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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FINAL



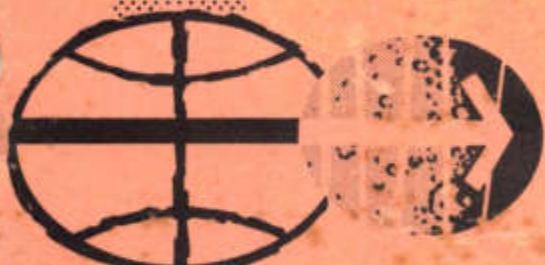
APOLLO 11 FLIGHT PLAN

AS-506/CSM-107/LM-5



JULY 1, 1969

PREPARED BY
FLIGHT PLANNING BRANCH
FLIGHT CREW SUPPORT DIVISION



MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

SECTION I

SECTION II

SECTION III

SECTION IV

SECTION V

SECTION VI

This final version of the Apollo 11 Flight Plan is number four of a set sent to Honeysuckle Creek Tracking Station, Canberra, Australia, for support of the mission.

It is dated July 1, 1969 and was received at the station on July 11, just five days before launch.

Honeysuckle Creek was one of NASA's three prime 26 metre dish tracking sites (the others being Goldstone, California and Madrid, Spain).

This copy was designated for the Telemetry (TLM) and Computer sections.

It has been preserved by Honeysuckle Creek's Bryan Sullivan, and includes his notations.

The Flight Plan was scanned, and this PDF file assembled, by Colin Mackellar for www.honeysucklecreek.net, May 2014.

For authenticity, the pages have been assembled without rotation of those pages where text and charts are sideways (they can be easily rotated in a PDF viewer). Page 1-7 is a foldout chart. Blank pages have also been retained.

www.honeysucklecreek.net

UNITED STATES GOVERNMENT

Memorandum

TO : Distribution

DATE: July 8, 1969

FROM : CF/Chief, Flight Crew Support Division

In reply refer to:
CF342-9M-133

SUBJECT: Revision A to the Apollo 11 Final Flight Plan

Enclosed is Revision A to the Apollo 11 Final Flight Plan. Enclosure 1 contains the pen and ink changes to be made on the indicated pages. Enclosure 2 contains the new pages which replace the same numbered pages in the final edition of the flight plan. Changes on the new pages are made with prestige elite type rather than gothic type so they will be readily evident.

Warren J. North
Warren J. North 7-8

Enclosures 2

CF342:TAGuillory:jat 7-8-69



~~CPTRS~~ | TLM





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

JULY 1, 1969

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



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.

the first time
in the history of
the world.

That is the
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has been

able to do
what he has

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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
LPQ	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

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

8-balls Flight Director Attitude Indicator (FDI)

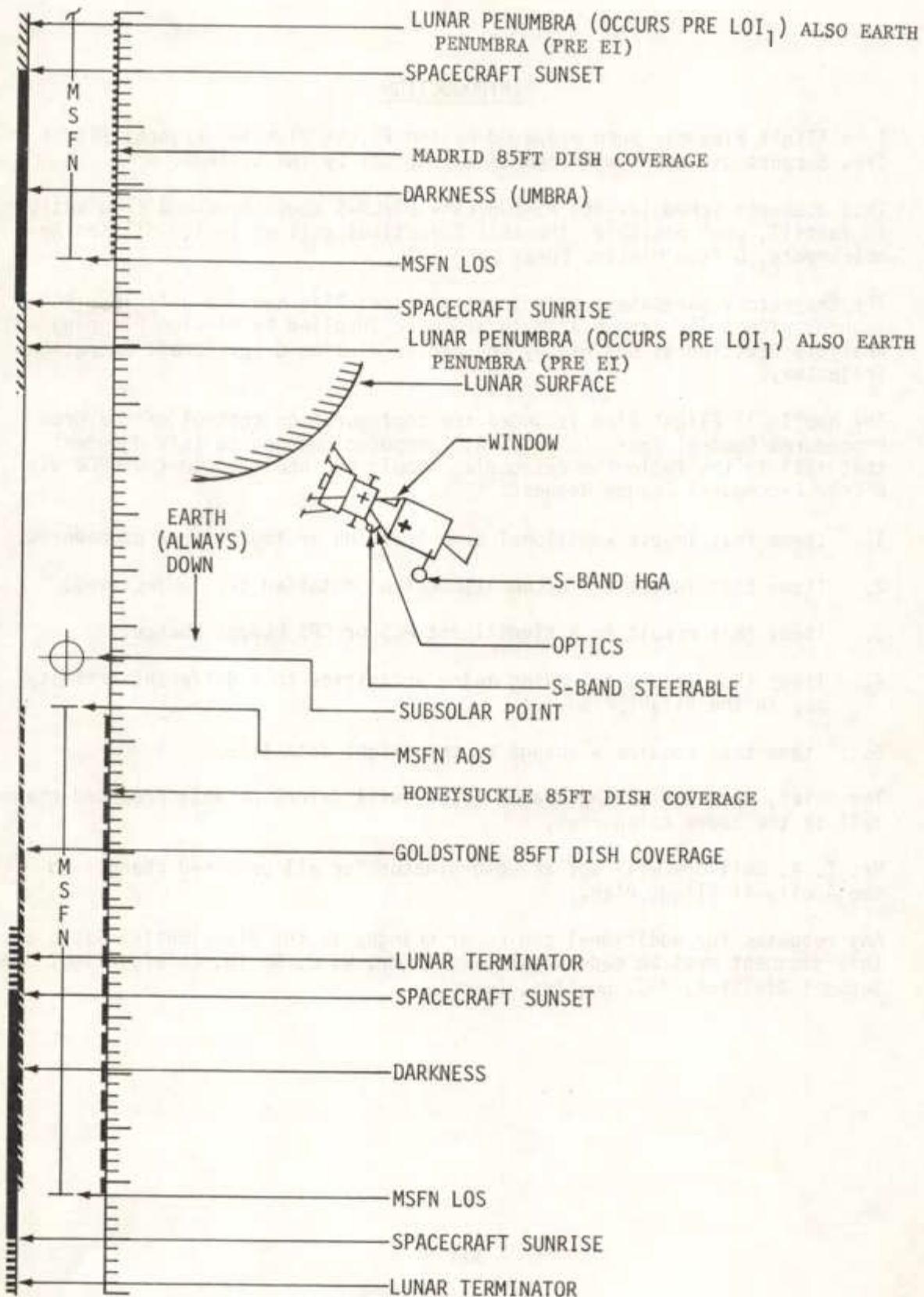
CAMERA NOMENCLATURE

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

INT (f5.6,250,INF) Intervalometer $\frac{1}{250}$ sec,
(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

ENCLOSURE 2
SYMBOL NOMENCLATURE



INTRODUCTION

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

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

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

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

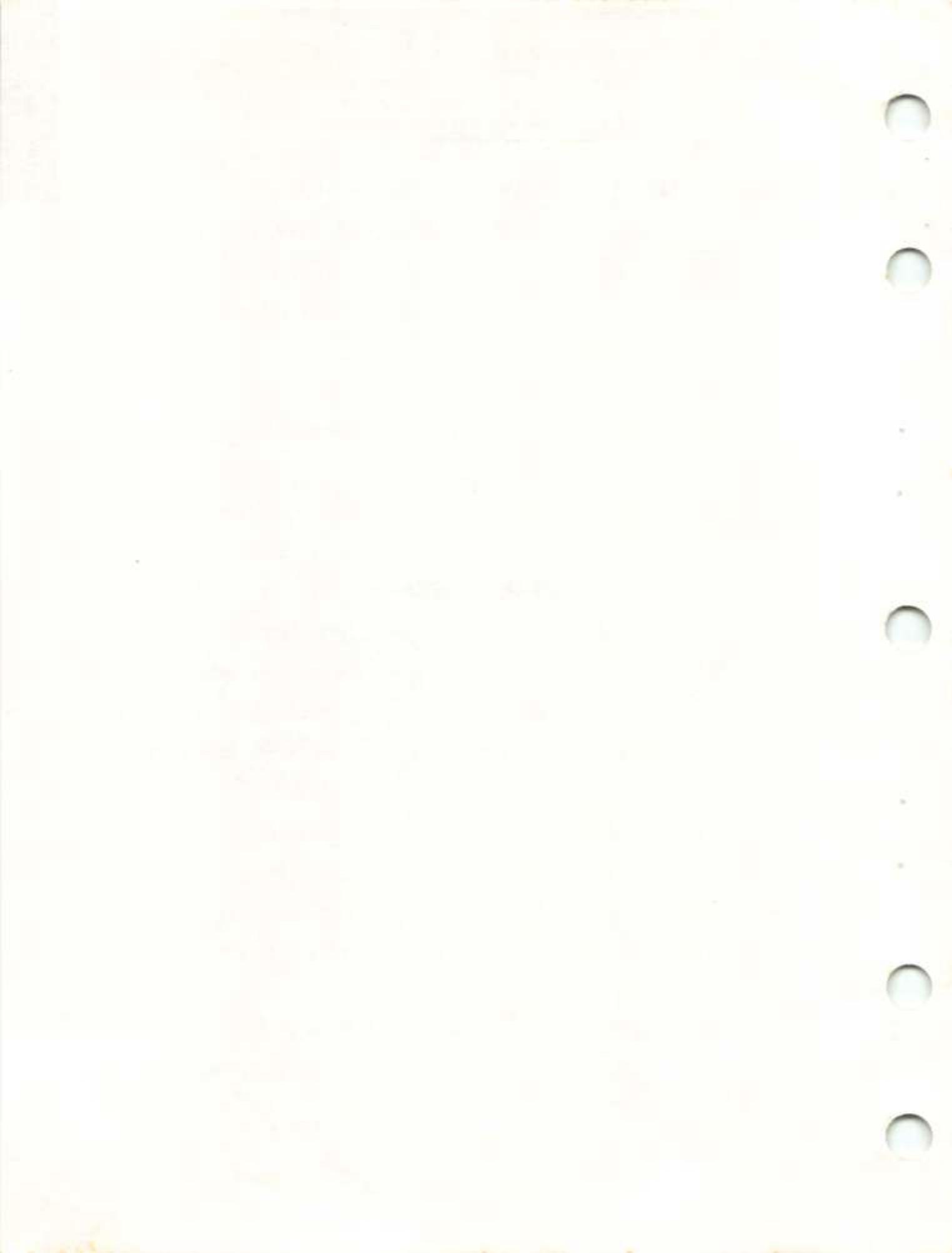
1. Items that impose additional crew training or impact crew procedures.
2. Items that impact the accomplishment of detailed test objectives.
3. Items that result in a significant RCS or EPS budget change.
4. Items that result in moving major activities to a different activity day in the Flight Plan.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

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

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

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

SECTION I - GENERAL



MISSION DESCRIPTION

1. Launch and EPO (Duration 2:44) LIFT OFF - 2:44 GET
 - (a) Nominal launch time is 9:32 EDT, July 16, 1969, with a launch window duration of 4 hrs. 24 min.
 - (b) Earth orbit insertion into a 100 nm circular orbit at 11 min. 43 sec. after lift-off
 - (c) CSM systems C/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 ΔV 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) LOI₁, 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) LOI₁
 - (b) Photos of targets of opportunity
 - (c) LOI₂
 - (d) Post LOI₂ LM entry and inspection. S-Band/VHF B Voice tests will be conducted.
 - (e) Post LOI₂ Pseudo landmark tracking (one set of sightings)
(See Table 1-4)
 - (f) Rest period of 9 hours

- DOI and EVA Day (Duration 28:00) 94:00 - 122:00 GET
- (a) Docked LM activation and checkout
 - (b) Docked landing site landmark sighting (one set of sightings)
(See Table 1-3)
 - (c) Undocking and separation
 - (d) DOI thru landing (See Figure 1-3 Powered Descent)
 - (e) LM post touchdown and simulated liftoff
 - (f) Rest period (LM) of 4 hours
 - (g) CSM plane change
 - (h) Rest period (CSM) of 4 hours

- (i) EVA prep
- (j) EVA for 2 hours 40 minutes
- (k) Post EVA
- (l) Rest period (LM) 4 hours 40 minutes
- (m) Rest period (CSM) 4 hours 50 minutes

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

(a) LM Lift-Off and Insertion

(b) LM active rendezvous

CSI

PC

CDH

TPI

Braking

(c) Docking

(d) LM jettison

(e) TEI

(f) Rest Period

4. 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.

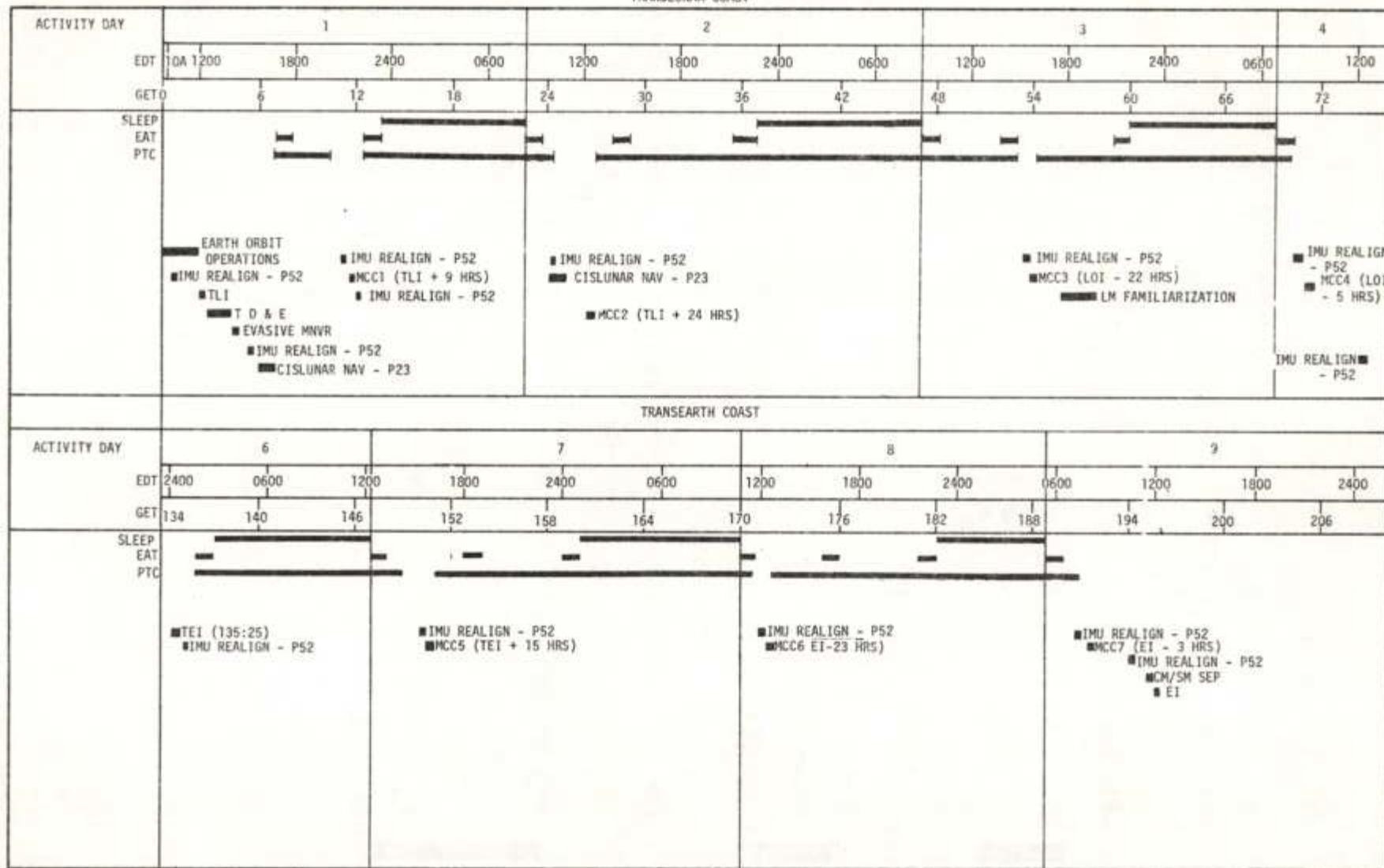
(c) S/C night period duration - 47 min.

(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° sun angle) at REV. 7
 - (k) S/C subvehicle point to horizon 327 nm.
5. Transearch Coast and Entry (Duration 59:39) 131:52 - 195:03 GET
Transearch 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 ΔV nominally zero.
 - (b) CM/SM separation takes place at 194:51 GET and Entry Interface occurs at 195:03 GET.
 - (c) Splashdown will occur in the Pacific Ocean at a longitude of about 172.4° West at 195:17 GET. This will occur approximately 25 minutes prior to sunrise local time.

FIGURE 1-1
MISSION SUMMARY FLIGHT PLAN
TRANSLUNAR COAST



LUNAR ORBIT SUMMARY FLIGHT PLAN

FIG 1-2

ACTIVITY DAY	4 (LOT DAY)												5 (LOS - EVA DAY)												6 (ASCENT - TEL DRF)						
	SLEEP	1330	1530	1730	1930	2130	2330	0130	0330	0530	0730	0930	1130	1330	1530	1730	1930	2130	2330	0130	0330	0530	0730	0930	1130	1330	1530	1730	1930	2130	2330
EDT	76	78	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110	112	114	116	118	120	122	124	126	128	130	132	134	136
SET	76	78	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110	112	114	116	118	120	122	124	126	128	130	132	134	136
REV NO.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
LM (CDR - LMP)	LMP INT TO LM ENTRY STATUS CHECKS HOUSEKEEPING COMM CHECKS CLOSEOUT, INT TO CSM	LMP INT TO LM LMP PREP GLOVES LMP CHECK INSTRUMENTATION LMP INT TO LM LCS ACTIVATION S-BAND CHECKS SFT FANTHORPE SFT FAULT ISOLATION VHF ACTIVATION, CHECKOUT LMP INT TO CSM CON PGM INT TO LN	LMP INT TO LM LMP CHECK INSTRUMENTATION CDR ASSIST CDR, CLOSE AND SECURE LM HATCH ASCENT BATTERIES ACT AND CHECKOUT DON HELMET & GLOVES, ARS/PGA CHECK CABIN REGULATOR CHECK DOFF HELMET & GLOVES FINE ALUMINUM ADS ACTIVATION AND DEPLOY LABORATORY GEAR INITIALIZE EVA RESCUE EQUIPMENT AND CHECKOUT RR ACT & SELF TEST DPM, PPE AND CHECKOUT DON HELMET & GLOVES INDOCK PREPS FOR INSPECTION ADS DEPARTURE ALARM RR, VHF, XMT, CSM AND LA RTV, CSM, CDS EMU SEALER, PS2 SAT PPE POD FREE POWERED DESCENT THALASSO	POST TOUCHDOWN CHECKLIST BEGIN SIMULATED COUNTDOWN PS2, GRAVITY MEASURE PS2, 2 CELESTIAL BODIES PS2, GRAVITY & 1 CELESTIAL BODY END SIMULATED COUNTDOWN CAT PERIOD	EAT PERIOD SYSTEMS PREP FOR EGRESS PREP FOR EGRESS PLSS/OPS DONNING PLSS/EVS ELECTRICAL CK FINAL EVA EQUIP EK FINAL SYSTEMS PREP PREP FOR CABIN DEPRESS PRESSURE INTEGRITY CK 2 hr 40 min EVA POST EVA SYSTEMS CONFIG PLSS/OPS DOPPING FINAL SYSTEMS CONFIG PREP FOR EQUIP JET PRESSURE INTEGRITY CK CABIN DEPRESS HATCH OPENING CABIN DEPRESS FINAL SYSTEMS CONFIG POST EVA CABIN CONFIG EAT PERIOD	AGS TURN ON, SELF TEST PS2, GRAVITY & 1 CELESTIAL BODY EAT PERIOD VERIFY AGS PS2, 2 CELESTIAL BODY ASCENT PREP INSERTION MR SELF TEST IMU REALIGN PS2 RR TRACK OF CSM CSI BURN - RCS PLANE CHANGE, BURN - RCS CDH BURN - RCS TFI BURN - RCS MCCI BURN RCS MCC2 BURN RCS BRAKING BURNS - RCS DOCKING TRANSFER & STOW EQUIP AND EQUIP VACUUM & CLEAN SUITS COR TRANSFER TO CSM LMP CONFIGURE LM FOR JETTISON LMP INT TO CSM	✓TEO																								
CSM (DP)	LOT = 1 PREP LOT = 1 EAT (ALL) IMU REALIGN PS2 CDR & LMP DON LSC CMF DON INGA IMU REALIGN PS2 INSTALL PROBE AND DROPOLE, CLOSE HATCH TRACK PSEUDO LANDMARK A-1	IMU REALIGN, PS2 SXT TRACK LANDED LM IMU REALIGN PS2, PULSE TORQUE EAT PERIOD PLANE CHANGE PREP PLANE CHANGE IMU REALIGN, PS2, PULSE TORQUE	IMU REALIGN, PS2 SXT TRACK LANDED LM IMU REALIGN PS2, PULSE TORQUE EAT PERIOD PHOTOGRAPH LANDED LM EAT PERIOD	EAT PERIOD IMU REALIGN, PS2 BACKUP LM CST BURN BACKUP LM CDH BURN MONITOR MCC & BRAKING TRANSFER & STOW EQUIPMENT CLOSE CSM HATCH PREP FOR JETTISON JETTISON LM IMU REALIGN, PS2 EAT PERIOD IMU REALIGN PS2 FINAL PREP FOR TEL TEL																											
SLEEP	76	78	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110	112	114	116	118	120	122	124	126	128	130	132	134	136
SET	76	78	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110	112	114	116	118	120	122	124	126	128	130	132	134	136

LM POWERED DESCENT

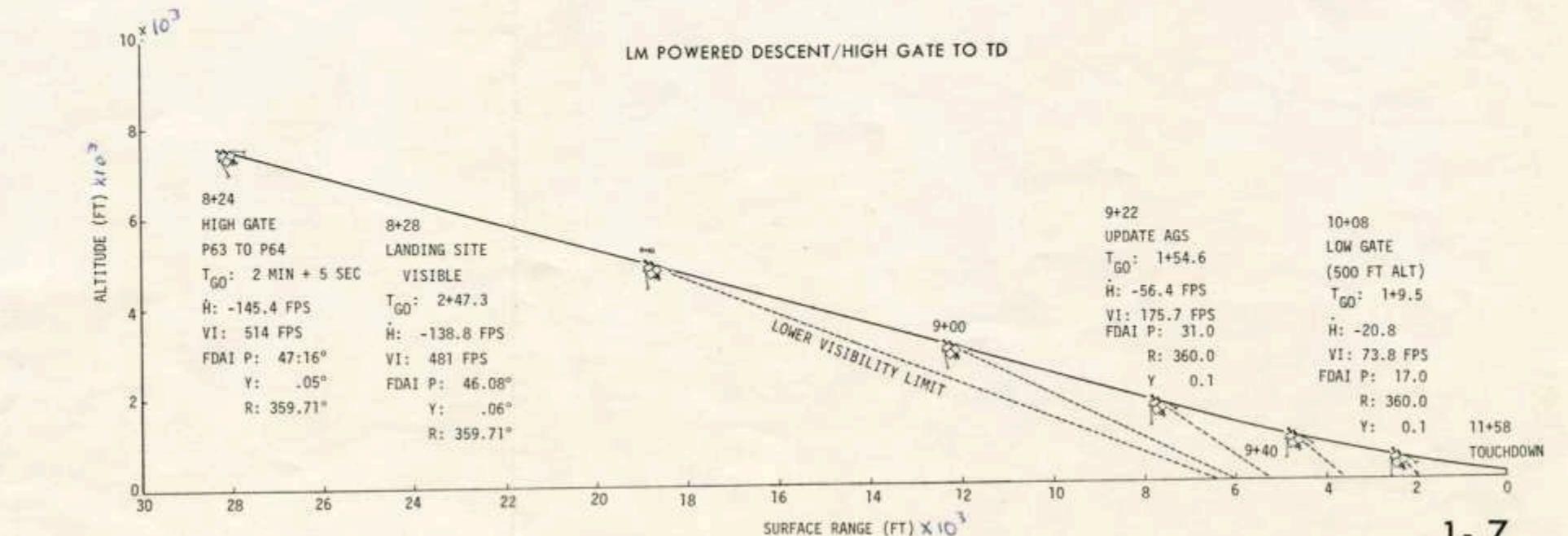
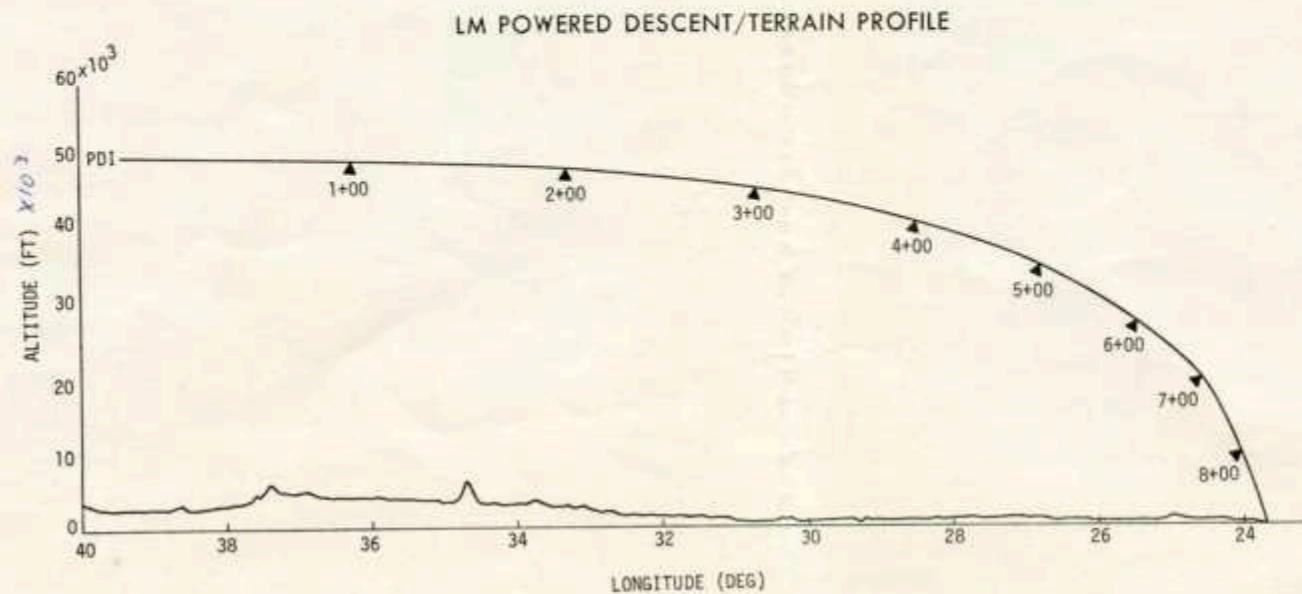
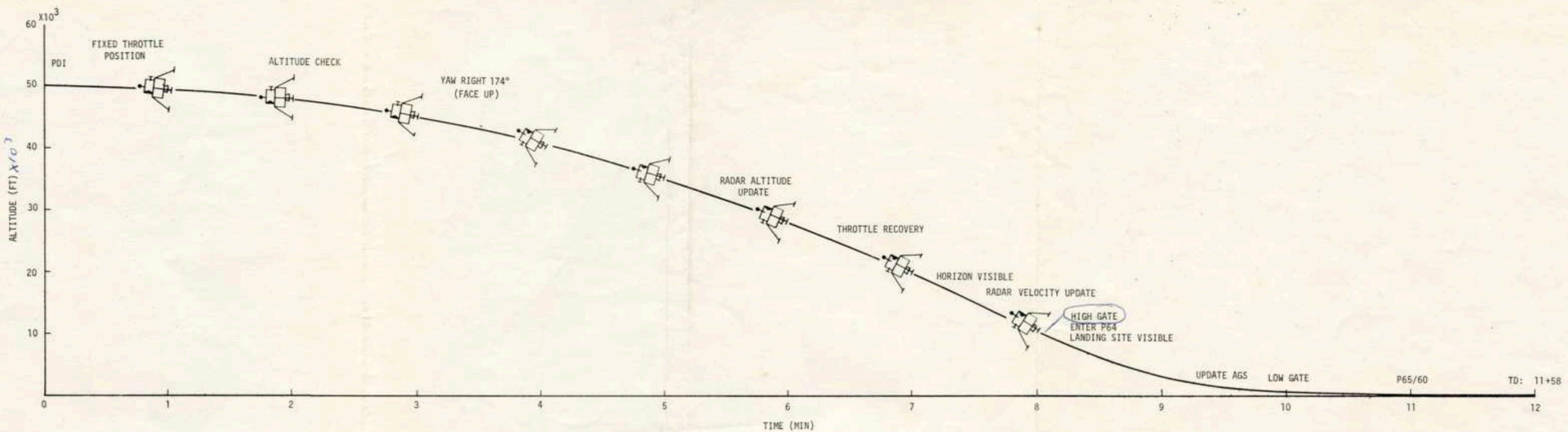


TABLE 1-1 CSM BURN SCHEDULE

BURN/MANEUVER	GETI BURN TIME ΔV_c	ATTITUDE (DEG)		LIGHTING	ΔV (FPS)	ULLAGE	TVC MODE	REFSMMAT	S/C WT. RESULTANT HA, HP	REMARKS
		LH/LV	INERTIAL							
S-IVB TLT	2:44:26 5 MIN 20 SEC			BURNOUT AT SUNRISE	ΔV_x : — ΔV_y : — ΔV_z : — ΔV REQ: 10,451.2	—	—	PAD	WT: — HP: — HA: —	S-IVB BURN
CSM/LM S-IVB EVASIVE MNVR	04:39:44.9 2.8 SEC 15.6 FPS			DAYLIGHT	ΔV_x : 5.1 ΔV_y : 0.0 ΔV_z : 19.0 ΔV REQ: 19.7	NOT REQUIRED	G&N AUTO	PAD	WT: 96662.3 HP: 123.8 HA: 281953.9	SPS BURN
MIDCOURSE CORRECTIONS MCC ₁ to MCC ₄	11:45 26:45 53:55 70:55			—	ΔV_x : NOMINALLY ΔV_y : ZERO ΔV_z : — ΔV REQ:	NOT REQUIRED	G&N AUTO	PAD PTC PTC LDG SITE	—	TLI + 9 TLI + 24 LOI - 22 LOI - 5
LOI ₁	75:54:28.4 5 MIN 58.9 SEC 2914.8 FPS			DAYLIGHT (SS-1HR 7 MIN)	ΔV_x : -2891.8 ΔV_y : -433.1 ΔV_z : 20.4 ΔV REQ: 2924.1	NOT REQUIRED	G&N AUTO	LDG SITE	WT: 95207.4 HP: 59.2 HA: 169.8	SPS BURN
LOI ₂	80:09:29.7 16.4 SEC			DAYLIGHT (SR + 9 MIN)	ΔV_x : 138.3 ΔV_y : 0.0 ΔV_z : 75.9 ΔV REQ: 157.8	2 JET 20 SEC	G&N AUTO	LDG SITE	WT: 71320.8 lbs HP: 53.6 NM HA: 65.6 NM	SPS BURN
CSM/LM SEP	100:39:50.4 8 SEC			SUNLIGHT (SS-14 MIN)	ΔV_x : 0.0 ΔV_y : 0.0 ΔV_z : 2.5 ΔV REQ: 2.5	—	G&N AUTO	LDG SITE	WT: 36407.9 HP: 55.6 HA: 63.1	RCS BURN
*CSM PLANE CHANGE	107:05:33.4 .8 SEC 5.7			DARKNESS (SS + 17 MIN)	ΔV_x : 0.0 ΔV_y : 16.6 ΔV_z : 0.0 ΔV REQ: 16.6	2 JET 20 SEC	G&N AUTO	PLANE CHANGE	WT: 36325.4 HP: NO CHANGE HA: NO CHANGE	SPS BURN
LM JETTISON	131:53:04.7 3.1 SEC 0.8 FPS			DAYLIGHT (SR + 36 MIN)	ΔV_x : -1.0 ΔV_y : — ΔV_z : — ΔV REQ: 1.0	—	G&N AUTO	LIFT OFF	WT: 36154.7 HP: 58.5 HA: 59.4	RCS BURN
TEI	135:24:33.8 2 MIN 29.4 SEC NOT AVAILABLE			DAYLIGHT (SR + 10 MIN)	ΔV_x : 3213.3 ΔV_y : 705.0 ΔV_z : -138.8 ΔV REQ: 3292.7	2 JET 16 SEC	G&N AUTO	LIFT OFF	WT: 36111.4 HP: — HA: —	SPS BURN
MIDCOURSE CORRECTIONS MCC ₅ to MCC ₇	150:24 172:00 192:06			—	ΔV_x : ΔV_y : NOMINALLY ΔV_z : ZERO ΔV REQ:	—	G&N AUTO	PTC PTC ENTRY	—	TEI + 15 EI -23 EI -3

* NEW DATA INDICATES THIS BURN MAY BE NOMINALLY ZERO

TABLE 1-2 LM BURN SCHEDULE

BURN/MANEUVER	GETI BURN TIME	ATTITUDE (DEG)		LIGHTING	ΔV (FPS)	ULLAGE ΔV (FPS)	TVC MODE	REFSMAT	S/C WT RESULTANT HR, HP	REMARKS
		LH	INERTIAL							
B01	101:38:48 28.5 SEC			DARKNESS (SR-4 MIN)	ΔVX: -67.46 ΔVY: -26.68 ΔVZ: -12.51 ΔV REQ: 70 FPS	2 JET 7.5 SEC 1.3 FPS	PGNCS AUTO	L0G SITE	WT: 33,404 HP: 8.97 HA: 57.87NM	DPS BURN
P01	102:35:13 11MIN 58SEC			DAYLIGHT	ΔVX: - ΔVY: - ΔVZ: - ΔV REQ: 6766	2 JET 7.5 SEC 1.3 FPS	PGNCS AUTO	L0G SITE	WT: 16,569 HP: 0 HA: 0	DPS BURN
ASCENT	124:23:26 7 MIN 18 SEC			DAYLIGHT	ΔVX: - ΔVY: - ΔVZ: + ΔV REQ: 5060	—	PGNCS AUTO	LIFT OFF	WT: 5,894 AT INS: HP: 60,000 ft HA: 45 NM	RPS BURN
CSE	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	125:50:29 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	
COH	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 ₁	127:13:08 0			DARKNESS (SR - 8 MIN)	ΔVX: 0.0 ΔVY: 0.0 ΔVZ: 0.0 ΔV REQ: 0.0	—	PGNCS AUTO	LIFT OFF	WT: - HP: - HA: - RCS + Z 2 JET BURN NOMINALLY ZERO	
MCC ₂	127:28:08 0			DAYLIGHT (SR + 7 MIN)	ΔVX: 0.0 ΔVY: 0.0 ΔVZ: 0.0 ΔV REQ: 0.0	—	PGNCS AUTO	LIFT OFF	WT: - HP: - HA: - RCS + Z 2 JET BURN NOMINALLY ZERO	
1st BRAKING MNVR	127:36:57 0			DAYLIGHT (SR + 15 MIN)	ΔVX: 0.0 ΔVY: 0.0 ΔVZ: 0.0 ΔV REQ: 0.0	—	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	127:43:36.7 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	¹ LAUNCH AZIMUTH/ SUN ELEVATION	² LAUNCH AZIMUTH/ SUN ELEVATION
JULY 16 0932 EDT 1209 EDT	2(IIP6)	00°42'50"N 00.71388889°N	23°42'28"E 23.70777778°E (00.6914°N)	72°/10.5° (23.7169°E) ³	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.

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

TABLE 1-4 LANDMARK TRACKING DATA

July 16 Launch

LANDMARK DESIG.	LATITUDE	LONGITUDE	DELTA ALTITUDE	SUN EL (nm)
A1(Pseudo)	2°N 2.000°N	65° 30' 60.500°E 65.500°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 (01.24307°N)	-001.68	8.5°
123(Alternate LDG SITE 2)	00°30'19"N 00.50527778°N	24°53'20"E 24.88888889°E	-001.71	-
129(Alternate LDG SITE 2)	01°17'06"N 01.28500000°N	23°44'37"E 23.74361111°E	-001.76	-
133(Alternate LDG SITE 2)	00°47'14"N 00.78722222°N	23°30'55"E 23.51527778°E	-001.68	-

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

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

July 18 Launch

LANDMARK DESIG.	LATITUDE	LONGITUDE	DELTA ALTITUDE 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 -001.76	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

T. CSM

Crew procedures called out in the flight plan may be found in the following documents:

- 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:
- Apollo Operations Handbook LM-5 Volume 2
 - Crew Checklist
 - LM Rendezvous Procedures
 - LM Descent/Ascent Summary Document
 - Lunar Landing Phase Photographic Operations Plan
 - Data Priority Documents
 - EVA Procedures
 - Apollo Lunar Surface Operations Plan

D. Communications

1. General

- CSM and LM HBR data transmissions in lunar orbit will normally require the use of the high gain or steerable antennas
- During communications, the spacecraft will be referred to by name (Apollo 11) and MCC-H will be referred to as Houston.
- 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)
- 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.
- 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.
- 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

- 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.
- 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.
- DSE will be used for CSM HBR and voice recording during all CSM engine burns.
- 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 H₂ and O₂ purging is scheduled as follows H₂ approximately every 48 hours and O₂ 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 H₂O inlet valve will be opened prelaunch.
- f. FC purges and waste water dumps will not be scheduled within one hour prior to optical sightings.
- g. Waste H₂O dumping will be managed to allow:
 - (1) Maximum QTY: 85-90%
 - (2) Minimum QTY: 25%
 - (3) At LOI: QTY = 75%
 - (4) At CM-SM SEP: QTY = 90% to 100%
 - (5) No dumping after MCC3 until after LOI
 - (6) Dumps will be performed (if required) within 2 hours preceding MCC maneuvers
 - (7) In lunar orbit if dumping is required, dumps will be performed immediately prior to sleep periods
 - (8) The water dump will not be operated in the automatic mode at anytime during the mission
- h. The cryogenic heaters will be in AUTO during the mission and the fans will be operated manually. The fans will be cycled for one minute before and after each sleep cycle.
- i. The batteries will be charged according to the following schedule:

Time	Battery
5:20:00	B
12:20:00	A
48:10:00	B
80:25:00	A
107:15:00 - 103:30:00	B
151:00:00 - 148:00:00	A
172:00:00 - 154:00:00	B

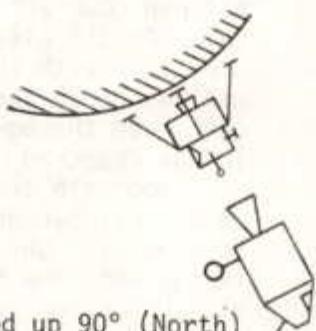
2. Environmental Control System and Cabin Pressurization

- a. One C₀₂ odor absorber filter (LiOH canister) is changed approximately every 12 hours or if C₀₂ partial pressure is greater than 7.6mm Hg. There are 20 filters (2 in the canisters onboard and 18 stowed).

- b. The coolant loop operation will be as follows:
- (1) Launch - primary loop operation
 - (2) Earth Orbit - primary loop operation and secondary loop test
 - (3) Post TLI - deactivate both evaporators
 - (4) Pre LOI sec rad leak ck only.
 - (5) At 112:30 activate primary evaporator
 - (6) Post TEI - deactivate primary evaporator
 - (7) Entry interface minus 1 hour - activate primary and secondary evaporator.

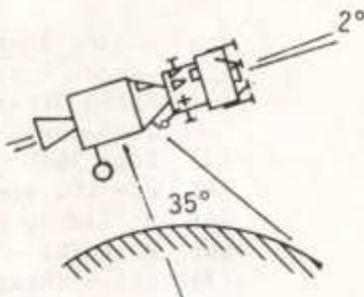
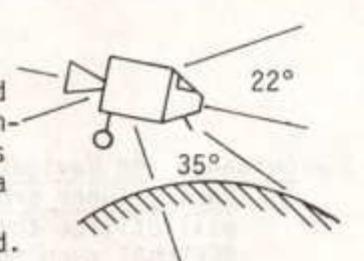
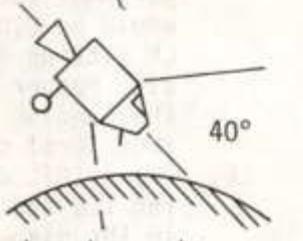
3. Guidance and Navigation

- 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.

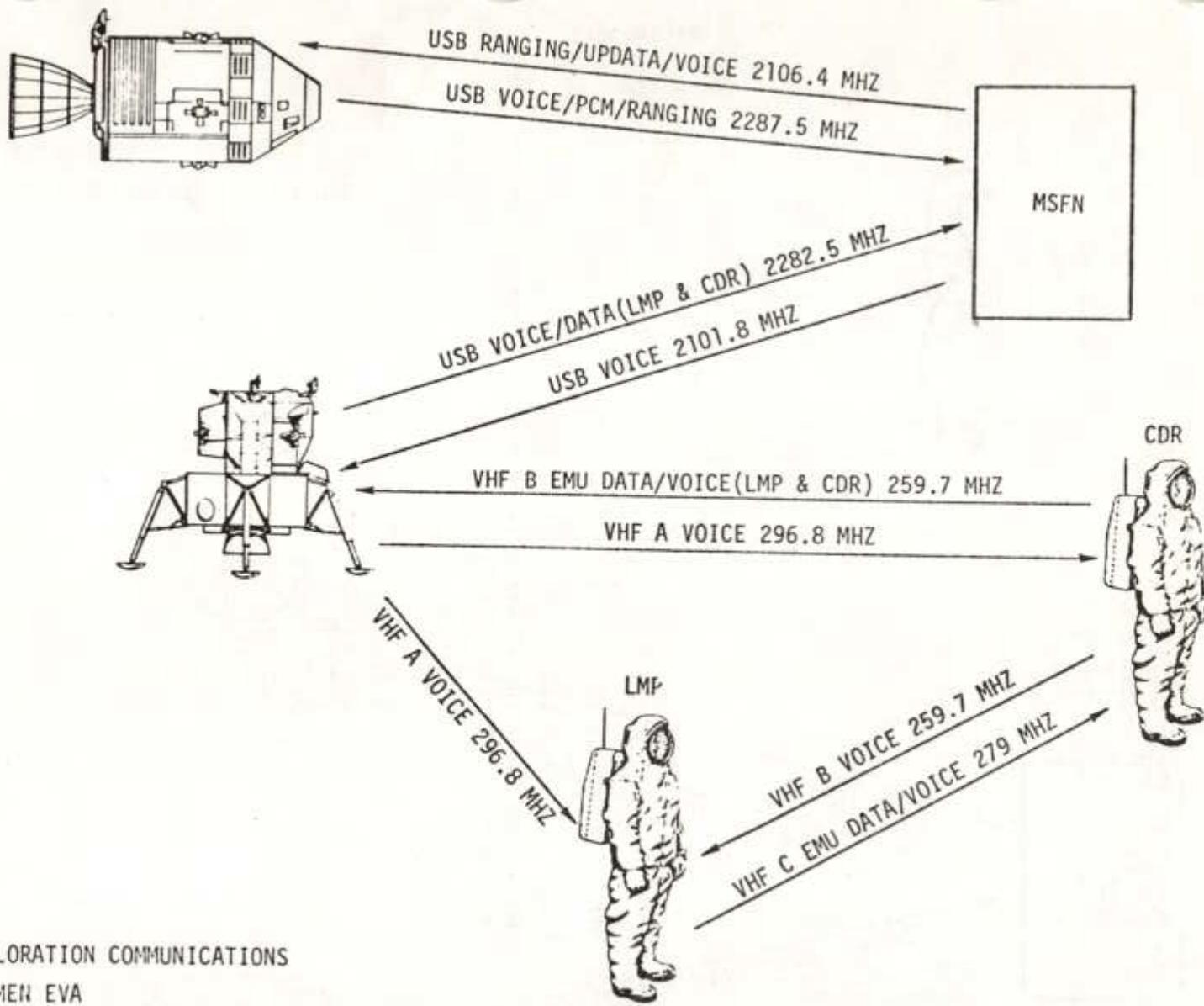
- d. In the docked configuration the CSM/LM approaches the landmark in an inertial hold attitude. This inertial attitude places the spacecraft 2° below the local horizontal at the 35° elevation angle point. At 35° elevation angle a pitch down of $0.3^\circ/\text{sec}$ is initiated. Five marks are then 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 $0.2^\circ/\text{sec}$ or $0.5^\circ/\text{sec}$. unless other rates are required.
 NOTE: At $0.2^\circ/\text{sec}$, 15 minutes is required to maneuver 180° .
 At $0.5^\circ/\text{sec}$, 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

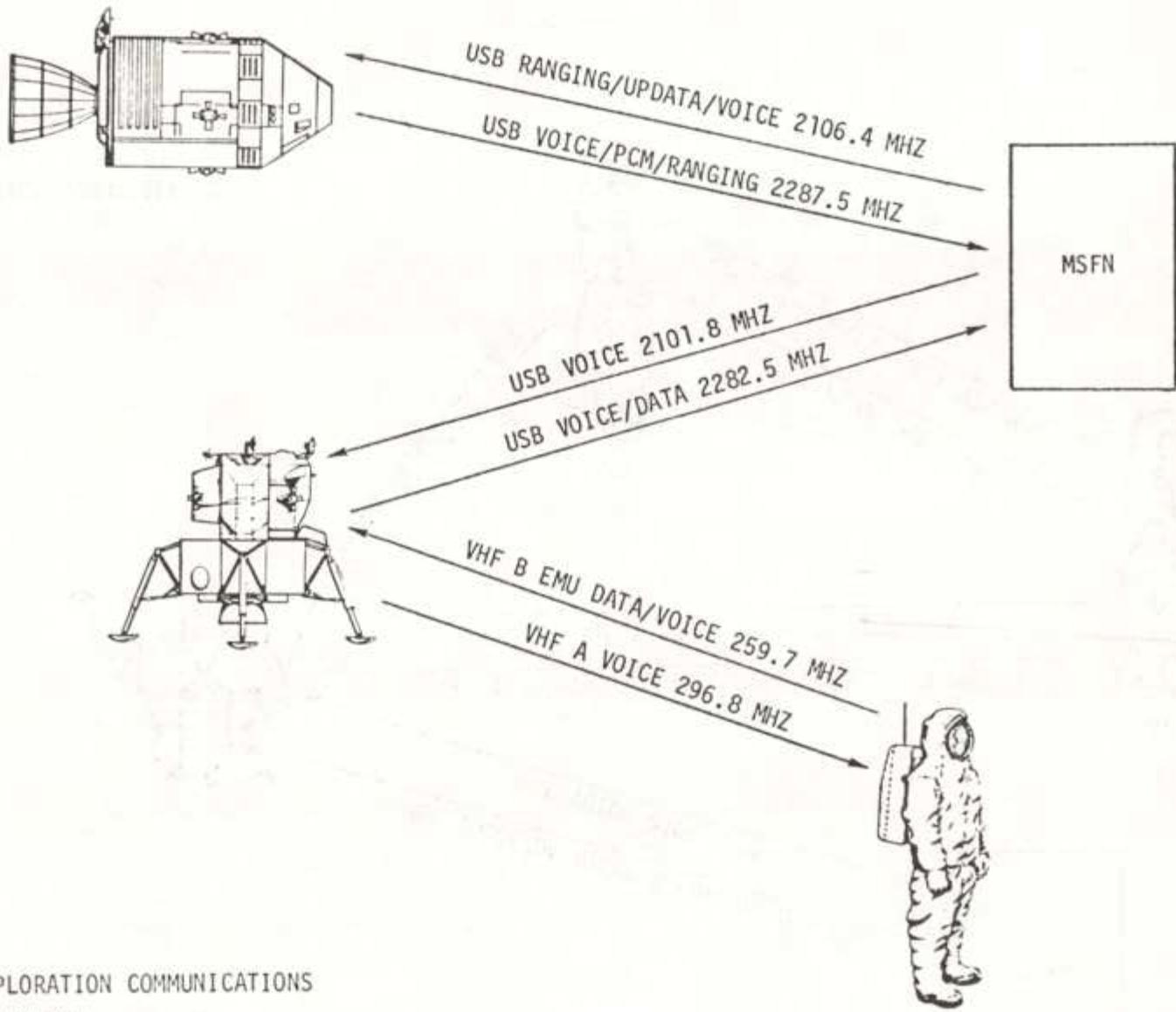
1. Entries into the LM
 - a. Three entries into the LM are scheduled in the timeline at 56:30, 81:30 and 95:52 GET respectively.

- 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)



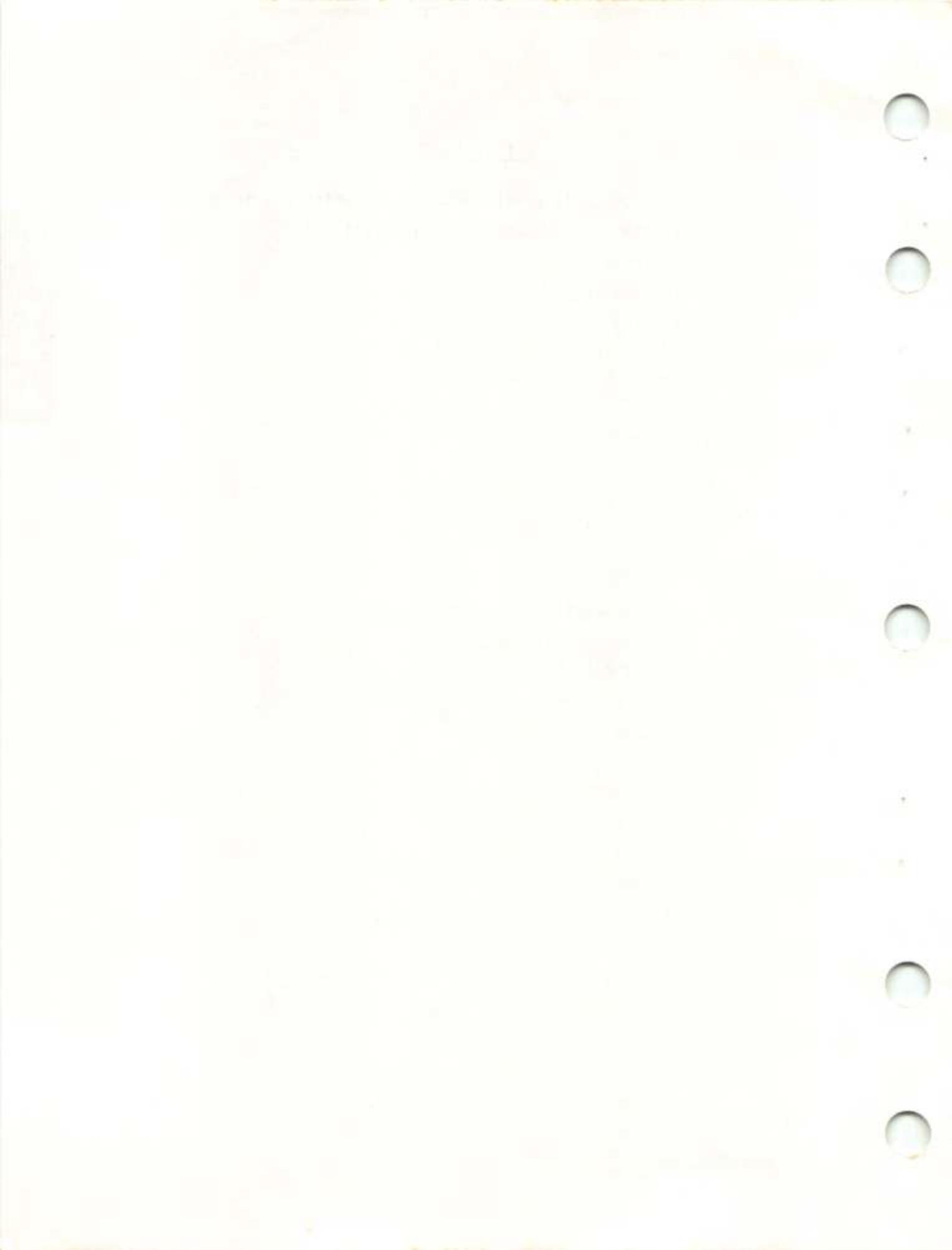
LUNAR EXPLORATION COMMUNICATIONS
BOTH CREWMEN EVA
EVCS DUAL MODE (RELAY)



LUNAR EXPLORATION COMMUNICATIONS
ONE CREWMAN EVA
PRIMARY MODE

Figure 1-5

SECTION II - UPDATE FORMS



UPDATE FORMS

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

The CSM forms are as follows:

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

The LM forms are:

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

TLI	TLI												TLI
X	•	•	•	X	•	•	•	TB6p					
X	X	X		X	X	X		R					
X	X	X		X	X	X		P TLI					
X	X	X		X	X	X		Y					
X	X	X	•	X	X	X	•	BT					
+			•	+				ΔVC'					
X	X	X		X	X	X		VI					
X	X	X		X	X	X		R SEP					
X	X	X		X	X	X		P					
X				X	X	X		Y					
X				X	X	X		R					
X				X	X	X		P EXTRAC					
X				X	X	X		Y					

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
ΔVC	XXXX.X (FPS)	NOMINAL TLI ΔV SET INTO EMS ΔV COUNTER
VI	+XXXXX (FPS)	NOMINAL INERTIAL VELOCITY DISPLAYED ON DSKY AT TLI CUTOFF
R SEP	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													
		P37						P37							
APRIL 1, 1969	P37														
		X			X			GETI							
		X			X			ΔVT							
		X			X			LONG							
								GET _{400K}							
		X			X			GETI							
		X			X			ΔVT							
		X			X			LONG							
								GET _{400K}							
		X			X			GETI							
		X			X			ΔVT							
		X			X			LONG							
								GET _{400K}							

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					
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													
N34		HRS	X	X	X			X	X	X			
		MIN	X	X	X	X		X	X	X	X		
NAV CHECK SEC			X	X				X	X				
N43		LAT		0				0					
		LONG											
		ALT	+	0				+	0				

APRIL 1, 1969

P27

P27

P27 UPDATE - CSM

PURP	XXX	TYPE OF DATA TO BE RECEIVED (SUCH AS: CMC TIME)
V	XX (VERB)	TYPE OF COMMAND LOAD (70-71-72-73)
GET	XXX:XX:XX (HR:MIN:SEC)	TIME DATA RECORDED
304 01	XX (OCTAL)	INDEX NO. OF COMMAND WORDS IN LOAD
02-24	XX (OCTAL)	CORRECTION IDENTIFIERS
N34 NAV CHECK	XXX:XX:XX.XX (HR:MIN:SEC)	TIME FOR CONFIRMATION OF 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

TE1 - P31

		P30 MANEUVER								
P30	APRIL 5, 1969	SET STARS				PURPOSE			P30	
		+/-	000	000	000	PROP/GUID	WT	N47		
R ALIGN		+	3	6	6	9	1	P	TRIM N48	
P ALIGN		-	0	0	0	6	1	Y	TRIM	
Y ALIGN		+	0	0	0	4	6	HRS	GETI	
ULLAGE		+	0	0	1	3	7	MIN	N33	
		+	0	0	0	2	2	SEC		
		+	0	3	8	8	5	ΔV_X	N81	
		+	3	2	8	3	8	ΔV_Y		
		+	0	6	8	4	5	ΔV_Z		
		-	0	2	4	8	7			
		X	X	X	N/A			R		
		X	X	X	052			P		
		X	X	X	N/A			Y		
		M/A↓						H_A	N42	
								H_P		
HORIZON/WINDOW		+						ΔVT		
		X	X	X				BT		
		X						ΔVC		
		X	X	X	X			SXTS		
		+				0		SFT		
		+				0	0	TRN		
		X	X	X				BSS		
		X	X					SPA		
		X	X	X				SXP		
OTHER			0					LAT	N61	
								LONG		
		+						RTGO	EMS	
		+						VIO		
								GET	0.05G	

P30 MANEUVER

PURPOSE	XXXXX	TYPE OF MNVR TO BE PERFORMED
PROP/GUID	XXX/XXX	PROPELLION SYSTEM (SPS/RCS)/ GUIDANCE (SCS/G&N)
WT	+XXXXX (lbs)	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 COORDINATES
ΔVY	<u>±</u> XXXX.X (FPS)	
ΔVZ	<u>±</u> XXXX.X (FPS)	
R	XXX (DEG)	IMU GIMBAL ANGLES OF MANEUVER ATTITUDE
P	XXX (DEG)	
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									
97d	APRIL 5, 1969	+			0 0			PURPOSE		P76	
		+			0 0 0			HR	N33		
		+			0 0 0			MIN	TIG		
		+			0	*	0			SEC	
		•	•	•	•	•	•	•	•	ΔV_X	N84
		•	•	•	•	•	•	•	•	ΔV_Y	
		•	•	•	•	•	•	•	•	ΔV_Z	
								PURPOSE			
		+			0 0			HR	N33		
		+			0 0 0			MIN	TIG		
		+			0	*	0			SEC	
		•	•	•	•	•	•	•	•	ΔV_X	N84
		•	•	•	•	•	•	•	•	ΔV_Y	
		•	•	•	•	•	•	•	•	ΔV_Z	
								PURPOSE			
		+			0 0			HR	N33		
		+			0 0 0			MIN	TIG		
		+			0	*	0			SEC	
		•	•	•	•	•	•	•	•	ΔV_X	N84
		•	•	•	•	•	•	•	•	ΔV_Y	
		•	•	•	•	•	•	•	•	ΔV_Z	
								PURPOSE			
		+			0 0			HR	N33		
		+			0 0 0			MIN	TIG		
		+			0	*	0			SEC	
		•	•	•	•	•	•	•	•	ΔV_X	N84
		•	•	•	•	•	•	•	•	ΔV_Y	
		•	•	•	•	•	•	•	•	ΔV_Z	

P76 UPDATE PAD

PURPOSE	XXXXX	PURPOSE OF MANEUVER
N33 TIG	XX:XX:XX.XX (HR:MIN:SEC)	TIME OF IGNITION
N84		
ΔV_x	XXXX.X (FPS)	COMPONENTS OF
ΔV_y	XXXX.X (FPS)	ΔV APPLIED ALONG
ΔV_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	-	0002.5
22	XXX		XXX		XXX	

DOI PAD

84	•		•		•	
33	•	•	•	•	•	•

PDI₁ +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 ₂)	37	00	•	000	•	•	.

RESCUE TWO PAD

47	+	•	+	00000.			
48	.		.	.			
33	00	•	000	•	0	.	
81	
22	XXX		XXX		XXX		
ΔV_C	X	.					
11	00	•	000	•	0	.	
37	00	•	000	•	0	.	
N							

CSI ONE

11		•	000	•	0	.
81
N						

CSI TWO

11	00	•	000	•	0	.
81
N						

CSI THREE

11	00	•	000	•	0	.
81
N						

CSI FOUR

11	00	•	000	•	0	.
81
N						

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

NOMINAL LM IGNITION TIMES

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

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
ΔVc	ΔVc	XX.X (FPS)	VELOCITY TO BE SET IN EMS COUNTER FOR RESCUE BURN
11	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF CSI BURN BASED ON RESCUE BURN
37	GETI	XXX:XX:XX.XX (HRS:MIN:SEC)	GET OF TPI BURN BASED ON RESCUE BURN
N		X	THE FUTURE APSIDAL CROSSING (APOLUNE OR PERILUNE) OF THE ACTIVE VEHICLE AT WHICH CDH SHOULD OCCUR

CSI ONE

11	GETI	XXX:XX:XX.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) <u>XX</u> (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							
		X X X			X X X			AREA	
		X X X			X X X			R 0.05 G	
		X X X			X X X			P 0.05G	
		X X X			X X X			Y 0.05G	
		.			.			GET HOR	
		X X X			X X X			CK	
		0			0			P	
		.			.			LAT N61	
		X X X			X X X			LONG	
		.			.			MAX G	
		+			+			V _{400K} N60	
		- 0 0			- 0 0			γ _{400K}	
		+			+			RTGO EMS	
		+			+			VIO	
		.			.			RRT	
		X X			X X			RET 0.05G	
		+ 0 0			+ 0 0			D _L MAX _{N69}	
		+ 0 0			+ 0 0			D _L MIN	
		+			+			V _L MAX	
		+			+			V _L MIN	
		X X X			X X X			D _O	
		X X			X X			RET V _{CIRC}	
		X X			X X			RETBBO	
		X X			X X			RETEBO	
		X X			X X			RETDRO	
		X X X X			X X X X			SXTS	
		+			+			SFT	
		.			.			TRN	
		0			0			BSS	
		+			+			SPA	
		0 0			0 0			SXP	
		X X X			X X X			LIFT VECTOR	
		.			.			LUNAR ENTRY	

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

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APRIL 16, 1969

EARTH ORBIT ENTRY UPDATE

X		-	X		-	AREA
X X	-	.	X X	-	.	ΔV TO
X X X			X X X			R 0.05G EMS
X X X			X X X			P 0.05G
X X X			X X X			Y 0.05G
+		.	+		.	RTGO EMS
+		.	+		.	VIO
X X	.	.	X X	.	.	RET 0.05G
0	.	.	0	.	.	LAT N61
	LONG
X X	.	.	X X	.	.	RET 0.2G
						DRE (55°) N66
R R	/		R R	/		BANK AN
X X	.	.	X X	.	.	RET RB
X X	.	.	X X	.	.	RET BBO
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 ±100 nm N66
R R	/	R R	/	BANK AN
X X	.	X X	.	RETRB
X X	.	X X	.	RET BBO
X X	.	X X	.	RETEBO SEC
X X	.	X X	.	RET DROG TO MAIN

E.O.
ENTRYE.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	+XX.XX (DEG)	LATITUDE OF IMPACT LANDING POINT
LONG	+XXX.XX (DEG)	LONGITUDE OF IMPACT LANDING POINT
N66		
RET .2G	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO .2G
DRE (55°)	+XXXX.X (NM)	DOWNRANGE ERROR AT .2G
BANK AN	XX/XX (DEG/DEG)	BACKUP BANK ANGLE FOR SCS ENTRY: ROLL RIGHT/ROLL LEFT

RETRB	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO REVERSE BACKUP BANK ANGLE
RETBB0	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
RETDROP	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO DROGUE CHUTE DEPLOYMENT
CHART UPDATE		
90°/FPS DRE (90°)	+XX +XXX	VALUES USED TO RE-PLOT BACKUP ENTRY CHART - ΔV AND 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 0.2G	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO 0.2G
DRE	+XXXX.X (NM)	DOWN RANGE ERROR
BANK AN	XX/XX (DEG/DEG)	BACKUP BANK ANGLE FOR SCS ENTRY: ROLL RIGHT/ROLL LEFT
RETRB	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO REVERSE BACKUP BANK ANGLE

RETBBO	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO BEGINNING OF COMMUNICATIONS BLACKOUT
RETEBO	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO END OF COMMUNICATIONS BLACKOUT
RETDROG	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO DROGUE CHUTE DEPLOYMENT

EARTH ORBIT BLOCK DATA										E.O. BLOCK
X	X		-	X	X		-	AREA		
X	X	X		.	X	X	X		LAT	LAT LONG
X	X			.	X	X			LONG	
			GETI	GETI ΔV_C
X	X	X		.	X	X	X		ΔV_C	
X	X			.	X	X			AREA	AREA
X	X	X		.	X	X	X		LAT	
X	X			.	X	X			LONG	LONG
			GETI	
X	X	X		.	X	X	X		ΔV_C	ΔV_C
X	X			.	X	X			AREA	
X	X	X		.	X	X	X		LAT	LAT LONG
X	X			.	X	X			LONG	
			GETI	GETI ΔV_C
X	X	X		.	X	X	X		ΔV_C	
X	X			.	X	X			AREA	AREA
X	X	X		.	X	X	X		LAT	
X	X			.	X	X			LONG	LONG
			GETI	GETI ΔV_C
X	X	X		.	X	X	X		ΔV_C	
X	X			.	X	X			AREA	AREA
X	X	X		.	X	X	X		LAT	
X	X			.	X	X			LONG	LONG
			GETI	GETI ΔV_C
X	X	X		.	X	X	X		ΔV_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		V		
		GET	:	:	:	:	:	:	:	:	:		P27
APRIL 16, 1969	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			

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:			
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

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ASCENT PHASING			P30 LM MANEUVER		
HR	N33	+ 0 0	+ 0 0		
MIN	TIG	+ 0 0 0	+ 0 0	0	
SEC	+ 0	.	+ 0	.	
ΔV_x	N81
ΔV_y	LOCAL
ΔV_z	VERT
H _A	N42	+	.	+	.
H _P	
ΔV_R		+	.	+	.
BT		X X X	.	X X X	.
R	FDAI	X X X		X X X	
P	INER	X X X		X X X	
ΔV_x	AGS N86
ΔV_y	AGS
ΔV_z	AGS
BSS		X X X		X X X	
SPA		X X		X X	
SXP		X X X	.	X X X	.

ASCENT
PHASING

N33 PHASING TIG XXX:XX:XX.XX
 (HR:MIN:SEC) IGNITION TIME OF
 LM MANEUVER

N81 LOCAL VERTICAL ΔV

ΔVX +XXXX.X (FPS)
ΔVY +XXXX.X (FPS)
ΔVZ +XXXX.X (FPS) LOCAL VERTICAL ΔV COMPONENTS
 OF THE MANEUVER

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)

AGS ΔV

ΔVX AGS +XXXX.X (FPS)
ΔVY AGS +XXXX.X (FPS)
ΔVZ AGS +XXXX.X (FPS) LOCAL VERTICAL ΔV
 COMPONENTS OF THE
 MANEUVER TO TARGET
 THE AGS

BSS XX (OCTAL) BSS STAR FOR MANEUVER
 ATTITUDE CHECK

SPA +XX.X (DEG)
SXP +XX.X (DEG) BSS PITCH ANGLE ON
 COAS, & BSS X POSITION
 ON COAS FOR MANEUVER
 ATTITUDE CHECK

P30		P30 LM MANEUVER										P30	
							PURPOSE						
+	0	0					+ 0 0					HR	N33
	0	0	0				+ 0 0 0					MIN	TIG
	0			+ 0								SEC	
			.									ΔVX	N8I
			.									ΔVY	LOCAL
			.									ΔVZ	VERT
			.				+					Ha	N42
			.									Hd	
			.				+					ΔVR	
	X	X	X	.			X X X	X	X	X	.	BT	
	X	X	X				X X X	X	X	X		R	FDAI
	X	X	X				X X X	X	X	X		P	INER
				.								ΔVX	AGS N86
				.								ΔVY	AGS
				.								ΔVZ	AGS
	X	X	X				X X X	X	X	X		BSS	
	X	X					X X	X	X			SPA	
	X	X	X				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	+XXXX.X (FPS)	LOCAL VERTICAL ΔV COMPONENTS OF THE MANEUVER
ΔVY	+XXXX.X (FPS)	
ΔVZ	+XXXX.X (FPS)	
N42 ORBITAL PARAMETERS		
HA	+XXXX.X (NM)	PREDICTED APOGEE AND PERIGEE RESULTING FROM THE MANEUVER
HP	+XXXX.X (NM)	
ΔVR	+XXXX.X (FPS)	TOTAL ΔV REQUIRED FOR THE MANEUVER
BT	X:XX(MIN:SEC)	DURATION OF THE MANEUVER
FDI		
R	XXX (DEG)	INERTIAL FDI ANGLES AT THE BURN ATTITUDE
P	XXX (DEG)	
N86 AGS ΔV		
ΔVX AGS	+XXXX.X (FPS)	LOCAL VERTICAL ΔV COMPONENTS OF THE MANEUVER USED TO TARGET THE AGS
ΔVY AGS	+XXXX.X (FPS)	
ΔVZ AGS	+XXXX.X (FPS)	
BSS	XX (OCTAL)	BSS STAR FOR BURN ATTITUDE CHECK
SPA	+XX.X (DEG)	BSS PITCH ANGLE ON COAS, & BSS X POSITION ON COAS FOR MANEUVER
SXP	+XX.X (DEG)	ATTITUDE CHECK

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UDI DATA CARD

		P30						
HR	N33	+	0	0		+	0	0
MIN	TIG	+	0	0	0	+	0	0
SEC		+	0			+	0	
ΔV_x	N81			.		.		.
ΔV_y	LOCAL			.		.		.
ΔV_z	VERT			.		.		.
H_A	N42	+		.		.		.
H_p				.				.
ΔV_R		+		.	+			.
BT		X	X	X	:	X	X	X
R	FDAI	X	X	X		X	X	X
P	INER	X	X	X		X	X	X
ΔV_x AGS	N86			.		.		.
ΔV_y AGS				.		.		.
ΔV_z AGS				.		.		.
BSS		X	X	X		X	X	X
SPA		X	X		.	X	X	
SXP		X	X	X	:	X	X	X

OR.	MANUAL SHUT-DOWN	
	A. AVG NEGATIVE (PGNS)	
	B. V_T : 2 SECONDS OVER BURN -AND-	
	AGS VGS 2 FPS OVER	
	MANUAL TAKEOVER	
	ATT+5° RATE+5°/sec	

LR SELF TEST									
H TM (+7994+30)									
H TM (-480+6)									
H66 SLANTRNG (+08275,+5.0)									
H67 VX (-00494, +2.0)									
VY (+01858, +2.0)									
VZ (+01329, +2.0)									
RR/TM/VHF									
<input type="checkbox"/> R1	<input type="checkbox"/> R2	<input checked="" type="checkbox"/> R							
N78									
TM									
CME									
VHF									
P52	STAR	1	2	3					
NOS (STAR ≠ DIFF)									
N93 (TORQUING 3) X _____									
Y _____									
Z _____									
RESIDUALS									
ΔV_x	PGNS				AGS				
	N85				500				
ΔV_y					501				
ΔV_z					502				

DOI DATA CARD

N33 DOI TIG

XXX:XX:XX.XX
(HR:MIN:SEC)IGNITION TIME OF
LM MANEUVERN81 LOCAL VERTICAL ΔV LOCAL VERTICAL ΔV COMPONENTS
OF THE MANEUVER ΔV_x +XXXX.X (FPS) ΔV_y +XXXX.X (FPS) ΔV_z +XXXX.X (FPS)

N42 ORBITAL PARAMETERS

 H_A +XXXX.X (NM) PREDICTED APOGEE RESULTING
FROM MANEUVER H_P +XXXX.X (NM) PREDICTED PERIGEE RESULTING
FROM MANEUVER ΔV_R +XXXX.X (FPS) TOTAL ΔV REQUIRED FOR
THE MANEUVER

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

FDIAI

R XXX (DEG) INERTIAL FDAI ANGLES
AT THE BURN ATTITUDE

P XXX (DEG)

N86 AGS ΔV ΔV_x AGS +XXXX.X (FPS)
 ΔV_y AGS +XXXX.X (FPS)
 ΔV_z AGS +XXXX.X (FPS) LOCAL VERTICAL ΔV
COMPONENTS OF THE
MANEUVER TO TARGET
THE AGS

BSS XXX (OCTAL)

BSS STAR FOR MANEUVER
ATTITUDE CHECKSPA +XX.X (DEG)
SXP +XX.X (DEG)BSS PITCH ANGLE ON
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				
SEC	+ 0			+ 0				
TGO	N61	X X	•	X X	•			
CROSSRANGE								
R	FDAI	X X X		X X X				
P	AT TIG	X X X		X X X				
Y		X X X		X X X				
DEDA 231 IF RQD								

PDI ABORT < 10 MIN

LOG INSERTION GET=								
CSI TIG=								
HRS	N37	+ 0 0		+ 0 0				
MIN	TPI	+ 0 0 0		+ 0 0 0				
SEC	+ 0			+ 0				

PDI ABORT > 10 MIN

HRS	+ 0 0		+ 0 0					
MIN	+ 0 0 0		+ 0 0 0					
SEC	+ 0			+ 0				
PHASING TIG								
HRS	+ 0 0		+ 0 0					
MIN	+ 0 0 0		+ 0 0 0					
SEC	+ 0			+ 0				

NO PDI + 12 ABORT

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

R2 SUN CHECK
N22 _____ N20 _____

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

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LUNAR SURFACE DATA CARD

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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 ₁	+ 0 0 0 . .	+ 0 0 0 . .
SEC		+ 0 . . .	+ 0 . . .
HRS	N37	+ 0 0 . . .	+ 0 0 . . .
MIN	TPI	+ 0 0 0 . .	+ 0 0 0 . .
SEC		+ 0 . . .	+ 0 . . .

P68

N43

LAT

LONG

ALT

P12

N76

V (HOR) (5515.6)

V (VERT) (39.5)

CROSSRANGE (0.0)

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

N74

YAW

PITCH

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

P12

N76

V (HOR) (5535.6)

V (VERT) (32.0)

CROSSRANGE (0.0)

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

N74

YAW

PITCH

LUNAR SURFACE DATA CARD

T2 ABORT

T2 TIG	XXX:XX:XX.XX (HR:MIN:SEC)	LIFTOFF TIME- SECOND PREFERRED TIME AFTER 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

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

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

LM ASCENT PAD

ASCENT TIG	XXX:XX:XX.XX (HR:MIN:SEC)	TIME OF APS IGNITION FOR LM ASCENT
N76 INSERTION TARGET		
V(HOR)	XXXX.X (FPS)	HORIZONTAL VELOCITY AT ORBIT INSERTION
V(VERT)	XXXX.X (FPS)	VERTICAL VELOCITY AT ORBIT INSERTION
CROSSRANGE	+XXX.X (NM)	CROSSRANGE DISTANCE AT ORBITAL INSERTION
DEDA 047	XXXXXX (OCTAL)	SINE OF LANDING AZIMUTH ANGLE
DEDA 053	XXXXXX (OCTAL)	COSINE OF LANDING AZIMUTH ANGLE
DEDA 225	XXXXXX (100 FT)	LOWER LIMIT OF α_3 AT ORBIT INSERTION
DEDA 226	XXXXXX (100 FT)	UPPER LIMIT OF α_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	
MIN	CSI		+ 0 0 0		+ 0 0 0	
SEC			+ 0		+ 0	

N55 (+00001) (+02660) (+i3000)

HR	TIG	N37	+ 0 0		+ 0 0	
MIN	TPI		+ 0 0 0		+ 0 0 0	
SEC			+ 0		+ 0	

 ΔV_x N81 + 0 . . . + 0 . . . ΔV_y . 0 . . . 0 . . .

FDAT PITCH + X X . . . + X X . . .

373 (+0321.3) + . . . + . . .

275 (+0418.1) + . . . + . . .

275 (+0418.5) + . . . + . . .

410+1, 605+00777, 416+1

 ΔV_x AGS N86 0 0 . . . 0 0 . . . ΔV_y AGS 0 0 . . . 0 0 . . . ΔV_z AGS 0 0 . . . 0 0 . . .

P G N C S

A G S

A G S

A G S

A G S

A G S

A G S

A G S

A G S

A G S

A G S

RESIDUALS		
	PGNS	AGS
ΔV_x	500	.
N55	501	.
ΔV_y	502	.

P52

STAR 1 ____ 2 ____ 3 ____

NOS (STAR \rightarrow DIFF) _____N93 (TORQUING \downarrow) X _____

Y _____

Z _____

N82

 ΔV_x COH ΔV_y COH ΔV_z COH

(-0.4) (+0.0) (+0.0)

P G N C S

A G S

A G S

A G S

A G S

A G S

A G S

A G S

A G S

A G S

A G S

A G S

A G S

A G S

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

ΔV_x

XXX.X (FPS)

LOCAL VERTICAL ΔV
COMPONENTS OF THE
CSI MANEUVER

ΔV_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 ΔV

ΔV_x AGS

XX.XX (FPS)

LOCAL VERTICAL ΔV
COMPONENTS OF CSI USED
TO TARGET AGS EXT ΔV

ΔV_y AGS

XX.XX (FPS)

ΔV_z AGS

XX.XX (FPS)

June 19, 1969

CDH DATA CARD

CDH PAD			CDH DATA CARD		
HR	N13	+ 0 0	+ 0 0		
MIN	TIG	+ 0 0 0	+ 0 0 0		
SEC	CDH	+ 0	+ 0		
ΔV_x		0	0		
ΔV_y	N81	0	0		
ΔV_z		0	0		
PLM	FDAI	X X X	X X X		
373 (+0379.6)		+ +			
ΔV_x	N86	0	0		
ΔV_y	AGS	0	0		
ΔV_z		0	0		

PLANE CHANGE P30, V90, 410+5]					
TIG	CDH	- - - - -	3 0 0 0 0 0		
TIG	PC	- - - - -	- - - - -		
	YDOT	- - - - -	- - - - -		
CSM	N90	PGNS	N90	AGS	263
(-)		(-)		(-)	
(-)		(-)		(-)	
RESIDUALS					
		PGNS		AGS	
AVX		- - - - -	500		
AVY	N85	- - - - -	501		
AVZ		- - - - -	502		

R75			N81			PGNS			AGS		
P	RAH (15.0)	A1 TPI/CDH (37.31)	TPI S1TP (0.00)	A1	AVX	YDOT	CDH	N90	AVZ	1	PGNS
G					(-1.1)		(+0.0)		(-4.1)		
N							(-)				
C							(-)				
S							(-)				
A	492	480	452		AVX	AVY	AVZ				AGS
G	AM	AVX	AVZ								
S											

LSM SOLUTION

AVX	AVY	AVZ
AVX	AVY	AVZ

N90 (AGS)

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
COMPONENTS OF CDH
MANEUVER

ΔVY

+XXX.X (FPS)

ΔVZ

+XXX.X (FPS)

PLM FDAI

XXX (DEG)

FDAI INERTIAL
PITCH ANGLE AT
CDH BURN ATTITUDE

DEDA 373

XXXX.X (MIN)

AGS IGNITION TIME OF
NEXT MANEUVER

N86 AGS ΔV

ΔVX AGS

+XXX.X (FPS)

LOCAL VERTICAL ΔV
COMPONENTS OF CDH
USED TO TARGET AGS
EXT ΔV

ΔVY AGS

+XXX.X (FPS)

ΔVZ AGS

+XXX.X (FPS)

TPI DATA CARD

June 19, 1969

HR	N37	+ 0 0		+ 0 0	
MIN	TIG	+ 0 0 0		+ 0 0 0	
SEC	TPI	+ 0		+ 0	
N55 (BLANK) (+026.60) (+130.00)					
ΔVx	N81	0		0	
ΔVy		0		0	
ΔVz		0		0	
ΔVr	N42	+ 0 -0		+ 0 +0	
RLM		X X X		X X X	
PLM		X X X		X X X	
R TPI	N54	+ 0		+ 0	
R TPI TIG-5		0		0	
F/A (+/-)	N59	0 +0		0 +0	
R/L (+/-) ΔV		0 +0		0 +0	
D/U (+/-) LOS		0 +0		0 +0	
BT		X X	:	X X	:
307+043.00, 314+0					

RESIDUALS			
	PGNS	AGS	
ΔVx		506	
ΔVy		501	
ΔVz		502	
N81			

2-48

N58			N81			$\Delta V/F/A-$		
P	G	N	ΔVx	ΔVy	ΔVz	$\Delta V/F/A-$	$\Delta Vr/L-$	$\Delta VD/U^*$
G	()	()	()	()	()	()	()	()
N	-	-	-	-	-	-	-	-
C	-	-	-	-	-	-	-	-
S	-	-	-	-	-	-	-	-
A	267	371	ΔVx	ΔVy	ΔVz	$\Delta V/F/A-$	$\Delta Vr/L-$	$\Delta VD/U^*$
G	ΔV_{TPI}	$\Delta V_{TPI+TPF}$						
S	-----	-----	-----	-----	-----	-----	-----	-----
			CSH SOLUTION					
			ΔVx	ΔVy	ΔVz			
			-----	-----	-----			
			N86 (AGS)					
			ΔVx	ΔVy	ΔVz			
			-----	-----	-----			

TPI DATA CARD

N37 TPI TIG

XXX:XX:XX.XX
(HR:MIN:SEC)

IGNITION TIME FOR
THE TPI MANEUVER

N81 LOCAL VERTICAL ΔV

ΔVX +XX.X (FPS)
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
ROLL AND PITCH
FOAI ANGLES AT TPI
BURN ATTITUDE

RLM XXX (DEG)
PLM XXX (DEG)

N54 TIG-5

R TPI XX.XX (FT)
· R TPI +XXX.X (FPS)

RANGE AT TPI TIG - 5 MIN
RANGE RATE AT TPI TIG - 5 MIN

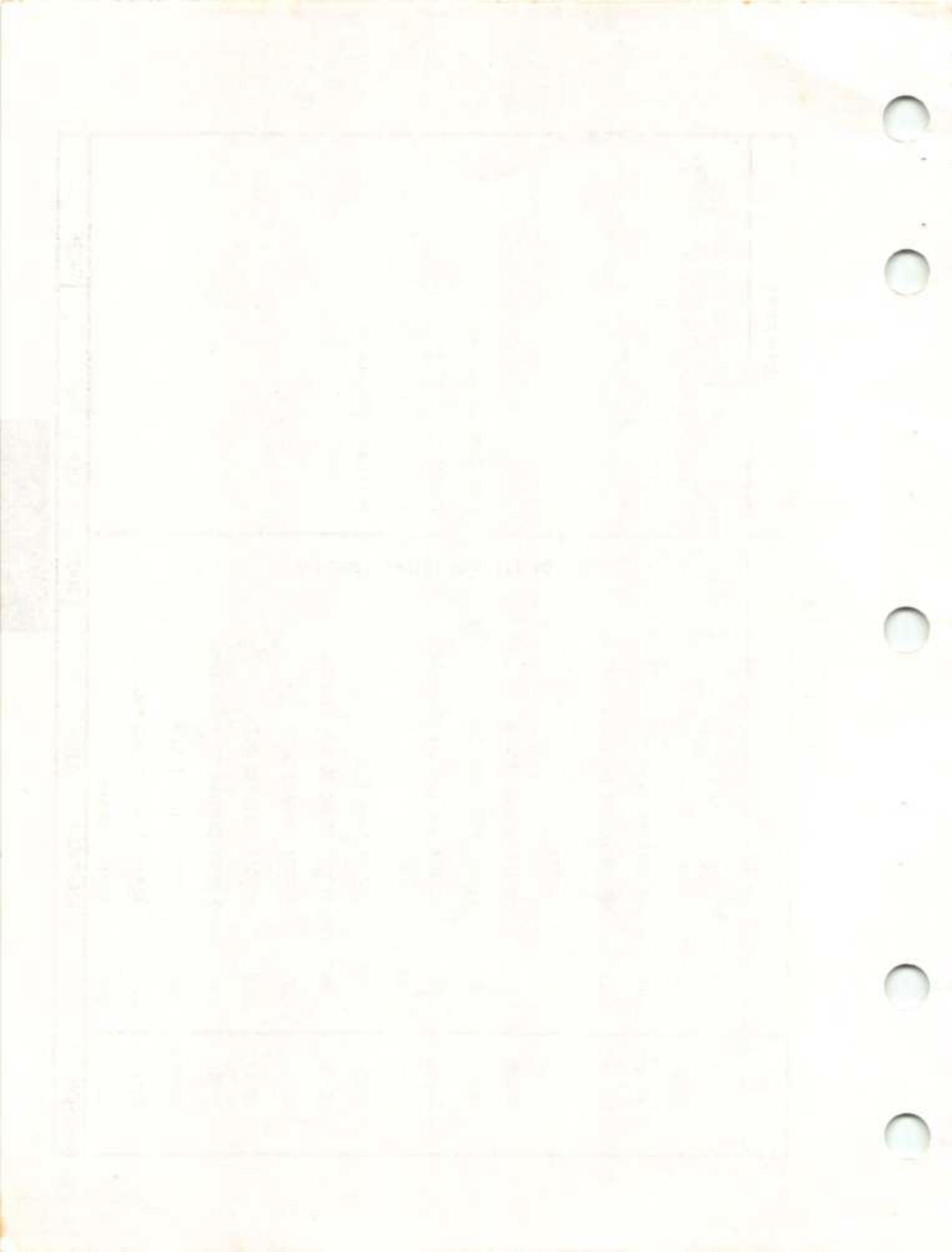
N59 Δ V LOS

F/A +XX.X (FPS)
R/L +XX.X (FPS)
D/U +XX.X (FPS)
BT XX:XX (MIN:SEC)

LINE-OF-SIGHT ΔV
COMPONENTS OF THE
TPI MANEUVER
DURATION OF THE MANEUVER

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SECTION III - DETAILED TIMELINE



FLIGHT PLAN

TIME	EVENT	REMARKS
- 00:09	LCC: <u>REPORT IGNITION</u>	
00:00	LCC: CDR: <u>REPORT LIFT-OFF</u>	FIRST OPPORTUNITY LIFT-OFF JULY 16, 0932 EDT, 72° LA, TARGETED FOR LANDING SITE 2. LIFT-OFF: 1332 GMT
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</u> <u>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 COI CAPABILITY	
06:00	CDR: <u>REPORT</u> S/C GO/NO GO	
07:00	CDR: <u>REPORT</u> S/C GO/NO GO	
08:00	CDR: <u>REPORT</u> 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: <u>REPORT</u> 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 ₅ = 0
	S-IVB MAINTAINS COMMANDED CUTOFF	IMU GIMBAL ANGLES @ INSERTION R 180°
	INERTIAL ATTITUDE	P 340°
		Y 0°
H pad 103.3 NM		
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	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)
:20	T C Y I	CMP - TRANS TO LEB - O2 MAIN REG CK CMP/LMP - SEC RAD LEAK CK CDR/CMP - ECS POST INSERTION CONFIG LMP - FUEL CELL PURGE CK, EPS MON. CK, FUEL CELL POWER PLANT CK, DC VOLT - AMP CK, ECS MON CK, SPS MON CK GDC ALIGN TO IMU - RECORD DRIFT CDR - UNSTOW SEQ CAMERA BRACKET AND ORDEAL INSTALL ORDEAL & COAS	
:30	T A N	MOUNT AND INITIALIZE ORDEAL SET UP CAMERA EQUIP(T&D) CMP - ECS REDUNDANT COMPONENT 16mm/18/CEX-BRKT-MIR CHECK SEC GLYCOL LOOP CK(f8,250,7) 6 FPS JETTISON OPTICS COVER (DIRECT, 1 MAG (FOR T&D) HIGH, SHAFT RIGHT) <u>RECORD ΔAZ CORRECTION</u> EL/80/CEX (f8,250,INF)	COOLANT CONTROL ATTEN- UATION PANEL NOT OPENED
:40	T C R O T	IMU REALIGN - P52 (OPTION 3 - REFSMMAT) (OPTIONAL)	REPORT P52 - (PAD REFSMMAT)
:50	T	S-BAND VOL - UP FOR HSK TWO-WAY USB VOICE CK	N71: _____ N05: _____ N93: X _____ Y _____ Z _____ GET _____ : _____
01:00			

UPDATE

ΔAZ CORRECTION

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

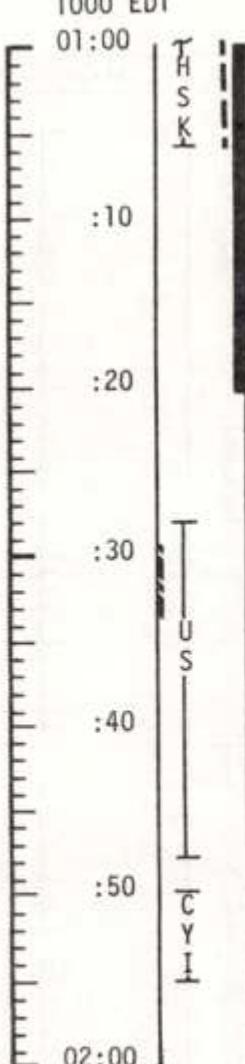
FLIGHT PLAN

NOTES

P52 - CONT'D

UPLINK CMC
CSM STATE VECTORUPDATE
PAD DATA

GO/NO GO

GDC ALIGN TO IMU
STOW OPTICSSCS ATT REF COMPARISON CK
EXTEND DOCKING PROBEV66 - TRANS CSM STATE VECTOR TO LM SLOT
RECORD PAD DATA
(TLI, TLI + 90 MIN ABORT, AND
P37 - TLI + 4 HR ABORT)
SM RCS HOT FIRE
(MIN IMPULSE - ALL JETS)GO/NO GO FOR PYRO ARM
BEGIN TLI PREPARATION (CHECKLIST PG L-2-19)
DON HELMETS & GLOVES - ALL

EMS AV TEST

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

MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

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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

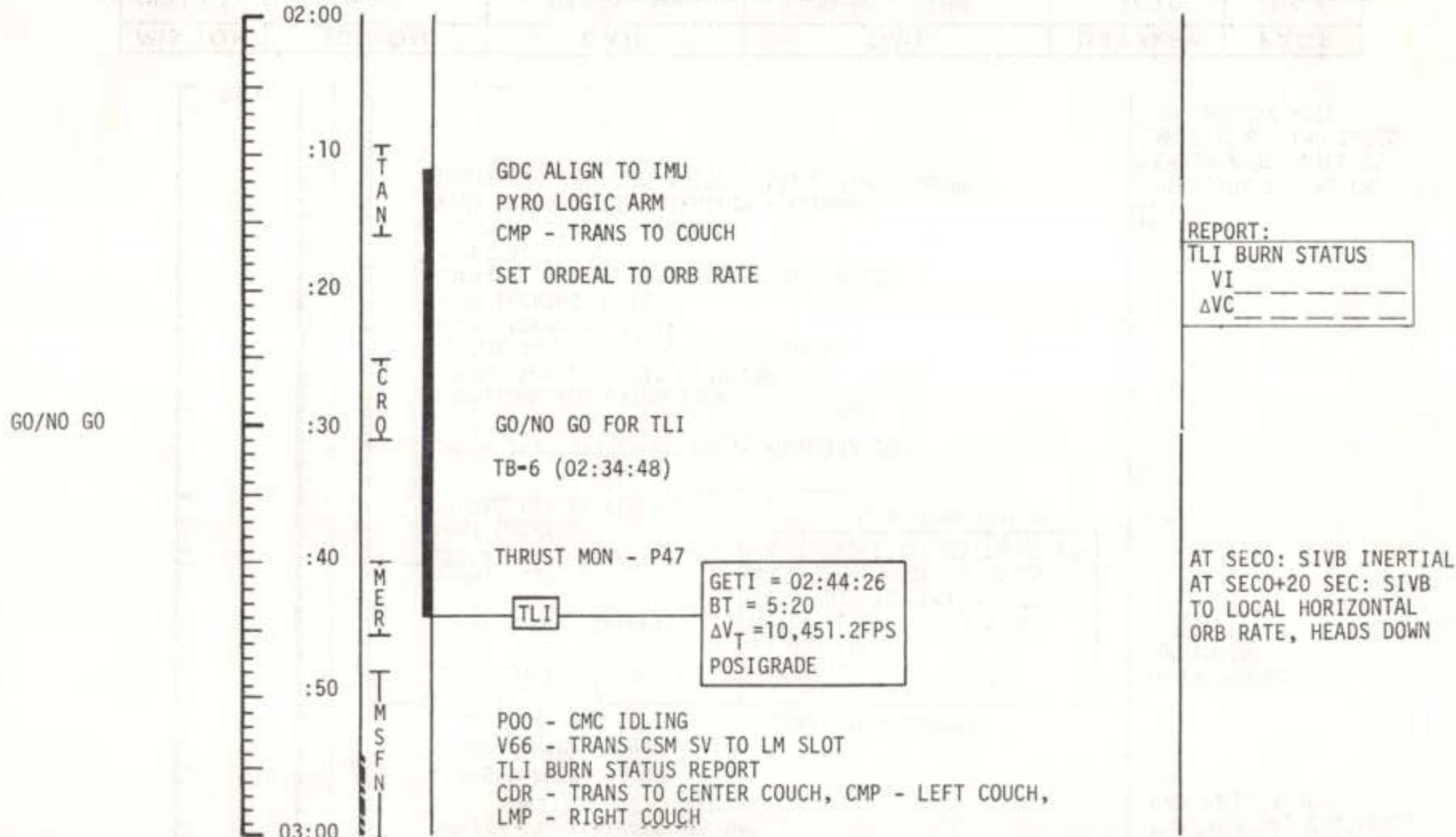
3-2a

MCC-H

1130 EDT
02:00

FLIGHT PLAN

NOTES



REPORT:
TLI BURN STATUS
VI _____
△VC _____

AT SECO: SIVB INERTIAL
AT SECO+20 SEC: SIVB
TO LOCAL HORIZONTAL
ORB RATE, HEADS DOWN

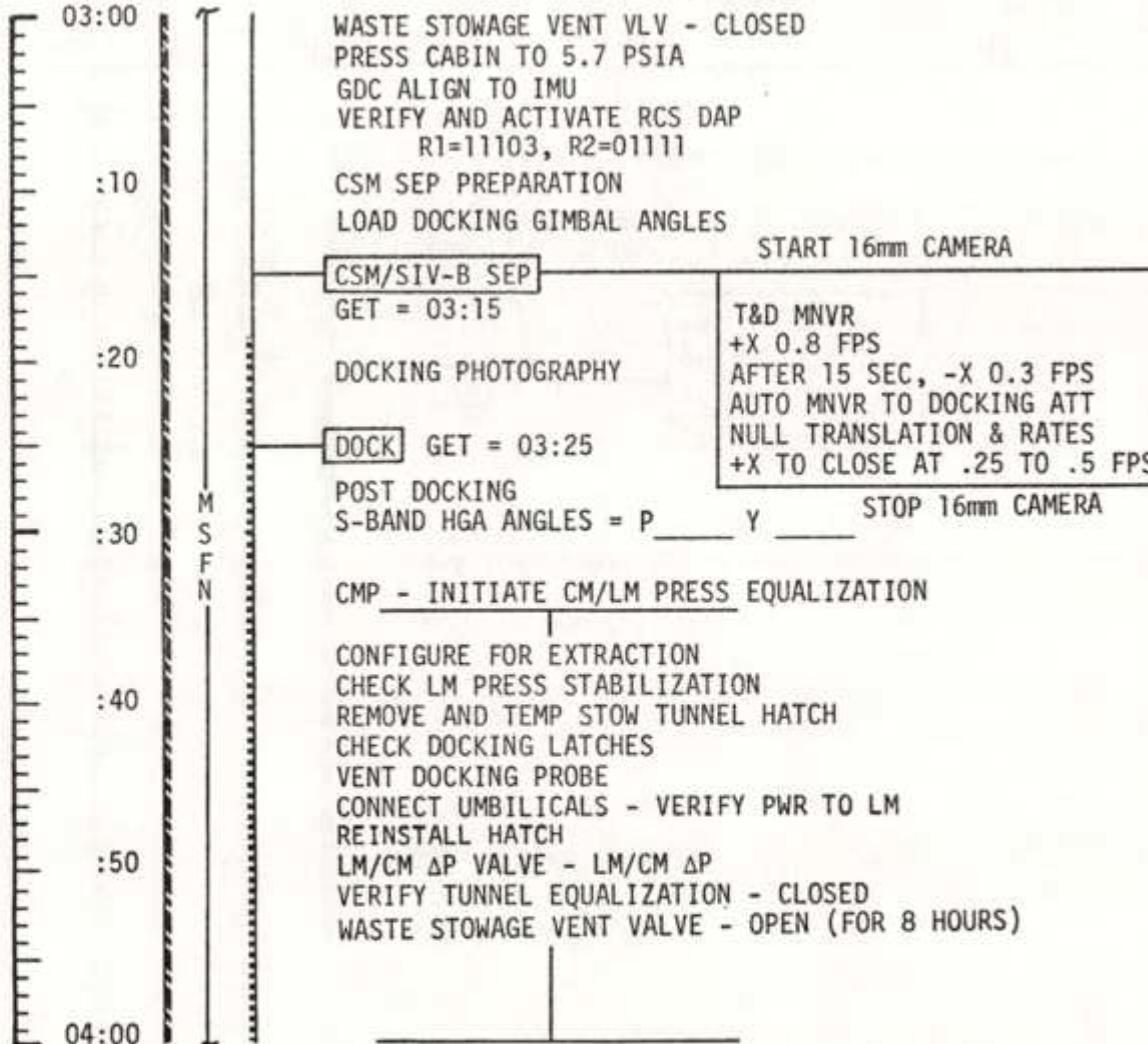
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	02:00 - 03:00	1/2	3-3

MCC-H

1230 EDT

FLIGHT PLAN

NOTES

DAP LOAD FOR SEPARATION
CSM, 0.5°DB, 2.0°/SEC,
B/D ROLL, 4 JETSEL PHOTOS AS
CONVENIENTDECISION TO END CM
CABIN PURGE WILL BE
MADE REAL TIME BASED
ON LM LEAK RATE

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	03:00 - 04:00	1/TLC	3-4

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EVASIVE MANEUVER
BURN CHART

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

3-4a

MCC-H

UPDATE
EVASIVE MNVR
IGO/NO GO-GO

TLI CUT OFF
+ 1 HR 50 MIN

1330 EDT
04:00

:10 :20 :30 :40 :50 05:00

M
S
F
N

FLIGHT PLAN

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

THRUST MONITOR - P47

LM EJECTION

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

SPS THRUST - P40

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

SM RCS MON CK

GDC ALIGN TO IMU

EVASIVE MNVR

SM RCS MON CK

SPS MON CK

BURN STATUS REPORT

V66 - TRANS CSM STATE VECTOR
TO LM SLOT
MANEUVER TO OBSERVE SLINGSHOT

DAP CONFIGURATION FOR
LM EJECTION: CSM & LM
0.5° DB, .05°/SEC, A/C
ROLL, 4 JETS

GETI = 04:09:45
BT = 3 SEC
ΔV_T =

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

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

NOTES

FOR LM EJECTION
RELATIVE ΔV FROM
SPRINGS = 1 FPS

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 _{gx}
		*	V _{gy}
		*	V _{gz}
		*	ΔV _C

X	X	X	FUEL
X	X	X	OX
X	X	X	UNBAL

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

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	04:00 - 05:00	1/TLC	3-5

MCC-H

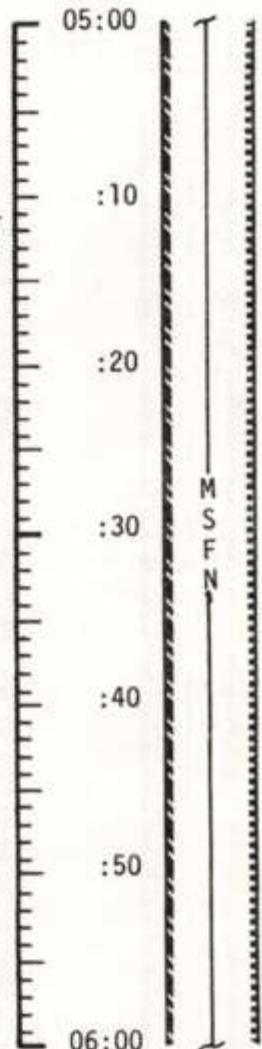
1430 EDT
05:00

FLIGHT PLAN

NOTES

UPLINK CMC

ZERO TRUNNION BIAS

UPDATE
BLOCK DATA

REPORT LM/CM ΔP

REPORT

P52 - (PAD REFSMMAT)

N71: ____ , ____

N05: ____ . ____

N93:

X ____ . ____

Y ____ . ____

Z ____ . ____

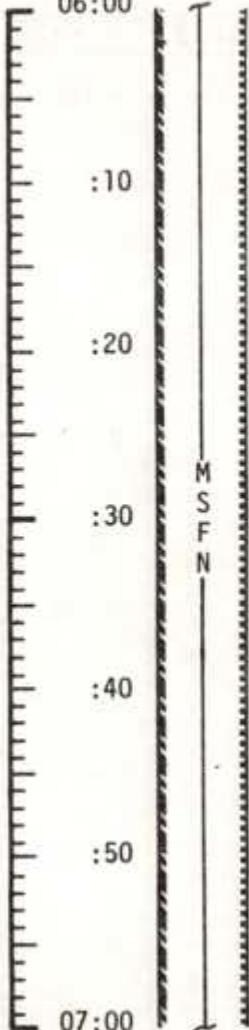
GET ____ : ____ : ____

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

MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

MCC-H

1500 EDT
06:00

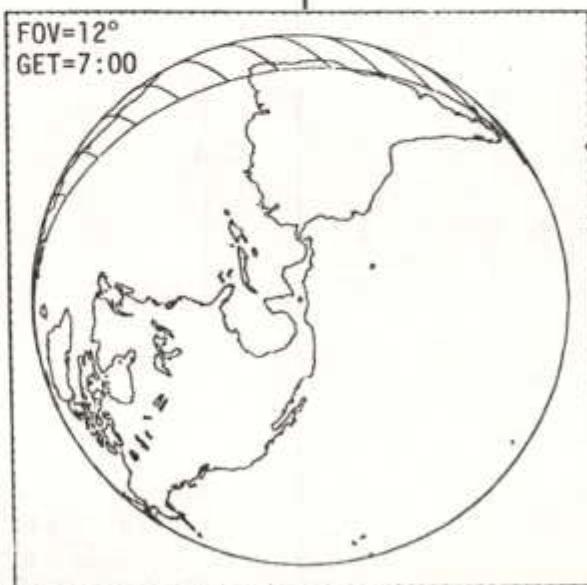
FLIGHT PLAN

CISLUNAR NAVIGATION - P23
OPTICS CALIBRATION

1. STAR 02 ENH (R3=00110)
2. STAR 40 EFH (R3=00120)
3. STAR 44 ENH (R3=00110)
4. STAR 44 ENH (R3=00110)
5. STAR 45 ENH (R3=00110)

NOTES

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



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

MCC-H

FLIGHT PLAN

NOTES



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

MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

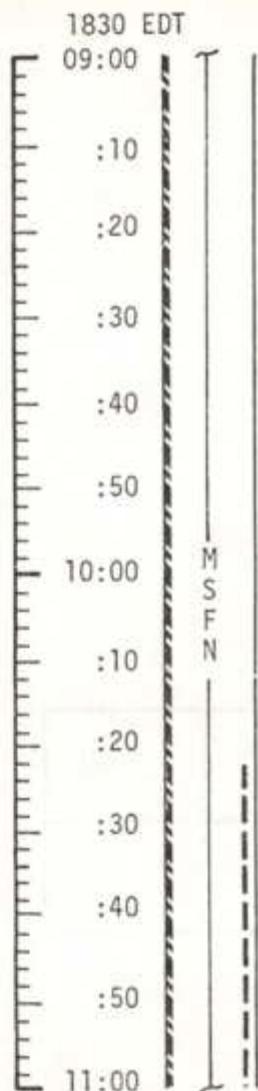
MCC-H

FLIGHT PLAN

NOTES

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

UPDATE
 MCC1 MNVR PAD



CO₂ FILTER CHANGE NO. 1
 (3 INTO A, STORE 1 IN B5)

V66 - TRANS CSM STATE VECTOR TO LM SLOT

O₂ FUEL CELL PURGE

RECORD MCC1 MNVR PAD

CONTINUE PTC IF MCC1 IS SCRUBBED

IMU REALIGN - P52
 OPTION 3 - REFSMMAT
 (OPTIONAL)

PTC

THE EARTH HORIZON BIAS
 (Δh) WILL BE UPDATED
 TO THE CMC IF THE
 DIFFERENCE BETWEEN
 THE SIGHTING Δh & THE
 E-MEMORY Δh IS > 3.3 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

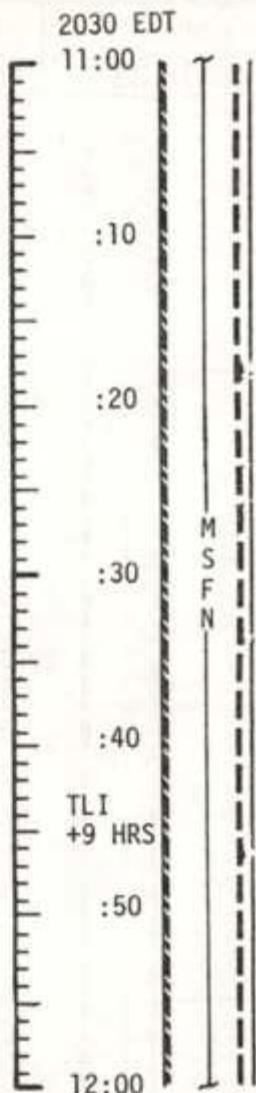
	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC1	10°/SEC TAKEOVER	+10° TAKEOVER	BT + 1 SEC	TRIM X AXIS ONLY (UNLESS X > 2 FPS)

3-9a

MCC-H

FLIGHT PLAN

NOTES



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

MCC1 ΔV = NOMINALLY ZERO

SM RCS MON CK

SPS MON CK

MCC1 BURN STATUS REPORT

V66 - TRANS CSM STATE VECTOR TO LM SLOT

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

UPLINK CMC
DESIRED ORIENTATION (PTC)
UPDATE
BLOCK DATA

BURN STATUS REPORT

X X	□	•	ΔTIG
X X	□	•	BT
□	□	•	V _{gx}
TRIM			
X X X			R
X X X			P
X X X			Y
□		•	V _{gx}
□		•	V _{gy}
□		•	V _{gz}
□		•	ΔV _c
X X X			FUEL
X X X			OX
X X X			UNBAL

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

~~MCC1 WILL BE DELAYED
TO MCC2 IF PROPELLANT
COST IS NOT PROHIBITIVE~~

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

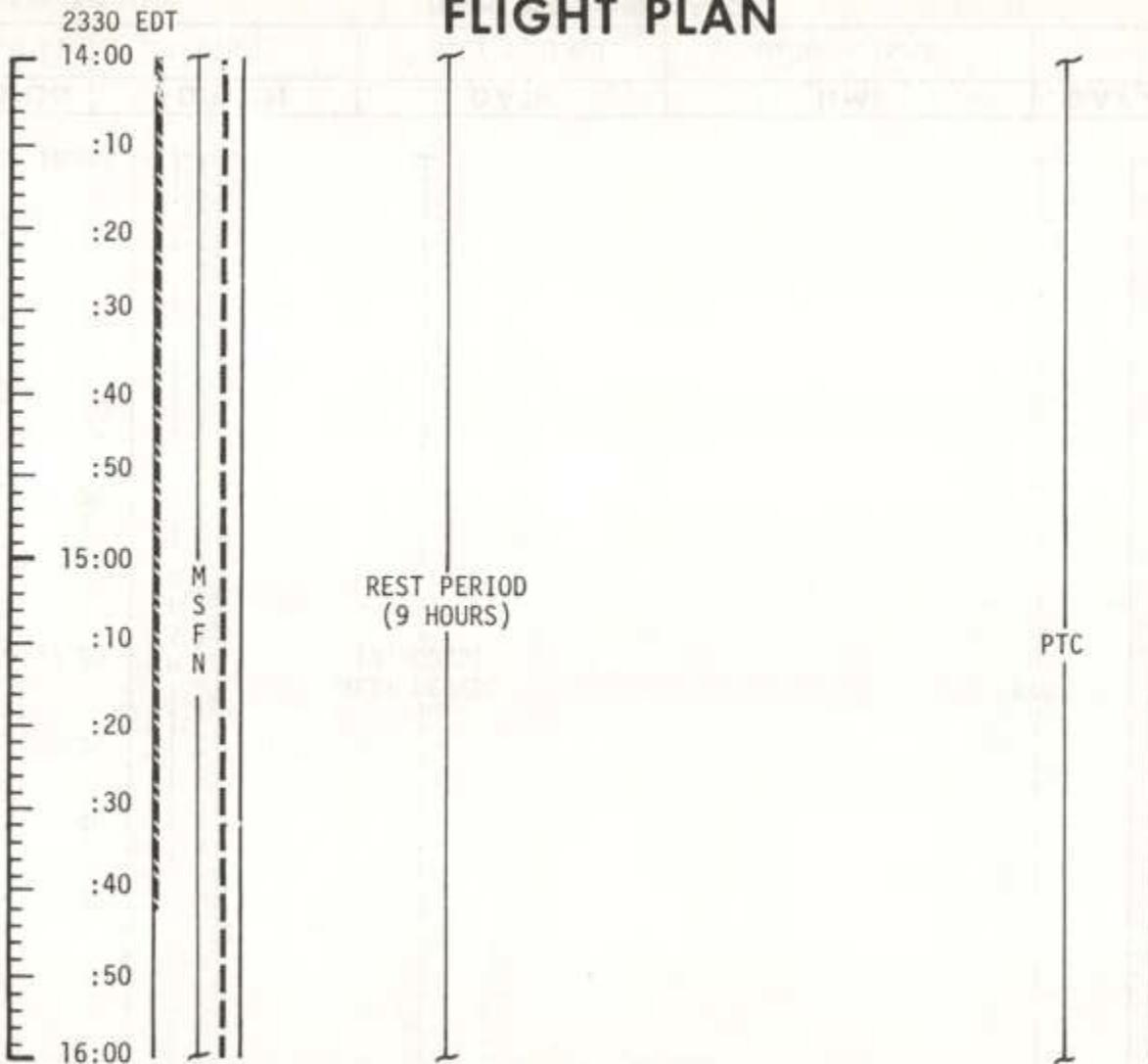
					NOTES
12:00			WASTE STOWAGE VENT VLV - CLOSED		P52 - PULSE TORQUE TO PTC REFSMMAT. ALIGNMENT CHECKED WITH OPTICS
:10			VENT BATT S UNTIL SYSTEM TEST		PTC ESTABLISHED IN G&N P, Y +30°DB, R RATE OF 0.3°/SEC
:20			METER (4A) = 0		
:30				START PTC P <u>90°</u> Y <u>0°</u>	
:40					ON BOARD READOUT
:50					BAT C _____
13:00			EAT PERIOD - ALL		PYRO BAT A _____
:10	M	S			PYRO BAT B _____
:20	S	F			RCS A _____
:30	F	N			B _____
:40					C _____
:50					D _____
14:00			REST PERIOD (9 HOURS)		DC IND SEL TO MNA OR MNB
					DURING REST PERIOD, 2 CREWMEN IN REST STATION, 1 IN LEFT COUCH
			PRESLEEP CHECKLIST		
			CREW STATUS REPORT (RADIATION, MEDICATION)		
			CYCLE O ₂ & H ₂ FANS		
			CHLORINATE POTABLE WATER		
			SELECT NORMAL LUNAR CONFIGURATION EXCEPT		
			S-BD NORMAL MODE VOICE - OFF		
			S-BD SQUELCH - ENABLE		
			S-BD AUX TAPE - OFF		
			S-BD ANT - OMNI		
			S-BD ANT OMNI - B		
			TAPE RCDR FWD - OFF		
			VERIFY:		
			WASTE MNGT OVBD DRAIN - OFF		
			WASTE STOW VENT VLV - CLOSED		
			EMERG CABIN PRESS VLV - BOTH		
			SURGE TK O ₂ VLV - ON		
			REPRESS PACK O ₂ VLV - ON		
			LM TUNNEL VENT VLV - LM/CM ΔP		
			POT H ₂ O HTR - OFF		
			AUTO RCS JET SELECT (16) - OFF		

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

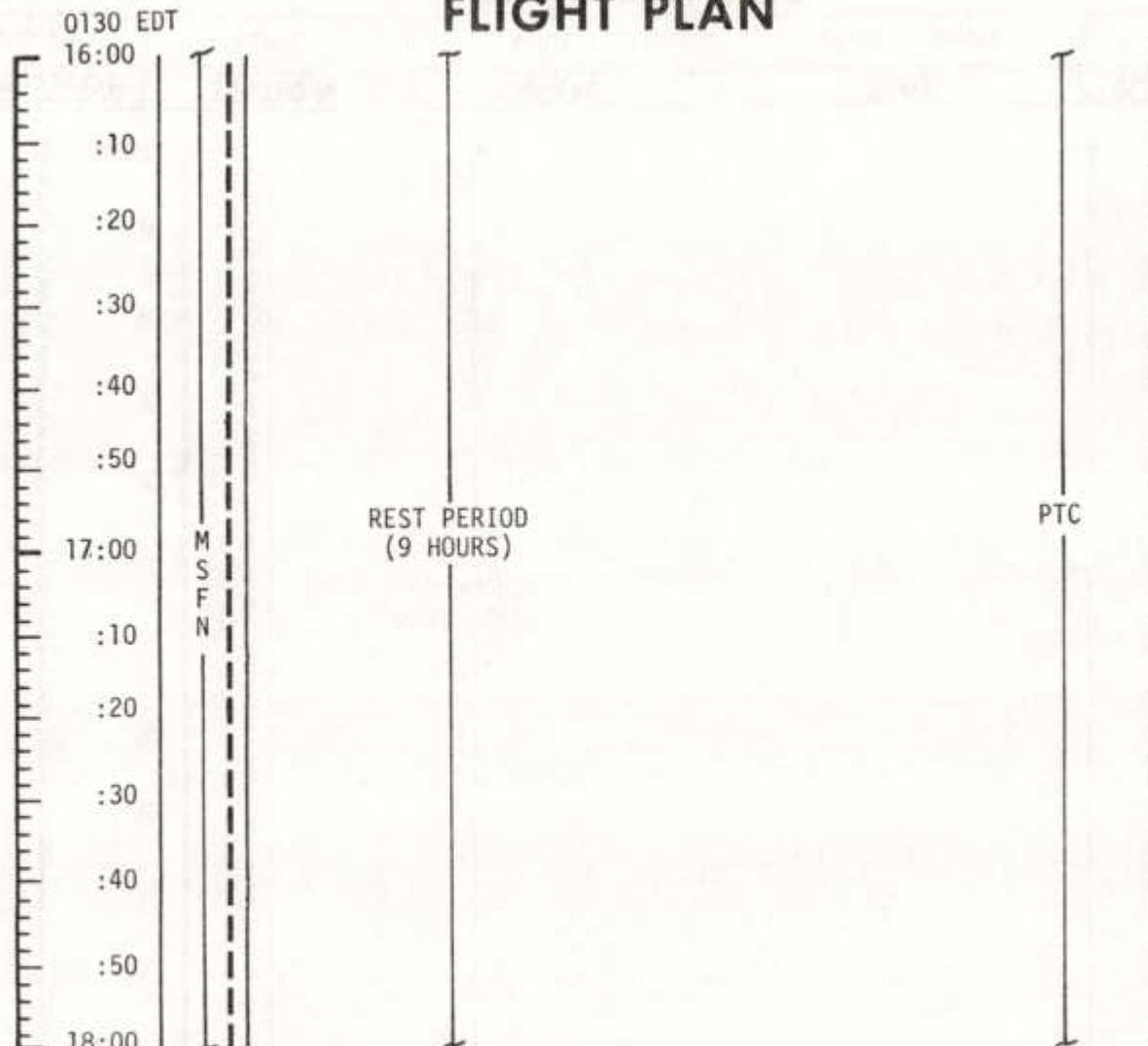


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	14:00 - 16:00	1/TLC	3-12

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)

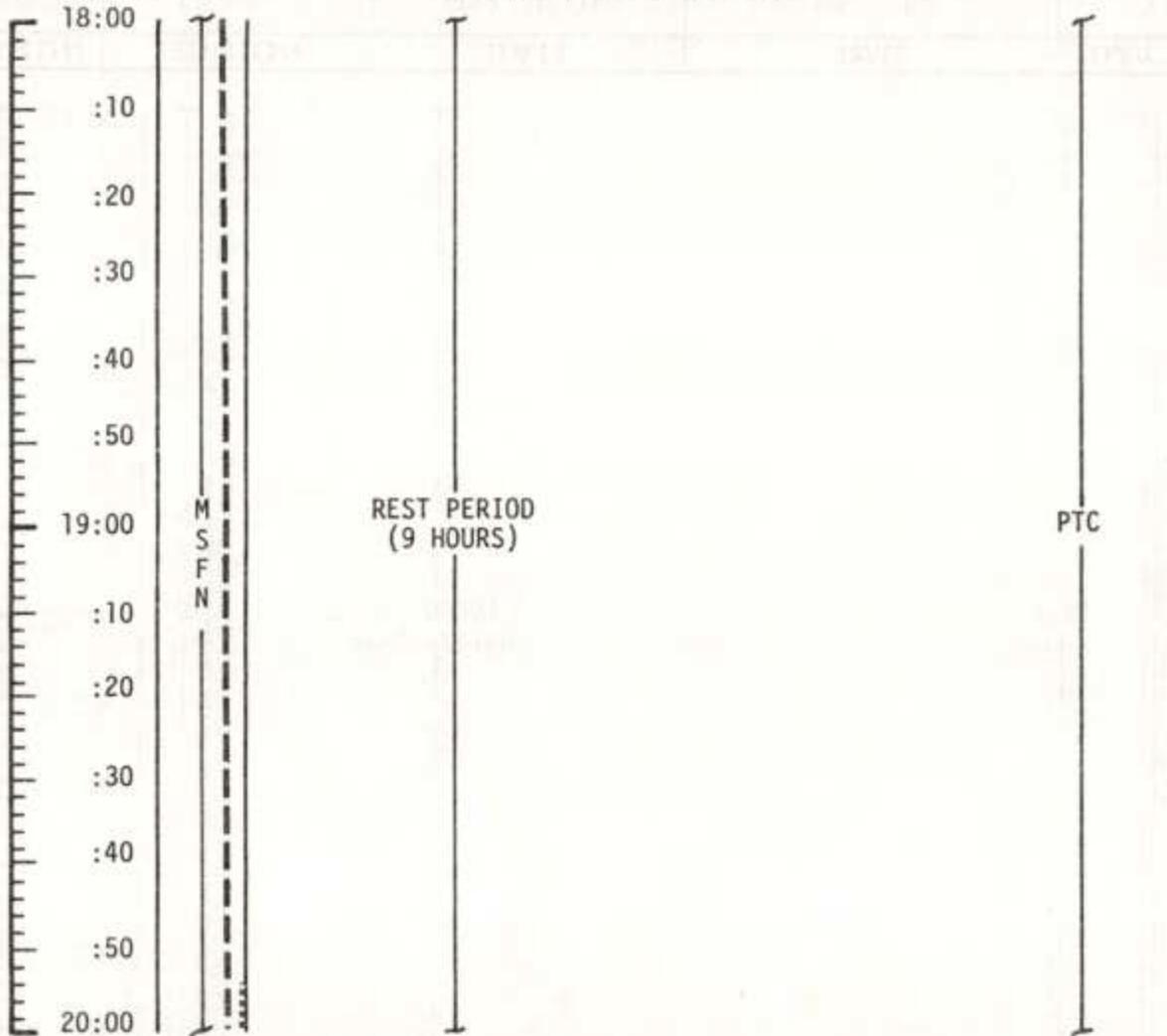
FLIGHT PLANNING BRANCH

MCC-H

0330 EDT

FLIGHT PLAN

NOTES



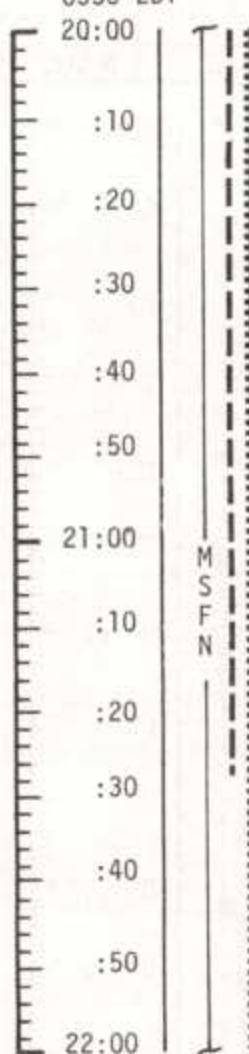
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	18:00 - 20:00	1/TLC	3-14

MCC-H

FLIGHT PLAN

NOTES

0530 EDT

REST PERIOD
(9 HOURS)

PTC

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

MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

MCC-H

FLIGHT PLAN

NOTES

UPDATE
CONSUMABLES

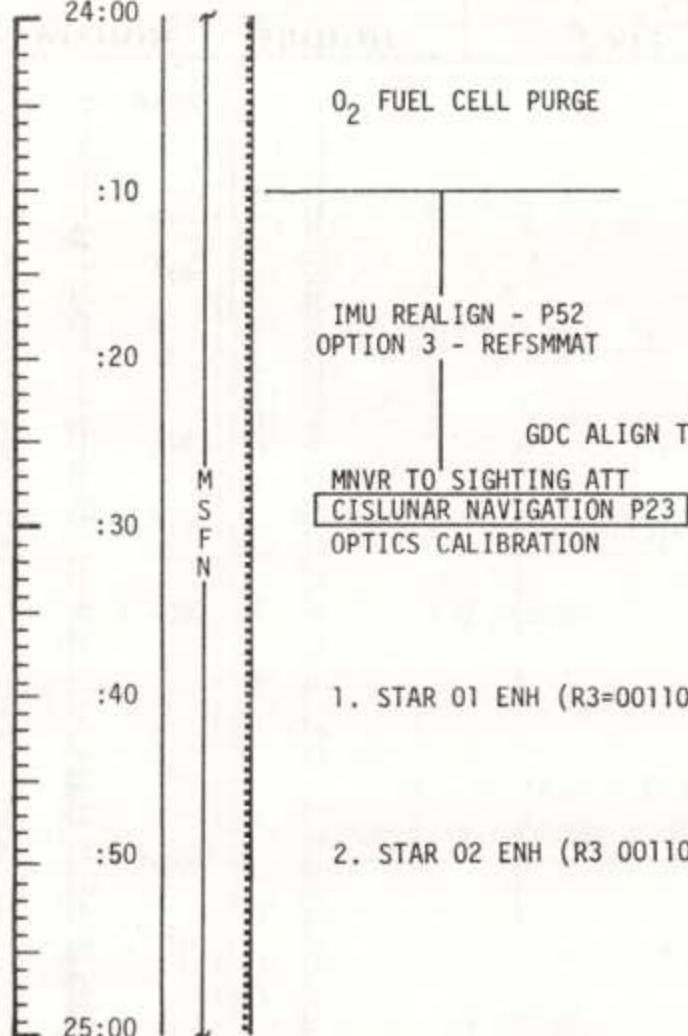
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	22:00 - 24:00	2/TLC	3-16

MCC-N

0930 EDT
24:00

FLIGHT PLAN

NOTES



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

FLIGHT PLAN

NOTES

1030 EDT
25:00

:10

3. STAR 44 EFH (R3=00120)

:20

4. STAR 44 EFH (R3=00120)

:30

5. STAR 45 EFH (R3=00120)

:40

V66 - TRANS CSM STATE VECTOR
TO LM SLOT

:50

RECORD MCC2 MNVR PAD

26:00

M

S

F

N

FOV=4°
GET=26:00

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

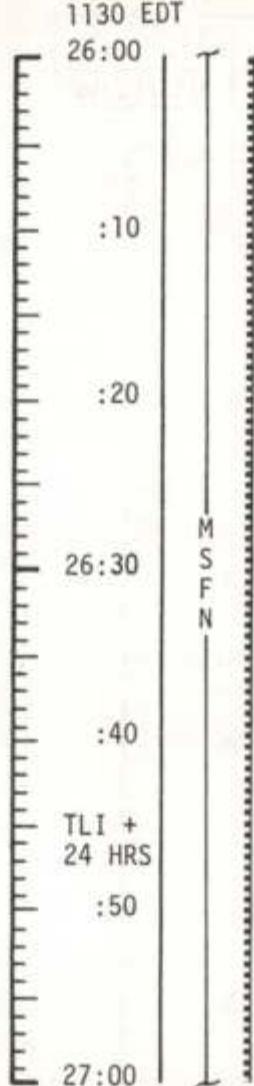
	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC2	10°/SEC TAKEOVER	+10° TAKEOVER	BT + 1 SEC	TRIM X AXIS ONLY (UNLESS X > 2 FPS)

3-18a

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}
TRIM			
X X X			R
X X X			P
X X X			Y
□			v_{gy}
□			v_{gz}
□			ΔV_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)~~
TO AVOID EXECUTION OF MCC3, A NON FREE MCC2 WILL BE EXECUTED (SPS BURN IF THE BT > 3 SEC)

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

MCC-H

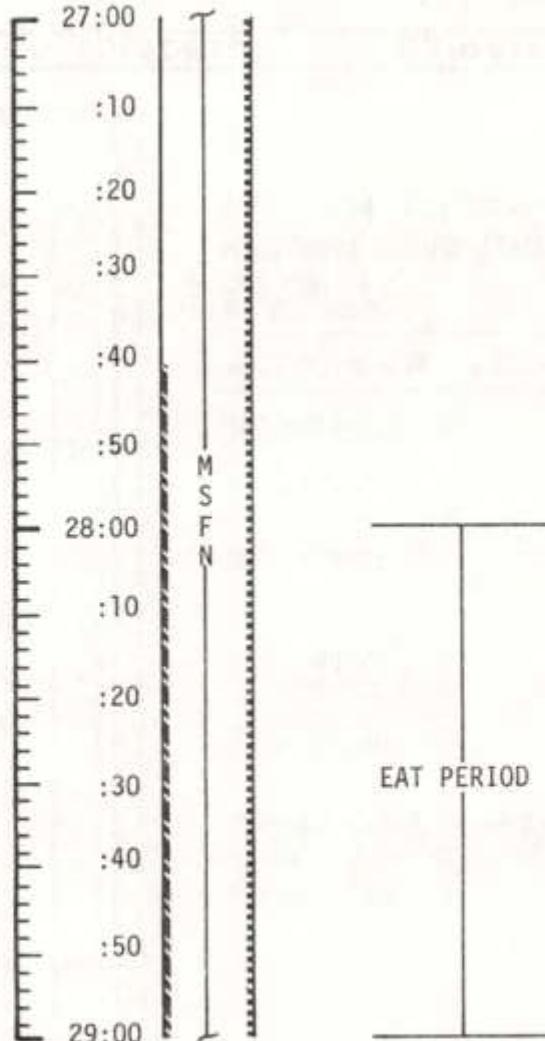
FLIGHT PLAN

NOTES

UPLINK
EARTH HORIZON
BIAS (ΔH)
(IF REQUIRED)

1230 EDT

27:00



START PTC
P 90 Y 0

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

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

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

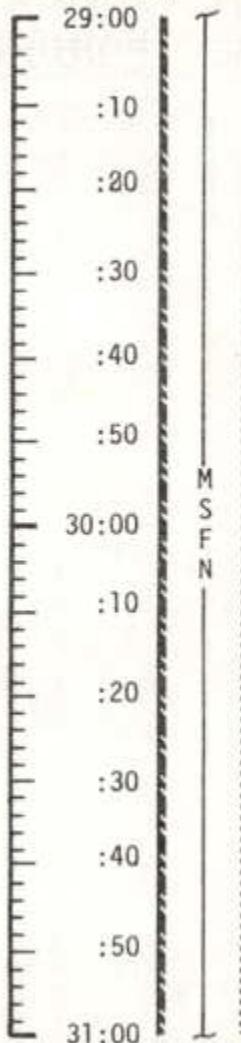
MSC Form 28 (May 69)

FLIGHT PLANNING BRANCH

MCC-H

FLIGHT PLAN

NOTES

1430 EDT
29:00

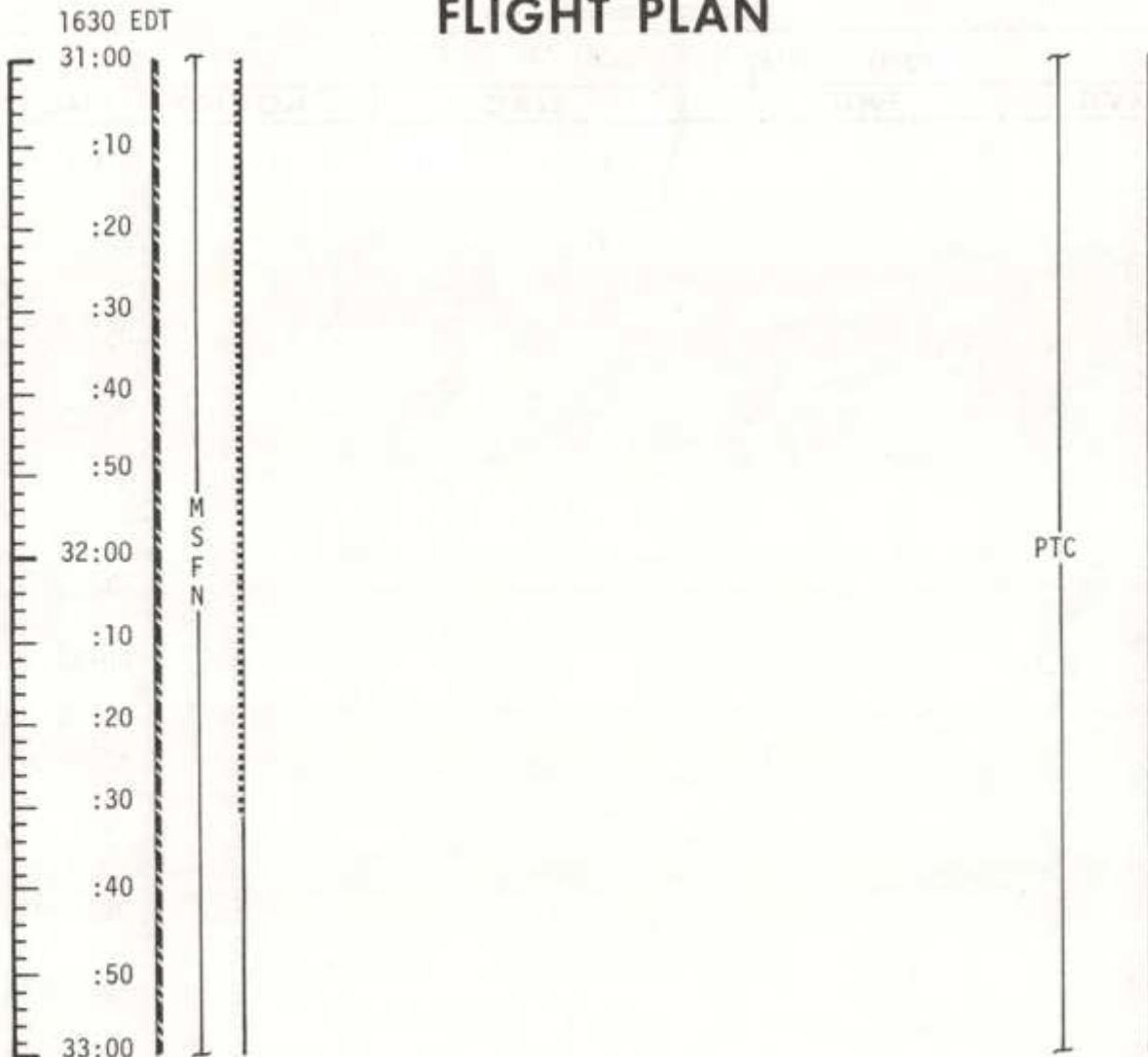
PTC

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

MCC-H

FLIGHT PLAN

NOTES



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)

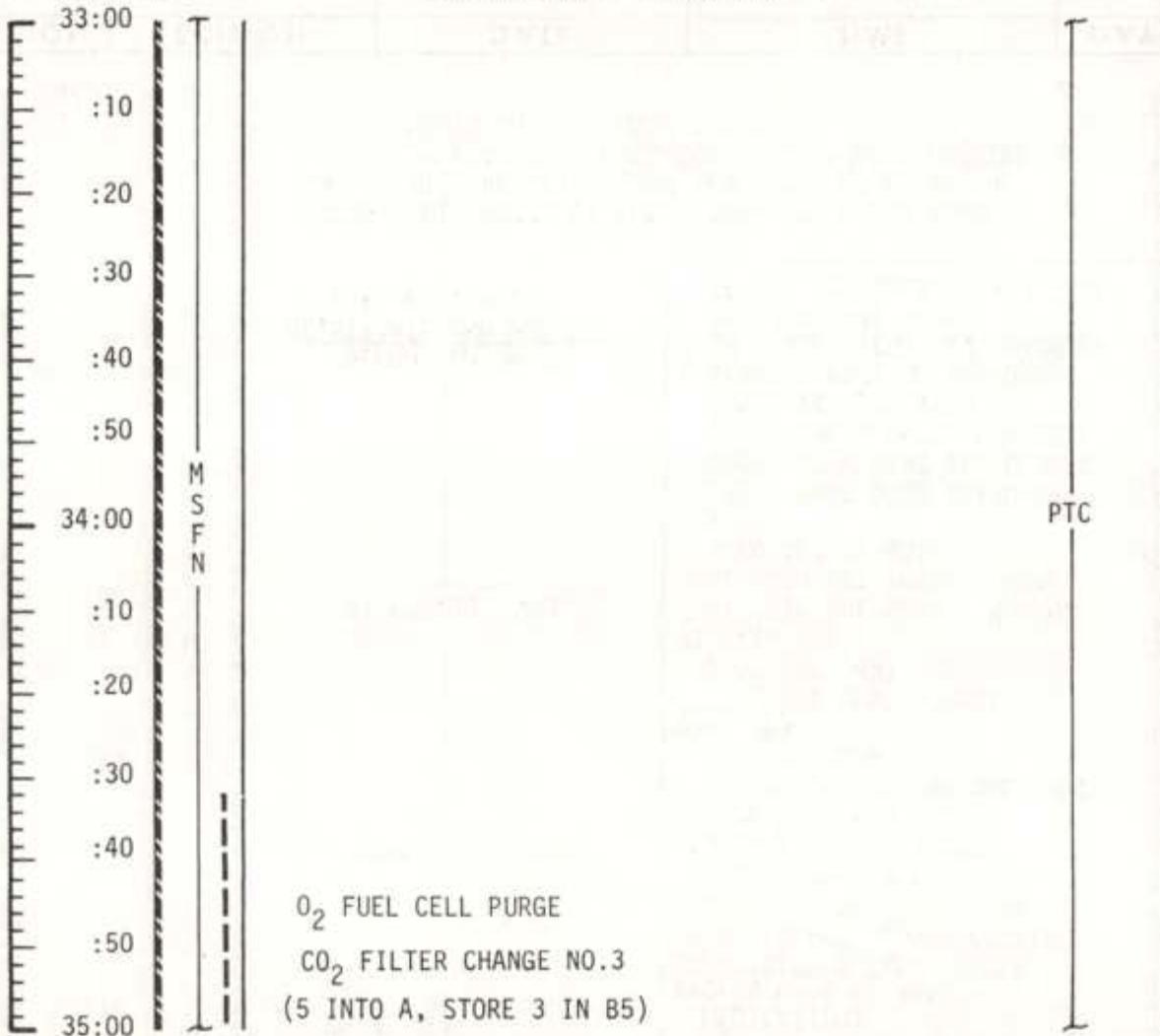
FLIGHT PLANNING BRANCH

MCC-H

1830 EDT

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

FLIGHT PLAN

NOTES

(2030 EDT)

35:00

RECORD BLOCK DATA-
LOI-5 FLYBY TO
PRIME CLA

PRESLEEP CHECKLIST
 CREW STATUS REPORT (RADIATION,
 MEDICATION)
 CYCLES O₂ & H₂ 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 O₂ VLV-ON
 REPRESS PACK O₂ VLV-OFF
 LM TUNNEL VENT VLV-LM/CM ΔP
 POT H₂O HTR - OFF
 AUTO RCS JET SELECT (16) - OFF

:10

:20

:30

:40

:50

M
S
F
N

36:00

EAT PERIOD - ALL

:10

:20

:30

:40

:50

:10

:20

:30

:40

:50

37:00

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 O₂ PURITY REQUIRE-
 MENTS ON THE LUNAR SURFACE

ONBOARD READOUT

BAT C _____

PYRO BAT A _____

PYRO BAT B _____

RCS A _____

B _____

C _____

D _____

DC IND SEL TO MNA

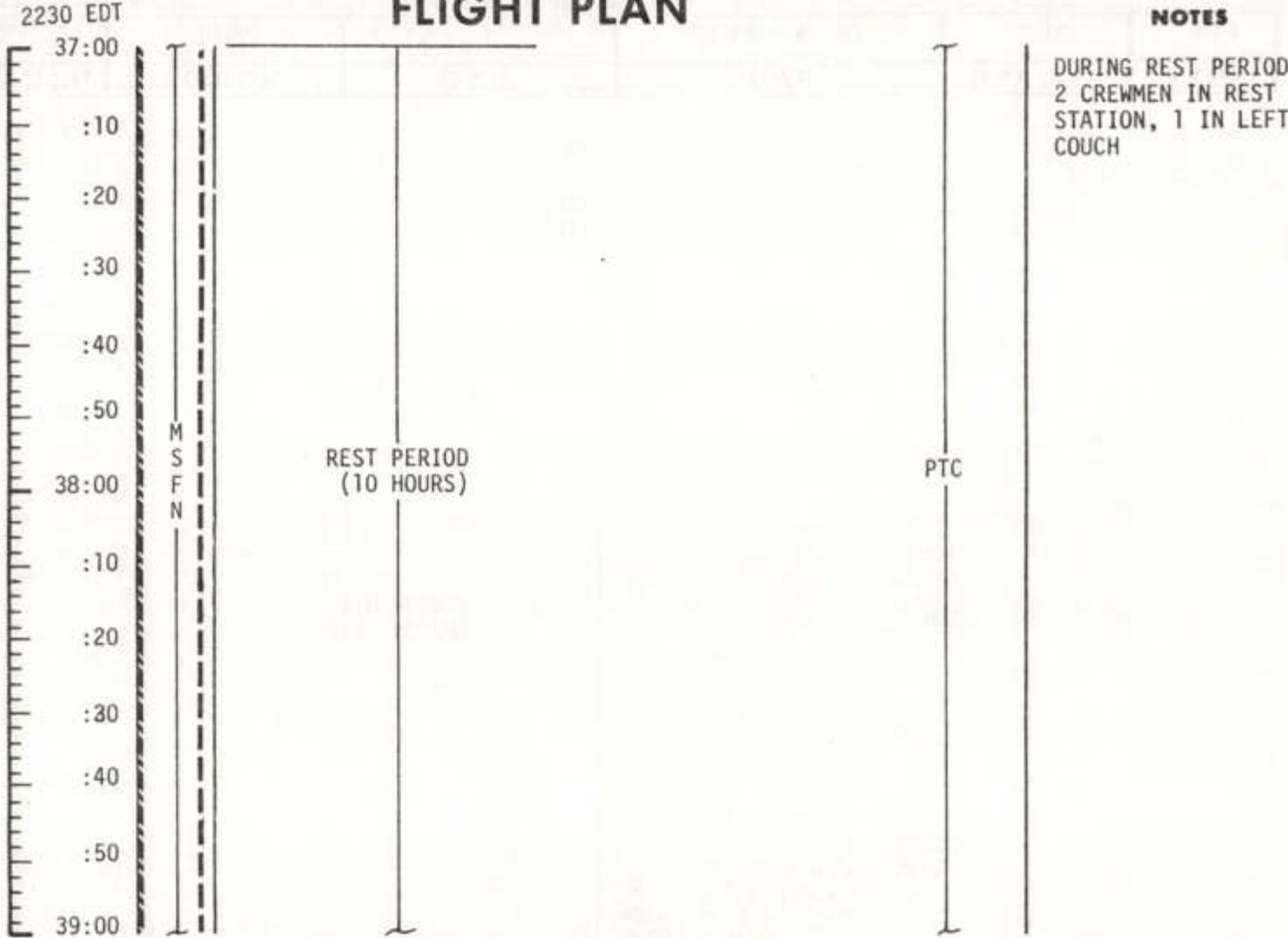
OR MNB

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

MCC-H

FLIGHT PLAN

NOTES



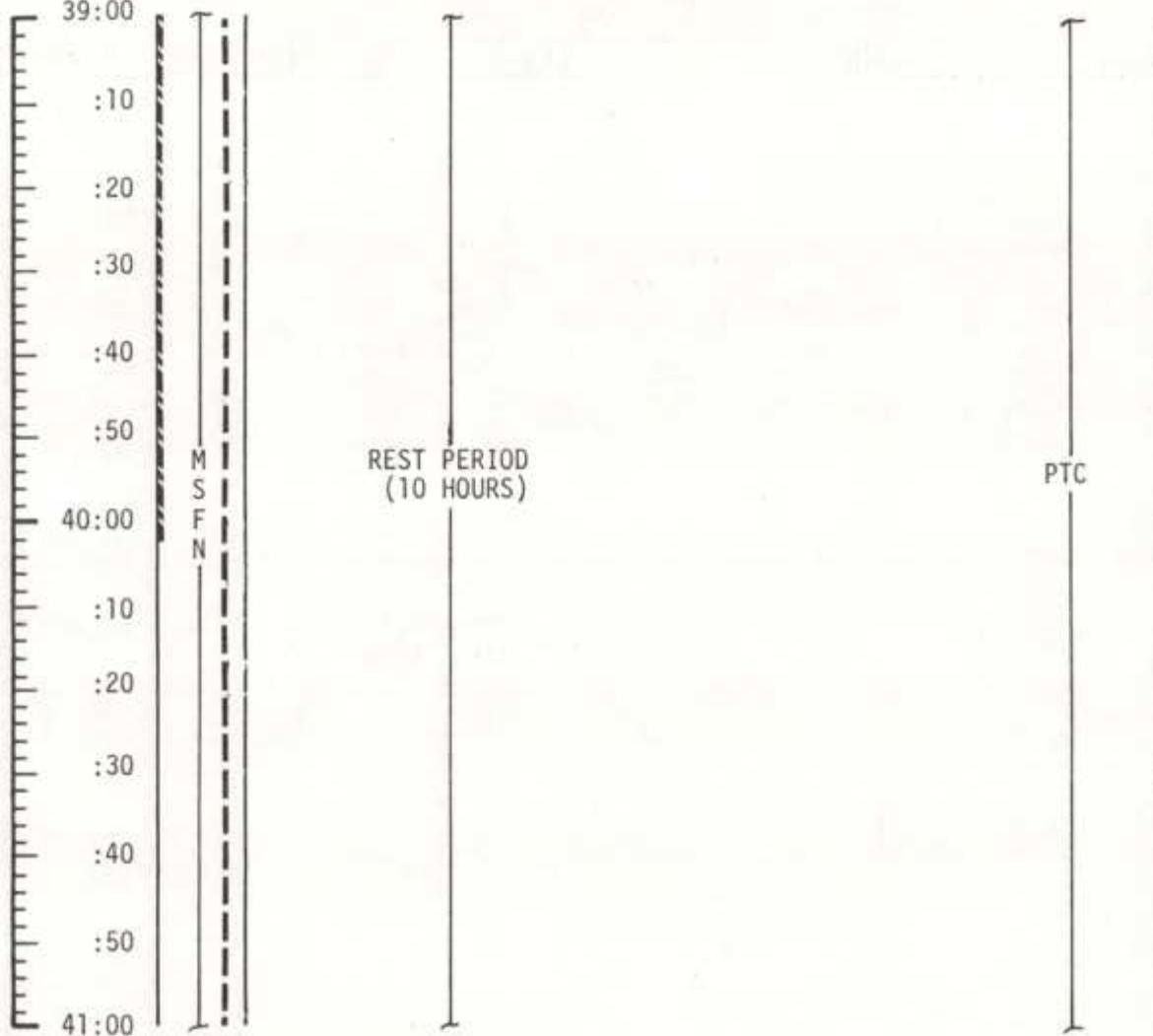
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	37:00 - 39:00	2/TLC	3-25

MCC-H

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)

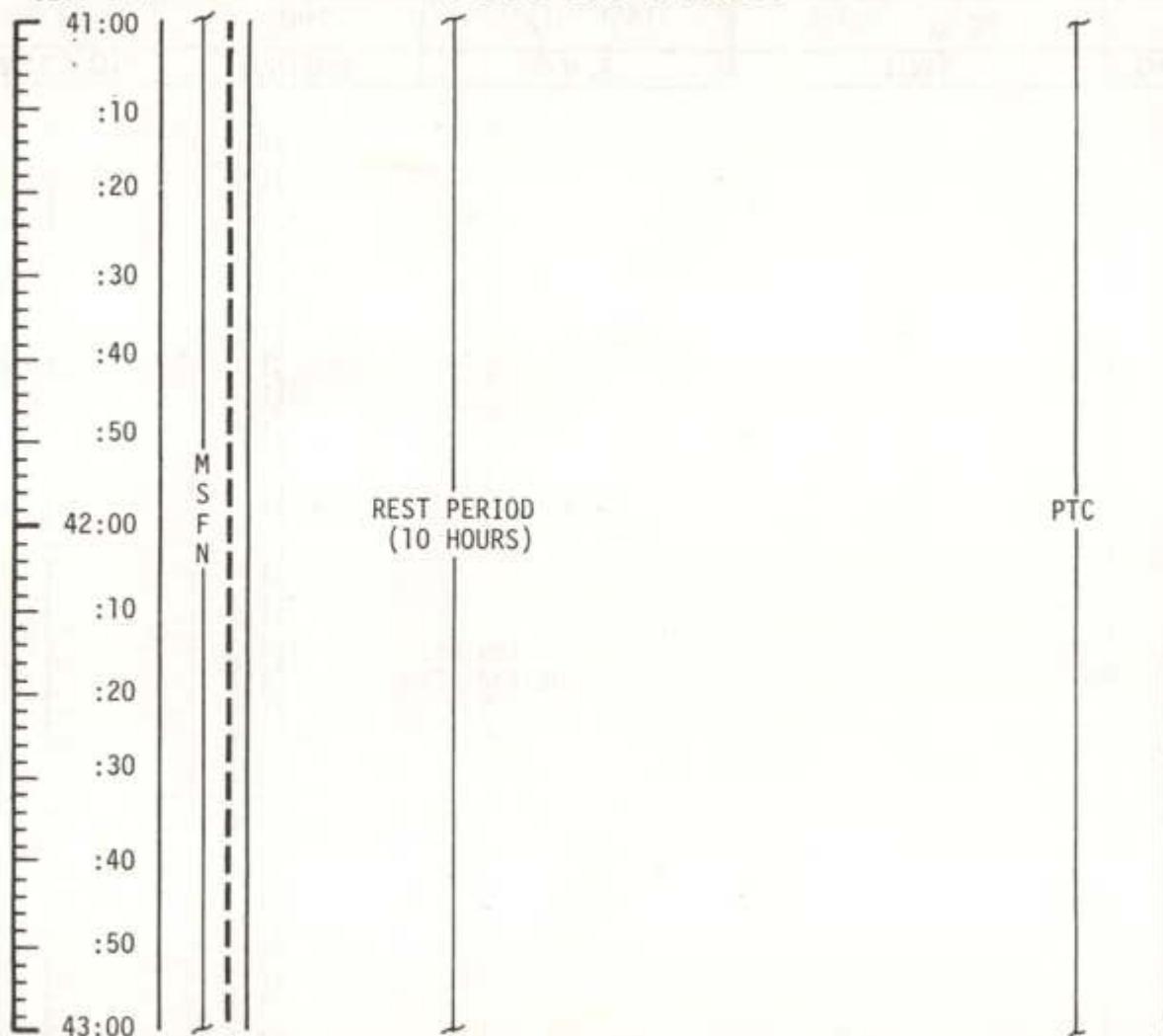
FLIGHT PLANNING BRANCH

MCC-H

0230 EDT

FLIGHT PLAN

NOTES



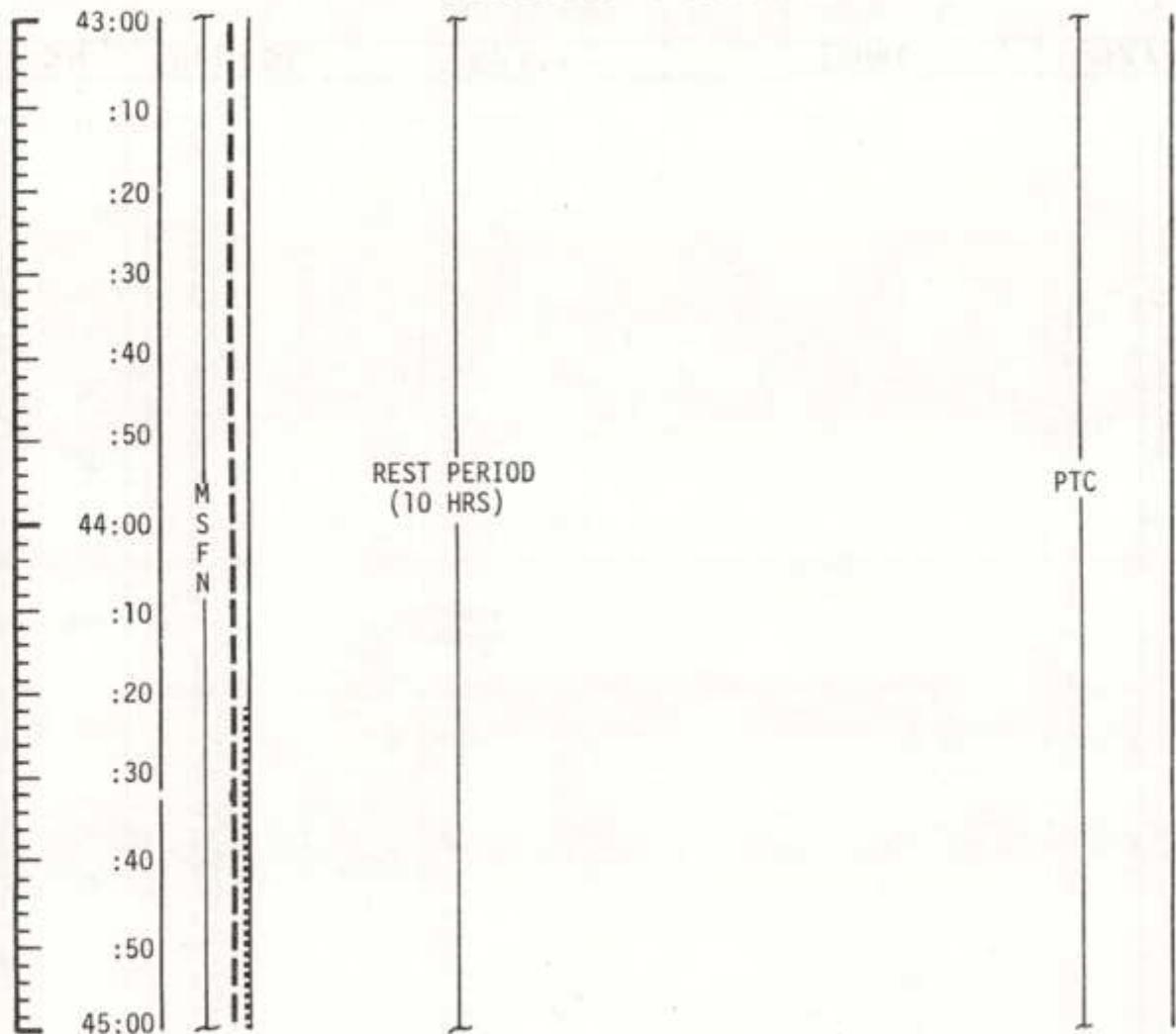
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	41:00 - 43:00	2/TLC	3-27

MCC-H

0430 EDT

FLIGHT PLAN

NOTES



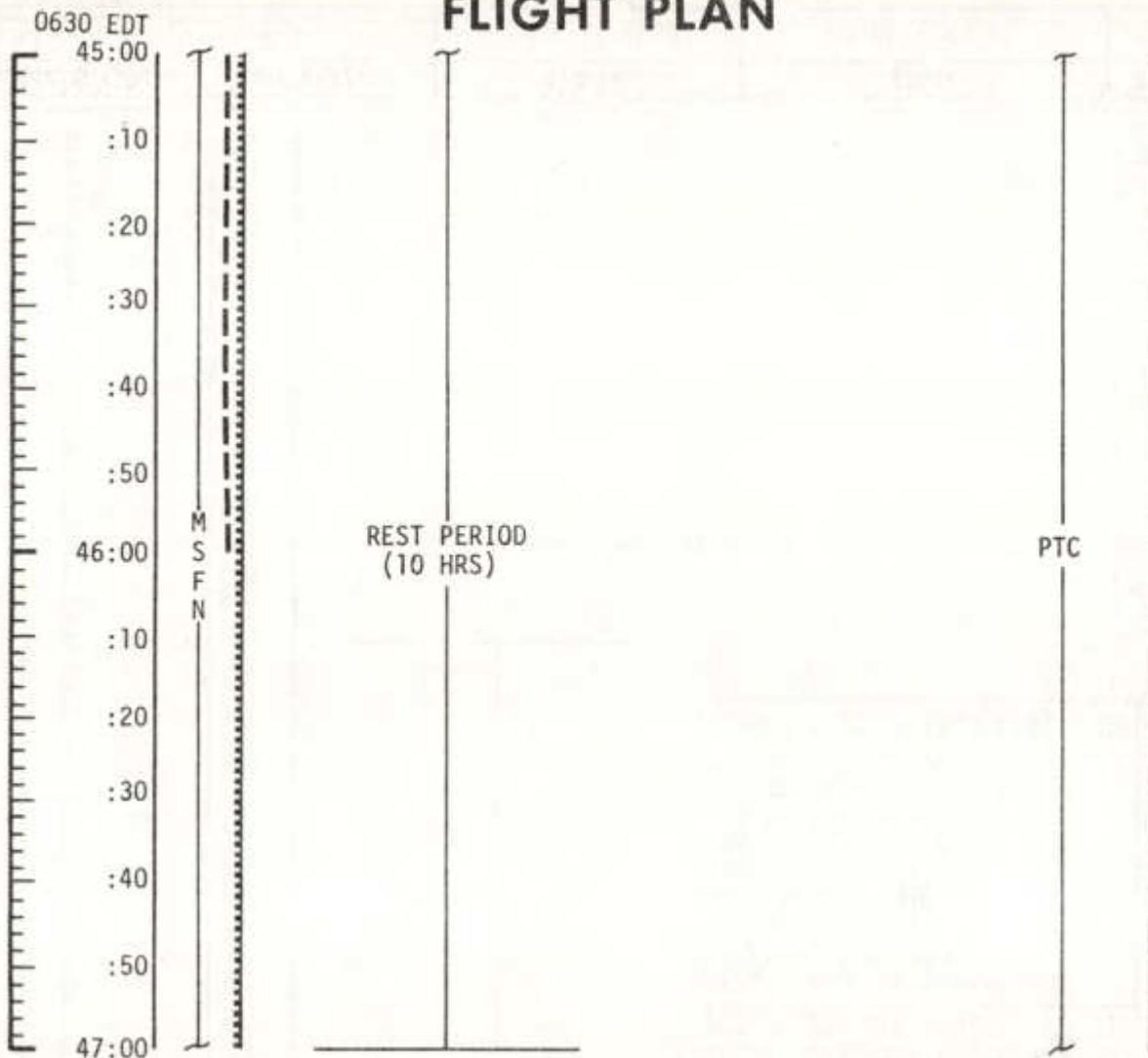
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	43:00 - 45:00	2/TLC	3-28

MSC Form 2B (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
CONSUMABLES

0830 EDT
47:00

:10

:20

:30 EAT PERIOD-ALL

:40

:50

48:00 M S F N

:10

:20

:30 BATTERY CHARGE, BATTERY B

:40

:50

49:00

CO₂ FILTER CHANGE NO.4
(6 INTO B, STORE 4 IN B5)
POST SLEEP CHECKLIST

CREW STATUS REPORT(SLEEP)
CYCLE O₂ & H₂ FANS
GDC ALIGN TO IMU
CONSUMABLES UPDATE
SELECT NORMAL LUNAR
CONFIGURATION EXCEPT:
S-BD AUX TAPE - OFF
TAPE RCDR FWD - OFF
POT H₂O HTR - ON
AUTO RCS JET SELECT (16) - ON

PTC

CONSUMABLES UPDATE
(Δ FROM NOMINAL)

GET: _____

RCS TOT _____

A _____

B _____

C _____

D _____

H₂ TOT _____O₂ TOT _____

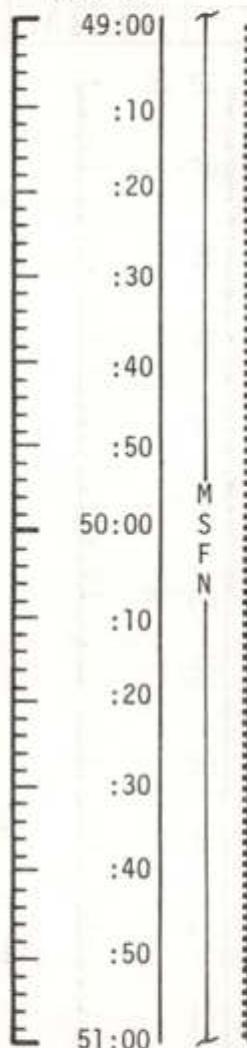
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	47:00 - 49:00	3/TLC	3-30

MCC-H

FLIGHT PLAN

NOTES

1030 EDT

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

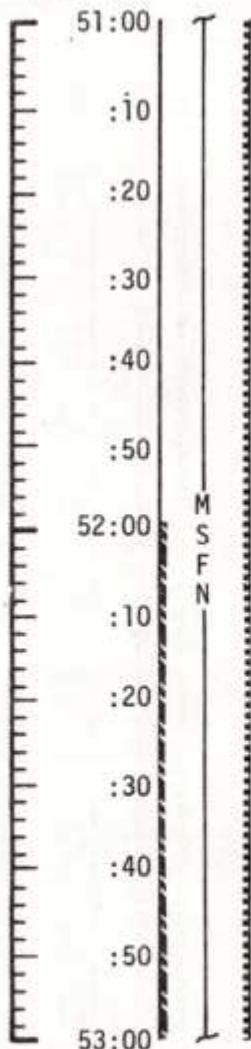
NOTES

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
H₂ PURGE LINE HTRS-ONO₂ & H₂ FUEL CELL PURGE

EAT PERIOD-ALL

PTC

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

THIS PAGE INTENTIONALLY LEFT BLANK.

MCC
BURN CHART

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

3-32a

MCC-H

1430 EDT



FLIGHT PLAN

IMU REALIGN - P52
OPTION 3 - REFSMMAT

EXT ΔV - P30

SPS/RCS THRUST - P40/41

MNVR TO BURN ATT

SXT STAR CK (STOW OPTICS)

EMS ΔV TEST

SM RCS MON CK

GDC ALIGN TO IMU

MCC3 ΔV=NOMINALLY ZERO

SM RCS MON CK

SPS MON CK

BURN STATUS REPORT

X	X		•	ΔTIG
X	X		•	BT
			•	V_{gx}
			•	TRIM
X	X	X		R
X	X	X		P
X	X	X		Y
			•	V_{gy}
			•	V_{gz}
			•	ΔV_c
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 DELAYED
TO MCC4 IF PROPELLANT
COST IS NOT PROHIBITIVE
~~MCC3 WILL BE EXECUTED
IF ΔV > 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-H

FLIGHT PLAN

NOTES

1530 EDT

54:00
 :10
 :20
 :30
 :40
 :50
 55:00
 :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

MSC Form 29 (May 69)

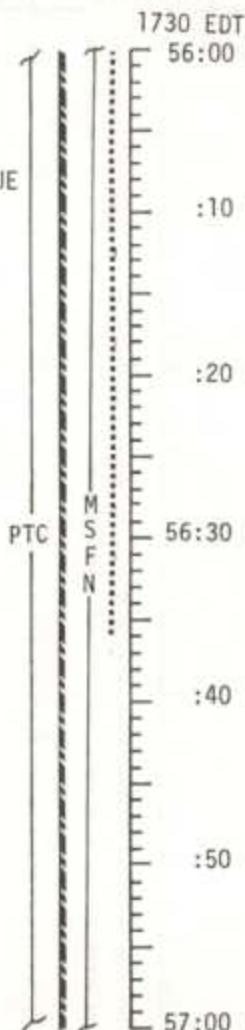
FLIGHT PLANNING BRANCH

FLIGHT 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
CSM PWR TO LM - ON
(AT LMP REQUEST)
DUMP DSE (LM DATA)
CSM PWR TO LM - OFF
(AT LMP REQUEST)



LM

CDR

IVT TO LM

LM FAMILIARIZATION

LMP

OPEN LM HATCH
RECORD ROLL CAL ANGLE
IVT TO LM
TRANS TO LM PWR

ACT VHF B FOR DATA
XMIT FOR 5 MINUTES
TRANS TO CSM PWR

ASSIST CDR

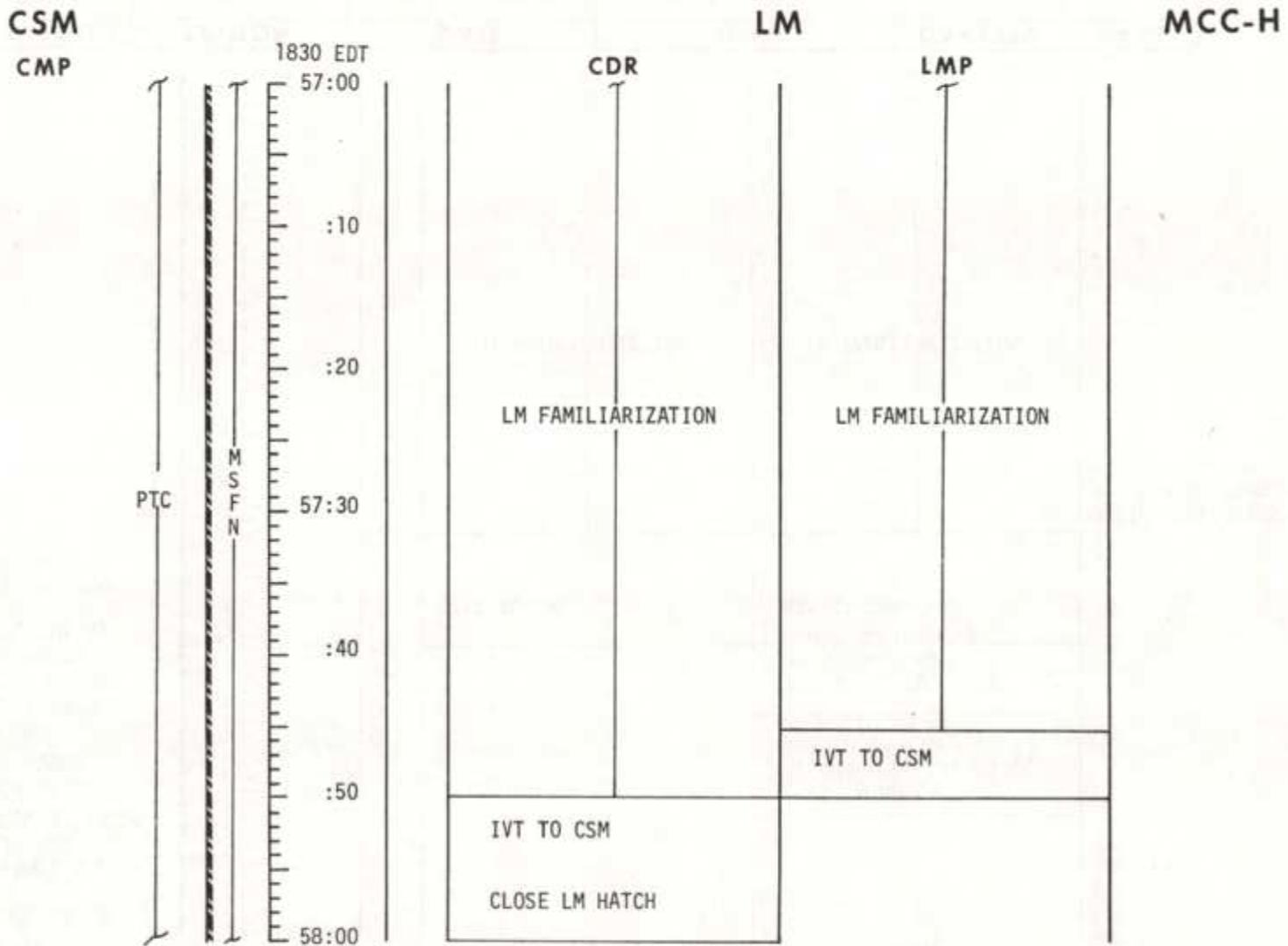
LM FAMILIARIZATION

MCC-H

VERIFY OPERATION
OF LM 16mm CAMERA

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	Revision A	July 8, 1969	56:00 - 57:00	3/TLC	3-35

FLIGHT PLAN

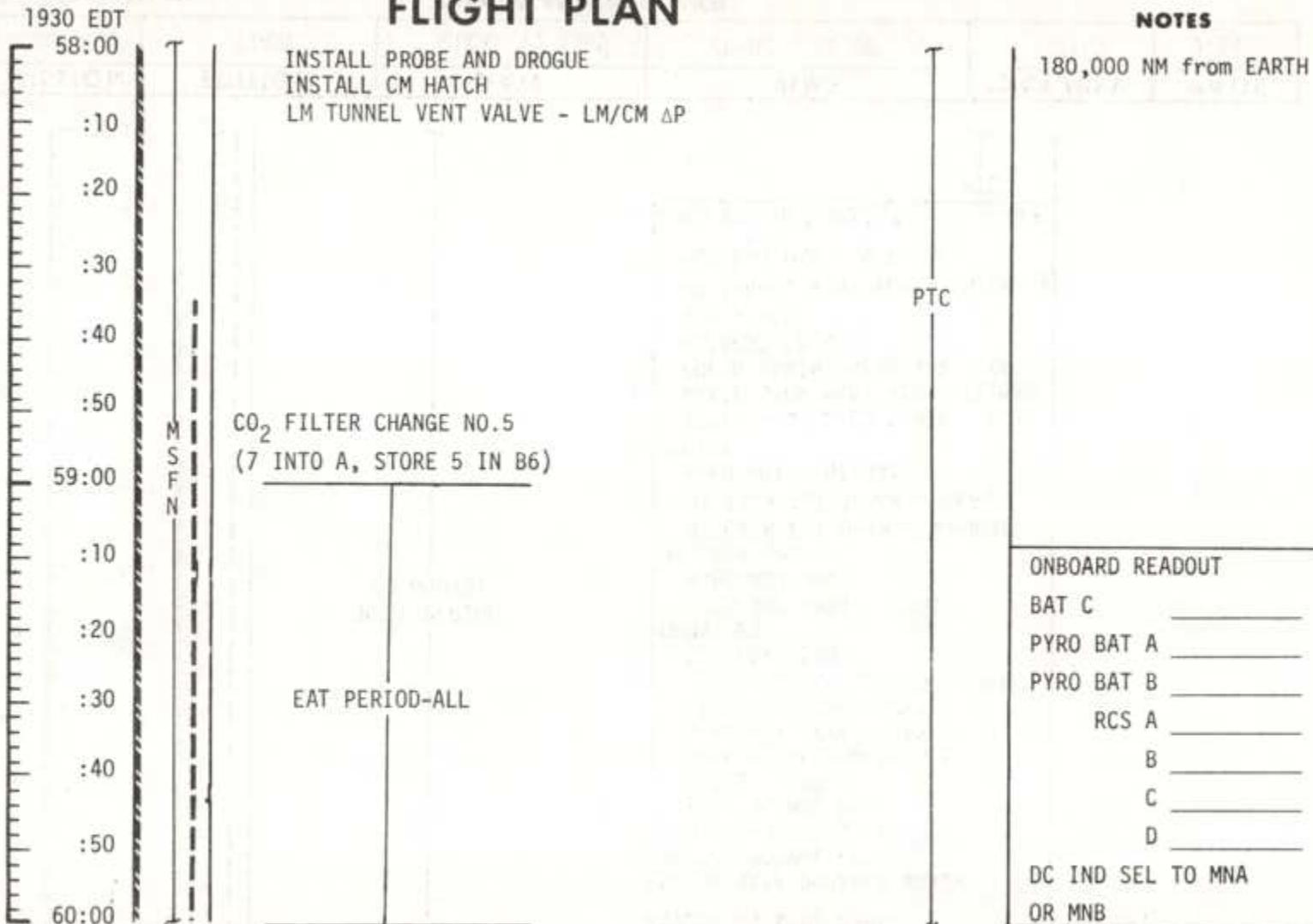


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	57:00 - 58:00	3/TLC	3-36

MCC-H

FLIGHT PLAN

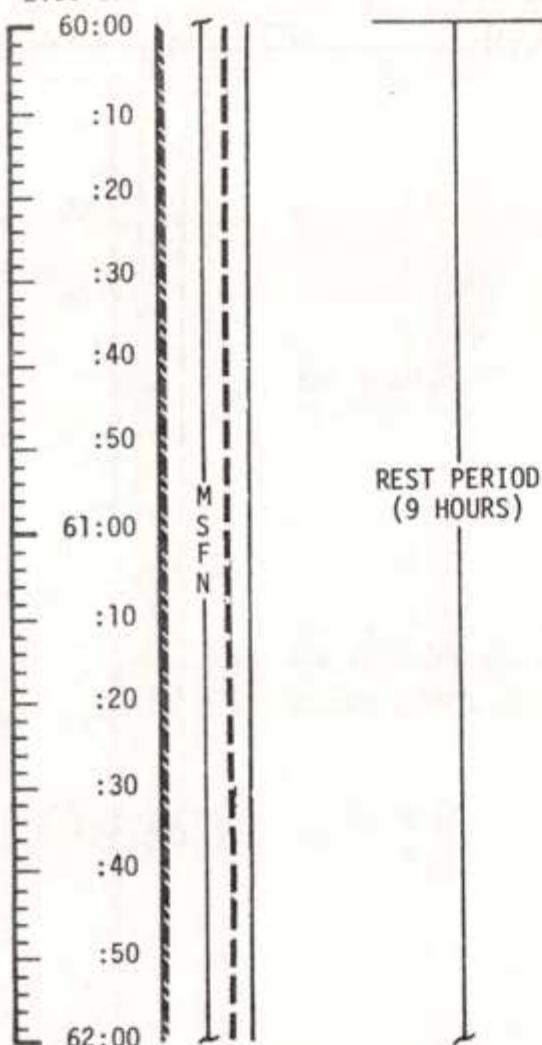
NOTES



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

MCC-N

2130 EDT



FLIGHT PLAN

NOTES

PRESLEEP CHECKLIST
 CREW STATUS REPORT (RADIATION & MEDICATION)
 CYCLE O₂ & H₂ 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 O₂
 VLV - OFF
 LM TUNNEL VENT VLV - LM/CM ΔP
 POT H₂O 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

2330 EDT

62:00

:10

:20

:30

:40

:50

63:00

:10

:20

:30

:40

:50

64:00

M

S

F

N

REST PERIOD
(9 HOURS)

PTC

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

MCC-H

0130 EDT

64:00
 :10
 :20
 :30
 :40
 :50
 65:00
 :10
 :20
 :30
 :40
 :50
 66:00

M
S
F
NREST PERIOD
(9 HOURS)

PTC

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)

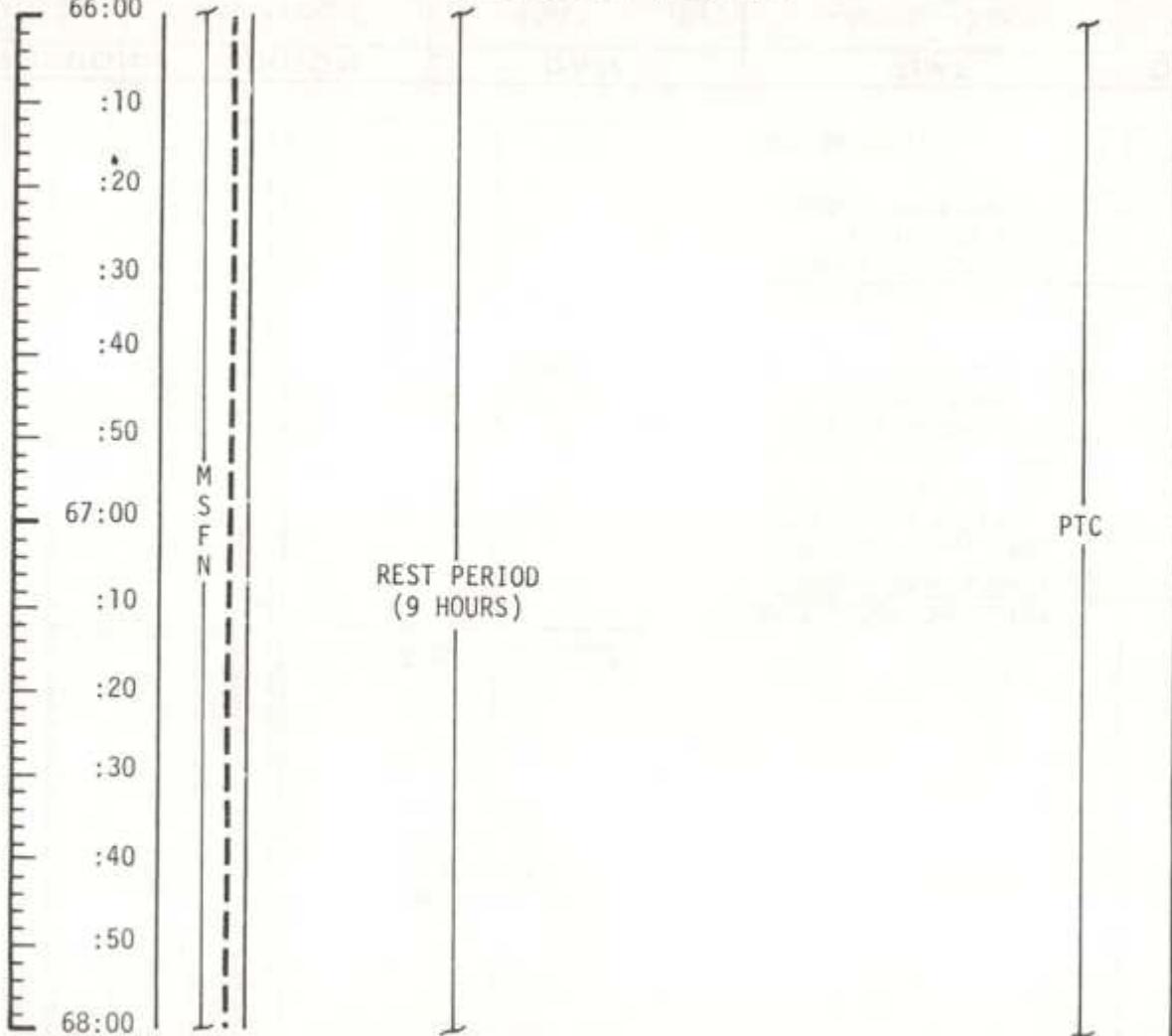
FLIGHT PLANNING BRANCH

MCC-H

0330 EDT
66:00

FLIGHT PLAN

NOTES



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

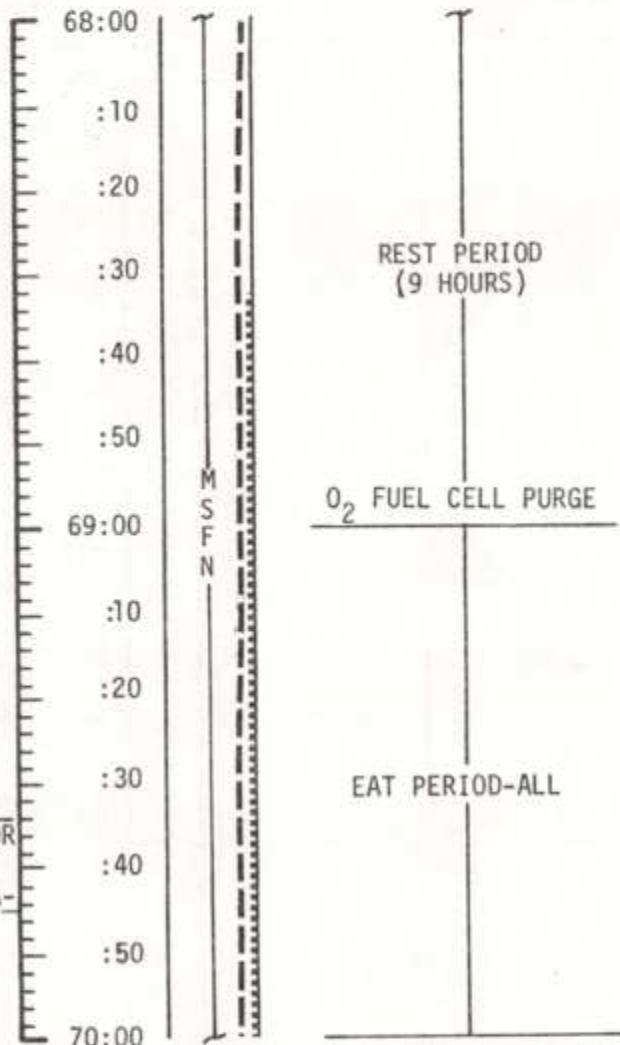
MCC-N

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 O₂ & H₂ FANS
 GDC ALIGN TO IMU
 CONSUMABLES UPDATE
 SELECT NORMAL LUNAR
 CONFIGURATION EXCEPT:
 S-BD AUX TAPE - OFF
 TAPE RCDR FWD - OFF
 POT H₂O 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 _____

H₂ TOT _____O₂ TOT _____

PTC

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

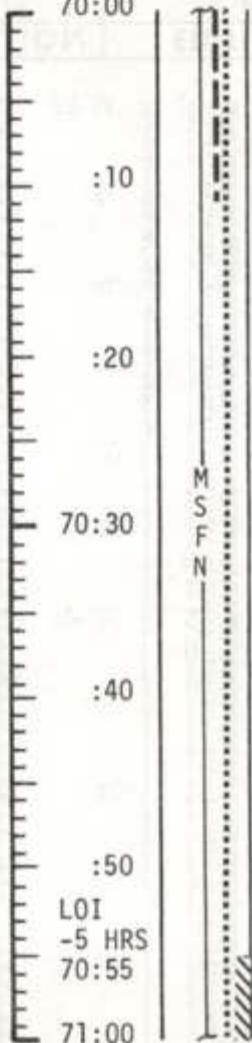
	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC4	10°/SEC TAKEOVER	+10° TAKEOVER	BT + 1 SEC	TRIM X AXIS ONLY

3-42a

MCC-H

UPDATE
BLOCK DATA0730 EDT
70:00

FLIGHT PLAN

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

BURN STATUS REPORT

X X	ΔTIG
X X	BT
	TRIM
X X X	R
X X X	P
X X X	Y
	V _{gx}
	V _{gy}
	V _{gz}
	ΔV _c
X X X	FUEL
X X X	OX
X X X	UNBAL

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

MCC3 WILL BE
EXECUTED WITH THE
SPS IF THE BT >3 SECMCC 4 WILL BE
EXECUTED ONLY IF
LOI CANNOT BE
TARGETED TO CONNECT
MCC 3 DISPERSIONS

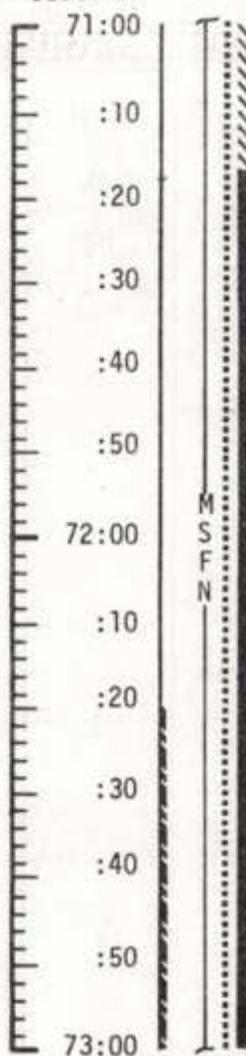
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	70:00 - 71:00	3/TLC	3-43

MCC-H

0830 EDT

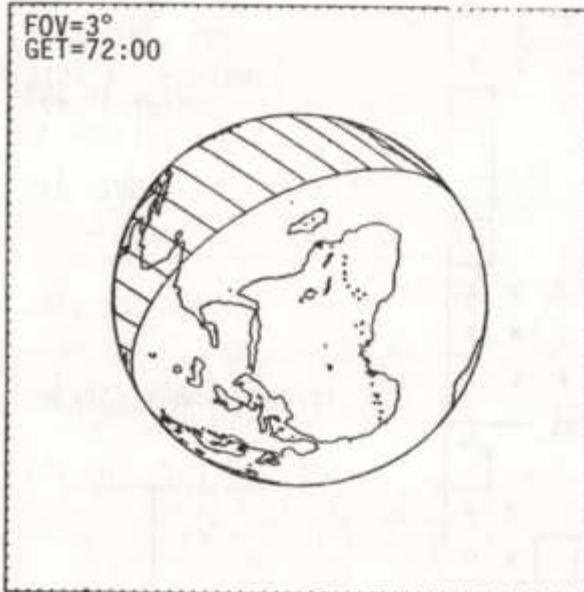
FLIGHT PLAN

NOTES



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

CO_2 FILTER CHANGE NO.6
(8 INTO B, STORE 6 IN B6)
~~PRE-LOI ECS REDUNDANT COMPONENT CK~~ SECONDARY RADIATOR
ACTIVATE PRIMARY EVAPORATOR LEAK CHECK



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

MCC-H

1030 EDT
73:00

FLIGHT PLAN

NOTES

UPLINK CMC
CSM STATE VECTOR
LOI₁ TGT LOAD

UPDATE CSM
LOI₁ MNVR PAD

V66 TRANSFER CSM STATE VECTOR TO LM SLOT

COPY LOI₁ P30 MANEUVER PAD

TEI₁ BLOCK DATA ASSUMED
LOI₁ ACCOMPLISHED
TEI₄ ASSUMES LOI₁
ACCOMPLISHED BUT
NO LOI₂

M
S
F
N

73:30

IMU REALIGN - P52
AND DRIFT CK
OPTION 3 - REFSMMAT

73:52

COPY BLOCK DATA (TEI₁ & TEI₄)

UPDATE CSM
BLOCK DATA

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

FLIGHT PLAN

NOTES

	P30 EXTERNAL ΔV EXT ΔV - P30 P00. V49
74:00	MANEUVER TO BURN ATTITUDE R 357.9, P 225.4, Y 346.2
74:03	<u>SEXTANT STAR CHECK</u>
	ROLL TO ACQUIRE MSFN SPS PRETHRUST - P40 (TVC TEST) ROLL TO BURN ATTITUDE
	S-BAND SQUELCH - OFF PITCH UP 360° AT 0.2°/SEC TO OBSERVE LUNAR SURFACE
74:30	M S F N
	GO INERTIAL V64 REACQUIRE MSFN
75:00	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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LOI₁
BURN CHART

	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
LOI ₁	10°/SEC TAKEOVER	+10° TAKEOVER	BT + 10 SEC	DO NOT TRIM
LOI ₁ ABORT MODES				
LOI ₁ V _{GO}	BT	TRAJECTORY	ABORT MODE	
2924.0 - 2129.0	0-01:50	HYPERBOLIC	MODE I	- COAST 2 HR - DPS - P37 (P37 BEYOND SPHERE FOR VGO >2279 AND BT <01:30)
2129.0 - 1589.0	01:50 - 03:00	UNSTABLE	MODE II	- COAST 2 HR - 2 DPS BURNS FOR STABILIZA- TION AND WATER or CLA LANDING
1589.0 - 0	03:00 - 06:05	LUNAR ORBIT	MODE III	- DPS BURN AFTER ONE REV

MCC-H

1230 EDT

75:00

UPDATE CSM
LOS AND AOS
(WITH & WITHOUT
LOI₁)

M
S
F
N

GO/NO GO

75:30

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

R357.9, P225.4, Y346.2

SEXTANT STAR CHECK

GO/NO GO FOR LOI₁
PCM-LO
S-BAND AUX-DOWN VOICE BACKUP

75:46

GDC ALIGN TO IMU

LOI₁

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

NOTE: INITIATE LOI₁
WITH BANK B BALL VALVES

76:00

FLIGHT PLANNING BRANCH

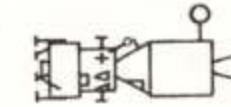
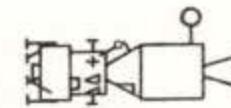
NOTES

FLIGHT PLAN

CMP - PRE LOI₁ 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 LOI₁ _____:
AOS W/O LOI₁ _____:



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

MCC-H

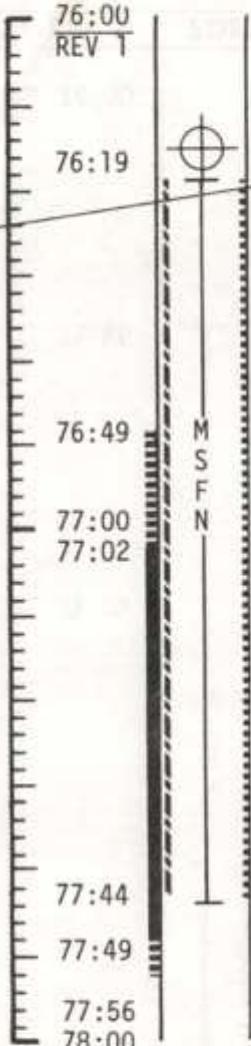
1330 EDT

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	□	•	ΔT_{IG}
X X	□	•	BT
□	□	•	V_{gx}
	TRIM		R
X X X			P
X X X			Y
X X X	□	•	V_{gy}
	□	•	V_{gz}
	□	•	ΔV_c
X X X			FUEL
X X X			OX
X X X			UNBAL

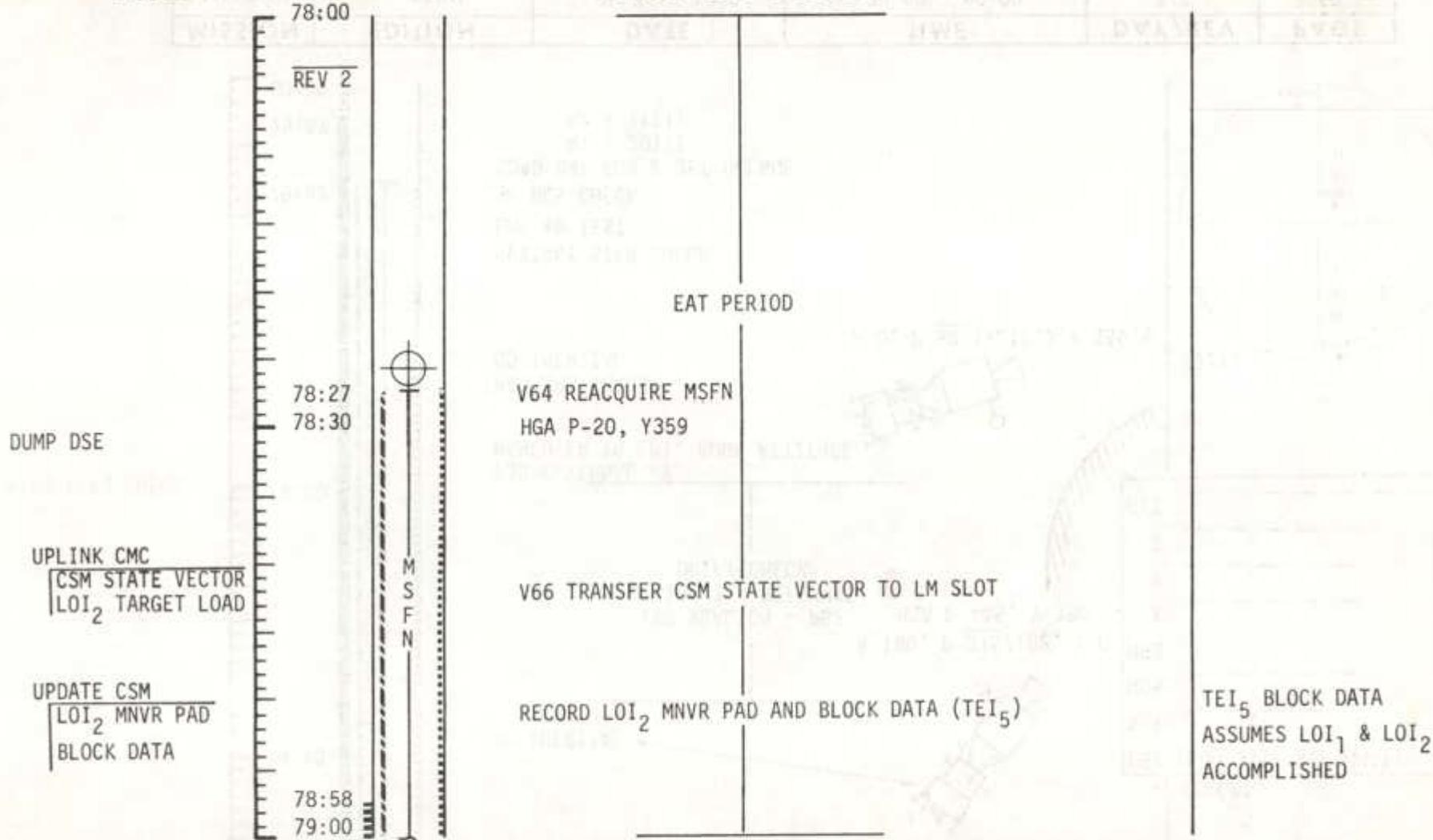
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	76:00 - 78:00	4/1	3-48

MCC-H

1530 EDT
78:00

FLIGHT PLAN

NOTES



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

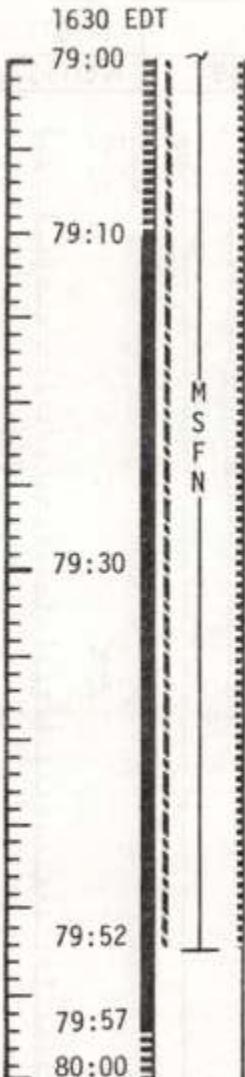
MCC-H

1630 EDT

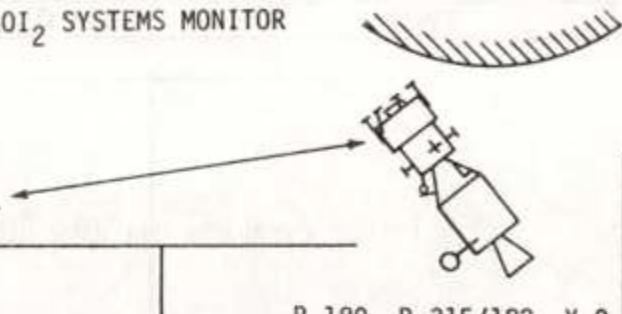
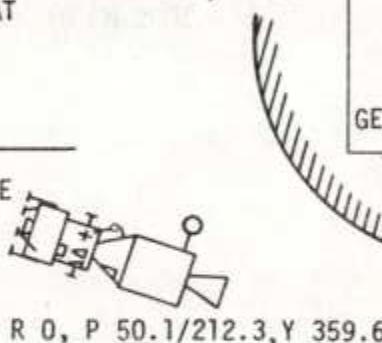
FLIGHT PLAN

NOTES

PIPA BIAS CHECK

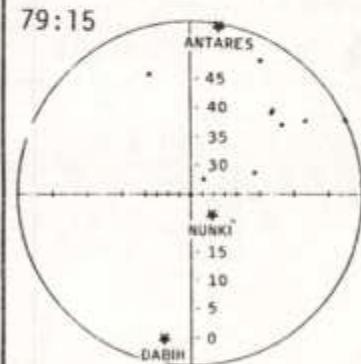
CMP - PRE LOI₂ SYSTEMS MONITOR

GO INERTIAL

P30 EXTERNAL ΔV
MANEUVER TO LOI₂ BURN ATTITUDEP40 SPS THRUST
GO INERTIAL

SEXTANT STAR CHECK
 EMS ΔV 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 _____ : _____



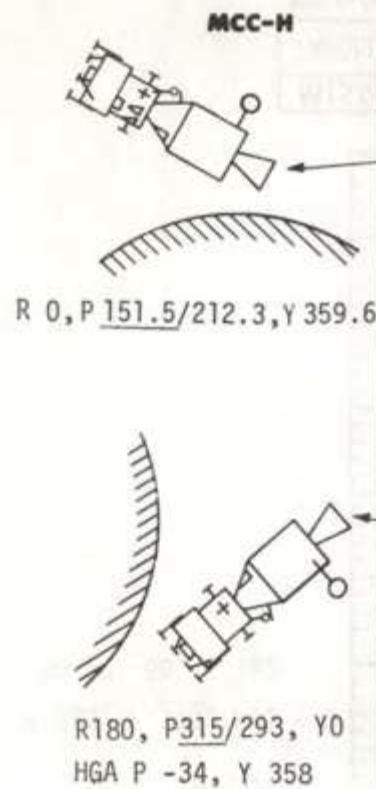
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	79:00 - 80:00	4/2	3-50

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LOI₂
BURN CHART

	P OR Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
LOI ₂	10°/SEC TAKEOVER	+10° TAKEOVER	BT + 1 SEC	TRIM X AXIS TO 1 FPS

3-50a



R180, P315/293, Y0
HGA P -34, Y 358

DUMP DSE

1730 EDT

80:00

80:04

REV 3

80:30

80:37

81:00

M S F N

FLIGHT PLAN

NOTES

GDC ALIGN TO IMU

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

TRIM X AXIS TO 1 FPS

SM RCS CHECK

SPS MONITOR CHECK

V66 - TRANSFER CSM STATE VECTOR TO LM SLOT
BATTERY CHARGE, BATTERY A

ROLL 180°, PITCH DOWN 81°, ORB RATE

OBSERVE LUNAR SURFACE

V64 ACQUIRE MSFN

LOI₂ BURN STATUS REPORT

PRESSURIZE THE LM
CM/LM PRESSURE EQUALIZATION
VALVE - OPEN

BURN STATUS REPORT

X	X	<input type="checkbox"/>	•	ΔTIG
X	X	<input type="checkbox"/>	•	BT
<input type="checkbox"/>			•	V_{gx}
TRIM				R
X	X	X		P
X	X	X		Y
<input type="checkbox"/>			•	V_{gy}
<input type="checkbox"/>			•	V_{gz}
<input type="checkbox"/>			•	ΔV_c
X	X	X		FUEL
X	X	X		OX
X	X	X		UNBAL

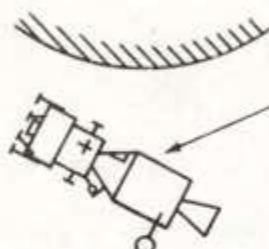
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	80:00 - 81:00	4/3	3-51

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 REFSMMATTUNNEL VENT VALVE - LM/CM ΔP VERIFY LM/CM $\Delta P < 0.2$

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 _____:_____

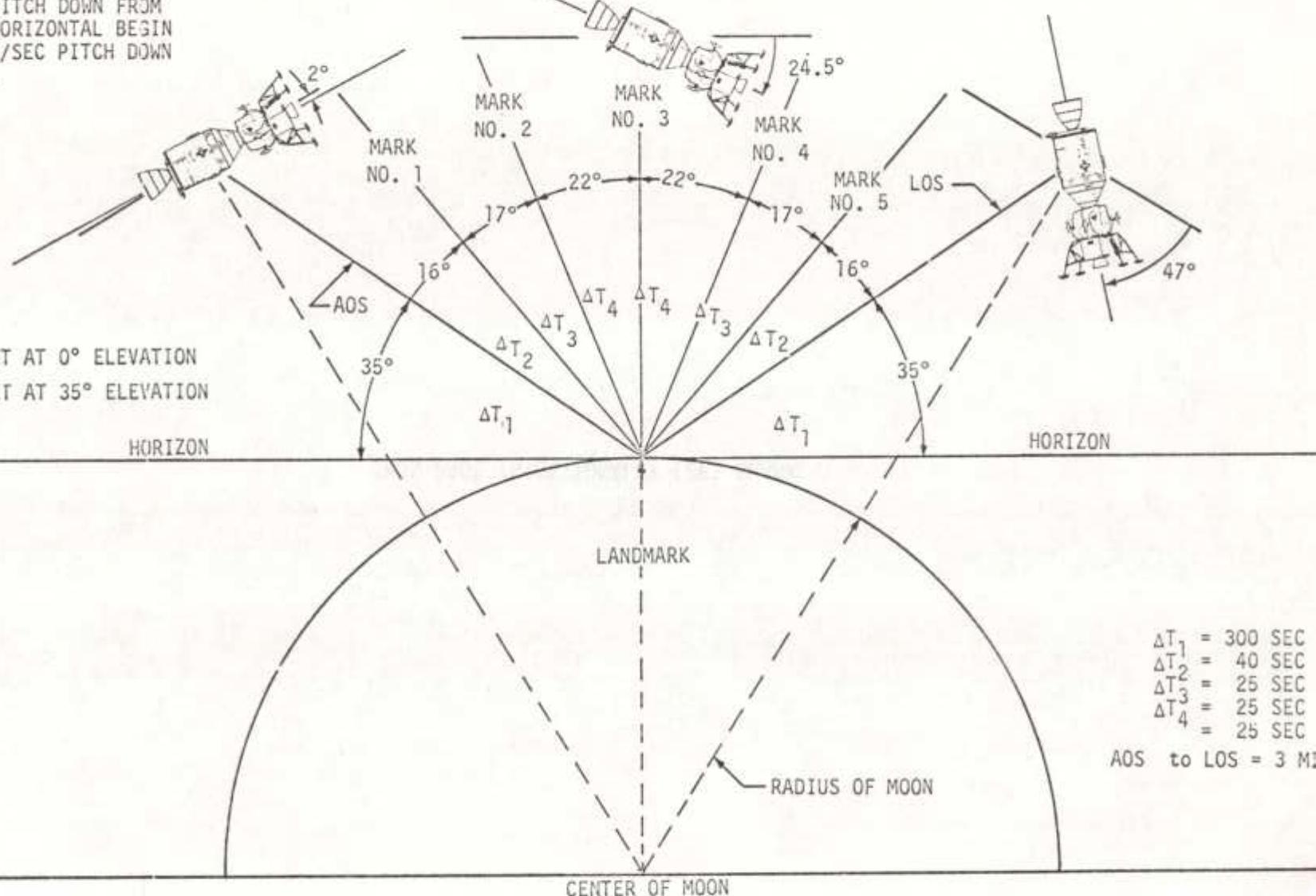
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	81:00 - 82:00	4/3	3-52

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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.

- T1 GET AT 0° ELEVATION
T2 GET AT 35° ELEVATION



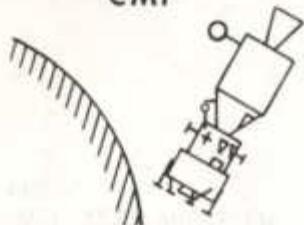
$$\begin{aligned}
 \Delta T_1 &= 300 \text{ SEC} \\
 \Delta T_2 &= 40 \text{ SEC} \\
 \Delta T_3 &= 25 \text{ SEC} \\
 \Delta T_4 &= 25 \text{ SEC} \\
 \Delta T_5 &= 25 \text{ SEC}
 \end{aligned}$$

AOS to LOS = 3 MIN

FLIGHT PLAN

MCC-H

CMP



R O, P 257/297 Y O
P 296/303
MANEUVER TO LANDMARK
TRACK ATTITUDE
GO INERTIAL
SELECT OMNI B

P22 ORBITAL NAVIGATION
UNSTOW OPTICS

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

STOW OPTICS

CSM

1930 EDT

82:00
82:02

REV 4

82:30

82:35

M
S
F
N

83:00

CDR

AID LMP AS REQUIRED

LM

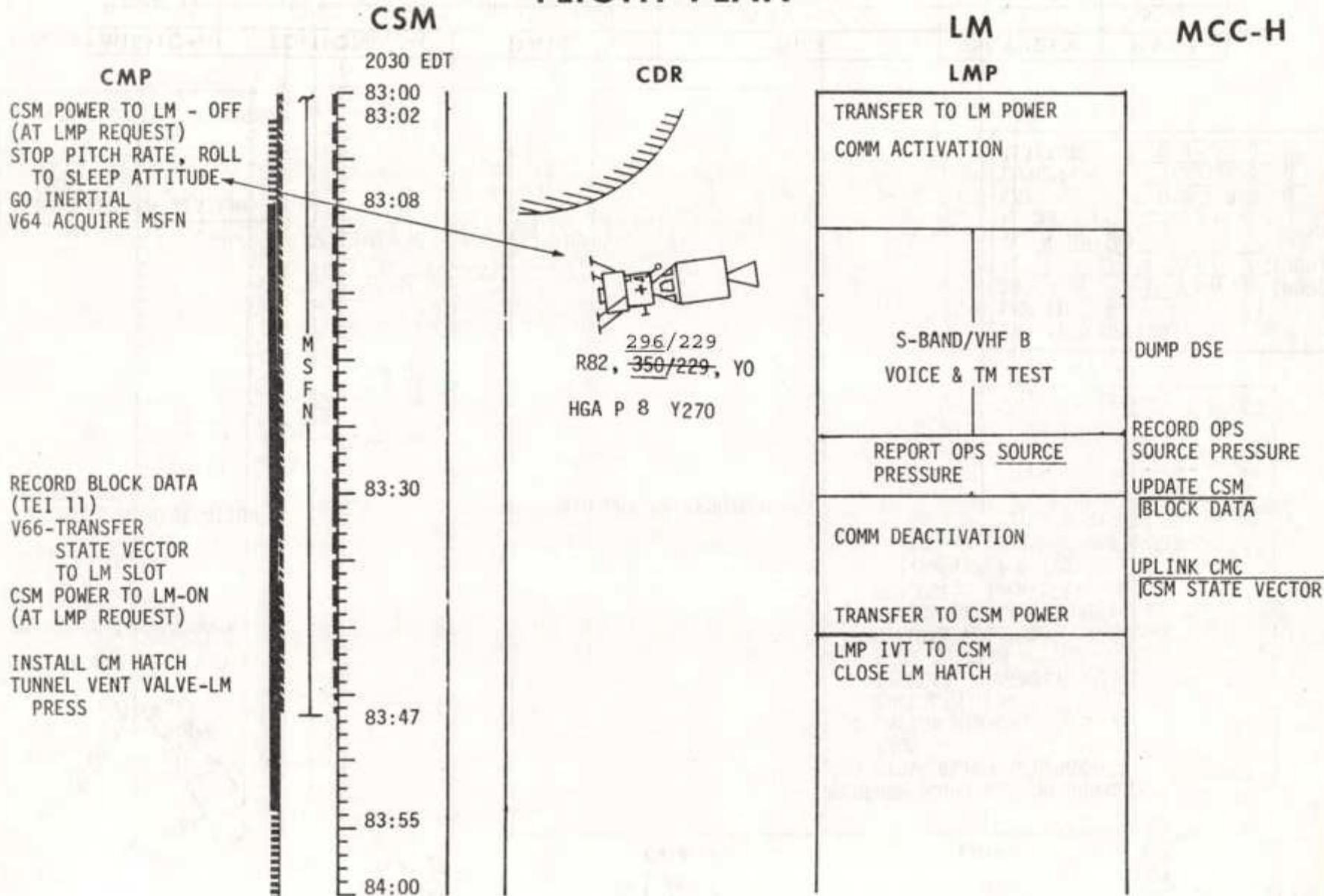
LMP

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

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
LONG/2	3 2 . 7 5 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 PLAN



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

MCC-H

2130 EDT

84:00

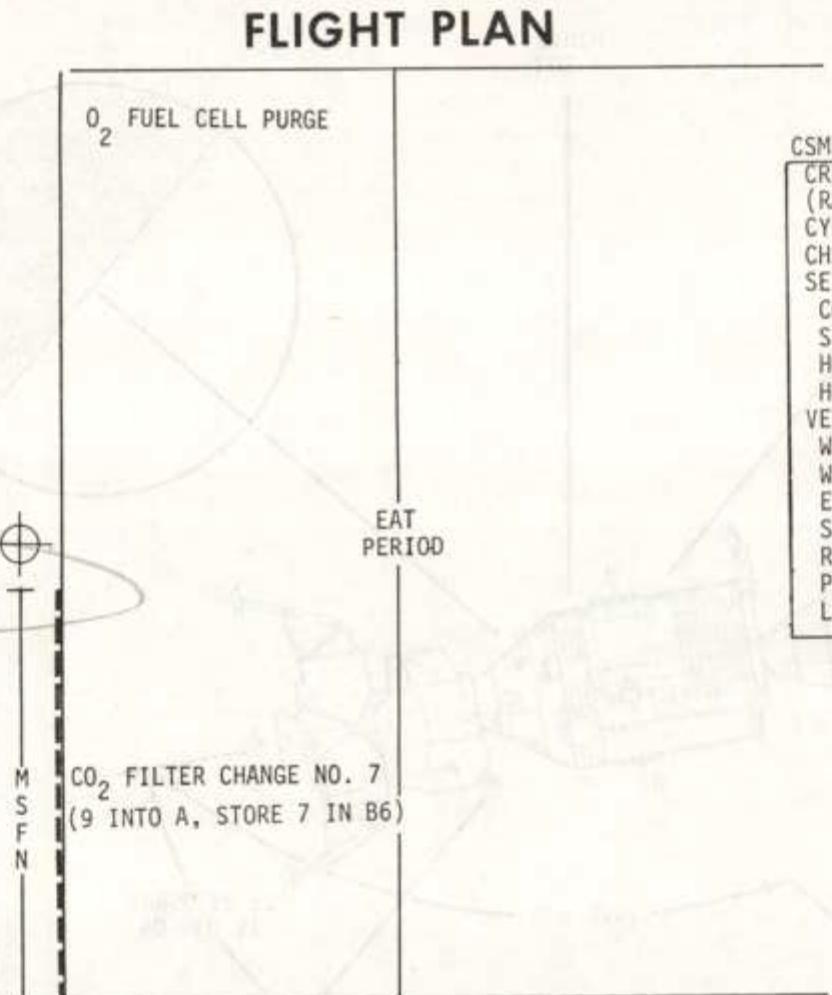
84:01

REV 5

84:30

84:33

85:00

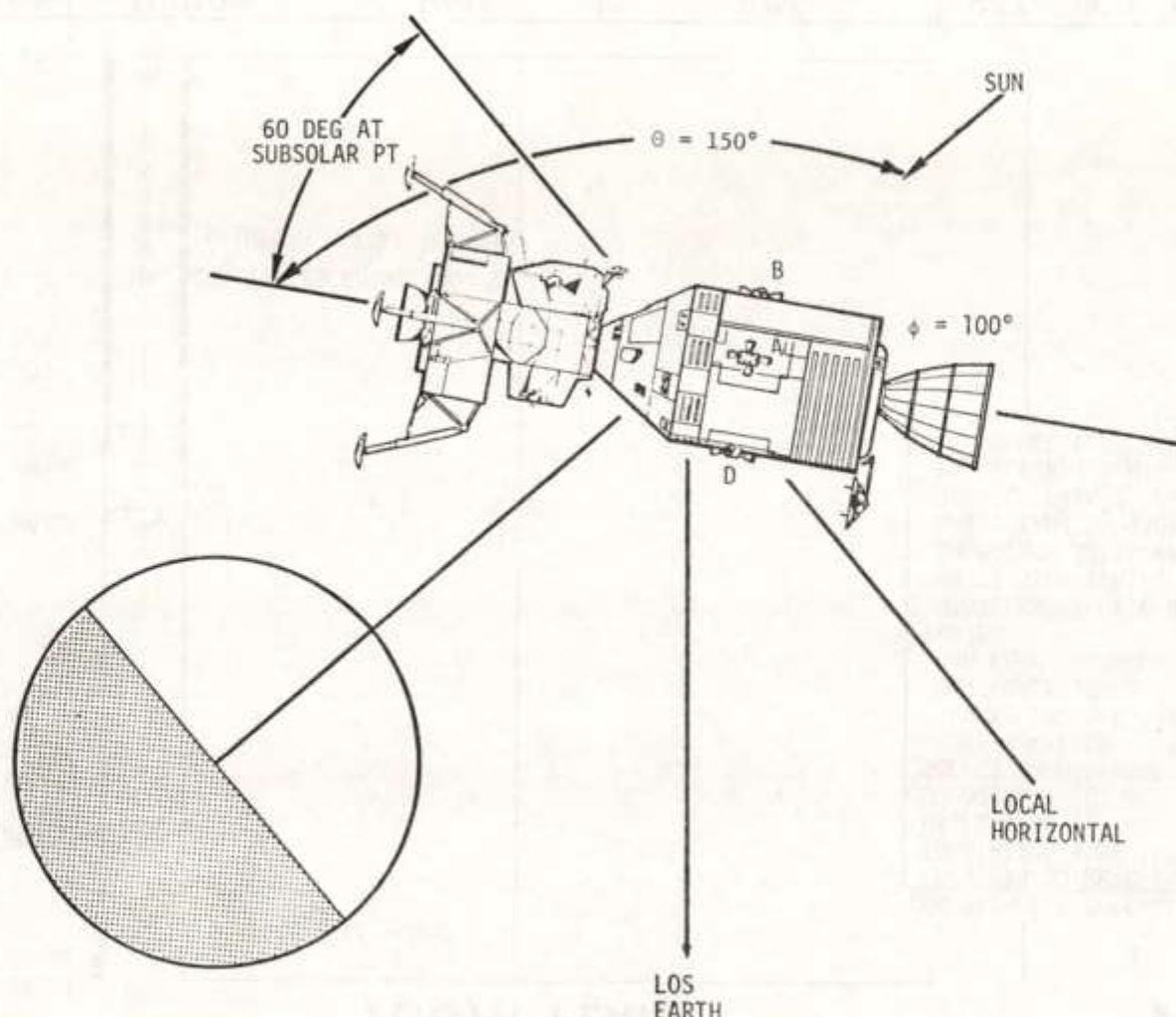


NOTES

CSM PRESLEEP CHECKLIST
CREW STATUS REPORT
(RADIATION & MEDICATION)
CYCLE O_2 & H_2 FANS
CHLORINATE POTABLE WATER
SELECT NORMAL LUNAR COMM
CONFIGURATION - EXCEPT:
S-BAND SQUELCH-ENABLE
HGA TRACK-REACQ
HGA BEAM - NARROW
VERIFY:
WASTE MNGMT OVBD DRAIN-OFF
WASTE STOW VENT-CLOSED
EMERGENCY CABIN PRESS-BOTH
SURGE TANK O_2 VALVE-ON
REPRESS PACK O_2 VALVE - OFF
POTABLE WATER HTR-OFF
LM TUNNEL VENT VALVE-LM PRESS

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



3-55a

Revision A

FLIGHT PLAN

MCC-H
DUMP DSE

NOTES

2230 EDT

85:00

85:07

M
S
F
N

85:30

REST PERIOD
(9 HOURS)

85:45

85:53

85:59

86:00

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

MCC-H

FLIGHT PLAN

NOTES

DUMP DSE

2330 EDT
86:00

REV 6

86:30

86:32

86:59

87:00

87:05

87:30

87:43

87:52

87:58

88:00

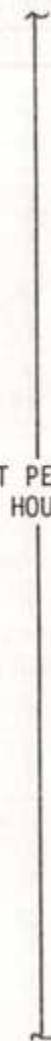


M

S

F

N

REST PERIOD
(9 HOURS)

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)

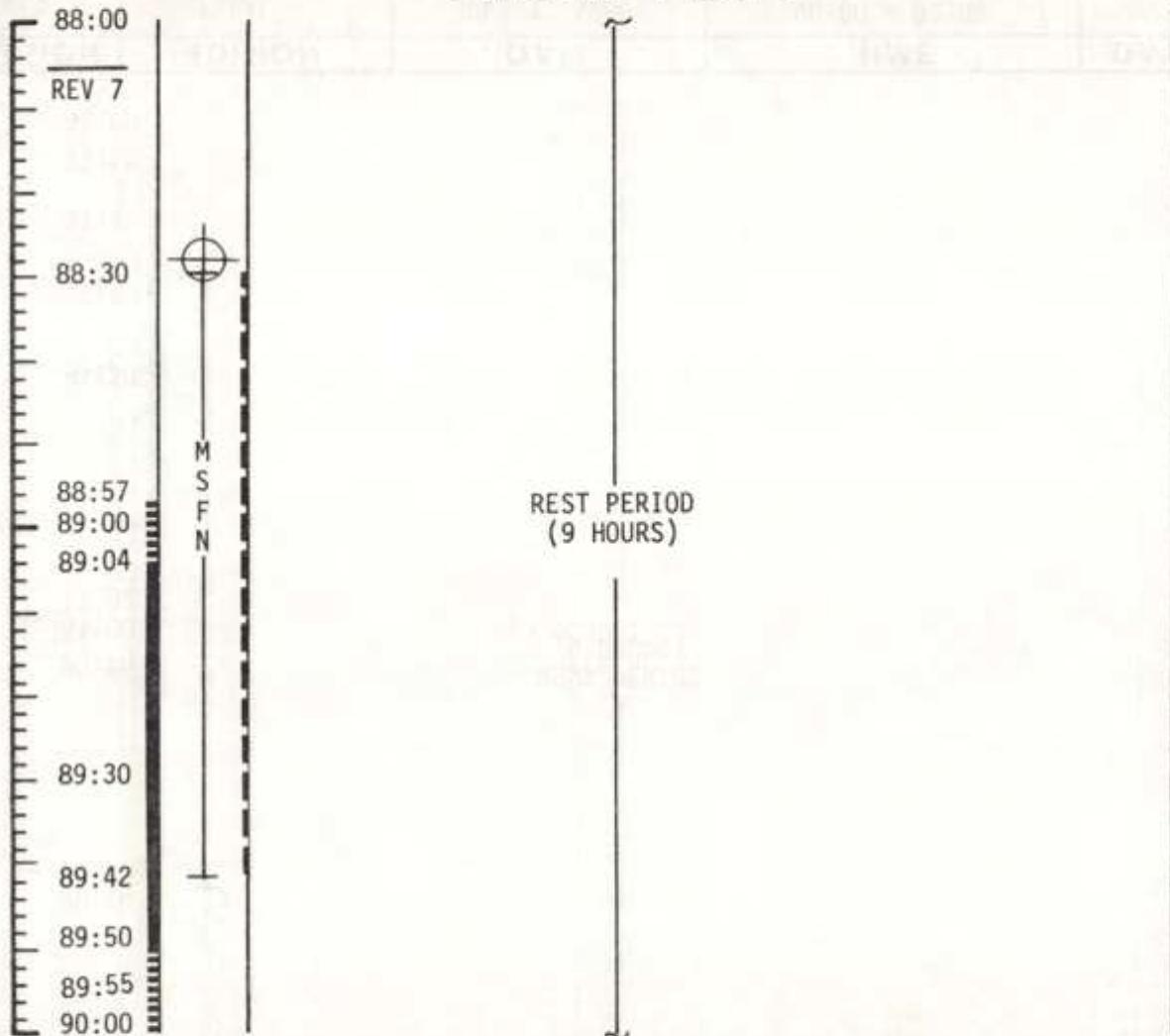
FLIGHT PLANNING BRANCH

MCC-H

FLIGHT PLAN

NOTES

DUMP DSE



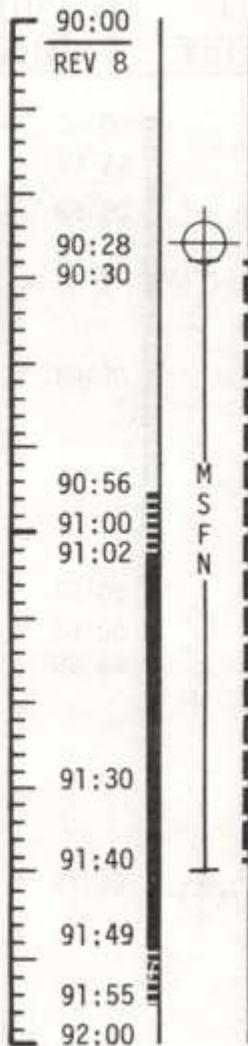
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	88:00 - 90:00	4/7	3-58

MCC-H

FLIGHT PLAN

NOTES

DUMP DSE

REST PERIOD
(9 HOURS)

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

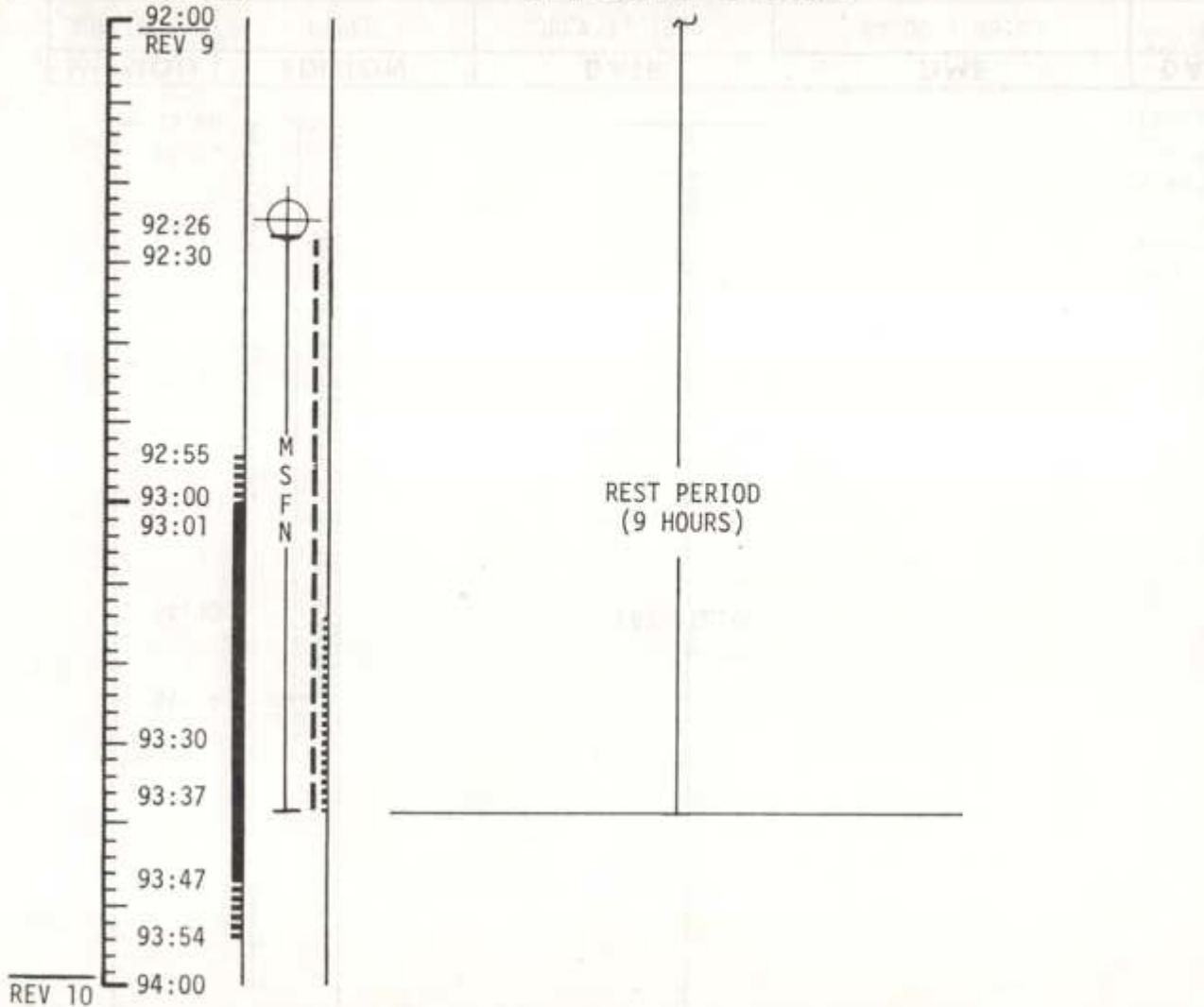
0530 EDT

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

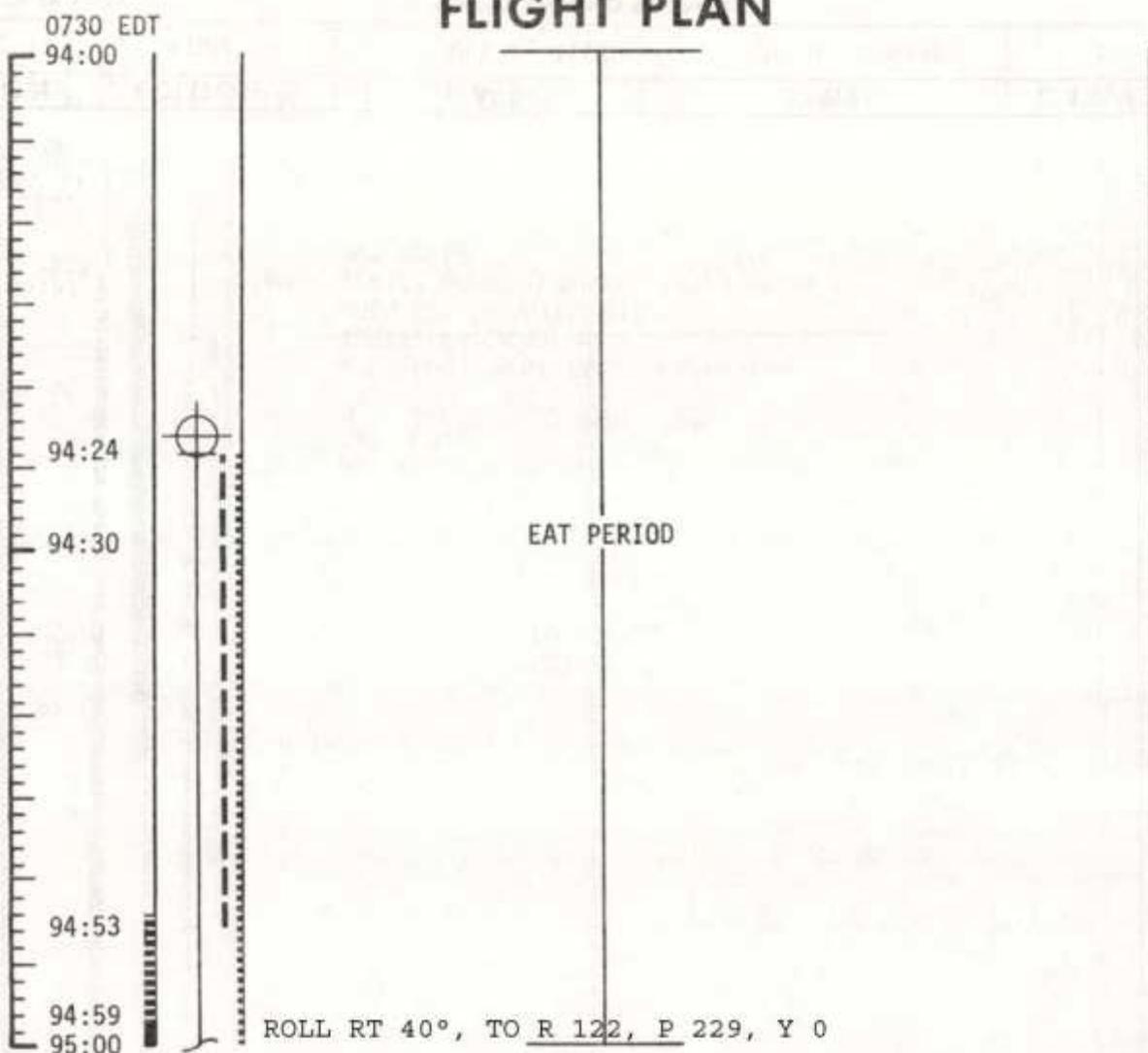
MCC-H

0730 EDT

FLIGHT PLAN

NOTES

DUMP DSE



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 89)

FLIGHT PLANNING BRANCH

MCC-H0830 EDT
95:00

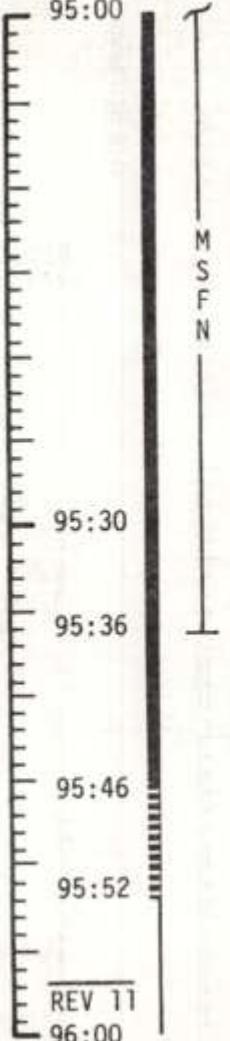
FLIGHT PLAN

NOTESUPDATE
BLOCK DATAUPDATE
BASELINE
ALTITUDE FOR
DESCENT ALTITUDE
SIGHTINGSCDR & LMP DON LCG'S
CMP-RECORD BLOCK DATA - TEI₃₀

LMP-COPY BASELINE ALTITUDE

POST SLEEP CHECKLIST
 CREW STATUS REPORT (SLEEP)
 CYCLE H₂, O₂ FANS
 GDC ALIGN TO IMU
 CONSUMABLES UPDATE
 SELECT COMM NORMAL
 LUNAR CONFIGURATION

CONSUMABLES UPDATE
 (Δ FROM NOMINAL)
 GET:
 RCS TOT _____
 A _____
 B _____
 C _____
 D _____
 H₂ TOT _____
 O₂ TOT _____

CO₂ FILTER CHANGE NO. 8
(10 INTO B, STORE 8 IN B6)

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

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

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

LM

CDR

LMP

DON PGA
W/O HELMET AND
GLOVES

LM FAMILIARIZATION

MCC-H

DUMP DSE

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

CSM POWER TO LM-OFF
(AT LMP REQUEST)

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

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

FLIGH. PLAN

CSM

REPORT: **CMP**

P52 (LDG SITE REFSMMAT)

N71: _____

N05: _____

N93:

X _____

Y _____

Z _____

GET _____ : _____ :

VHF CHECKOUT

CSM TIME MARK TO LM

STOW OPTICS

VO6N20E

(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 $\Delta P > 3.5$ psia

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

LM

CDR

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

LMP

SEC S-BAND T/R AND
POWER AMPLIFIER CHECK

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

IVT TO CSM

DON PGA

IVT TO LM
TRANSFER HELMET & GLOVES

CONNECT TO LM ECS
AND COMM

ASCENT BATTERY
ACTIVATION AND CHECKOUT
RECORD ED BAT VOLTS

MCC-H

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

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

COPY GIMBAL
ANGLES AND TIME

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

CSM/LM TYPICAL LANDMARK TRACKING PROFILE

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

T1 GET AT 0° ELEVATION
T2 GET AT 35° ELEVATION

HORIZON

HORIZON

LANDMARK

CENTER OF MOON

RADIUS OF MOON

MARK NO. 1
MARK NO. 2
MARK NO. 3
MARK NO. 4
MARK NO. 5

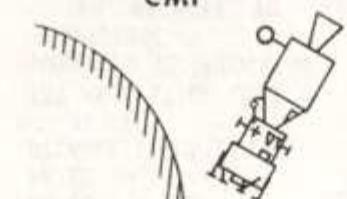
22° 22° 22° 22°
17° 17° 17° 17°
16° 16° 16° 16°
 ΔT_1 ΔT_2 ΔT_3 ΔT_4
 ΔT_1 ΔT_2 ΔT_3 ΔT_4

$\Delta T_1 = 300$ SEC
 $\Delta T_2 = 40$ SEC
 $\Delta T_3 = 25$ SEC
 $\Delta T_4 = 25$ SEC
AOS to LOS = 3 MII

FLIGHT PLAN

CSM

CMP



MANEUVER TO TRACKING
ATTITUDE
R O , P297/270,Y0
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

CONTINUE PITCH TO
AGS CAL PITCH ATT (22.5)

V64 ACQUIRE MSFN

1130 EDT
98:00

98:21

98:30

98:50

98:56

99:00

M
S
F
N

LM

LMP

MCC-H

CDR

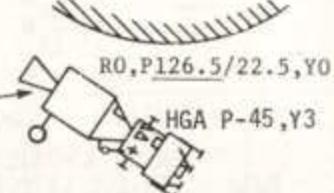
DON HELMET & GLOVES

ARS/PGA PRESSURE
INTEGRITY CHECK

CABIN REGULATOR CHECK

DOFF HELMET & GLOVES
COPY DAP DATA
COPY GYRO TORQUE ANGLES
AND FINE ALIGN IMU
X __, Y __, Z __

RATE GYRO
CHECK



DON HELMET & GLOVES

ARS/PGA PRESSURE
INTEGRITY CHECK

CABIN REGULATOR CHECK

DOFF HELMET & GLOVES
SELECT OMNI FWD
BIO MED SWITCH - RIGHT

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 0 1 . 4 6 NM

AGS ACT &
SELF TEST

V64 ACQUIRE MSFN
ANT P 187, Y 70

DUMP DSE

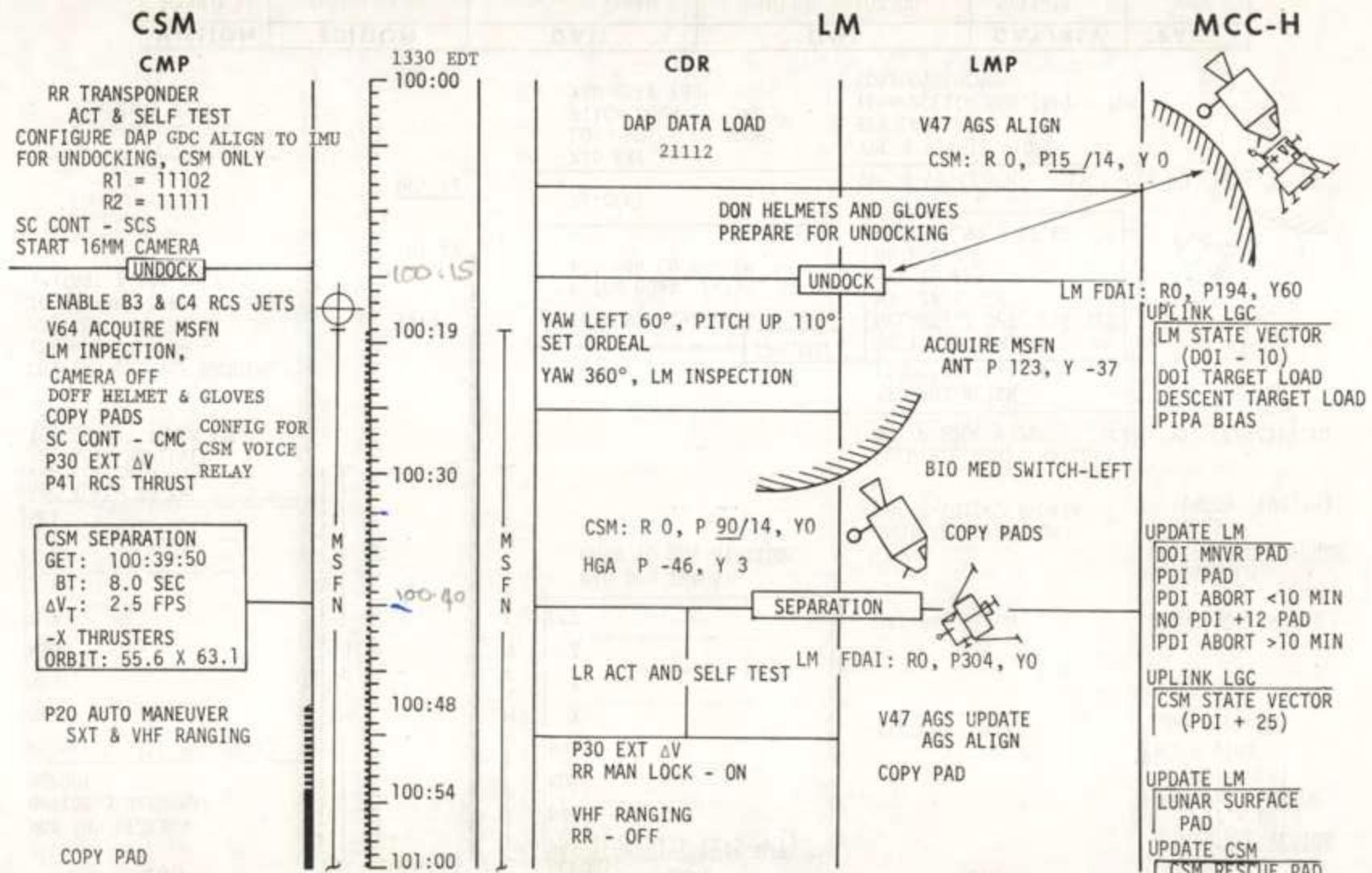
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	Revision A	July 8, 1969	98:00 - 99:00	5/12	3-65

FLIGHT PLAN

CSM		LM	MCC-H
CMP			
STOW FLIGHT PLAN UNSTOW SOLO BOOK COPY PADS	1230 EDT 99:00	CDR DRIFT CHECK-REPORT GIMBAL ANGLES & TIME TO MSFN DEPLOY LANDING GEAR ORDEAL INITIALIZATION	LMP
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	M S F N 99:30 99:32	LOAD DAP DATA - 32012 CSM WT _____ P TRIM _____ Y TRIM _____ DPS GIMBAL DRIVE AND THROTTLE TEST	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
VERIFY TUNNEL VENT VALVE - OFF RECORD LM PCM DATA SC CONT - CMC AUTO MANEUVER TO AGS CALIBRATION ATTITUDE	99:43 99:49 REV 13 100:00	RCS PRESSURIZATION RCS CHECKOUT RR ACT & SELF TEST DPS PRESS & CHECKOUT	LM & CSM STATE VECTORS UPDATE CSM P30 MNVR PAD (SEPARATION) GO/NO-GO UPDATE LM STEERABLE ANTENNA ANGLES(GET:100:25)
SC CONT - SCS RATES <0.1°/SEC DISABLE THRUSTERS FOR 32 SEC (AT REQUEST OF LMP) MANEUVER TO UNDOCKING ATTITUDE R0, P320/14, Y0		 AFT OMNI - LBR SLEW STEERABLE ANTENNA ANT P 123, Y -37 AGS ACCEL & GYRO CALIBRATION	

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	Revision A	July 6, 1969	99:00 - 100:00	5/12-13	3-66

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	Revision A	July 8, 1969	100:00 - 101:00	5/13	3-67

FLIGHT PLAN

CSM

CMP

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

SEXTANT AND VHF
TRACKING OF LM

1430 EDT
101:00

CDR

P52 (LDG SITE REFSMMAT)

N71: ____,-

N05: ____,-

N93:

X ____,-

Y ____,-

Z ____,-

GET ____ : ____ :

P40 DPS THRUST
MNVR TO DOI ATTITUDE

DPS,DOI

TRIM V_X RESIDUALS

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

RR-OFF

P30 EXT ΔV
LOAD PDI + 12 ABORT
PITCH DOWN TO 106.5°
YAW LEFT 180°

LM

LMP

SYSTEMS CHECKS

V47 AGS ALIGN

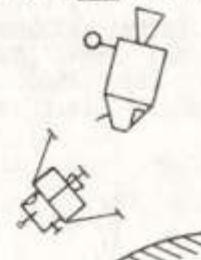
OMNI AFT, PCM LBR
VHF A-VOICE, B-DATA

SLEW STEERABLE ANTENNA
ANT P 220, Y 28

CSM: R0, P215/319,Y0

N20 AGS ALIGN
LOADS AGS EXT ΔV

GETI: 101:38:19.6
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

MCC-H

UPLINK CMC

CSM STATE VECTOR
(PDI + 25)
LM STATE VECTOR
(DOI - 10)
PIPA BIAS

DUMP DSE

GO/NO GO FOR DOI

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

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	Revision A	July 8, 1969	101:00 - 102:00	5/13-14	3-68

FLIGHT PLAN

CSM		LM	MCC-H
CMP T SEXTANT AND VHF TRACKING OF LM			
	1530 EDT 102:00		
TERMINATE P20 TRACK			
P20 AUTO MANEUVER TO SEXTANT TRACK LM			
POO, PITCH DOWN 0.2°/SEC			
CONFIRM STAY/NO STAY V44 SET LS FLAG CONFIRM STAY/NO STAY STOP PITCH AT R 0, P 206/80, Y 0 RR TRANSPONDER - OFF V64 ACQ MSFN			
VHF RANGING OFF	ON	EDITION	DATE
	APOLLO 11	Revision A	July 8, 1969
			TIME
			102:00 - 103:00
			DAY/REV
			5/14
			PAGE
			3-69

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	1630 EDT 103:00	DOFF 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
COPY LM TRACKING PAD (SEE GET - 104:35)	103:29 103:30	RR TO STANDBY REPORT ESTIMATE OF LANDED LOCATION CLOSE SHADES	P57-IMU ALIGN (REFSMMAT) GRAVITY MEASUREMENT N04: _____
P22 AUTO MNVR TO TRACKING ATTITUDE ORB RATE(IF TIME PERMITS IF NOT, AT 104:10) RO P338/76, YO	103:39	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	AGS LUNAR ALIGNMENT P57-IMU ALIGN (REFSMMAT) 2 CELESTIAL BODIES N04: _____ N05: _____ N71: _____ N93: _____ X _____ Y _____ Z _____ N89: LAT _____ LONG/2 _____ ALT _____ GET _____ : _____ : _____
	103:45 REV 15	PHOTOGRAPH LUNAR SURFACE	INITIALIZE AGS COPY AND LOAD ASCENT PAD DATA INSTALL WINDOW SHADES COARSE ALIGN RR CDU
	104:00		UPDATE CSM LM TRACKING PAD
			COPY P57 DATA
			COPY AGS AZIMUTH UPLINK LGC
			RLS CSM STATE VECTOR (TD + 1:40) UPDATE LM ASCENT PAD

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	Revision A	July 8, 1969	103:00 - 104:00	5/14-15	3-70

FLIGHT PLAN

CSM

CMP

S/C CONT - SCS

P22 AUTO MANEUVER TO
TRACKING ATTITUDE,
ORB RATE

RD, 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

1730 EDT
104:00

104:15

104:30

104:45

104:51

105:00

M
S
F
N

CDR

DON HELMET & GLOVES

STAY/NO STAY FOR LUNAR SURFACE OPERATIONS

DAP LOAD 12012

LM WT _____

CSM WT _____

P12 - ASCENT PROGRAM

END SIMULATED COUNTDOWN AT
CLOSE FUEL VENT

CONFIGURE SYSTEMS FOR PWR DWN

DOFF HELMET & GLOVES

EAT PERIOD
(40 MIN)

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

T₄ THRU T₇
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	Revision A	July 8, 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

VHF AM A - SIMPLEX

EAT PERIOD
(1 HOUR)

1830 EDT
105:00

M
S
F
N

105:26
M
S
F
N

105:30
M
S
F
N

105:38
M
S
F
N

105:44
REV 16
M
S
F
N

106:00

LM

CDR

EAT PERIOD
(40 MIN)
CONFIGURE LM
COMM FOR LUNAR
STAY SLEEP
VHF A XMIT - OFF
VHF A RCV - OFF
VHF B XMIT - OFF
VHF B RCV - OFF

CREW STATUS REPORT (RADIATION, MEDICATION)
CONFIGURE SLEEP STATION
STOW PLSS IN DONNING STATION

REST PERIOD
(4 HOURS)

LMP

EAT PERIOD
(40 MIN)

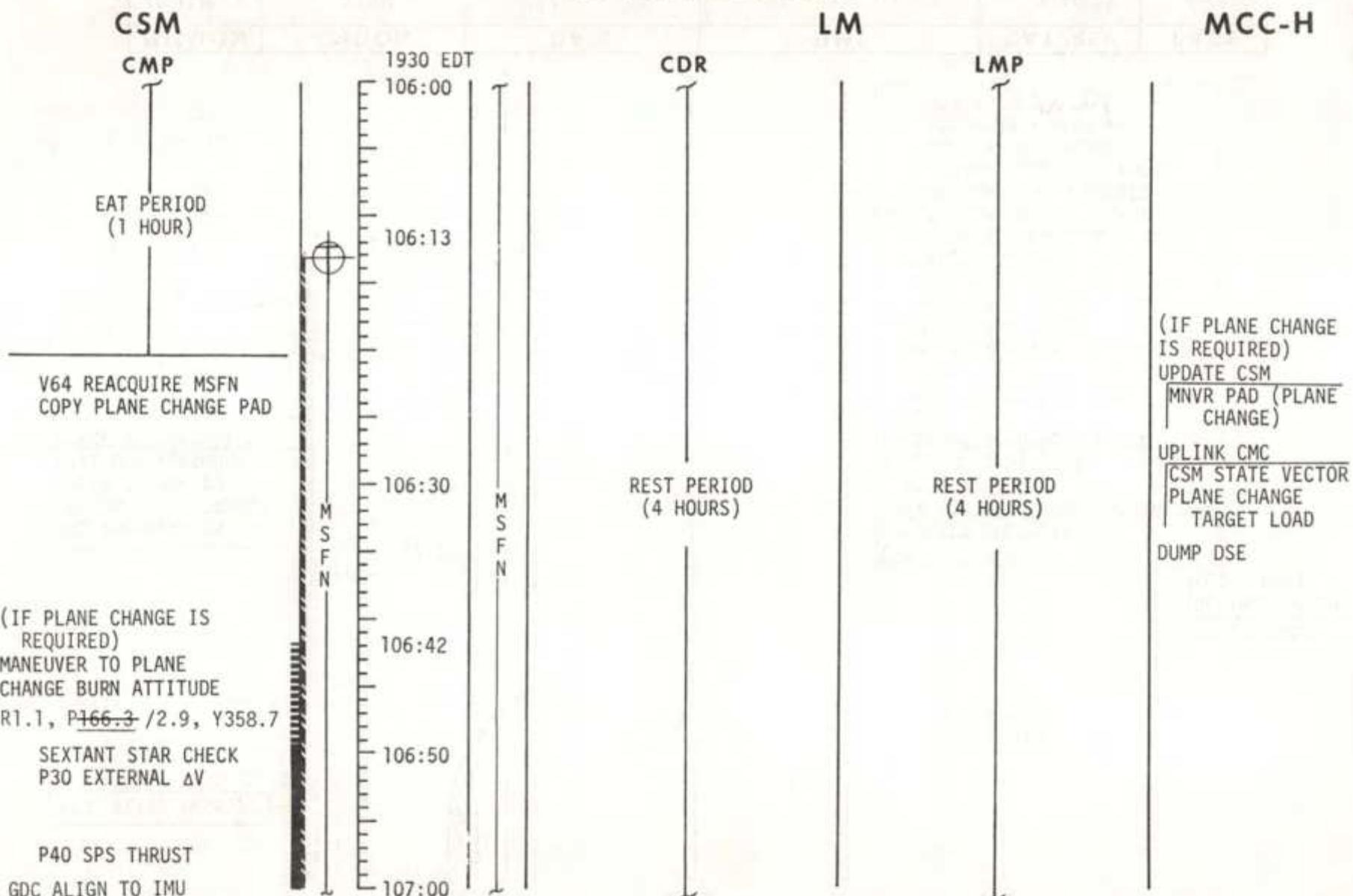
REST PERIOD
(4 HOURS)

MCC-H

DUMP DSE

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	Revision A	July 8, 1969	105:00 - 106:00	5/15-16	3-72

FLIGHT PLAN



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
 ΔV =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



2030 EDT
107:00

M
S
F
N

107:25

107:30

107:36

107:43

REV 17

108:00

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 O₂ & H₂ FANS
CHLORINATE POTABLE WATER
VERIFY:
WASTE MNGMT OVBD DRAIN VLV -
OFF
WASTE STOW VENT VLV - CLOSED
EMER CABIN PRESS VLV - BOTH
SURGE TANK O₂ VLV - ON
REPRESS PACK O₂ VLV - OFF
POTABLE H₂O 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

REST PERIOD
(4 HOURS)

2130 EDT
108:00

108:11

108:30

108:42

108:48

109:00

M
S
F
N

CDR

REST PERIOD
(4 HOURS)

LM

LMP

MCC-H

DUMP DSE

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

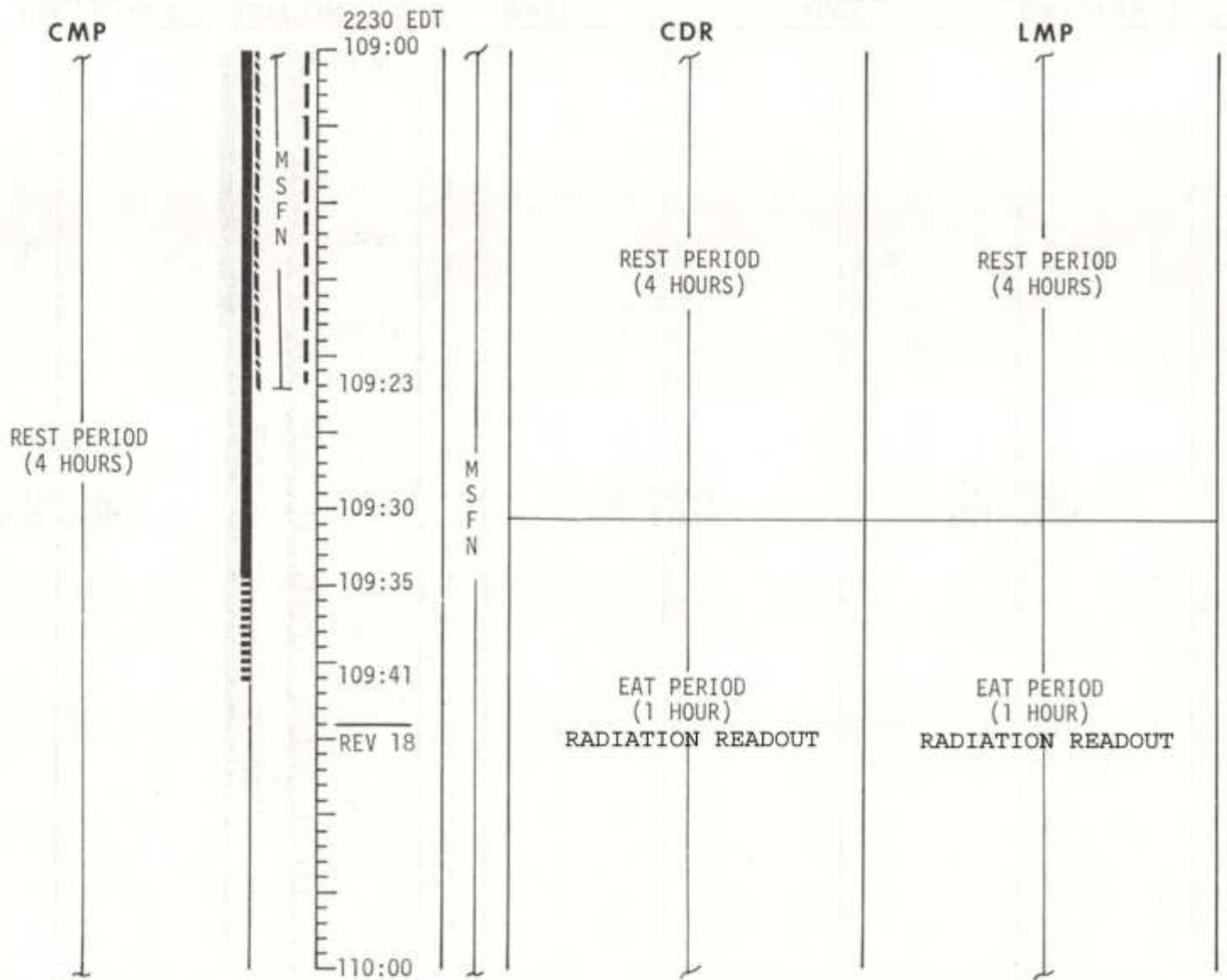
FLIGHT PLAN

CSM

CMP

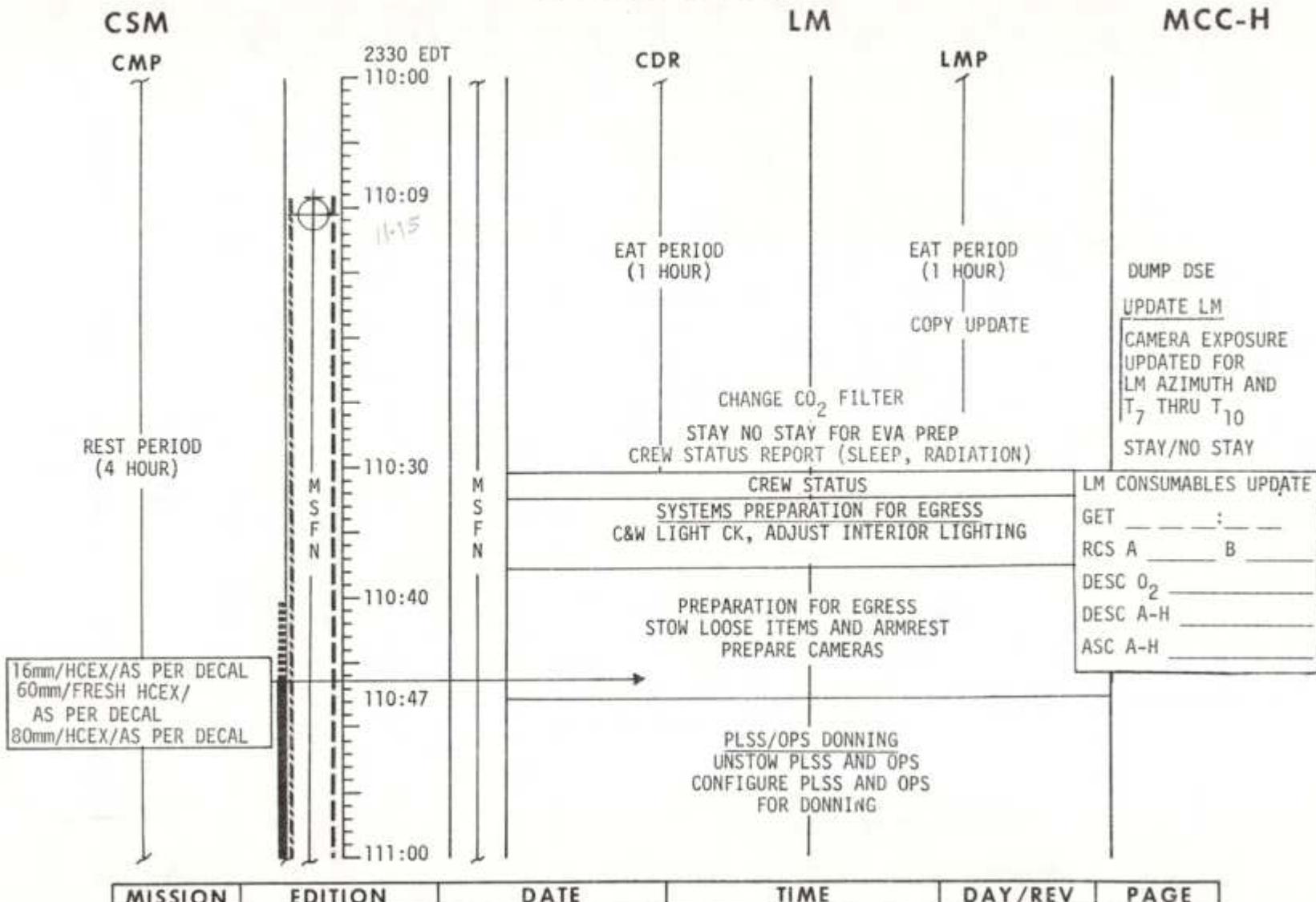
LM

MCC-H



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

FLIGHT PLAN



FLIGHT PLAN

CSM		LM	MCC-H		
CMP		CDR	LMP		
	0030 EDT 111:00				
REST PERIOD (4 HOURS)			LMP UNSTOW AND DON OVERSHOES CDR UNSTOW AND DON OVERSHOES		
	111:21		ATTACH OPS TO PLSS		
	111:30		LMP DON PLSS		
	111:33		UNSTOW AND CONNECT RCU		
CO ₂ FILTER CHANGE NO. 9 (11 INTO A, STORE 9 IN A3)	111:33		VERIFY PLSS SWITCH AND VALVE POSITIONS		
O ₂ FUEL CELL PURGE	111:39		PREPARE CDR PLSS FOR DONNING ATTACH OPS TO PLSS CDR DON PLSS		
EAT PERIOD (1 HOUR)	REV 19		UNSTOW AND CONNECT RCU		
	112:00		VERIFY PLSS SWITCH AND VALVE POSITIONS		
		<u>PLSS/EXTRA VEHICULAR COMM SYSTEM ELECTRICAL CHECKOUT</u> <u>AUDIO SWITCHES CHECK</u> <u>ACTIVATE PLSS COMM SYSTEMS</u> <u>(TV C/B - CLOSE THEN OPEN)</u> <u>FINAL EVA EQUIPMENT PREP FOR EGRESS</u> <u>UNSTOW AND CONNECT OPS O₂ HOSE AND ACTUATOR</u> <u>FINAL SYSTEMS PREP FOR EGRESS</u> <u>CONFIRM "GO" FOR CABIN DEPRESS</u> <u>VERIFY C/B, VALVES AND O₂/H₂O QUANTITY</u>			
			GO/NO GO		
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	Revision A	July 8, 1969	111:00 - 112:00	5/18-19	3-78

FLIGHT PLAN

CSM

CMP

LM

MCC-H

		0130 EDT 112:00	CDR	LMP	
EAT PERIOD (1 HOUR)		112:08	PREP FOR CABIN DEPRESS		DUMP DSE
CREW STATUS REPORT (SLEEP) SELECT COMM NORMAL LUNAR CONFIGURATION ACTIVATE PRIM EVAPORATOR	M S F N	112:30	CONNECT OPS O ₂ HOSES LMP DON HELMET CDR DON HELMET CONNECT PLSS H ₂ O HOSES DON GLOVES		START EVA 0+00
COPY PAD (SEE GET 114:20)	M S F N	112:39	PRESSURE INTEGRITY CHECK PLSS O ₂ ON SET CHRONOMETER		0+10
	M S F N	112:45	FINAL PRE-EVA OPERATIONS DEPRESS CABIN FINAL SYSTEMS CHECKS PLSS H ₂ O ON	OPEN FWD HATCH ASSIST AND MONITOR CDR TURN TV ON ACT 16mm CAMERA	UPDATE CSM LM ACQUISITION TIME 0+20
	M S F N	113:00	INITIAL EVA EGRESS TO PLATFORM RELEASE MESA DESCEND LADDER REST/CHECK EMU SYSTEM	MONITOR CDR OPERATE 16mm CAMERA	0+30
			ENVIRONMENTAL FAMILIARIZATION CHECK STABIL, MOBIL, EMU		
			CONT SAMPLE COLLECTION COLLECT AND STOW SAMPLE		

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

FLIGHT PLAN

CSM

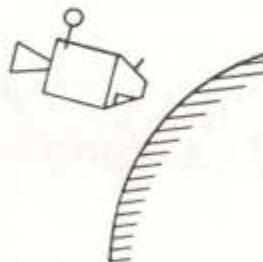
CMP

LM

MCC-H

SET UP CAMERA FOR
TRACKING
EL/250/BW-BRKT
INT (f5.6,250,INF)

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



R180, P282/44, Y0

		CDR	LMP	
	113:00	PRELIMINARY CHECKS CK LM STATUS CK LIGHTING VISIBILITY	STILL-CAMERA TO SURFACE FINAL LM CK EVA GO	0+30
M S F N		REST MONITOR AND PHOTOGRAPH LMP EGRESS	INITIAL EVA EGRESS DESCEND TO SURFACE	EVA GO
	113:19	TV DEPLOYMENT CAMERA EQPT FROM MESA CARRY TV TO SITE MOUNT TRIPOD, PANORAMA, POSITION FOR EVA PHOTOGRAPH SWC PHOTO BULK SAMPLE AREA	ENVIRONMENT FAMILIARIZATION CK BALANCE, STABILITY, REACH, WALKING, EMU	0+40
	113:30	BULK SAMPLE COLLECTION CAMERA ON MESA PREPARE SRC COLLECT ROCK FRAGMENTS AND LOOSE MATERIAL WEIGH SAMPLE PACK AND SEAL SRC, CONNECT TO LEC REST	SWC DEPLOYMENT DEPLOY SWC IN SUN	0+50
M S F N	113:32		EVA AND ENVIRON EVAL EVAL EVA CAPABILITY AND EFFECTS EVAL LIGHTING/VISIBILITY AND SURFACE CHARACTERISTICS PHOTO PANORAMA	1+00
	113:38		LM INSPECTION PHOTO QUAD I, +Z GEAR PHOTO BULK SAMPLE AREA DEPLOY ALSCC	1+10
	REV 20		PHOTO QUAD IV, +Y GEAR PHOTO PANORAMA PHOTO QUAD III, -Z GEAR CAMERA TO CDR	1+20
	114:00	LM INSPECTION INSPECT QUAD IV, +Y GEAR EVAL TERRAIN, VISIBILITY INSPECT QUAD III, -Z GEAR PHOTO QUAD II, EASEP OFF LOADING INSPECT, PHOTO -Y GEAR PHOTO PANORAMA TAKE CLOSEUP PHOTOS EASEP DEPLOYMENT	EASEP DEPLOYMENT REMOVE EXPERIMENTS	1+30

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

FLIGHT PLAN

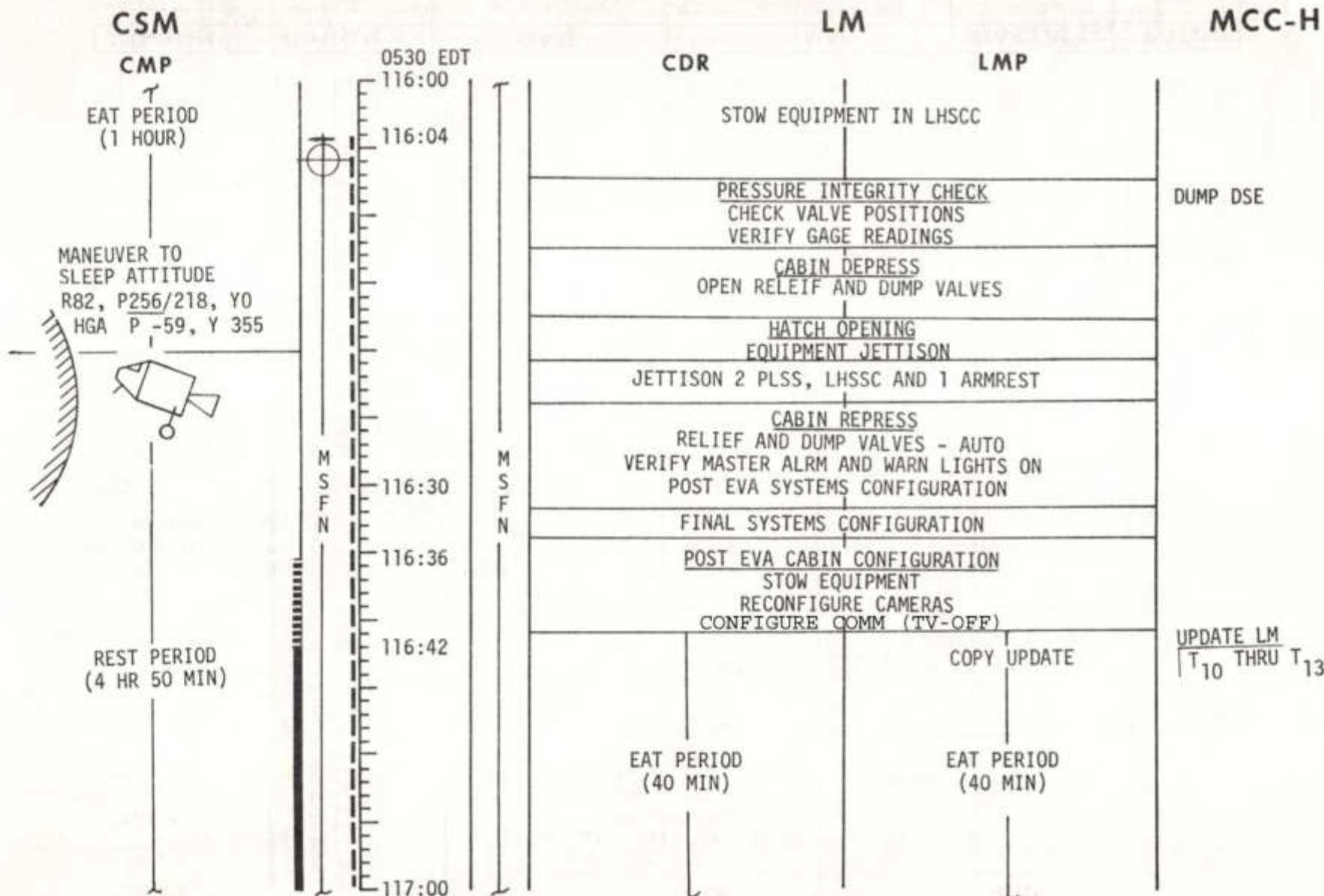
CSM CMP		LM	MCC-H
	0330 EDT 114:00		
EL/250/BW-BRKT, INT (f5.6,250,INF)	114:06	SELECT DEPLOY SITE CARRY CAMERAS DEPLOY LR ³ EXPERIMENT PHOTO EXPERIMENTS	1+30
CHANGE		DOCUMENTED SAMPLE COLLECTION REST/PHOTO LMP CLOSE-UP PHOTOS TETHER SAMPLE BAG TO LMP PHOTO SAMPLING UNSTOW GNOMON PHOTO DS AREA PHOTO SAMPLE COLLECTION STOW ALSCC FILM COLLECT ENVIRONMENTAL SAMPLES RETRIEVE AND STOW SWC PACK SRC CLOSE AND SEAL SRC	1+40
SHUTTER TO 1/125 PITCH UP 38° ROLL 180° TO HEADS UP RO, P320/229,YO PITCH DOWN, PHOTOGRAPH LM WHILE TRACKING THROUGH COAS	M S F N	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	DUMP DSE 1+50 LM ACQUISITION GET: -----:-----
STOP PITCH AND ROLL 180° TO HEADS DOWN ATTITUDE FOR SURFACE OBSERVATIONS STOP CAMERA	M S F N	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	2+00 2+10 2+20
R180, P282/185, YO HGA P -7, Y 183	114:30 114:37 114:43 115:00	REST/PHOTO LMP SRC TRANSFER TRANSFER BULK SRC AND STILL CAMERA MAGAZINE REST CHECK EMU TRANSFER DS SRC	2+30

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	Revision A	July 8, 1969	114:00-115:00	5/21	3-81

FLIGHT PLAN

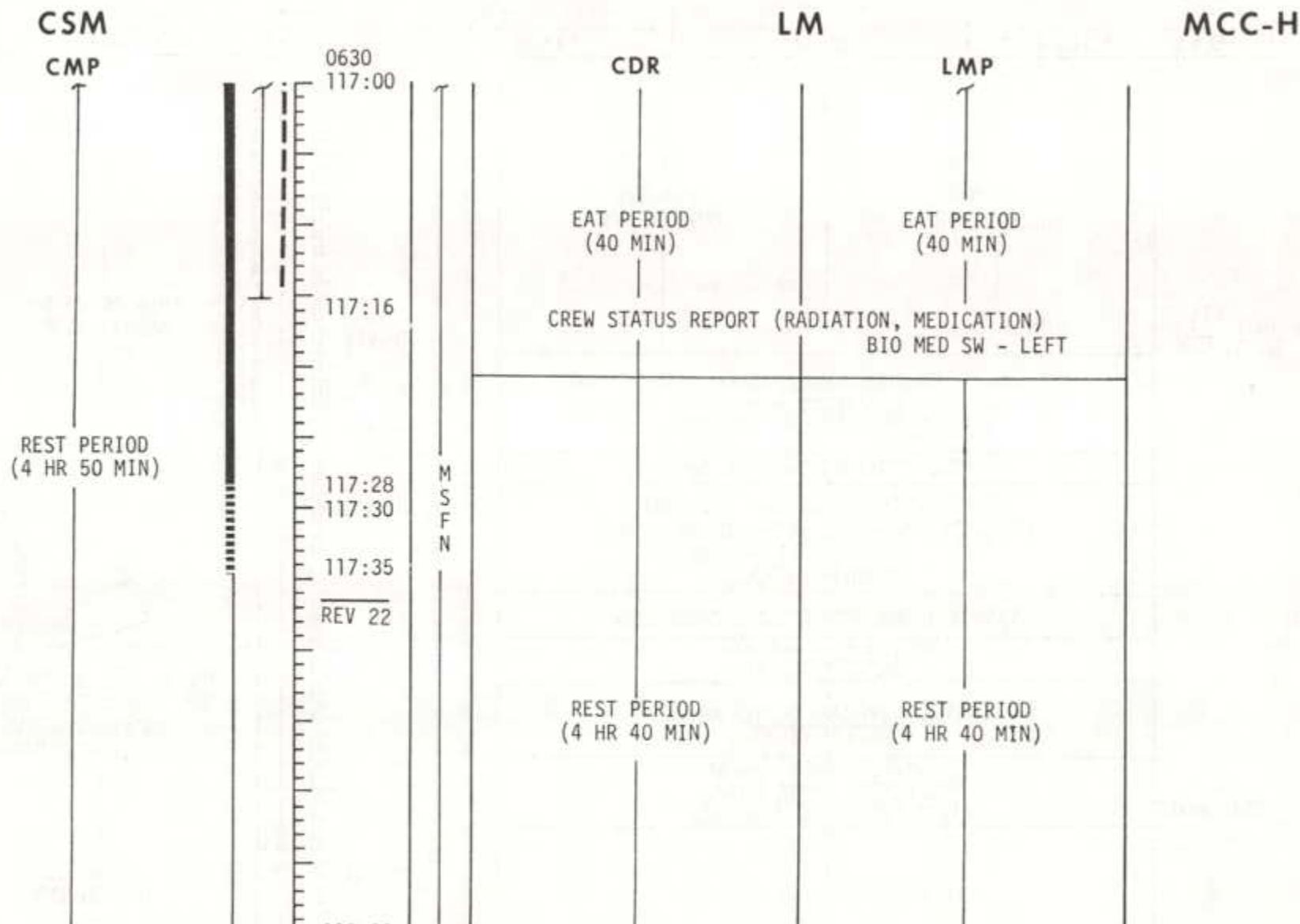
CSM		LM	MCC-H
CMP PRESLEEP CHECKLIST CREW STATUS REPORT RADIA- TION, MEDICATION) CYCLE O ₂ & H ₂ FANS CHLORINATE WATER VERIFY: WASTE MNGMT OVBD DRAIN VLV - OFF WASTE STOW VENT VLV - CLOSED EMER CABIN PRESS VLV - BOTH SURGE TANK O ₂ VLV - ON REPRESS PACK O ₂ VLV-OFF POTABLE H ₂ O HTR - OFF SELECT COMM NORMAL LUNAR CONFIGURATION - EXCEPT: S-BAND SQUELCH - ENABLE HGA TRACK - REACQ HGA BEAM - NARROW HGA P <u>-59</u> , Y <u>355</u> EAT PERIOD (1 HOUR)	0430 EDT 115:00 115:18 115:30 115:37 REV 21 116:00	CDR TERMINATE EVA WIPE FEET ON LANDING PAD AND LADDER ASCEND LADDER CABIN REPRESS <u>POST EVA SYSTEMS CONFIGURATION</u> VERIFY CAUTION LIGHTS OFF DISCONNECT RCU DISCONNECT OPS O ₂ HOSES CONNECT LM O ₂ HOSES CONFIGURE VALVES AND CIRCUIT BREAKERS DISCONNECT PLSS H ₂ O HOSES SWITCH TO LM COMM SYSTEM <u>PLSS/OPS DOFFING</u> REMOVE LMP RCU OPS CHECK STOW PLSS/OPS ON CABIN FLOOR REMOVE CDR RCU STOW PLSS/OPS ON CABIN FLOOR <u>FINAL SYSTEMS CONFIGURATION</u> PREP FOR EQUIPMENT JETTISON REPORT PLSS FEEDWATER REMOVE OPS FROM PLSS	LMP JETT EQUIP CLOSE FWD HATCH 2+30 2+40 END EVA 80mm/HCEX/EVA CARD #1 6 FRAMES EACH, FAR & NEAR FIELD (FOCUS 50' & 20') AND 80mm/BW/EVA CARD #1 6 FRAMES EACH, FAR & NEAR FIELD (FOCUS 50' & 20') COPY REPORT
MISSION APOLLO 11	EDITION Revision A	DATE July 8, 1969	TIME 115:00-116:00
DAY/REV 5/20-21		PAGE 3-82	

FLIGHT PLAN



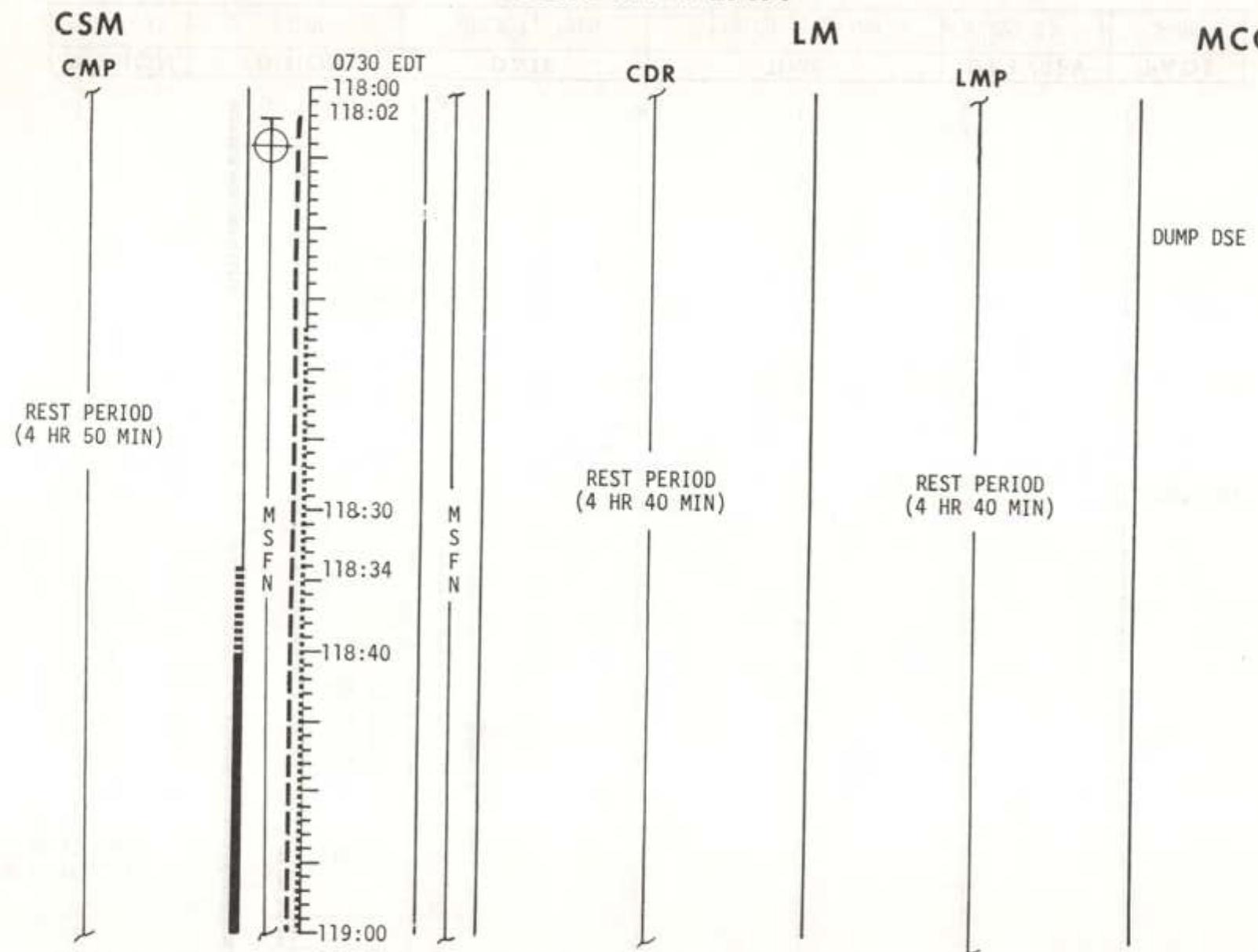
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	116:00 - 117:00	5/21	3-83

FLIGHT PLAN



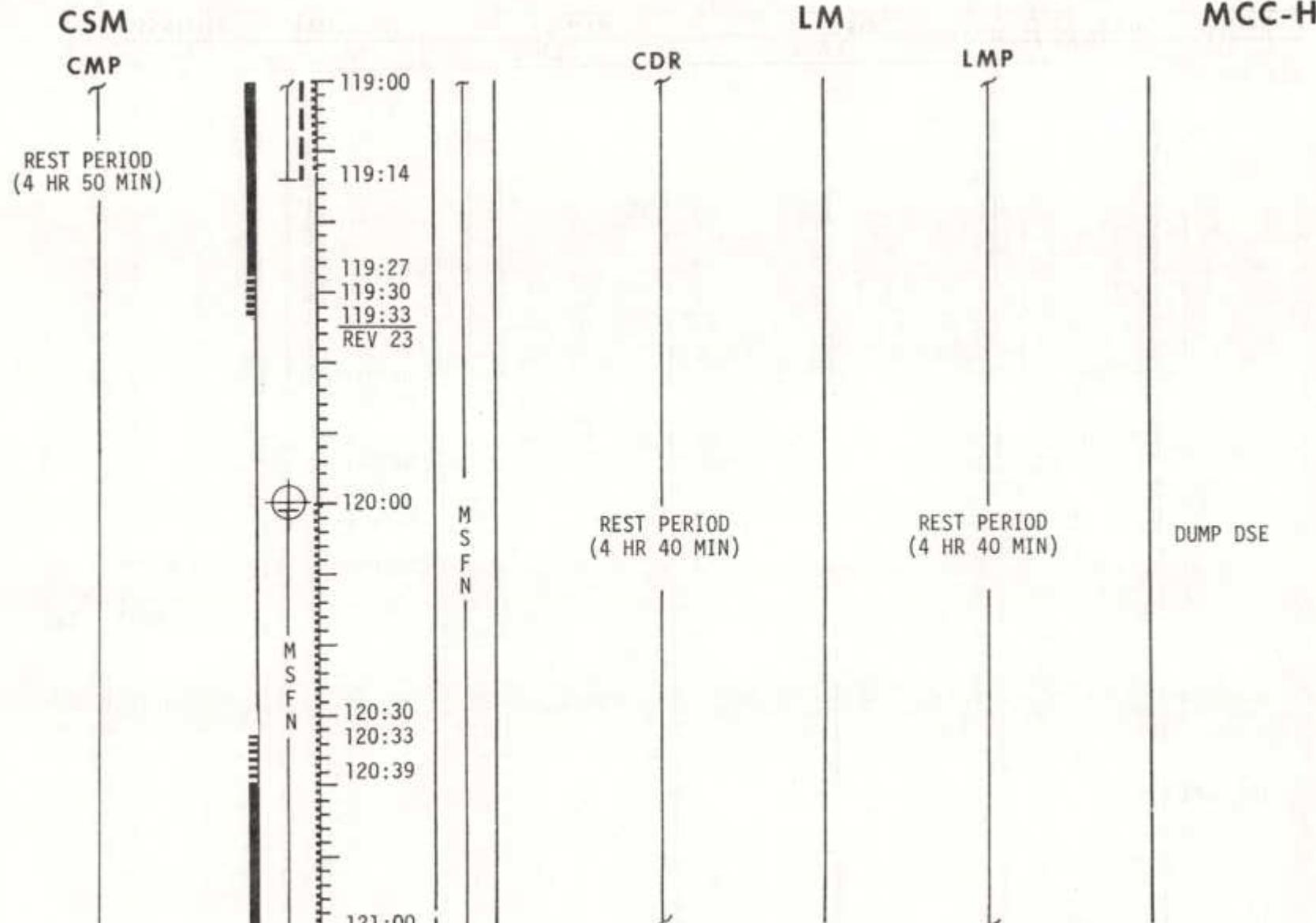
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	117:00 - 118:00	5/20-21	3-84

FLIGHT PLAN



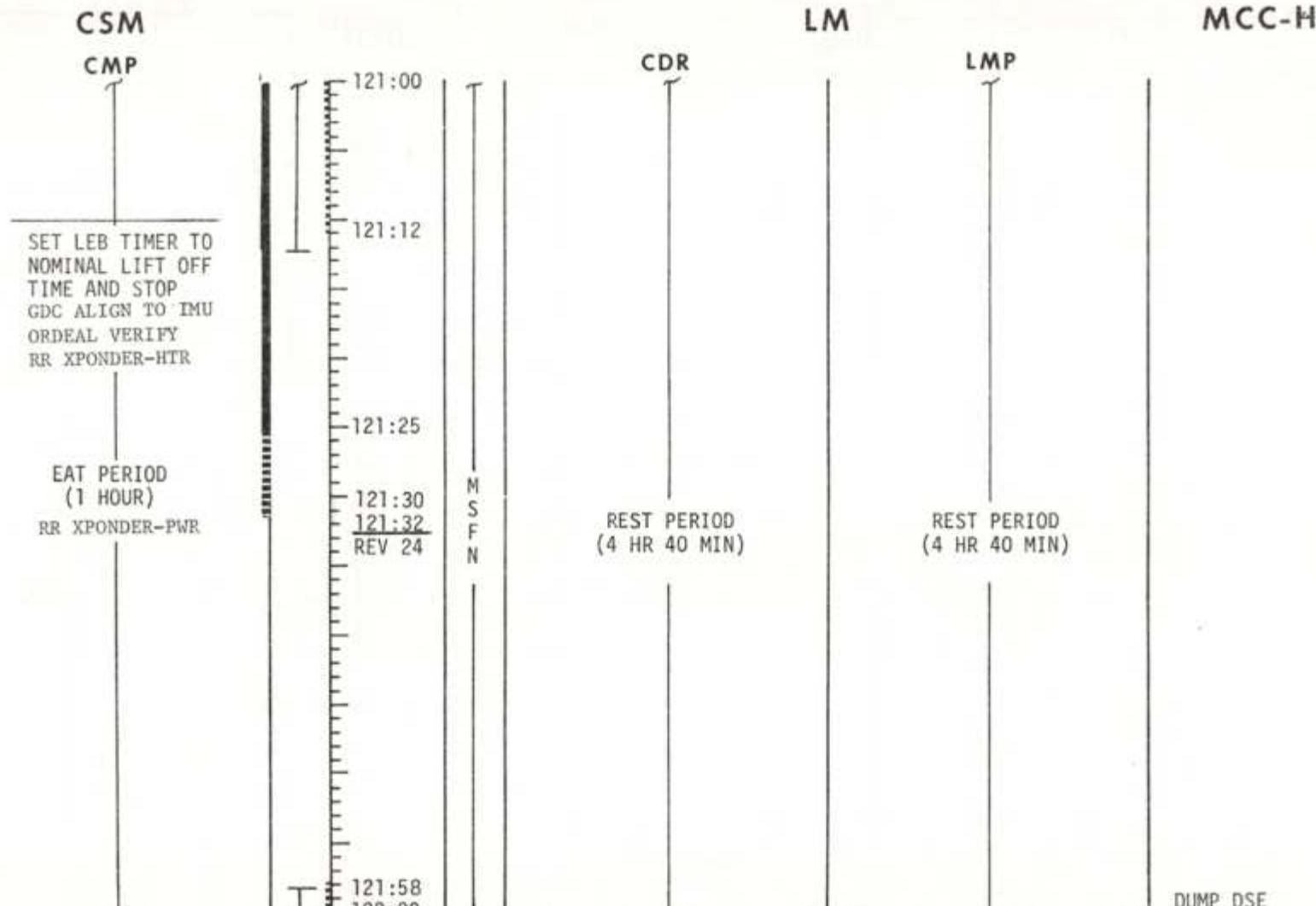
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	118:00 - 119:00	5/22-23	3-85

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	Revision A	July 8, 1969	121:00 - 122:00	5/23-24	3-87

FLIGHT PLAN

CSM		LM	MCC-H
CMP	1130 EDT 122:00	CDR	LMP
SELECT COMM: NORMAL LUNAR CONFIGURATION CREW STATUS REPORT(SLEEP)		CREW STATUS REPORT (SLEEP)	LGC SELF TEST AGS TURN ON, SELF TEST AND SYSTEM TESTS INITIALIZE AGS TIME REPORT BIAS TO MCC-H REPORT:
V45 RESET LUNAR SURFACE FLAG		RR - ON, SELF TEST, OFF	P57 - GRAVITY AND ONE CELESTIAL BODY (REFSMAT) N04: _____ N71: _____ N93: X _____ Y _____ Z _____ GET _____ : _____ : _____
P52 IMU REALIGN OPTION 3 (REFSMAT) REPORT	M S F N 122:30 122:31 122:37	RCS HOT FIRE	AGS GYRO CALIBRATE
P52 LIFT OFF REFSMAT N71: _____, _____ N05: _____, _____ N93: X _____ Y _____ Z _____ GET: _____ : _____ : _____	M S F N 123:00	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)
EDITION	DATE	TIME	DAY/REV
APOLLO 11	Revision A	July 8, 1969	122:00 - 123:00
			6/24
PAGE			3-88

FLIGHT PLAN

CSM

CMP

COPY CONSUMABLES UPDATE

1230 EDT
123:00

M S F N

RR XPONDER - SELF
TEST THEN PNR
 O_2 FUEL CELL PURGE

123:10
123:24
123:30
REV 25

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

123:56
124:00

CDR

COPY CONSUMABLES UPDATE

LM

LMP

COPY ASCENT PAD
LOAD PAD DATA

VERIFY AGS:
AZIMUTH CORRECTION = 0
H = 60,000 FT
H DOT = 32 FPS
NO S-BAND YAW MNVR
ORBIT INSERTION MODE
SET CAMERA FOR ASCENT
16mm/HCEX/OVERHEAD
(f4,500,INF) 12 fps

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

ENTER AGS LUNAR ALIGN

MCC-H

UPDATE LM
ASCENT PAD & CSI PAD

CONSUMABLES UPDATE
(Δ FROM NOMINAL)

GET: _____

RCS TOT _____

A _____

B _____

C _____

D _____

H_2 TOT _____

O_2 TOT _____

LM CONSUMABLES UPDATE

GET: ____ : ____

RCS A ____ B ____

DESC O_2 _____

DESC A-H _____

ASC A-H _____

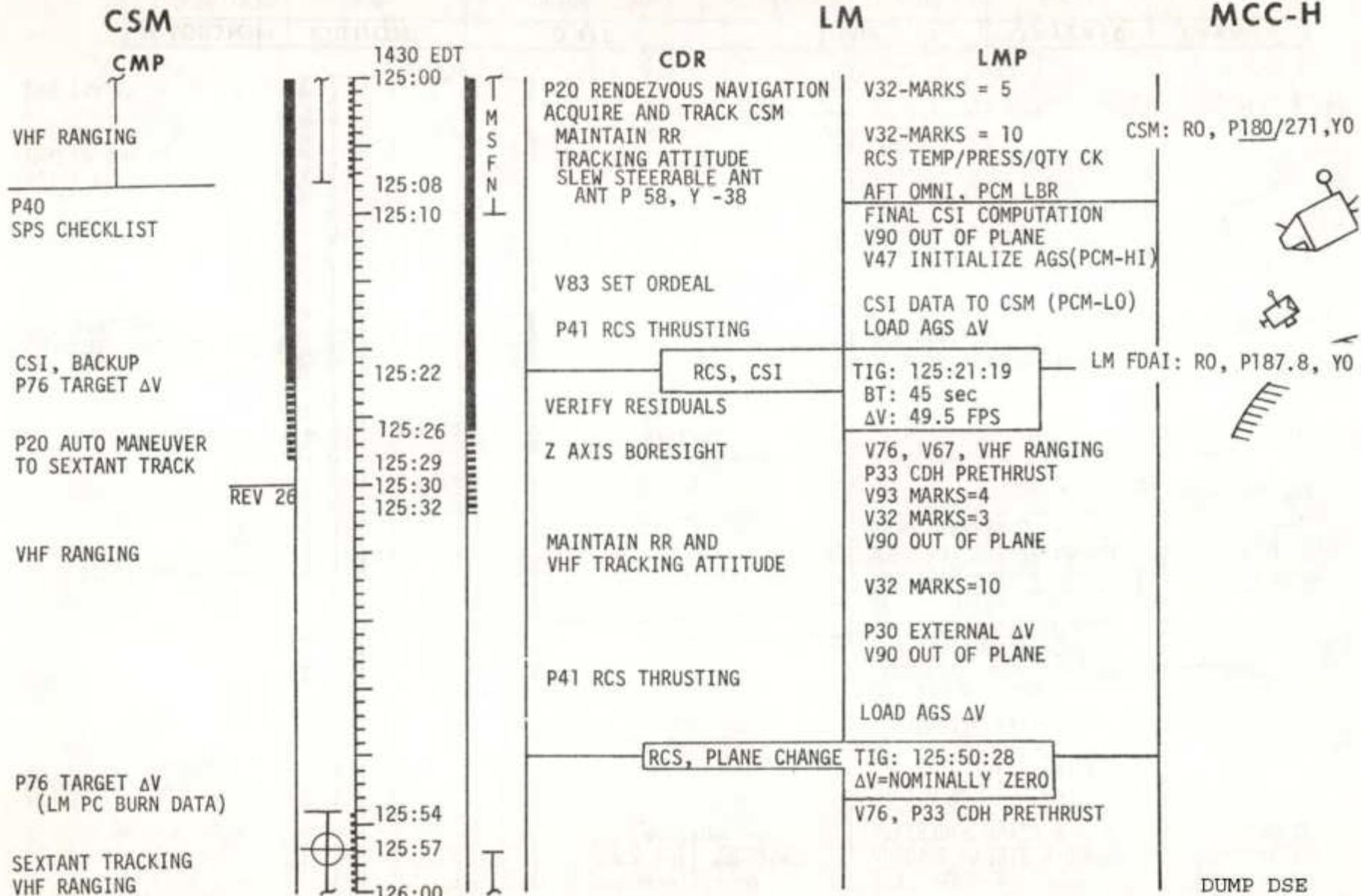
DUMP DSE

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	Revision A	July 8, 1969	123:00-124:00	6/24-25	3-89

FLIGHT PLAN

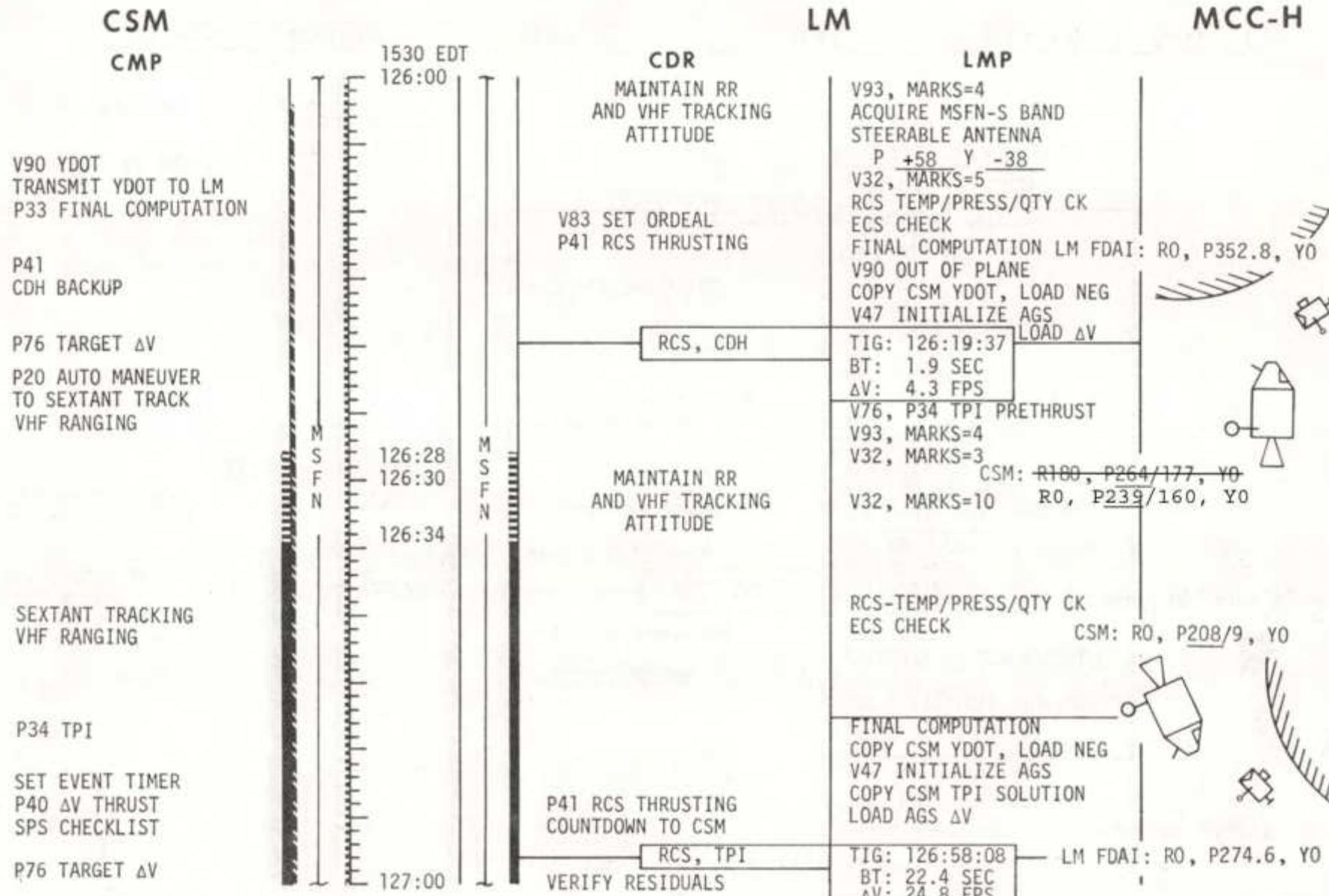
CSM	CMP	1330 EDT 124:00	CDR	LM	LMP	MCC-H
V64 ACQUIRE MSFN			LOAD DAP - 12012 DON HELMET AND GLOVES P12 ASCENT PROGRAM RR-ON		DON HELMET AND GLOVES GO/NO GO FOR PGNCS ASCENT GUIDANCE AND LIFT OFF THIS REV PRELAUNCH SWITCH CK VERIFY RESTRAINTS	UPDATE LM [GO/NO GO]
VHF RANGING MNVR TO SUPPORT LIFT OFF RO, P <u>250</u> /207, YO			PRELAUNCH SWITCH CK (PRESS VERIFY RESTRAINTS APS)		LIFT OFF COMM START 16mm CAMERA V47 INITIALIZE AGS AGS GUIDANCE STEERING	LIFT OFF -6 MIN DISABLE S-BAND RELAY
EXT RNDZ LT - ON			TIG-5 SEC, ABORT STAGE		TIG: 124:23:26 BT: 7 MIN 18 SEC ΔV: 6060 FPS ORBIT: 60 KFT x 45NM	
PITCH DOWN, 0.2°/SEC			APS, LIFT OFF		LM FDAI: RO, PO, YO	
CONFIRM INSERTION		124:30 MSF N	RR LOCK ON, MODE II		CSM: RO, P <u>300</u> /207, YO	
VHF RANGING REPORT:		124:31 MSF N	ORBIT INSERTION		UPLINK CMC LM STATE VECTOR	
P52 (LIFT OFF REFSMMAT) OPTION 3		124:36 MSF N	RR-OFF VERIFY INSERTION VEL		LM FDAI: RO, P257.3, YO	
N71: _____		124:37 MSF N	P52 (LIFT OFF REFSMMAT) OPTION 3			
N05: _____			N71: _____			
N93:			N05: _____			
X _____			N93: _____			
Y _____			X _____			
Z _____			Y _____			
GET _____ : _____ :			Z _____			
		125:00	GET _____ : _____ :	RR - ON	V93 (BEFORE FIRST MARK) V80, V47 INITIALIZE AGS P32 CSI PRETHRUST	
<hr/>						
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE	
APOLLO 11	Revision A	July 8, 1969	124:00 - 125:00	6/25	3-90	

FLIGHT PLAN



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

FLIGHT PLAN



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

FLIGHT PLAN

CSM		LM	MCC-H																														
CMP GO/NO GO FOR PYRO ARM 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 EXT RNDZ LT - OFF	<p>1630 EDT 127:00</p> <p>127:06</p> <p>127:21</p> <p>127:27 REV 27 127:30</p> <p>127:53</p> <p>128:00</p>	CDR ANT P Y P41 RCS THRUSTING MAINTAIN LOS CSM P41 RCS THRUSTING 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 <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">GET</th> <th style="text-align: left;">AT FROM TPI</th> <th style="text-align: left;">ΔV FT/SEC</th> <th style="text-align: left;">RANGE NM</th> <th style="text-align: left;">RANGE RATE FT/SEC</th> </tr> </thead> <tbody> <tr> <td>127:36:57</td> <td>28:49</td> <td colspan="3">NOMINALLY NOT PERFORMED</td> </tr> <tr> <td>127:39:24</td> <td>41:16</td> <td>10.8</td> <td>12.0</td> <td>-19.7</td> </tr> <tr> <td>127:40:37</td> <td>42:29</td> <td>8.8</td> <td>9.8</td> <td>-9.8</td> </tr> <tr> <td>127:42:16</td> <td>44:08</td> <td>4.3</td> <td>4.8</td> <td>-4.8</td> </tr> <tr> <td>127:43:35</td> <td>45:27</td> <td>4.2</td> <td>4.7</td> <td>-0.2</td> </tr> </tbody> </table>	GET	AT FROM TPI	ΔV FT/SEC	RANGE NM	RANGE RATE FT/SEC	127:36:57	28:49	NOMINALLY NOT PERFORMED			127:39:24	41:16	10.8	12.0	-19.7	127:40:37	42:29	8.8	9.8	-9.8	127:42:16	44:08	4.3	4.8	-4.8	127:43:35	45:27	4.2	4.7	-0.2	GO/NO GO FOR PYRO ARM
GET	AT FROM TPI	ΔV FT/SEC	RANGE NM	RANGE RATE FT/SEC																													
127:36:57	28:49	NOMINALLY NOT PERFORMED																															
127:39:24	41:16	10.8	12.0	-19.7																													
127:40:37	42:29	8.8	9.8	-9.8																													
127:42:16	44:08	4.3	4.8	-4.8																													
127:43:35	45:27	4.2	4.7	-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

CSM

CMP

CONTACT: CMC - FREE
NULL RATES

ROLL RIGHT 60°,
PITCH UP 53°

GO INERTIAL
PRESS CSM TO 5.5 PSIA
DISABLE JETS B3 & C4
ADJUST O₂ FLOW TO
.6 LBS/HR
PRESS TUNNEL TO 3 PSID
FOR LEAK CK, THEN
EQUALIZE CM/LM ΔP
INFORM LM WHEN PRESS
EQUAL.
REMOVE HATCH AND STOW
VERIFY LATCHES
PASS BAGS & BRUSH
TO LM

1730 EDT
128:00

M
S
F
N
128:26
128:30
128:32
129:00

LM

CDR

DOCKING 128:00

LMP



CSM: R300, P4/332, Y0

LM FDAI: R0, P152, Y0

DOFF HELMET & GLOVES
AND TEMPORARILY STOW

OPEN LM HATCH
REMOVE AND STOW PROBE
& DROGUE

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

CONFIGURE CDR SUIT
LOOP FOR VACUUM
CLEANING

DOFF HELMET & GLOVES
AND TEMPORARILY STOW

ASSIST CDR

TEMPORARILY STOW
BAGS AND BRUSH

ASSIST CDR

MCC-H

CSM: R0, P 102/25, Y0

HGA: P -53, Y 3

LM FDAI: R0, P 205, Y60

ANT: P 173, Y 72

CSM: R0, P 205, Y60

ANT: P 173, Y 72

LM FDAI: R0, P 205, Y60

ANT: P 173, Y 72

LM FDAI: R0, P 205, Y60

ANT: P 173, Y 72

LM FDAI: R0, P 205, Y60

ANT: P 173, Y 72

LM FDAI: R0, P 205, Y60

ANT: P 173, Y 72

LM FDAI: R0, P 205, Y60

ANT: P 173, Y 72

LM FDAI: R0, P 205, Y60

ANT: P 173, Y 72

LM FDAI: R0, P 205, Y60

ANT: P 173, Y 72

LM FDAI: R0, P 205, Y60

ANT: P 173, Y 72

LM FDAI: R0, P 205, Y60

ANT: P 173, Y 72

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

FLIGHT PLAN

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

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

FLIGHT PLAN

CSM

CMP

LM

MCC-H

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

UNSTOW AND INSTALL
CSM HATCH

HATCH INTEGRITY CHECK
DEPRESSURIZE TUNNEL

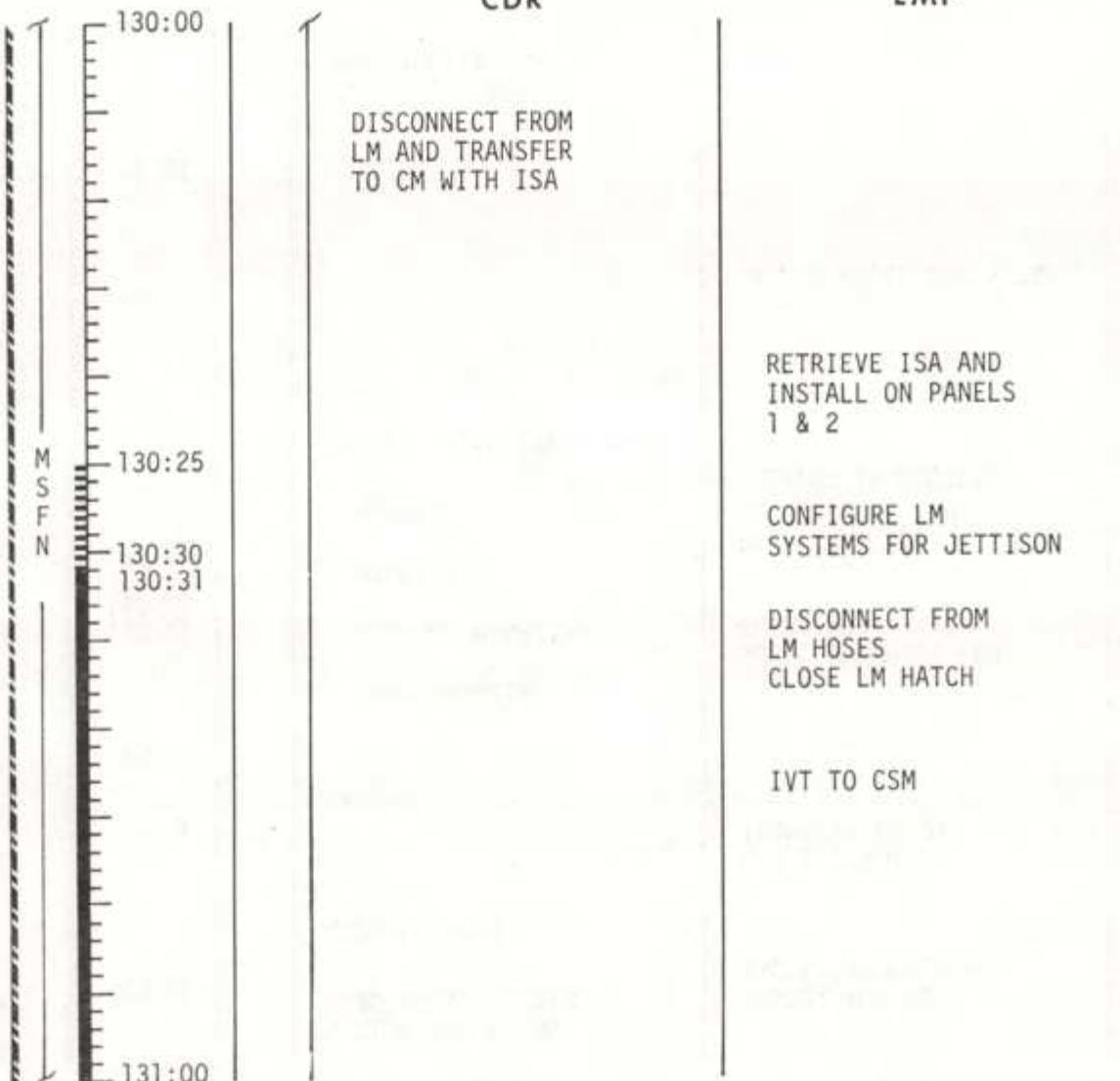
DISCONNECT FROM
LM AND TRANSFER
TO CM WITH ISA

RETRIEVE ISA AND
INSTALL ON PANELS
1 & 2

CONFIGURE LM
SYSTEMS FOR JETTISON

DISCONNECT FROM
LM HOSES
CLOSE LM HATCH

IVT TO CSM



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

2030 EDT

131:00
131:03

1

GO/NO GO

DUMP DSE

131:50

132:00

FLIGHT PLAN

NOTES

EQUIPMENT STOWAGE

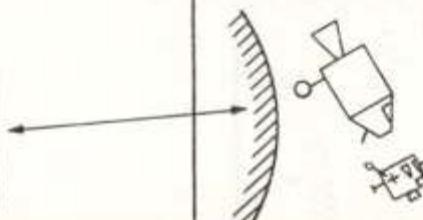
VACUUM PGAS

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 =
 $\Delta V = 1.5 \text{ FPS}$
 RETROGRADE
 ORBIT: 58.5 X 59.4

R0, P45/25, Y0
 HGA P-53, Y3



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

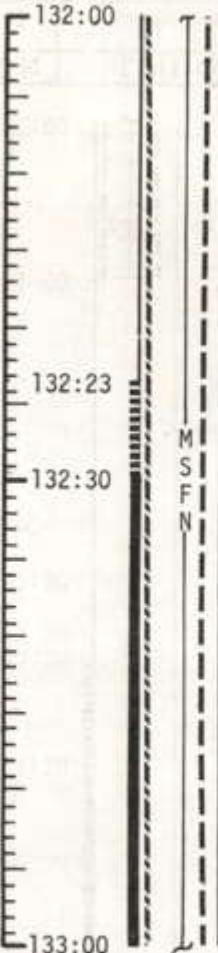
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	Revision A	July 8, 1969	131:00 - 132:00	6/29	3-97

MCC-H

2130 EDT
132:00

FLIGHT PLAN

NOTES:

UPDATE
TEI₃₀ MNVR PAD

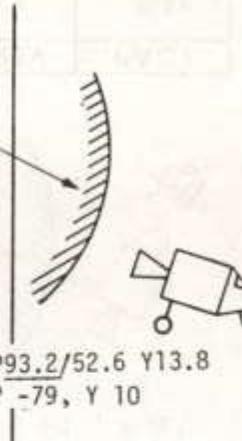
MNVR TO TEI BURN ATTITUDE (EXCEPT ROLL)

V66 - TRANS CSM STATE VECTOR TO LM SLOT
BURN STATUS REPORT
RECORD PRELIMINARY TEI₃₀ MNVR PAD

GO INERTIAL

DOFF AND BAG PGA'S HELMETS
AND GLOVES

EAT PERIOD

R1.1 P93.2/52.6 Y13.8
HGA P -79, Y 10

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	Revision A	July 8, 1969	132:00 - 133:00	6/29	3-98

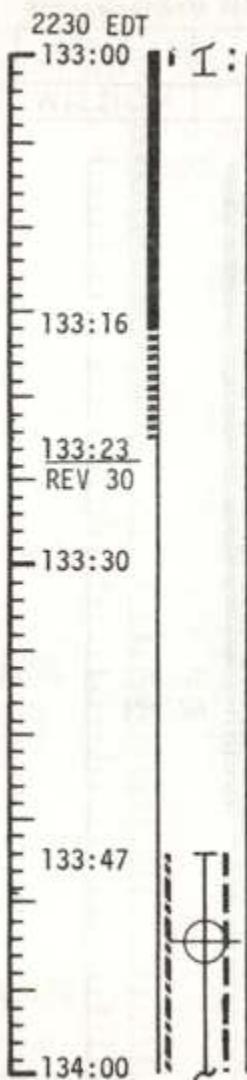
MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

MCC-H

FLIGHT PLAN

NOTES



CO₂ FILTER CHANGE NO. 10
(12 INTO B, STORE 10 IN A3)

EAT PERIOD

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

MCC-H

2330 EDT

FLIGHT PLAN

NOTES

UPDATE
 TEI₃₀ MNVR PAD
 BLOCK DATA
 (TEI₃₁)
 GO/NO GO
 UPLINK CMC
 CSM STATE VECTOR
 TEI TGT LOAD

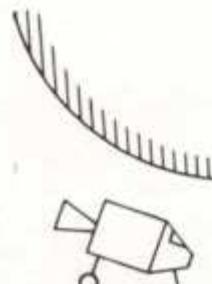


PRE TEI SYSTEMS CKS:
 C&W CK
 CM RCS MON CK
 SM RCS MON CK
 EPS MONITOR CK
~~ECS REDUNDANT COMPONENTS CK~~

RECORD FINAL TEI₃₀ MNVR PAD AND
 BLOCK DATA
 GO/NO GO FOR TEI₃₁
 THIS REV 31

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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MAILED 7/12
7/13 1967 TO DIRECTOR

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NAME	NUMBER	PERIOD	PERIOD	PERIOD
		PERIOD 1	PERIOD 2	PERIOD 3

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 AXIS TO 0.2 FPS
TEI ABORT MODES				
TEI V _{GO}	BT	TRAJECTORY	ABORT MODE	
3292.7 - 1436.0	0-01:30	LUNAR ORBIT	MODE III - AFTER 1 REV	
1436.0 - 1207.0	1:30- 1:40	UNSTABLE	MODE II - 2 SPS BURNS FOR ORBIT STABILIZATION AND WATER OR CLA LANDING.	
1207.0 - 0	1:40-02:29	UNSTABLE/ HYPERBOLIC	MODE I - 1 BURN AT TEI + 2 HRS P37 AT SPHERE OF INFLUENCE HYPERBOLIC (ΔV 580 to 0, BT 02:05 - 02:29)	

MCC-H

0030 EDT

135:00

135:02

135:10

135:15

135:20

135:25

135:30

135:35

135:40

135:45

135:50

135:55

135:60

135:65

135:70

135:75

135:80

135:85

135:90

135:95

136:00

FLIGHT PLAN

NOTES

SPS THRUST - P40
 ROLL TO BURN ATT
 DAP - R1=10101 R2=11111
 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 ΔV TEST

SM RCS CK

GDC ALIGN TO IMU

[TEI]

DAP - R1=10111 R2=11111
 GET: 135:24:34
 ULLAGE = 2 JET 16 SEC
 ΔV = 3292.7 FPS
 BT = 2 MIN 29 SEC

V48-DAP UPDATE (S/C WT)

SM RCS MON CK

SPS MON CK

V66 - TRANS CSM STATE VECTOR TO LM SLOT
 PITCH DOWN TO ACQ MSFN AND
 VISUALLY ACQ MOON

IMU REALIGN - P52
 OPTION 1 - PREFERRED
 AND STAR CK

BURN STATUS REPORT

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

R181.1, P355/52.6, Y13.8

UPLINK

DESIRED ORIENTATION
(PTC)SET CAMERA FOR POST-TEI
EL/80/CEX(f5.6,250,INF)

OR

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

M

S

F

N

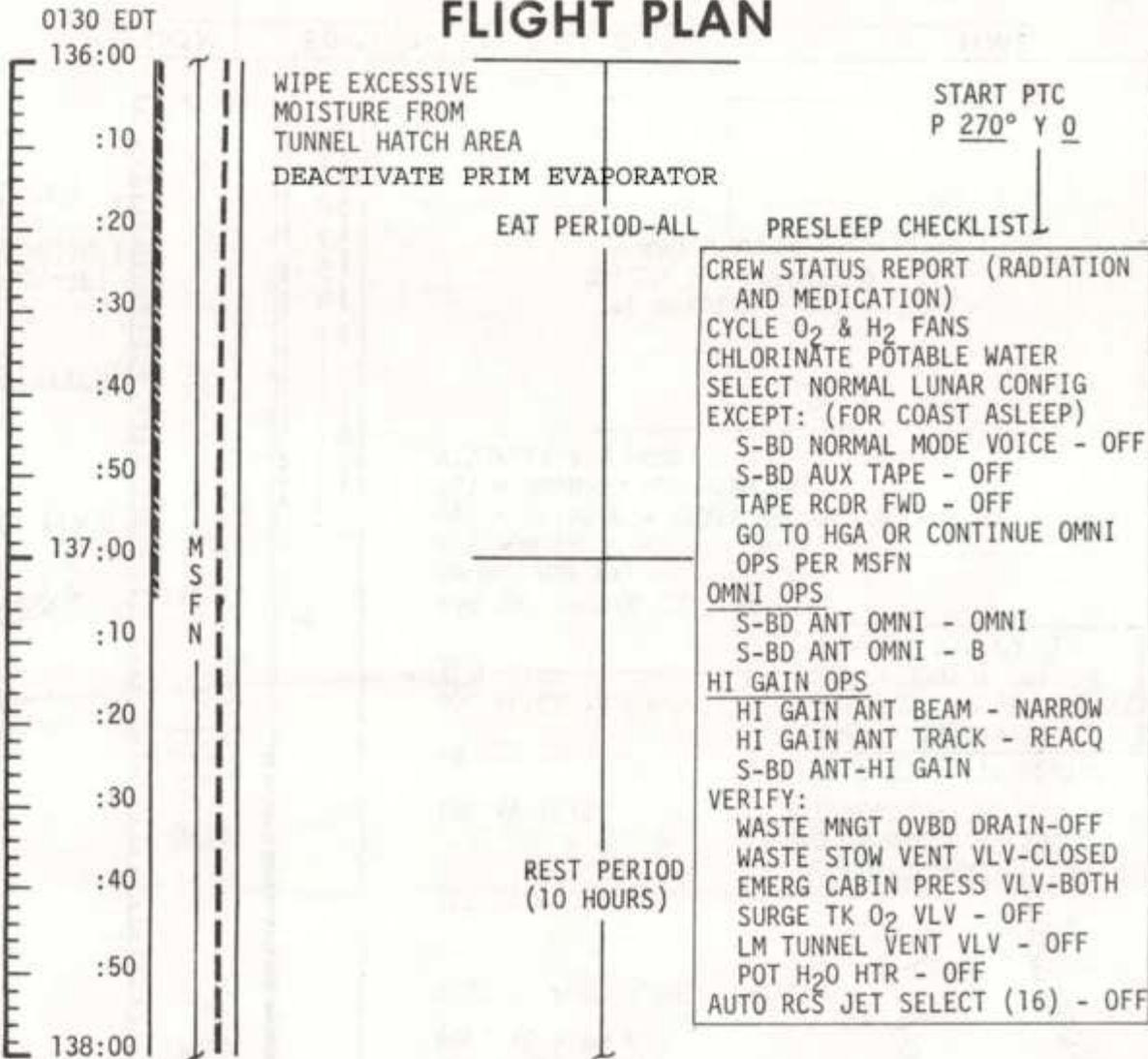
P52 - PULSE TORQUE
 TO PTC REFSMMAT
 PLATFORM ALIGN
 CHECKED WITH
 OPTICS

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

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 _____

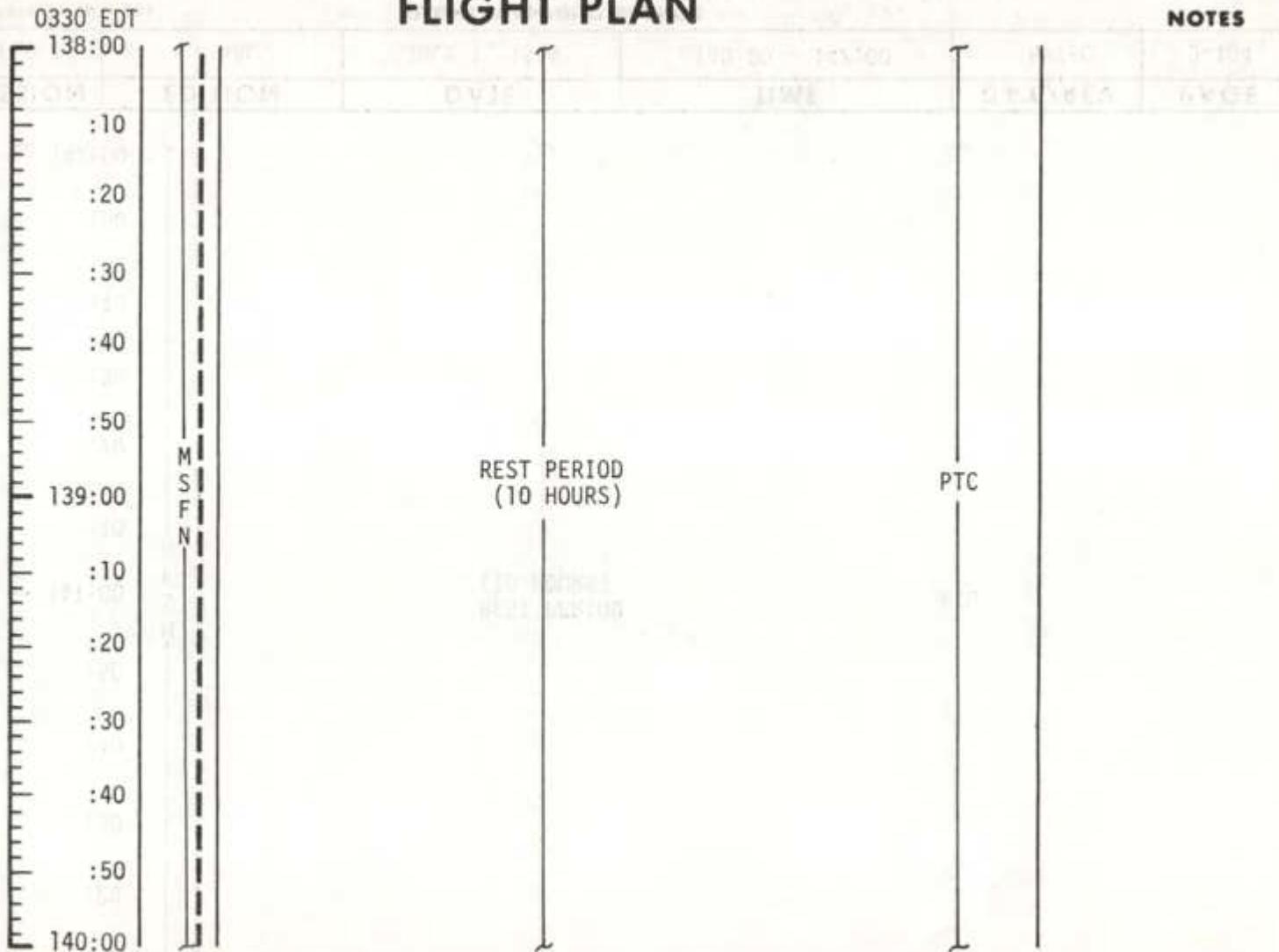
DC IND SEL TO MNA
OR MNB

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

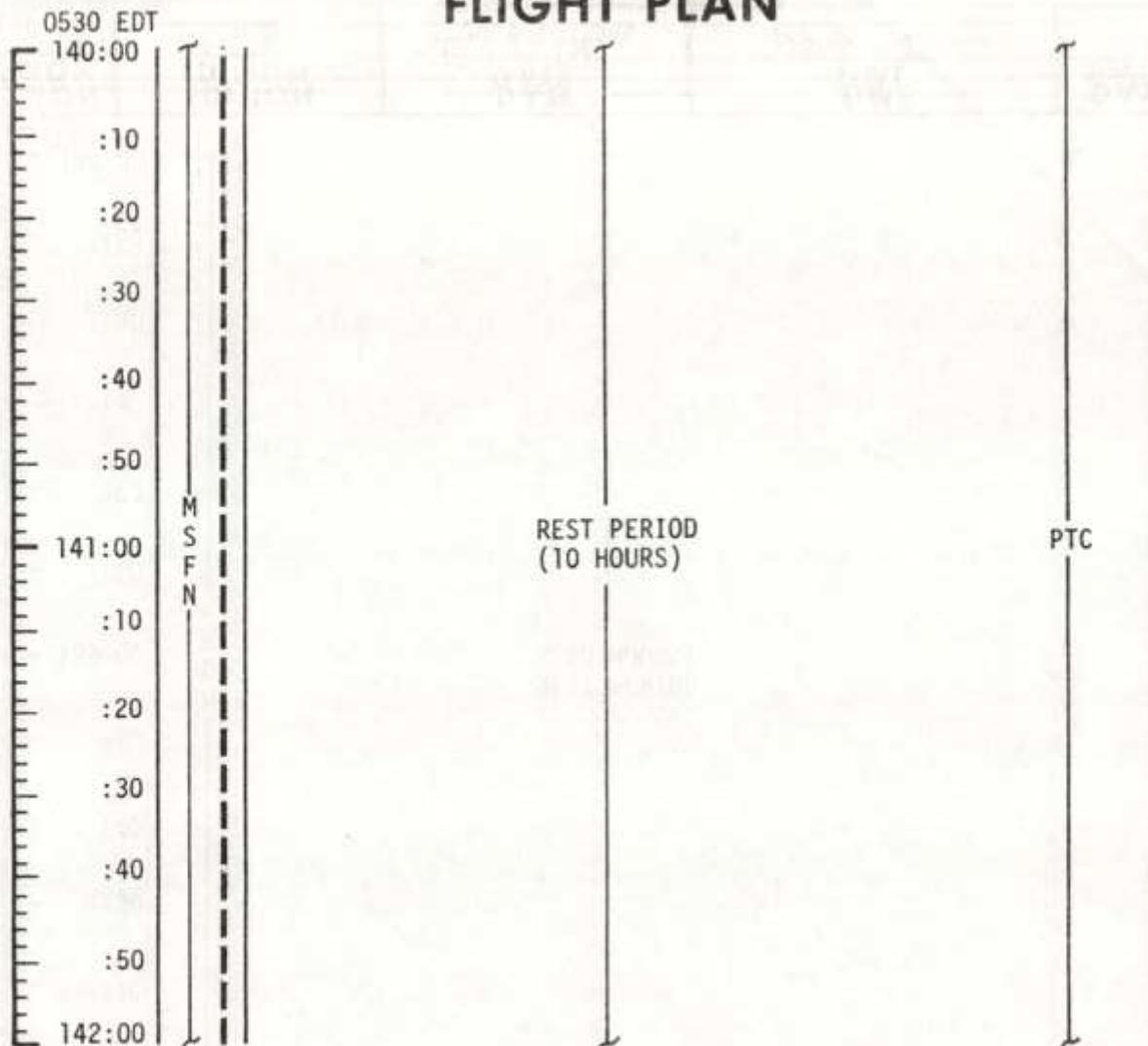


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	138:00 - 140:00	6/TEC	3-103

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 28 (May 69)

FLIGHT PLANNING BRANCH

MCC-H

FLIGHT PLAN

NOTES

0730 EDT

142:00

:10

:20

:30

:40

:50

143:00

M

S

F

N

:10

:20

:30

:40

:50

144:00

REST PERIOD
(10 HOURS)

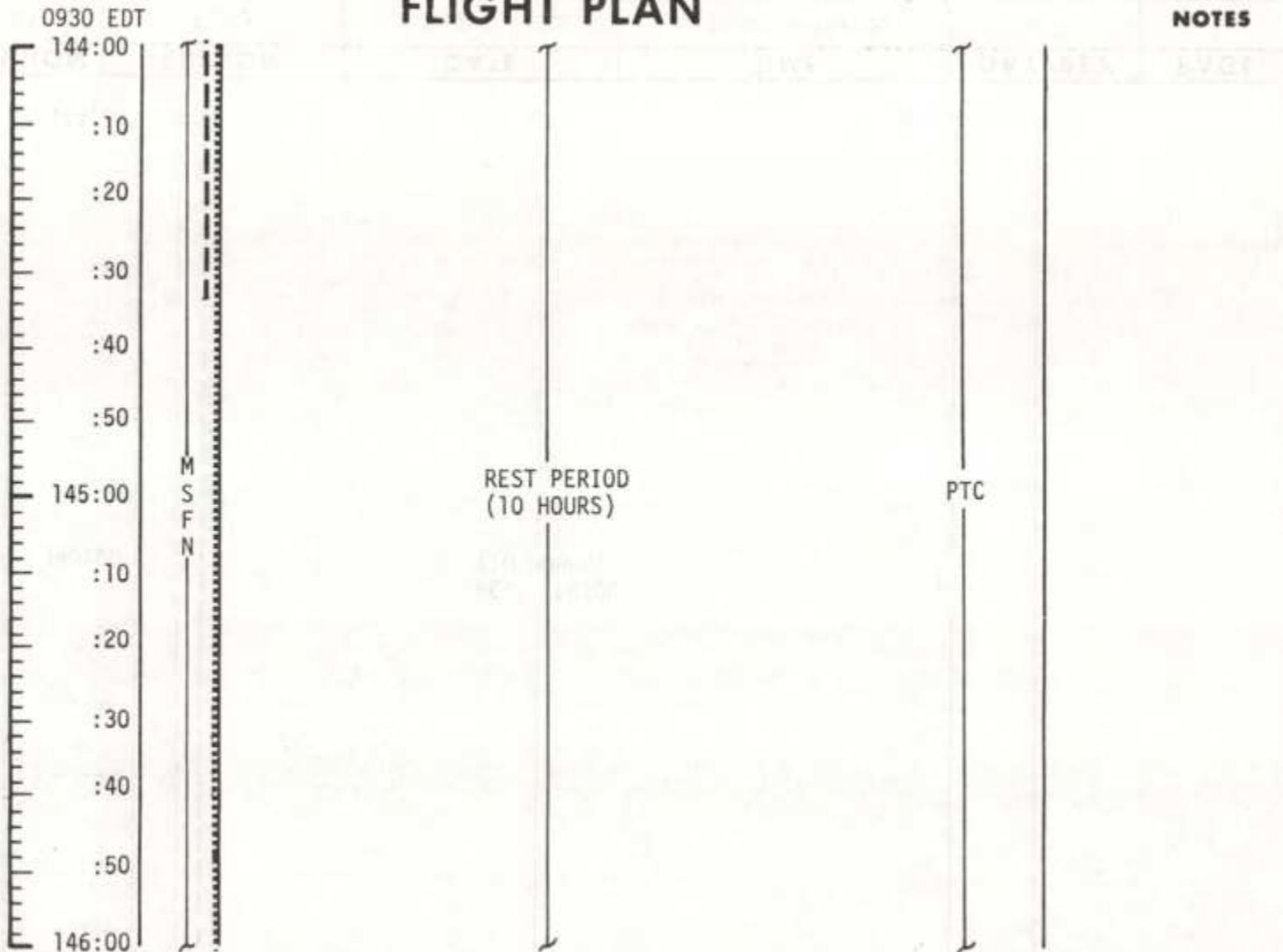
PTC

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

MCC-H

FLIGHT PLAN

NOTES



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)1130 EDT
146:00:10
:20
:30
:40
:50
147:00
:10
:20
:30
:40
:50
148:00M
S
F
NCO₂ FILTER CHANGE NO. 11
(13 INTO A, STORE 11 IN A3)H₂ PURGE LINE HTR-ONO₂ & H₂ FUEL CELL PURGEREST PERIOD
(10 HOURS)

POST SLEEP CHECKLIST
 CREW STATUS REPORT(SLEEP)
 CYCLE O₂ & H₂ FANS
 GDC ALIGN TO IMU
 CONSUMABLE UPDATES
 SELECT NORMAL LUNAR
 CONFIG EXCEPT:
 S-BD AUX TAPE - OFF
 TAPE RCDR FWD - OFF
 POT H₂O HTR - ON

EAT PERIOD - ALL

PTC

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 _____

H₂ TOT _____O₂ 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

NOTES

UPLINK

CSM STATE VECTOR
MCC5 TGT LOAD

UPDATE

MCC5 MNVR PAD

1330 EDT

148:00

:10 WIPE EXCESSIVE MOISTURE
FROM TUNNEL HATCH AREA

:20

:30

:40

:50

V66 - TRANS CSM STATE VECTOR TO
LM SLOT

149:00

M S F N

RECORD MCC5 MNVR PAD

:10

:20

:30

:40

:50

IMU REALIGN - P52
OPTION 3 - REFSMMAT

EXT ΔV - P30

SPS/RCS THRUST - P40/41

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

MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

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 _____ : _____

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1	2	3	4	5
6	7	8	9	10

HIGH LOW

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

MNVR TO BURN ATT

SXT STAR CK

EMS ΔV TEST

SM RCS MON CK

GDC ALIGN TO IMU

MCC5 ΔV=NOMINALLY ZERO

SM RCS MON CK

SPS MON CK

V66-TRANS CSM STATE VECTOR
TO LM SLOT

BURN STATUS REPORT

BATTERY CHARGE, BATTERY A

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

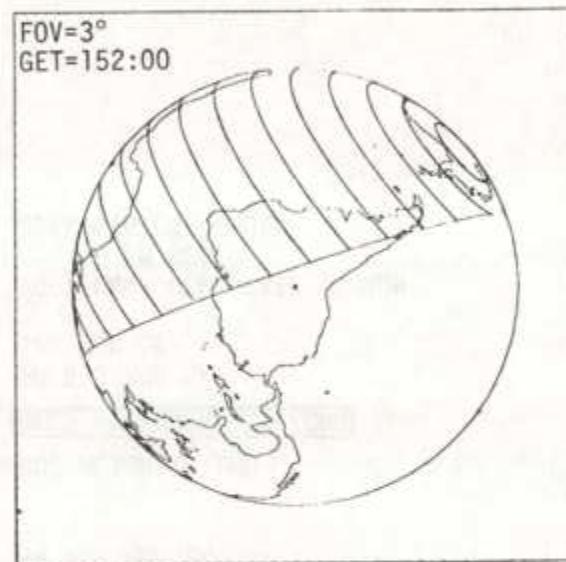
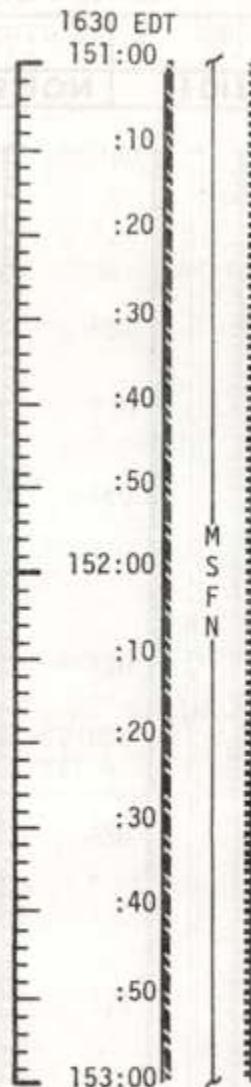
X	X		•	ΔTIG
X	X		•	BT
			•	V _{gx}
X	X	X		R
X	X	X		P
X	X	X		Y
			•	V _{gy}
			•	V _{gz}
			•	ΔV _c
X	X	X		FUEL
X	X	X		OX
X	X	X		UNBAL

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	150:00 - 151:00	7/TEC	3-109

MCC-H

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

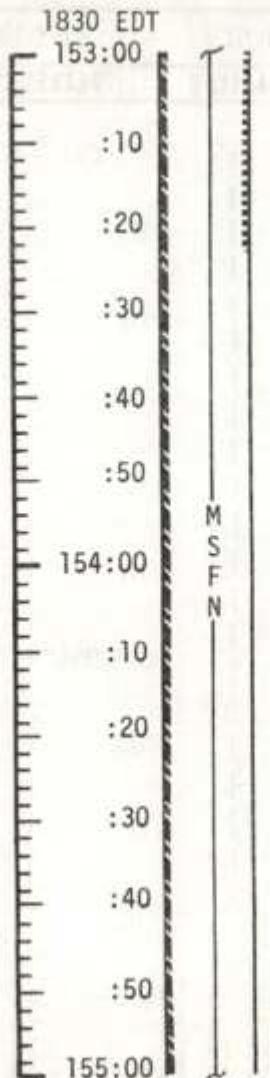
MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

MCC-H

FLIGHT PLAN

NOTES



EAT PERIOD - ALL

PTC

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

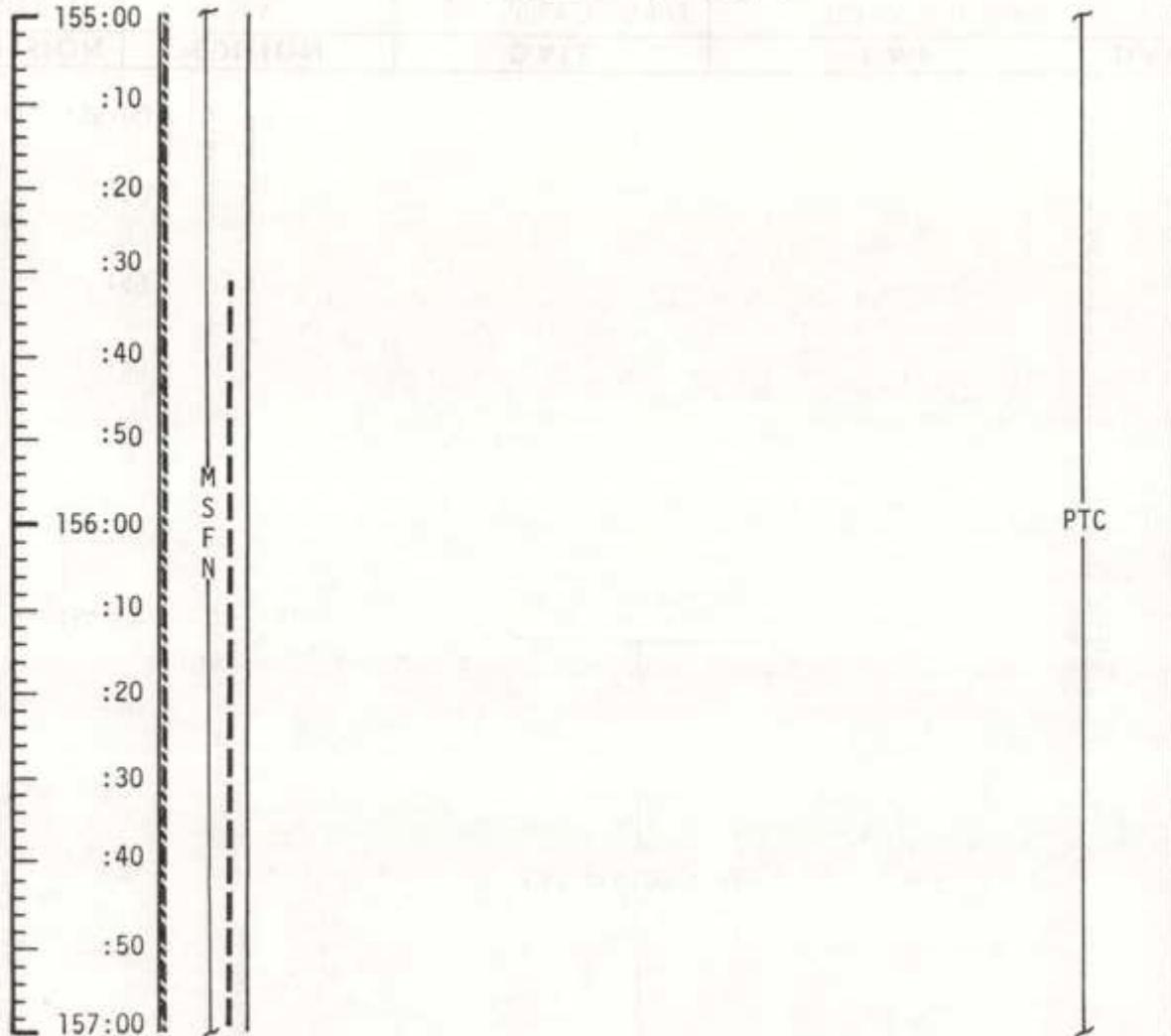
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	153:00 - 155:00	7/TEC	3-111

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

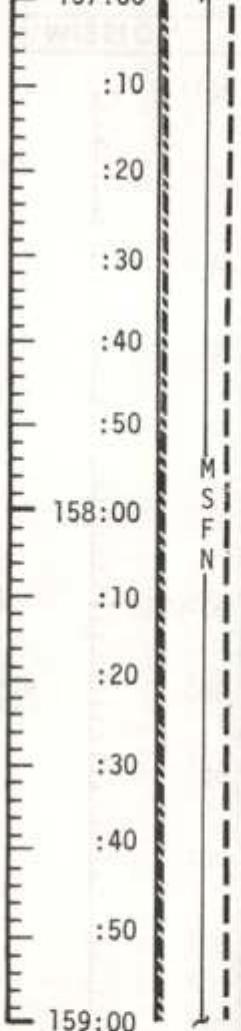
MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

MCC-H

FLIGHT PLAN

NOTES

2230 EDT
157:00

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_2 FUEL CELL PURGE

CO_2 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)

0030 EDT
159:00
:10
:20
:30
:40
:50
160:00
:10
:20
:30
:40
:50
161:00

M

S

F

N

EAT PERIOD - ALL

EMS CK
RECORD MCC6 &
PRELIMINARY ENTRY PADS

REST PERIOD
(10 HOURS)

PRESLEEP CHECKLIST
CREW STATUS REPORT (RADIATION,
MEDICATION)
CYCLE O₂ & H₂ 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 O₂ VLV-ON
REPRESS PACK O₂ VLV-OFF
LM TUNNEL VENT VLV - OFF
POT H₂O HTR - OFF
AUTO RCS JET SELECT (16) - OFF

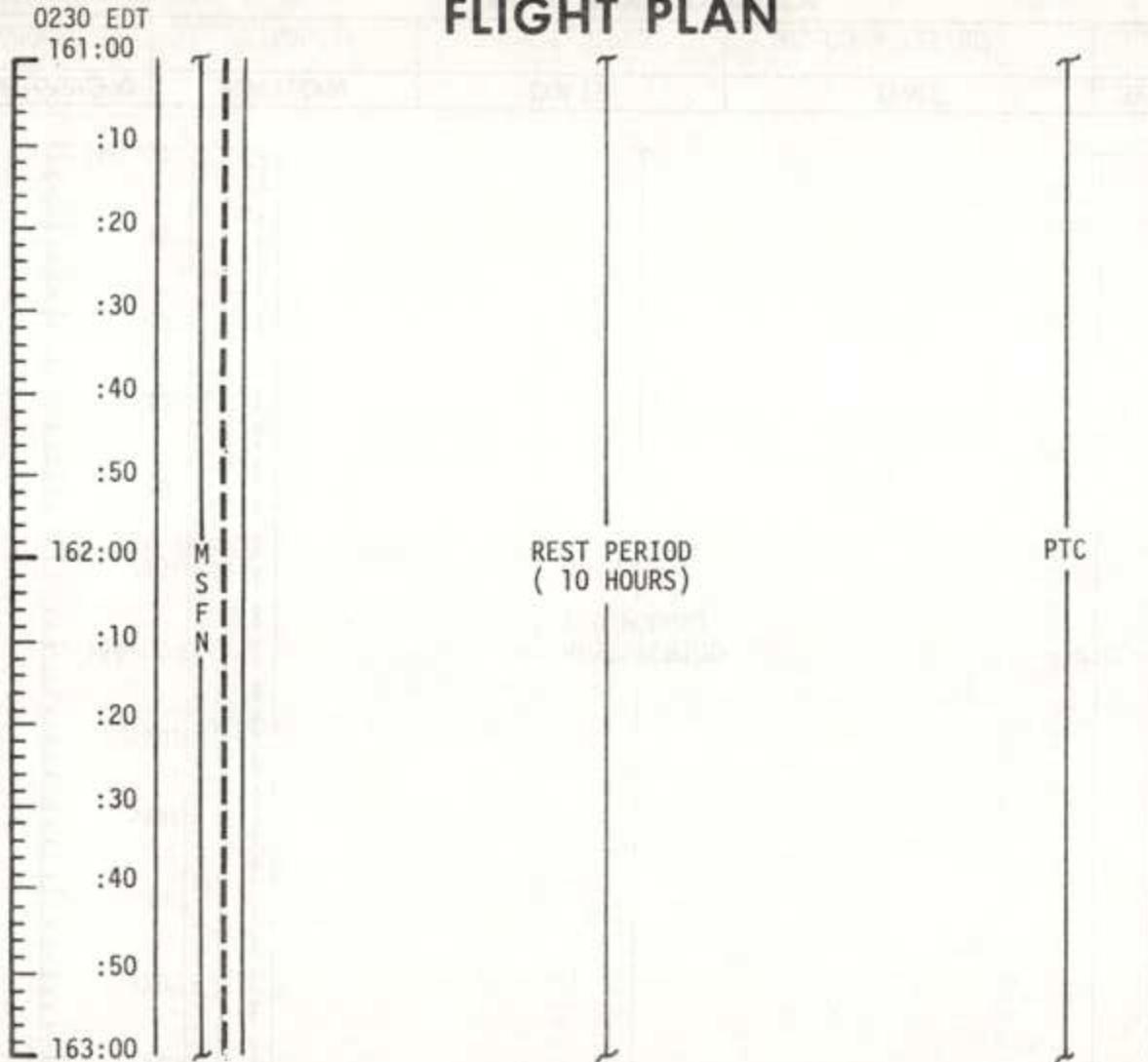
ON BOARD READOUT
BAT C _____
PYRO BAT A _____
PYRO BAT B _____
RCS A _____
B _____
C _____
D _____
DC IND SEL TO MNA OR
MNB

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

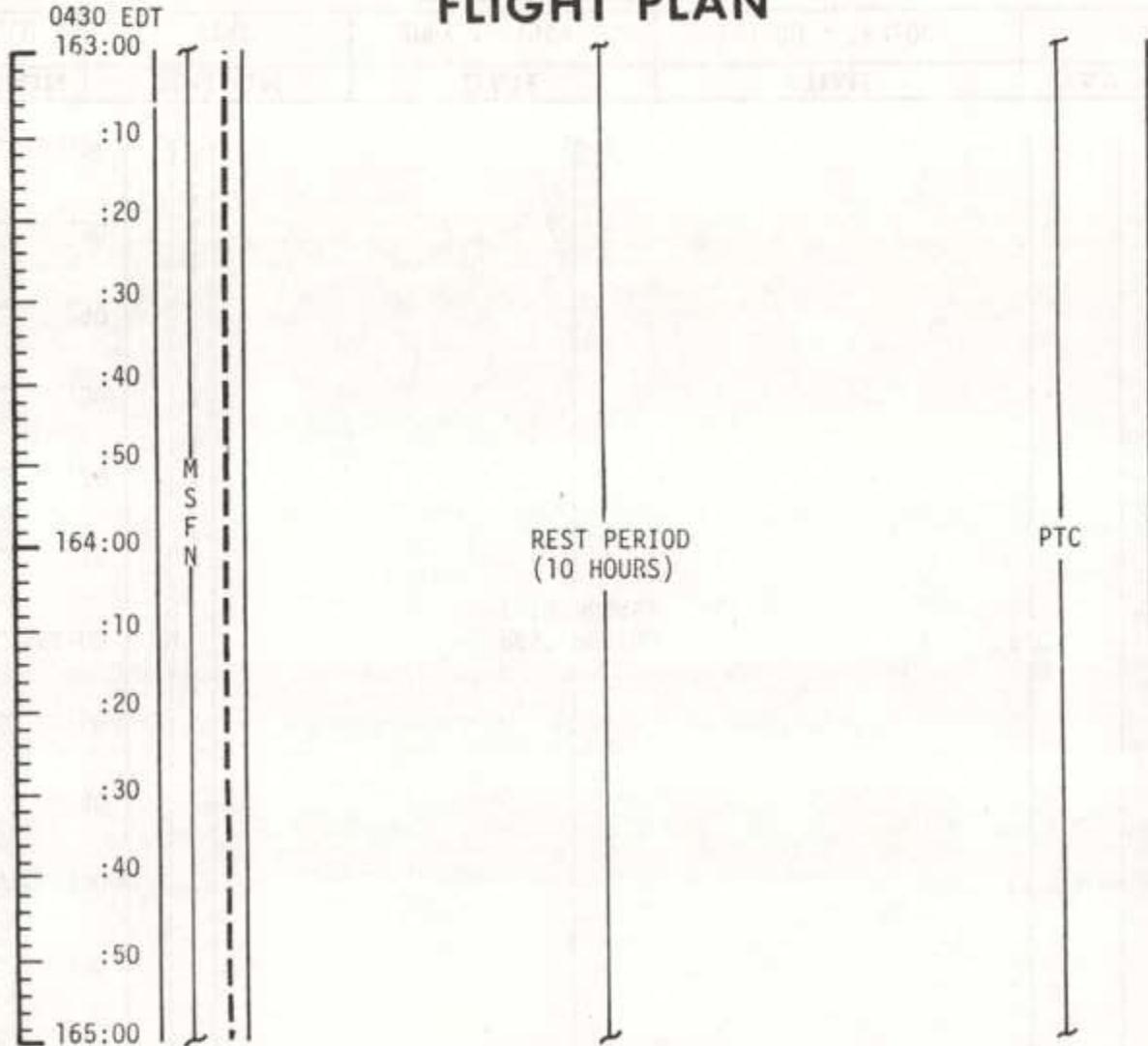


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	161:00 - 163:00	7/TEC	3-115

MCC-H

FLIGHT PLAN

NOTES



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

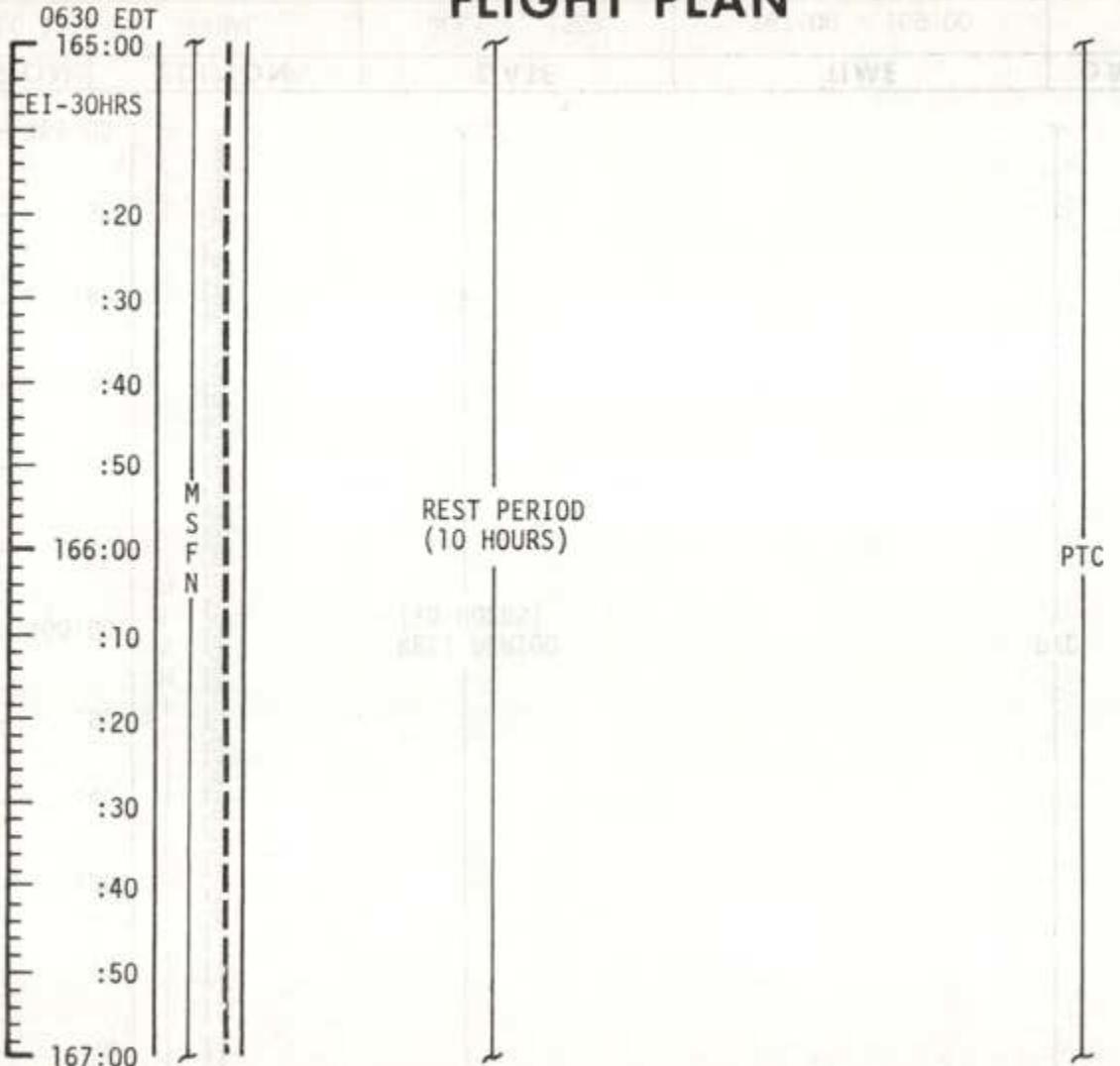
MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

MCC-H

FLIGHT PLAN

NOTES

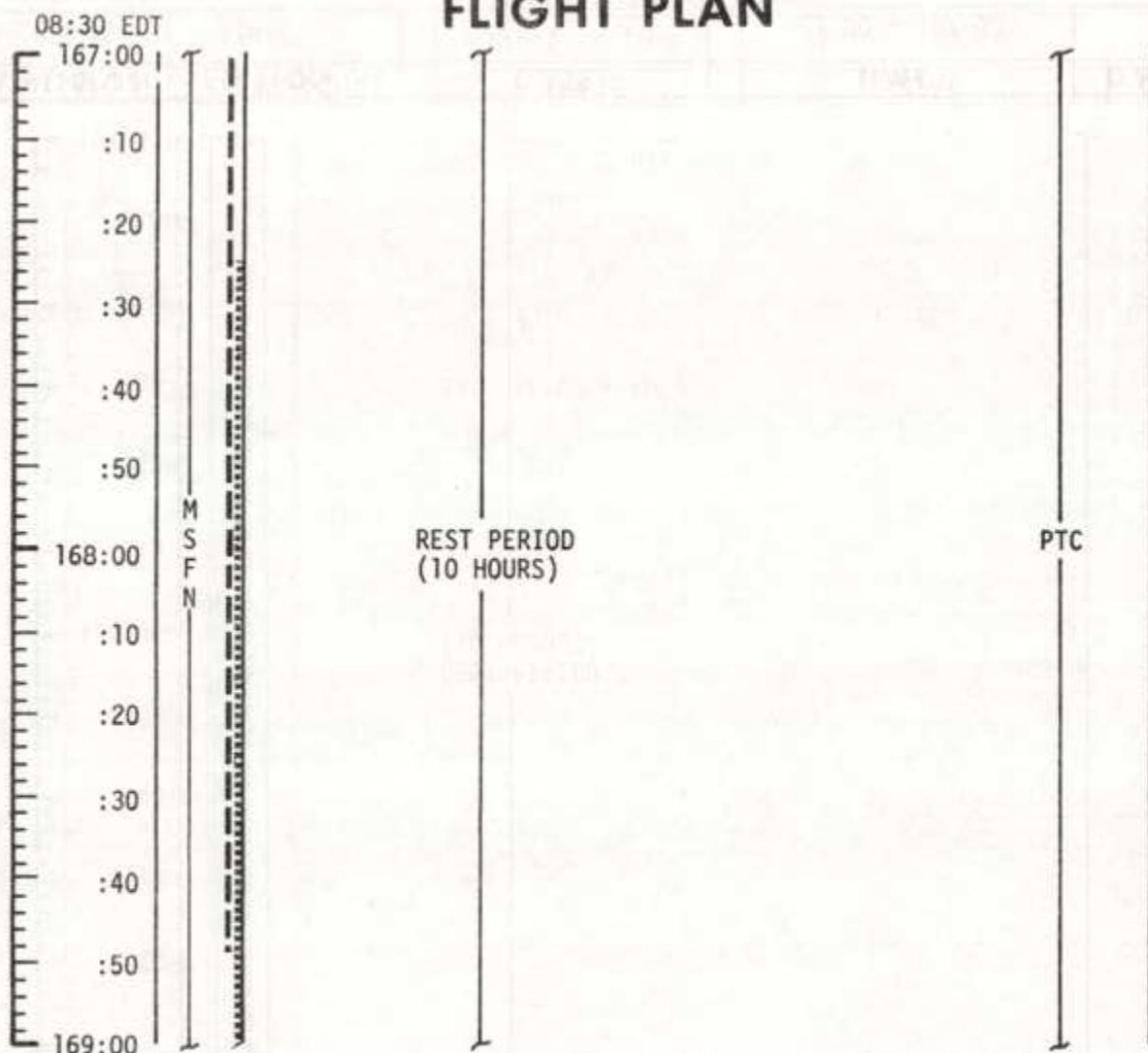


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	165:00 - 167:00	7/TEC	3-117

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)

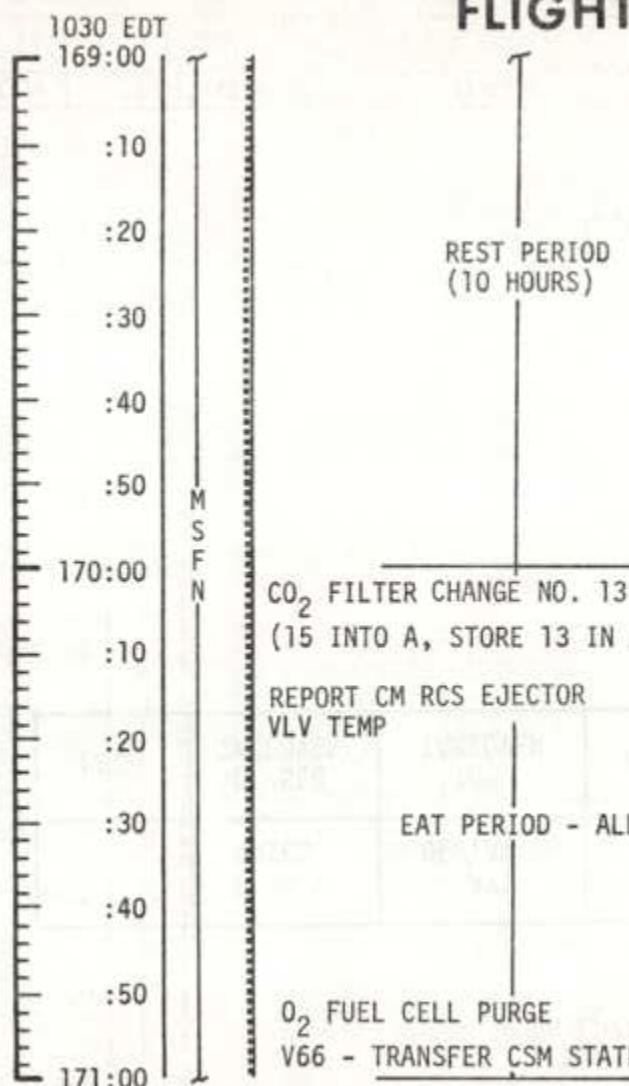
FLIGHT PLANNING BRANCH

MCC-H

FLIGHT PLAN

NOTES

UPLINK CMC
CSM STATE VECTOR
MCC6 TGT LOAD



POST SLEEP CHECKLIST
CREW STATUS REPORT (SLEEP)
CYCLE O₂ & H₂ FANS
GDC ALIGN TO IMU
CONSUMABLES UPDATE
SELECT NORMAL LUNAR
CONFIGURATION EXCEPT:
S-BD AUX TAPE - OFF
TAPE RCDR FWD - OFF
POT H₂O HTR - ON
AUTO RCS JET SELECT (16) - ON

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

CONSUMABLE UPDATE
(Δ FROM NOMINAL)

GET:
RCS TOT _____
A _____
B _____
C _____
D _____
H₂ TOT _____
O₂ TOT _____

PTC

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

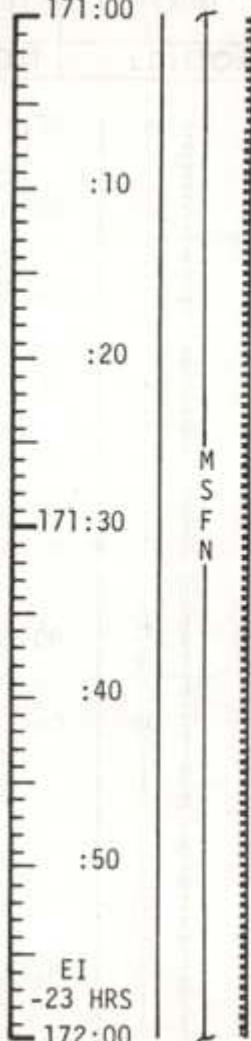
MCC-H

1230 EDT
171:00

FLIGHT PLAN

NOTES

UPDATE

MCC6 PAD DATA
ENTRY PAD
(ASSUMES
MCC6)

WIPE EXCESSIVE MOISTURE
FROM TUNNEL HATCH AREA
RECORD MCC6 AND PRELIMINARY ENTRY PAD DATA

IMU REALIGN - P52
(OPTION 3 - REFSMMAT)

P52 - PTC REFSMMAT

N71: ____
N05: ____.
N93:
X ____.
Y ____.
Z ____.
GET ____:

BURN STATUS REPORT

X	X		•
X	X		•
		TRIM	•
X	X	X	R
X	X	X	P
X	X	X	Y
			V _{gx}
			V _{gy}
			V _{gz}
			ΔV _c
X	X	X	FUEL
X	X	X	OX
X	X	X	UNBAL

ΔTIG

BT

V_{gx}

R

P

Y

V_{gy}V_{gz}ΔV_c

FUEL

OX

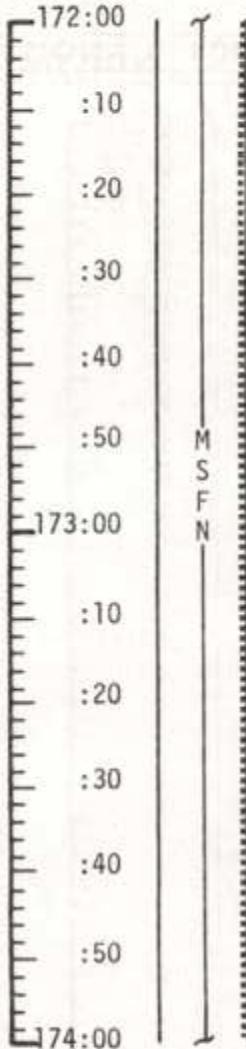
UNBAL

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

MCC-H

FLIGHT PLAN

1330 EDT



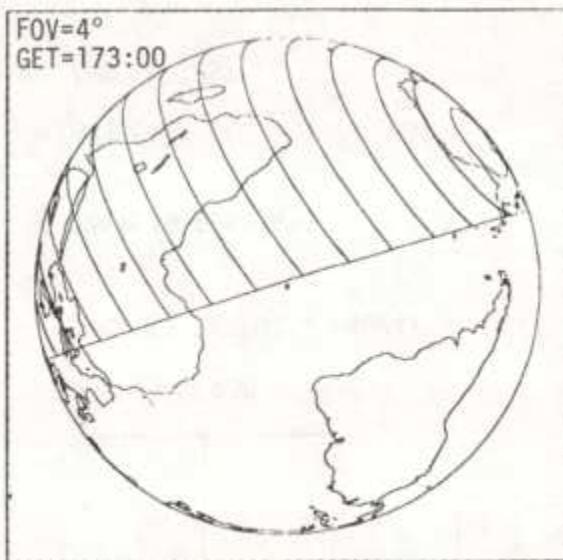
SM RCS MON CK
SPS MON CK
V66-TRANS CSM STATE VECTOR
TO LM SLOT
BURN STATUS REPORT
BATTERY CHARGE, BATTERY B

START PTC
P 270° Y 0

NOTES

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



PTC

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)

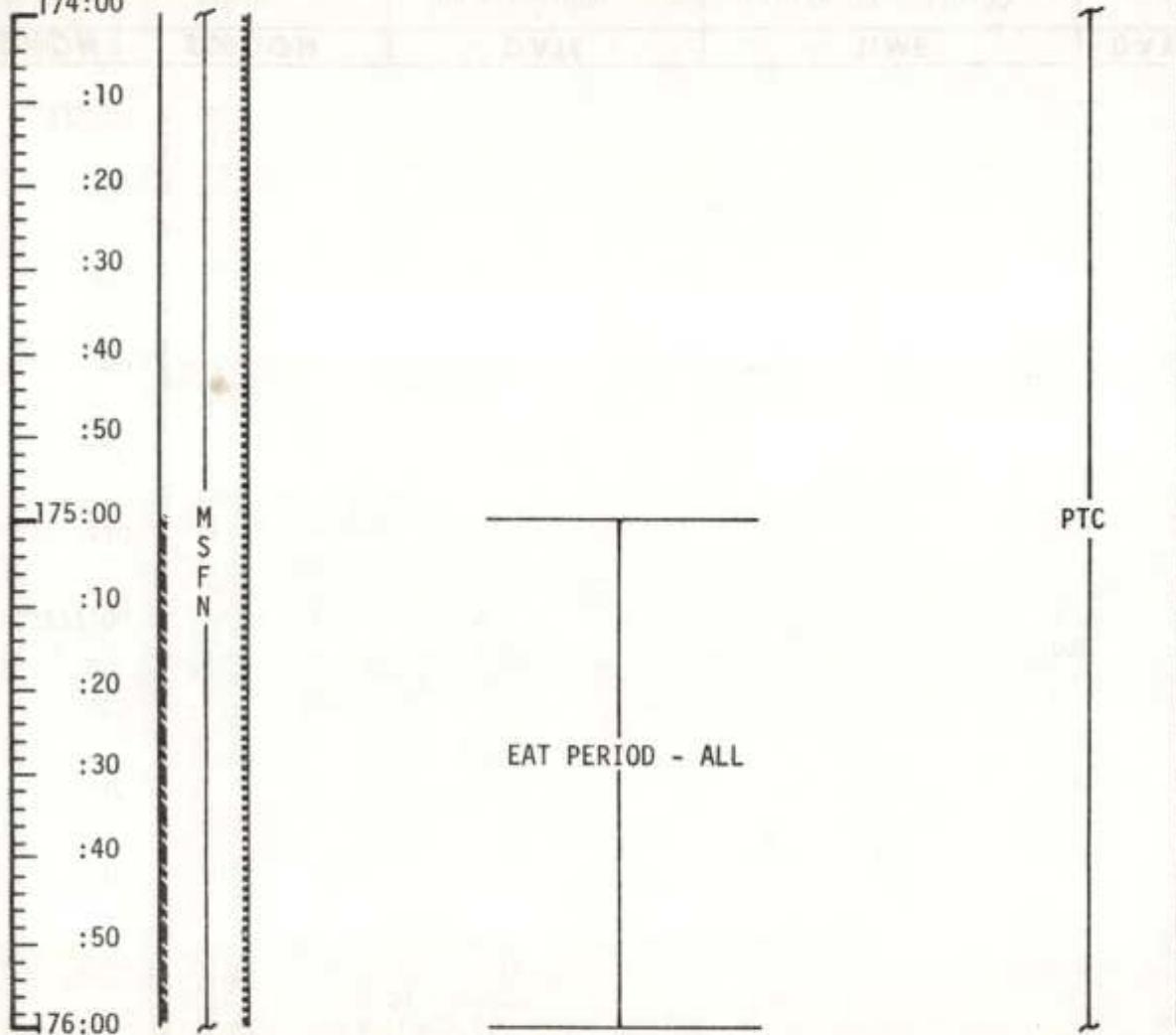
FLIGHT PLANNING BRANCH

MCC-H

1530 EDT
174:00

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

176:00

:10

:20

:30

:40

:50

177:00

:10

:20

:30

:40

:50

178:00

M
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 28 (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

180:00

M
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

:10

:20

:30

:40

:50

181:00

:10

:20

:30

:40

:50

182:00

WIPE EXCESSIVE MOISTURE
FROM TUNNEL HATCH AREAM
S
F
N O_2 FUEL CELL PURGE
 CO_2 FILTER CHANGE NO. 14
(16 INTO B, STORE 14 IN A4)

EAT PERIOD-ALL

PTC

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

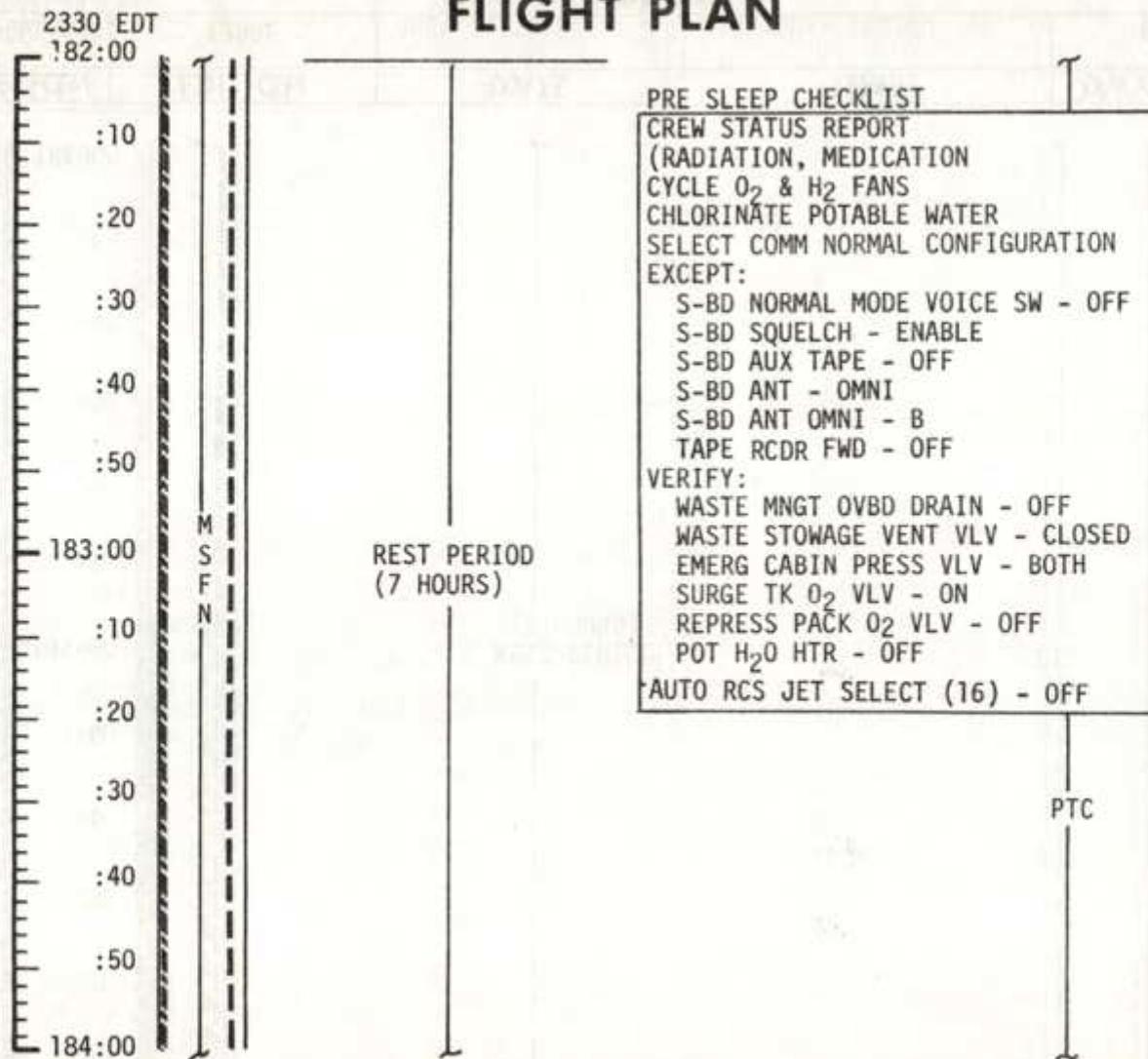
OR MNB

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

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

FLIGHT PLAN

NOTES

0130 EDT

184:00

:10

:20

:30

:40

:50

185:00

:10

:20

:30

:40

:50

186:00

M
S
F
NREST PERIOD
(7 HOURS)

PTC

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

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

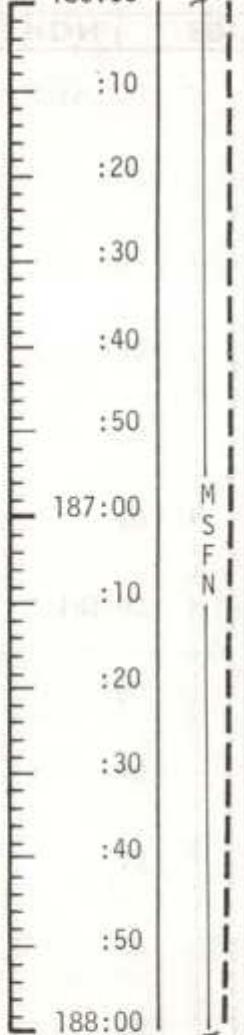
MSC Form 29 (May 69)

FLIGHT PLANNING BRANCH

MCC-H

FLIGHT PLAN

NOTES

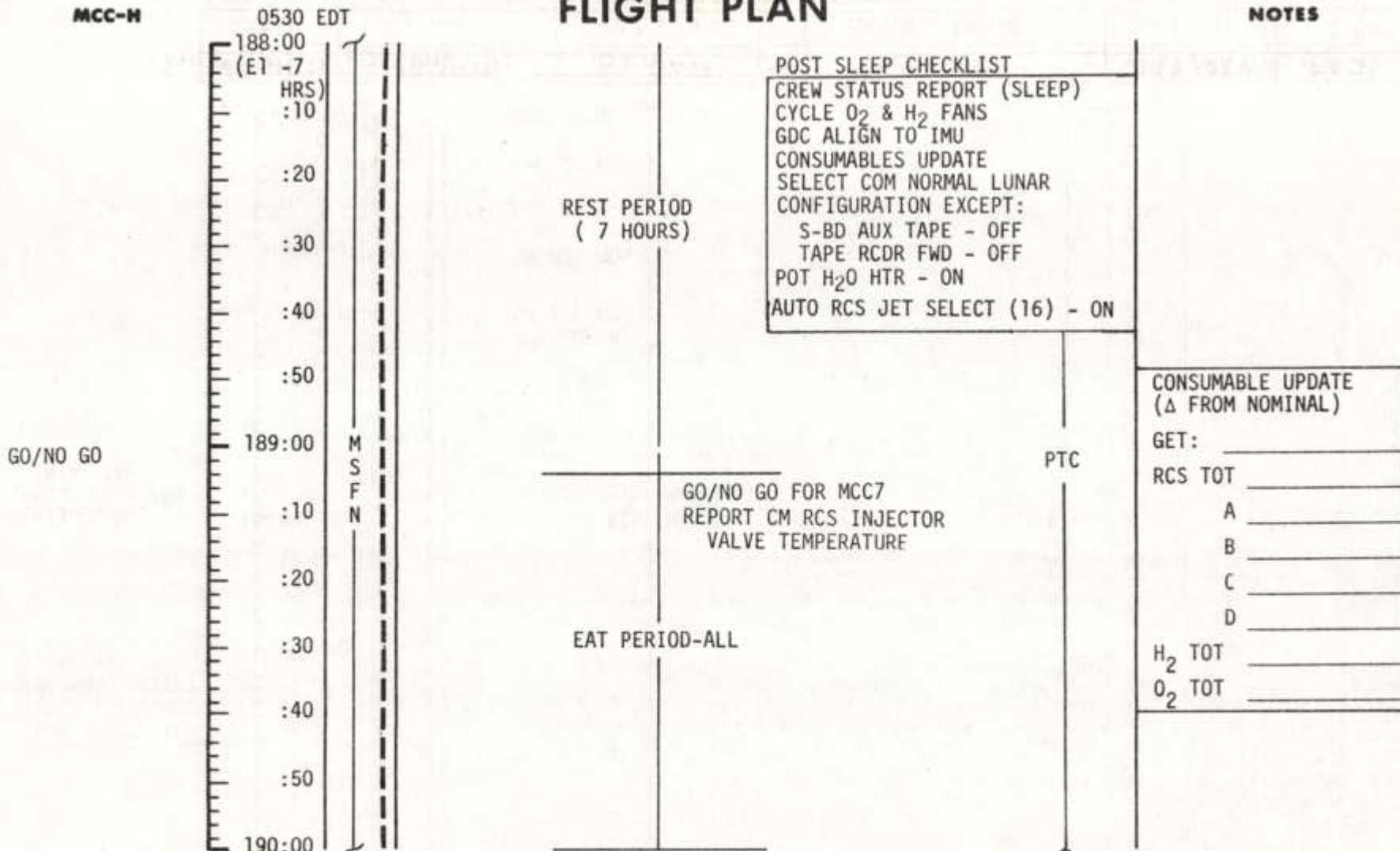
0330 EDT
186:00

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



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

MCC-H

0730 EDT

FLIGHT PLAN

NOTES

UPLINK CMC

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

190:00
(EI -5
HRS)

DON MAE WEST & FOOT RESTRAINTS

UPLINK CMC

MCC7 MNVR PAD
ENTRY PAD

190:30

M
S
F
N

RECORD MCC7 MNVR PAD & ENTRY PAD

PTC

:40

EPS CHECK

:50

SPS CHECK
CM RCS MON CK

SM RCS MON CK

C & W SYS CK

CMC SELF TEST

DSKY COND LT TEST

191:00

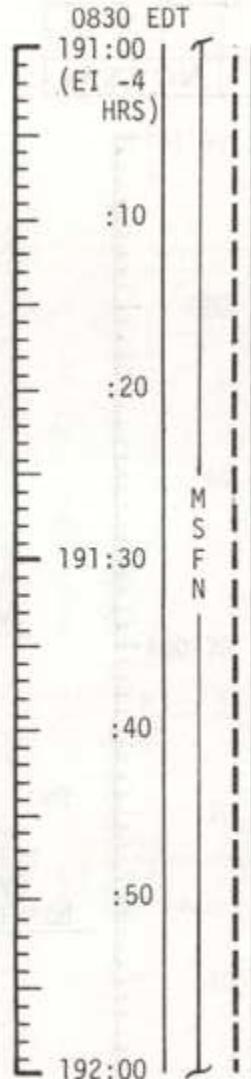
P23-NO COMM, (5 SETS)
TEI + 54:30 (190:00)
ALPHERATZ (01), ENH
MIRFAK (10), ENH
ALDEBARAN (11), ENH
CAPELLA (13), ENH
CAPELLA (13), ENH

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

MCC-H

FLIGHT PLAN

NOTES



IMU REALIGN - P52
OPTION 1 - PREFERRED

EXT ΔV - P30

SPS/RCS THRUST - P40/41

MNVR TO BURN ATT

SXT STAR CK

EMS ΔV TEST

SM RCS MON CK

GDC ALIGN TO IMU

P52 (ENTRY REFSMMAT)

N71: ____ , ____

N05: ____ , ____

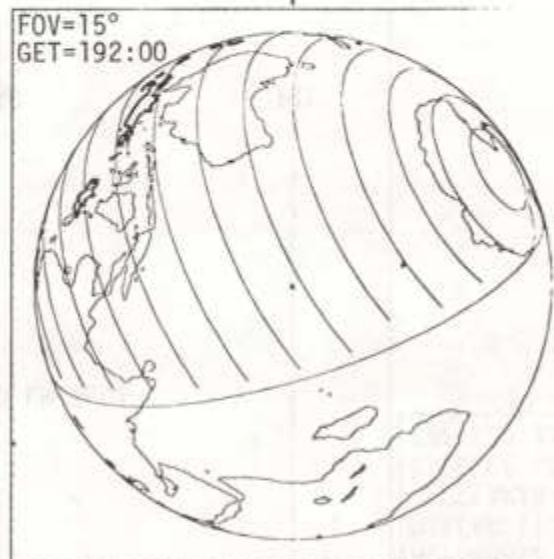
N93:

X: ____ , ____

Y: ____ , ____

Z: ____ , ____

GET: ____ : ____ : ____



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

MSC Form 29 (May 68)

FLIGHT PLANNING BRANCH

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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

192:00
(EI -3
HRS)

:10

:20

192:30

:40

:50

193:00

GO/NO GO

FLIGHT PLAN

NOTES

MCC7 ΔV=NOMINALLY ZERO

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

P23-NO COMM (3 SETS)
 TEI + 57:00 (192:30)
 MENKAR (07) ENH EFH
 CAPELLA (13) ENH
 CAPELLA (13) ENH

BURN STATUS REPORT

X X	□	•	ΔTIG
X X	•	•	BT
□	•	•	V _{gx}
TRIM			
X X X			R
X X X			P
X X X			Y
□	•	•	V _{gy}
□	•	•	V _{gz}
□	•	•	ΔV _c
X X	/		FUEL
X X X			OX
X X X			UNBAL

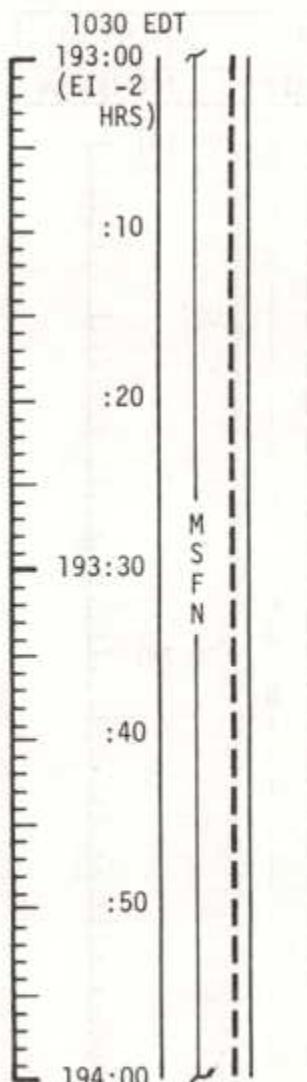
GO/NO GO FOR PYRO ARM SEQUENCE
 VHF ACTIVATION

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 ____ : ____ :

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

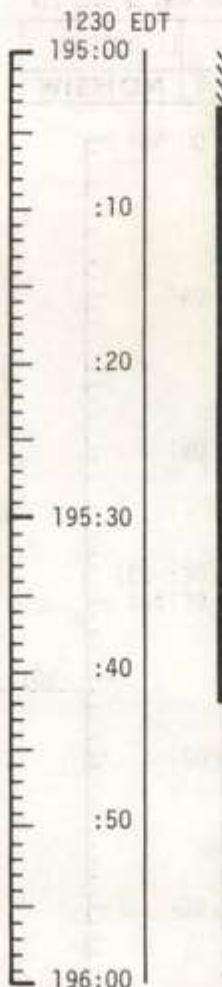
NOTES

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



TRAJECTORY EVENT	TIME FROM ENTRY INTERFACE MIN:SEC
400,000 FEET (GET 195:05:04)	00:00
ENTER S-BAND BLACKOUT	00:18
0.05G	00:28
KA - INITIATE CONSTANT DRAG	00:52
RDOT = -700 FPS	01:18
PEAK G (6.6)	01:22
SUBCIRCULAR VELOCITY	02:08
P64 to P67	02:08
EXIT S-BAND BLACKOUT	03:24
GUIDANCE TERMINATION	07:14
DROGUE DEPLOYMENT	08:12
MAIN DEPLOYMENT	09:00
SPLASHDOWN	13:55

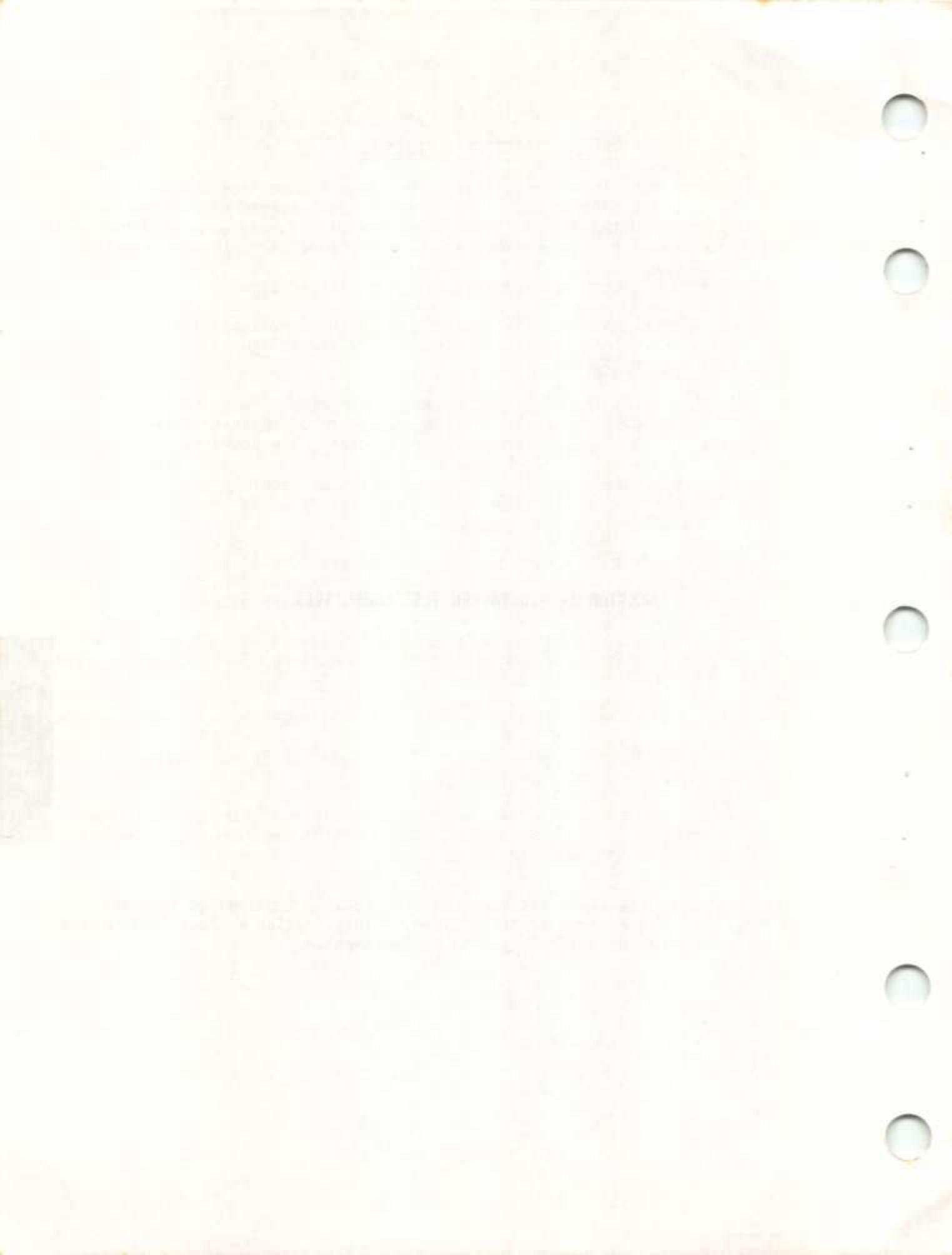
$\gamma = -6.50^\circ$, $L/D = 0.295$, $V = 36,195$, & $R = 1285$

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	Revision A	July 8, 1969	195:00 - 196:00	9/TEC	3-135

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FLIGHT PLANNING BRANCH

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 D-2 D-3 D-4	Landing Effects on LM LM Landing Gear Performance Under Landing Conditions Effects of Landing on LM Structure and Components Descent Engine Skirt Damage/Clearance After Landing Effects of RCS Plume Impingement on LM Structure & Components	LM Descent External LM Observ/Photo External LM Observ/Photo External LM Observ/Photo External LM Observ/Photo	4-6 4-15 4-15 4-15 4-15
E E-1 E-2 E-3	Lunar Surface Characteristics Data on Behavior/Characteristics of the Lunar Surface Lunar Soil Erosion from DPS Plume Impingement Effect of DPS Venting on the Lunar Surface	Surface Sample Collection Lunar Surface Observ/Photo Lunar Surface Observ/Photo Lunar Surface Observ/Photo	4-13 4-17 4-17 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	Landed LM Location	LM Descent	4-6
G-1	Determine Location of Landed LM from LM Data	Lunar Surface Navigation	4-8
G-2	Determine Location of Landed LM from CSM Data	Lunar Surface Navigation	4-8
G-3	Capability of Locating Landed LM in Real Time	LM Descent	4-6
		Lunar Surface Navigation	4-8
H	Lunar Environment Visibility		
H-1	Data on Landing Aids & Final Approach Visibility	LM Descent	4-6
H-2	Crew Performance of Visual Tasks on Lunar Surface	Lunar Surface Observ/Photo	4-17
I	Assessment of Contamination by Lunar Material		
I-1	Prevent Earth Contamination by Lunar Exposed Materials	Contamination Prevention	4-22
I-2	Minimize Crew/CM Contamination by Lunar Exposed Materials	Contamination Prevention	4-22
I-3	Lunar Sample for Quarantine Testing	Surface Sample Collection	4-13
J	Documented Sample Collection		
J-1	Obtain an Aseptic Sample of the Lunar Surface	Deleted	
J-2	Obtain a Core Sample of the Lunar Surface	Surface Sample Collection	4-13
J-3	Collect Lunar Geologic Samples	Surface Sample Collection	4-13
J-4	Collect a Lunar Environment Sample	Surface Sample Collection	4-13
J-5	Study and Describe Lunar Topography Features	Lunar Surface Observ/Photo	4-17
K	Lunar Surface Structure Photograph (Objective Deleted)	Deleted	

TABLE 4-2
TEST OBJECTIVE/MISSION ACTIVITY
CROSS REFERENCE

DTO/FTO NUMBER	TEST OBJECTIVE	MISSION ACTIVITY	SECTION PAGE NO.
L	Television Coverage		
L-1	TV Coverage of Astronaut Descending to the Lunar Surface	EVA Preparation and Egress	4-10
L-2	TV Coverage of External Landed LM	External LM Observ/Photo	4-15
L-3	TV Coverage of Lunar Surface Near LM	Lunar Surface Observ/Photo	4-17
L-4	TV Panoramic Coverage of Distant Terrain Features	Lunar Surface Navigation	4-8
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 Phtographs During EVA	Surface Sample Collections	4-13
S-031	Lunar Passive Seismology	External LM Observ/Photo	4-15
S-078	Laser Ranging Retro-Reflector	Lunar Surface Observ/Photo	4-17
S-080	Solar Wind Composition	Experiment Deployment/Conduct	4-20
		Experiment Deployment/Conduct	4-20
		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 O₂ flowrate, low vent flow, low feed water pressure or PGA pressure low remote control unit status indicators and audible warning tone come on. [C] (M)

- c. Record EMU radiation dosimeter readings just prior to the EVA. [C] (M)
 - d. Notify MSFN if noxious odors occur or any condensation on the visor assembly. [C] (HD)
 - e. Comment on the adequacy of procedures and difficulties encountered during donning of EMU equipment. [C] (HD)
 - f. Comment on time required and adequacy of the EMU checkout procedures. [C] (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 O₂ flowrate, low vent flow, low feed water pressure or PGA pressure low remote control unit status indicators and audible warning tone come on. [C] (M)
 - c. Provide data on the adequacy of hardware and procedures, and the time required to perform the ingress to the LM. [B] (M)
 - d. Comment on the adequacy of procedures and difficulties encountered during doffing of EMU equipment. [C] (HD)
 - e. Record quantity of water drained from PLSS at end of EVA period. [C] (M)
 - f. Record EMU radiation dosimeter readings after completion of the EVA. [C] (M)
 - g. Provide sequence camera coverage and TV camera coverage of a crew member ascending the LM ladder. [B] (M)

Contamination Prevention

A. Test Objectives

- I-1 Prevent Earth Contamination by Lunar Exposed Materials
- I-2 Minimize Crew/CM Contamination by Lunar Exposed Materials

B. Test Requirements

1. All contamination related operations from the initial astronaut egress to the lunar surface until postflight crew/cm quarantine will be completed per procedures contained in the documents listed below. [I]

C. Procedures/Checklist

1. Lunar Surface Operations Plan
2. EVA Procedures Document
3. Quarantine Procedures

D. Data Requirements

1. Flight Crew Reports/Logs/Photographs
 - a. Crew comments on the adequacy of Biological Isolation Garment, sample return containers, Mobile Quarantine Facility and related equipment and procedures used to prevent back contamination. [I] (M)
 - b. Photograph boots, clothing and equipment showing adhesion of particles. [I, M] (HD)
2. Ground Support
 - a. Deliver samples, CM and Mobile Quarantine Facility to the Lunar Receiving Laboratory. [I] (M)
 - b. Comment on ground procedures and hardware used for retrieval, biological isolation and CM transfer to the Lunar Receiving Laboratory. [I] (M)
 - c. Report on the existence of contamination of the crew on CM. [I] (M)

SECTION V - CONSUMABLES ANALYSIS



NOTE

Acknowledgement is made to the Consumables Analysis Section (CAS) of the Mission Planning and Analysis Division (MPAD) for their work in the preparation of the consumable analysis presented herein and to the Crew Systems Division for the PLSS Consumables.

CSM-107/LM5 PROPELLANT BUDGET

The results of the Propellant Budget Analysis are summarized in the following Tables and Figures:

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

TABLE 5-2

TIME (HR)	EVENT	SM-RCS PROPELLANT BUDGET		SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM-RCS LEFT (%)
		(a)	(b)			
*0	MISSION G	63457.	*0	1220.0	100.0	
*0	INITIALIZE PROP LOADING	63457.	*0	1220.0	100.0	
1.7	SM RCS CHECKOUT	63451.	5.8	1214.2	100.0	
3.2	TRANSPOSITION AND DOCKING +X 0.8 FPS	63445.	6.1	1208.1	99.0	
3.2	-X 0.3 FPS	63443.	2.4	1205.7	99.0	
3.2	PITCH TO ACQUIRE SIVB PITCH 180 DEG AT 1.5 DEG/SEC	63440.	2.3	1203.4	99.0	
3.2	ROLL CSM 60 DEG 2 DEG/SEC	63439.	1.3	1202.1	99.0	
3.2	NULL RELATIVE DEL V 0.5 FPS	63435.	4.0	1198.1	98.0	
3.5	INDEX AND DOCK	63409.	26.0	1172.1	96.0	
4.2	LM EJECTION -X 5 SEC 4 JET	96717.	7.4	1164.6	95.0	
4.5	SPS BURN TO EVADE SIVB ORIENT AT 0.2 DEG/SEC	96712.	4.4	1160.2	95.0	
4.5	ATTITUDE HOLD 0.5 DEG DB PGNCS	96712.	.8	1159.4	95.0	
4.5	START TRANSIENT CONTROL	96710.	1.3	1158.1	95.0	
4.5	SPS BURN BUILD UP	96707.	*0	1158.1	95.0	
4.5	STEADY STATE BURN	96508.	*3	1157.8	95.0	

(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 (%)
4.5	TAILOFF	96467.	.7	1157.4	95.
4.5	DAMP SHUTDOWN TRANSIENT	96466.	1.1	1156.1	95.
5.5	PS2 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	PS2 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 0.2 DEG/SEC	96355.	4.1	1124.3	92.
12.5	ATTITUDE HOLD 0.5 DEG DB PGNCS	96354.	.8	1123.5	92.
12.5	ROLL 0.3 DEG/SEC	96354.	.4	1123.1	92.
24.2	TERMINATE PTC DAMP RATES	96349.	4.4	1118.7	92.
24.3	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 TO BURN ATT	96336.	4.4	1105.4	91.
26.6	ATTITUDE HOLD 0.5 DEG DB PGNCS	96335.	.8	1104.7	91.
26.7	DELTA VEL = NUMINALLY ZERO	96335.	.0	1104.7	91.
27.0	ORIENT FOR PTC 3AXIS 0.2 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	MIDCOURSE CORRECTION NO 3 MNVR TO BURN ATT	96321.	4.4	1090.3	89.
53.6	ATTITUDE HOLD 0.5 DEG DB PGNCS	96320.	.8	1089.5	89.
53.6	START TRANSIENT CONTROL	96319.	1.3	1088.2	89.
53.6	SPS BURN BUILD UP	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 AT (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 = NOM ZERO	96212.	.0	1059.9	87.
72.7	PSZ IMU ALIGN	96212.	.2	1059.7	87.
74.0	ORIENT AND SAT 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 Z 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 LOG SITE OBS ATT	71265.	3.5	1006.3	82%
82.3	LOG 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	REORIENT	71261.	3.5	1002.3	82.
82.3	REACQUIRE MSFN	71261.	.2	1002.1	82.
84.2	MANEUVER TO SLEEP ATTITUDE 3 AXIS 0.2 DEG/SEC	71258.	3.5	998.6	82.
94.4	DAMP RATES	71254.	3.5	995.0	82.
94.5	REACQUIRE MSFN	71254.	.1	994.9	82.
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 LOG SITE OBS ATT	71241.	3.5	981.5	80.
98.5	LOG 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	70.
100.0	ORIENT TO UNDOCKING ATTITUDE ROLL 0.2 DEG/SEC	71212.	.2	953.6	70.
100.2	CSM ACTIVE UNDOCK SEP AND NULL VEL 0.5 FPS	37893.	4.5	949.0	70.

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 (S)
400.2	FORMATION FLYING	37883.	10.0	939.0	77.
100.2	REACQUIRE MSFN	37883.	.1	938.9	77.
100.6	ORIENT FOR SEP BURN	37880.	3.1	935.8	77.
100.7	RCS SEPARATION BURN 2.5 FPS	37868.	11.2	924.6	76.
400.7	REV 13 ATTITUDE HOLD	37865.	3.0	921.6	76.
101.5	MANEUVER TO SXT TRACKING	37862.	3.1	918.6	75.
102.6	MANEUVER TO SXT TRACKING	37859.	3.1	915.5	75.
104.4	REACQUIRE MSFN ROLL 0.5 DEG/SEC	37859.	.3	915.3	75.
104.5	MANEUVER TO SXT TRACKING	37856.	3.1	912.2	75.
104.6	REV 14 ATTITUDE HOLD	37853.	3.0	909.2	75.
104.6	MNVR TO LDG SITE OBS ATT	37850.	3.1	906.1	74.
104.6	LDG SITE OBS	37850.	.4	905.7	74.
104.7	TRACK LM	37846.	3.1	902.6	74.
104.9	REACQUIRE MSFN ROLL 0.5 DEG/SEC	37846.	.3	902.3	74.
105.0	REV 15 ATTITUDE HOLD	37843.	3.0	899.3	74.

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	SEATANT TRACKING	37695+	1.3	862+2	71+
120.0	REACQUIRE MSFN	37695+	.1	862+1	71+
120.2	REV 23 ATTITUDE HOLD	37692+	3.0	859+1	70+
122.2	REV 24 ATTITUDE HOLD NARROW DEADBAND	37687+	5.2	853+9	70+
124.5	SUPPORT LM LIFT OFF	37669+	18+0	835+9	69+
124.6	MANEUVER TO TRACK LM POST LIFTOFF	37666+	3.1	832+8	68+
125.5	MANEUVER TO SUPPORT LM CSI BURN	37663+	3.1	829+7	68+
125.6	MANEUVER TO TRACK LM POST CSI	37660+	3.1	826+6	68+
125.6	REV 25 ATTITUDE HOLD NARROW DEADBAND	37654+	5.2	821+4	67+
126.5	MANEUVER TO SUPPORT LM CDH BURN	37651+	3.0	818+4	67+
126.6	MANEUVER TO TRACK LM POST CDH	37648+	3.1	815+3	67+
126.6	RNDZ NAV	37645+	3.1	812+2	67+
126.6	REINITIATE RNDZ NAV	37642+	3.1	809+1	66+
127.0	MANEUVER TO SUPPORT LM TPI BURN	37639+	3.1	806+1	66+

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	799.9	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 BORESIGHT	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 (HR)	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	687.0	56+
135.5	STEADY STATE SPS BURN	27470.	.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 1HR	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 (HRS)	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	RULL 0.3 DEG/SEC	27406.	.1	655.7	54.
190.0	TERMINATE PTC	27404.	1.3	654.4	54.
191.2	P52 IMU ALIGN	27404.	.6	653.8	54.
192.0	MIDCOURSE CORRECTION NO 7 MNVR TO BURN ATT	27402.	1.3	652.5	53.
192.0	ATTITUDE HOLD 0.5 DEG DB PGNCS	27402.	.8	651.7	53.
192.0	DEL VEL = NOM ZERO	27402.	.0	651.7	53.
192.0	STAR CHECK MIN IMPULSE	27401.	.4	651.3	53.
193.0	MANEUVER TO REENTRY ATTITUDE	27399.	2.6	648.7	53.
193.0	ATTITUDE HOLD 0.5 DEG DB PGNCS	27390.	8.6	640.1	52.
194.8	MANEUVER TO SEP ATTITUDE	27387.	2.6	637.4	52.
194.8	CM/SM SEPARATION DELTA VEL=3 FPS	15001.	7.9	629.6	52.

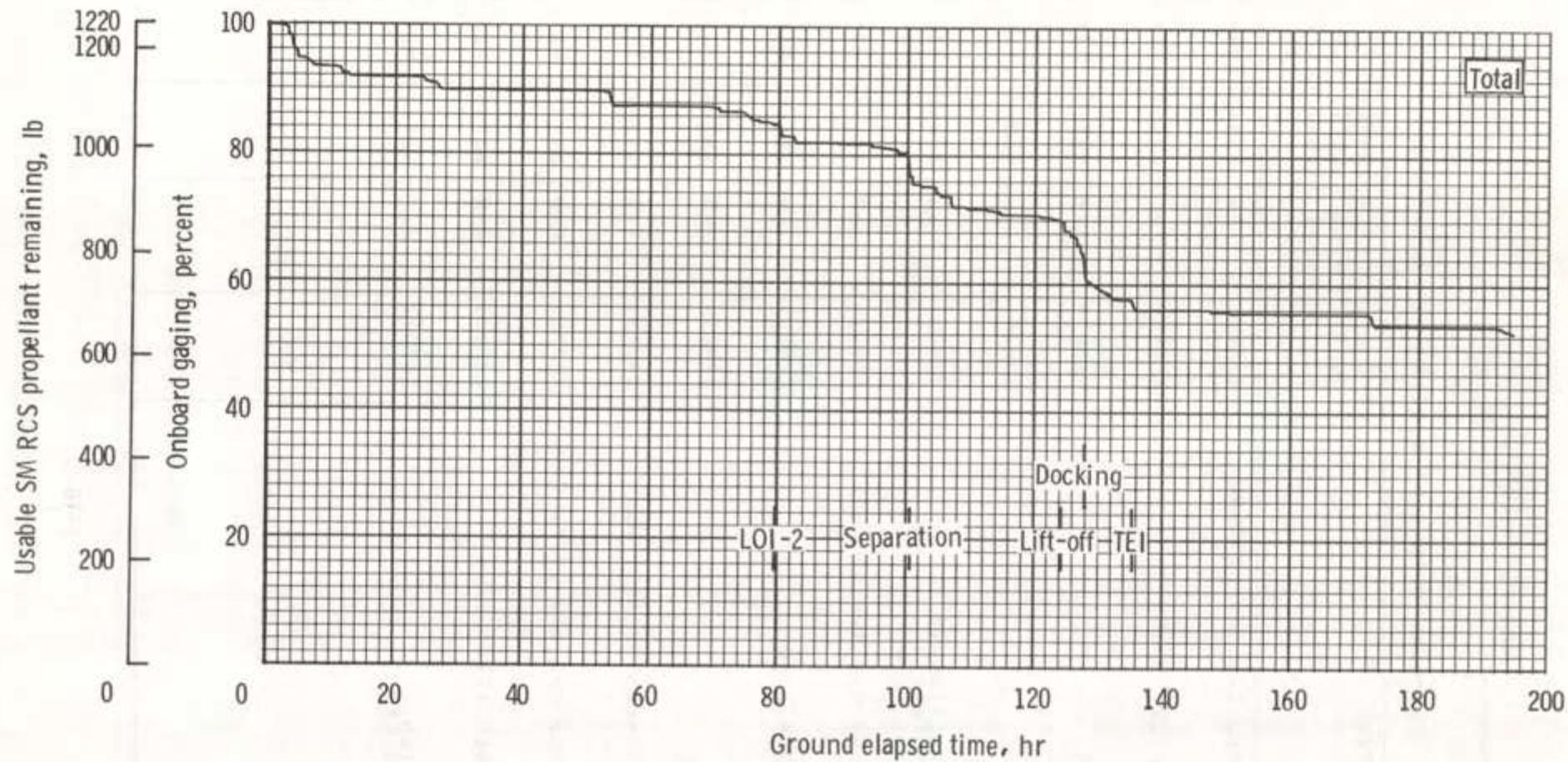


FIGURE 5-1
SM RCS propellant profile - total.

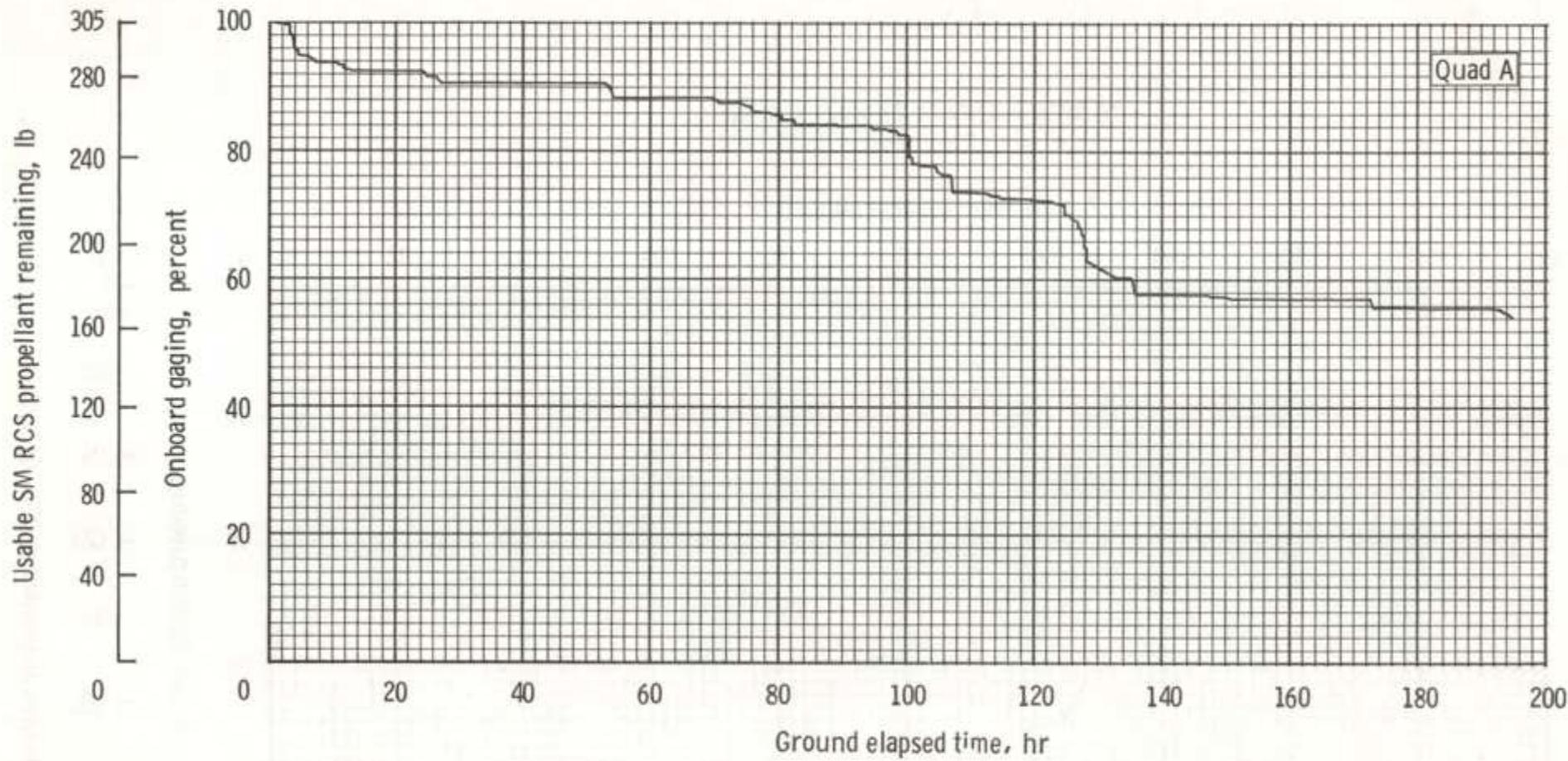


FIGURE 5-2
SM RCS propellant profile - quad A.

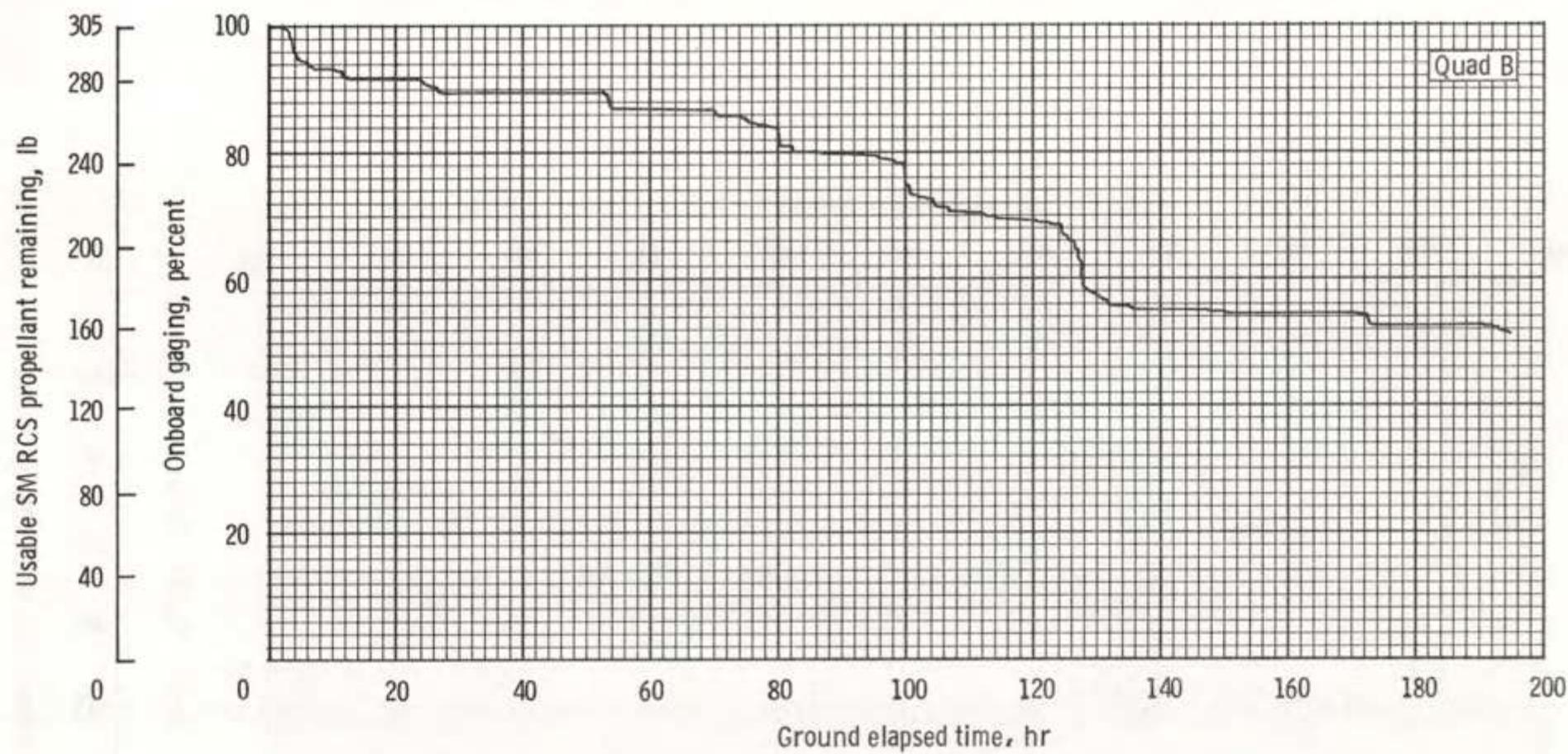


FIGURE 5-3
SM RCS propellant profile - quad B.

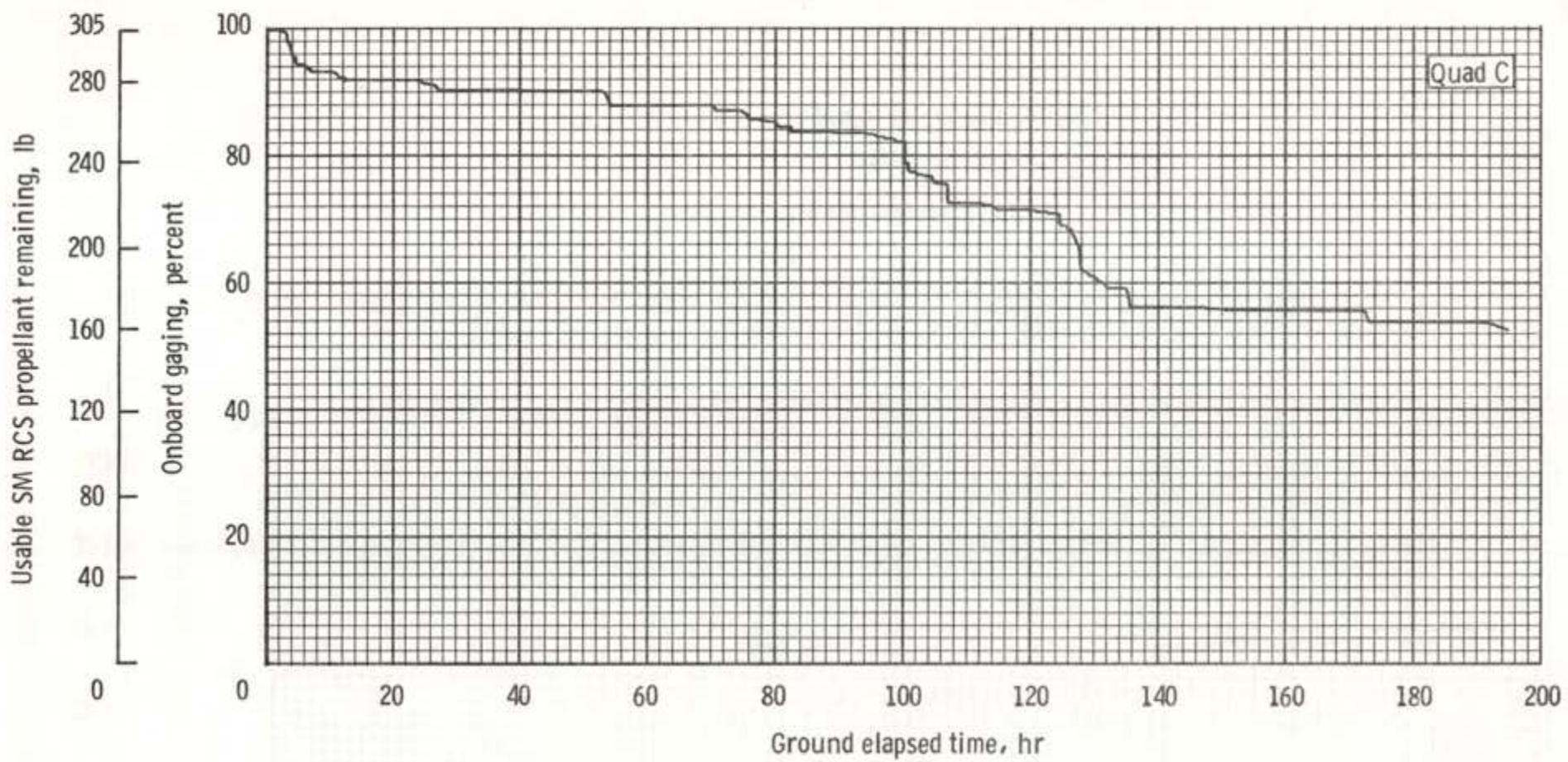


FIGURE 5-4
SM RCS propellant profile - quad C.

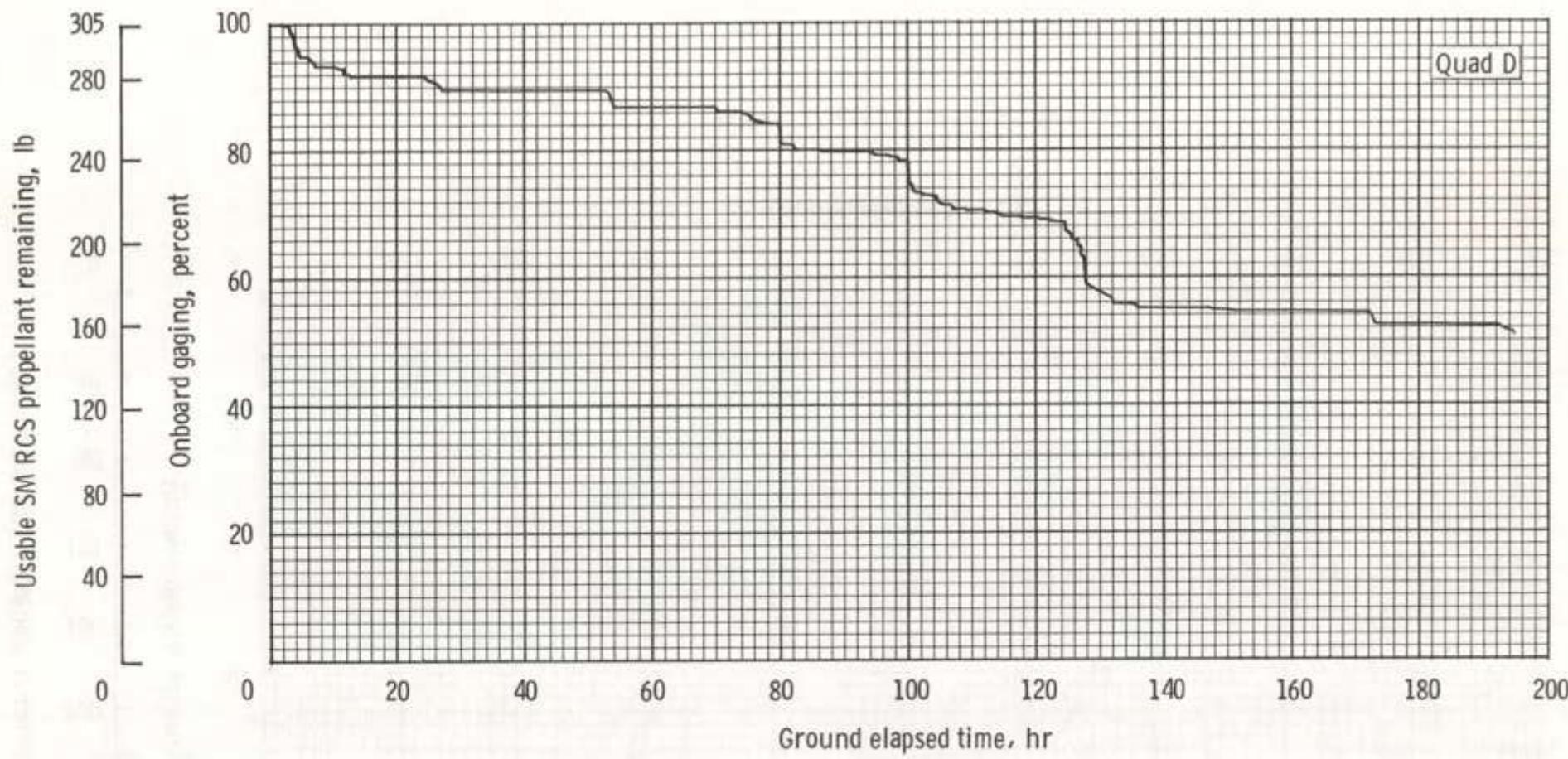


FIGURE 5-5
SM RCS propellant profile - quad D.

TABLE 5-3
CM RCS Propellant Summary

Item	Propellant required, lb.	Propellant remaining, lb.
Loaded	--	245.0
Trapped	36.4	208.6
Available for mission planning	--	208.6
Nominal usage	39.3	169.3
Nominal remaining	--	169.3

SERVICE PROPULSION SYSTEM

SERVICE PROPULSION SYSTEM (SPS). - The budget presented in table 5-4 is for a July 16 launch, 72 degree launch azimuth, first opportunity injection, 59.5 hour lunar parking orbit, and fast earth return. The assumptions used in preparing this budget are presented in table 5-5. ΔV requirements were coordinated with IMAB 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 ΔV had already been used (e.g., for LM rescue). Table 5-4 shows 3906 lbs of propellant remaining nominally and a total propellant margin (accounting both for the flexibility ΔV and the fast return) of 1268 lb.

TABLE 5-4 - APOLLO 11 SPS PROPELLANT SUMMARY

ITEM	PROPELLANT REQUIRED, LB	PROPELLANT REMAINING, LB
Loaded ^a	--	40803.0
Trapped and unavailable	441.4	40361.6
Outage	59.5	40302.1
Unbalance meter	100.0	40202.1
Available for ΔV	--	40202.1
Required for ΔV		
TLMC (120 fps) ^b	1166.4	39035.7
LOI-1 (2924 fps, 5 min. 59 sec.)	23862.4	15175.3
LOI-2 (157.8 fps, 16.4 sec.)	1115.4	14057.9
LOPC (16.6 fps, .9 sec.)	73.8	13984.1
TEI (3292.7 fps, 149 sec.)	10077.8	3906.3
Nominal remaining	--	3906.3
Mission flexibility (900 fps)	2212.4	1693.9
Dispersions (-3 σ)	426.0	1267.9
Propellant margin	--	1267.9

^a 15712.0 lb of fuel and 25091.0 lb of oxidizer; this is loaded on CSM-107.

^b Includes 19.7 fps for evasive maneuver

TABLE 5-5 - ASSUMPTIONS FOR THE APOLLO 11 SPS PROPELLANT BUDGET

1. There is a non-propulsive propellant loss of 14.4 lb for each engine start. LM rescue assumed three engine starts.
2. A mission flexibility ΔV of 900 fps has been included in the SPS budget to provide the capability to perform a worst case LM rescue, or to handle several other contingencies (such as loss of PGNCS), or to perform a quicker earth return.

3. Spacecraft weight:

CM	12	280.0	lb	
SM	10	551.3	lb	
SLA Ring		98.0	lb	
Tanked SPS	40	600.7	lb	
LM (unmanned)	33	278.3	lb	
 Total		96	808.3	lb

4. Lunar Orbit Activity

Total weight transfer (CSM to LM) = 436.7 lb

Total weight transfer (LM to CSM) = 284.0 lb

5. SM RCS, EPS, and ECS weight losses:

<u>Mission Period</u>	<u>Incremental Weight Loss, lb</u>
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 $2.0^{\circ}/sec.$.
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	^a S/C WT (LBS)	LM RCS USED	LM ^b RCS LEFT (LBS)	LM ^b 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

^a These weights were used for analysis only and do not reflect the actual weight after consumables loading.^b RCS propellant remaining of total loaded

TABLE 5-7 (CONT'D)

LM - RCS PROPELLANT BUDGET				PAGE 2	
TIME HRS M	EVENT TITLE	S/C WT (LBS)	LM RCS USED (LBS)	LM RCS LEFT (LBS)	LM 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 R CS/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 +2	5923.	33.6	480.6	75.9
125 26	MAINTAIN LOS	5920.	3.3	477.2	75.4
125 44	MNVR TO PLANE CHANGE ATTITUDE	5919.	.4	476.8	75.3

^a These weights were used for analysis only and do not reflect the actual weight after consumables loading.

^b RCS propellant remaining of total loaded

TABLE 5-7 (CONT'D)

LM - RCS PROPELLANT BUDGET				PAGE 3	
TIME HRS	EVENT TITLE	S/C WT ^a (LBS)	LM RCS USED	LM ^b RCS LEFT (LBS)	LM ^b 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	RR 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	CDH RCS BURN	5906.	4.0	463.7	73.3
126 19	MAINTAIN LOS	5902.	4.0	459.7	72.6
126 53	ATTITUDE HOLD	5901.	1.3	458.4	72.4
126 58	RCS TPI BURN	5884.	17.0	441.4	69.7
126 58	MAINTAIN LOS	5883.	1.3	440.1	69.5
127 36	MCC AND BRAKING	5849.	33.9	406.3	64.2
127 36	ATTITUDE AND LOS CONTROL	5833.	16.0	390.3	61.7
128 00	LM CONTROL CSM ACTIVE DOCKING	5823.	10.0	380.3	60.1

^a These weights were used for analysis only and do not reflect the actual weight after consumables loading.

^b RCS propellant remaining of total loaded

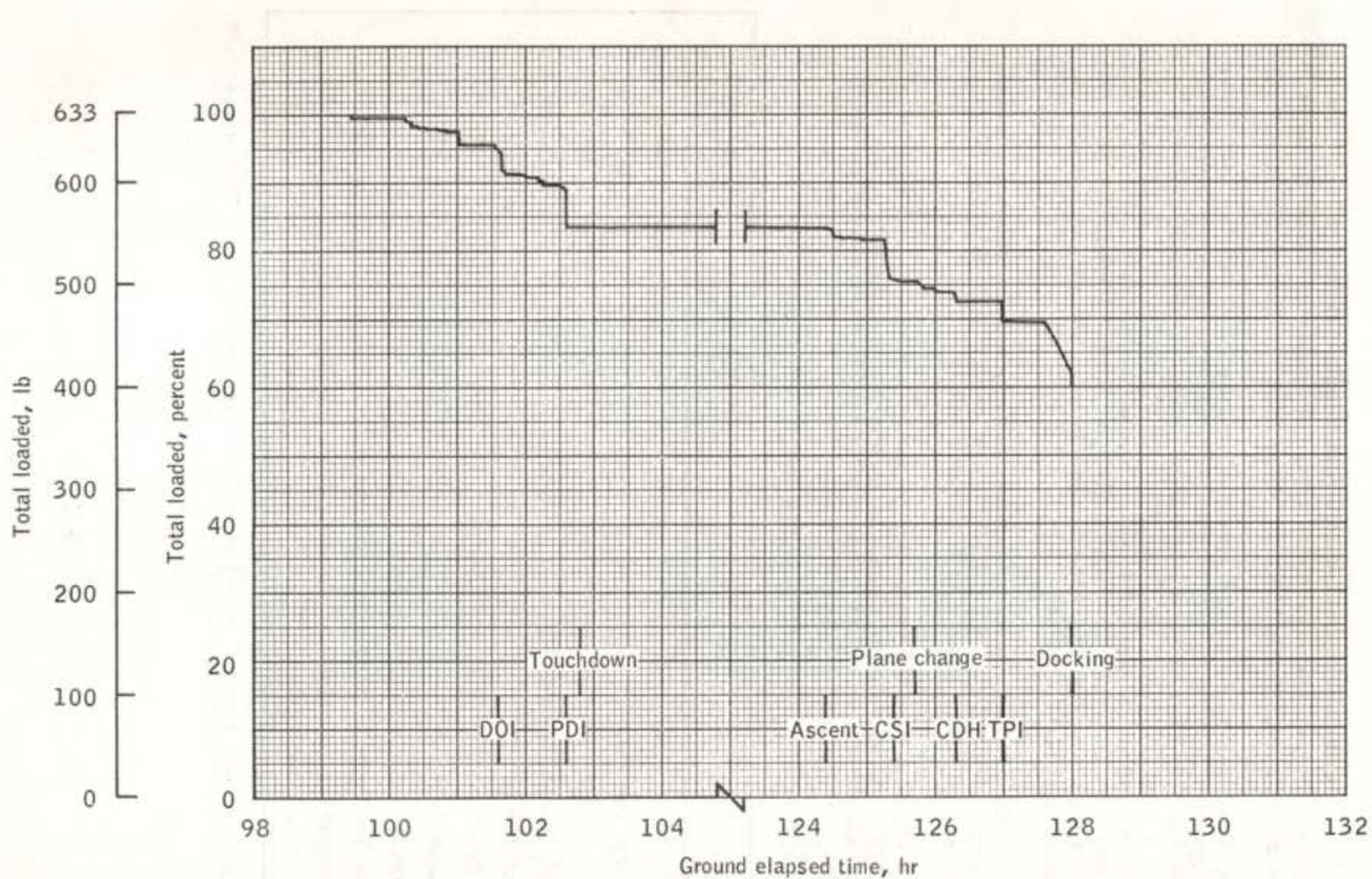


Figure 5-6.- LM RCS propellant profile.

DESCENT PROPULSION SYSTEM PROPELLANT BUDGET

Descent Propulsion Subsystem (DPS) - The DPS budget is shown in table 5-8 and the ground rules and assumptions in table 5-9.

Previously, the uncertainty in the low-level sensor (68.7 lb) has been shown as a contingency allowance. This is now included as part of the unusables. Also, there has previously been a contingency allowance for manual hover to allow for 2 minutes of burn time from 500 feet to touchdown. The present budget shows a nominal ΔV which includes a manual allowance of 477 fps (90 sec) from 500 feet to touchdown. Any additional hover time will be used from the propellant margin (unassigned capability). The rate of use for hover is approximately 9.1 lb/sec.

Propellant loads are those actually loaded on LM-5, and trapped and residual propellants are from Volume III, SODB. Engine performance data and ΔV requirements have been coordinated with LAB in MPAD.

Three sigma dispersions represent total propellant cost due to 3σ uncertainties in propellant loading, trapped, I_{sp}, ΔV , separation weight, non- ΔV consumables weight, and mixture ratio. There is a total propellant margin of 669 lb or approximately 73 seconds of hover time.

TABLE 5-8 - APOLLO 11 DPS PROPELLANT SUMMARY

ITEM	PROPELLANT REQUIRED, LB	PROPELLANT REMAINING, LB
Loaded ^a	--	18184.2
Trapped and unavailable	223.5	17960.7
Outage	14.0	17946.7
Low-Level Sensor Uncertainty	68.7	17878.0
Available for ΔV	--	17878.0
Nominal Required for ΔV of 6728.6 fps	16799.7	1078.3
Dispersions (- 3σ)	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

^a 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 ± 3.54 seconds
2. LM separation weight = 33746. lb
3. Mixture ratio = 1.596 ± 0.0108
4. Nominal ΔV = 6728.6 ± 96 fps
5. Non- ΔV consumables of 47.4 lb from separation to DOI and 106.1 lb from DOI to touchdown

ASCENT PROPULSION SYSTEM PROPELLANT BUDGET

Ascent Propulsion Subsystem (APS) - Tables 5-10 and 5-11 present the ascent propellant budget for the current mission. Propellant loads are those actually on LM-5. Mission ΔV was coordinated with LAB in MPAD. The budget shown in table 5-10 accounts for an engine valve-pair malfunction, a PGNCS to AGS 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 ^a	--	5238.4
Trapped and Unavailable	48.9	5189.5
Outage	17.5	5172.0
Available for ΔV	--	5172.0
Nominal Required for ΔV of 6072.5 fps	4965.8	206.2
Dispersions (-3 σ)	57.8	148.4
Contingencies		
Engine Valve-pair Malfunction ($\Delta MR=+0.016$)	19.6	128.8
PGNCS to AGS Switchover (40 fps)	23.8	105.0
Touchdown Abort ($\Delta W=+99.9$ lb, $\Delta \Delta V=-15$ fps)	36.8	68.2
Margin (6 seconds)	--	68.2

^a Includes 2019.9 lb fuel and 3218.5 lb oxidizer; this is loaded on the LM-5 spacecraft.

TABLE 5-11 - ASSUMPTIONS FOR THE APOLLO 11 APS PROPELLANT BUDGET

- | | |
|----|---|
| 1. | $I_{sp} = 308.97 \pm 3.553$ seconds |
| 2. | Mixture ratio = 1.602 ± 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 O₂ PROFILE

FIGURE 5-8 CSM H₂ PROFILE

FIGURE 5-9 CSM POWER PROFILE

FIGURE 5-10 CSM BUS VOLTAGE VS TIME

FIGURE 5-11 LM DESCENT POWER PROFILE

FIGURE 5-12 LM ASCENT POWER PROFILE

FIGURE 5-13 LM TOTAL CURRENT PROFILE

FIGURE 5-14 LM DESCENT O₂ PROFILE

FIGURE 5-15 LM ASCENT O₂ PROFILE

FIGURE 5-16 LM DESCENT H₂O PROFILE

FIGURE 5-17 LM ASCENT H₂O PROFILE

CSM EPS BUDGET

ASSUMPTIONS AND GROUND RULES

1. The system was assumed to operate with three fuel cells and two inverters.
2. Fuel cell purging is included in the EPS requirements.
3. 100% fill for both H_2 and O_2 .
4. Three entry and postlanding batteries were considered available to supply the total spacecraft power required for entry, parachute descent, and postlanding time. Each battery was assumed to have a 40 A-h capacity until splashdown, at which time the capacity was uprated to 45 A-h.
5. Two batteries were considered to be in parallel with the fuel cells during ascent and for each SPS maneuver.
6. No cryogenic venting was assumed in flight.
7. The EPS hydrogen consumption rate (lb/hr) = $0.00257 \times I_{fc}$
8. The EPS oxygen consumption rate (lb/hr) = $7.936 \times \dot{H}_2$
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 ¹		
1.	Inline HTR + Pressure Relief (T-28 to T-3 (Incl 12.5 hr hold))	1.61	18.60
2.	Power Production (plus ECS O_2) (T-3 to liftoff)	<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

¹ KSC Supplied Data

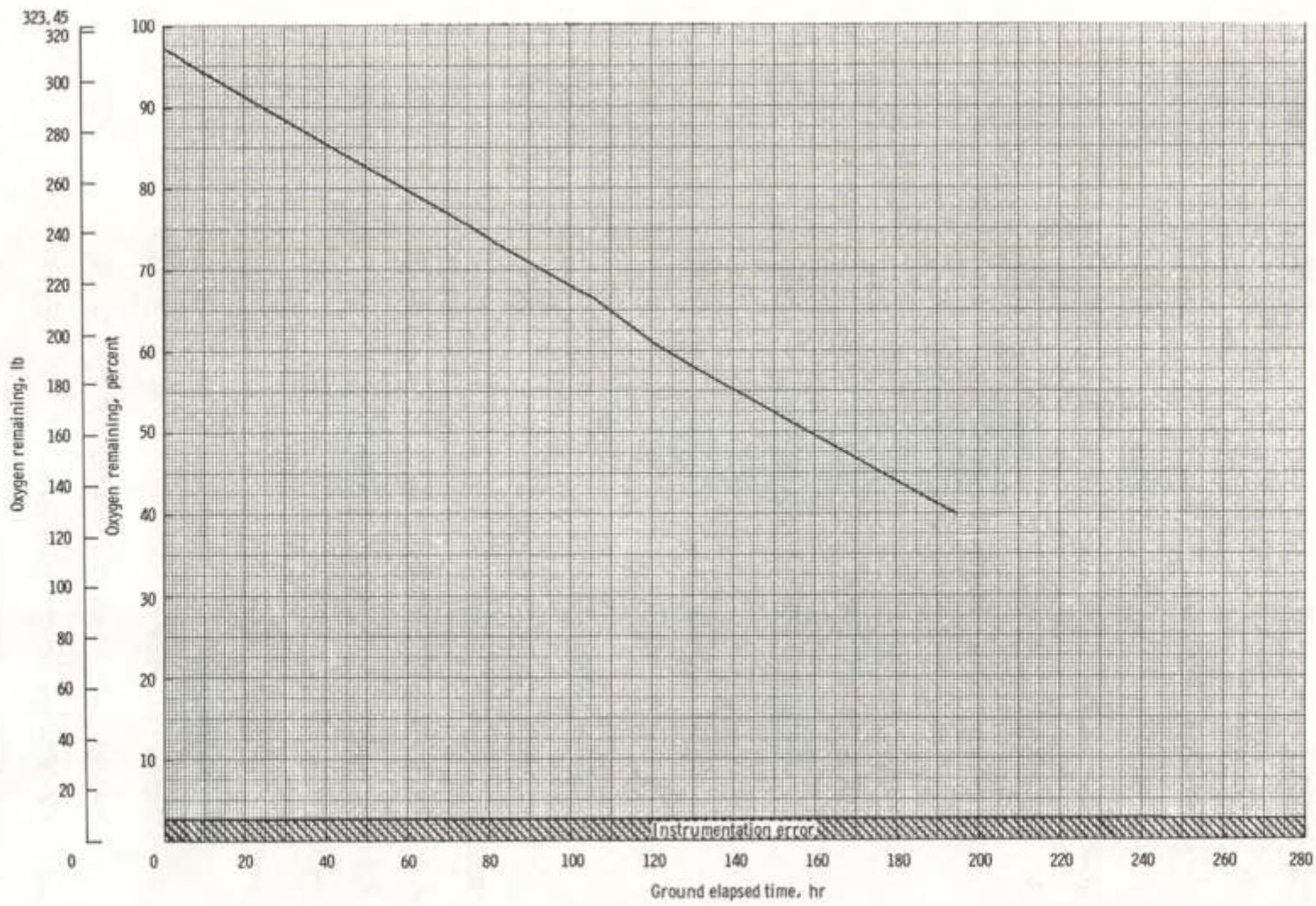


Figure 5-7. - Oxygen remaining for mission for one tank versus time.

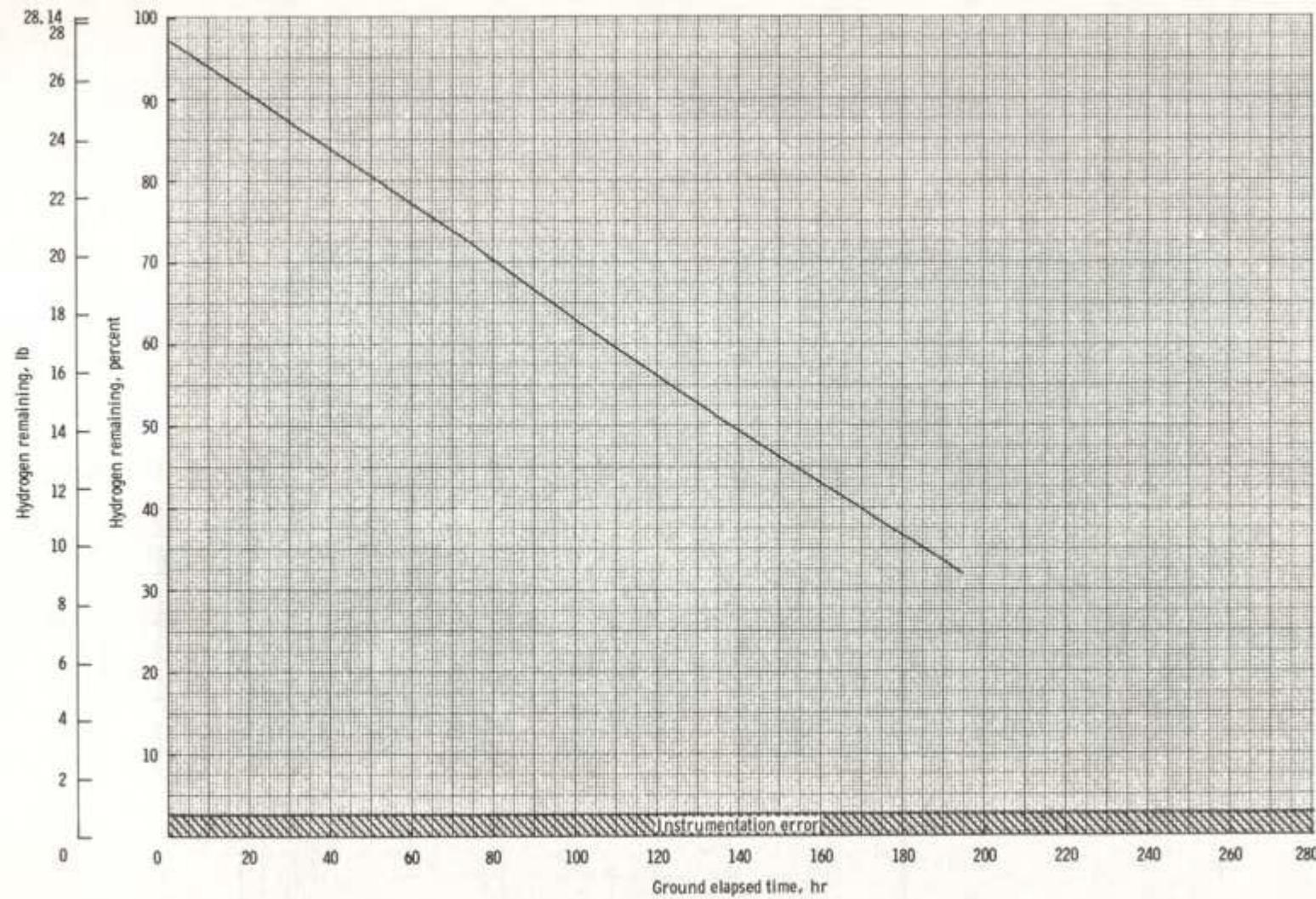


Figure 5-8.- Hydrogen remaining for mission for one tank versus time.

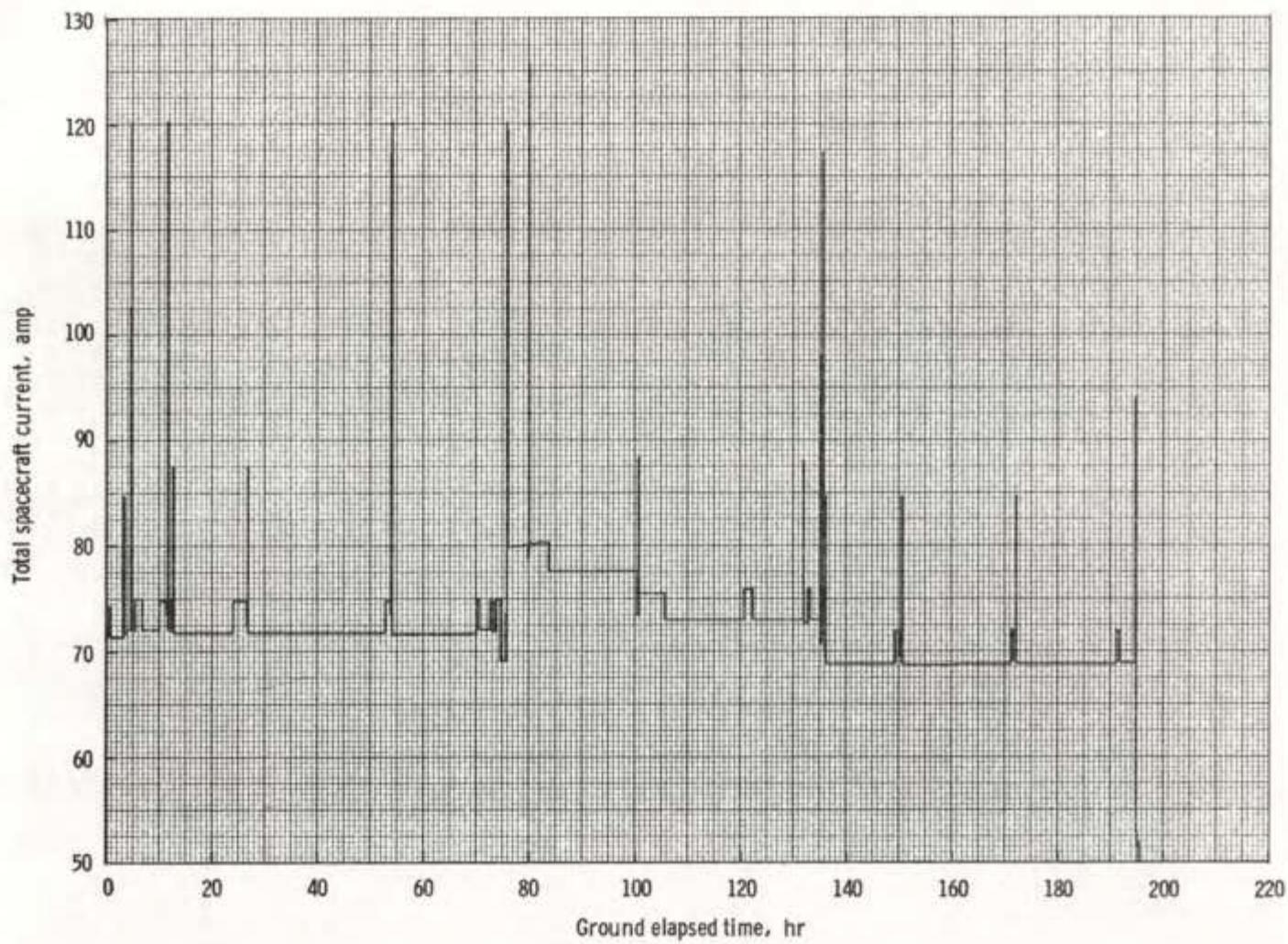


Figure 5-9 - CSM total spacecraft current profile.

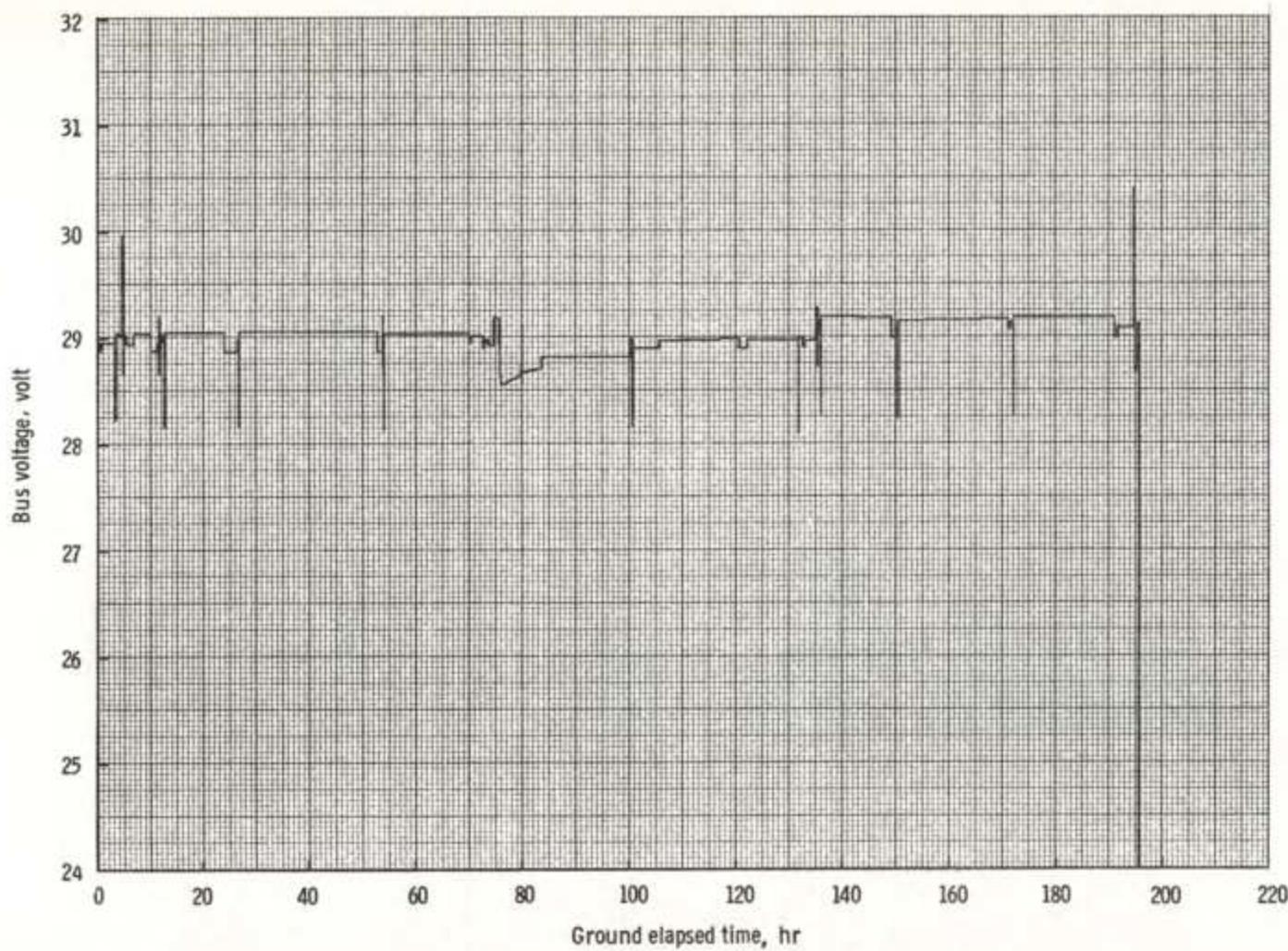


Figure 5-10. - CSM bus voltage versus time.

LM EPS ANALYSIS

GROUND RULES AND ASSUMPTIONS

1. The descent stage batteries go on the line 30 minutes prior to earth liftoff.
2. A 3.8 hour checkout was assumed for lunar orbit.
3. Ascent and descent batteries were paralleled for the powered descent burn and prior to liftoff from the lunar surface.
4. The S-band equipment was assumed on 100 percent from initial activation in lunar orbit until completion of the mission.
5. The rendezvous radar electronics was assumed to be operational for the period of time dictated by the current G Mission flight plan.
6. The primary navigation and guidance subsystem (PGNCS) was left in the operate mode for the entire lunar stay.
7. The forward window heaters were left off for the entire mission.

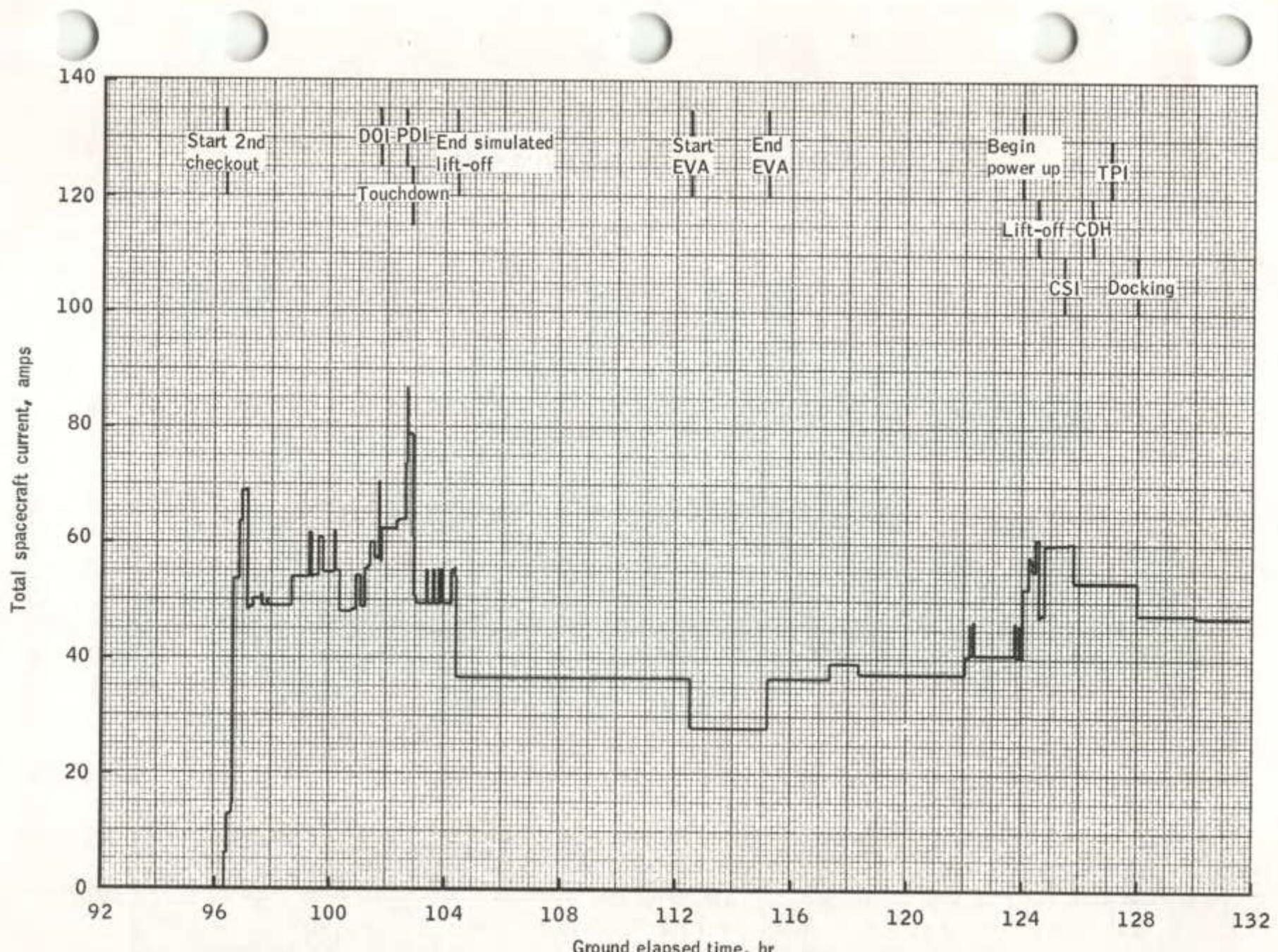


Figure 5-11.- LM-5 total spacecraft current.

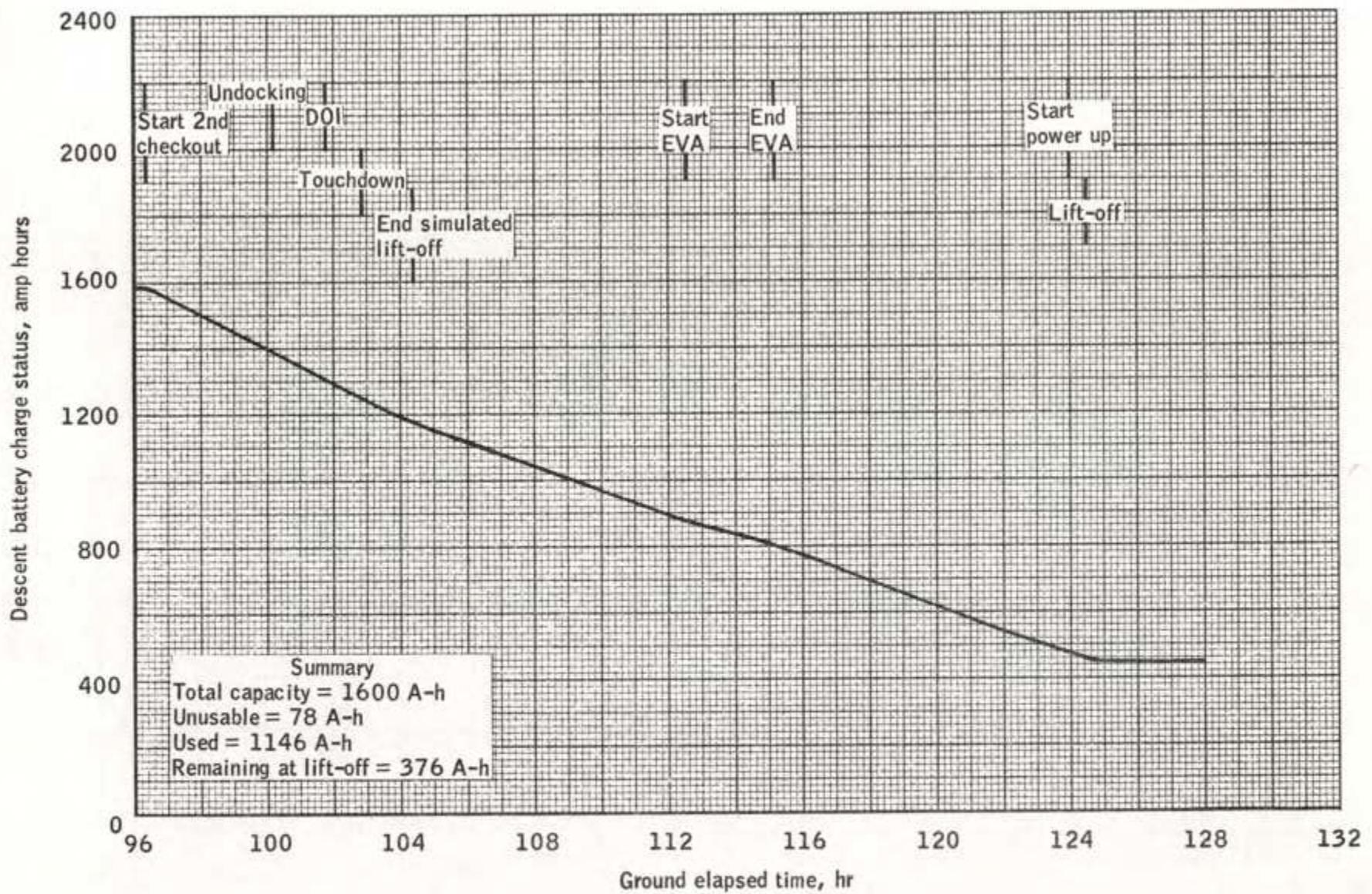


Figure 5-12.- Descent stage amp hours remaining.

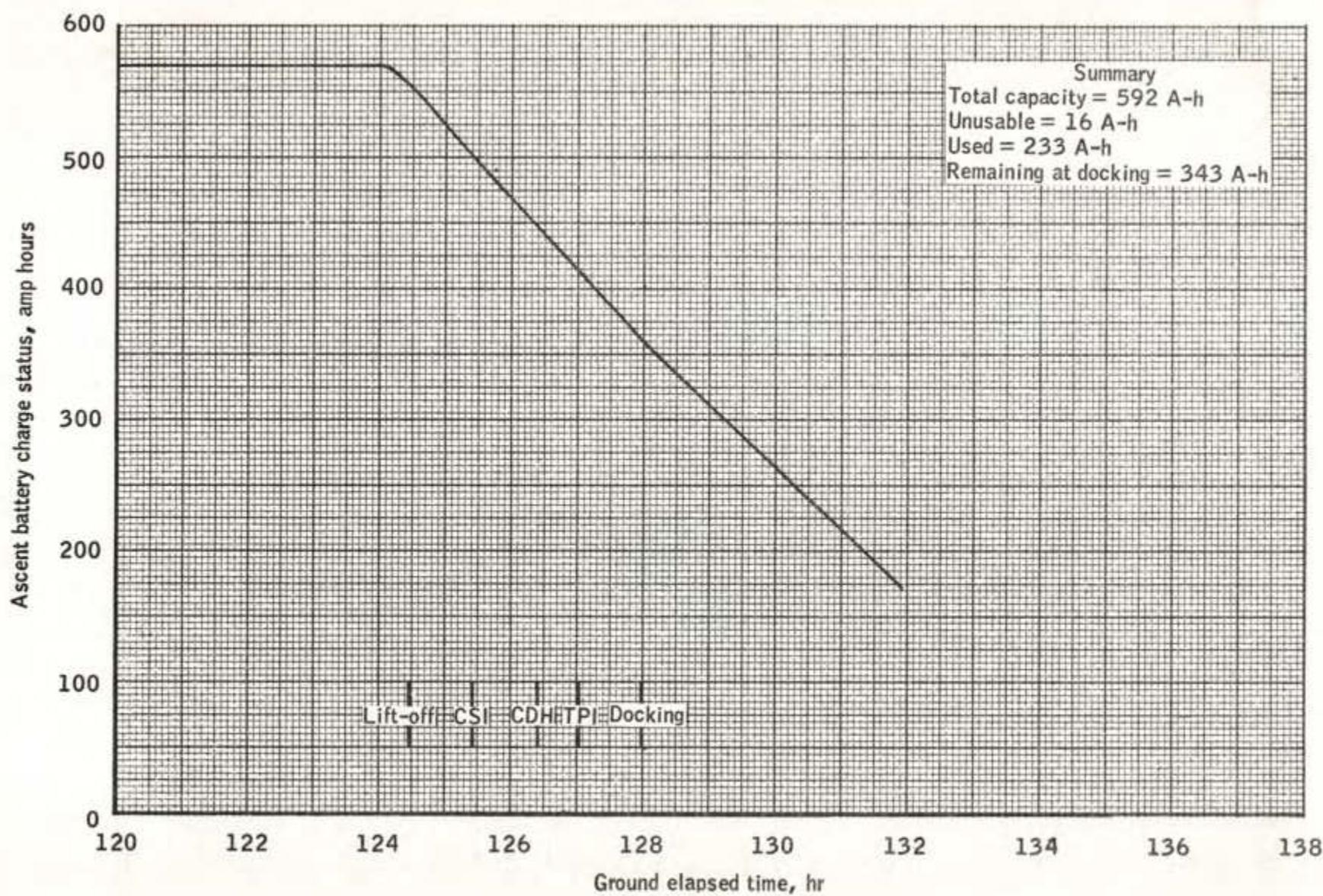


Figure 5-13 .- Ascent stage amp hours remaining.

LM ECS BUDGET

GROUND RULES AND ASSUMPTIONS

1. Cabin O_2 leakage rate was 0.2 lb/hr while pressurized
2. Metabolic rates were varied according to Volume 2 of the Spacecraft Operational Data Book
3. Metabolic O_2 consumed was $(1.643 \times 10^{-4}) \times (\text{metabolic rate})$
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 1040 (btu per lb) of H_2O
7. H_2O lost due to urination was 0.11 lb/hr per man
8. Cabin temperature control was set to 72° F
9. Average glycol flow rate was 250 lb/hr
10. Budget was performed on the operational trajectory and may change when the revision 1 is analyzed.

TABLE 5-13
LM ECS Summary

(a) Descent Stage

<u>Description</u>	O_2 , lb	H_2O , lb
Loaded	48.00	210.6
Unusable	3.40	16.4
Available for mission.	44.60	194.2
Required for mission	26.17	142.4
Usable remaining in tanks	18.43	51.8

(b) Ascent Stage

Loaded	4.86	85.00
Unusable74	4.20
Available for mission	4.12	80.80
Required for mission	1.95	45.48
Usable remaining in tanks	2.17	35.32

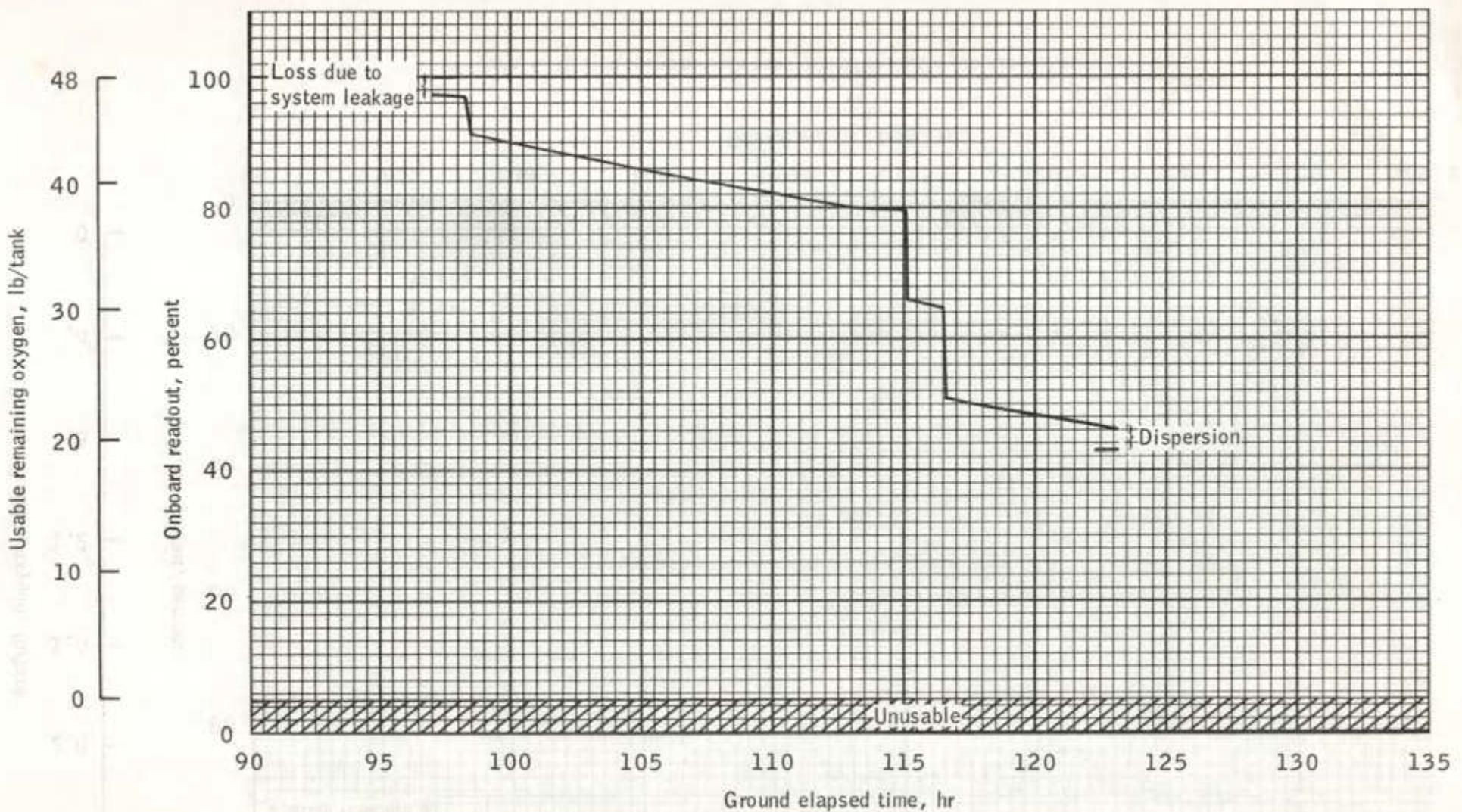


Figure 5-14 .- Descent oxygen tank quantities as a function of mission time.

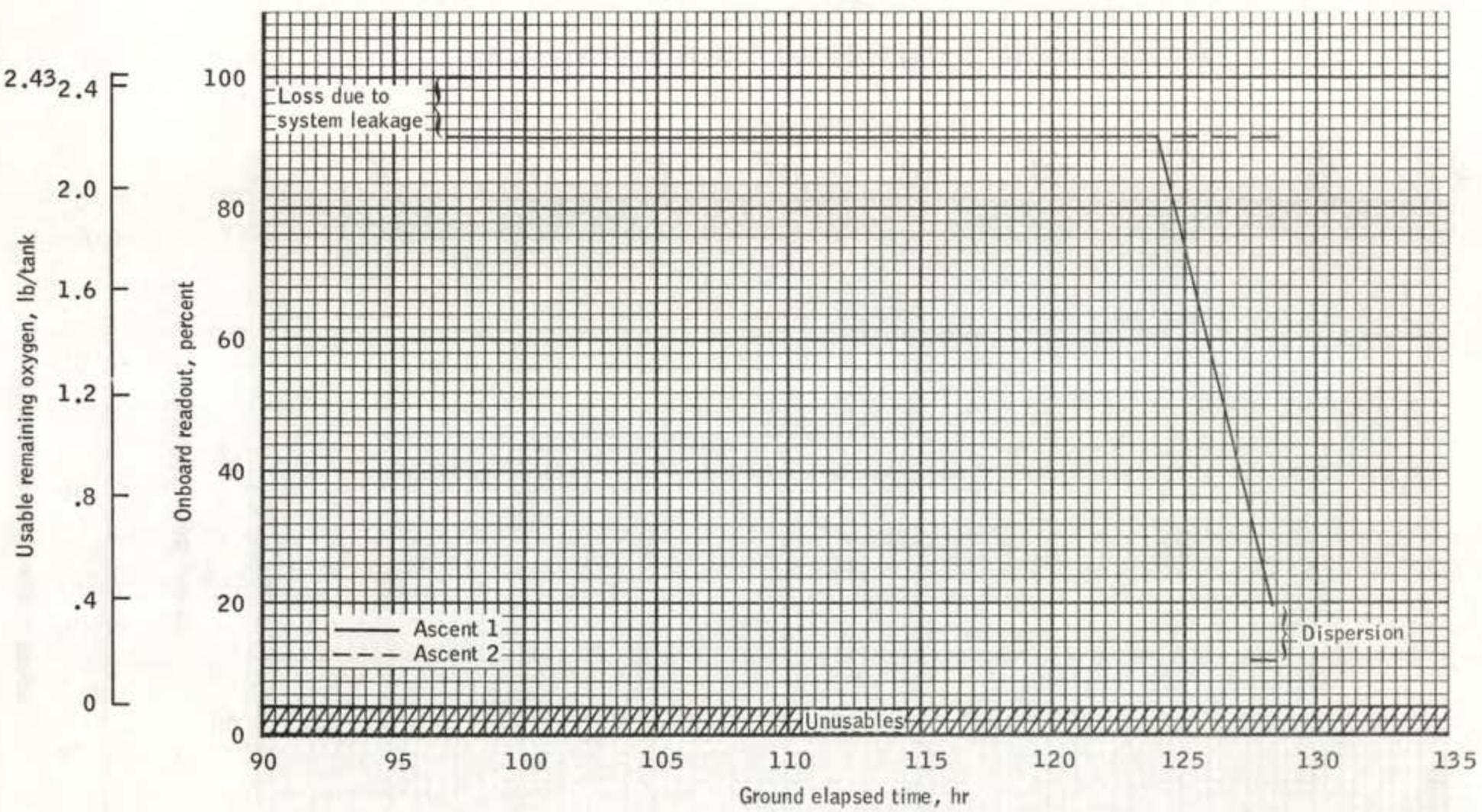


Figure 5-15 .- Ascent oxygen tank quantities as a function of mission time.

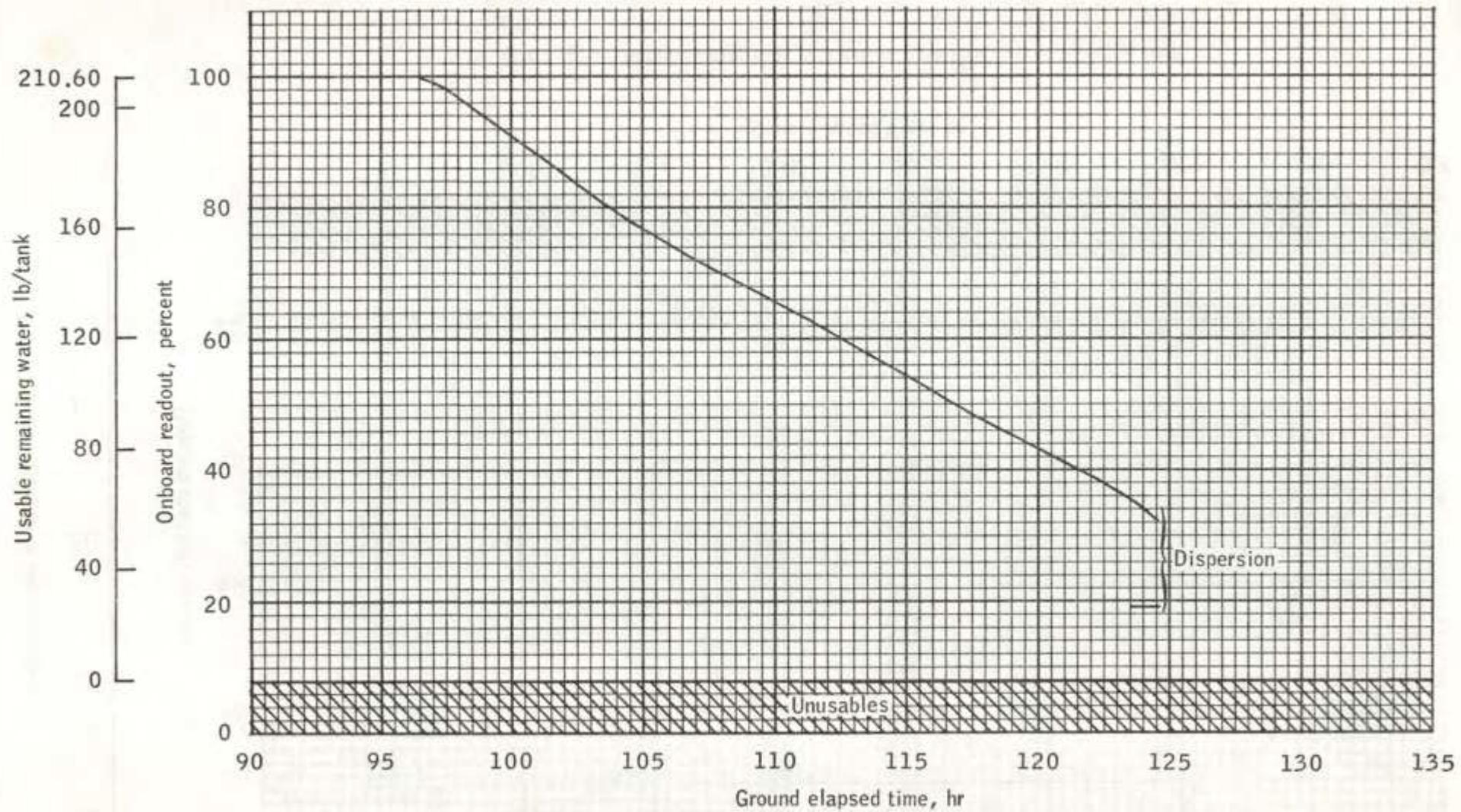


Figure 5-16 .- Descent water tank quantities as a function of mission time.

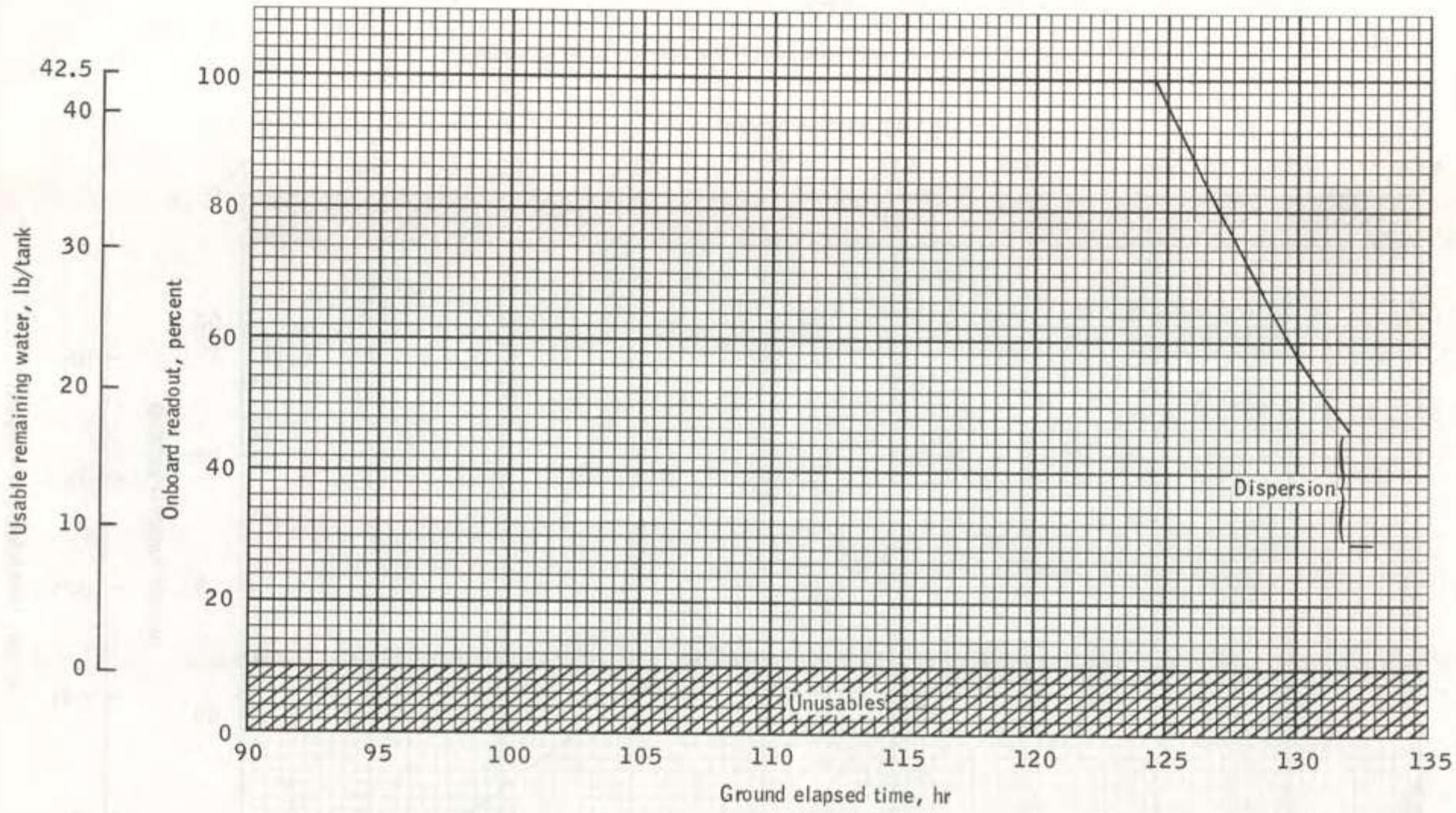


Figure 5-17 .- Ascent water tank quantities as a function of mission time.

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_2O PROFILE |
| FIGURE 5-22 | LMP H_2O PROFILE |
| FIGURE 5-23 | LMP AND CDR LiOH CO_2 PROFILE |

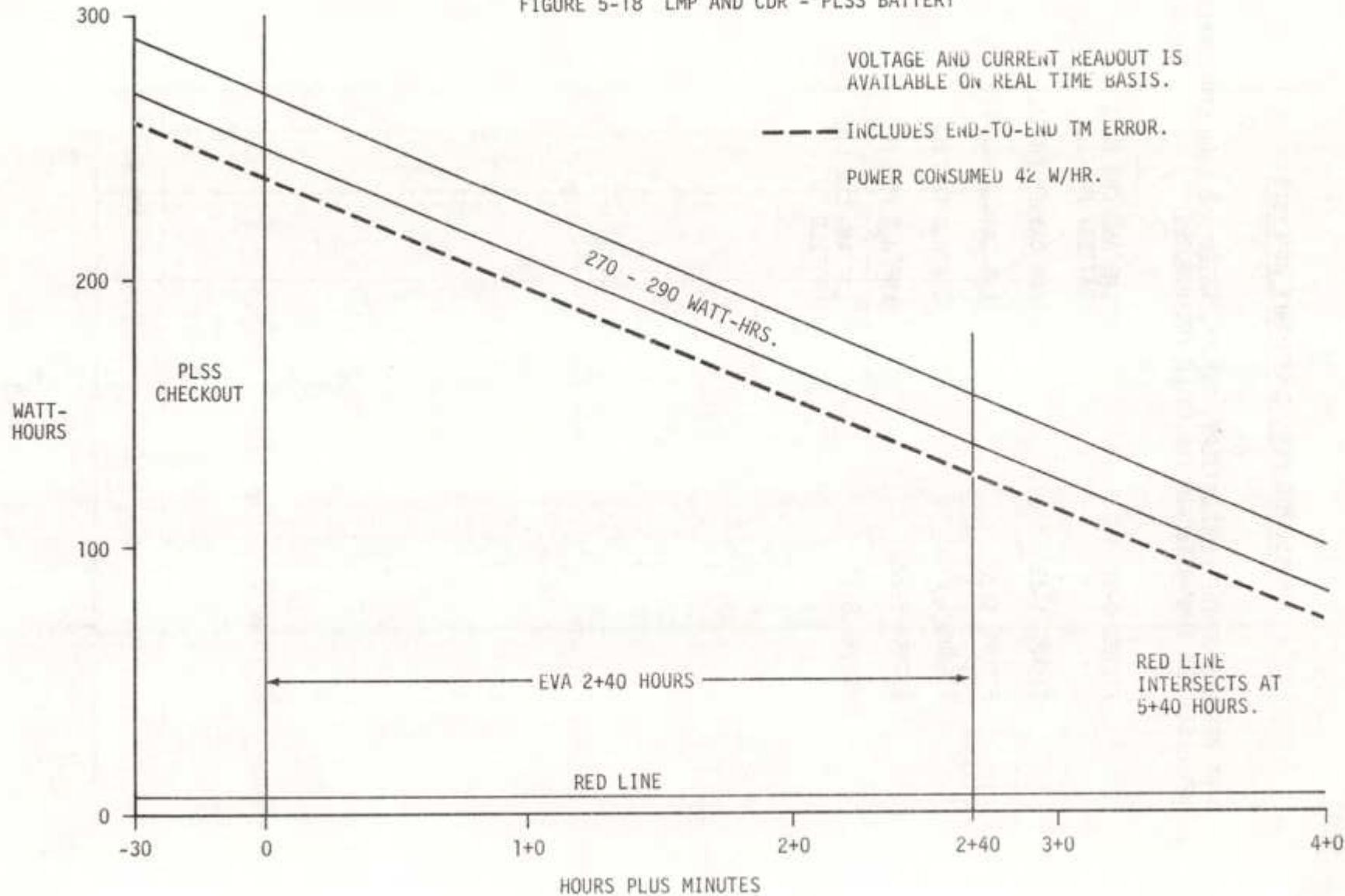
NOMINAL LUNAR SURFACE EVA

FIGURE 5-18 LMP AND CDR - PLSS BATTERY

VOLTAGE AND CURRENT READOUT IS
AVAILABLE ON REAL TIME BASIS.

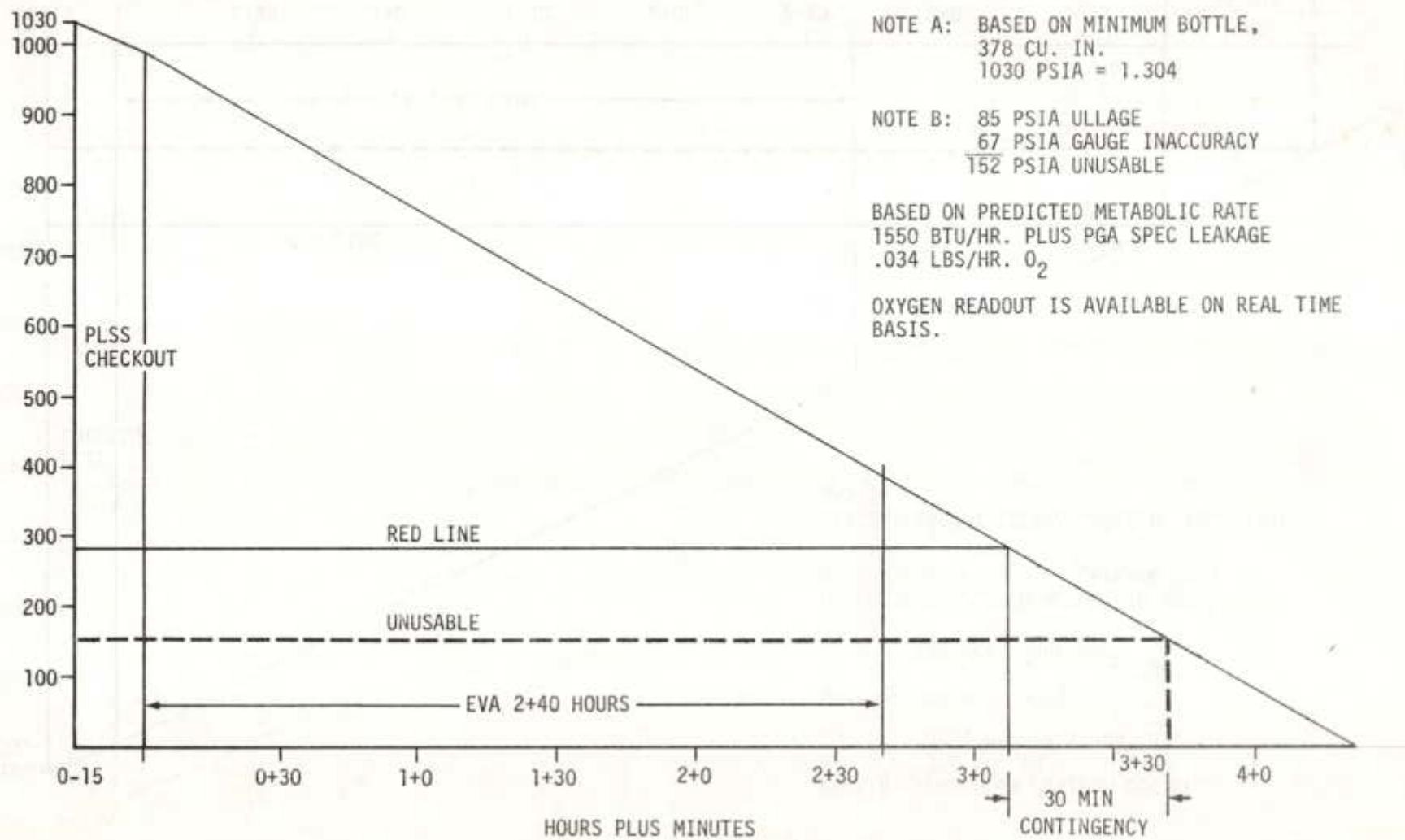
— INCLUDES END-TO-END TM ERROR.

POWER CONSUMED 42 W/HR.



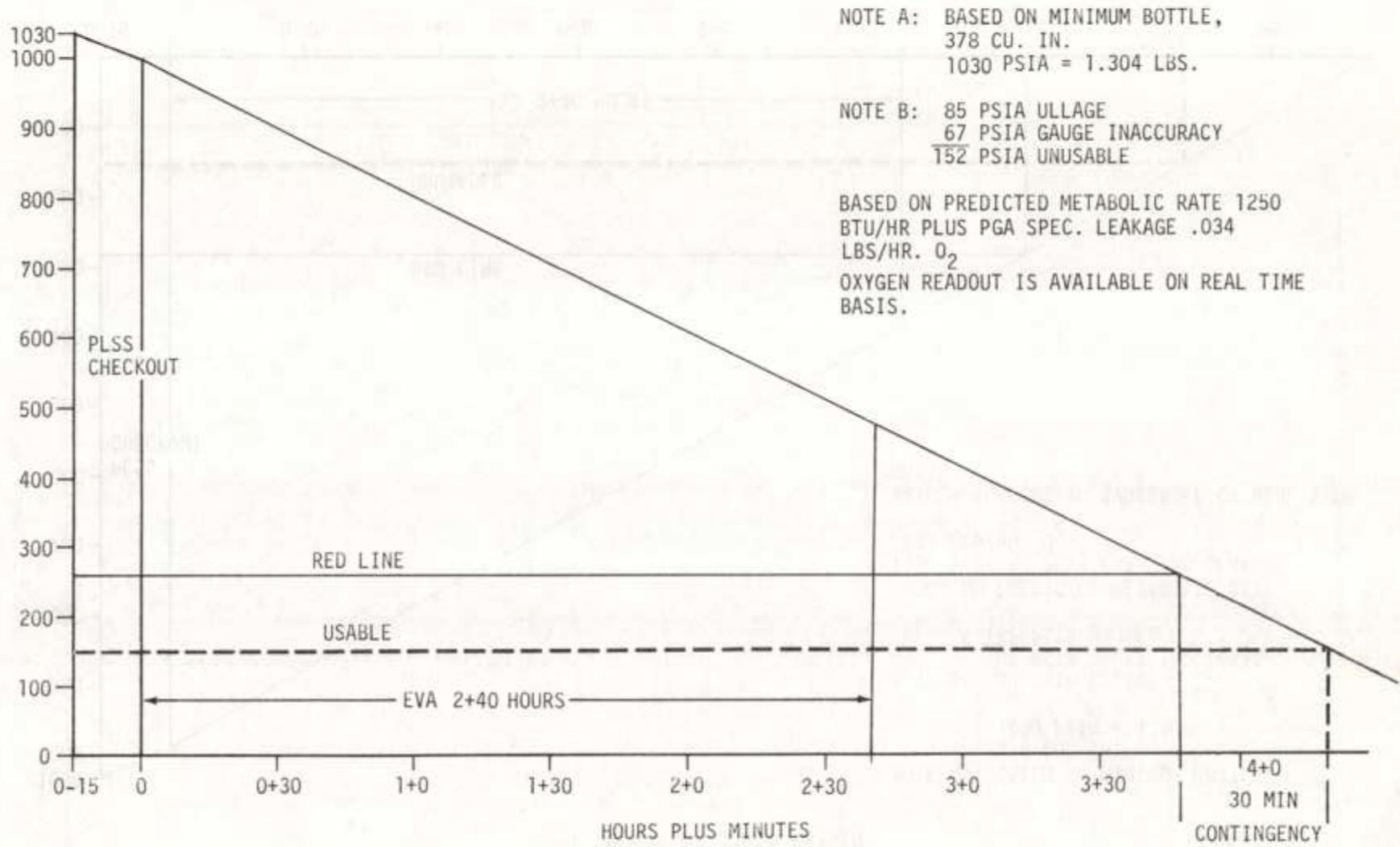
NOMINAL LUNAR SURFACE EVA

FIGURE 5-19 CDR - OXYGEN



NOMINAL LUNAR SURFACE EVA

FIGURE 5-20 LMP - OXYGEN

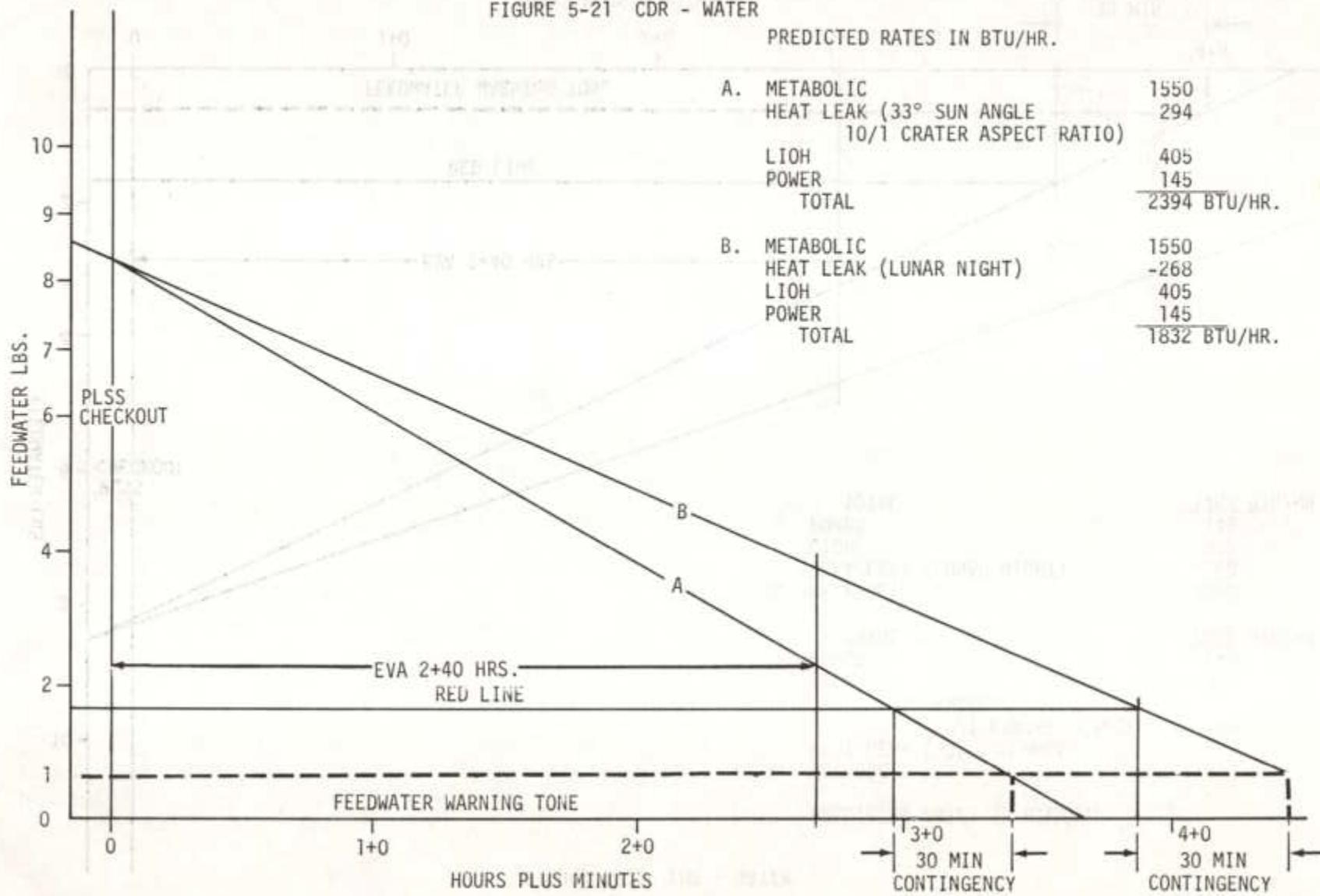


NOMINAL LUNAR SURFACE EVA

FIGURE 5-21 CDR - WATER

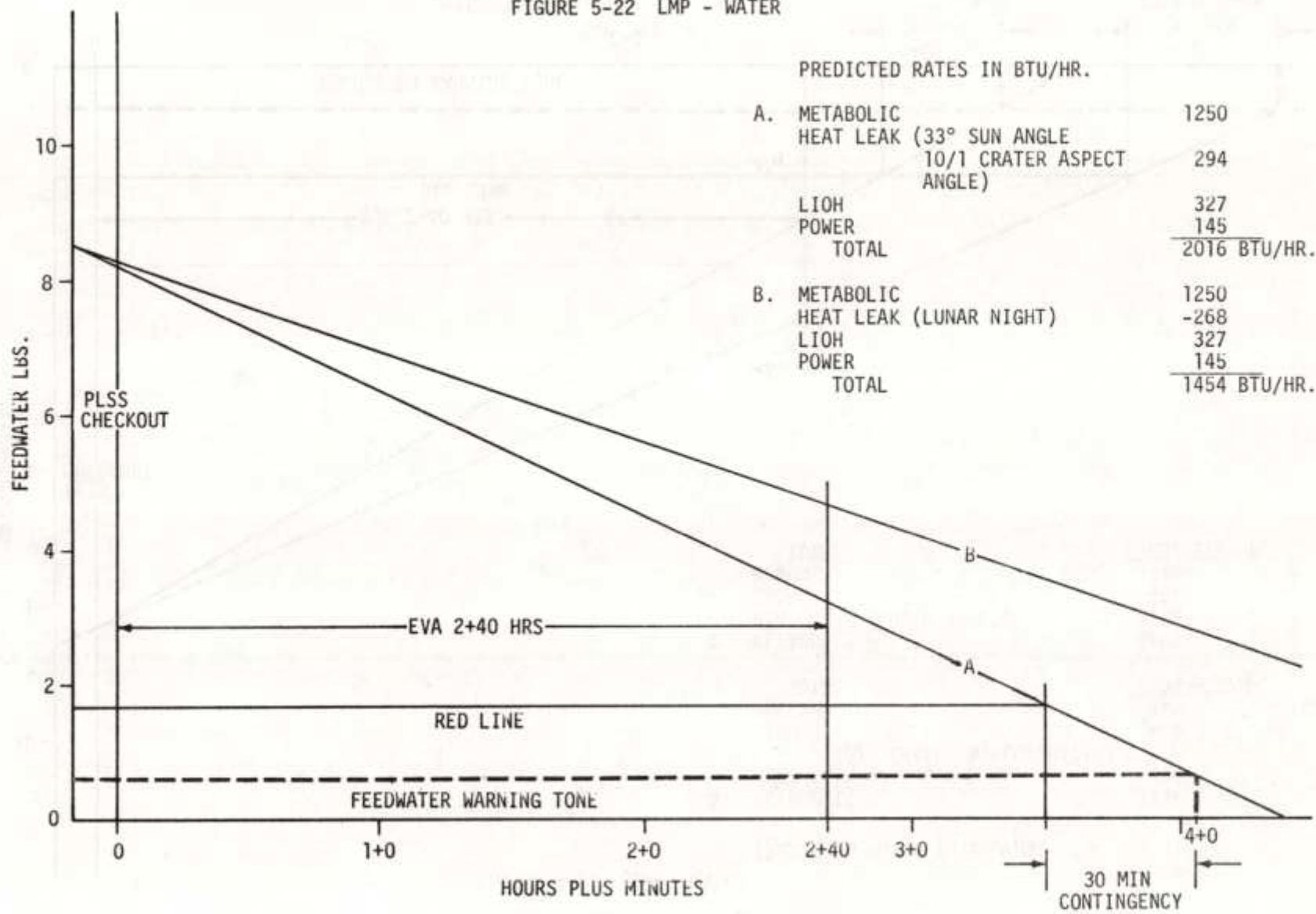
PREDICTED RATES IN BTU/HR.

A.	METABOLIC	1550
	HEAT LEAK (33° SUN ANGLE 10/1 CRATER ASPECT RATIO)	294
	LIOH	405
	POWER	145
	TOTAL	2394 BTU/HR.
B.	METABOLIC	1550
	HEAT LEAK (LUNAR NIGHT)	-268
	LIOH	405
	POWER	145
	TOTAL	1832 BTU/HR.



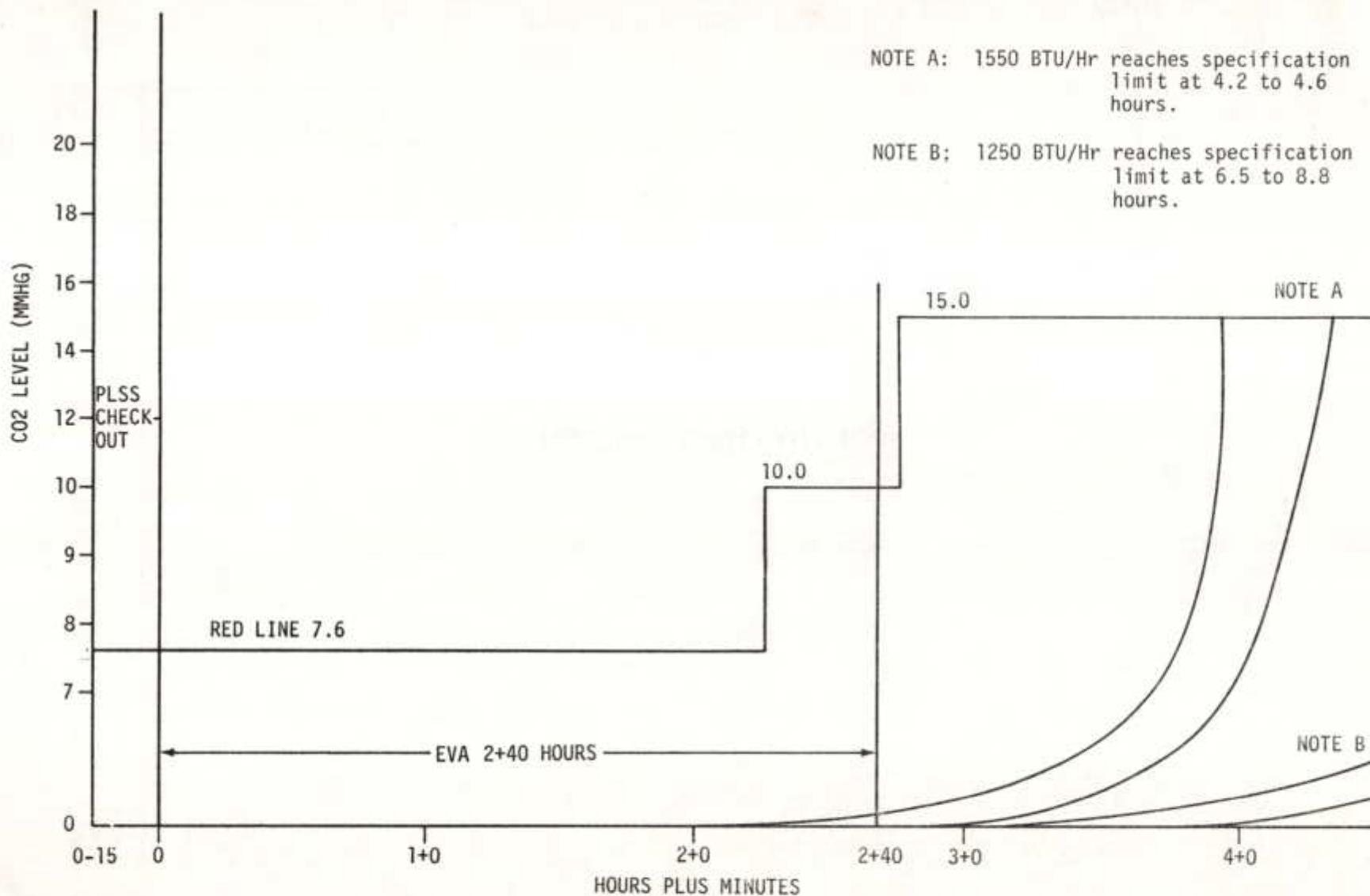
NOMINAL LUNAR SURFACE EVA

FIGURE 5-22 LMP - WATER



NOMINAL LUNAR SURFACE EVA

FIGURE 5-23 LMP & CDR LiOH

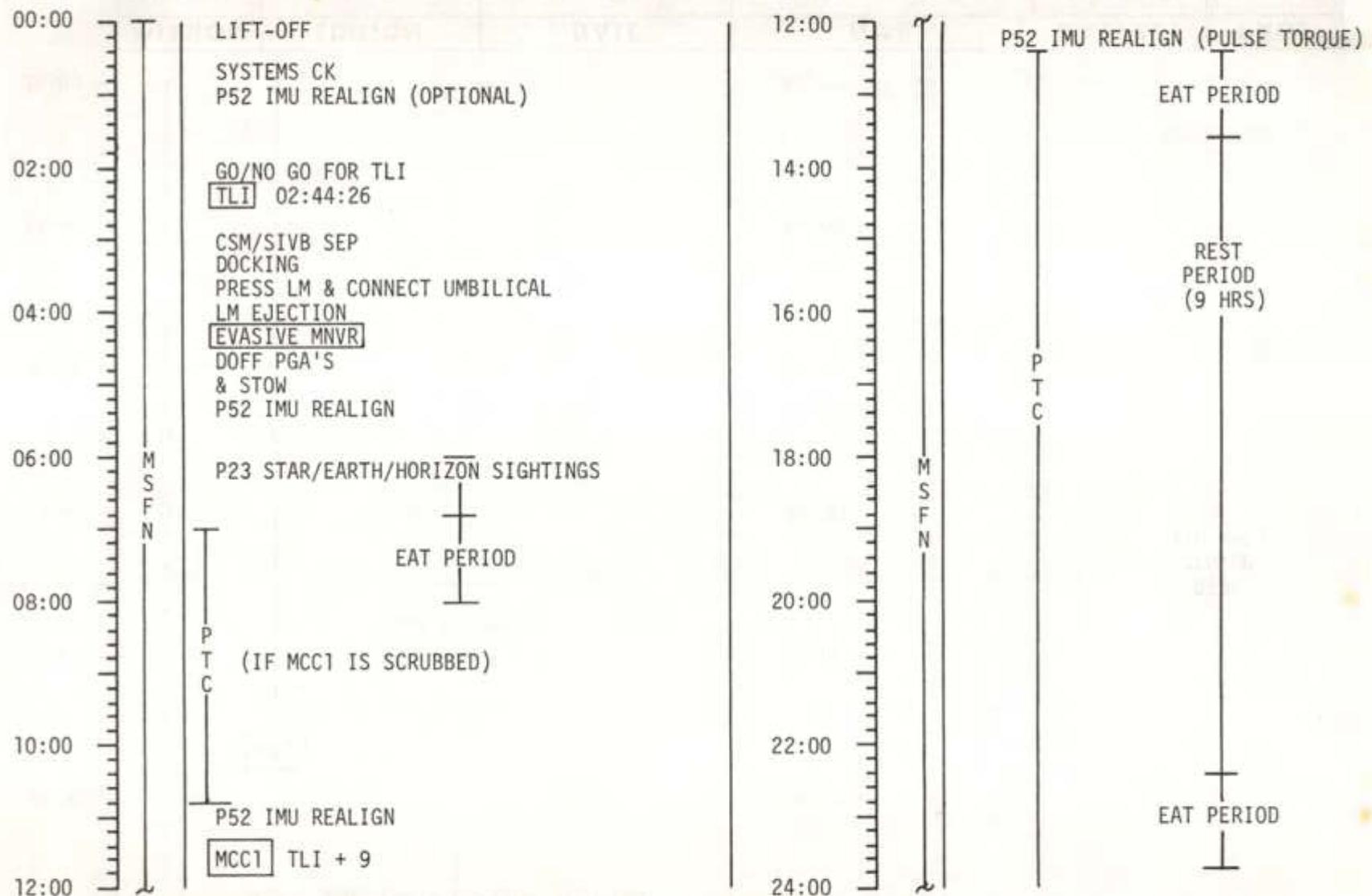


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SECTION VI - SUMMARY FLIGHT PLAN

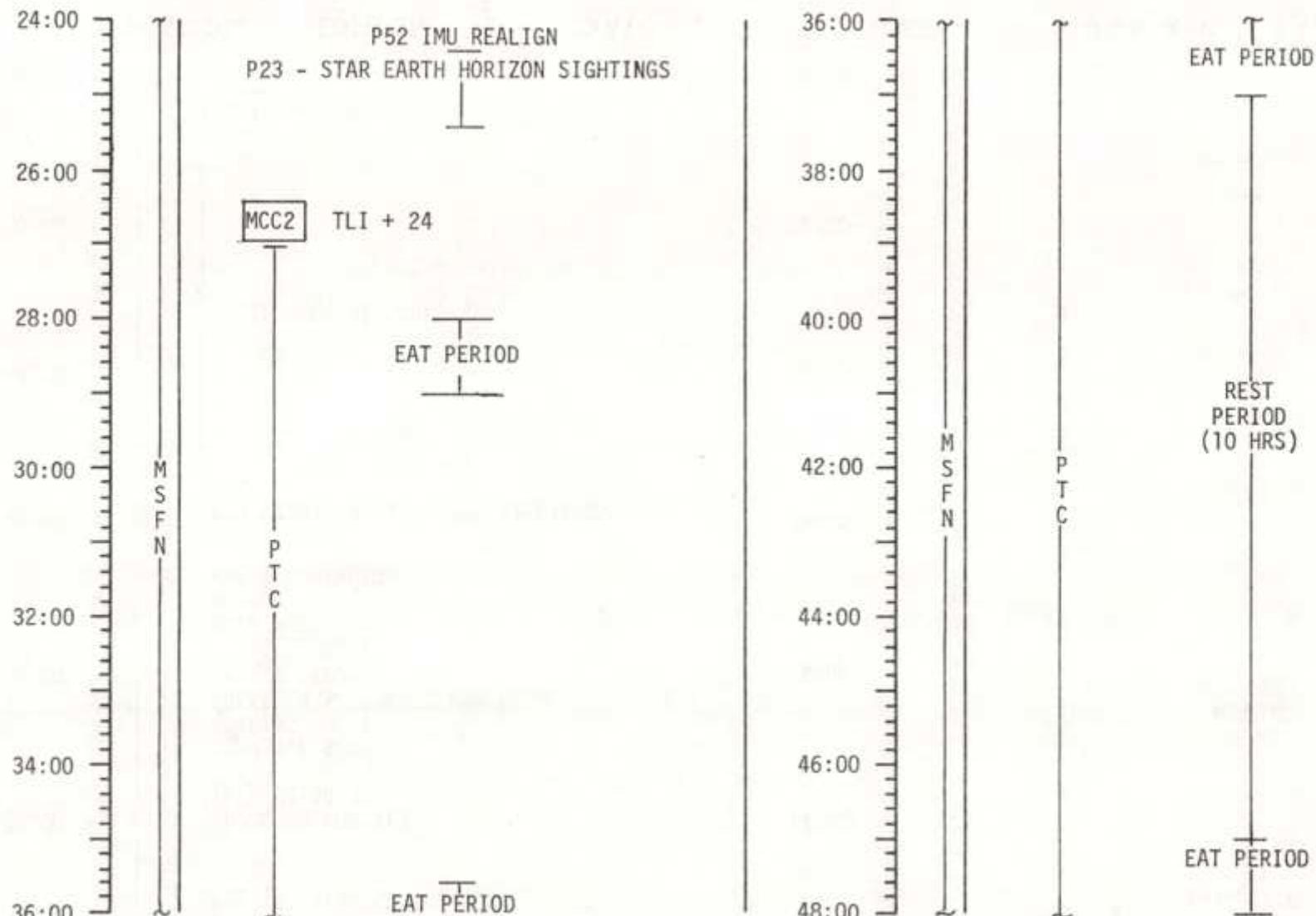


FLIGHT PLAN



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

FLIGHT PLAN

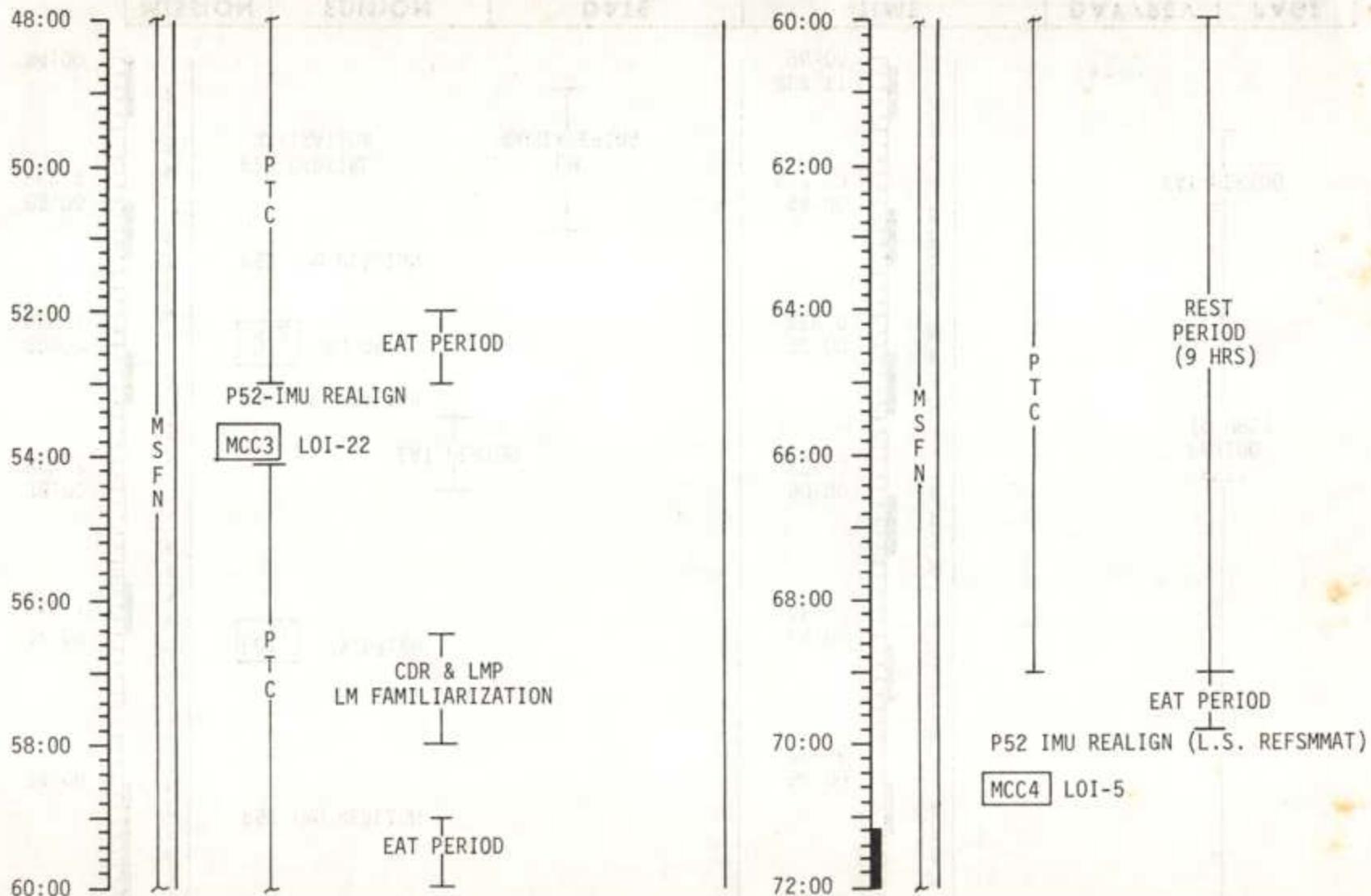


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
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MSC Form 6450 (Jan 69)

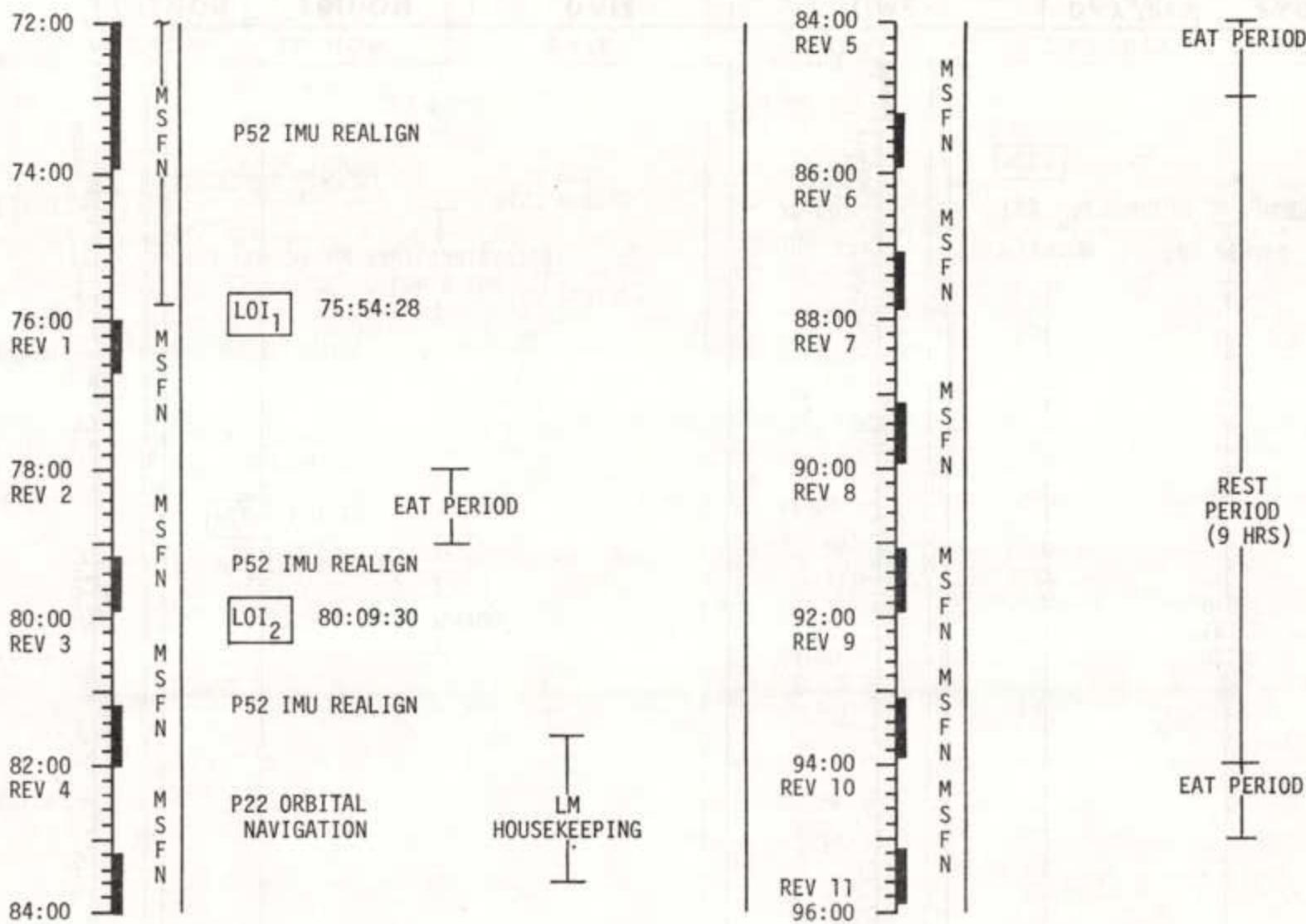
FLIGHT PLANNING BRANCH

FLIGHT PLAN



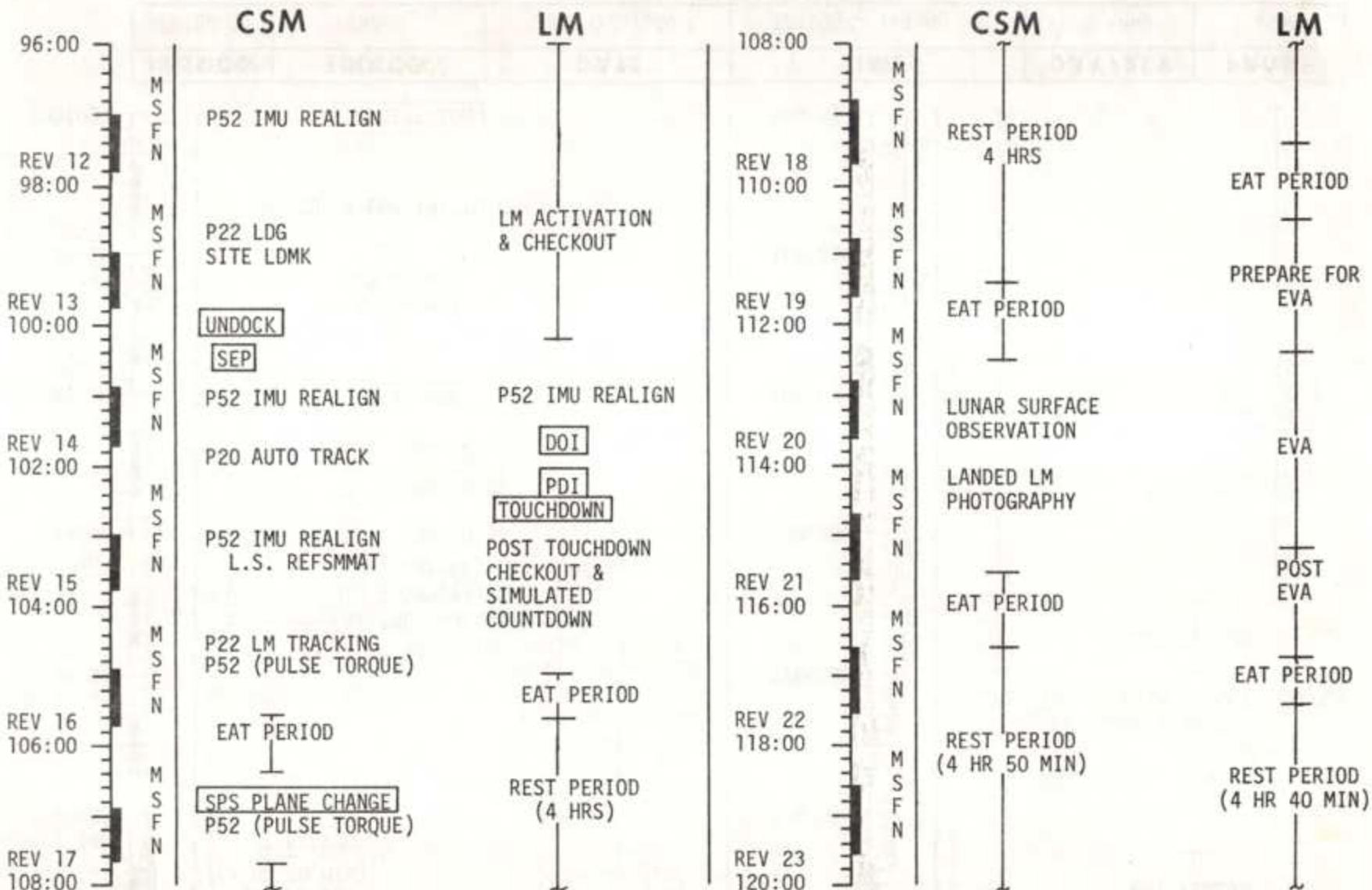
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FLIGHT PLAN



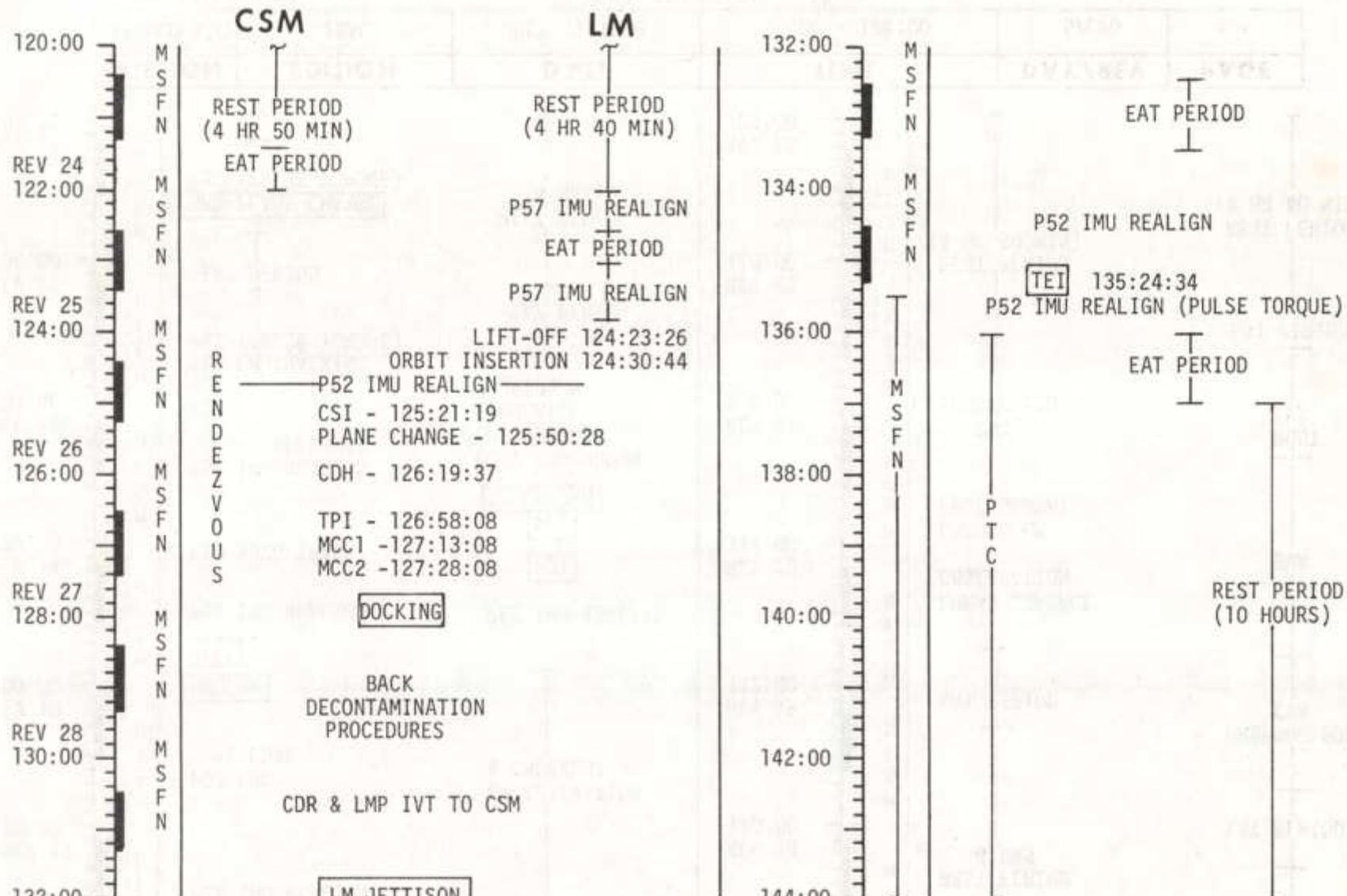
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
APOLLO 11	FINAL	JULY 1, 1969	72:00 - 96:00	4/1 THRU 10	6-4

FLIGHT PLAN



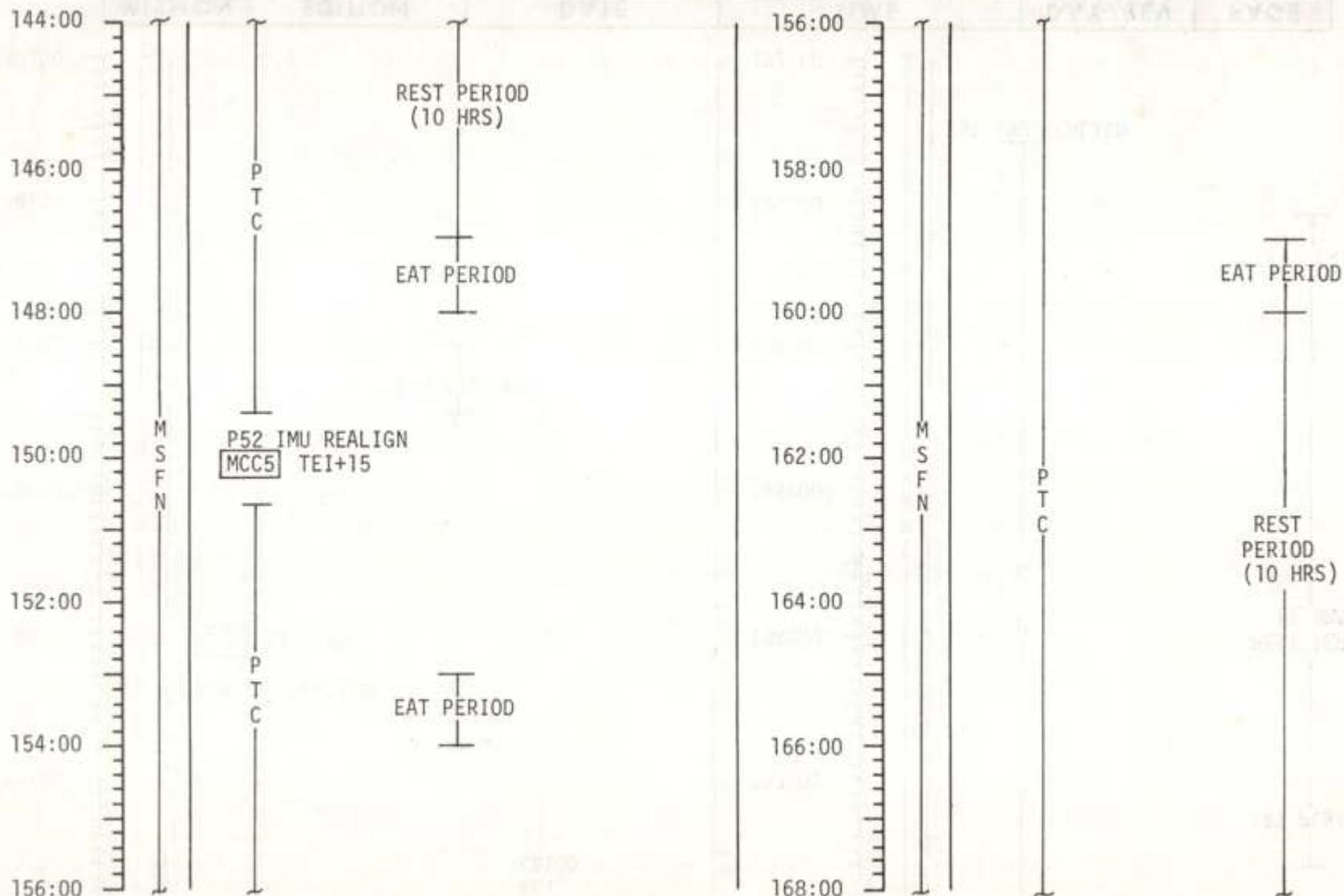
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FLIGHT PLAN



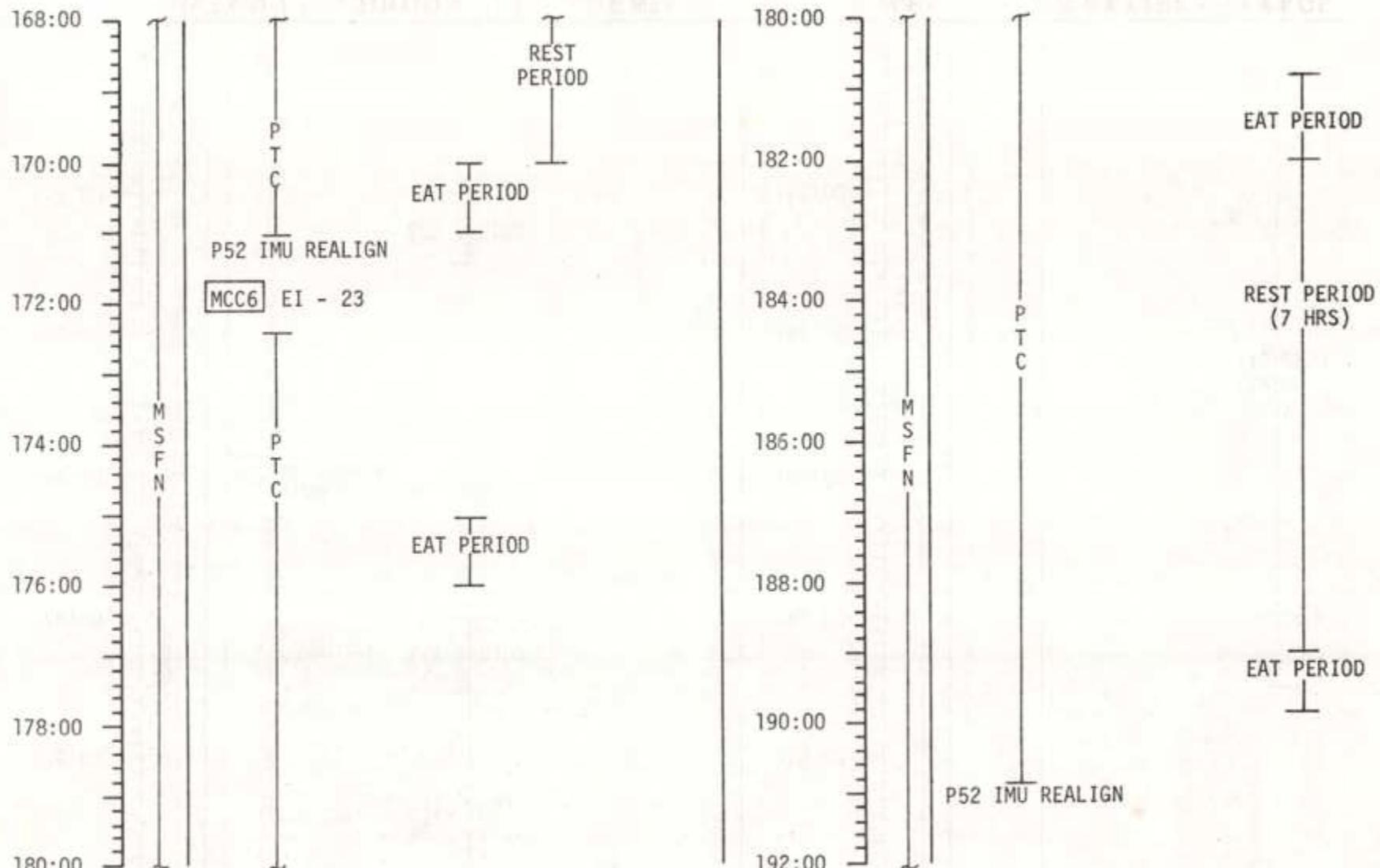
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FLIGHT PLAN



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

FLIGHT PLAN

192:00

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P52 IMU REALIGN

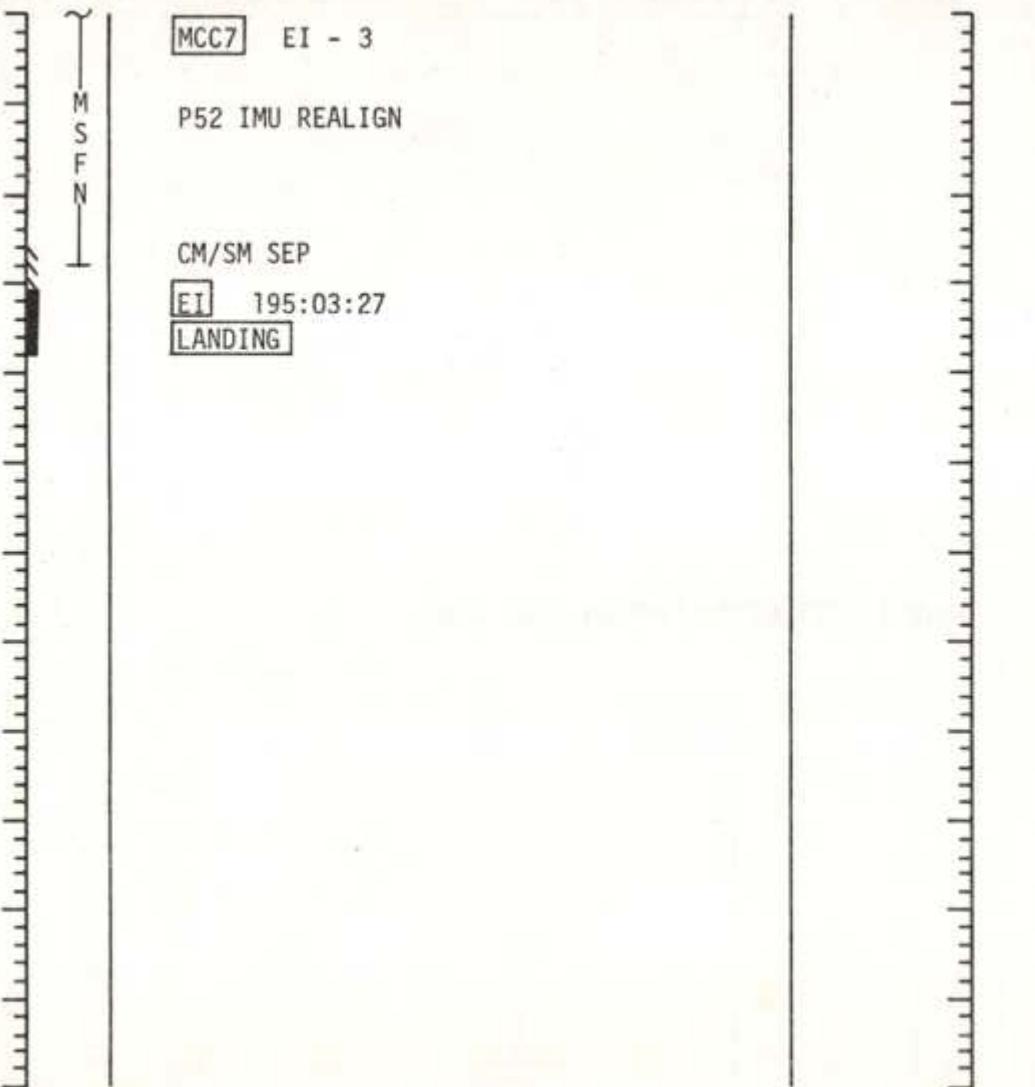
194:00

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

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