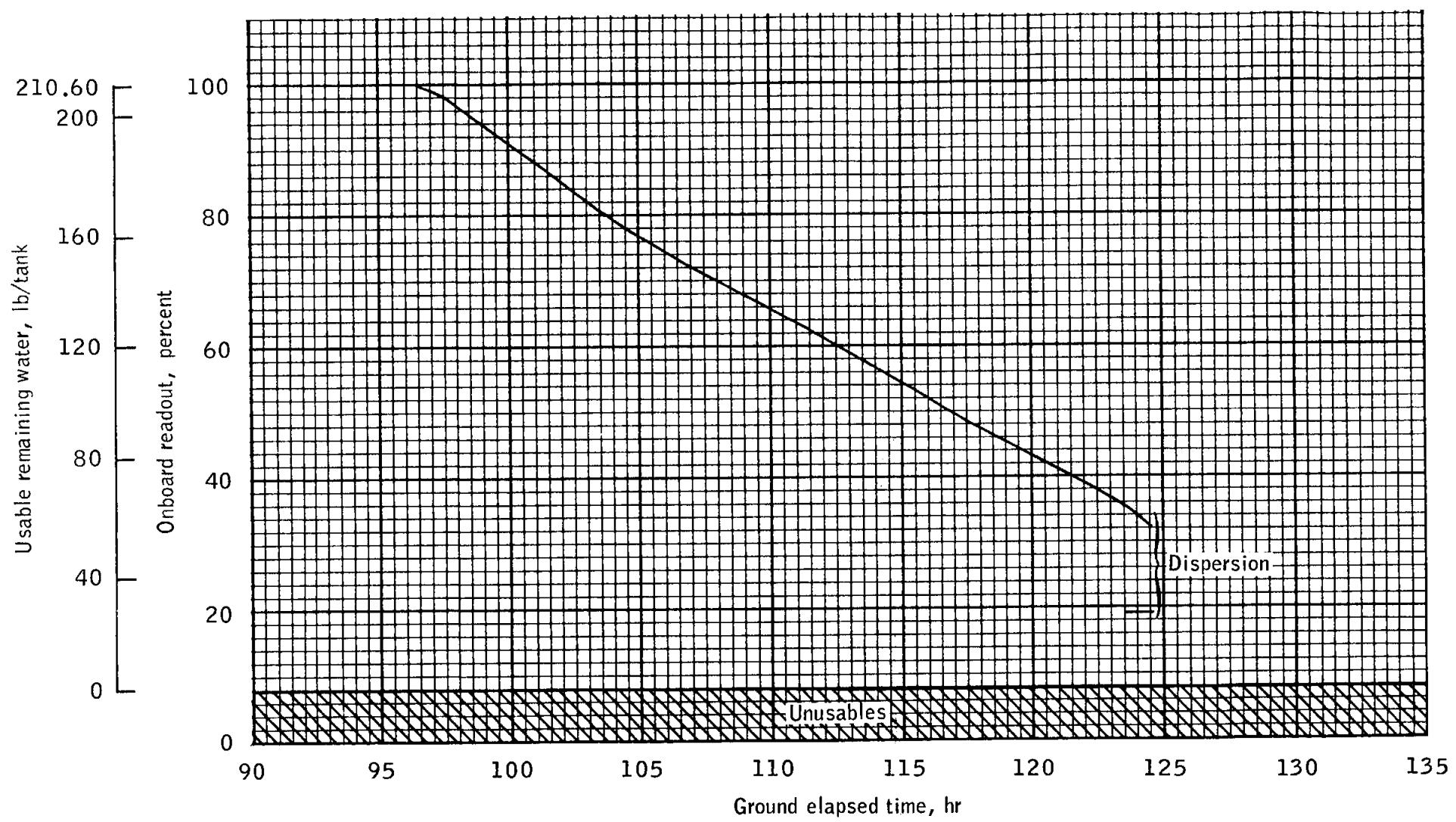


Figure 5-16 .- Descent water tank quantities as a function of mission time.

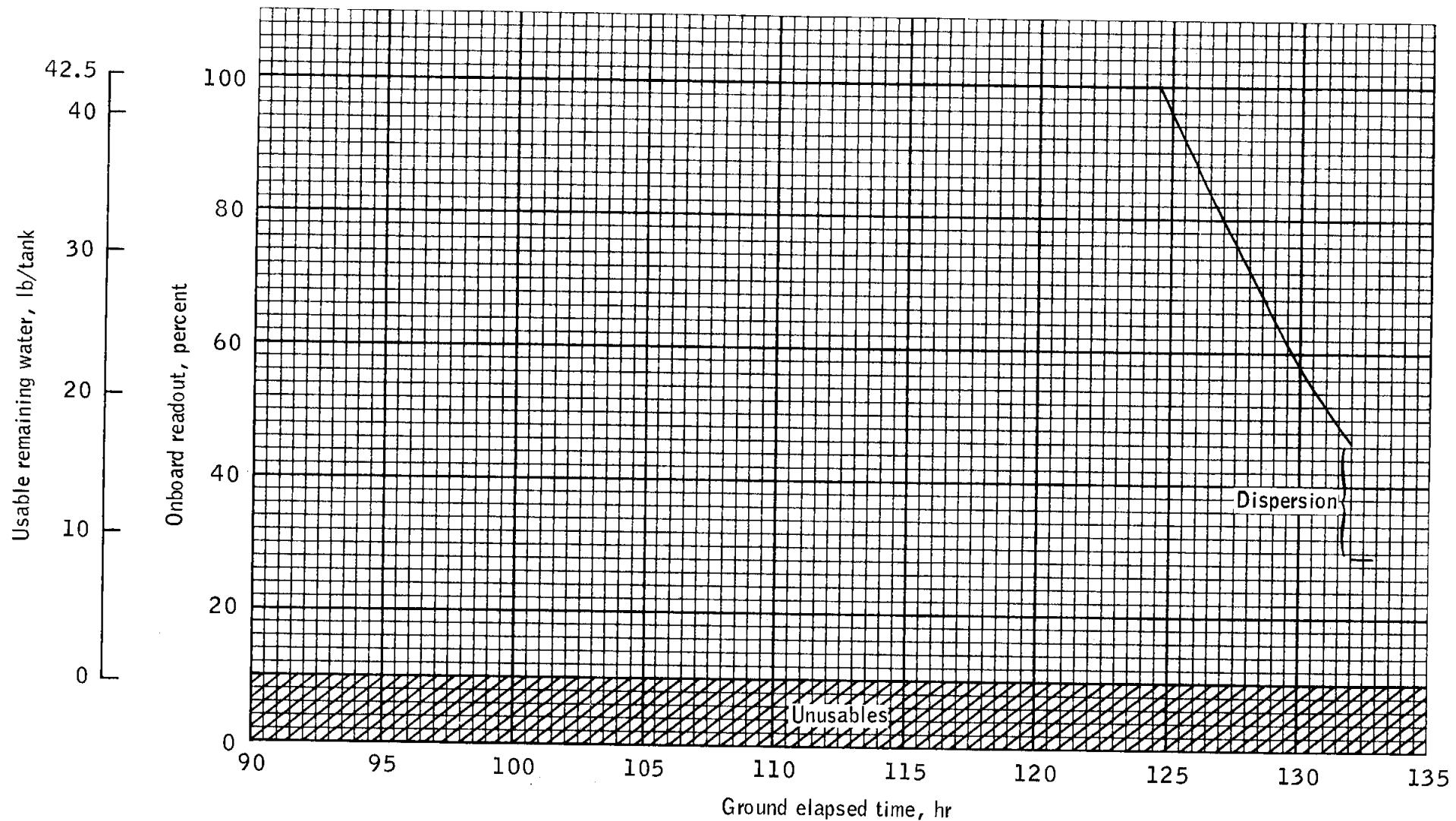


Figure 5-17 . - Ascent water tank quantities as a function of mission time.

MISSION G PLSS CONSUMABLE ANALYSIS

THE RESULTS OF THE PLSS BATTERY, OXYGEN, WATER AND LiOH CONSUMABLE ANALYSIS ARE SUMMARIZED IN THE FOLLOWING FIGURES:

FIGURE 5-18

LMP AND CDR PLSS  
BATTERY PROFILE

FIGURE 5-19

CDR OXYGEN PROFILE

FIGURE 5-20

LMP OXYGEN PROFILE

FIGURE 5-21

CDR H<sub>2</sub>O PROFILE

FIGURE 5-22

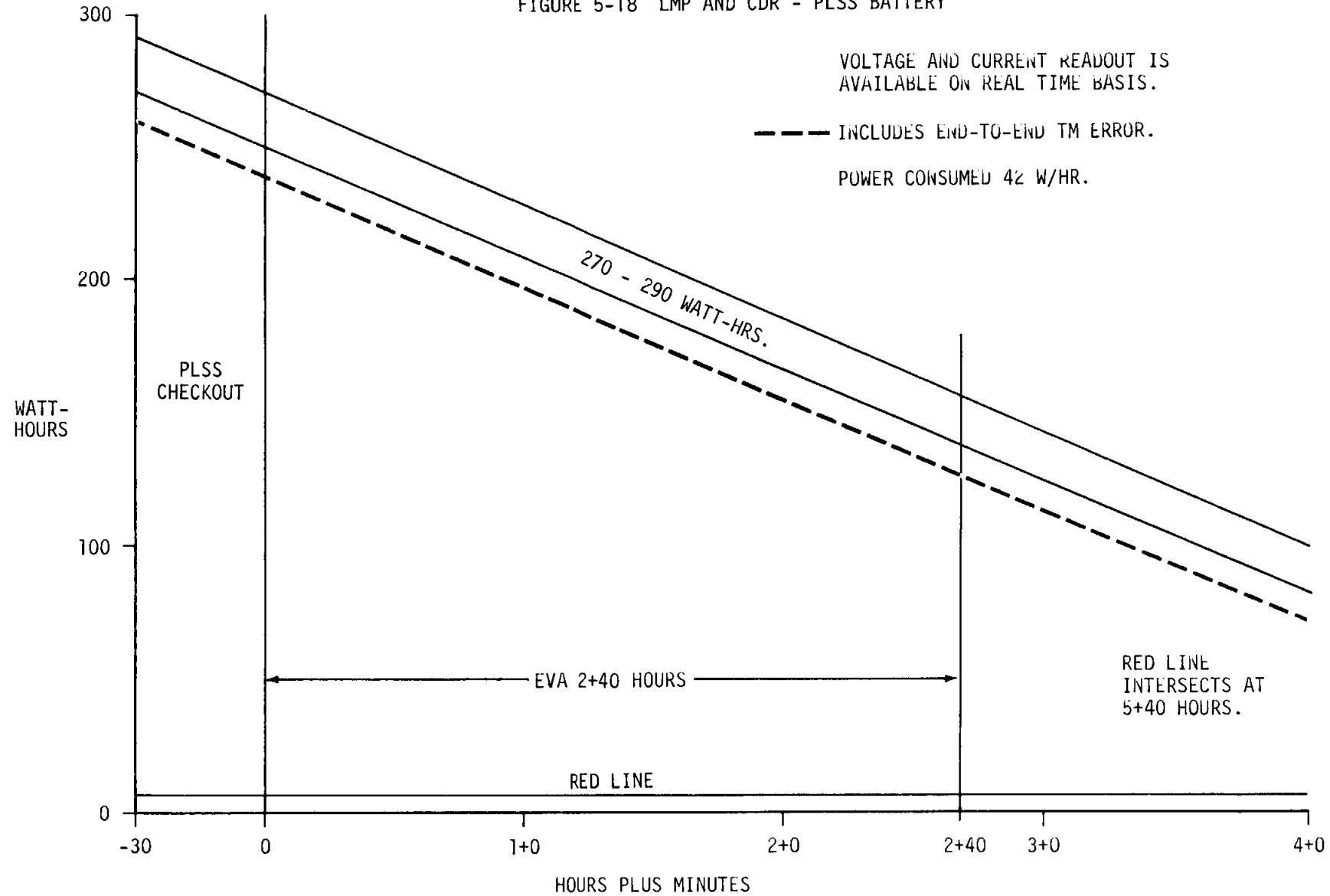
LMP H<sub>2</sub>O PROFILE

FIGURE 5-23

LMP AND CDR LiOH CO<sub>2</sub>  
PROFILE

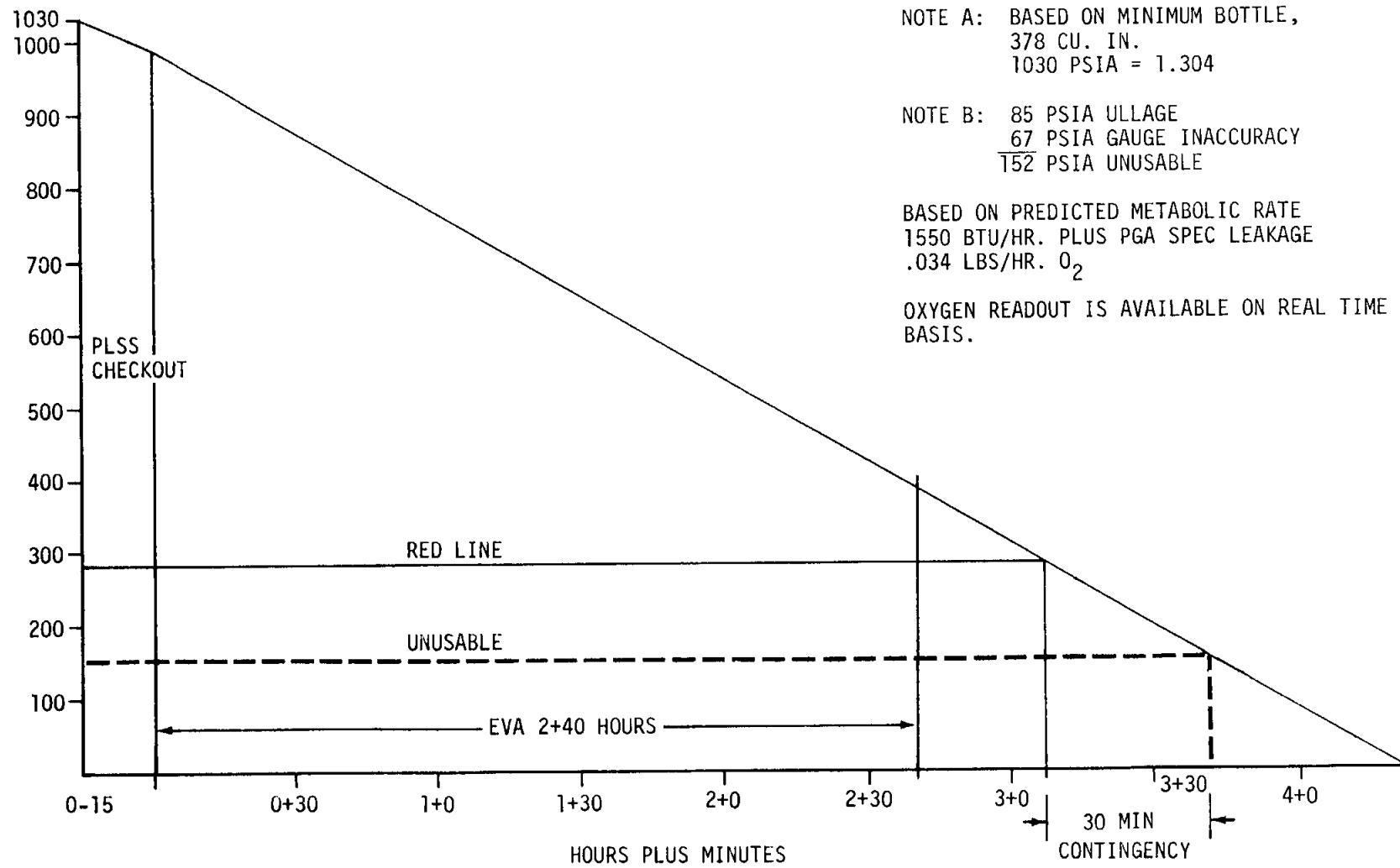
NOMINAL LUNAR SURFACE EVA

FIGURE 5-18 LMP AND CDR - PLSS BATTERY



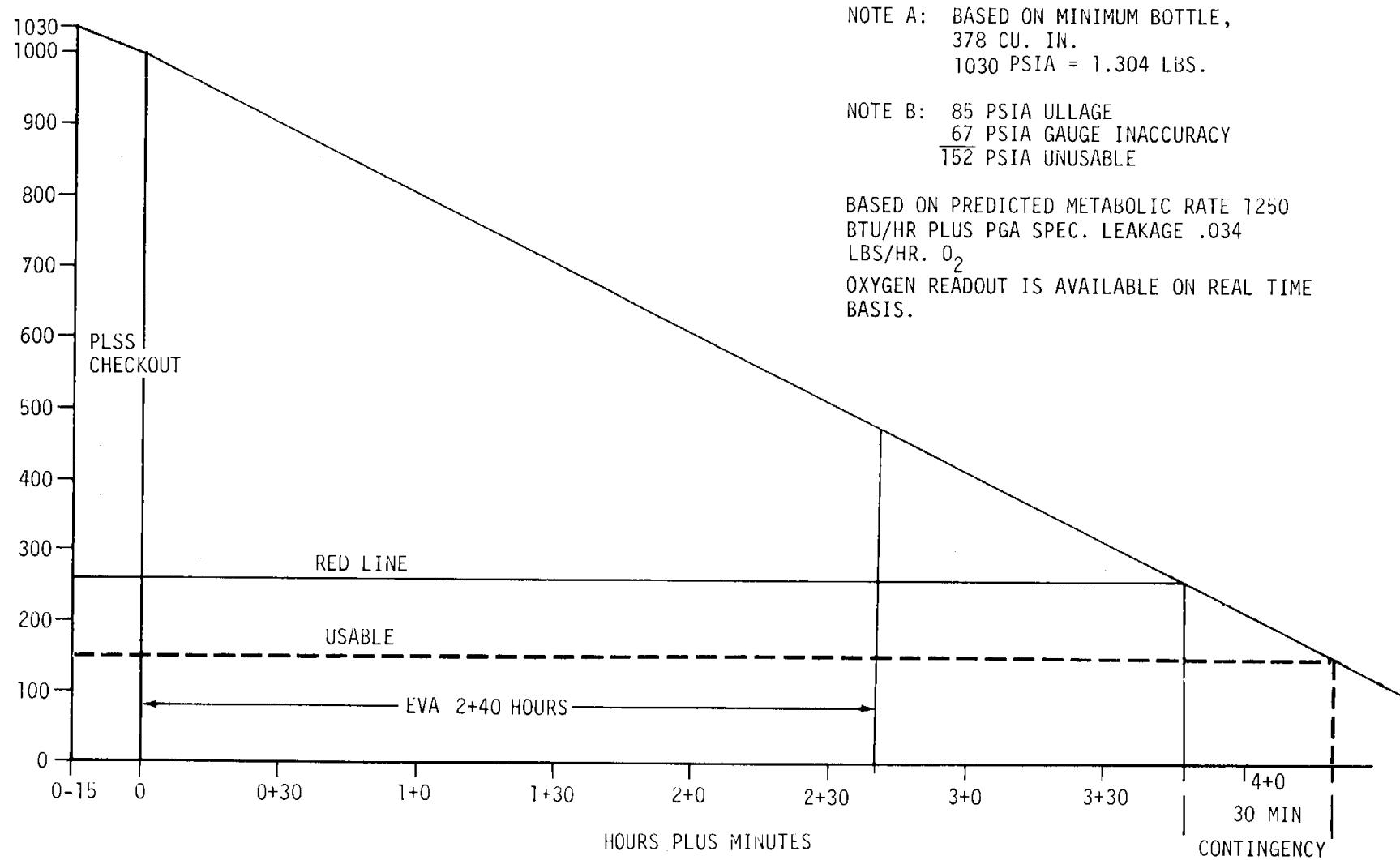
NOMINAL LUNAR SURFACE EVA

FIGURE 5-19 CDR - OXYGEN



NOMINAL LUNAR SURFACE EVA

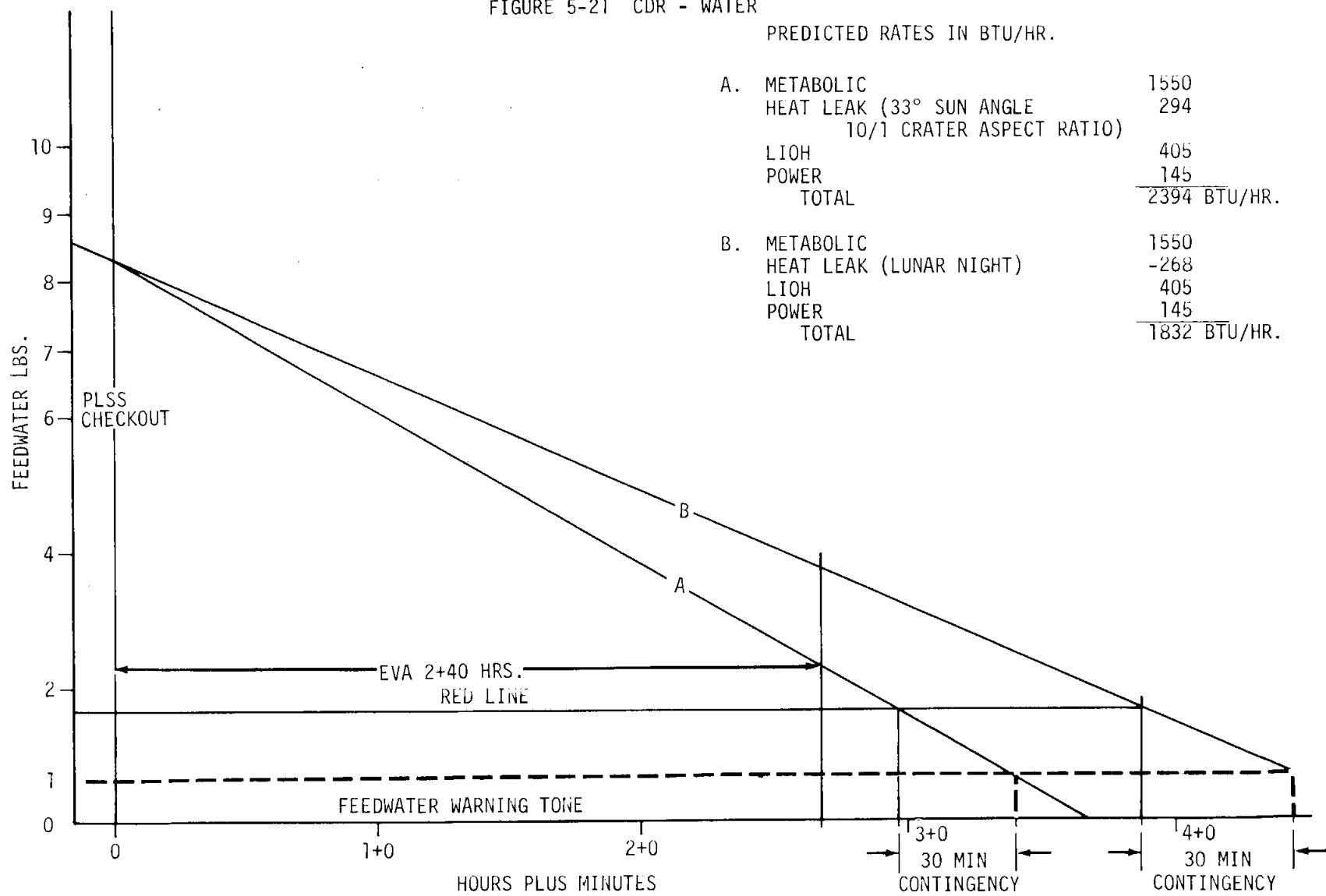
FIGURE 5-20 LMP - OXYGEN



NOMINAL LUNAR SURFACE EVA

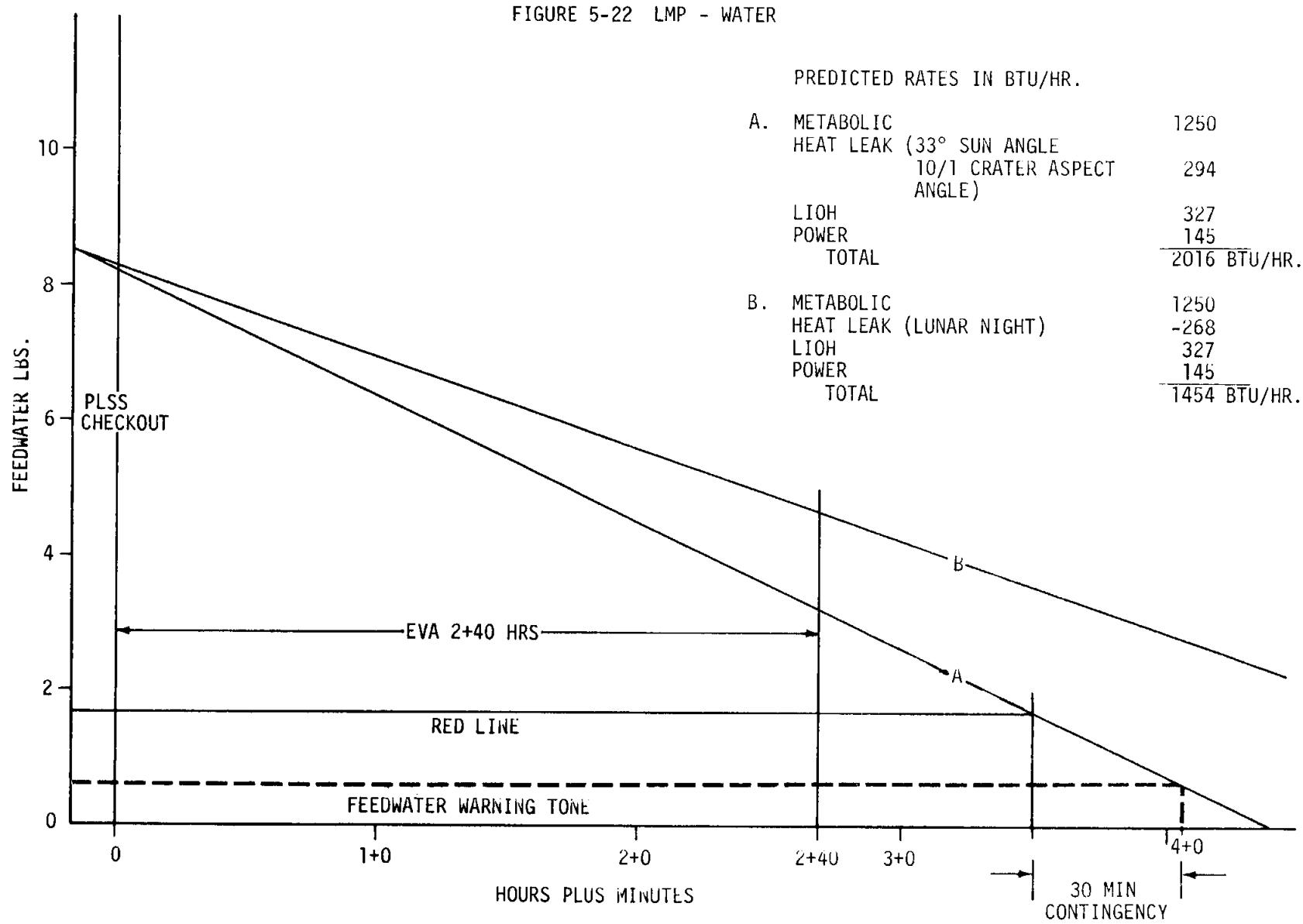
FIGURE 5-21 CDR - WATER

PREDICTED RATES IN BTU/HR.



NOMINAL LUNAR SURFACE EVA

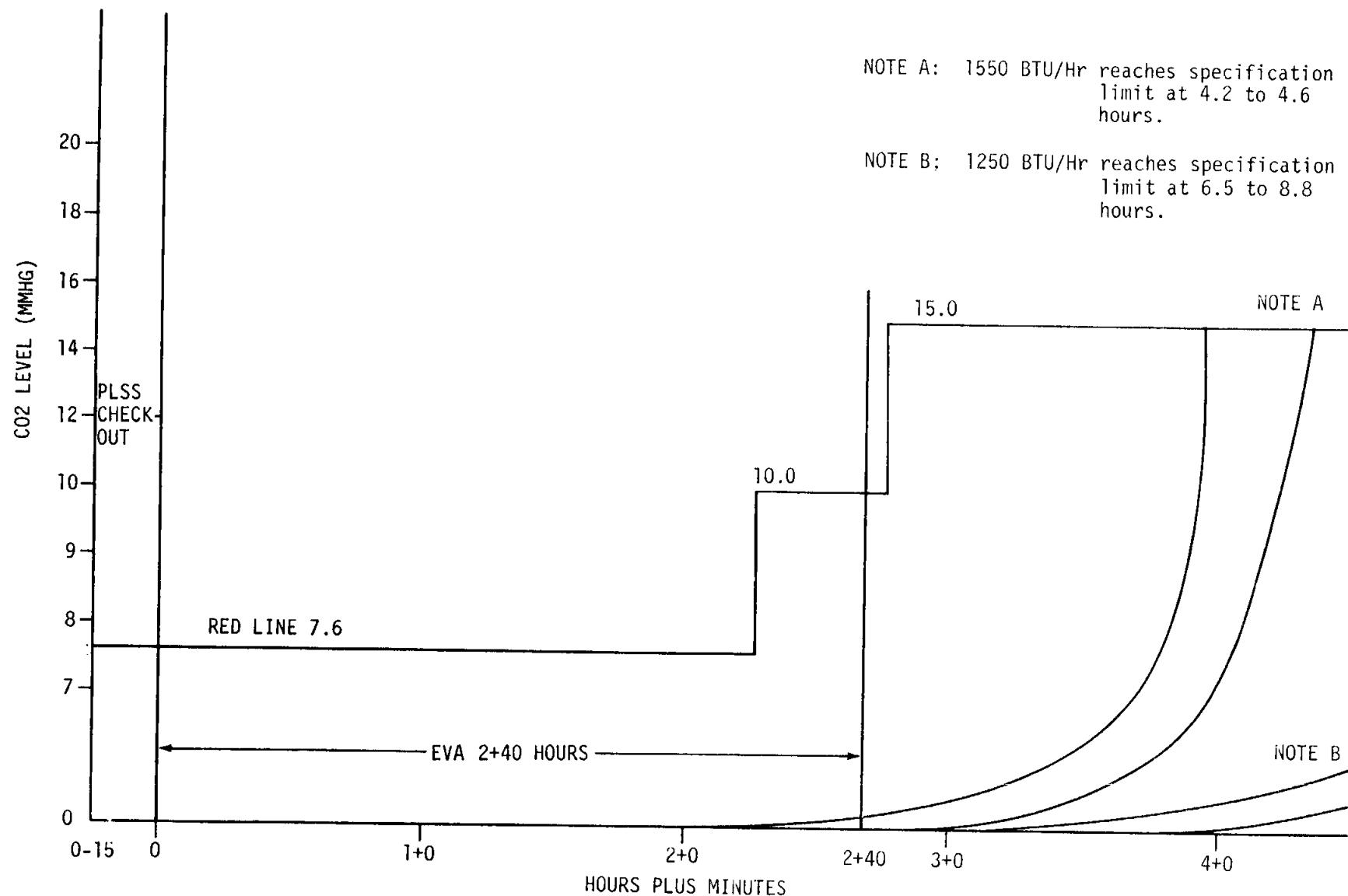
FIGURE 5-22 LMP - WATER



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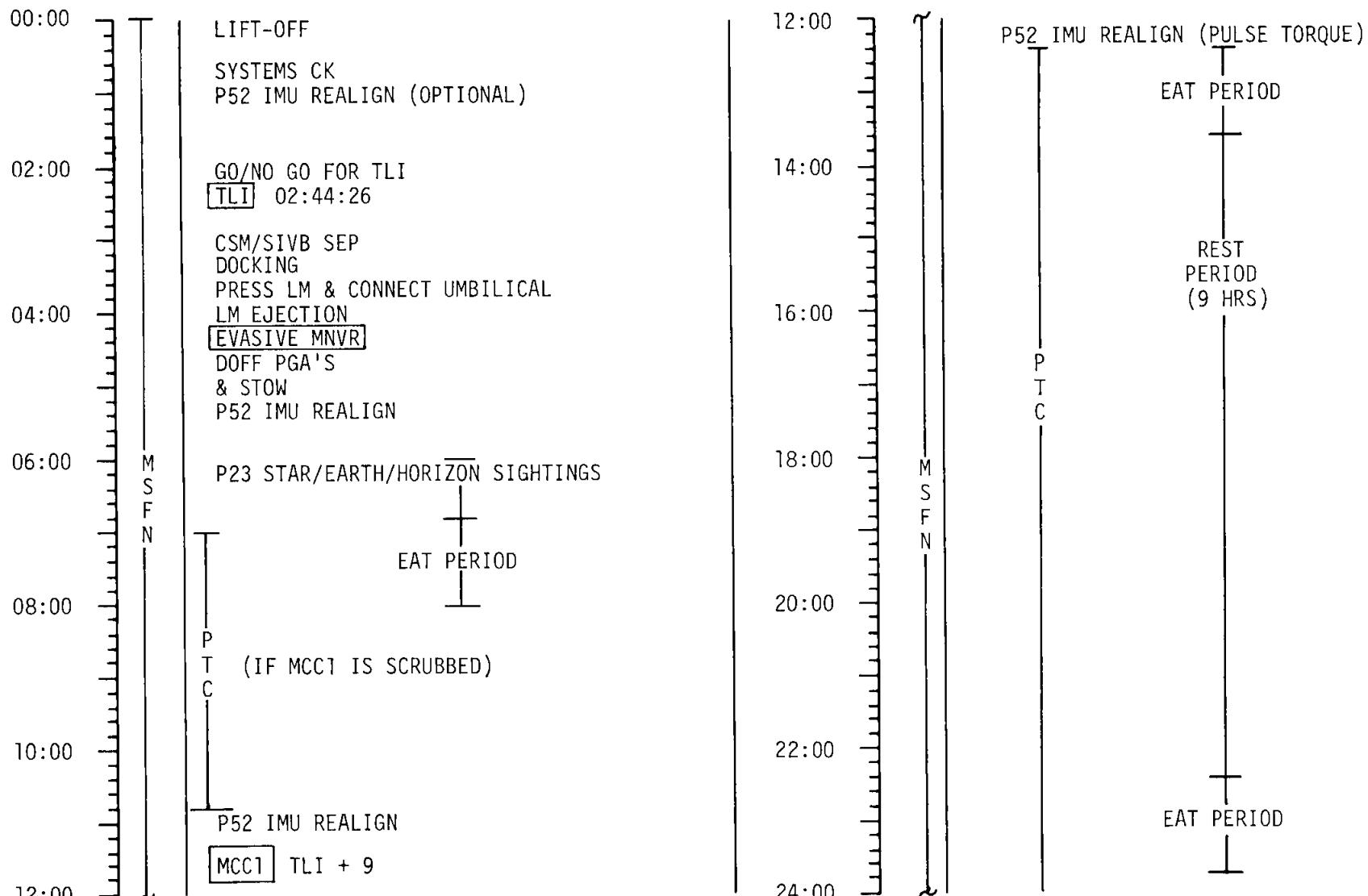
NOMINAL LUNAR SURFACE EVA

FIGURE 5-23 LMP & CDR LiOH



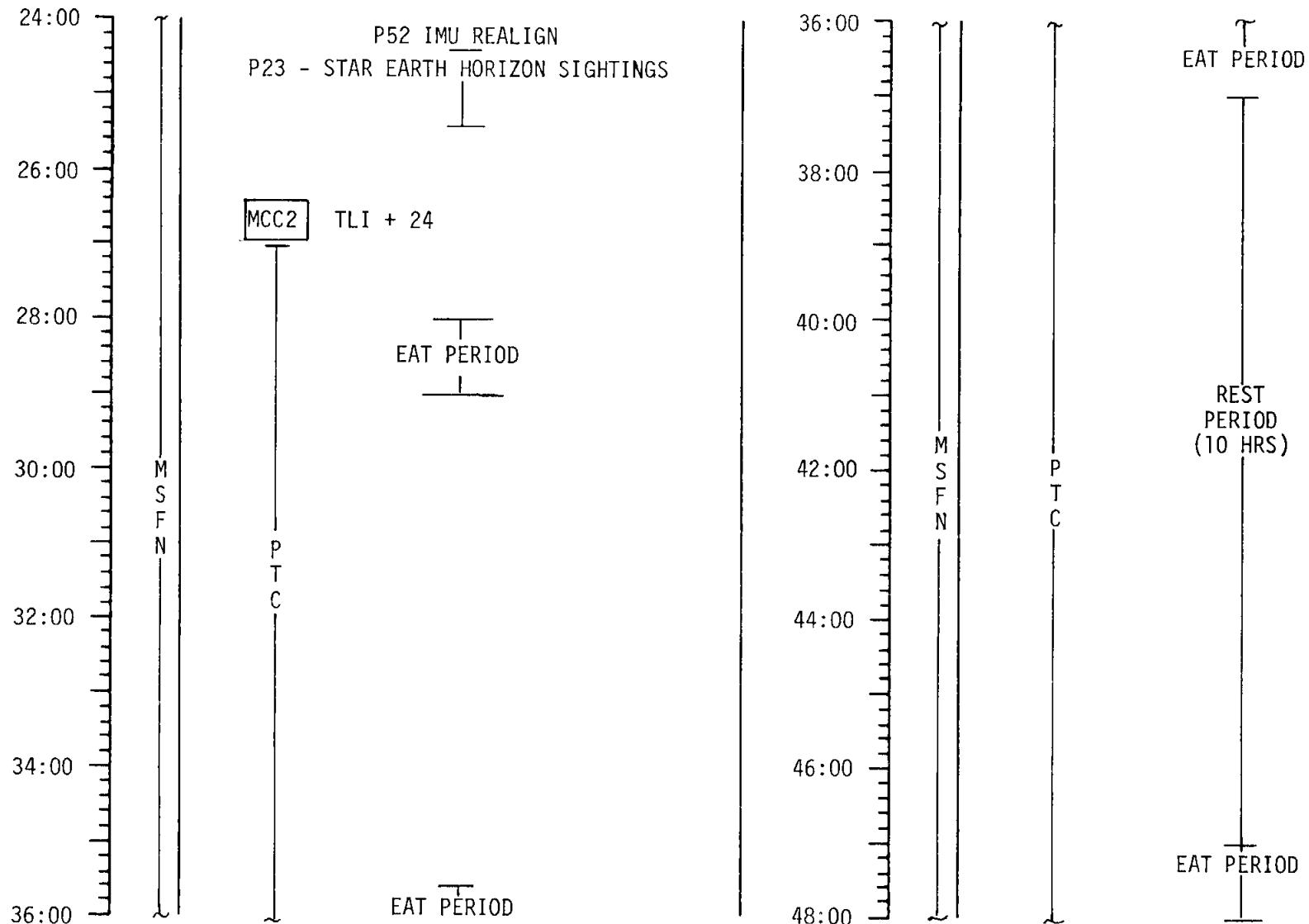
SECTION VI - SUMMARY FLIGHT PLAN

# FLIGHT PLAN



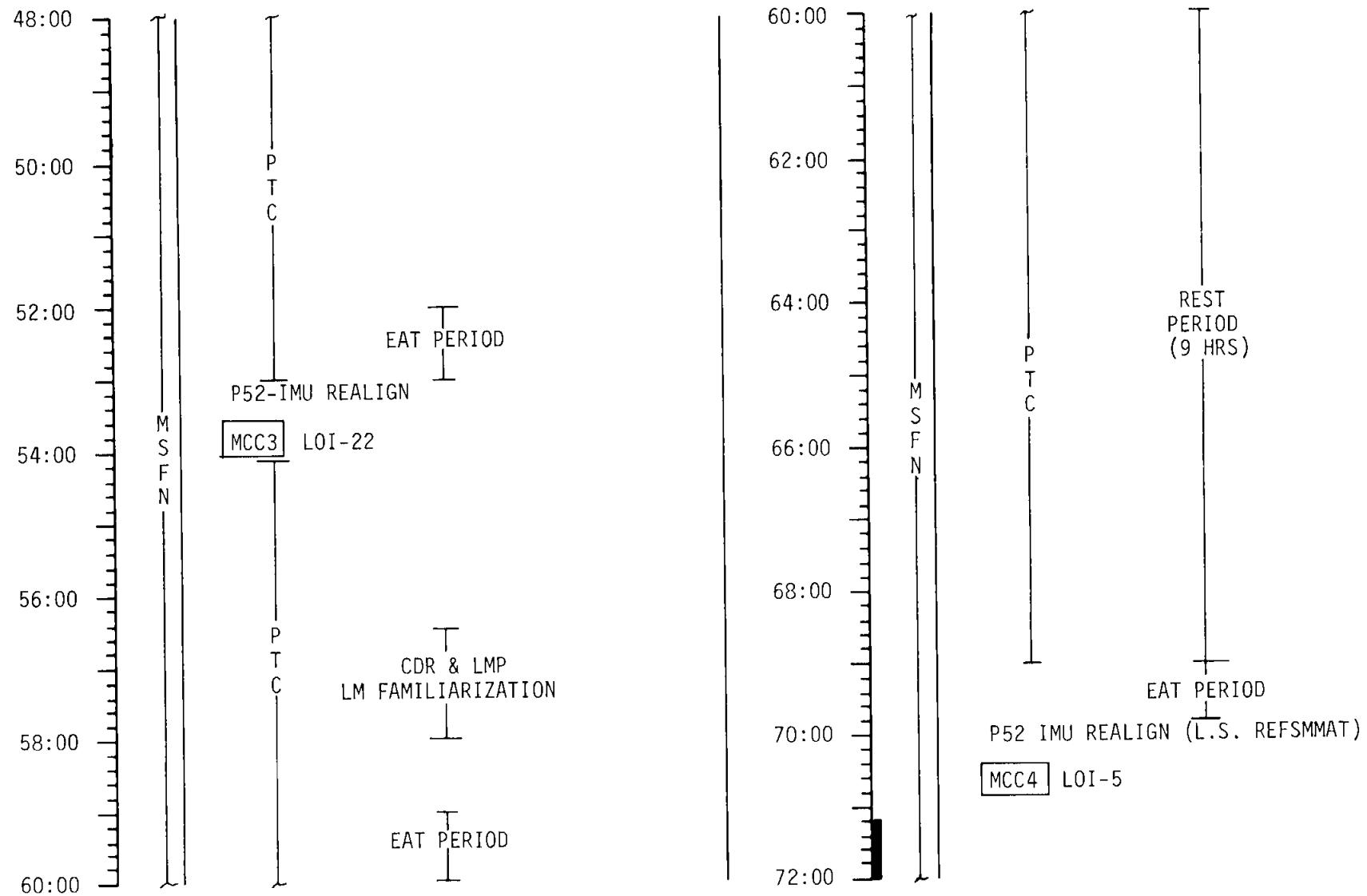
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APOLLO 11	FINAL	JULY 1, 1969	00:00 - 24:00	1/TLC	6-1

# FLIGHT PLAN



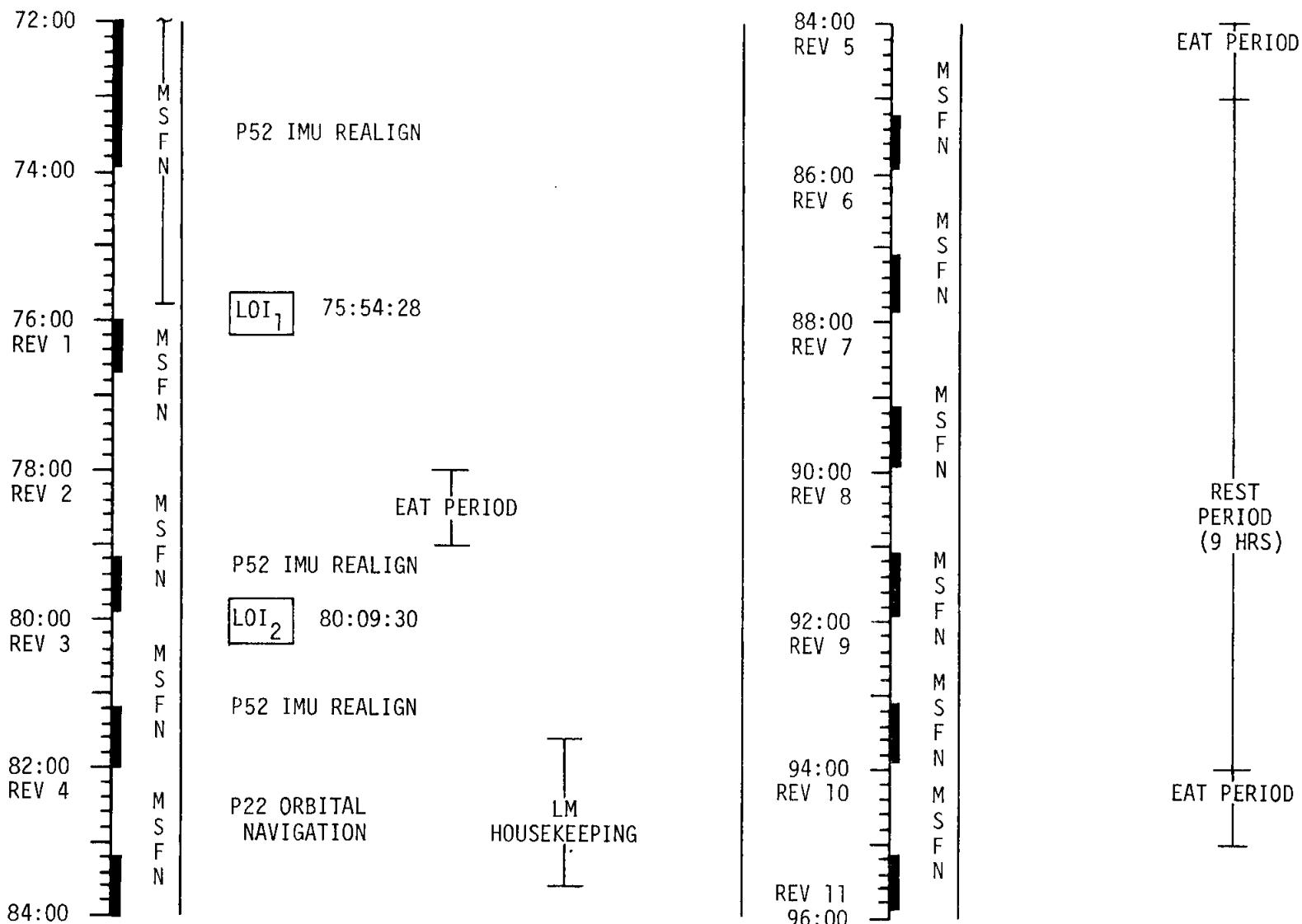
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APOLLO 11	FINAL	JULY 1, 1969	24:00 - 48:00	2/TLC	6-2

# FLIGHT PLAN



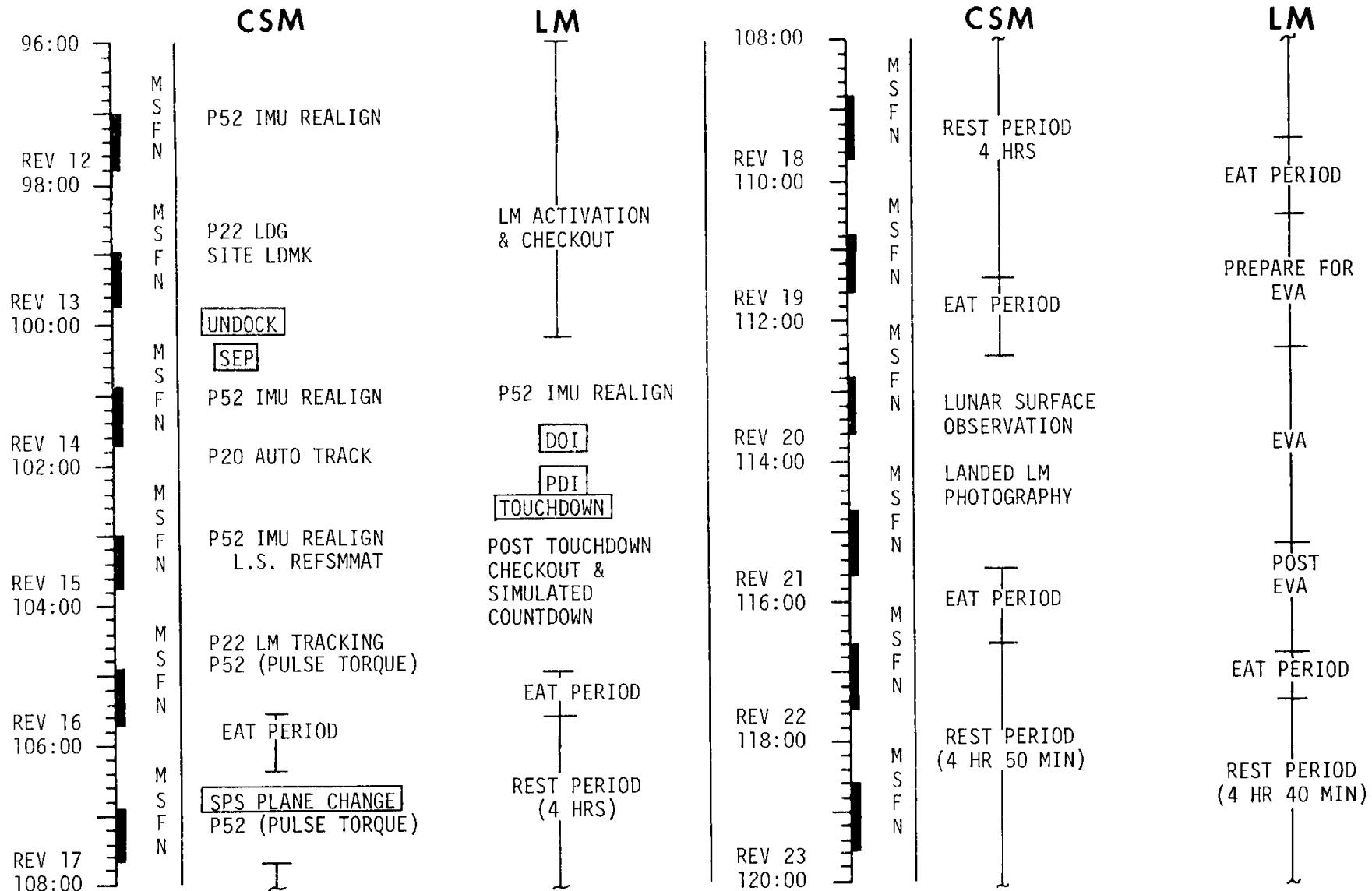
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APOLLO 11	FINAL	JULY 1, 1969	48:00 - 72:00	3/TLC	6-3

# FLIGHT PLAN



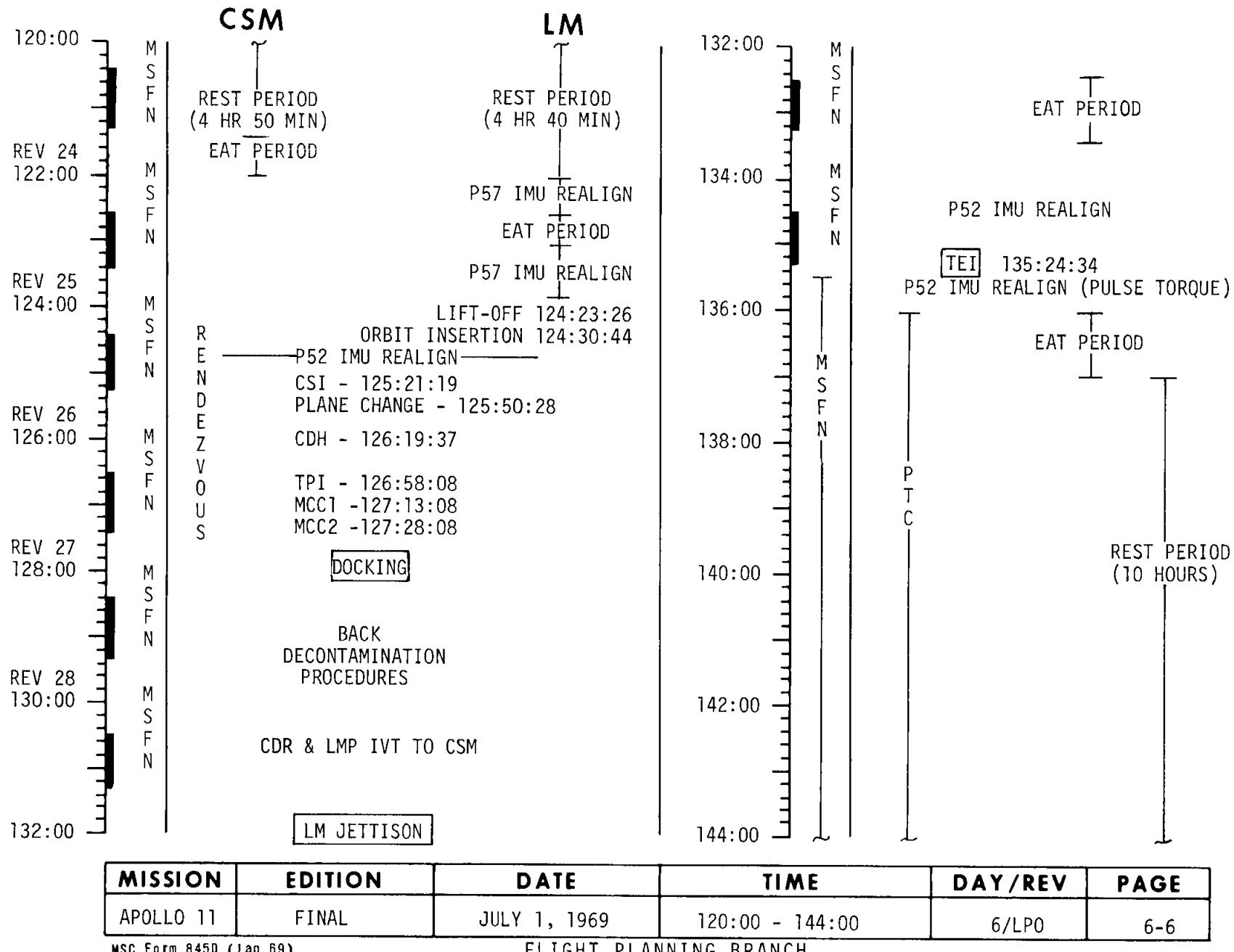
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APOLLO 11	FINAL	JULY 1, 1969	72:00 - 96:00	4/1 THRU 10	6-4

# FLIGHT PLAN

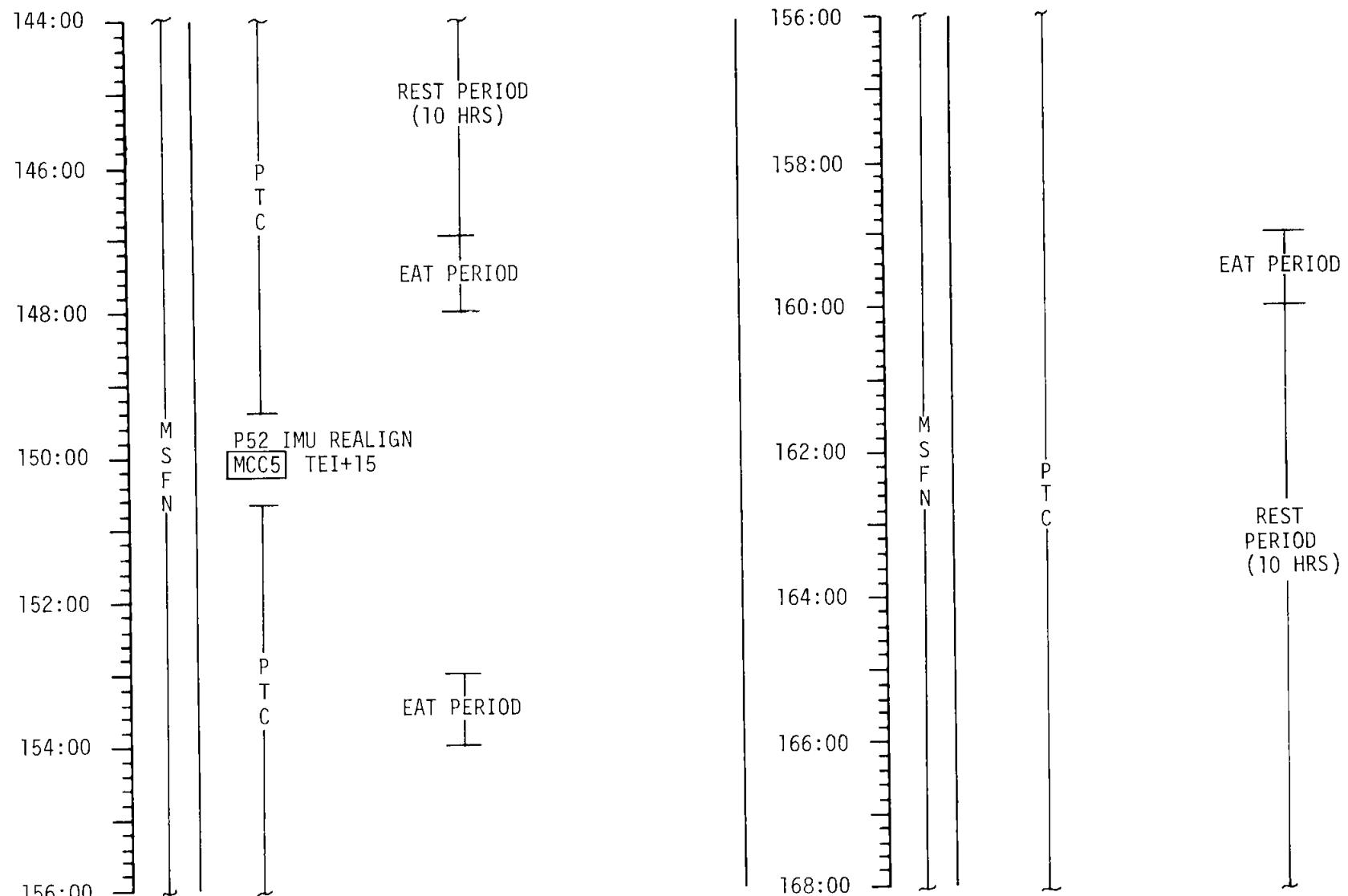


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# FLIGHT PLAN

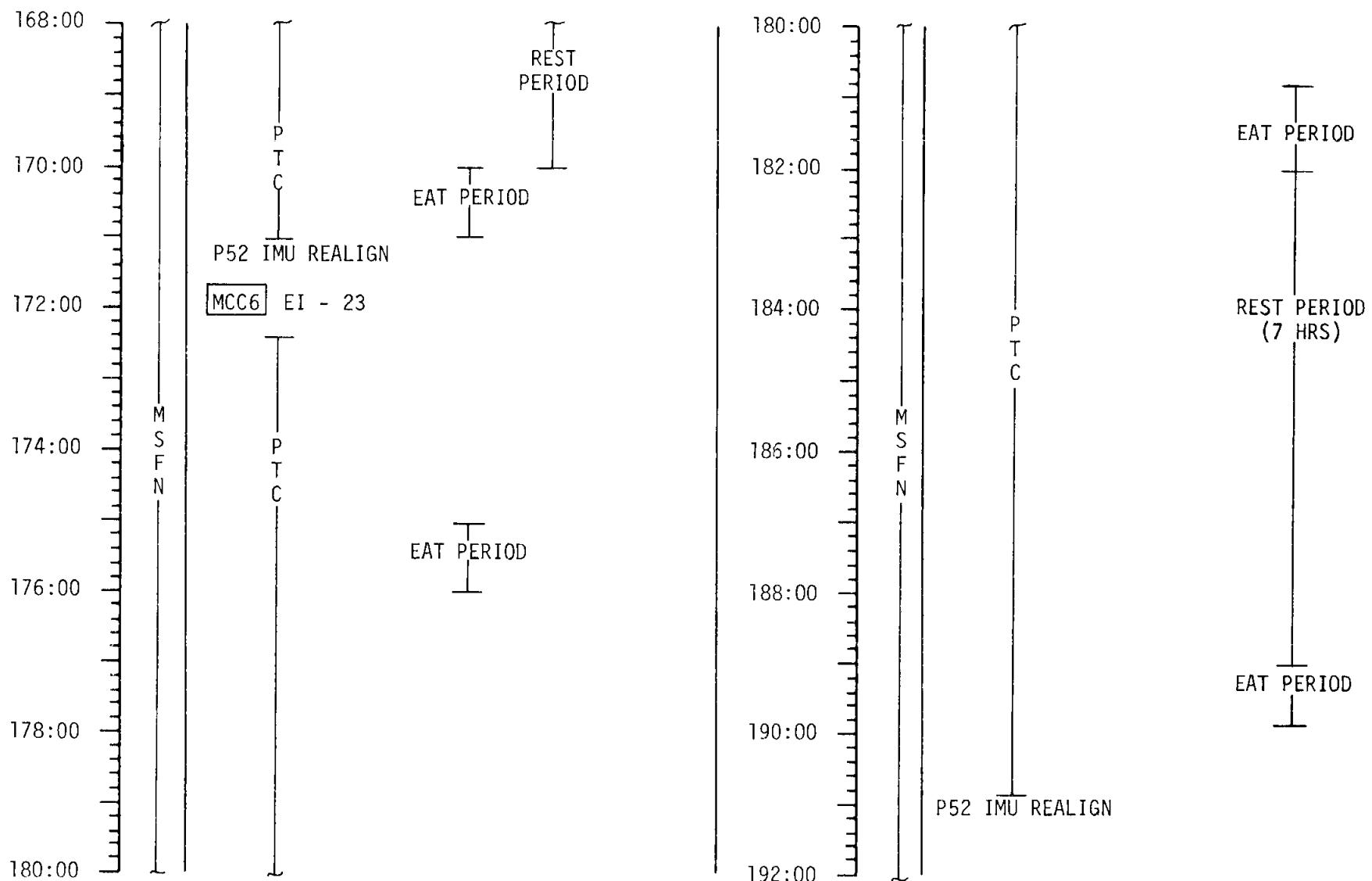


# FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	144:00 - 168:00	7/TEC	6-7

# FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	168:00 - 192:00	8/TEC	6-8

MSC Form 845D (Jan 69)

FLIGHT PLANNING BRANCH

# FLIGHT PLAN

192:00

M  
S  
F  
N

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 - 195:00	9	6-9