



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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FINAL

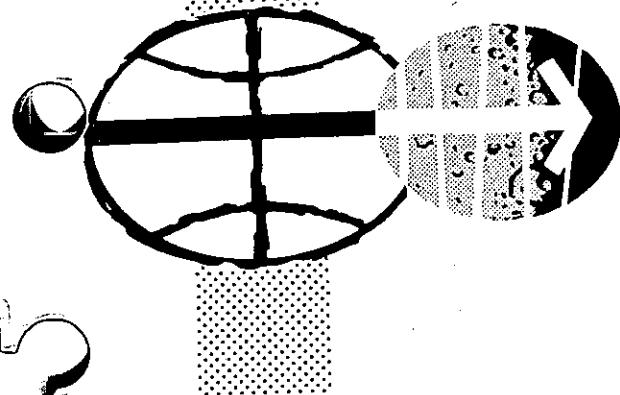
FLIGHT PLAN APOLLO 8

AS-503/CSM-103

NOV 22, 1968

PREPARED BY
FLIGHT PLANNING BRANCH
FLIGHT CREW SUPPORT DIVISION

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS



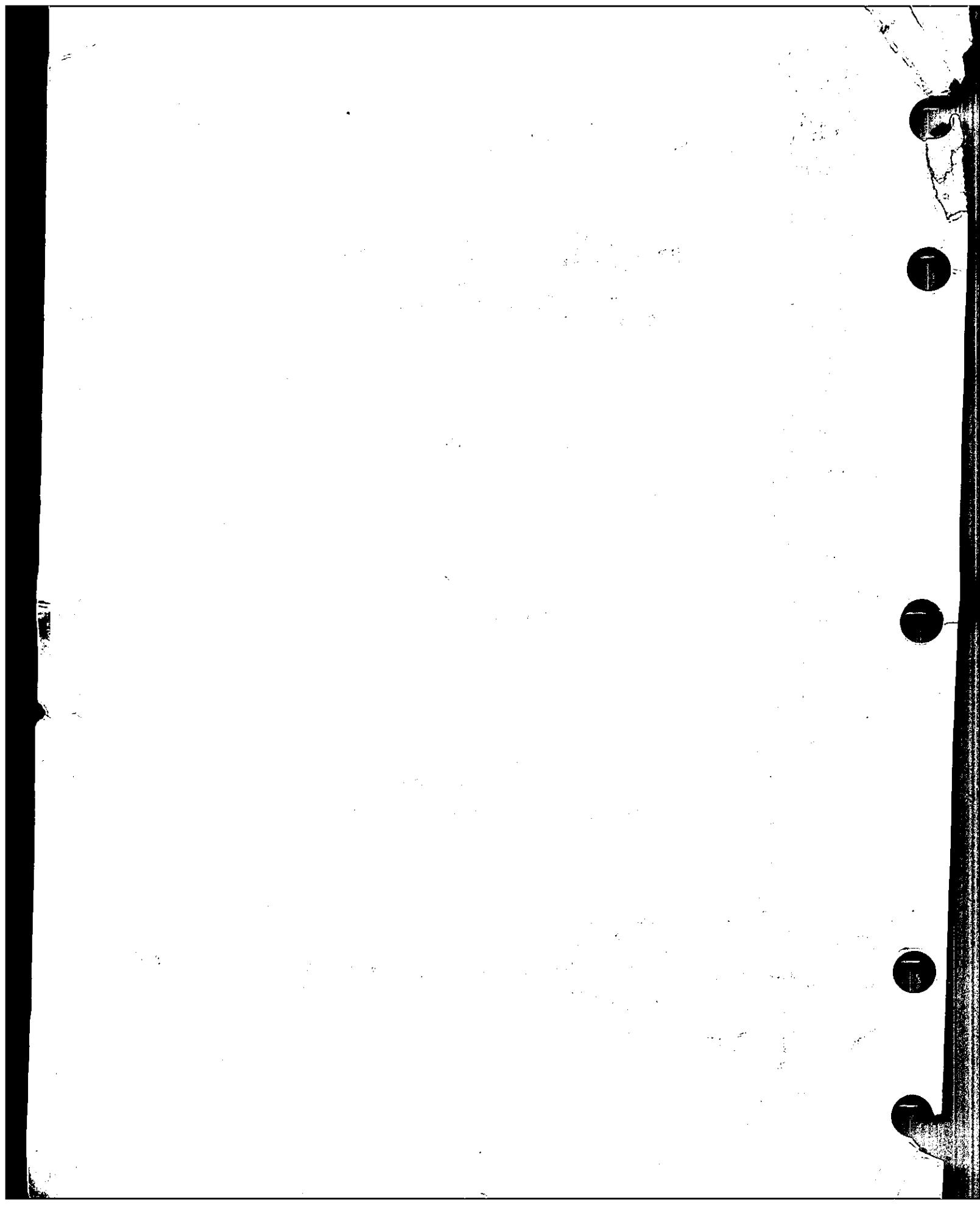
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SECTION III

SECTION IV

SECTION V



APOLLO AS503/CSM 103

FINAL FLIGHT PLAN

November 22, 1968

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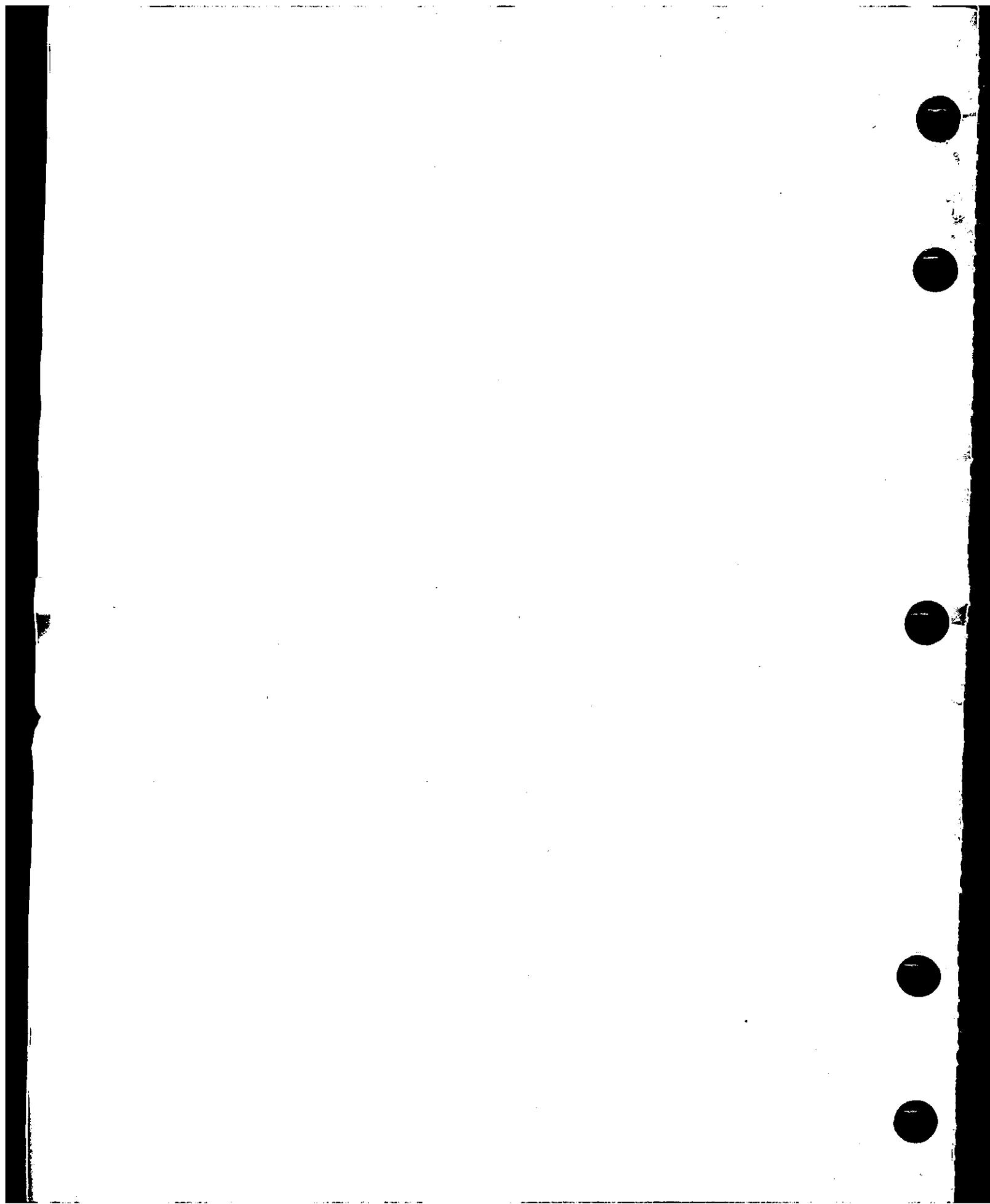


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INTRODUCTION

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 AS503/CSM103 operations and crew activities to fulfill, when possible, the test objectives defined in the Mission Requirements, SA503/CSM103, C' Type Mission, (Lunar Orbit).

The trajectory parameters used in this Flight Plan are for a December 21, 1968 launch, with a 72° launch azimuth and were supplied by Mission Planning and Analysis Division as defined by the Apollo Mission C' Spacecraft Operational Trajectory.

The Apollo 8 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 8 Flight Plan.

This Flight Plan is not to be reproduced without the written approval of the Chief, Flight Crew Support Division.

ABBREVIATIONS

ACCEL	Accelerometer	CDH	Constant Delta Altitude
ACT	Activation	CDR	Commander
ACQ	Acquisition	CDU	Control Data Unit
AEA	Abort Electronics Assembly	CIRC	Circularization
AGS	Abort Guidance Sybsystem	CK	Check
AH	Ampere Hours	CM	Command Module
ALIGN	Alignment	CMC	Command Module Computer
ALT	Altitude	CONT	Continue
AMP or amp	Ampere	CMD	Command
AMPL	Amplifier	CMP	Command Module Pilot
ANG	Antigua	CNTL	Control
Ant	Antenna	CNTLS	Controls
AOS	Acquisition of Signal	C.O.	Cut off
AOT	Alignment Optical Telescope	C/O	Check out
APS	Ascent Propulsion Subsystem	COAS	Crew Optical Alignment Sight
E:	ARS	COMM	Communications
ASC	Atmosphere Revitalization	COMP	Computational
ASCT	Ascension	CONFIG	Configuration
ATT	Ascent	CP	Control Point
AUX	Attitude	CRO	Carnarvon, Australia
AZ	Auxiliary	CRYO	Cryogenic
BAT	Azimuth	CSI	Coelliptic Sequence Initiation Maneuver
BDA	Battery	CSM	Command Service Module
BP	Bermuda	C&WS	Caution and Warning System
BT	Barber Pole	CYI	Grand Canary Island
Bio	Burn time	DAP	Digital Auto Pilot
BiW	Bio-Medical Data on Voice Downlink	D/B	Deadband
BU	Black & white	DEDA	Data Entry and Display Assembly
BRKT	Backup	DEGS	Degrees
	Bracket	DEPL	Depletion
CAL	Pt. Arquillo, California	DET	Determination or Digital Event Timer
CAL	Calibration Angle	DIFF	Difference
CAM	Camera	DK	Docked
CB	Circuit Breaker	DOI	Descent Orbit Insertion

ABBREVIATIONS (Cont'd)

DPS	Descent Propulsion Subsystem	GET	Ground Elapsed Time
DSE	Data Storage Equipment	GETI	Ground Elapsed Time of Ignition
DSKY	Display and Key Board	GLY	Glycol
DTO	Detailed Test Objective	GMT	Greenwich Mean Time
DUA	Digital Uplink Assembly	G&N	Guidance and Navigation
DWN	Down	GNCS	Guidance Navigation Control System
E	Erasable	GWM	Guam
ECS	Environmental Control Subsystem	GYM	Guaymas, Mexico
EPH	Earth Far Horizon	HA	Apogee Altitude
ET	Earth (atmosphere) Interface	HAW	Hawaii
ELDMK	Earth Landmark	HBR	High Bit Rate (TLM)
EMS	Entry Monitor System	HD	Highly Desirable
ENH	Earth Near Horizon	HGA	High Gain Antenna
EPO	Earth Parking Orbit	HI	High
EPS	Electrical Power Subsystem	Hp	Perigee Altitude
EQUIP	Equipment	HSK	Honeysuckle (Canberra, Australia)
EST	Eastern Standard Time	HTR	Heater
EVAP	Evaporator	HTV	USNS Huntsville
EVT	Extravehicular Transfer	ID	Identification
EXT	External	IGN	Ignition
f	F Stop	IMU	Inertial Measurement Unit
FC	Fuel Cell	INIT	Initialization
FDAI	Flight Director Attitude Indicator	INT	Intervalometer
FLT	Flight	IP	Initial Point
FM	Frequency Modulated	IU	Instrumentation Unit
FOV	Field of View	IVT	Intravehicular Transfer
fps	Feet per second	JETT	Jettison
FQ	Flight Qualification	kwh	Kilowatt Hour
FT or ft	Feet	LAT	Latitude
FTP	Full Throttle Position	LBR	Low Bit Rate (TLM)
GBI	Grand Bahama	LBS or lbs	Pounds
GDC	Gyro Display Coupler		
GDS	Goldstone, California		

ABBREVIATIONS (Cont'd)

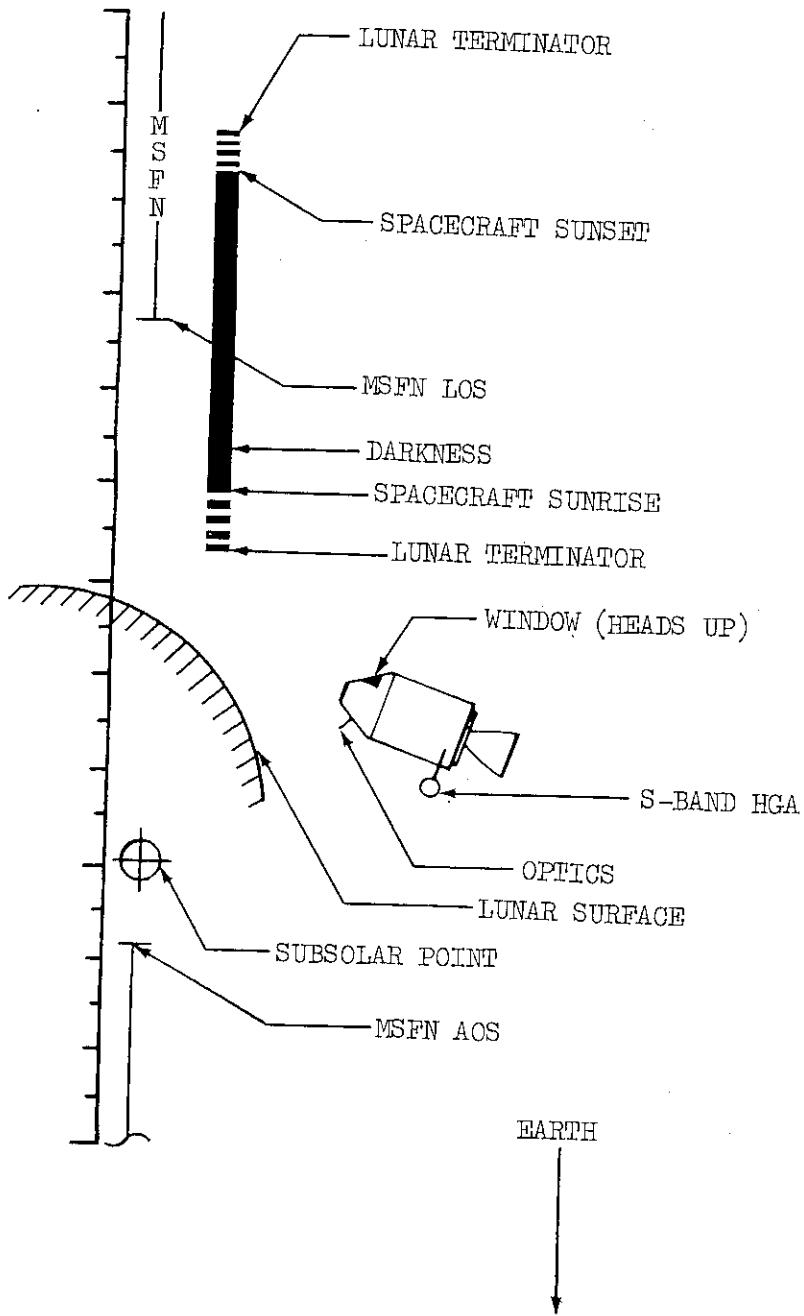
LCG	Liquid Cooled Garment	MEAS	Measurement
LDG	Landing	MER	USNS Mercury
LDMK	Landmark	MET	Mission Event Timer
LEB	Lower Equipment Bay	M/I	Minimum Impulse
LFH	Lunar Far Horizon	MIN	Minimum
LGC	LM Guidance Computer	MLA	Merritt Island
LH	Left-hand	MNVR	Maneuver
L/H	Local Horizontal	MON	Monitor
LHEB	Left-hand Equipment Bay	MSFN	Manned Space Flight Network
LHFEB	Left-hand Forward Equipment Bay	MTVC	Manual Thrust Vector Control
LIOH	Lithium Hydroxide	NAV	Navigation
LLM	Lunar Landing Mission	NCC	Corrective Combination Maneuver
LLOS	Landmark Line of Sight	nm	Nautical Miles
LM	Lunar Module	NOM	Nominal
LMP	Lunar Module Pilot	NSR	Nominal Slow Rate
LNH	Lunar Near Horizon	NXX	Noun XX
LOI	Lunar Orbit Insertion	OBS	Observation
LONG	Longitude	O/F	Oxidizer to Fuel
LOS	Loss of Signal	OPER	Operate
LPO	Lunar Parking Orbit	ORB	Orbital
LR	Landing Radar	ORDEAL	Orbit Rate Display Earth and Lunar
LT	Light	ORIENT	Orientation
LTG	Lighting	OVHD	Overhead
LV	Launch Vehicle	P	Pitch
L/V	Local Vertical	PAD	Voice Update
LVPD	Launch Vehicle Pressure Display	PCM	Pulse Code Modulation
M	Mandatory	PC	Pericynttian
MAD	Madrid, Spain	PGA	Pressure Garment Assembly
MAN	Manual	PGNCS	Primary Guidance Navigation Control Section
MAX	Maximum	PIPA	Pulse Integrating Pendulous Accelerometer
MAX Q	Maximum Dynamic Pressure	PM	Phase Modulated
MCC	Midcourse Correction	POL	Polarity or Polarizing
MCC-H	Mission Control Center - Houston		
MDC	Main Display Console		

ABBREVIATIONS (Cont'd)

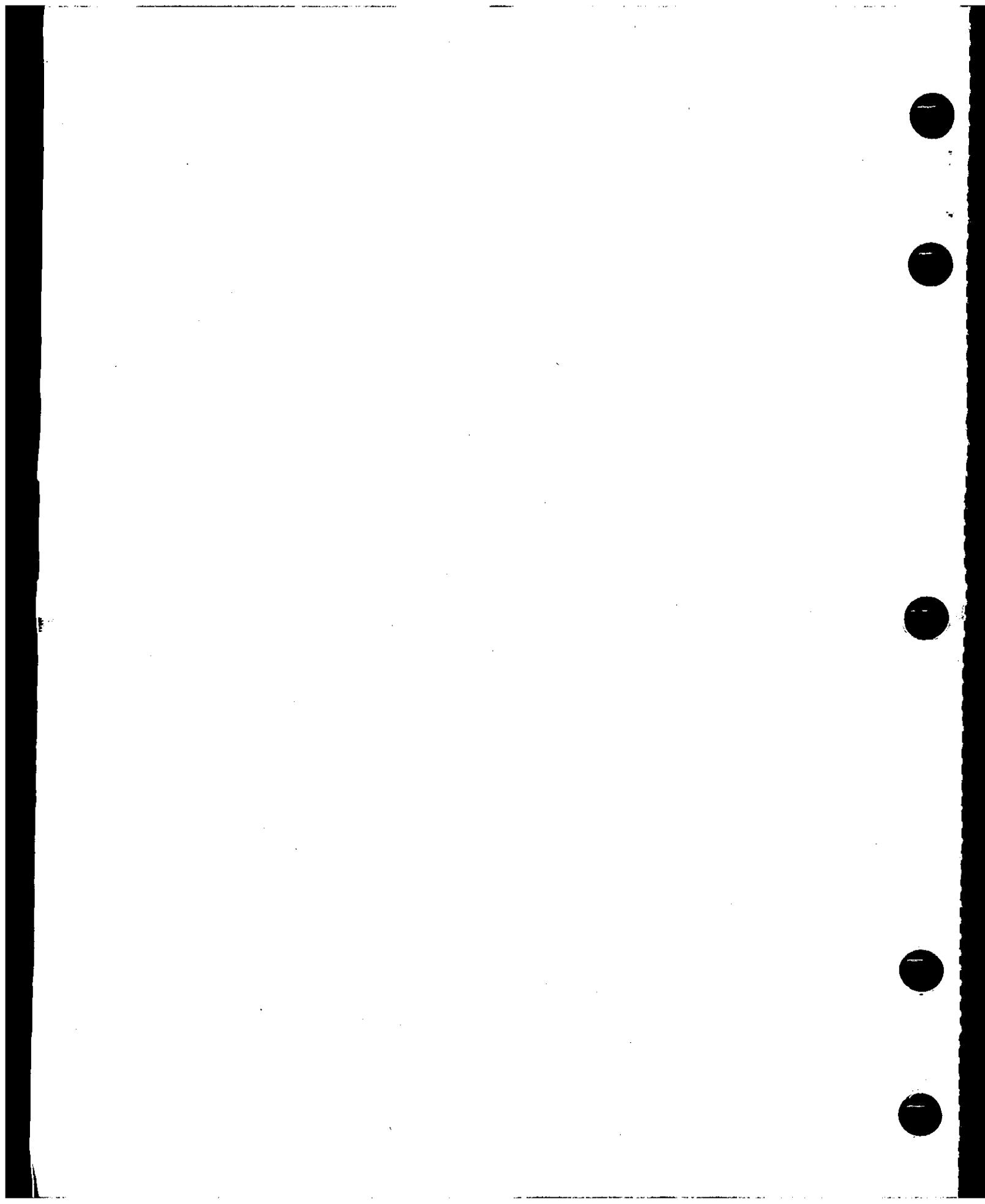
PREF	Preferred	S	Shaft
PREP	Preparation	SA	Shaft Angle
PRESS	Pressure	S/C	Spacecraft
PRIM	Primary	SCE	Signal Conditioning Equipment
PT	Point	SCS	Stabilization Control System
PRN	Pseudo-Random Noise	SCT	Scanning Telescope
PROP	Proportional	SEC	Secondary
PU	Propellant Utilization	SECO	S-IVB Engine Cut-off
PUGS	Propellant Utilization and Gaging System	SEP	Separate
PTC	Passive Thermal Control	SEQ	Sequence
PWR	Power	SLA	Service Module LM Adapter
Pxx	Program XX	SLOS	Star Line-of-Sight
Qty	Quantity	SM	Service Module
R	Roll	SPOT	Spot Meter
R&B	Red & Blue	SPS	Service Propulsion System
RAD	Radiator	SR	Sunrise
RCDR	Recorder	SRX	S-Band Receiver Mode No. X
RCS	Reaction Control Subsystem	SS	Sunset
RCU	Remote Control Unit	STX	S-Band Transmit Mode No. X
RCV	Receiver	STBY	Standby
RED	USNS Redstone	Sw	Switch
REFSMMAT	Reference Stable Member Matrix	SXT	Sextant
REG	Regulator	SYNC	Synchronization
REQD	Required	T	Trunnion
RH	Right-hand	T EPHEM	Time of Ephemeris Update
RNDZ	Rendezvous	TA	Trunnion Angle
RR	Rendezvous Radar	TAN	Tananarive
RSI	Roll Stability Indicator	TCA	Time of Closest Approach
RT	Real Time	TBD	To Be Determined
RTC	Real-Time Command	TEC	Trans Earth Coast
Rxx	Routine XX	TEI	Transearch Insertion

ABBREVIATIONS (Cont'd)

TEMP	Temperature	ΔV	Velocity Change (Differential)
TERM	Terminate	ΔVC	Velocity Change at Engine Cutoff
TEX	Corpus Christi, Texas	ΔR	Position Change (Differential)
T&D	Transposition and Docking	8-balls	Flight Director Attitude Indicator (FDAI)
TGT	Target	LBS or lbs	Pounds
TIG	Time of Ignition		
TLC	Trans Lunar Coast		
TLI	Translunar Insertion		CAMERA NOMENCLATURE
TLM	Telemetry		
TPF	Terminal Phase Final		2/80/B3 - Hasselblad No. 2/80mm Lens/Stowage Location
TPI	Terminal Phase Initiation		16/18/20 - 16mm Camera/18mm Lens/20 Frames Per Second
TPM	Terminal Phase Midcourse		1/150/New B&W/INT - Hasselblad No. 1/150mm Lens/VSE New
T/R	Transmitter/Receiver		B&W Magazine/with interferometer
TRANS	Translation		C-EX - color film - external
TV	Television		POL FILTER 1/4 - Polarization filter, Shutter Speed 1/4
TVC	Thrust Vector Control		S0368 - Type of External Film
TWR	Tower		2/80/H.S. - Hasselblad No. 2/80mm Lens/High Speed Film
UMB	Umbilical		Cable/BRRT/R&B - Use Power Cable, Camera Mounted on Bracket
UNDK	Undock		with Red & Blue Filter
US	United States Pass		
VHF	Very High Frequency		
VLV	Valve		
Vxx	Verb xx		
W/O	Without		
WRT	With Respect to		
WTN	USNS Watertown		
XFER	Transfer		
XMIT	Transmit or Transmitter		
XPONDER	Transponder		
Y	Yaw		



SECTION I - GENERAL



FLIGHT PLAN DESCRIPTION

DAY 1

The spacecraft is launched into a 100-nm circular orbit with a launch azimuth that varies between 72° and 108° during the daily launch window. The lift-off time varies during the monthly launch window, but is constrained to daylight launches. The trajectory for this flight plan is a 72° launch azimuth December 21, 1968 with a 12:51:00 GMT (7:51:00 AM, EST) lift-off. Both the variable lift-off time and launch azimuth effect the earth-orbit station coverage, IMU alignment time, translunar and trans-earth coast time, and lunar surface lighting conditions.

The spacecraft remains attached to the S-IVB for approximately 4 hours. During this time, the crew checks out the CSM systems, performs an optics check, IMU realignment to the pad REFSMMAT, monitors the TLI maneuver, and performs transposition and separation from the S-IVB. The crewmen doff and stow their helmets and gloves prior to TLI and they are not donned again. The TLI maneuver places the S/C in a free return lunar trajectory.

Following TLI, the CMP doffs his PGA, performs an IMU realign, and a series of star/earth horizon sightings. All translunar and transearth sightings contain three marks per set. After these sightings, the CDR and LMP doff and stow their PGA's. At this point, the first eat period is scheduled.

At TLI + 6 hours (09:00 GET), the first MCC decision point is scheduled. Before this point and prior to each midcourse, there is a MCC-H state vector update, target load, maneuver pad update, an IMU alignment, and systems checks. For the nominal trajectory, the midcourses are nominally zero.

After MCC₁, a series of star/earth landmark sightings is scheduled at which time the CDR sleep period begins (11:00 GET) followed by the CMP and LMP sleep period (18:00 GET). During the CDR sleep period, the CMP performs a series of star/earth horizon sightings.

DAY 2

Crew activity on day 2 begins at approximately 24:00 GET. At 26:30 GET, the CMP performs a series of star/earth horizon sightings, then MCC₂ at TLI + 25 hours (28:00 GET), followed by another series of star/earth horizon sightings. Then the CDR sleep period begins (29:00 GET) followed by the CMP and LMP sleep period (36:00 GET). During the CDR sleep period, TV is scheduled for 15 minutes (31:15 GET) and a series of star/earth horizon sightings is performed at (34:15 GET). During day 2, MCC₃ occurs at LOI -22 hours (47:00 GET). The maneuver is preceded by a series of star/earth horizon sightings.

DAY 3

Crew activity on day 3 begins at approximately 48:00 GET. During the CDR sleep period (52:00 GET), the CMP performs a series of star/lunar horizon sightings (52:15 GET) and TV is scheduled for 15 minutes (55:15 GET). At LOI - 8 hours (61:00 GET), MCC₄ is scheduled. The CMP and LMP sleep period (62:00 GET) is scheduled between MCC₄ and LOI₁.

At 69:07 GET, the LOI₁ maneuver places the S/C into a 60 x 170-nm lunar orbit. Scheduled during the first two lunar revolutions are camera preparation, eat period, COAS ground track determination, control point and pseudo landing site, observations, photographs of targets of opportunity, TV transmission, and LOI₂ preparation. The IMU is realigned once during each dark period in lunar orbit.

DAY 4

Crew activity on day 4 begins at approximately 72:00 GET. At 73:31 GET, the LOI₂ circularization maneuver places the S/C into a 60-nm circular orbit. Scheduled during revolutions 3 and 4 are a 2-hour CMP rest period, landmark training photography, vertical stereo photography, and landmark lighting evaluation.

Scheduled during revolutions 5 and 6 are a 3-hour CDR rest period, one control point landmark tracking, and a pseudo landing site tracking during each daylight period. Each tracking consists of 4 marks.

Scheduled during revolutions 7 and 8 are a 2-hour LMP rest period, three control point landmark trackings, and a pseudo landing site tracking during each daylight period. Each tracking consists of 4 marks.

Scheduled during revolutions 9 and 10 are a 2-hour CMP rest period, convergent stereo photography, an eat period, TEI preparation, and the TEI maneuver at 89:15 GET.

After TEI, the CDR sleep period begins (89:20 GET) followed by the CMP and the LMP sleep period (94:00 GET). During the CDR sleep period, the CMP performs a series of star/lunar horizon sightings.

DAY 5

Crew activity on day 5 begins at approximately 96:00 GET. After the sleep period, the CMP performs a series of star/lunar horizon and star/earth horizon sightings; then MCC₅ at TEI + 15 hours (104:00 GET), followed by TV transmission at 104:15 GET and a series of star/earth horizon sightings (105:15 GET).

During the CDR sleep period (105:00 GET), the CMP performs a series of star/lunar horizon and star/earth horizon sightings. The CMP and LMP sleep periods begin at 112:00 GET.

DAY 6

Crew activity on day 6 begins at approximately 120:00 GET. After a series of star/earth horizon sightings, MCC₆ is scheduled at TEI + 33 hours (122:00 GET) followed by a series of star/lunar horizon and star/earth horizon sightings. Also scheduled is the CDR sleep period (127:00) and both the CMP and LMP sleep periods (134:00). During the CDR sleep period, TV transmission is scheduled (128:00 GET), and the CMP performs a series of star/earth horizon and star/lunar horizon sightings. After the sleep period, the CMP does a series of star/earth horizon sightings.

DAY 7

Crew activity on day 7 begins at approximately 144:00 GET. At EI minus 2 hours (144:50 GET), MCC₇ is scheduled. CM/SM separation nominally occurs at 146:35 GET with splashdown in the Pacific Ocean approximately 20 minutes later.

FLIGHT PLAN NOTES

A. CREW

1. Crew designation is as follows:

<u>Designation</u>	<u>Couch Position</u>	<u>Prime</u>	<u>Backup</u>
Commander (CDR)	Left	Borman	Armstrong
Command Module Pilot (CMP)	Center	Lovell	Aldrin
Lunar Module Pilot (LMP)	Right	Anders	Haise

2. The crew will nominally follow a 17-hour work/7-hour rest cycle where possible. One crewman will be awake at all times with all crewmen awake during major burns. The crew will eat together when possible with additional activities held to a minimum during eat periods. The eat period is normally one-hour duration.
3. The pressure suits will be doffed after TLI and donned prior to entry. Helmets and gloves will be doffed prior to TLI and will remain off until prior to entry.
4. A crew status report will be made twice a day on each crewman.
5. General flight plan updates containing changes to the following day's activity schedule, will be voiced up once per day.
6. Negative reporting will be used in reporting completion of each checklist.

B. COMMUNICATIONS AND INSTRUMENTATION

1. S-band will be prime for voice, ranging and PCM with the VHF used as backup for voice during near earth phases (< 4000 nm). The S-band backup voice system will be checked during the first orbit and the high gain antenna checked after S-IVB/CSM separation.
2. The Flight Qual Recorder will be used as follows:
 - a. Lift-off -45 seconds through 0:12:00 GET
 - b. TLI -2 minutes through TLI cutoff +1 minute
 - c. CSM/S-IVB Sep -2 minutes through Sep +1 minute
 - d. LOI₁ -2 minutes to end of tape

3. The DSE will normally be dumped by real time command (RTC).
4. During communications, the spacecraft will be referred to as "Apollo 8" and the ground as "Houston". The crew member call sign will be their assigned crew position.

C. CSM SYSTEMS

1. The spacecraft (S/C) lift-off switch positions are listed in Apollo (CSM 103) Operations Handbook (AOH), Volume 2, August 1, 1968.
2. Fuel cell purging for H₂ and O₂ will be scheduled R/T.
3. The S/C will remain fully powered up throughout the mission (IMU, CMC and SCS always in operate) with the optics on as required.
4. IMU drift checks are scheduled after TLI, before LOI₁, on revolutions 2 and 4 through 10 in lunar orbit, and prior to entry.
5. The potable water is chlorinated at 24-hour intervals.
6. All onboard gage readings will be read directly from the spacecraft gages and not corrected by the appropriate factors.

SCHEDULED COMMUNICATION TESTS

GET	ALTITUDE nm	CSM ANTENNA	SIGNAL COMBINATION	GROUND ANT	COMMUNICATIONS MODE
03:20		OMNI	4.2	85'	GDS Carrier, PRN, voice, 51.2 KBPS TM
05:45	24,000	HI GAIN	4.2	85'	GDS Carrier, PRN, voice, HBR TM
	24,000	HI GAIN	6.2	85'	GDS Carrier, PRN, Voice, HBR TM
	24,000	HI GAIN	.2	85'	GDS Plybk of Recorded Voice & LBR TM
07:00	35,000	HI GAIN	4.3	85'	GDS Carrier, PRN, voice, LBR TM
to	35,000	HI GAIN	6.3	85'	GDS Carrier, PRN, voice, LBR TM
08:00	35,000	HI GAIN	5.2	85'	GDS Carrier, PRN, voice HBR TM
	35,000	HI GAIN	8.1	85'	GDS Carrier, voice and LBR TM
29:00	110,000	HI GAIN	4	30'	ASC Carrier, PRN, Voice
to	110,000	HI GAIN	5	30'	ASC Carrier, PRN, Updata
30,000	110,000	HI GAIN	6	30'	ASC Carrier, PRN, Voice, Updata
or	110,000	HI GAIN	8	30'	ASC Carrier, BU Voice
125,000	110,000	HI GAIN	4.2	30'	ASC Carrier, PRN, Voice, HBR TM
to	110,000	HI GAIN	5.2	30'	ASC Carrier, PRN, Voice, HBR TM
126,000	110,000	HI GAIN	4.3	30'	ASC Carrier, PRN, Voice, LBR TM
	110,000	HI GAIN	8.1	30'	ASC Carrier, Voice, HBR TM
	110,000	OMNI	1	30'	ASC Carrier, PRN
	110,000	OMNI	.5	30'	ASC Carrier, LBR TM
	110,000	OMNI	.6	30'	ASC Carrier, Key Subcarrier
	110,000	OMNI	1.7	30'	ASC Carrier, PRN Ranging
	110,000	OMNI	.8	30'	ASC Carrier, BU Voice, LBR TM
	110,000	OMNI	.10	30'	ASC Carrier, EU Voice
31:15	120,000	HI GAIN	.4	85'	GDS CSM Television
69:00	205,000	HI GAIN	6.2	85'	Carrier, PRN, Voice, HBR TM
	205,000	HI GAIN	6.3	85'	Carrier, PRN, Voice, LBR TM
	205,000	HI GAIN	.2	85'	Plybk of Recorded voice &LBR TM
89:00	205,000	HI GAIN	.4	85'	CSM television
<u>NORMAL OPERATING MODES</u>					

Pages 1-8 thru 1-21 contain the following voice update forms
and the explanation for the abbreviations and symbols used.

- | | |
|-------------------|----------------------------|
| Pg 1-8 and 1-9 | TLI PAD/EXPLANATION |
| Pg 1-10 and 1-11 | P27 UPDATE PAD/EXPLANATION |
| Pg 1-12 thru 1-14 | MANEUVER PAD/EXPLANATION |
| Pg 1-15 thru 1-17 | ENTRY PAD/EXPLANATION |
| Pg 1-18 thru 1-21 | MAP UPDATE PAD/EXPLANATION |

TLI		
X : :	X : :	TB6p
X X X	X X X	R
X X X	X X X	P
X X X	X X X	Y
X X X : :	X X X : :	BT
+	+	AVC VI
X X X	X X X	R SEP
X X X	X X X	P SEP
X X X	X X X	Y SEP

TLI PAD

TB6p	X:XX:XX(HRS:MIN:SEC)	PREDICTED TIME OF BEGINNING OF S-IVB RESTART PREPARATION FOR TLI (TB6 = TLI IGN -9 MIN)
R	XXX (DEG)	PREDICTED SPACECRAFT IMU GIMBAL ANGLES AT TLI IGNITION
P	XXX (DEG)	
Y	XXX (DEG)	
BT	XX:XX (MIN:SEC)	DURATION OF TLI BURN
ΔVC	XXXXX.X (fps)	NOMINAL TLI ΔV SET INTO EMS ΔV CONTROL
VI	+XXXXX (fps)	NOMINAL INERTIAL VELOCITY DISPLAYED ON DSKY AT TLI CUTOFF
R SEP	XXX (DEG)	PREDICTED SPACECRAFT IMU GIMBAL ANGLES AT COMPLETION
P SEP	XXX (DEG)	OF S-IVB MNVR TO CSM/S-IVB
Y SEP	XXX (DEG)	SEP ATTITUDE

P27. UPDATE						
PURP	V		V		V	
GET	:	:	:	:	:	:
304	01	INDEX		INDEX		INDEX
02						
03						
04						
05						
06						
07						
10						
11						
12						
13						
14						
15						
16						
17						
20						
21						
22						
23						
24						
N34	HRS	X	X	X	X	X
	MIN	X	X	X	X	X
NAV CHECK	SEC	X	X		X	X
N43	LAT	O			O	
	LONG					
	ALT	+	O		+	O

P27 UPDATE

PURP	XXX	TYPE OF DATA TO BE RECEIVED (SUCH AS: NAV - LIFT-OFF TIME)
V	XX	TYPE OF COMMAND LOAD (70 - 71 - 72 - 73)
GET	XXX:XX:XX(HR:MIN:SEC)	TIME DATA RECORDED
01	XX (OCTAL)	INDEX NO. OF COMMAND WORDS IN LOAD
02-24	XXXXX	NO. OF CORRECTION COMMAND WORDS
NAV CHECK		TO CONFIRM POINT ABOVE GROUND TRACK FOR A GIVEN TIME
T	XX:XX:XX(HRS:MIN:SEC)	TIME
LAT	XX:XX (DEG)	LATITUDE
LONG	XXX:XX (DEG)	LONGITUDE
ALT	XXX.X (nm)	ALTITUDE

MANEUVER		
NORTH & SOUTH SET STARS	/ /	PURPOSE PROP/GUID
R ALIGN	+	WT N47
P ALIGN	O O .	PTIM N48
Y ALIGN	O O .	YTIM
	+ O O	HRS GETI
	+ O O O	M:N N33
	+ O .	SEC
ULLAGE		ΔV_X N61
		ΔV_Y
		ΔV_Z
	X X X	R
	X X X	P
	X X X	Y
	+	HA N44
		HP
	+	ΔV_T
HORIZON/WINDOW	X X X .	BT
	X . .	ΔV_C
	X X X X	SXTS
	+	O SFT
	+	C O TRN
	X X X	BSS
	X X .	SPA
	X X X .	SXP
OTHER	O . .	LAT N61
		LONG
	+	RTGO EMS
	+	VIO
	:	GET .05G

MANEUVER PAD

PURPOSE	XXXXXX	TYPE OF MNVR TO BE PERFORMED
PROP/GUID		PROPELLION SYSTEM (SPS/RCS)/ GUIDANCE (SCS/G&N)
WT	XXXXX (lbs)	PREMANEUVER VEHICLE WEIGHT
P TRIM	X.XX (DEG)	SPS PITCH GIMBAL OFFSET TO PLACE THRUST
Y TRIM	X.XX (DEG)	SPS YAW GIMBAL OFFSET TO PLACE THRUST
GETI	XX:XX:XX (HRS:MIN:SEC)	TIME OF MNVR IGNITION
ΔV_X	XXXX.X (fps)	
ΔV_Y	XXXX.X (fps)	
ΔV_Z	XXXX.X (fps)	P30 VELOCITY TO BE GAINED COMPONENTS IN LOCAL VERTICAL COORDINATES
R	XXX (DEG)	
P	XXX (DEG)	
Y	XXX (DEG)	IMU GIMBAL ANGLES OF MANEUVER ATTITUDE
H_A	XXXX.X (nm)	PREDICTED APOGEE ALTITUDE AFTER MANEUVER
H_P	XXXX.X (nm)	PREDICTED PERIGEE ALTITUDE AFTER MANEUVER
ΔV_T	XXXX.X	TOTAL VELOCITY OF MANEUVER
BT	X:XX (MIN:SEC)	MANEUVER DURATION
ΔV_C	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	XXX (OCTAL)	BORESIGHT STAR FOR MANEUVER ATTITUDE CK USING THE COAS
SPA	XX.X (DEG)	BSS PITCH ANGLE ON COAS

MANEUVER PAD (cont'd)

SXP	X.X (DEG)	BSS X POSITION ON COAS
LAT LONG	XX.XX XXX.XX	LATITUDE AND LONGITUDE OF THE LANDING POINT FOR ENTRY GUIDANCE
RTGO	XXXX.X	RANGE TO GO FOR EMS INITIALIZATION
VIO	XXXXXX (fps)	INERTIAL VELOCITY AT .05G FOR EMS INITIALIZATION
GET(.05G)	XX:XX:XX	TIME OF .05G
NORTH & SOUTH SET STARS		STARS FOR TELESCOPE FOR BACKUP GDC ALIGN
R, P, Y (ALIGN)		ATTITUDE TO BE SET IN ATTITUDE SET TW FOR BACKUP GDC ALIGN
ULLAGE		NO. OF SM RCS JETS USED AND LENGTH OF TIME OF ULLAGE
HORIZON WINDOW		WINDOW MARKING AT WHICH HORIZON IS PLACED AT A SPECIFIED TIG (ATT CK)

ENTRY							AREA
X X X				X X X			R .05G
X X X				X X X			P .05G
X X X				X X X			Y .05G
	•	•	•		•	•	GET HOR
X X X				X X X			P CK
O				O			LAT N61
							LONG
X X X			•	X X X			MAX G
+				+			V400K N60
- O O			•	- O O			T400K
+			•	+			RTGO EMS
+				+			VIO
	•	•	•		•	•	RRT
X X		•	•	X X		•	RET.05G*
+	O O		•	+	O O		D _L MAX*
+	O O		•	+	O O		D _L MIN* ^{N69}
+				+			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		•	RET BBO
X X			•	X X		•	RETEBO
X X			•	X X		•	RET DRO
X X X X				X X X X			SXTS
+			0	+		0	SFT
+			0 0	+		0 0	TRN
X X X				X X X			BSS
X X				X X			SPA
X X X				X X X			SXP
X X X X				X X X X			LIFT VECTOR

ENTRY PAD

AREA	XXX	SPLASHDOWN AREA DEFINED BY TARGET LINE
R .05G	XXX(DEG)	SPACECRAFT IMU GIMBAL ANGLES
P .05G	XXX(DEG)	REQUIRED FOR AERODYNAMIC
Y .05G	XXX(DEG)	TRIM AT .05G
GET (HOR CK)	XX: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
V _{400K}	XXXXX (fps)	INERTIAL VELOCITY AT ENTRY INTERFACE
γ _{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	+XXXXX.(fps)	INERTIAL VELOCITY AT .05G FOR EMS INITIALIZATION
RRT	XX: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)
D _L MAX	X.XX (G's)	MAXIMUM ACCEPTABLE VALUE OF PREDICTED DRAG LEVEL (FROM CMC)
D _L MIN	X.XX (G's)	MINIMUM ACCEPTABLE VALUE OF PREDICTED DRAG LEVEL (FROM CMC)
V _L MAX	XXXXX (fps)	MAXIMUM ACCEPTABLE VALUE OF EXIT VELOCITY (FROM CMC)
V _L MIN	XXXXX (fps)	MINIMUM ACCEPTABLE VALUE OF EXIT VELOCITY (FROM CMC)

ENTRY PAD (cont'd)

DO	X.XX (G's)	PLANNED DRAG LEVEL DURING CONSTANT G
RET V _{CIRC}	XX:XX (MIN:SEC)	TIME FROM EI THAT S/C VELOCITY BECOMES CIRCULAR
RETBBO	XX:XX (MIN:SEC)	TIME FROM EI TO THE BEGINNING OF BLACKOUT
RETEBO	XX:XX (MIN:SEC)	TIME FROM EI TO THE END OF BLACKOUT
RETDRO	XX:XX (MIN:SEC)	TIME FROM EI TO DROGUE DEPLOY
SXTS	XX(OCTAL)	SEXTANT STAR FOR ENTRY ATTITUDE CHECK
SFT	XXX.X(DEG)	SEXTANT SHAFT SETTING FOR ENTRY ATTITUDE CHECK
TRN	XX.X(DEG)	SEXTANT TRUNNION SETTING FOR ENTRY ATTITUDE CHECK
BSS	XXX(OCTAL)	BORESIGHT STAR FOR ENTRY ATTITUDE CHECK USING THE COAS
SPA	XX.X(DEG)	BSS PITCH ANGLE ON COAS
SXP	X.X(DEG)	BSS X POSITION ON COAS
LIFT VECTOR	XX	LIFT VECTOR DESIRED AT .05G's BASED ON ENTRY CORRIDOR

MAP UPDATE

REV 1/2	REMARKS
GET (hrs:min:sec)	
LOS	
PM	
AOS	
SS	
LOS	
SR	
PM	
AOS	
SS	

REV 2/3	REMARKS
GET (hrs:min:sec)	
LOS	
SR	
PM	
AOS	
SS	

REV 3/4	REMARKS
GET (hrs:min:sec)	
LOS	
SR	
PM	
AOS	
SS	

MAP UPDATE

REV 7/8 REMARKS _____

GET (hrs:min:sec) _____

LOS _____

SR _____

PM _____

AOS _____

SS _____

REV 8/9 REMARKS _____

GET (hrs:min:sec) _____

LOS _____

SR _____

PM _____

AOS _____

SS _____

REV 9/10 REMARKS _____

GET (hrs:min:sec) _____

LOS _____

SR _____

PM _____

AOS _____

SS _____

REV 10 REMARKS _____

GET (hrs:min:sec) _____

LOS _____

SR _____

AOS _____

SS _____

MAP UPDATE

REV 4/5 REMARKS _____

GET (hrs:min:sec) _____

LOS _____

SR _____

PM _____

AOS _____

SS _____

REV 5/6 REMARKS _____

GET (hrs:min:sec) _____

LOS _____

SR _____

PM _____

AOS _____

SS _____

REV 6/7 REMARKS _____

GET (hrs:min:sec) _____

LOS _____

SR _____

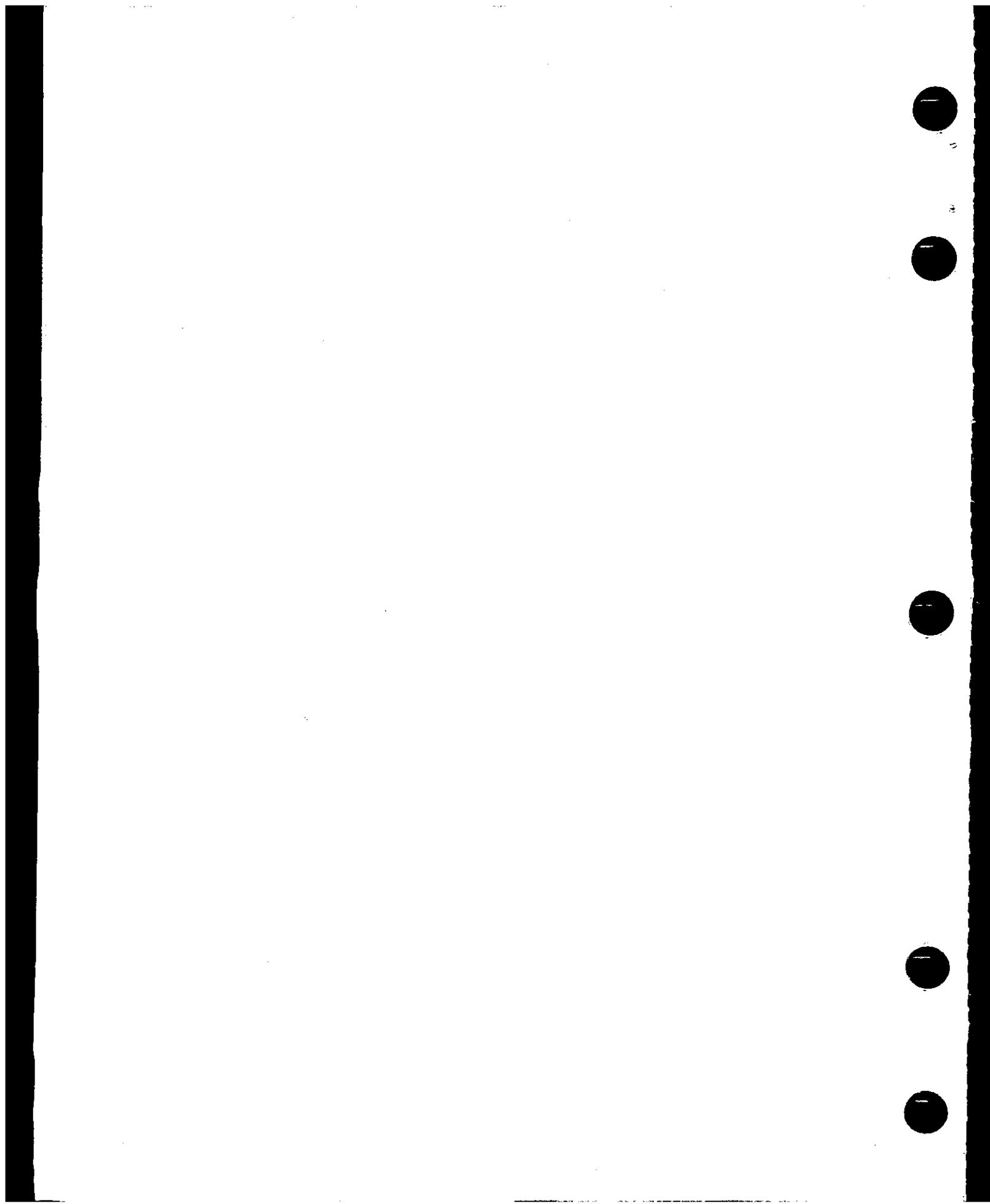
PM _____

AOS _____

SS _____

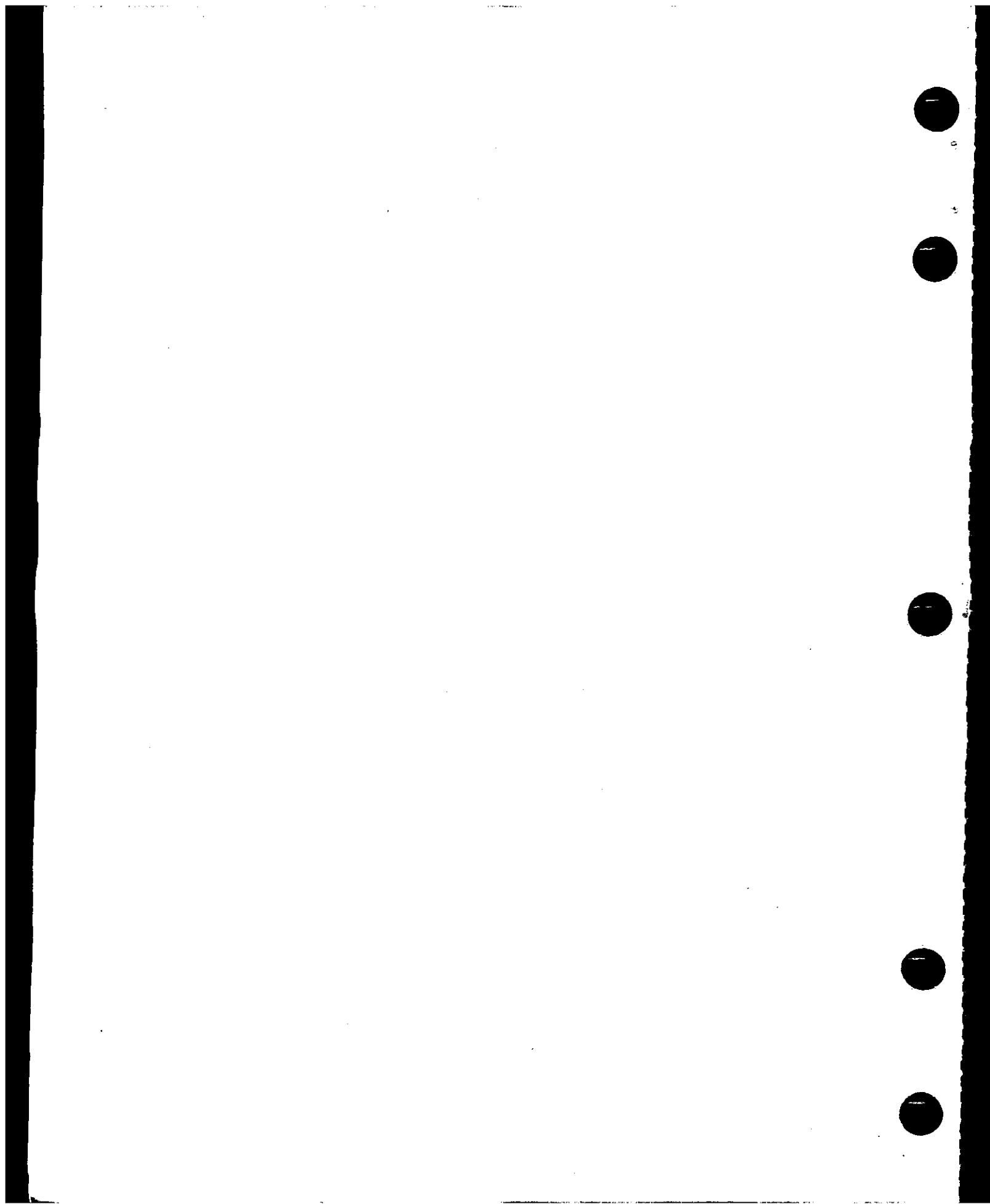
MAP UPDATE

LOS	XX:XX:XX(HRS:MIN:SEC)	TIME OF MSFN LOSS OF SIGNAL IN LUNAR ORBIT
AOS	XX:XX:XX(HRS:MIN:SEC)	TIME OF MSFN ACQUISITION OF SIGNAL
SS	XX:XX:XX(HRS:MIN:SEC)	TIME OF SPACECRAFT SUNSET IN LUNAR ORBIT
SR	XX:XX:XX(HRS:MIN:SEC)	TIME OF SPACECRAFT SUNRISE IN LUNAR ORBIT
PM	XX:XX:XX(HRS:MIN:SEC)	TIME OF CROSSING OF MOON'S PRIME MERIDIAN (150°W)



SECTION II

SECTION II - DETAILED TIMELINE



FLIGHT PLAN

TIME	EVENT		REMARKS
-00:45	LMP:	FLT RCDR - RECORD	
-00:09	LCC:	IGNITION COMMAND	
-00:01		L/V ENGINE LTS (5) - OUT	
00:00	LCC:CDR:	<u>REPORT</u> LIFT-OFF P11 AUTO	LIFT-OFF LT - ON, MET STARTS COUNT
00:02	CDR:	<u>REPORT</u> YAW MNVR	
00:11	CDR:	<u>REPORT</u> ROLL AND PITCH PROGRAM INITIATE	
00:28	CDR	<u>REPORT</u> ROLL COMPLETE	
00:42	MCC-H:CDR:	<u>REPORT</u> MARK MODE 1B	
00:50	LMP:	<u>REPORT</u> CABIN PRESS DECREASE	
01:17	CDR:	<u>REPORT</u> MAX Q	
01:50	MCC-H:CDR:	<u>REPORT</u> MARK MODE 1C	
02:00	MCC-H:CDR:	<u>REPORT</u> GO/NO GO FOR STAGING	
02:05	CDR:	<u>REPORT</u> INBOARD ENGINE CUTOFF	
02:31	CDR:	<u>REPORT</u> OUTBOARD ENGINE CUTOFF	LTS 1, 2, 3, & 4 - ON
02:32	CDR:	<u>REPORT</u> S-IC/S-II STAGING	LTS OFF

MISSION AS503/103

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DATE November 22, 1968

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FLIGHT PLAN

TIME	EVENT	REMARKS
03:00	CDR: <u>REPORT</u> 2ND PLANE SEP	>65% THRUST-S-II SEP LIGHT OUT
03:07	CDR: <u>REPORT</u> TWR JETT & MODE II	
03:25	CDR: <u>REPORT</u> GUIDANCE INITIATE	
03:53	MCC-H: <u>REPORT</u> TRAJECTORY AND GUID. GO/NO GO	
04:00	CMP: <u>REPORT</u> S/C GO/NO GO	
05:00	LMP: <u>REPORT</u> S/C GO/NO GO	
05:53	MCC-H: CDR: <u>REPORT</u> S-IVB TO ORBIT CAPABILITY	
06:00	CDR: <u>REPORT</u> S/C GO/NO GO	
06:15	LMP: OMNI ANT-D	IF LAUNCH AZIMUTH <90°
07:00	CDR: <u>REPORT</u> S/C GO/NO GO	
08:00		
08:20	MCC-H: CDR: <u>REPORT</u> GO/NO GO FOR STAGING	
08:40	CDR: <u>REPORT</u> S-II CUTOFF, S-II STAGING	

MISSON AS503/103

EDITION

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DATE

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FLIGHT PLAN

TIME	EVENT	REMARKS
08:45	CDR: <u>REPORT</u> S-IVB IGNITION	
09:00	CDR: <u>REPORT</u> S/C GO/NO GO MCC-H: <u>REPORT</u> TRAJECTORY AND GUID. GO/NO GO	
09:50	MCC-H:CDR: <u>REPORT</u> MARK MODE IV	
10:00	MCC-H:CDR: <u>REPORT</u> GO/NO GO FOR ORBIT MCC-H: <u>REPORT</u> PREDICTED TIME OF SECO	
11:21	CDR: <u>REPORT</u> SECO AND HP	
11:31	MCC-H:CDR: <u>REPORT</u> ORBITAL GO/NO GO	
12:00	LMP: FLT RCDR - OFF	

MISSON AS503/103

EDITION

FINAL

DATE November 22, 1968

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FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
00:00				
T U S	POST INSERTION CONFIG	POST INSERTION CONFIG SM RCS CK CM RCS CK C&W CK REMOVE HELMET & GLOVES	POST INSERTION CONFIG	
00:15	REMOVE HELMET & GLOVES		REMOVE HELMET & GLOVES	
T C Y I	ECS POST INSERTION CONFIG		ECS POST INSERTION CONFIG	
T A N	GDC ALIGN TO IMU	INGRESS LEB O ₂ MAIN REG CK	EPS PERIODIC MONITOR ECS MONITOR CK	
00:30	MOUNT & INITIALIZE ORDEAL		SPS PERIODIC MONITOR PUGS TEST	
T C R O	INSTALL COAS COAS HORIZON CK	JETTISON OPTICS COVER RECORD ΔAZ CORRECTION	ECS REDUNDANT COMP CK FC PURGE CK	
00:45				
T C R O		OPTICS CK IMU REALIGN P52 OPTION 3 - REFSMMAT STAR ID _____	BIOMED SW - CENTER	VOICE UPDATE: ΔAZ CORREC- TION
01:00		(cont'd)		

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	00:00 - 01:00	1/LPO	2-1

MSC Form 1910 (OT) (Oct 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
01:00	H S K	STAR ANGLE DIFF		
01:15		TORQUE ANGLES: X Y Z		
01:30	SCS ATT REFERENCE COMPARISON CK U S	REPORT: GYRO TORQUE ANGLES RECORD ABORT BLOCK PAD (TLI +90 MIN AND TLI +4 HOUR)	BACKUP COMM CK	GIVE GO FOR COMM CK VOICE UPDATE: BLOCK DATA
01:45	C Y I	RECORD TLI PAD		VOICE UPDATE: TLI PAD P27 UPDATE: STATE VECTORS
02:00			BIOMED SW - RIGHT	

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	01:00 - 02:00	1/LPO	2-2

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_i : h : h : ΔV_c

X X X FUEL

X X X OX

X X X UNBALANCE

2-2a

REMARKS:

TLI
BURN CHART

	P or Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
TLI	10°/SEC SHUTDOWN	+45° SHUTDOWN	B/T+6 SEC & V_i =PAD VALVE	NO TRIM

TLI PREMATURE SHUTDOWN	
ha >60,000 nm	LUNAR ORBIT OR FLYBY (DEPENDING ON ΔV REQD)
ha >22,000 nm	TWO PHASING MANEUVERS TO SEMI-SYNCHRONOUS ORBIT. DIRECT ENTRY
ha >41,000 nm	HIGH ALTITUDE ORBITS FOLLOWED BY DEBOOST TO 400 nm APOGEE
ha 100 - 41,000 nm	EITHER HI ALTITUDE (41,000 ha) OR LOW ALT, DEPENDING ON LANDMARKS

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
02:00				
T A N				
02:15	TLI PREP EMS AV TEST	TLI PREP TRANS TO COUCH	TLI PREP	
C R O	GO/NO-GO FOR PYRO ARM GO/NO-GO FOR TLI			GO/NO-GO
02:30	GDC ALIGN AND DRIFT CK		BIOMED Sw - LEFT	
T B -	TB-6			
02:45	P47 BURN ATT CK TLI	GETI = 2:50:31	FLT RCDR - RECORD	
R E D H A W	SECO S-IVB INERTIAL SECO +20 SEC S-IVB TO LH, ORB RATE, HEADS DOWN		FLT RCDR - OFF	
03:00				

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	02:00 - 03:00	1/LPO	2-3

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
03:00	TLI BURN STATUS REPORT	RECORD GET SEP MNVR INIT		VOICE UPDATE: GET OF SEP MNVR INIT
	S-IVB MNVR TO SEP ATT	TRANS CSM STATE VECTOR TO LM SLOT		
03:15	GO/NO-GO FOR 90-MIN ABORT	UNSTOW PHOTO EQUIP B3 16mm DAC 18mm LENS RT ANG MIRROR 16mm C-EX MAG PWR CABLE 70mm CAM 80mm LENS 70mm C-MAG		GO/NO-GO
	TRANSPOSITION FROM S-IVB +X FOR 1 fps, COAST FOR 1 MIN, -X FOR 0.5 fps, PITCH UP 4°/SEC	R13 SPOTMETER	S-BAND XPONDER - SEC FLT RCDR - RECORD	COMM TEST MODE: 4.2
03:30	MS F N FLY FORMATION	DOFF & STOW PGA	FLT RCDR - OFF NONESS BUS - OFF PHOTOGRAPH S-IVB 16/18/C-EX, 1/250, f11, 6 fps (1 MAG) 2/80/C, 1/250, SPOT (10 EXP)	
03:45	MNVR TO LOCAL VERTICAL -X RADIALLY UPWARD 1.5 fps			
04:00		TRANS CSM STATE VECTOR TO LM SLOT		

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	03:00 - 04:00	1/TLC	2-4

MSC Form 1910 (OT) (Oct 68)

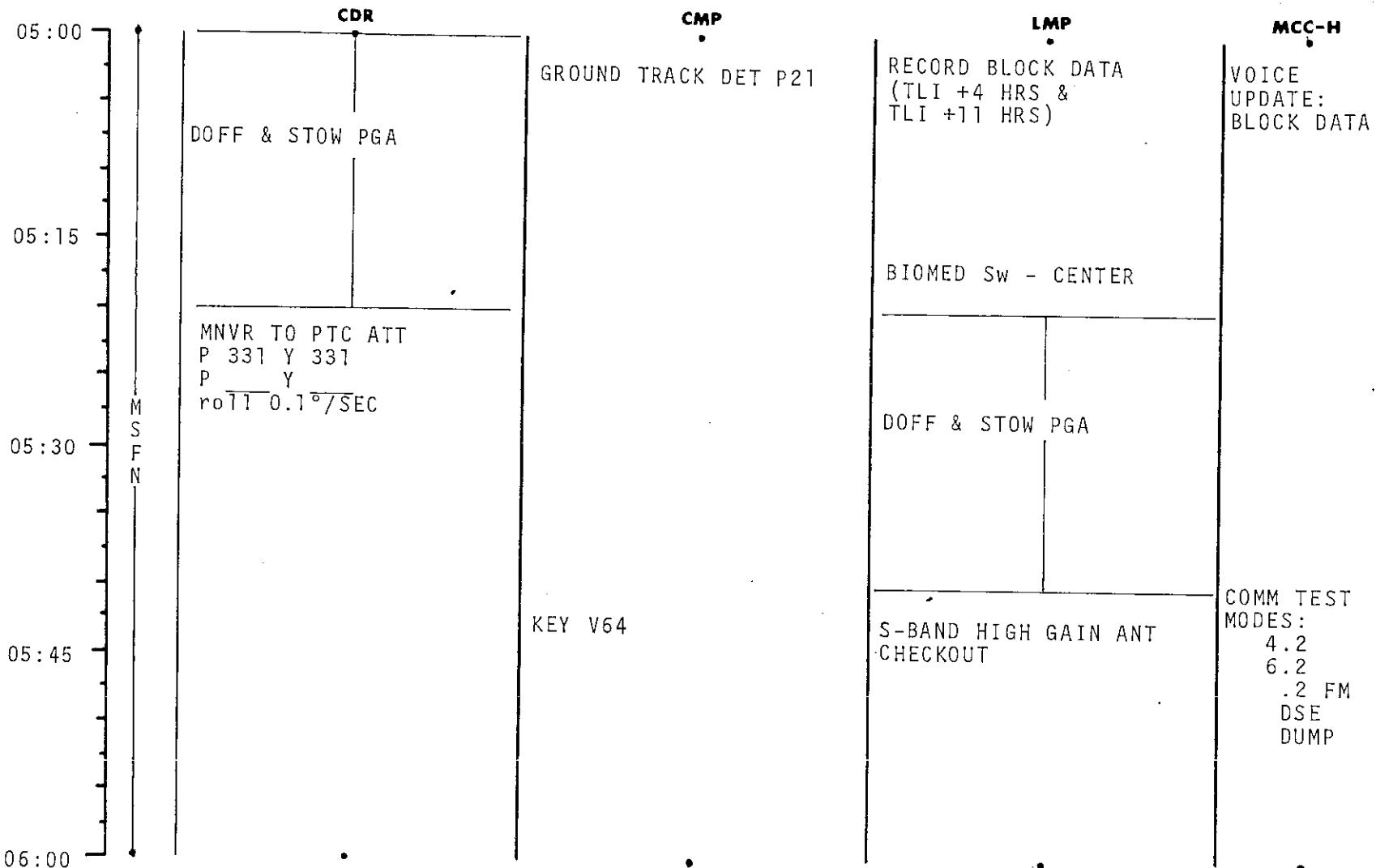
FLIGHT PLANNING BRANCH

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
04:00		IMU REALIGN P52 OPTION 3 - REFSMMAT STAR ID _____ STAR ANGLE DIFF _____ TORQUE ANGLES: X _____ Y _____ Z _____	REPORT PERSONAL RADIATION DOSIMETER READINGS	
04:15	GDC ALIGN TO IMU			
04:30	M S F N	TRN BIAS 1. STAR 14 ENH STAR _____ E _____ H 1 SET - 3 MARKS EACH		
04:45		2. STAR 15 EFH STAR _____ E _____ H 2 SETS - 3 MARKS EACH		
05:00		3. STAR 16 EFH STAR _____ E _____ H 2 SETS - 3 MARKS EACH		

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	04:00 - 05:00	1/TLC	2-5

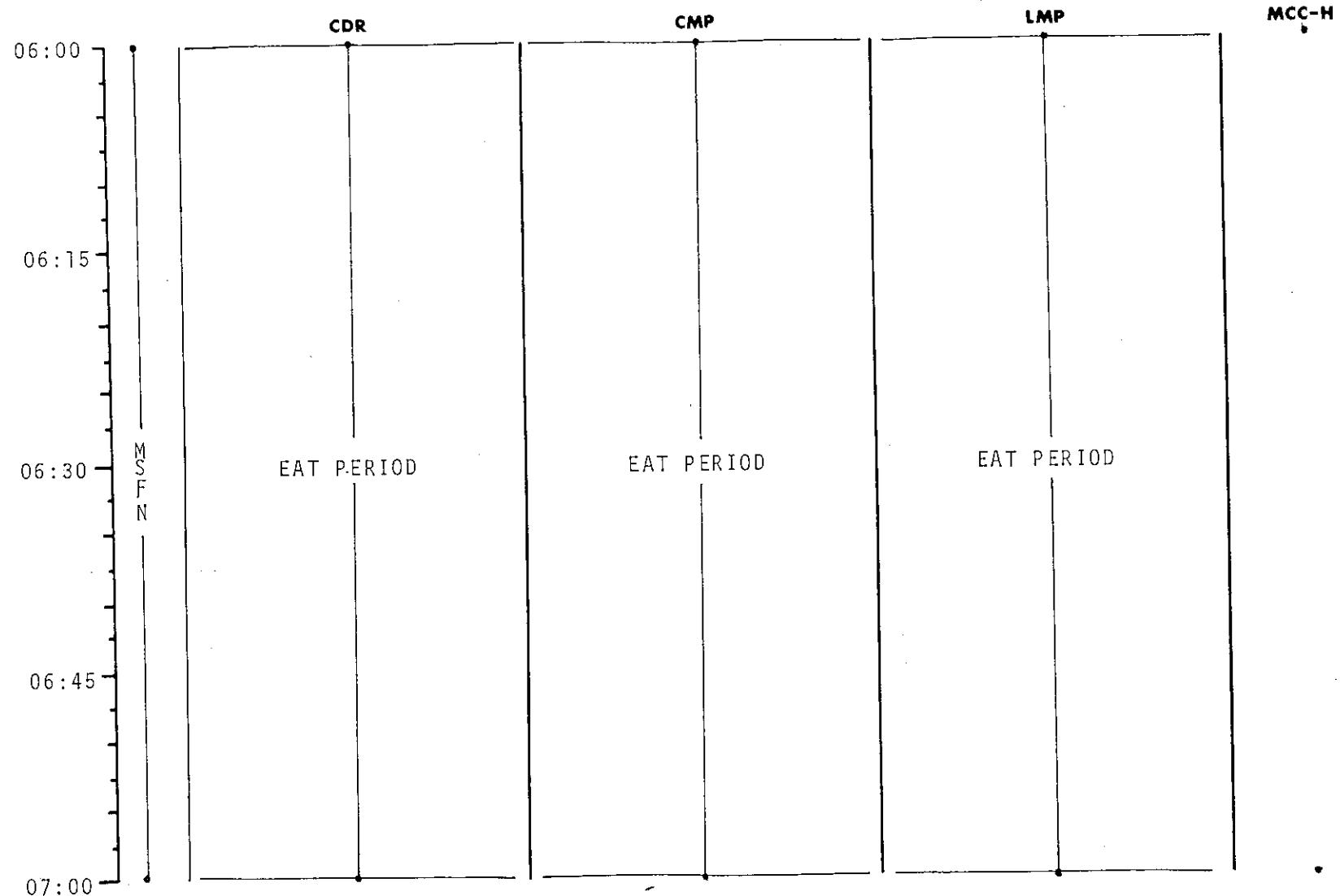
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	05:00 - 06:00	1/TLC	2-6

FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	06:00 - 07:00	1/TLC	2-7

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
07:00				PERFORM COMM TESTS MODES: 4.3 6.3 5.2 8.1
07:15				
07:30	M S F N	L10H CANISTER CHANGE (CARTRIDGE NO. 3 FROM A3 INTO CANISTER A)		
		OPEN COOLANT CONTROL ATTENUATION PANEL EVAP WATER CONT SEC VLV - OFF		
07:45		CLOSE COOLANT CONTROL ATTENUATION PANEL		
		WASTE STOWAGE VENT - CLOSED		P27 UPDATE:
		BAT VENT VLV - OPEN (UNTIL SERVICE METER = 0)		STATE
08:00		BAT VENT VLV - CLOSED		VECTOR
				TGT LOAD

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	07:00 - 08:00	1/TLC	2-8

MSC Form 1910 (Rev 68)

FLIGHT PLANNING BRANCH

BURN STATUS REPORT

X	X	<input type="checkbox"/>	•	•	ATIG
X	X		•	•	BT
<input type="checkbox"/>			•	•	V _{gx}

TRIM

X	X	X	R
X	X	X	P
X	X	X	Y
<input type="checkbox"/>		•	V _{gx}
		•	V _{gy}
		•	V _{gz}
		•	ΔV _c

FUEL

X	X	X	OX
---	---	---	----

UNBALANCE

REMARKS:

2-8a

MCC'S

BURN CHART

	P or Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC(ALL)	10°/SEC TAKEOVER	10° TAKEOVER	B/T +1 SEC	TRIM TO 0.2 fps

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
08:00	MNVR TO P52 ATT	IMU REALIGN P52 OPTION 3 - REFSMMAT AND DRIFT CK STAR ID _____, STAR ANGLE DIFF _____	RECORD MNVR PAD	VOICE UPDATE: MNVR PAD
08:15		TORQUE ANGLES X _____ Y _____ Z _____		
08:30 M S F N	V47 TRANS LM STATE VECTOR TO CSM SLOT EXT ΔV P30 SPS/RCS THRUST P40/P41 MNVR TO BURN ATT	SXT STAR CK	BIOMED SW - RIGHT	PIPA BIAS CK
08:45	EMS ΔV TEST	TRANS TO COUCH		
TLI +6 HRS	GDC ALIGN			
09:00	MCC 1 ΔV=NOMINALLY ZERO			

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	08:00 - 09:00	1/TLC	2-9

MSC Form 1910 (Nov 68)

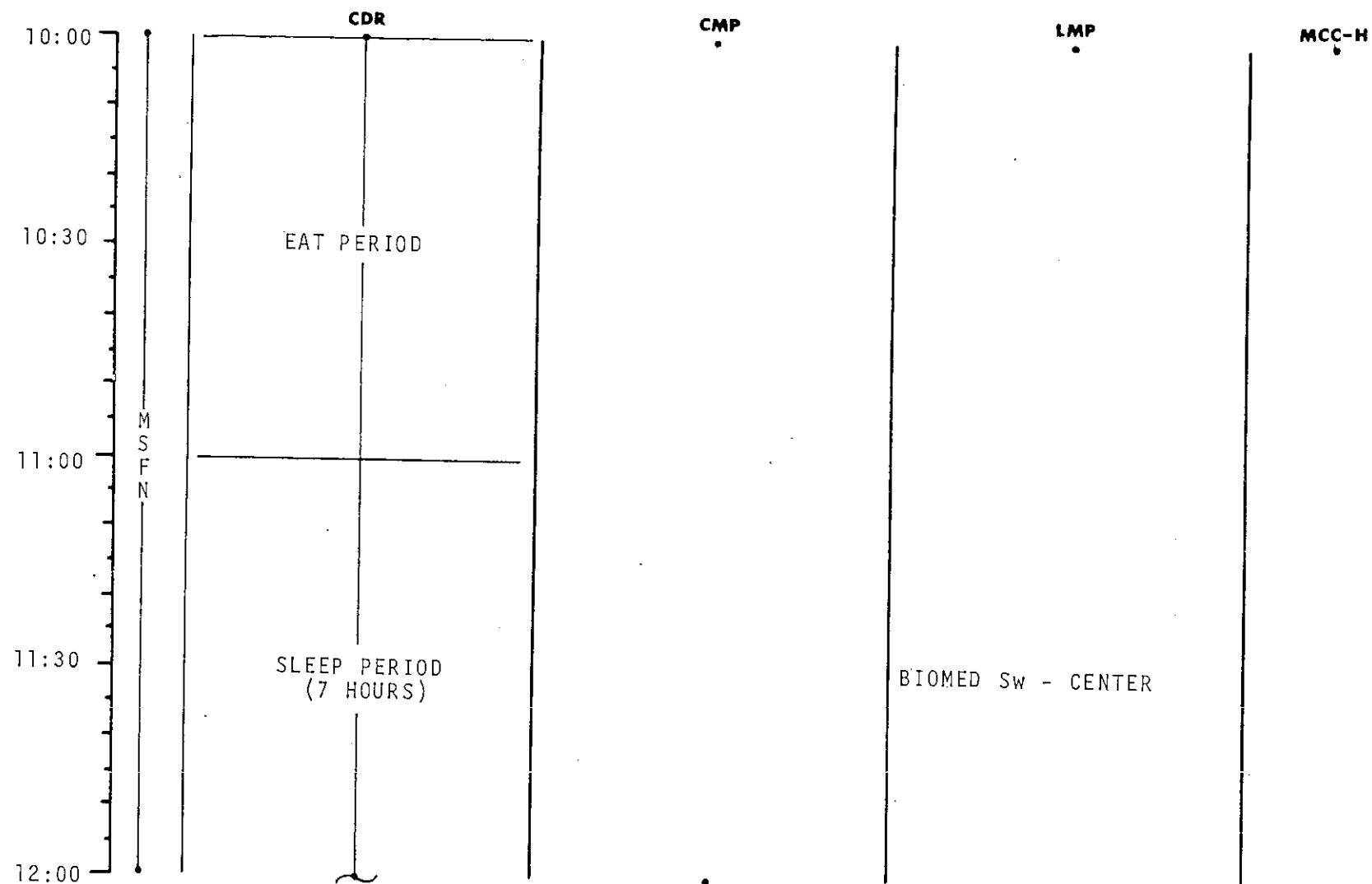
FLIGHT PLANNING BRANCH

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
09:00	V66 TRANS CSM STATE VECTOR TO LM SLOT MCC ₁ BURN STATUS REPORT MNVR TO SIGHTING ATT	SM RCS CK TRN BIAS	SPS MONITOR CK INITIATE BAT CHARGE	
09:30	M S F N	CISLUNAR NAVIGATION P23 1. STAR 15 ELDMK 10 LAT 28.876°N LONG/2 56.292°W ALT 000.01 STAR ELDMK LAT _____ LONG/2 _____ ALT _____ 2 SETS		
10:00	MNVR TO PTC ATT P 331 Y 331 P _____ Y _____ ROLL 0.1°/SEC	2. STAR 16 ELDMK 10 LAT 28.876°N LONG/2 56.292°W ALT 000.01 STAR ELDMK LAT _____ LONG/2 _____ ALT _____ GROUND TRACK DET P21		

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	09:00 - 10:00	1/TLC	2-10

FLIGHT PLAN

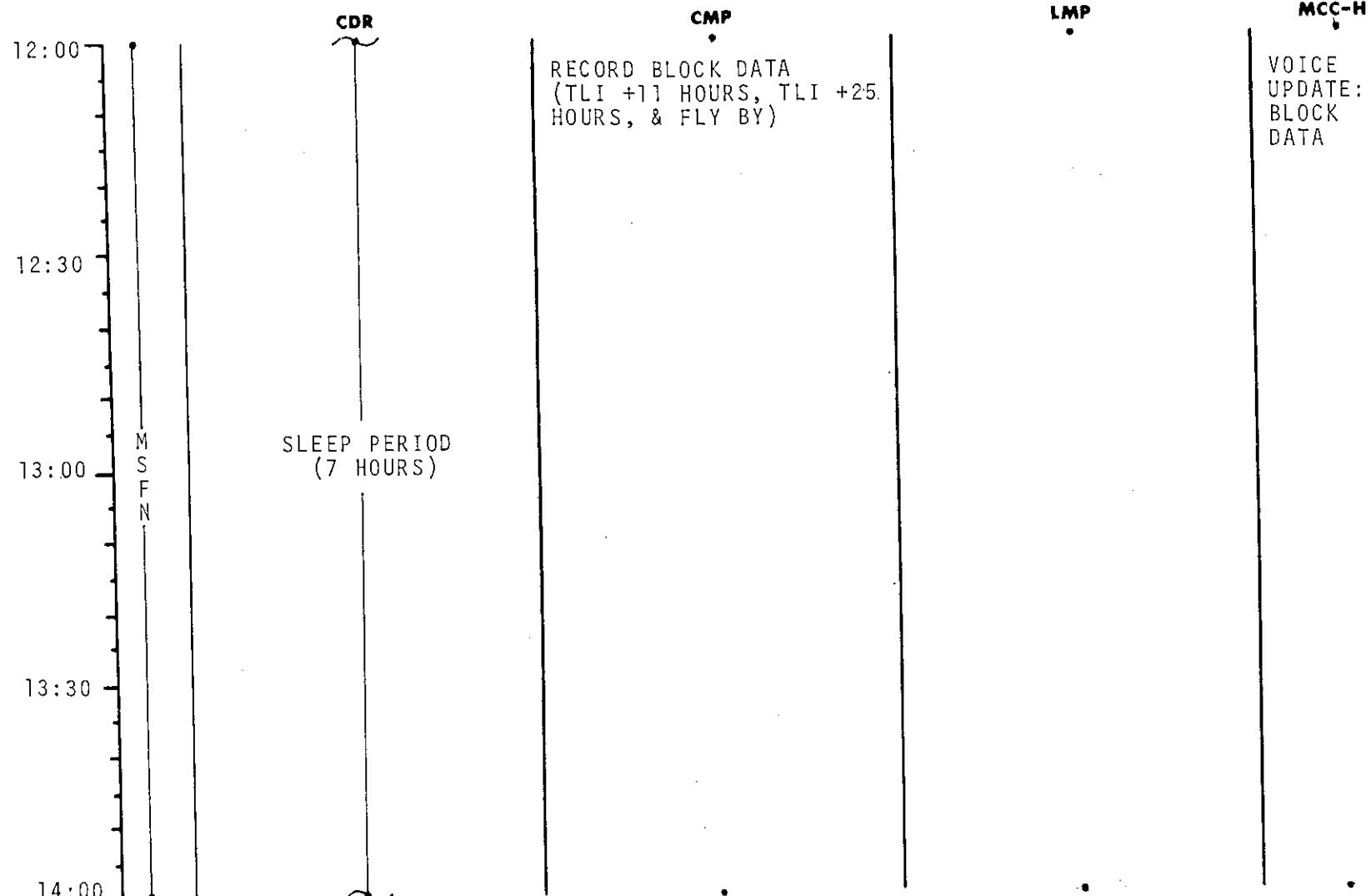


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	10:00 - 12:00	1/TLC	2-11

MSC Form 1910 (Nov 68)

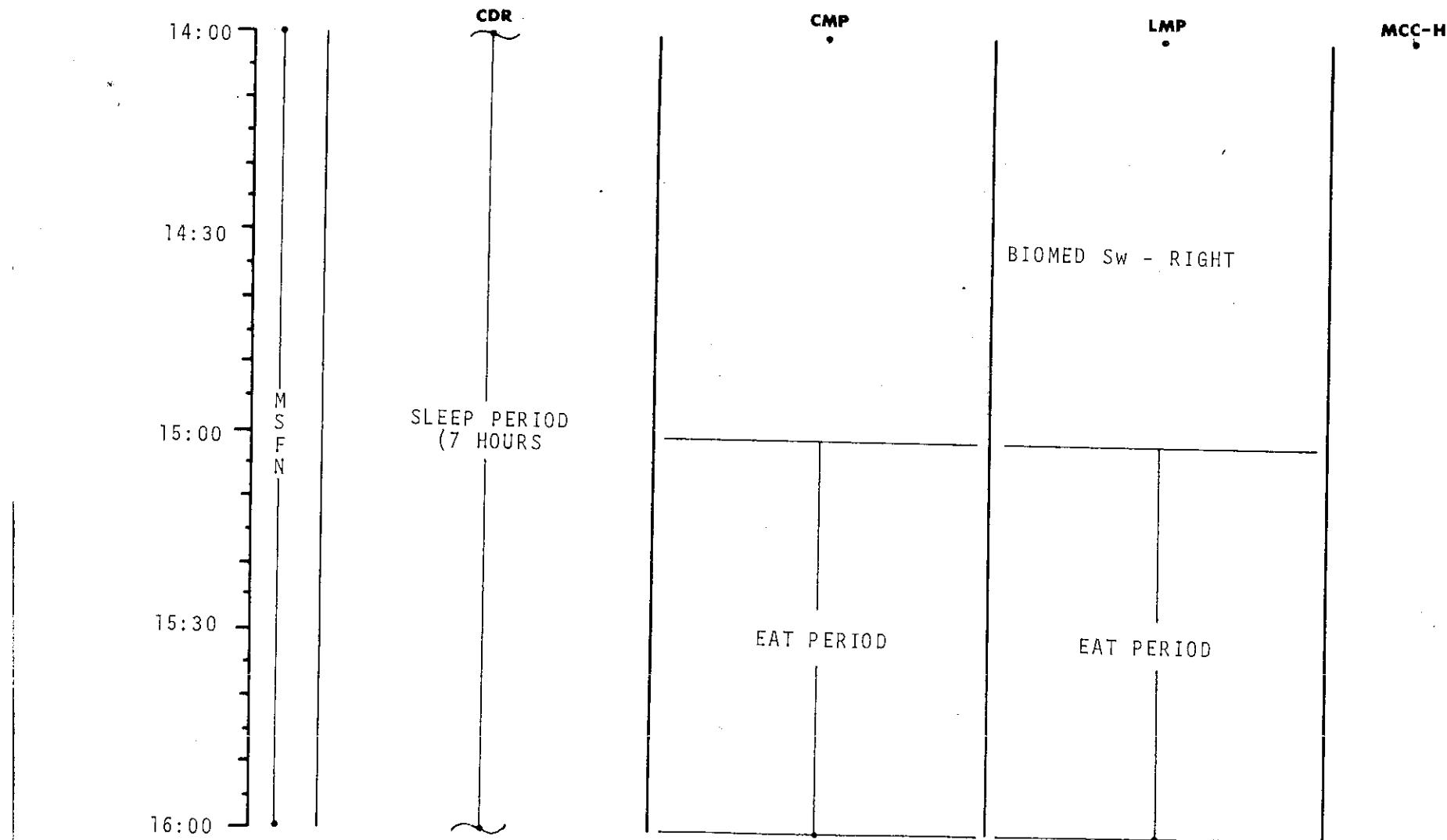
FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	12:00 - 14:00	1/TLC	2-12

FLIGHT PLAN

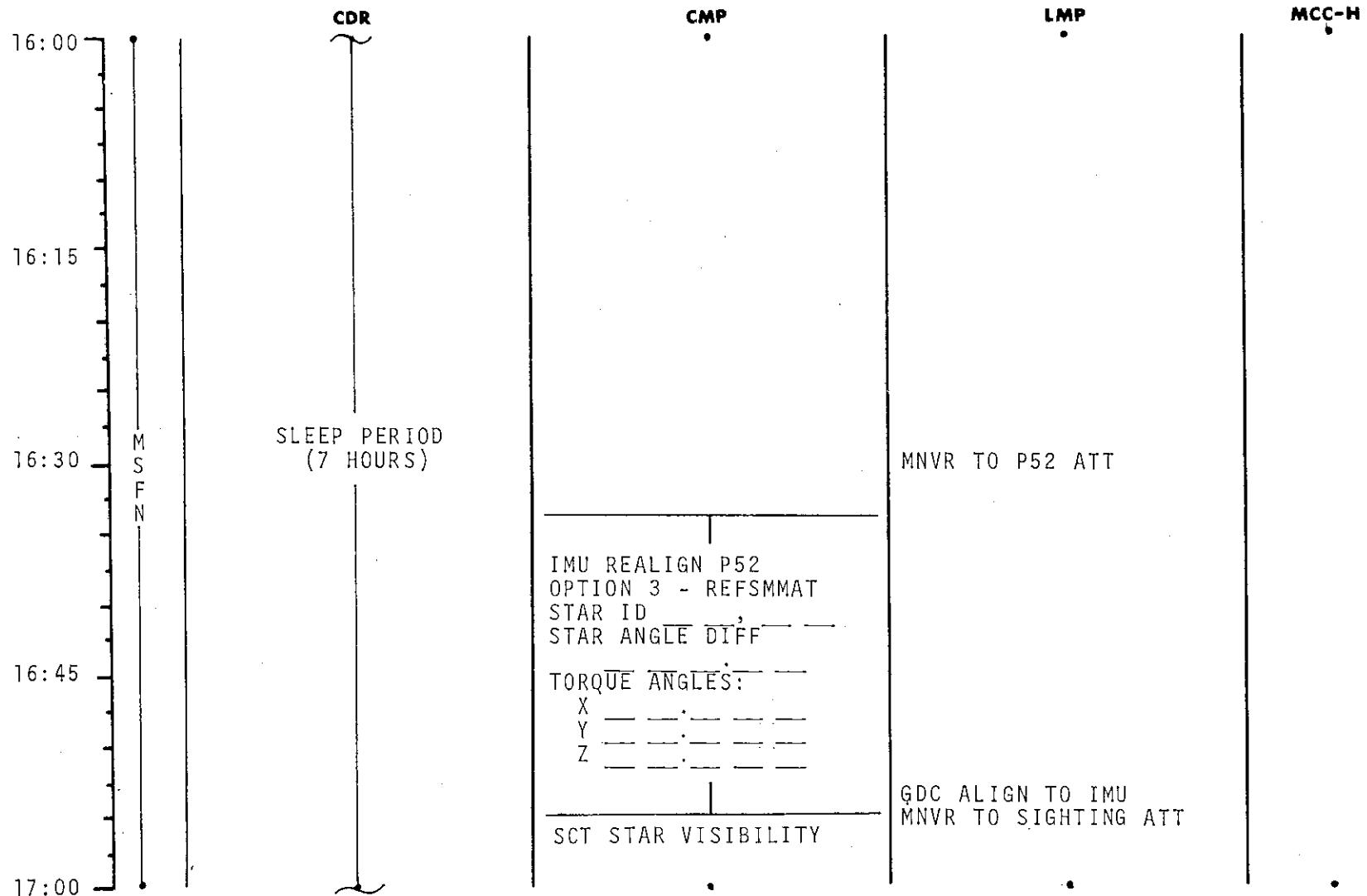


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	14:00 - 16:00	1/TLC	2-13

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103.	FINAL	November 22, 1968	16:00 - 17:00	1/TLC	2-14

FLIGHT PLAN

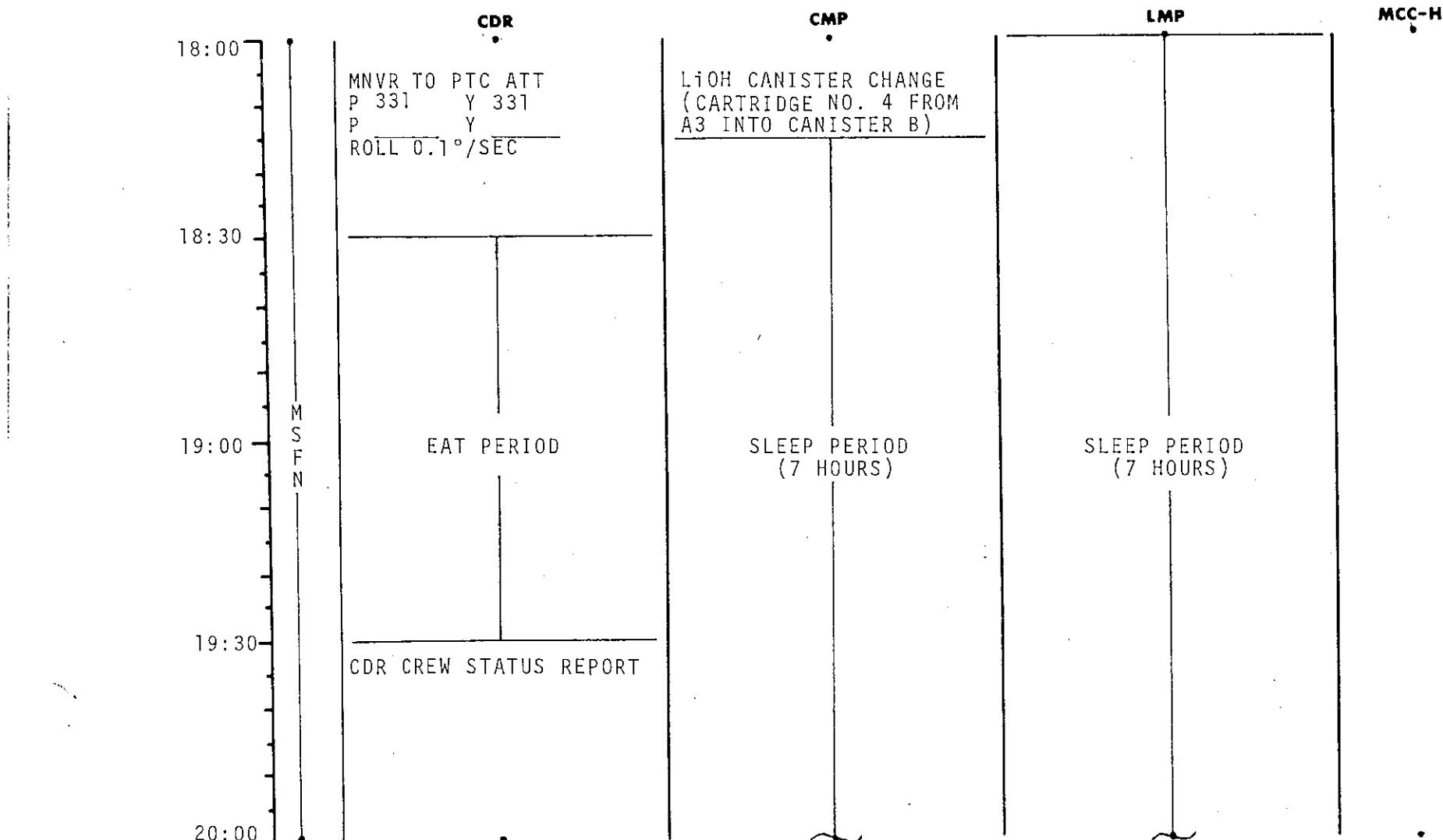
	CDR	CMP	LMP	MCC-H
17:00				
17:15		TRN BIAS		
		CISLUNAR NAVIGATION P23		
		1. STAR 22 EFH STAR ____ E ____ H 3 SETS		
		2. STAR 16 EFH STAR ____ E ____ H 2 SETS		
17:30 M S F N	SLEEP PERIOD (7 HOURS)			
17:45		GROUND TRACK DET P21		
18:00			BIOMED SW - LEFT	

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	17:00 - 18:00	1/TLC	2-15

MSC Form 1910 (Nov 68)

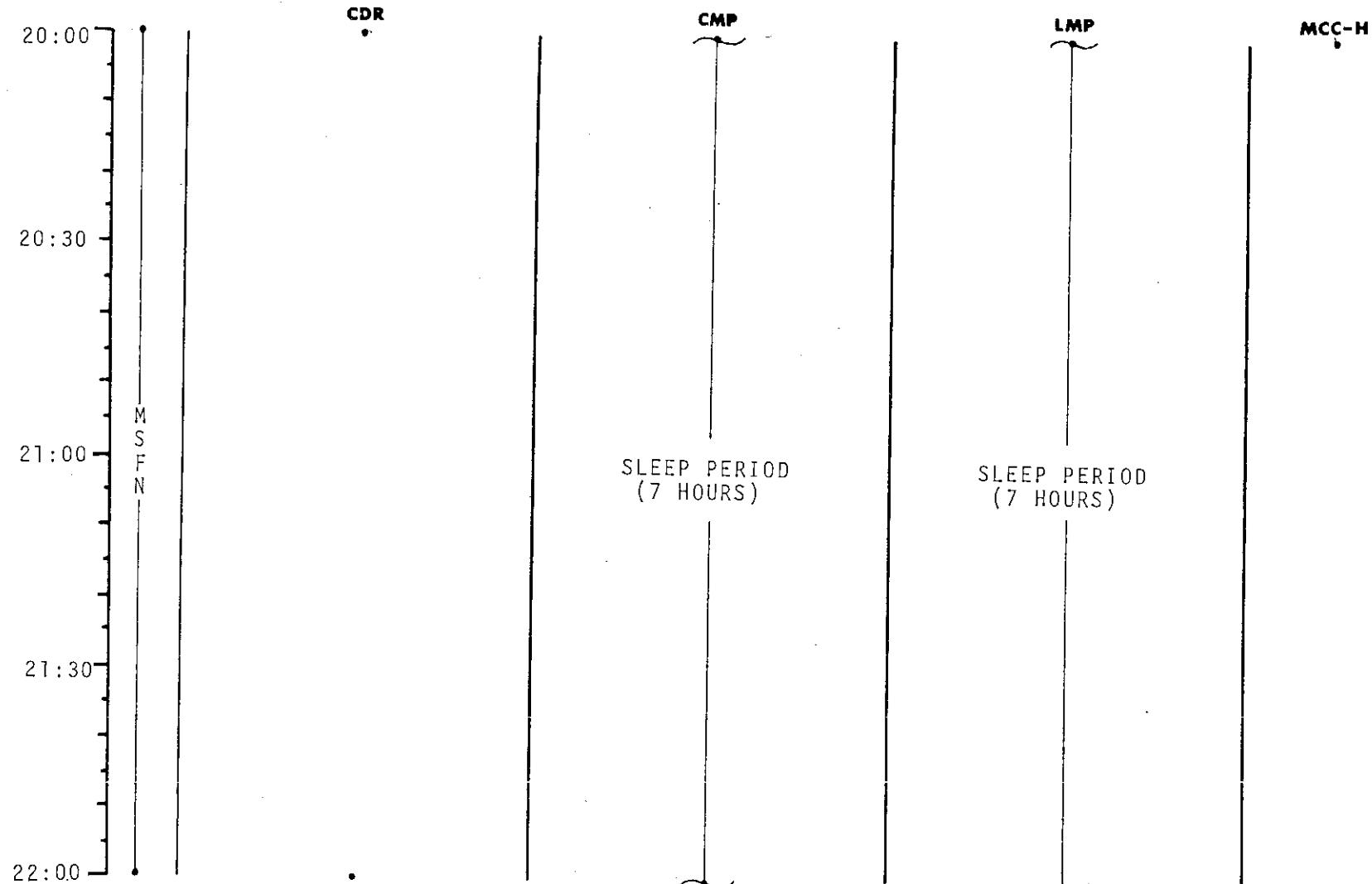
FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	18:00 - 20:00	1/TLC	2-16

FLIGHT PLAN

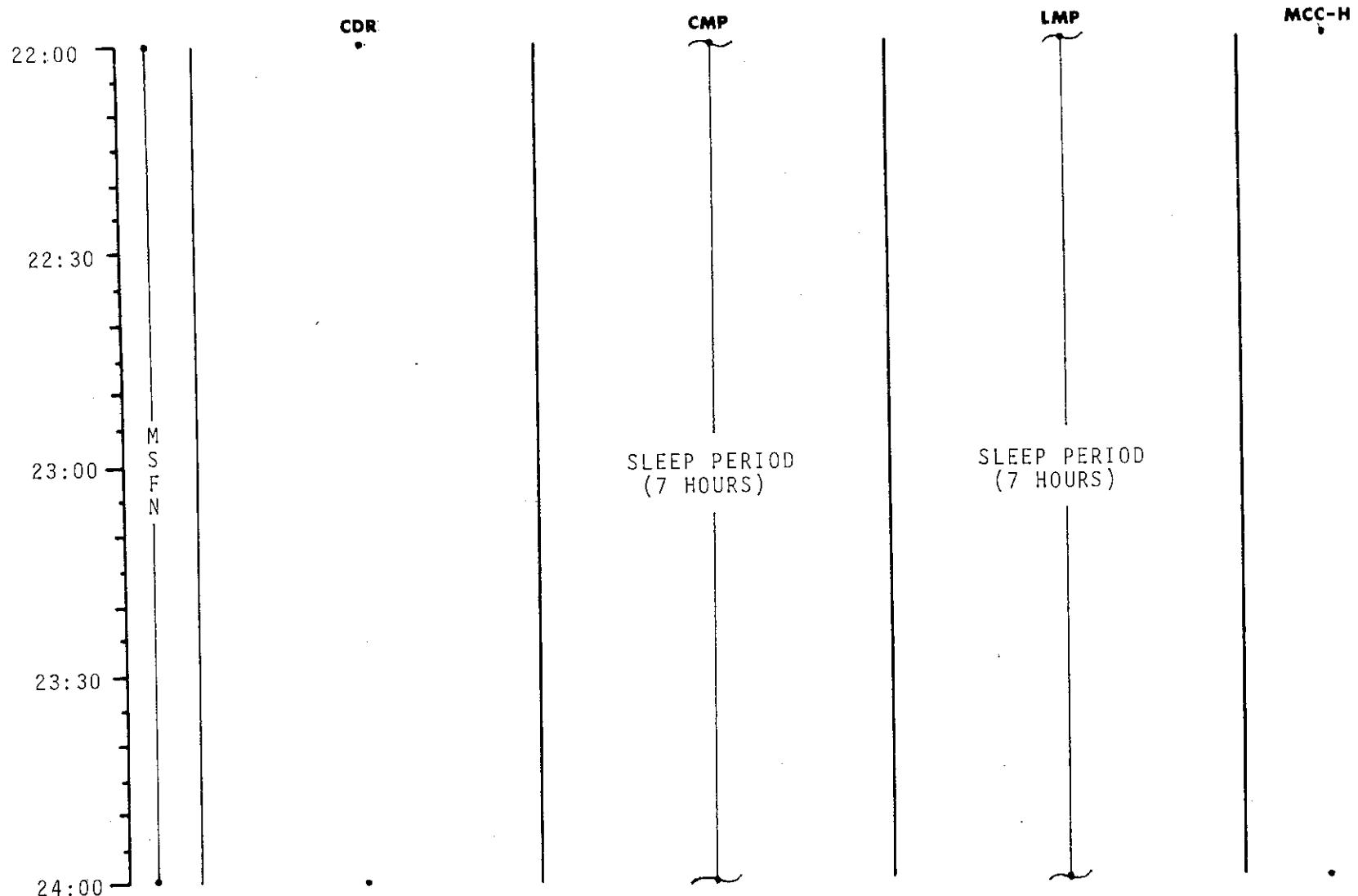


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	20:00 - 22:00	1/TLC	2-17

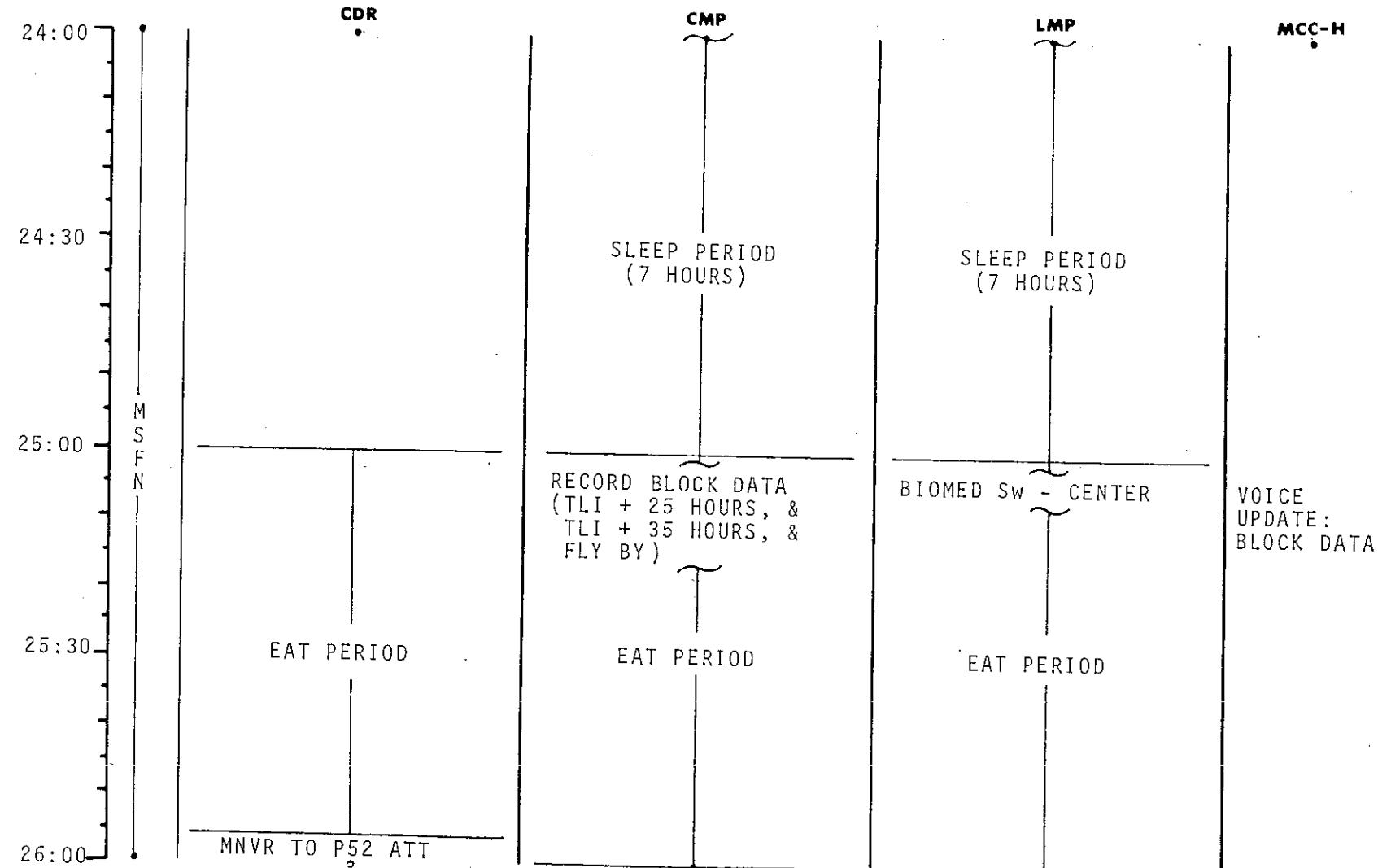
MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN



FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	24:00 - 26:00	2/TLC	2-19

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN

CDR

26:00

GDC ALIGN TO IMU
MNVR TO SIGHTING
ATTITUDE

M
S
F
N

26:30

26:45

27:00

CMP

IMU REALIGN P52
OPTION 3 - REFSMMAT
STAR ID _____
STAR ANGLE DIFF _____

TORQUE ANGLES:

X _____
Y _____
Z _____

TRN BIAS

CISLUNAR NAVIGATION P23

1. STAR 16 EFH
STAR _____ E _____ H
1 SET
2. STAR 22 EFH
STAR _____ E _____ H
1 SET
3. STAR 26 ENH
STAR _____ E _____ H
1 SET

LMP

CMP/LMP CREW STATUS
REPORT

MCC-H

RECORD MNVR PAD

VOICE
UPDATE:
MNVR PAD

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	26:00 - 27:00	2/TLC	2-20

BURN STATUS REPORT

X X	<input type="checkbox"/>	•	•	ΔTIG
X X	<input type="checkbox"/>	•	•	BT
	<input type="checkbox"/>	V	gx	
<hr/> TRIM				
X X X		R		
X X X		P		
X X X		Y		
	<input type="checkbox"/>	V	gx	
	<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		UNBALANCE		

2-20a.

REMARKS:

MCC'S

BURN CHART

	P or Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC(ALL)	10°/SEC TAKEOVER	10° TAKEOVER	B/T +1 SEC	TRIM TO 0.2 fps

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
27:00		GROUND TRACK DET P21		P27 UPDATE: STATE VECTOR TGT LOAD
27:15	V47 TRANS LM STATE VECTOR TO CSM SLOT EXT ΔV P30			
27:30	SPS/RCS THRUST P40/41 MNVR TO BURN ATT M S F N			PIPA BIAS CK
		SXT STAR CK TRANS TO COUCH		
27:45	EMS ΔV TEST			
TLI + 25 HRS	GDC ALIGN	SM RCS MON CK		
28:00	MCC ₂ ΔV=NOMINALLY ZERO			

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	27:00 - 28:00	2/TLC	2-21

FLIGHT PLAN

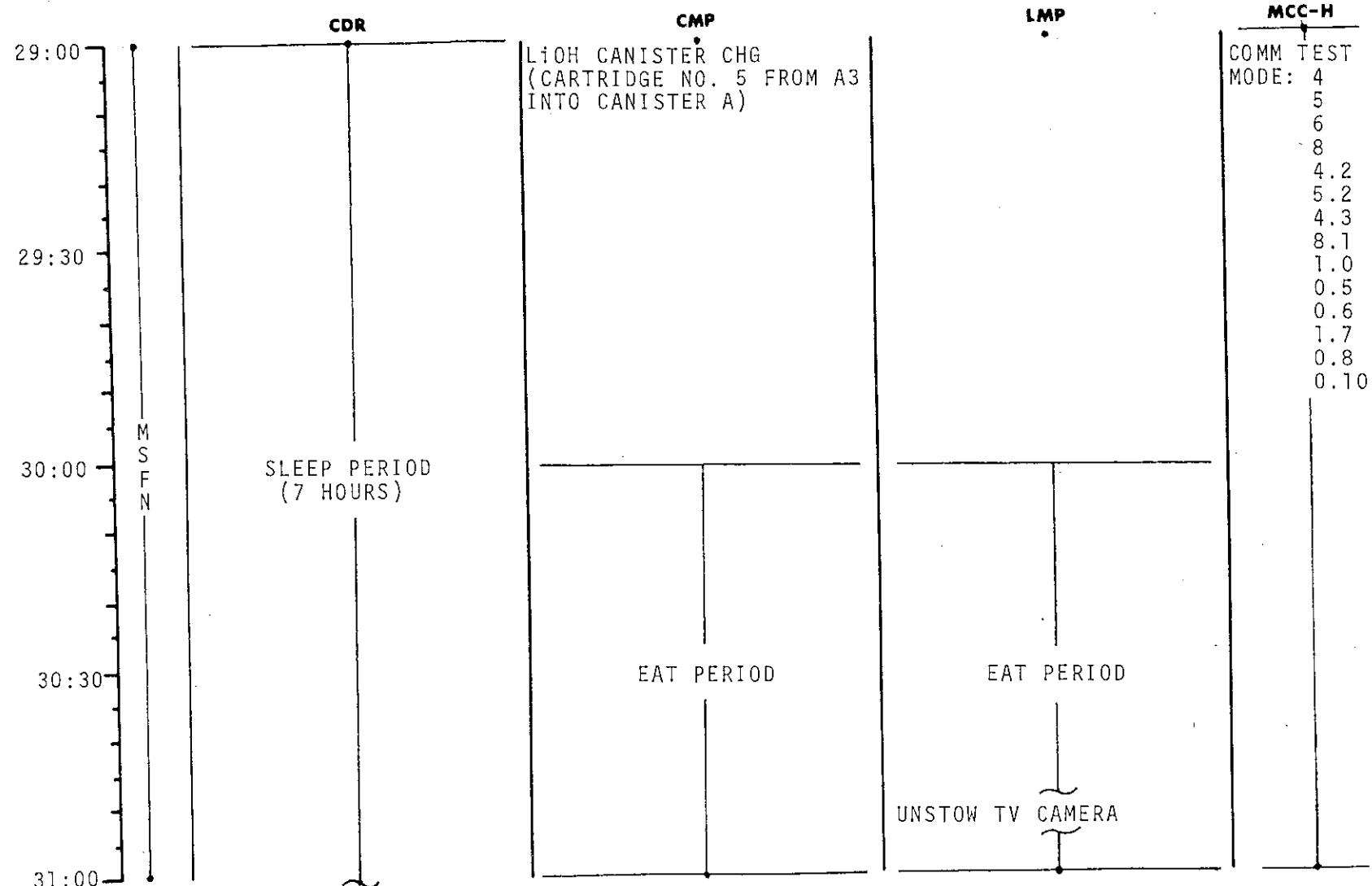
	CDR	CMP	LMP	MCC-H
28:00	V66 TRANS CSM STATE VECTOR TO LM SLOT MNVR TO SIGHTING ATT MCC ₂ BURN STATUS REPORT	SM RCS MONITOR CK TRN BIAS	SPS MONITOR CK INITIATE BAT CHARGE BIOMED SW - RIGHT	
28:15		CISLUNAR NAVIGATION P23 1. STAR 16 EFH STAR ____ E ____ H 1 SET		
28:30		2. STAR 22 EFH STAR ____ E ____ H 1 SET		
28:45		3. STAR 21 EFH STAR ____ E ____ H 1 SET		
		4. STAR 26 ENH STAR ____ E ____ H 1 SET		
		GROUND TRACK DET P21	MNVR TO PTC ATT P 331 Y 331 P ____ Y ROLL 0.1°/SEC	
29:00	CDR CREW STATUS REPORT			

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	28:00 - 29:00	2/TLC	2-22

MSC Form 1910 (Nov 68)

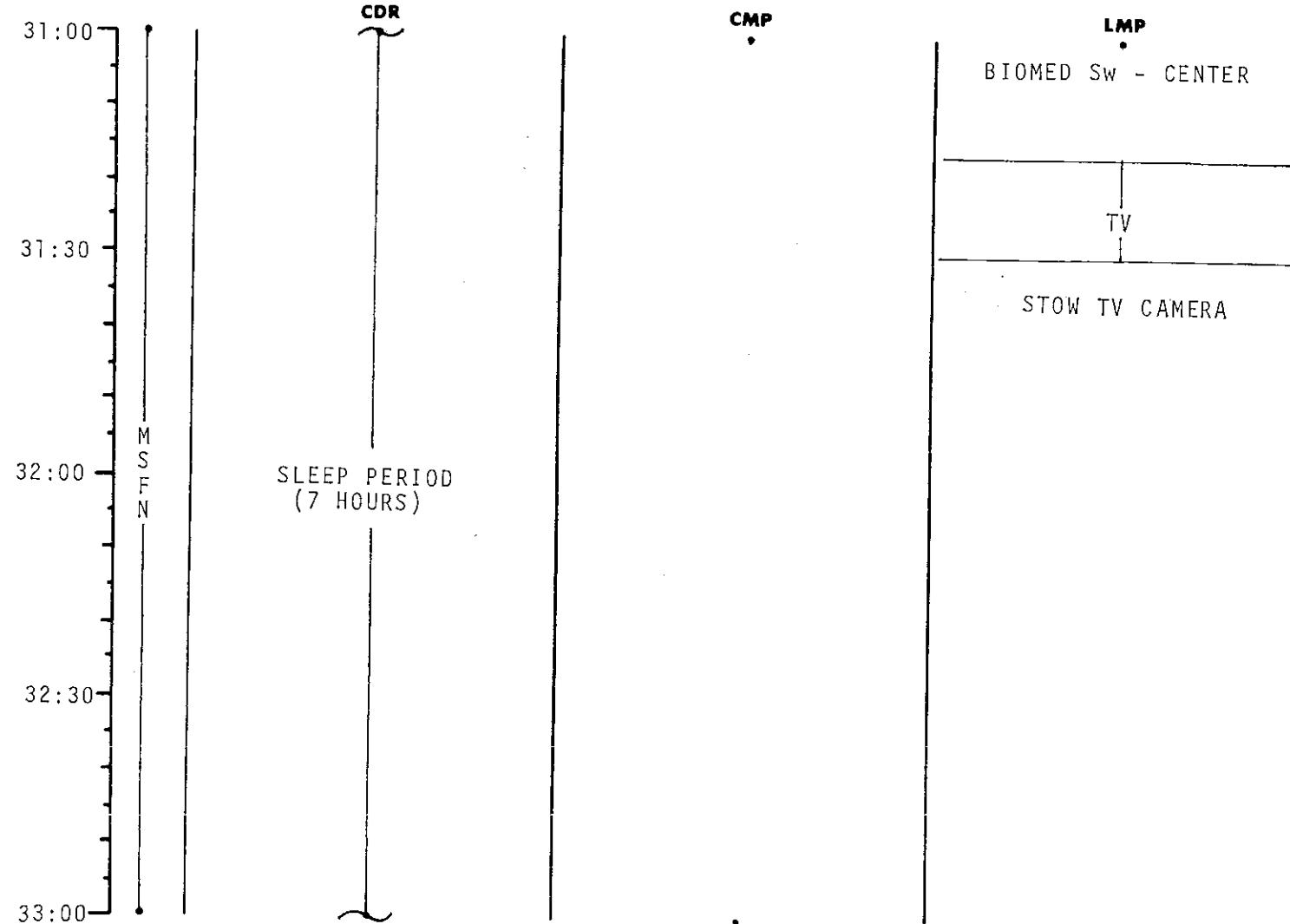
FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	29:00 - 31:00	2/TLC	2-23

FLIGHT PLAN

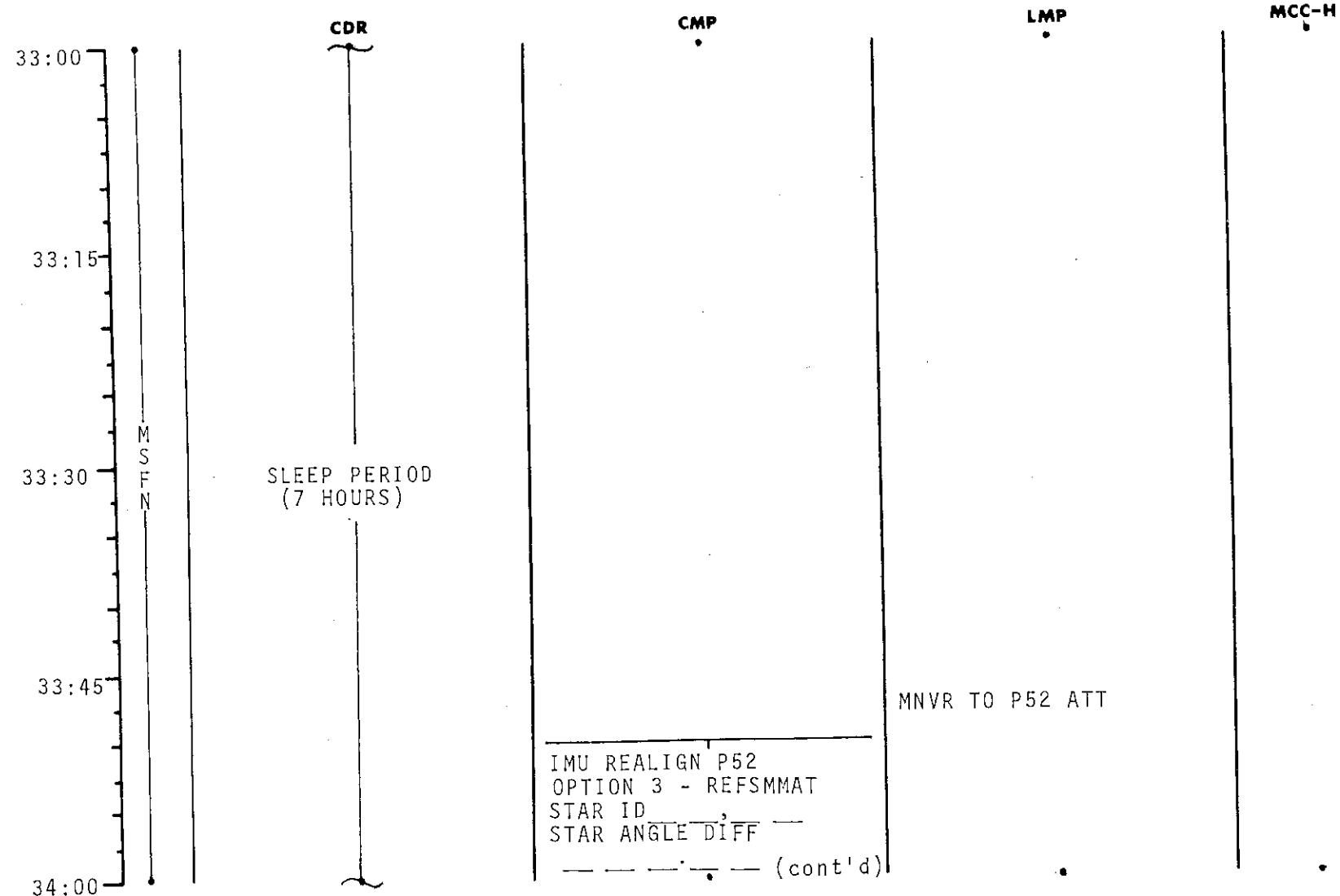


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	31:00 - 33:00	2/TLC	2-24

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	33:00 - 34:00	2/TLC	2-25

FLIGHT PLAN

34:00

MSFN

SLEEP PERIOD
(7 HOURS)

34:15

34:30

34:45

35:00

CDR

CMP

TORQUE ANGLES:

X _____._____._____.
Y _____._____._____.
Z _____._____._____.

SCT STAR VISIBILITY TRN BIAS

CISLUNAR NAVIGATION P23

1. STAR 16 EFH
STAR ____ E ____ H
1 SET
2. STAR 22 EFH
STAR ____ E ____ H
1 SET

3. STAR 26 ENH
STAR ____ E ____ H
1 SET
- GROUND TRACK DET P21

RECORD BLOCK DATA
(TLI + 35 HOURS, TLI +
44 HOURS, AND FLY BY)

LMP

BIOMED SW - RIGHT

MNVR TO SIGHTING ATT

MCC-H

MNVR TO PTC ATT
P 331 Y 331
P ____ Y
ROLL 0.1°/SEC

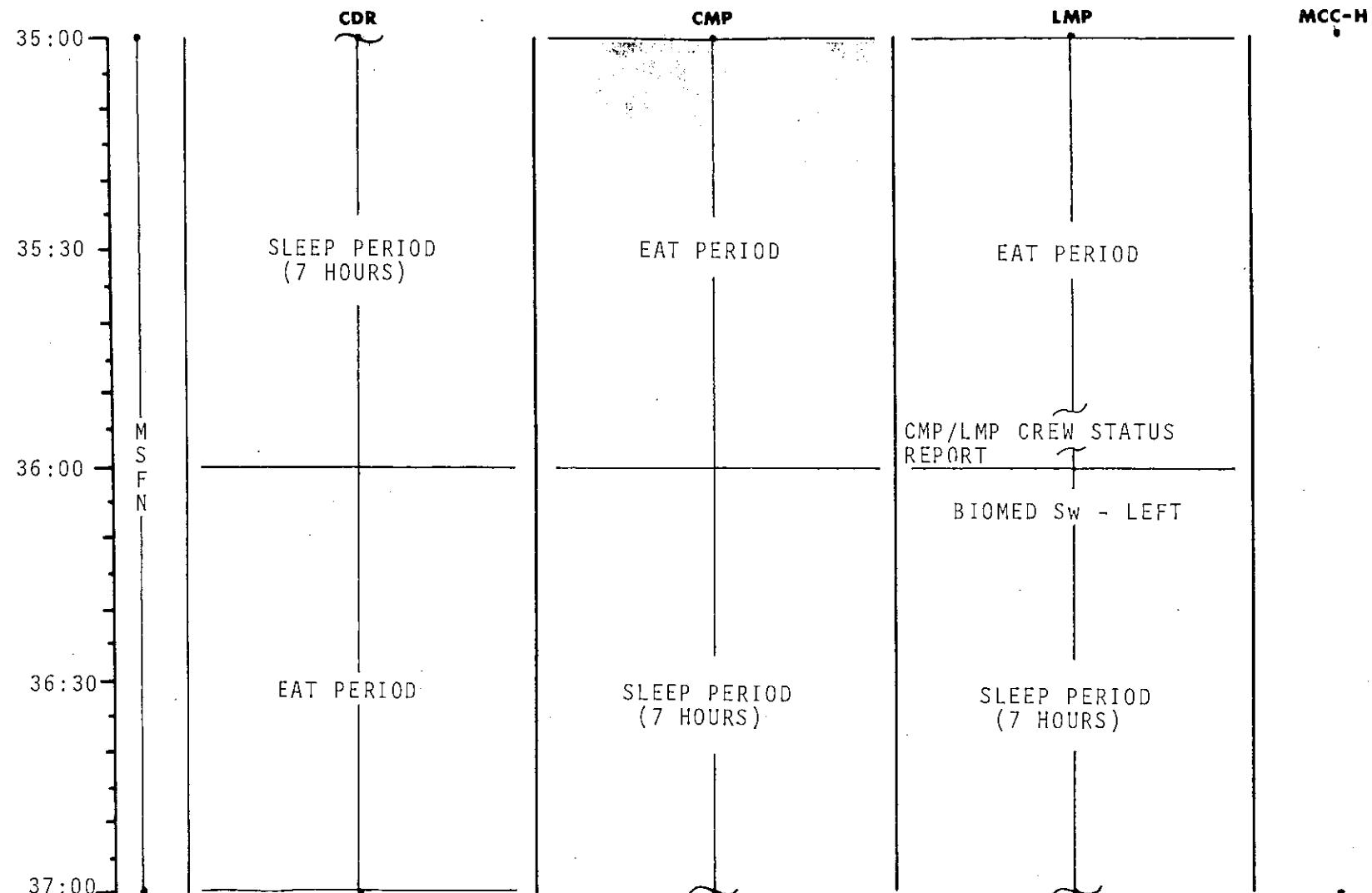
VOICE
UPDATE:
BLOCK DATA

MSC Form 1910 (Nov 68)

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	34:00 - 35:00	2/TLC	2-26

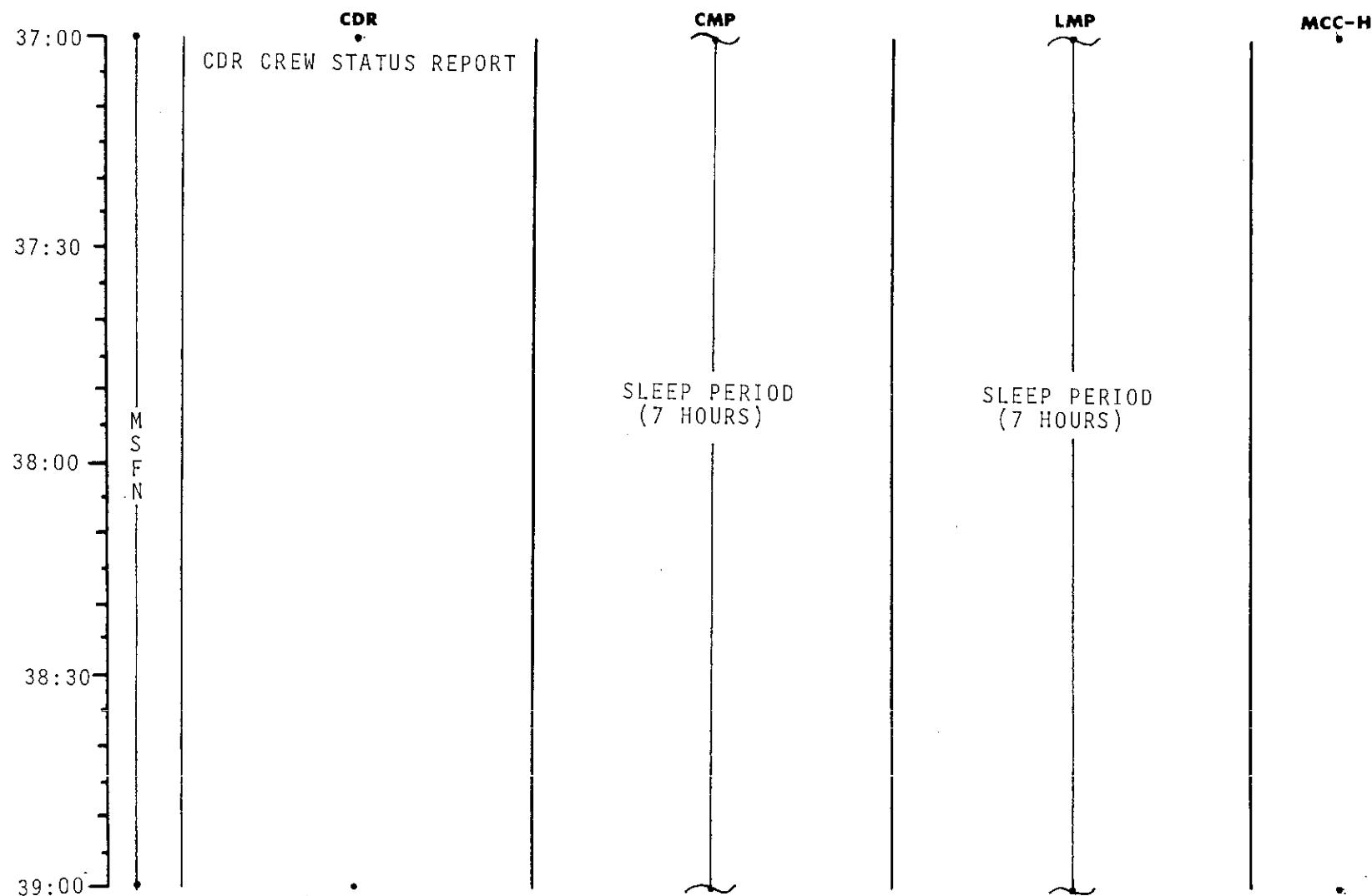
FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	35:00 - 37:00	2/TLC	2-27

FLIGHT PLAN

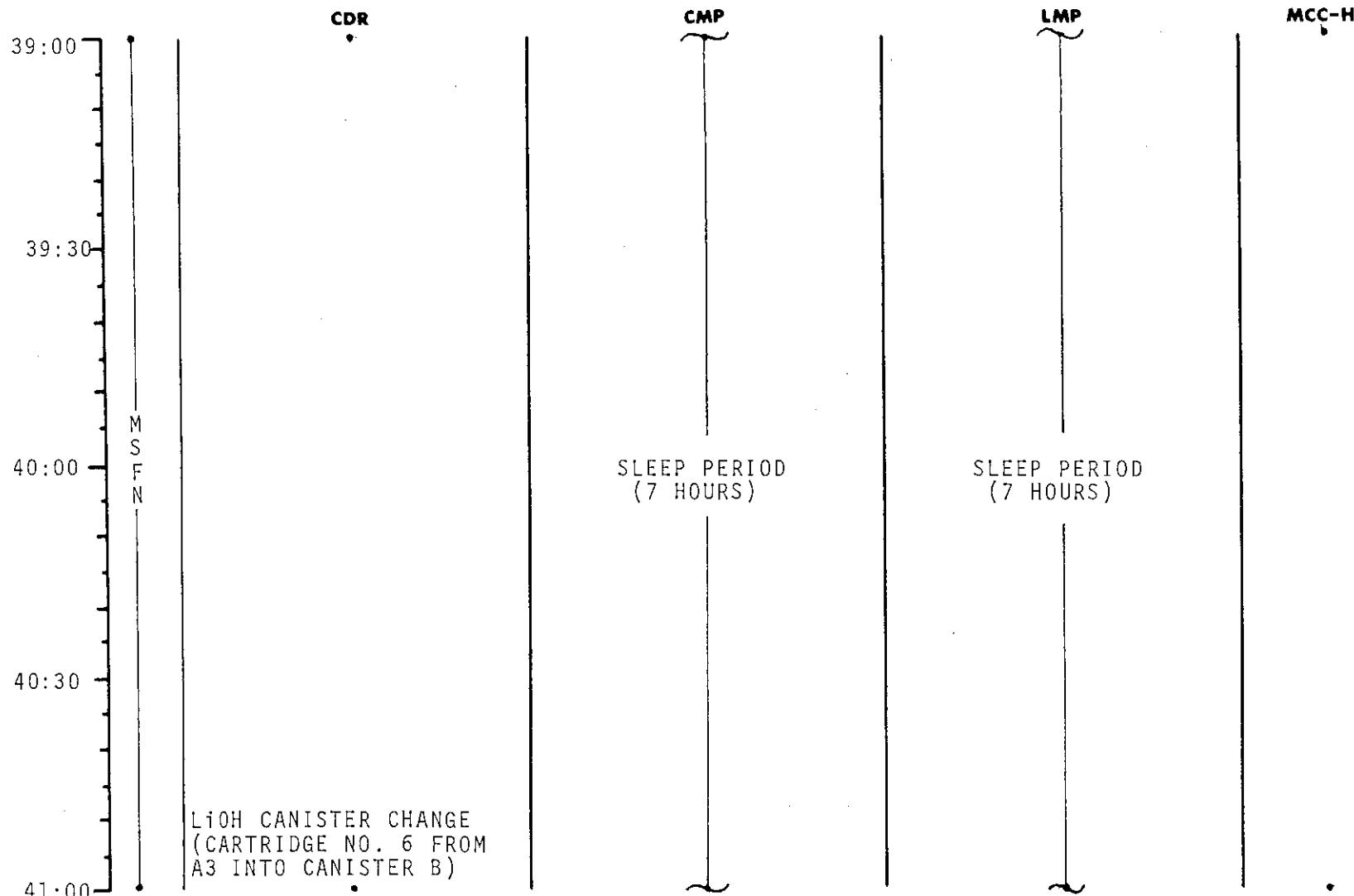


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	37:00 - 39:00	2/TLC	2-28

MSC Form 1910 (Nov 68)

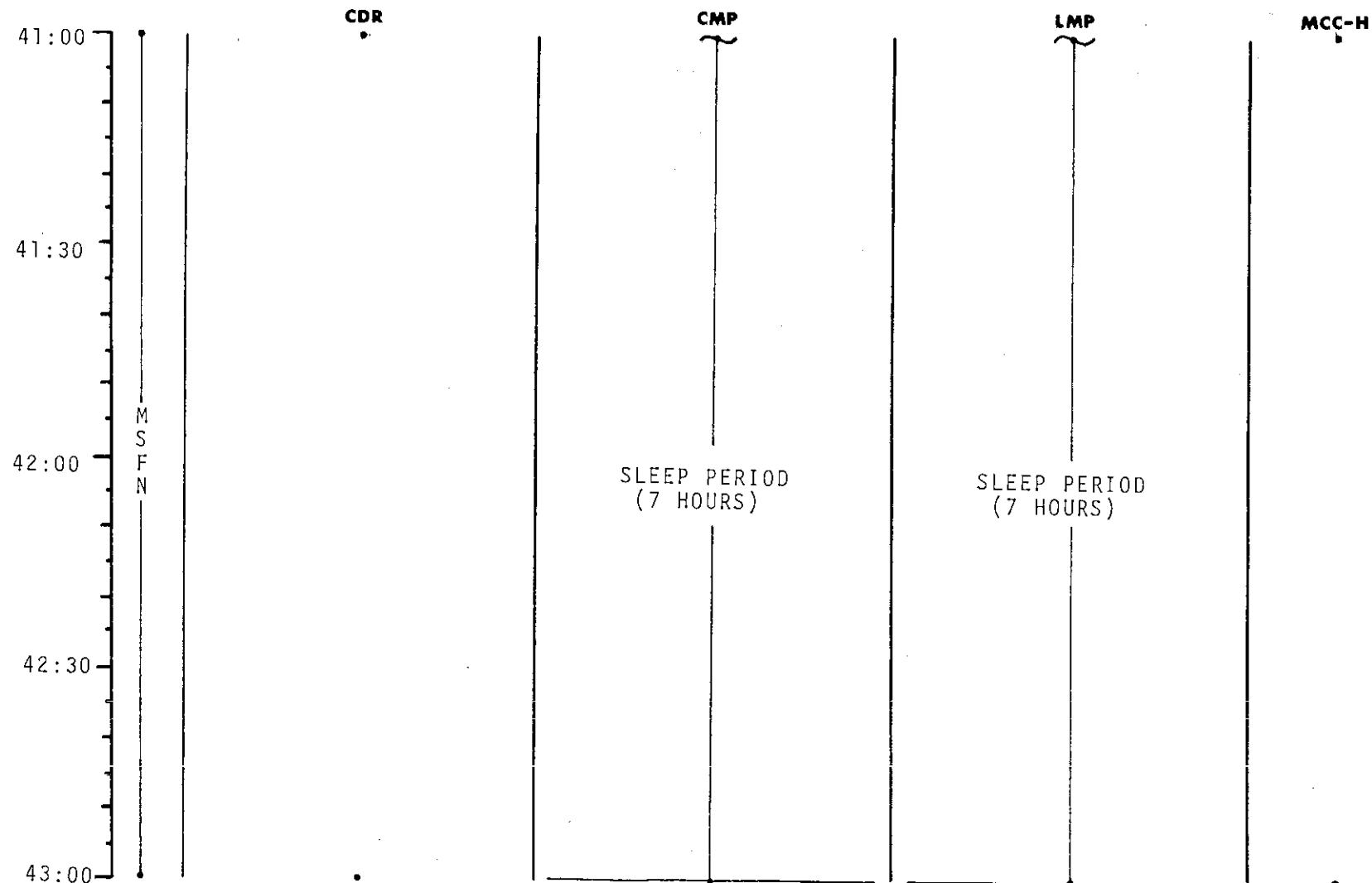
FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	39:00 - 41:00	2/TLC	2-29

FLIGHT PLAN

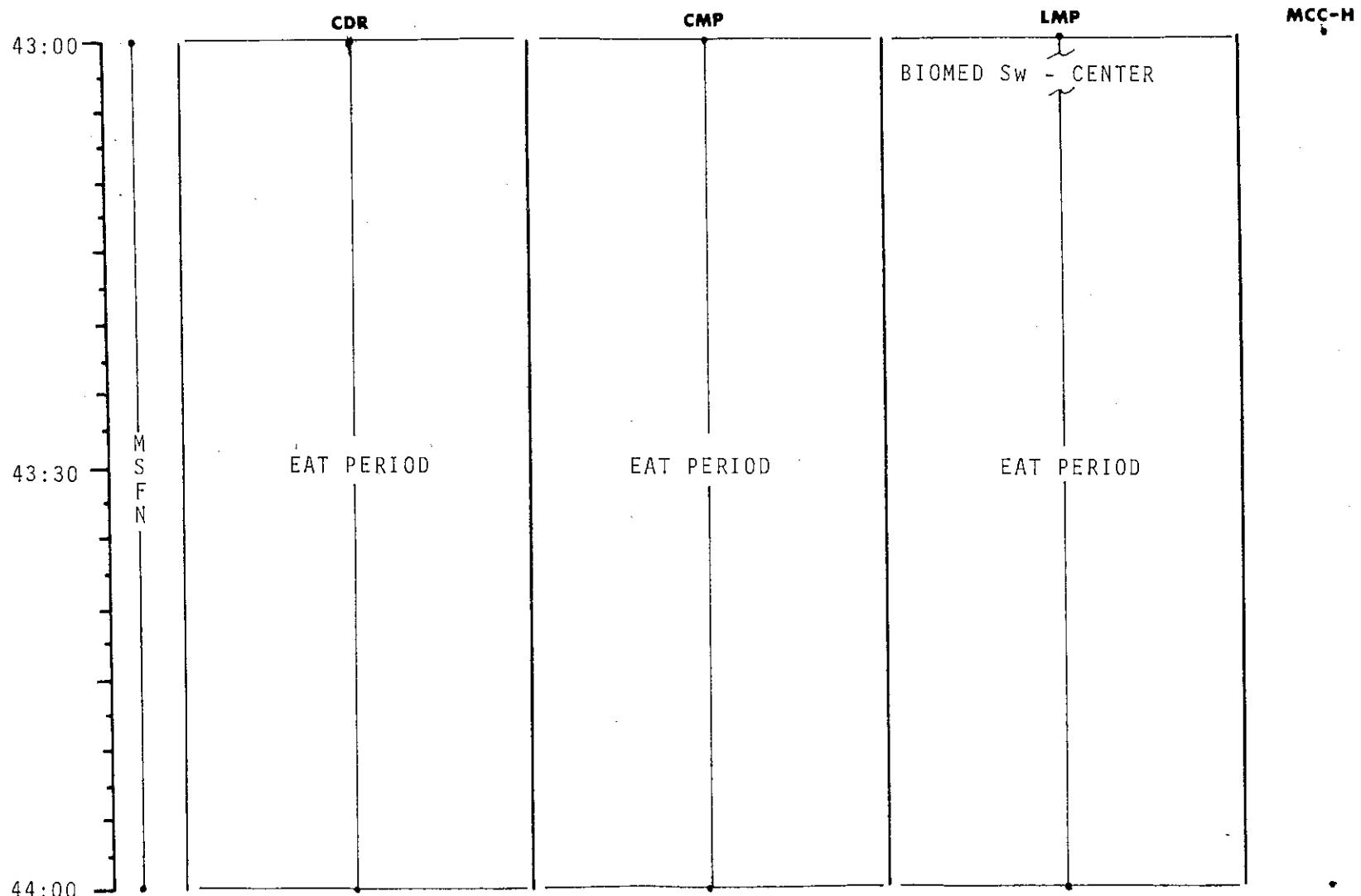


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	41:00 - 43:00	2/TLC	2-30

MSC Form 1910 (Rev 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	43:00 - 44:00	2/TLC	2-31

FLIGHT PLAN

44:00

CDR

CMP

LMP

MCC-H

RECORD BLOCK DATA
(TLI + 44 HOURS, FLY BY,
PC + 2 (QUICK RETURN),
& PC + 2)

CMP/LMP CREW STATUS
REPORT

VOICE
UPDATE:
BLOCK DATA

44:30

M
S
F
N

MNVR TO P52 ATT

IMU REALIGN P52
OPTION 3 - REFSMMAT
STAR ID _____
STAR ANGLE DIFF _____

TORQUE ANGLES:

X _____
Y _____
Z _____

45:00

GDC ALIGN TO IMU

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	44:00 - 45:00	2/TLC	2-32

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
45:00	MNVR TO SIGHTING ATT	TRN BIAS CISLUNAR NAVIGATION P23		
45:15		1. STAR 33 LNH STAR ____ L ____ H 2 SETS		
45:30	M S F N	2. STAR 37 LNH STAR ____ L ____ H 1 SET		
45:45		3. STAR 45 LFH STAR ____ L ____ H 1 SET		
46:00		4. STAR 42 LFH STAR ____ L ____ H 1 SET		

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	45:00 - 46:00	2/TLC	2-33

BURN STATUS REPORT

X	X	<input type="checkbox"/>	•	ΔT_{IG}
X	X		•	BT
		<input type="checkbox"/>	V	g_x
<hr/> TRIM				
X	X	X	R	
X	X	X	P	
X	X	X	Y	
			V	
			g_x	
			V	g_y
			V	g_z
			ΔV	c
X	X	X	FUEL	
X	X	X	OX	
X	X	X	UNBALANCE	

2-33a

REMARKS:

MCC'S

BURN CHART

	P or Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC(ALL)	10°/SEC TAKEOVER	10° TAKEOVER	B/T + 1 SEC	TRIM TO 0.2 f/s

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
46:00			BIOMED SW - RIGHT	
46:15	V47 TRANS LM STATE VECTOR TO CSM SLOT EXT ΔV P30	GROUND TRACK DET P21	RECORD MNVR PAD	P27 UPDATE: STATE VECTOR TGT LOAD VOICE UPDATE: MNVR PAD
46:30	M S F N SPS/RCS THRUST P40/41	SXT STAR CK		
46:45	MNVR TO BURN ATT EMS ΔV TEST	TRANS TO COUCH		PIPA BIAS CK
LOI -22 HRS 47:00	GDC ALIGN MCC ₃ ΔV=NOMINALLY ZERO	SM RCS MON CK		

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	46:00 - 47:00	2/TLC	2-34

FLIGHT PLAN

47:00

CDR

MNVR TO SIGHTING ATT

CMP

SM RCS MON CK

LMPSPS MON CK
INITIATE BAT CHARGE**MCC-H**

47:15

MCC₃ BURN STATUS REPORT

TRN BIAS

CISLUNAR NAVIGATION P231. STAR 16 EFH
STAR ____ E ____ H

1 SET

2. STAR 22 EFH
STAR ____ E ____ H

1 SET

3. STAR 26 ENH
STAR ____ E ____ H

1 SET

47:30
M
S
F
N

47:45

MNVR TO PTC ATT
P 331 Y 331
P ____ Y
ROLL 0.1°/SEC

GROUND TRACK DET P27

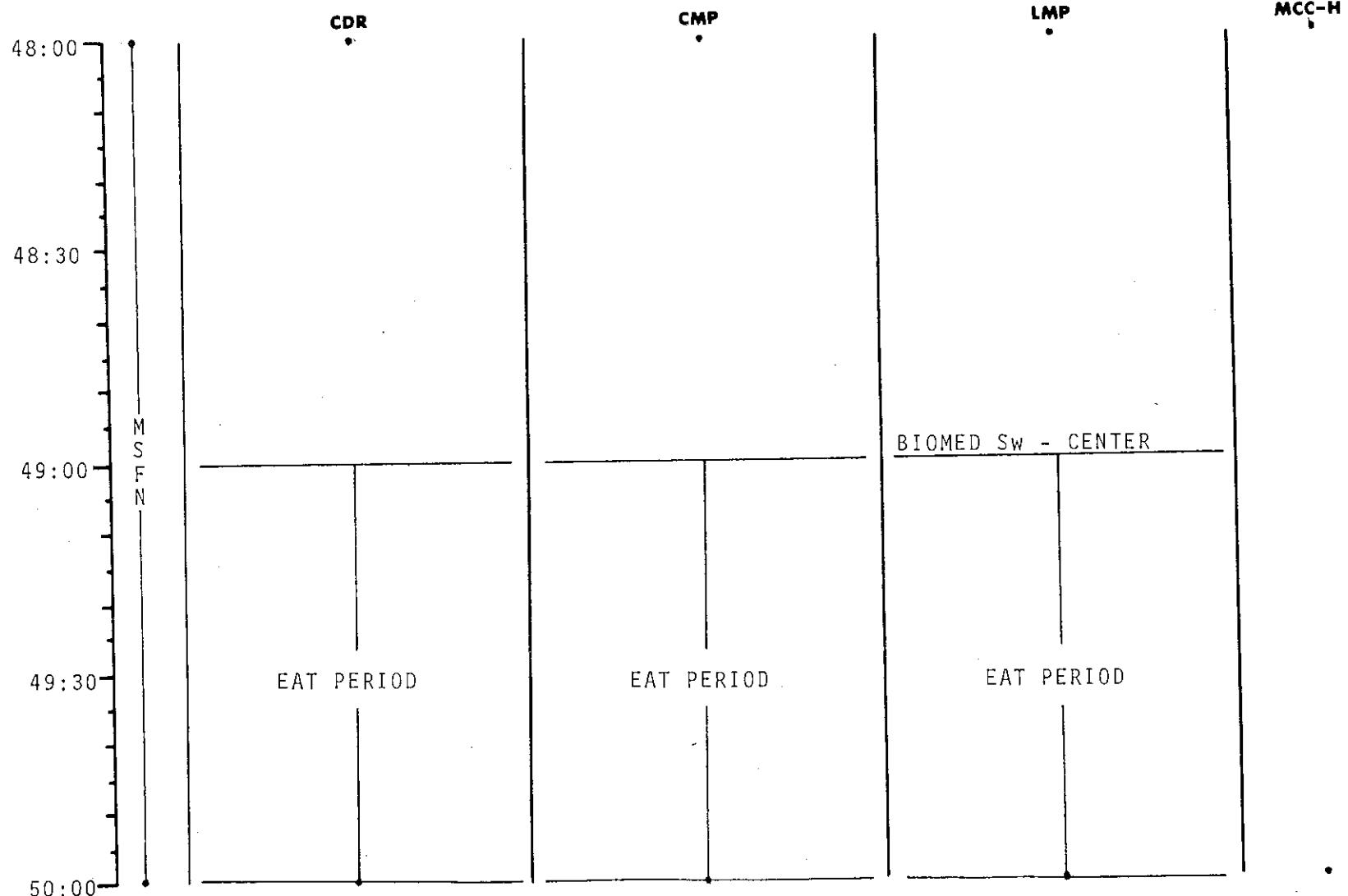
48:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	47:00 - 48:00	2/TLC	2-35

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	48:00 - 50:00	3/TLC	2-36

FLIGHT PLAN

50:00

CDR

CMP

LMP

MCC-H

50:30

M
S
F
N

51:00

MNVR TO P52 ATT

RECORD BLOCK DATA
(FLY BY & PC + 2 HOURS)VOICE
UPDATE:
BLOCK DATA

51:30

IMU REALIGN P52
OPTION 3 - REFSMMAT
STAR ID —
STAR ANGLE DIFF —

52:00

CDR CREW STATUS REPORT

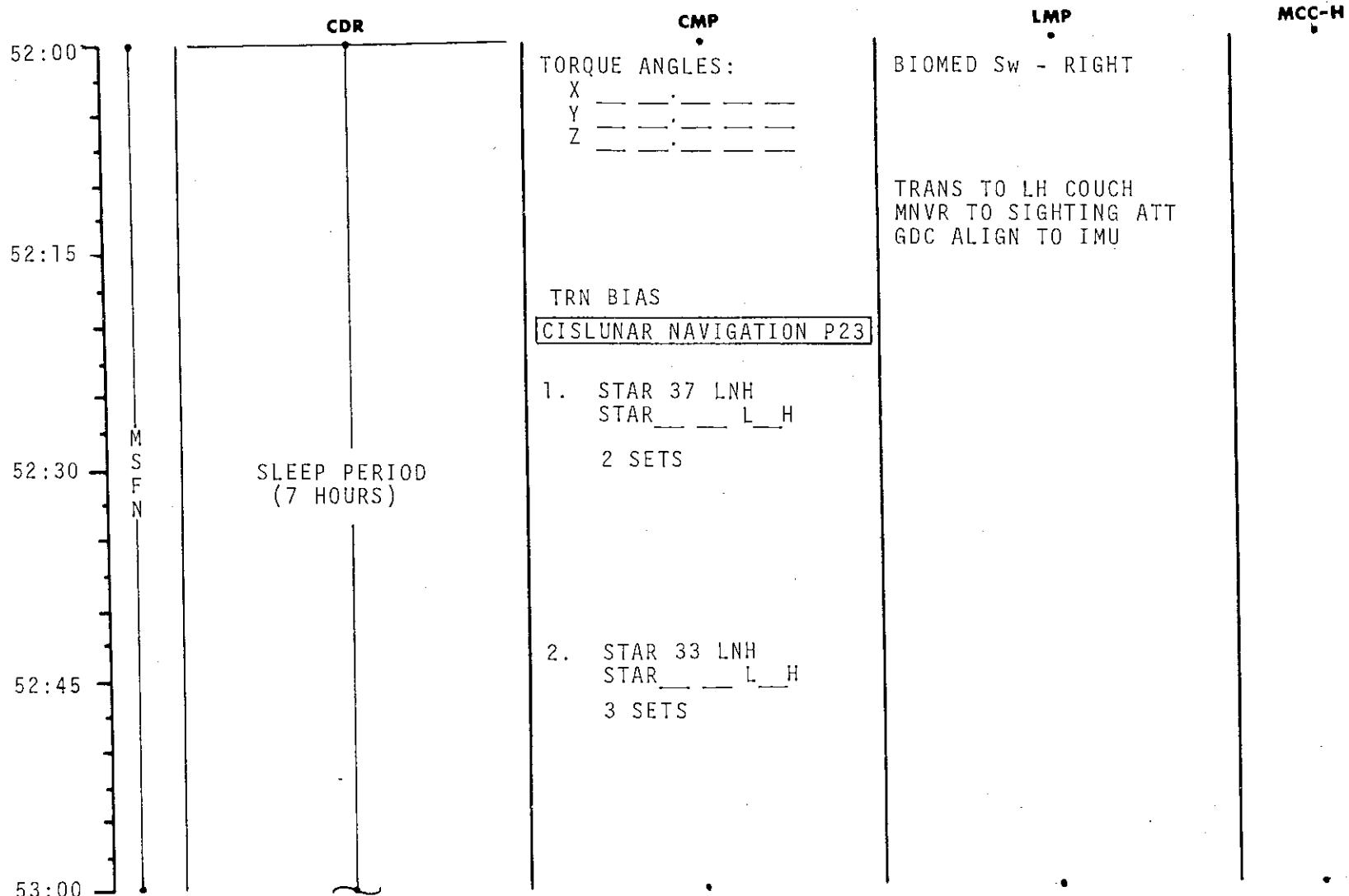
(cont'd)

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

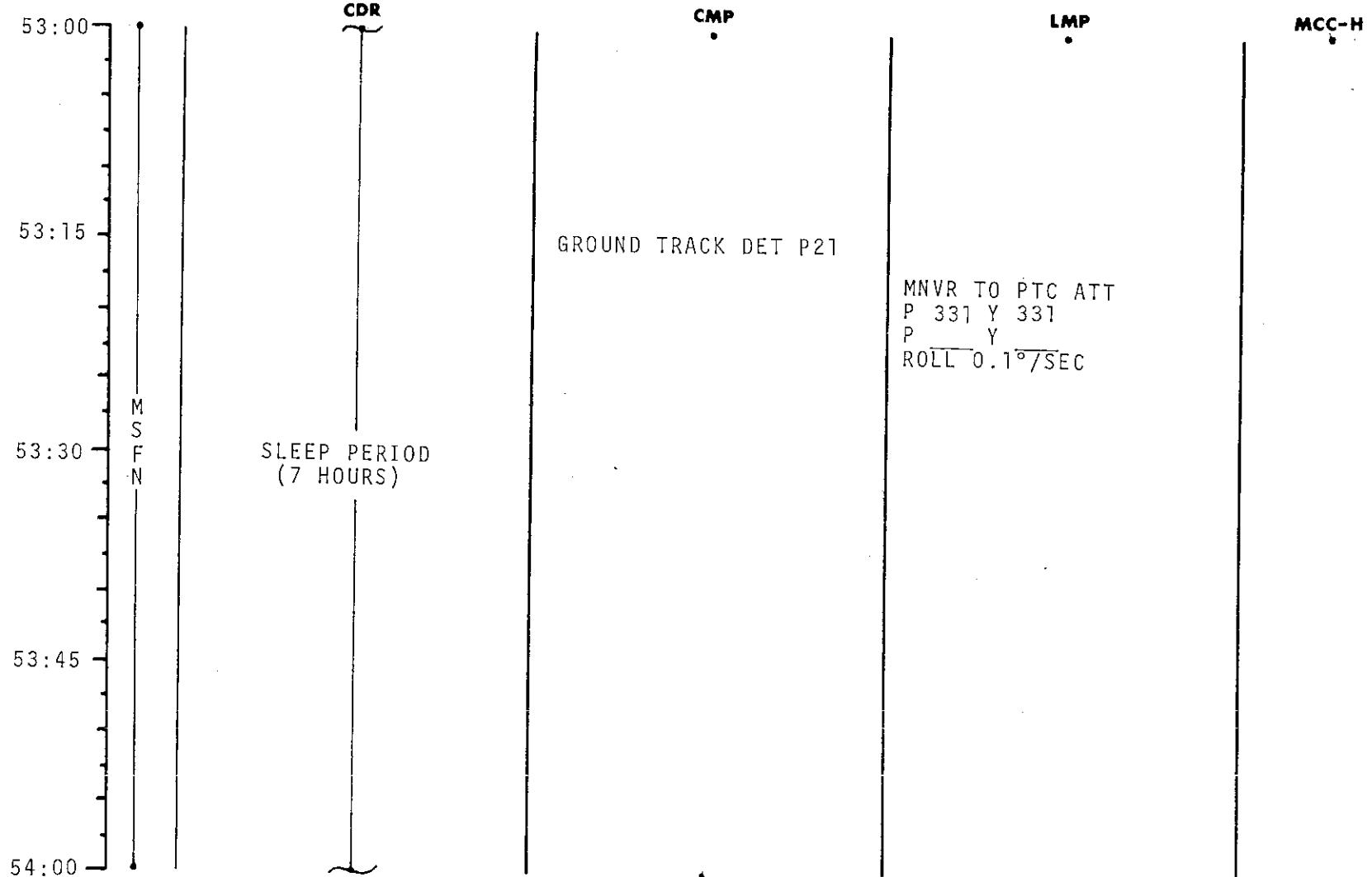
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	50:00 - 52:00	3/TLC	2-37

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	52:00 - 53:00	3/TLC	2-38

FLIGHT PLAN

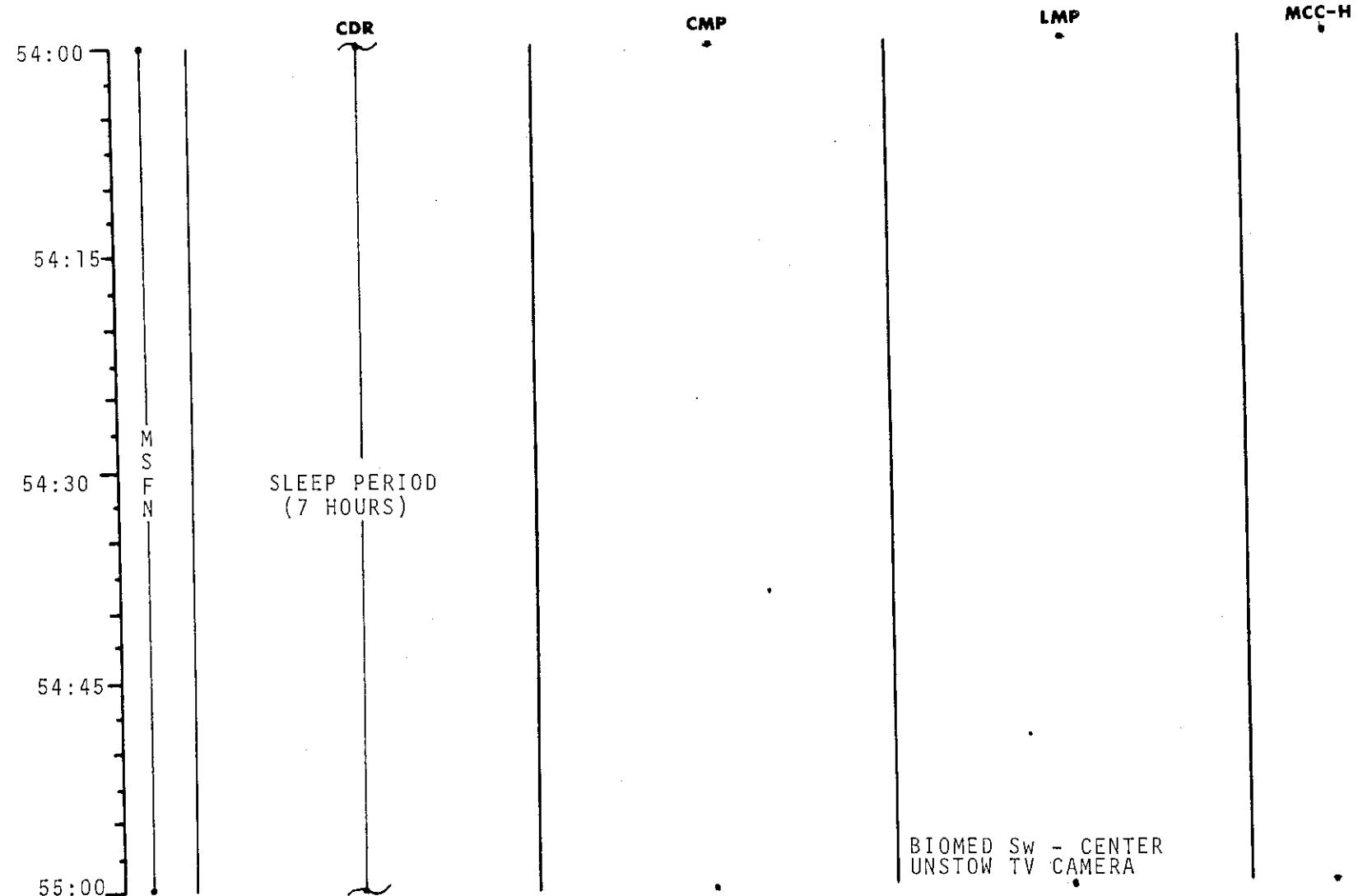


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	53:00 - 54:00	3/TLC	2-39

MSC Form 1910 (Nov 68)

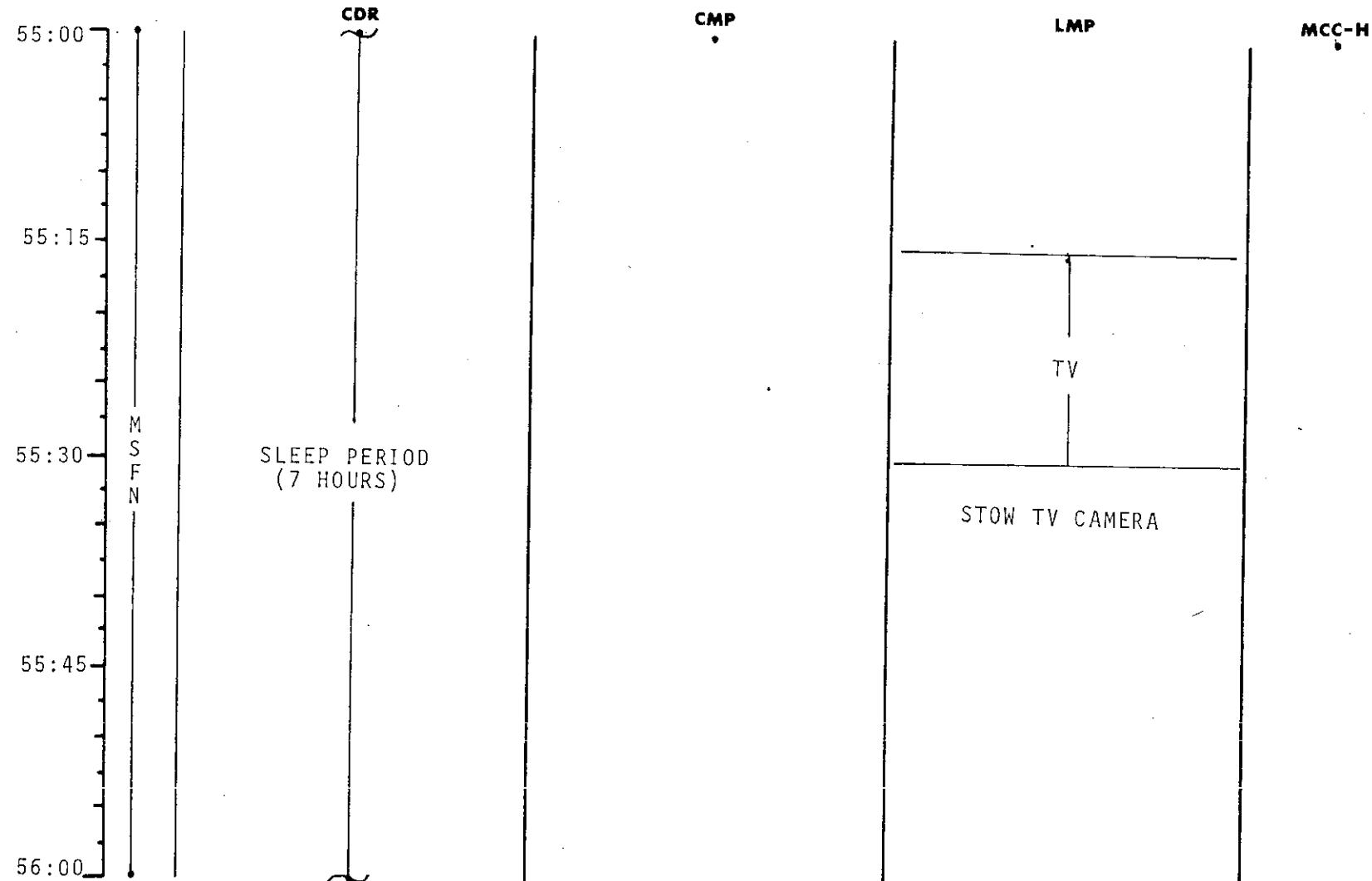
FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	54:00 - 55:00	3/TLC	2-40

FLIGHT PLAN

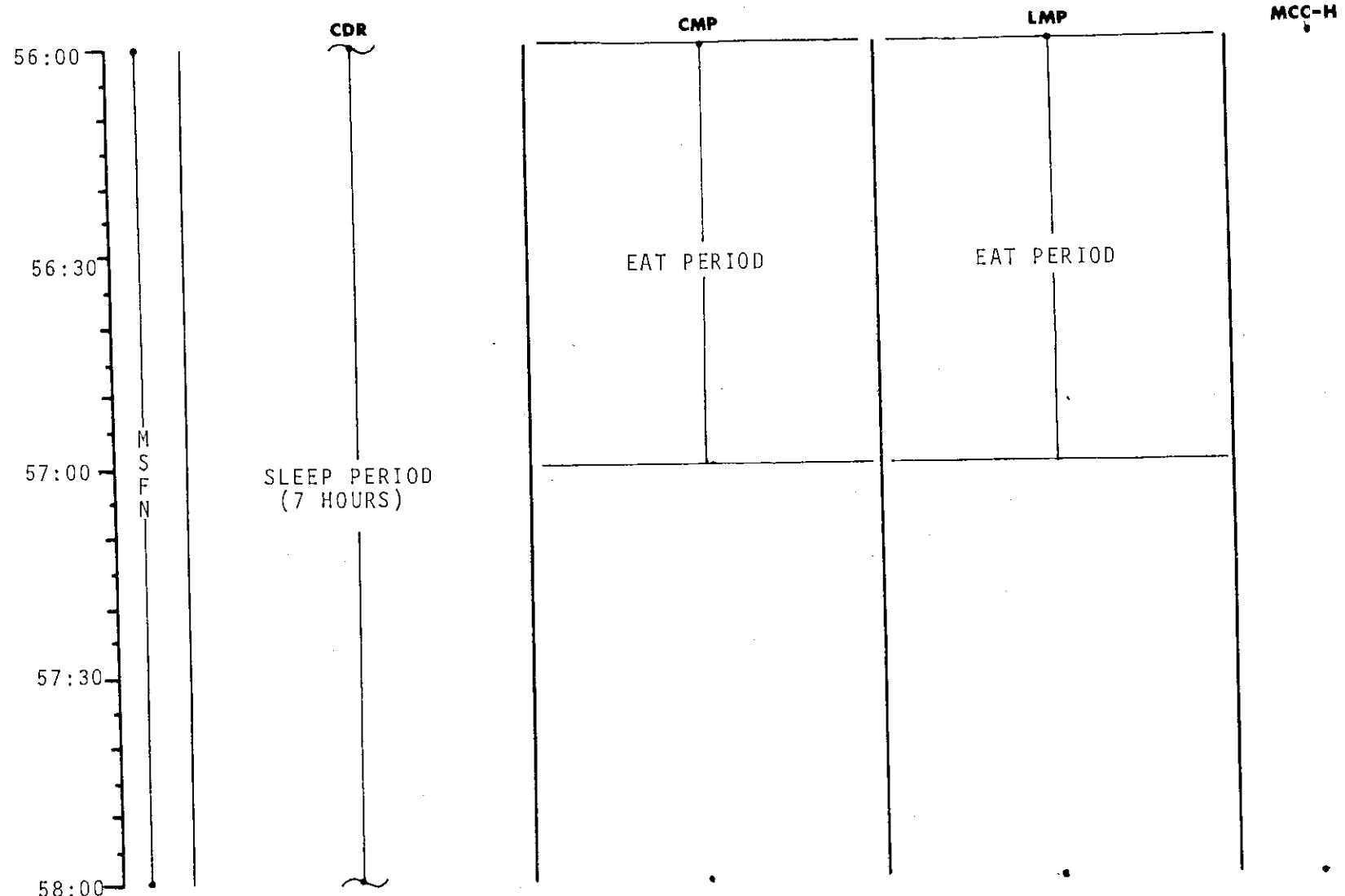


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	55:00 - 56:00	3/TLC	2-41

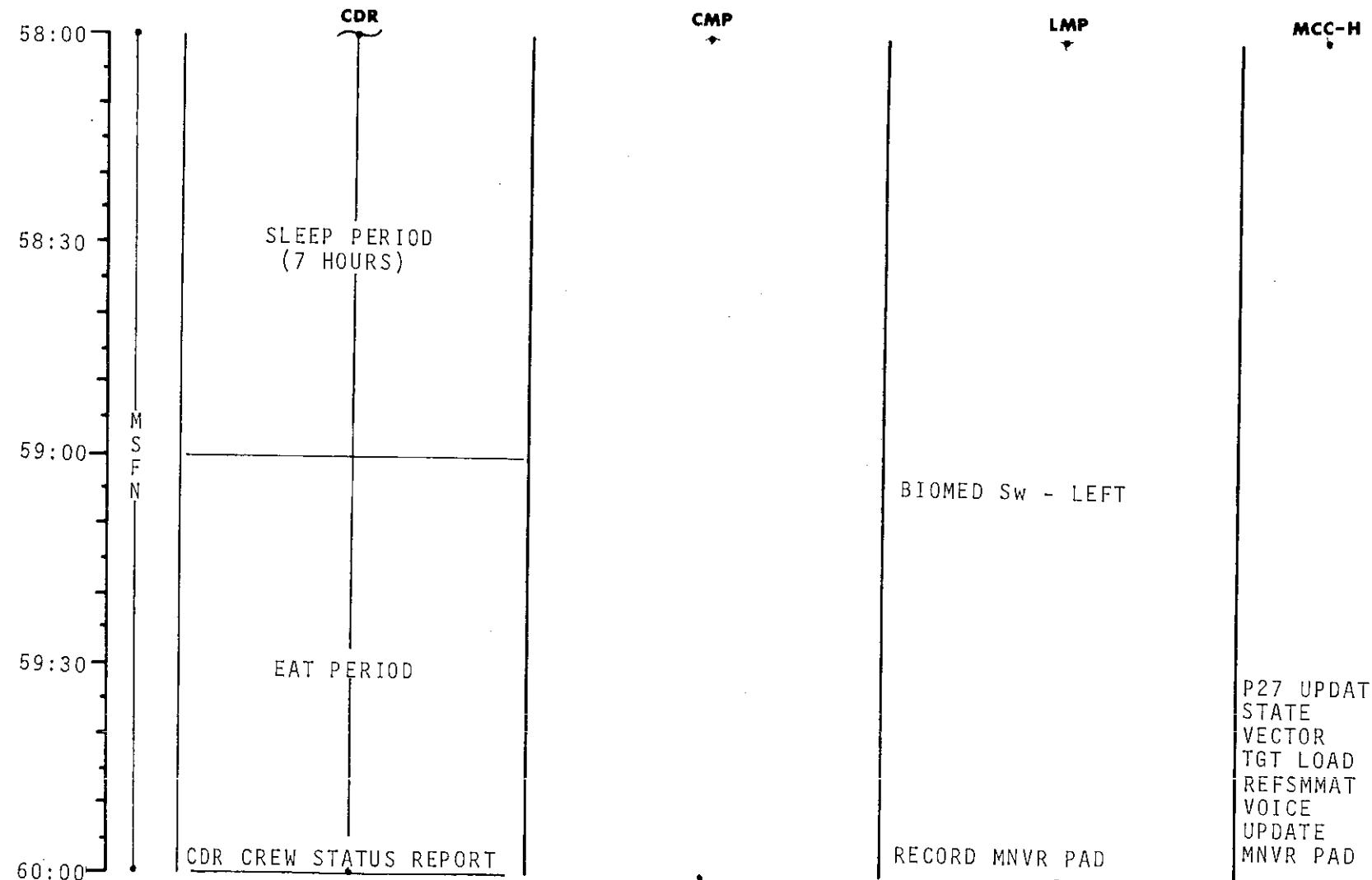
MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN



FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	58:00 - 60:00	3/TLC	2-43

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

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 UNBALANCE

REMARKS:

2-43a

MCC'S

BURN CHART

	P or Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC(ALL)	10°/SEC TAKEOVER	10° TAKEOVER	B/T +1 SEC.	TRIM TO 0.2 fns

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
60:00	MNVR TO P52 ATT			
60:15		IMU REALIGN P52 OPTION 1 - PREFERRED STAR ID —, STAR ANGLE DIFF —		
60:30	EXT ΔV P30 SPS/RCS THRUST P40/41 MNVR TO BURN ATT	TORQUE ANGLES: X — — — — Y — — — — Z — — — —		
60:45	EMS ΔV TEST	SXT STAR CK		PIPA BIAS CK
61:00	GDC ALIGN TO IMU MCC ₄ ΔV = NOMINALLY ZERO	TRANS TO COUCH	SM RCS MON CK	

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	60:00 - 61:00	3/TLC	2-44

MSC Form 1910 (Nov 68)

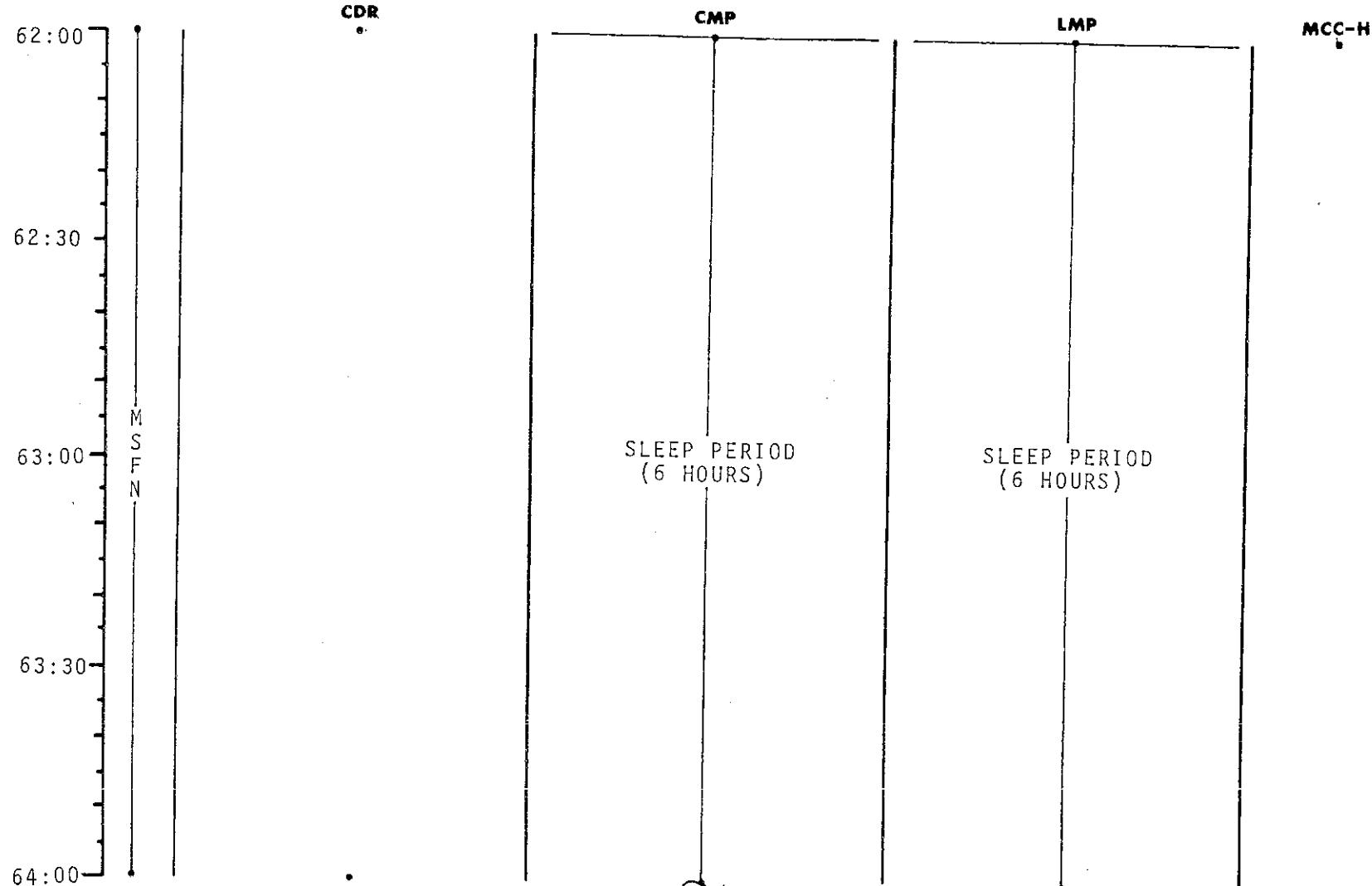
FLIGHT PLANNING BRANCH

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
61:00	V66 TRANS CSM STATE VECTOR TO LM SLOT	SM RCS MON CK GROUND TRACK DET P21 (STATE VECTOR CK)		
61:15	MNVR TO PTC ATT P 122 Y 315 P Y ROLL 0.1 °/SEC			SPS MON CK INITIATE BAT CHARGE ECS REDUNDANT COMP CK
61:30	M S F N			
61:45				
62:00				CMP/LMP CREW STATUS REPORT

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	61:00 - 62:00	3/TLC	2-45

FLIGHT PLAN

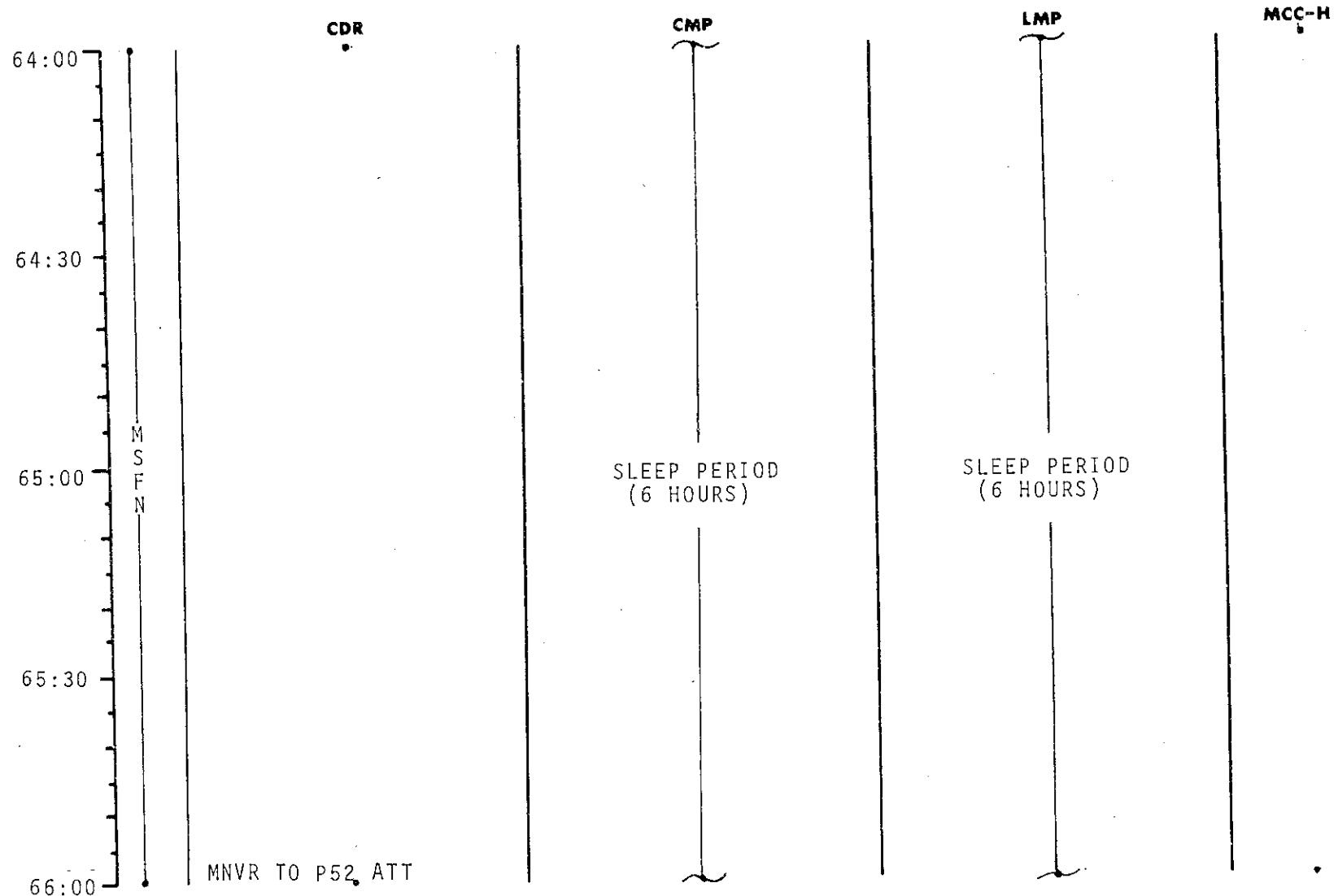


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	62:00 - 64:00	3/TLC	2-46

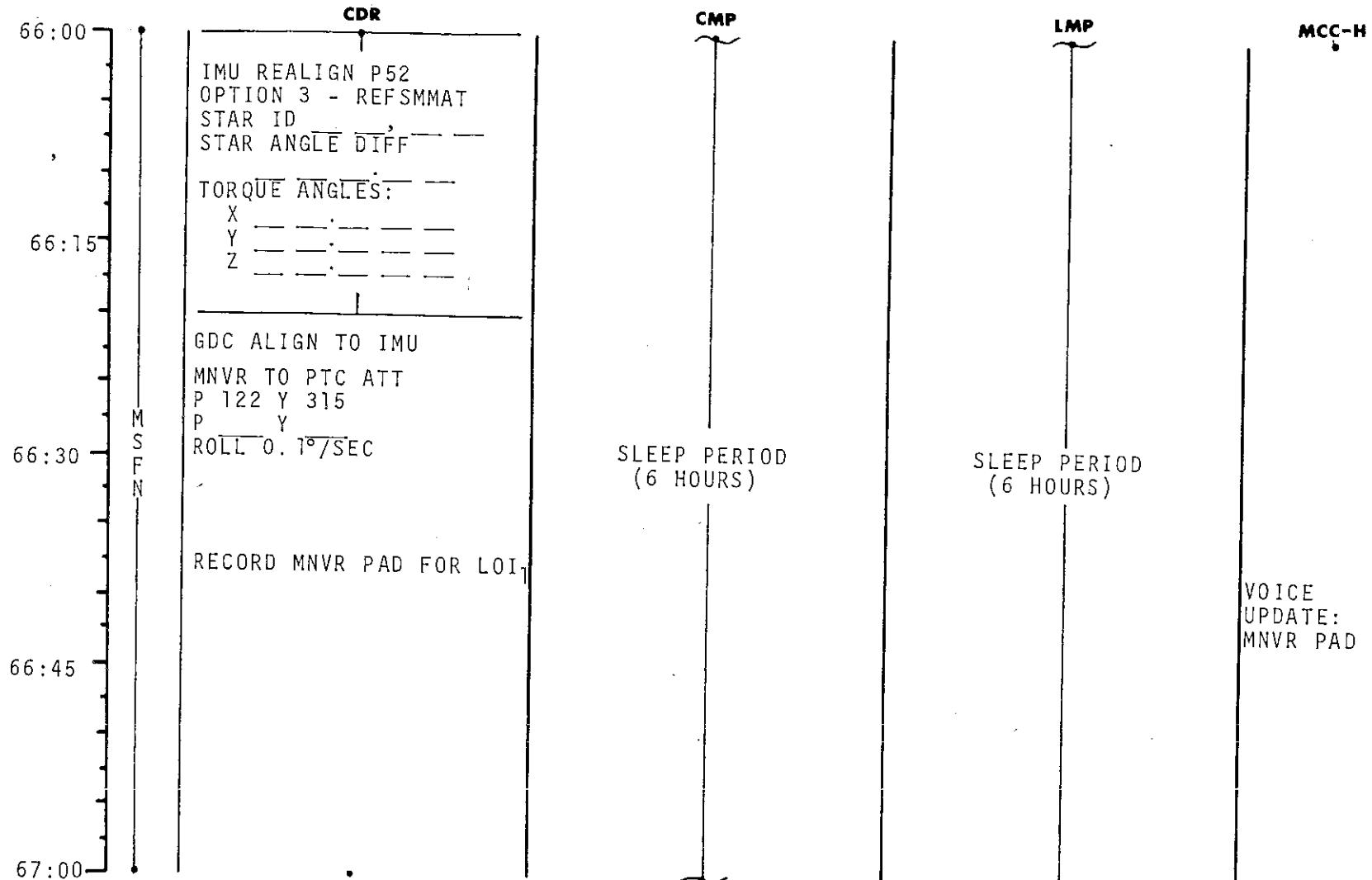
MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN



FLIGHT PLAN

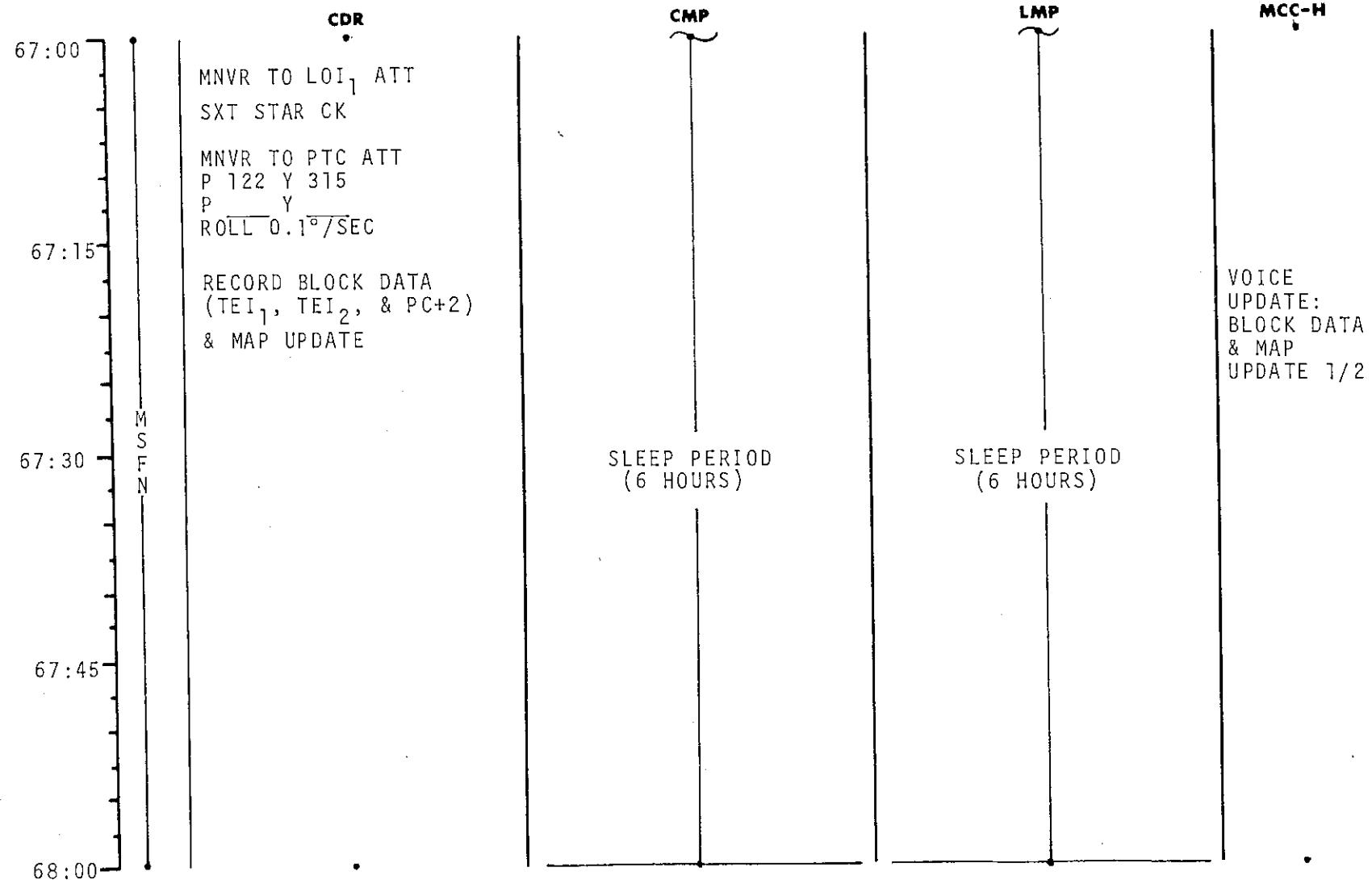


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	66:00 - 67:00	3/TLC	2-48

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	67:00 - 68:00	3/TLC	2-49

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
68:00	GO/NO GO FOR LOI, MNVR TO P52 ATT	GROUND TRACK DET - P21 (LOI ALTITUDE DET) IMU REALIGN P52 OPTION 3 - REFSMMAT AND GYRO DRIFT TEST STAR ID STAR ANGLE DIFF	CMP/LMP CREW STATUS REPORT RECORD MANEUVER PAD	GO/NO GO P27 UPDATE: STATE VECTOR TARGET LOAD VOICE UPDATE: MNVR PAD
68:30	M S F N EXTERNAL ΔV P30 EMS CK SPS THRUST P40 MNVR TO BURN ATT	TORQUE ANGLES: X ——— Y ——— Z ——— SXT STAR CK TRANSFER TO COUCH	PRE LOI SYSTEMS CKS: C&W CK CM RCS CK SM RCS CK SPS PERIODIC MONITOR EPS PERIODIC MONITOR ECS PERIODIC MONITOR	
68:57	GDC ALIGN TO IMU			
69:00				

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	68:00 - 69:00	3/TLC	2-50

MSC Form 1910 (OT) (Oct 68)

FLIGHT PLANNING BRANCH

BURN STATUS REPORT

X	X	<input type="checkbox"/>	:	ΔTIG
X	X		:	BT
		<input type="checkbox"/>	:	V_{gx}

TRIM

X	X	X	R
X	X	X	P
X	X	X	Y
		<input type="checkbox"/>	V_{gx}
			V_{gy}
			V_{gz}
			ΔV_c
X	X	X	FUEL
X	X	X	OX
X	X	X	UNBALANCE

2-50a

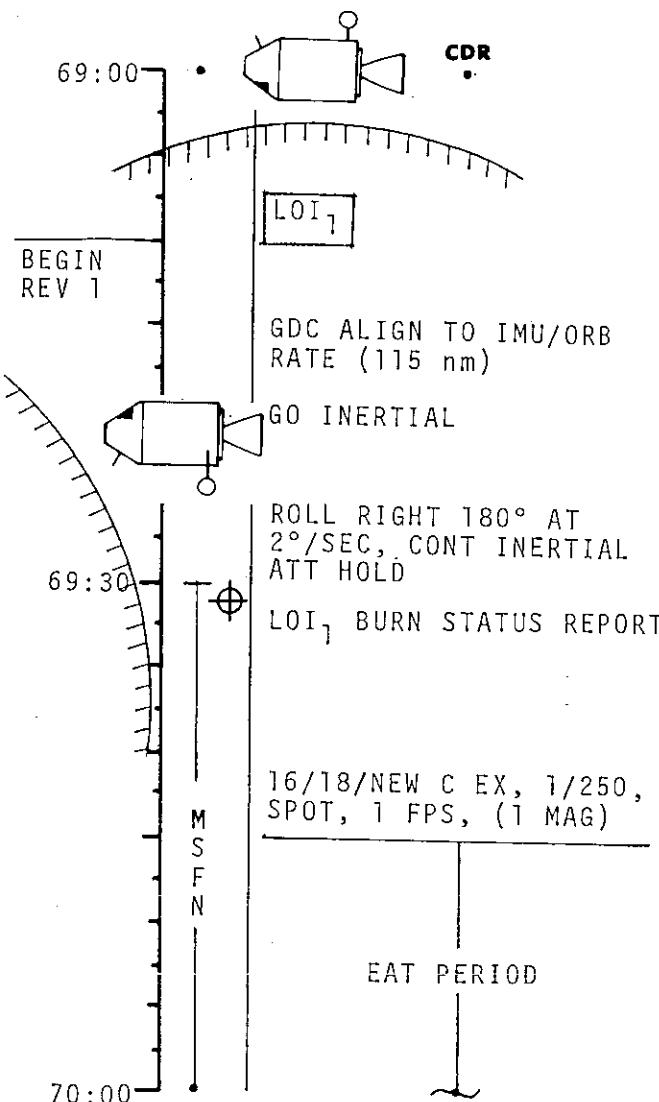
REMARKS:

LOI₁
BURN CHART

	P or Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
LOI ₁	10°/SEC TAKEOVER	10° TAKEOVER	B/T+6 SEC	NO TRIM

LOI ₁ ABORT MODES			
LOI V _{go}	B/T	TRAJECTORY	ABORT MODE
3050-2100	0 -1:20	HYPERBOLIC	COAST OUT OF SPHERE-P37
2100-1650	1:20-2:00	UNSTABLE	5 HR COAST. MODE I ABORT
1650-0	2:00-4:06	LUNAR ORBIT	MODE III ABORT AFTER 1 REV

FLIGHT PLAN



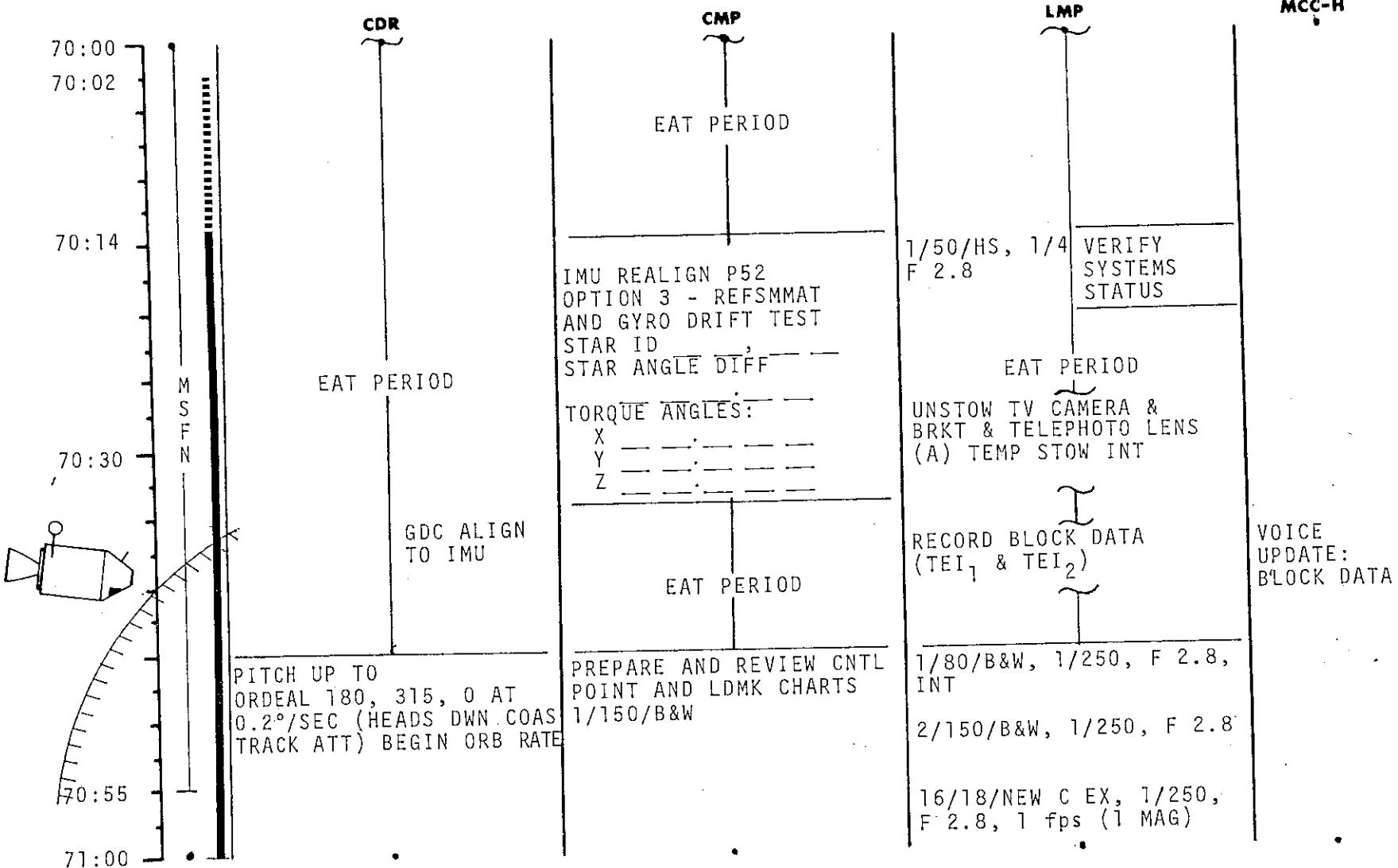
CMP	LMP	MCC-H
SM RCS MONITOR CK	BIOMED SW - CENTER	
GETI = 69:07:30 ΔV = 2991 fps BT = 4 MIN 5.8 SEC		
V66 TRANS CSM STATE VECTOR TO LM SLOT	SPS MONITOR CK	
SM RCS MONITOR CK	INITIATE BAT CHARGE CAMERA PREP	
2/80/B3 + 1/150/A8, R&B FILTER/U4, SPOT/ R13, INT/U4, 2 B&W FILM PACKS 1A8	V64 ACQUIRE MSFN ON HGA	ACQUIRE S/C
UNSTOW ORBITAL CHARTS, 16/18/NEW C-EX/CABLE/ BRKT/U3	2/150/NEW B&W 1/250	DUMP DSE
2/80/NEW B&W	1/80/B&W, 1/250	
EAT PERIOD	EAT PERIOD	EAT PERIOD

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	69:00 - 70:00	3/LPO	2-51

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	70:00 - 71:00	3/LPO	2-52

FLIGHT PLAN

MCC-H

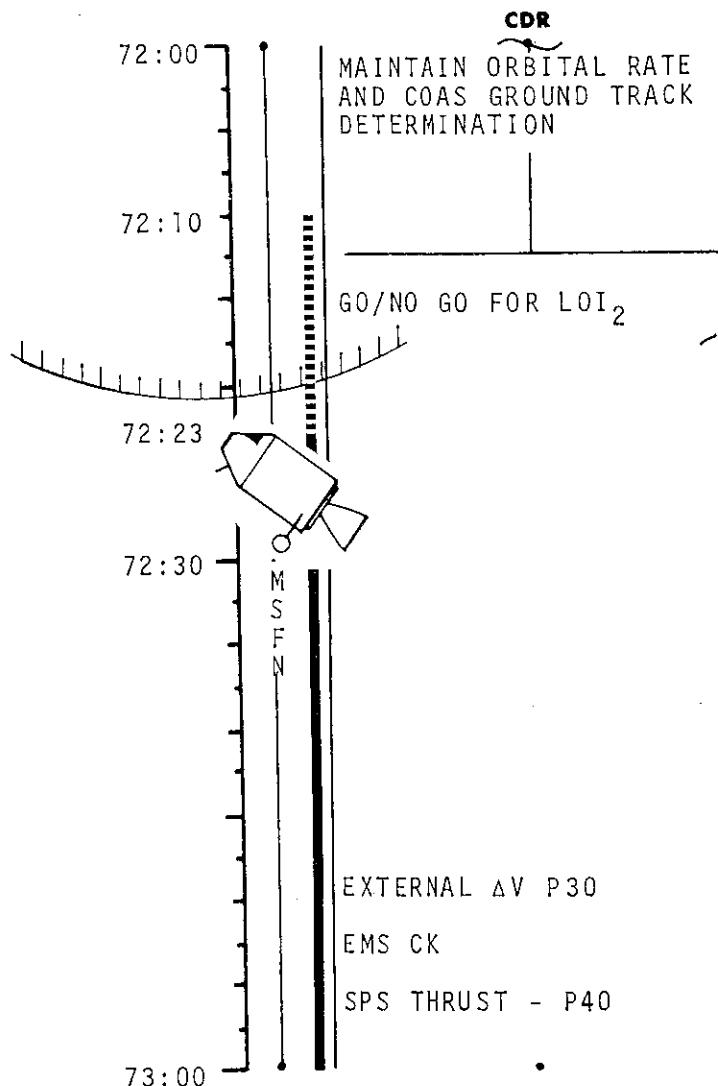
	CDR	CMP	LMP	
71:00				
71:09	MAINTAIN ORB RATE AND BEGIN COAS GROUND TRACK DETERMINATION	CONTROL PT (CP) SIGHTING (THRU HATCH WINDOW)	START 16 MM CAMERA AT TERMINATOR	
BEGIN REV 2		CP1 7 1 : 1 3 : 4 6 TCA : : : : : : CP1 NO. 504 LAT -05.250°S LONG -162.700°W ALT 000.00 nm	SPOT METER READINGS PHOTOGRAPH TARGETS OF OPPORTUNITY	
71:30	YAW RT 45° FOR TV ORDEAL 180, 315, 45	CP2 7 1 : 2 7 : 4 0 TCA : : : : : : CP2 NO. 526 LAT -10.200°S LONG +155.100°E ALT 000.00 nm	CONFIGURE FOR TV	
71:38	TV	CP3 7 1 : 4 6 : 3 8 TCA : : : : : : CP3 NO. 334 LAT -09.100°S LONG +95.900°E ALT 000.00 nm	V64 ACQUIRE MSFN ON HGA	ACQUIRE S/C P27 UPDATE: STATE VECTOR TARGET LOAD
	M S F N	PSEUDO LDG SITE LDMK SIGHTING (THRU HATCH WINDOW)	RECORD MAP UPDATE	VOICE UPDATE: MAP UPDATE 2/3
72:00				

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	71:00 - 72:00	3/LPO	2-53

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN



CMP

B-1	7	2 : 0	9 : 1	0
TCA	—	—	—	—

LDMK NO. B1
LAT +02.675°N
LONG +35.025°E
ALT -000.99 nm

LIOH CANISTER CHANGE
(CARTRIDGE 9 FROM B5
INTO CANISTER A)

IMU REALIGN P52
OPTION 3 - REFSMMAT
AND GYRO DRIFT TEST
STAR ID —, —
STAR ANGLE DIFF —

TORQUE ANGLES:
X —
Y —
Z —

LMP

BIOMED Sw - LEFT
STOP 16 MM CAMERA
RECORD MNVR PAD, BLOCK
DATA (TEI₃, TEI₃ NO
LOI₂).

1/80/HS, 1/4, F 2.8

PRE LOI SYSTEMS CKS:

C&W CK
CM RCS CK
SPS PERIODIC MONITOR
EPS PERIODIC MONITOR
ECS PERIODIC MONITOR

MCC-H

GO/NO GO
VOICE
UPDATE:
MNVR PAD
BLOCK DATA

DUMP DSE

PIPA BIAS
CK

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	72:00 - 73:00	4/LPO	2-54

BURN STATUS REPORT		
X	X	<input type="checkbox"/>
X	X	•
<input type="checkbox"/>	•	ATTIG
X	X	BT
		V_gx
		TRIM
X	X	X
X	X	X
X	X	X
		R
		P
		Y
		V_gx
		V_gy
		V_gz
		ΔV_c
X	X	X
X	X	X
X	X	X
		FUEL
		OX
		UNBALANCE

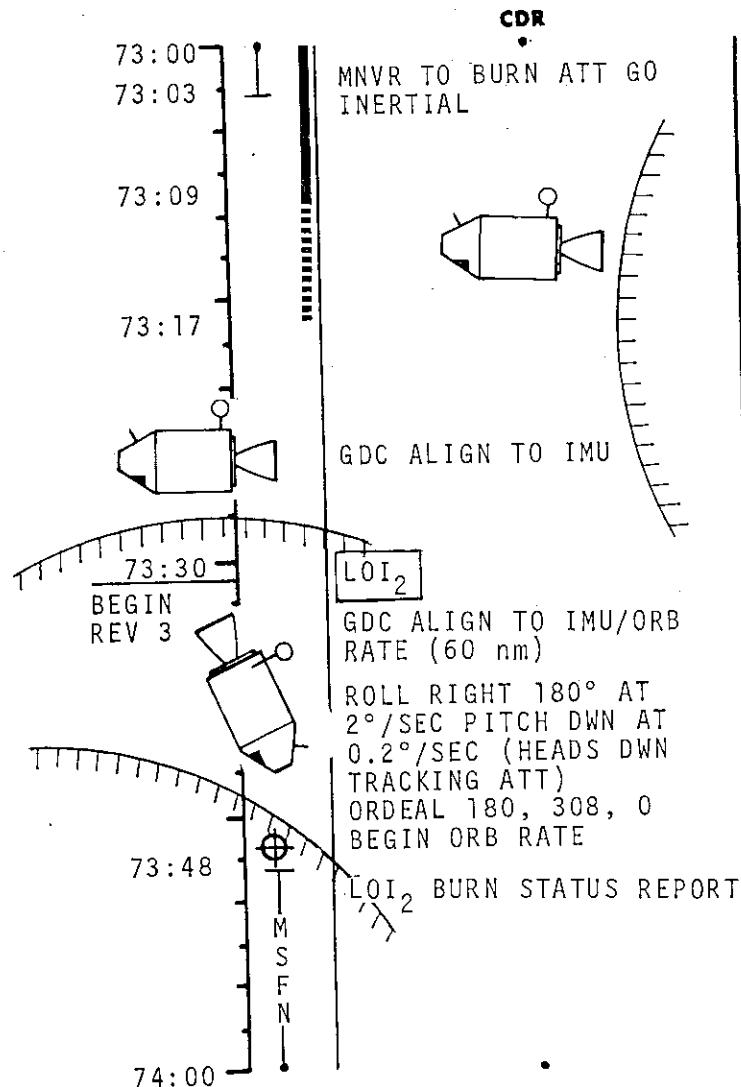
2-54a

REMARKS:

LOI_2
BURN CHART

	P or Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
LOI_2	10°/SEC TAKEOVER	10° TAKEOVER	B/T +1 SEC	NO TRIM

FLIGHT PLAN



CMP

SXT STAR CK

TRANSFER TO COUCH

SM RCS MONITOR CK

GETI = 73:30:54
ΔV = 138.5 fps
BT = 9.7 SEC

V66 TRANS CSM STATE VECTOR TO LM SLOT

SM RCS MONITOR CK

REST PERIOD (2 HOURS)

LMP

2/80/B&W, 1/250

16/18/C EX, 1/250

F CHART, 6 fps, BRACK

1/150/B&W, 1/60,

CHART, BRKT

PRE LOI SYSTEMS CKS

SPS MONITOR CK

INITIATE BAT CHARGE

V64 ACQUIRE MSFN ON HGA

ACQUIRE S/C

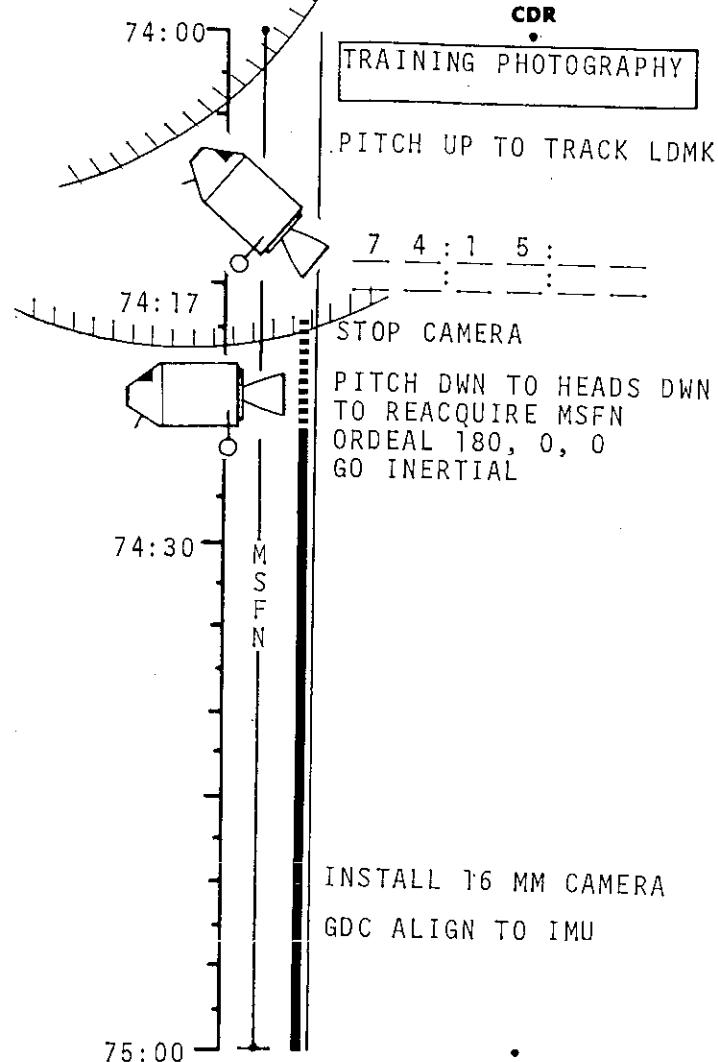
PIPA BIAS CK

BIOMED Sw - RIGHT

MCC-H

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	73:00 - 74:00	4/LPO	2-55

FLIGHT PLAN



CMP

REST PERIOD
(2 HOURS)

LMP

TRAINING PHOTOGRAPHY
70mm & 16mm

START CAMERAS 7 MIN PRIOR
LDMK 70mm - 20 SEC INT
UNTIL TRACKING - THEN
5 SEC F STOP FROM CHART

STOP CAMERAS

1/80/HS, 1/4, F 2.8

VERIFY SYSTEMS STATUS
RECORD MAP UPDATE

IMU REALIGN P52
OPTION 3 - REFSMMAT
AND GYRO DRIFT TEST
STAR ID —
STAR ANGLE DIFF —

TORQUE ANGLES:
X —
Y —
Z —

RECORD BLOCK DATA
(TEI₃ & TEI₄)

MCC-H

VOICE
UPDATE:
MAP UPDATE
3/4

DUMP DSE

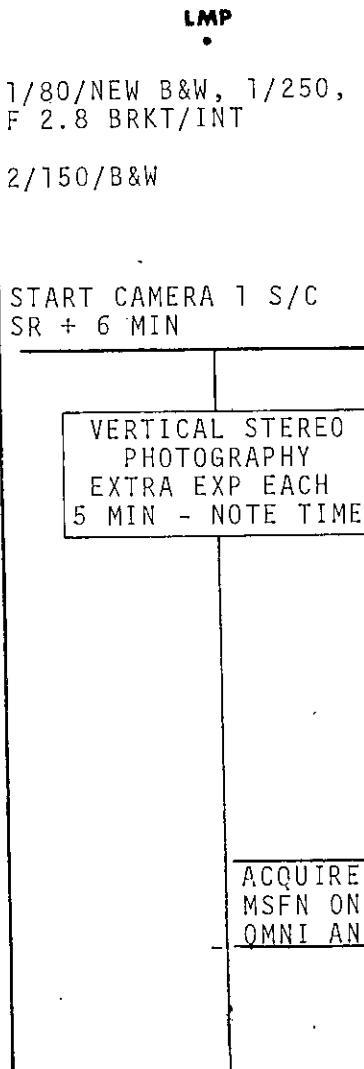
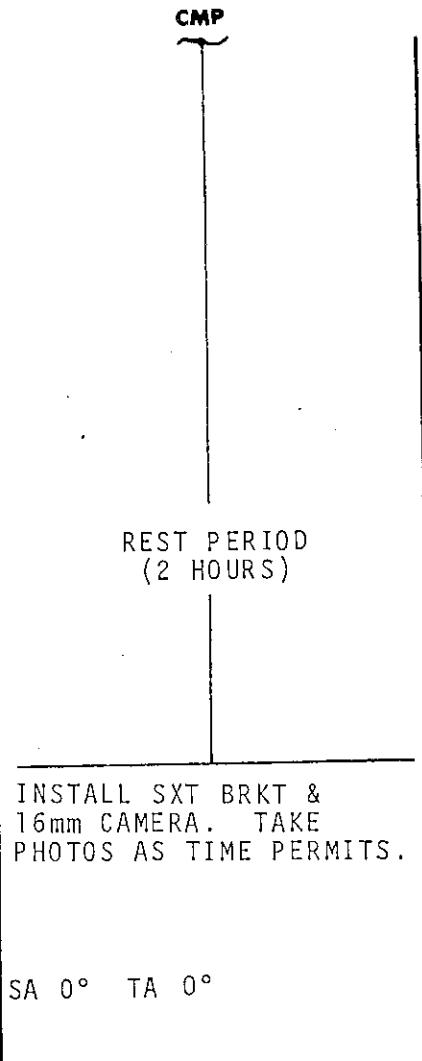
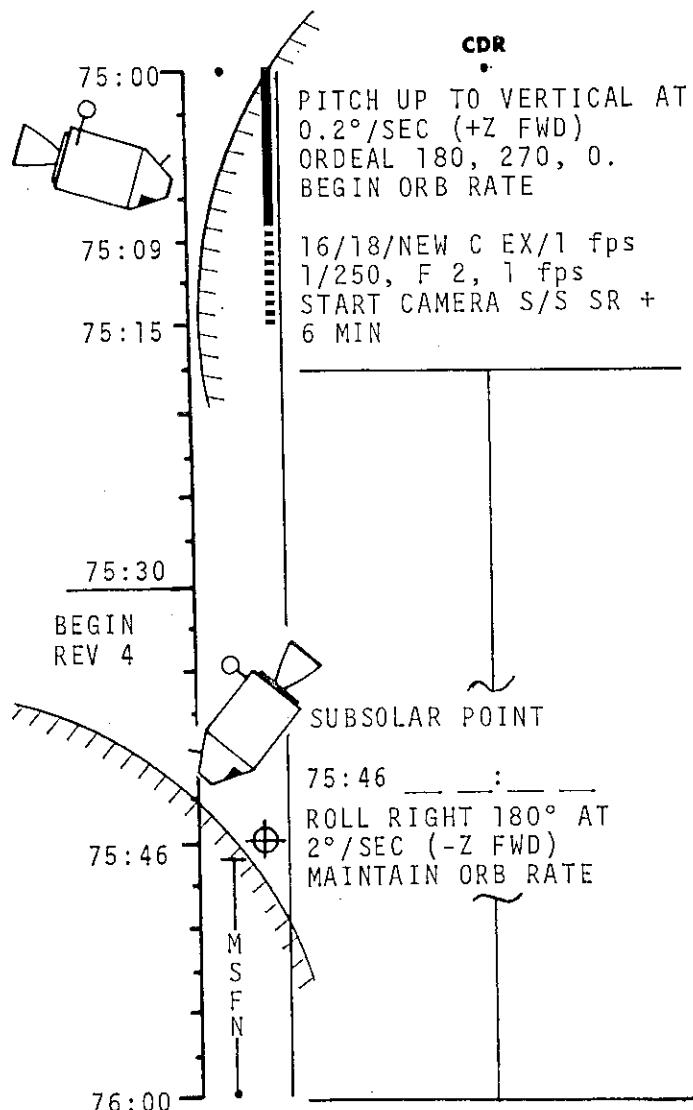
VOICE
UPDATE:
BLOCK DATA

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	74:00 - 75:00	4/LPO	2-56

MSC Form 1910 (Nov 68)

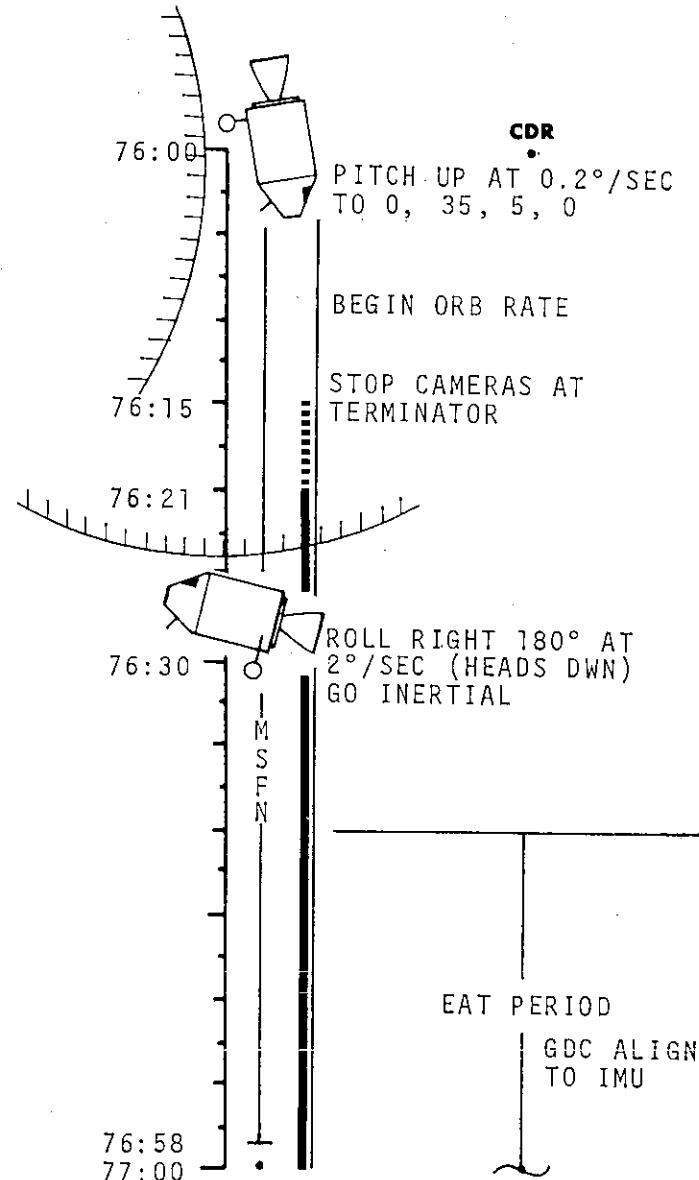
FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	75:00 - 76:00	4/LPO	2-57

FLIGHT PLAN



CMP	
IPI	— : — : — : —
ACQ	— : — : — : —
IPII	— : — : — : —
ACQ	— : — : — : —
LDMK LIGHTING EVALUATION (THRU OPTICS) OF LDMK B1	
IMU REALIGN P52 OPTION 3 - REFSMMAT AND GYRO DRIFT TEST STAR ID [REDACTED], STAR ANGLE DIFF [REDACTED]	
TORQUE ANGLES: X [REDACTED] Y [REDACTED] Z [REDACTED]	

LMP

AT PITCH UP 1/80/B&W,
1/250, F 11

STOP CAMERA 1 AT TERM

RECORD MAP UPDATE

V64 ACQUIRE MSFN ON HGA
1/80/HS, 1/4, F 2.8
(20 SEC STRIP - 20 EXP)

VERIFY SYSTEMS STATUS

RECORD BLOCK DATA:
(TEI₄ & TEI₅)

TRANS TO LEFT COUCH

1/80/B&W, 1/250, F 2.8
INT (CDR)

BIOMED SW - CENTER

MCC-H

VOICE UPDATE:
MAP UPDATE 4/5
P27 UPDATE:
STATE VECTOR

ACQUIRE S/C

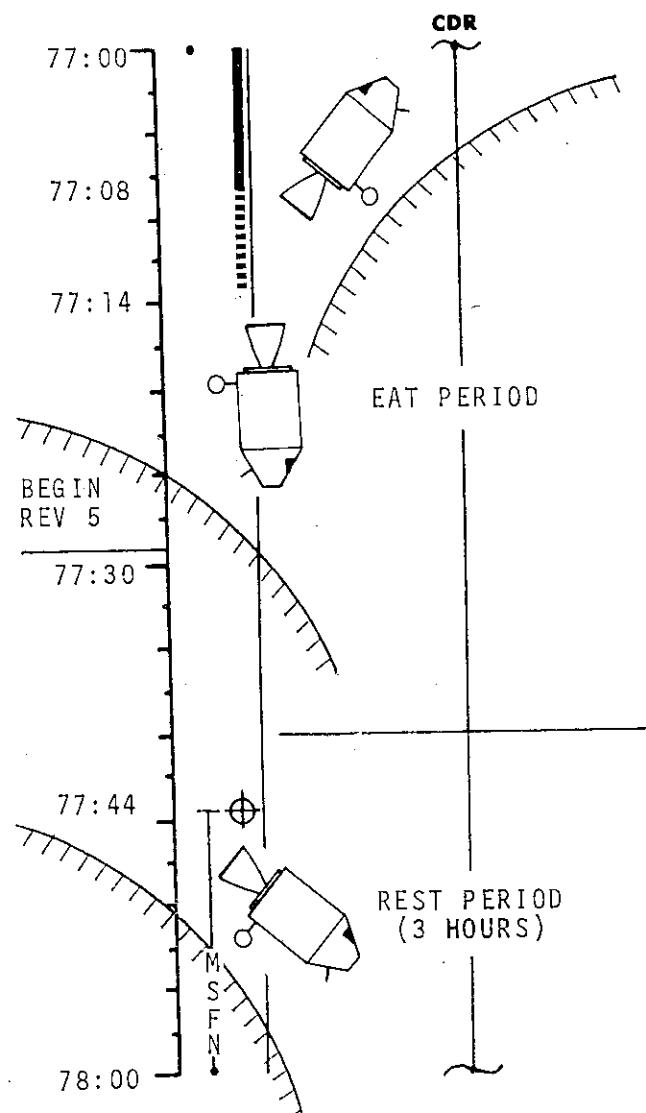
DUMP DSE

VOICE UPDATE:
BLOCK DATA

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	76:00 - 77:00	4/LPO	2-58

FLIGHT PLAN

MCC-H



CMP

MAP REVIEW

P22 MANUAL ACQ
SA 0°, TA 10°

CNTL POINT SIGHTING

IPI | ---:---:---
ACQ | ---:---:---

CP2 NO. 526
LAT -10.200°S
LONG/2 +77.550°
ALT +000.00 nm

NEW COORDINATES
LAT ---:---:---
LONG/2 ---:---:---
ALT ---:---:--- nm

REVIEW LDMK MAP

LMP

ROLL LEFT 180° AT
2°/SEC PITCH DWN AT
0.2°/SEC TO
ORDEAL 0, 5, 0. BEGIN
ORB RATE.

2/150/B&W, 1/250 F 2.8

2/150/B&W, 1/250 (CDR)
PITCH DWN AT 0.3°/SEC
AT ACQ

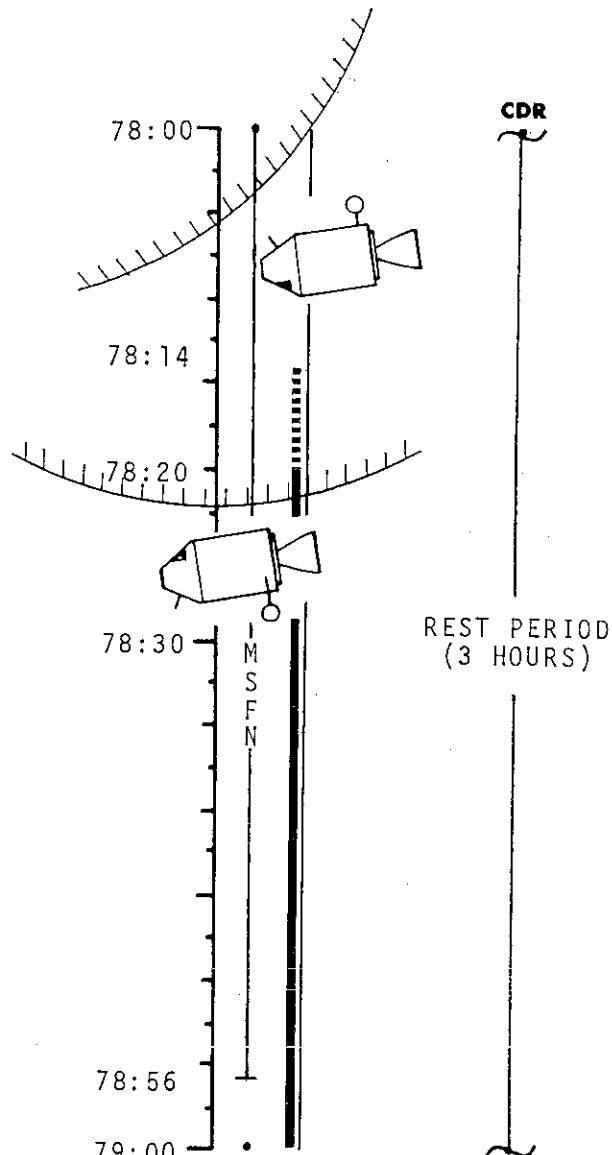
ACQUIRE MSFN ON OMNIS
AT LOSS PITCH UP AT
0.2°/SEC TO
ORDEAL 0, 5, 0. BEGIN
ORB RATE.

REPORT NEW CP COORDINATES

ACQUIRE S/C

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	77:00 - 78:00	4/LPO	2-59

FLIGHT PLAN



CMP

**PSEUDO LDG SITE
SIGHTINGS**

P22 - AUTO OPTICS

IPI

TCA

LDMK

NO.

B1

LAT +02.675°N

LONG/2 +17.512°

ALT -000.99 nm

NEW COORDINATES

LAT +

LONG/2 +

ALT

IMU REALIGN P52
OPTION 3 - REFSMMAT
AND GYRO DRIFT TEST
STAR ID
STAR ANGLE DIFF

TORQUE ANGLES:

X

Y

Z

LMP

PITCH DWN 0.3°/SEC AT ACQ

AT LOSS ROLL RIGHT 180°

AT 2°/SEC TO HEADS DWN

GO INERTIAL

V64 ACQUIRE MSFN ON HGA
1/80/HS, 1/4, F 2.8

REPORT NEW COORDINATES

RECORD BLOCK DATA
(TEI₆), & MAP UPDATE

VERIFY SYSTEMS STATUS

MCC-H

ACQUIRE S/C

P27 UPDATE:

STATE

VECTOR

VOICE

UPDATE:

BLOCK DATA

& MAP

UPDATE

5/6

DUMP DSE

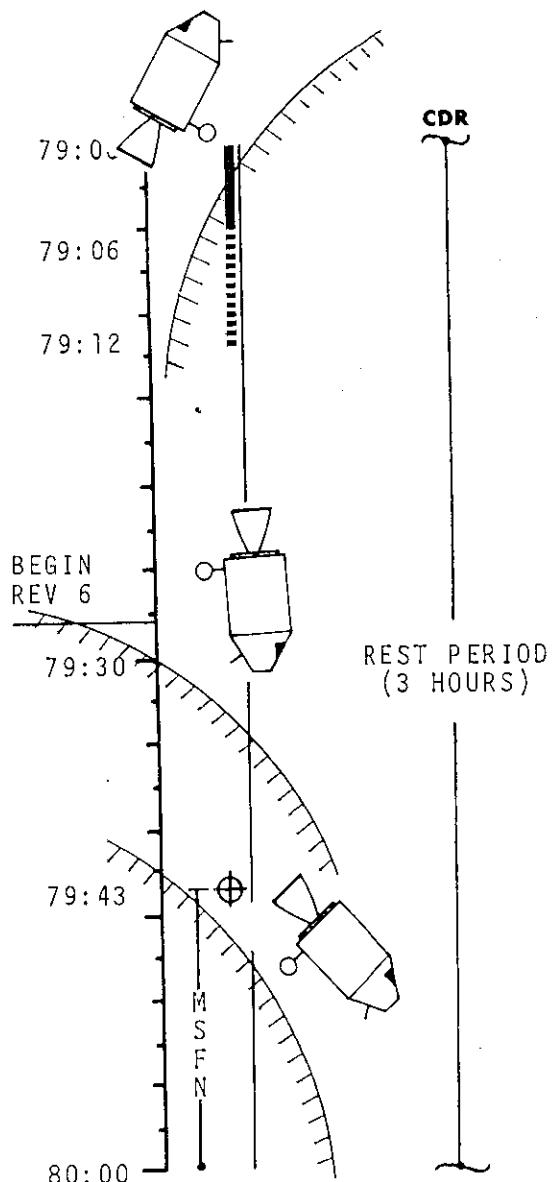
GDC ALIGN TO IMU
16/18/ C EX, 1/250, 1 fps
(MAGS)

2/150/C121/1/250 SPOT
GENERAL OBSERVATIONS

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	78:00 - 79:00	4/LPO	2-60

MSC Form 1810 (Nov 68)

FLIGHT PLANNING BRANCH

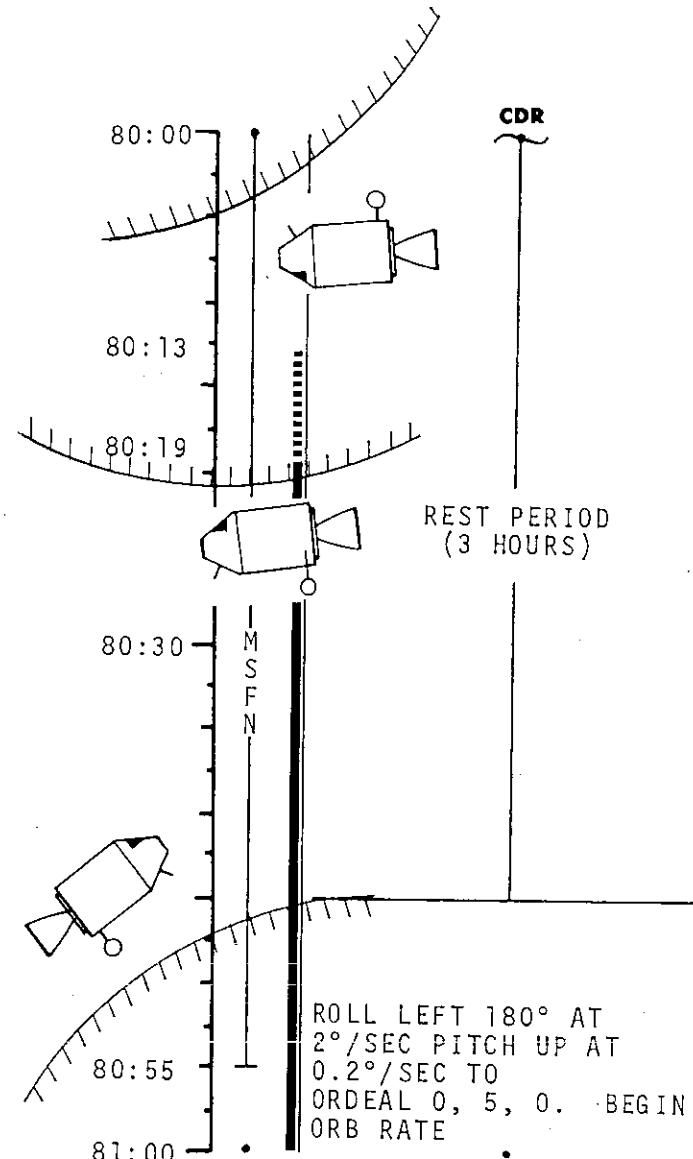


FLIGHT PLAN

CMP	LMP	MCC-H
REVIEW CONTROL POINT MAP	ROLL 180° AT 2°/SEC PITCH DWN AT 0.2°/SEC TO ORDEAL 0, 5, 0. BEGIN ORB RATE	
CNTL POINT SIGHTING		
P22 - AUTO OPTICS IPI _____ TCA _____ CP2 NO. 526 LAT -10.200° LONG/2 +77.550° ALT +000.00 nm	PITCH DWN 0.3°/SEC AT ACC	
NEW COORDINATES LAT _____ ° LONG/2 _____ ° ALT _____ nm	AT LOSS PITCH UP AT 0.2°/SEC TO ORDEAL 0, 5, 0. BEGIN ORB RATE	
REVIEW LDMK MAP	ACQUIRE MSFN ON OMNIS	ACQUIRE S/C
PSEUDO LDG SITE SIGHTING	REPORT NEW COORDINATES	

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	79:00 - 80:00	4/LPO	2-61

FLIGHT PLAN



CMP

P22 AUTO OPTICS
 IPI | --- : --- :
 TCA | --- : --- :
 LDMK NO. B1
 LAT +02.675°N
 LONG/2 +17.512°
 ALT -000.99 nm
 NEW COORDINATES
 LAT | --- : --- :
 LONG/2 | --- : --- :
 ALT | --- : --- : nm

IMU REALIGN P52
 OPTION 3 - REFSMMAT
 AND GYRO DRIFT TEST
 STAR ID
 STAR ANGLE DIFF

TORQUE ANGLES:
 X | --- : --- :
 Y | --- : --- :
 Z | --- : --- :

16/SXT/NEW C XT,
 6 fps

LMP

PITCH DWN 0.3°/SEC AT ACQ

AT LOSS ROLL RIGHT 180°
 AT 2°/SEC. GO INERTIAL

V64 ACQUIRE MSFN ON HGA

REPORT NEW COORDINATES

RECORD BLOCK DATA
 (TEI₇) & MAP UPDATE

VERIFY SYSTEMS STATUS

1/80/B&W, 1/250 F 2.8 INT

2/150/B&W, 1/250 (R&B)

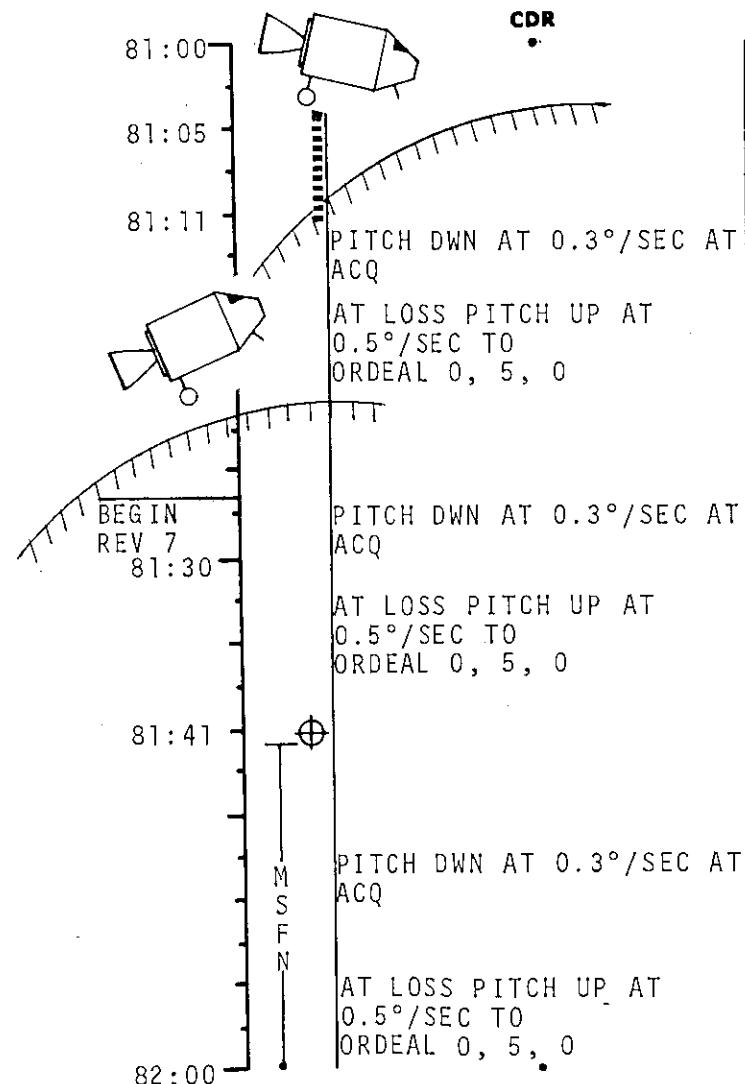
TRANS TO RIGHT COUCH

ACQUIRE S/C
 P27 UPDATE:
 STATE
 VECTOR
 VOICE
 UPDATE:
 BLOCK DATA
 & MAP
 UPDATE 6/7
 DUMP DSE

EAT PERIOD

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	80:00 - 81:00	4/LPO	2-62

FLIGHT PLAN

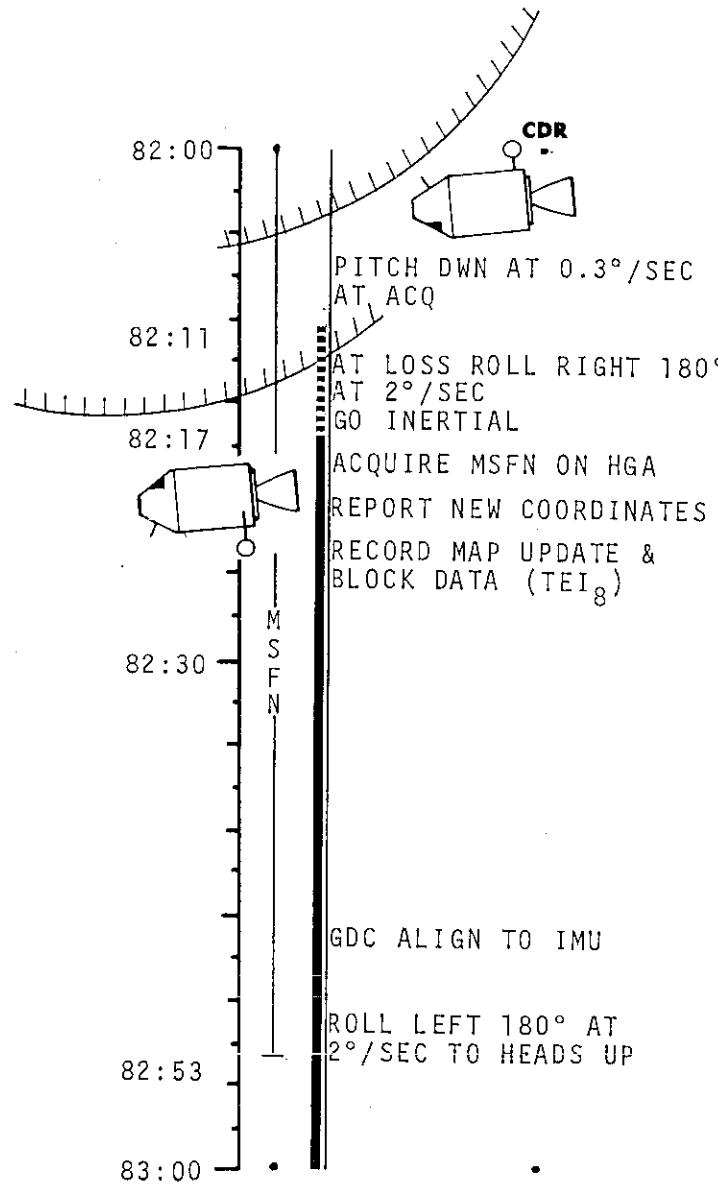


CMP	
CNTL PT SIGHTINGS (3)	
P22 MAN ACQ SA 0° TA 10°	IPI
ACQ	— — — — —
CP1 NO. 504	— — — — —
LAT -05.250°S	— — — — —
LONG/2 -81.350°	— — — — —
ALT +000.00 nm	— — — — —
P22 AUTO OPTICS	
IPI	— — — — —
TCA	— — — — —
CP2 NO. 526	— — — — —
LAT -10.200°S	— — — — —
LONG/2 +77.550°	— — — — —
ALT +000.00 nm	— — — — —
P22 MAN ACQ SA 0° TA 10°	
IPI	— — — — —
ACQ	— — — — —
CP3 NO. 334	— — — — —
LAT -09.100°S	— — — — —
LONG/2 +47.950°	— — — — —
ALT +000.00 nm	— — — — —
PSEUDO LDG SITE SIGHTING	
P22 AUTO OPTICS	

LMP	MCC-H
BIOMED Sw - LEFT	EAT PERIOD
NEW COORDINATES	LAT — . . . °
LAT — . . . °	LONG/2 — . . . °
ALT — . . . nm	ALT — . . . nm
EAT PERIOD	NEW COORDINATES
LAT — . . . °	LAT — . . . °
LONG/2 — . . . °	LONG/2 — . . . °
ALT — . . . nm	ALT — . . . nm
ACQUIRE S/C	NEW COORDINATES
LAT — . . . °	LAT — . . . °
LONG/2 — . . . °	LONG/2 — . . . °
ALT — . . . nm	ALT — . . . nm

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	81:00 - 82:00	4/LPO	2-63

FLIGHT PLAN



CMP

IPI | - - - - -
TCA | - - - - -
LDG SITE NO. BT
LAT +02.675°N
LONG/2 +17.512°
ALT -000.99 nm
NEW COORDINATES
LAT | - - - - -
LONG/2 | - - - - -
ALT | - - - - - nm

IMU REALIGN P52
OPTION 3 - REFSMMAT
AND GYRO DRIFT TEST
STAR ID
STAR ANGLE DIFF

TORQUE ANGLES:
X | - - - - -
Y | - - - - -
Z | - - - - -

16/SXT/CXT, , 6 fps

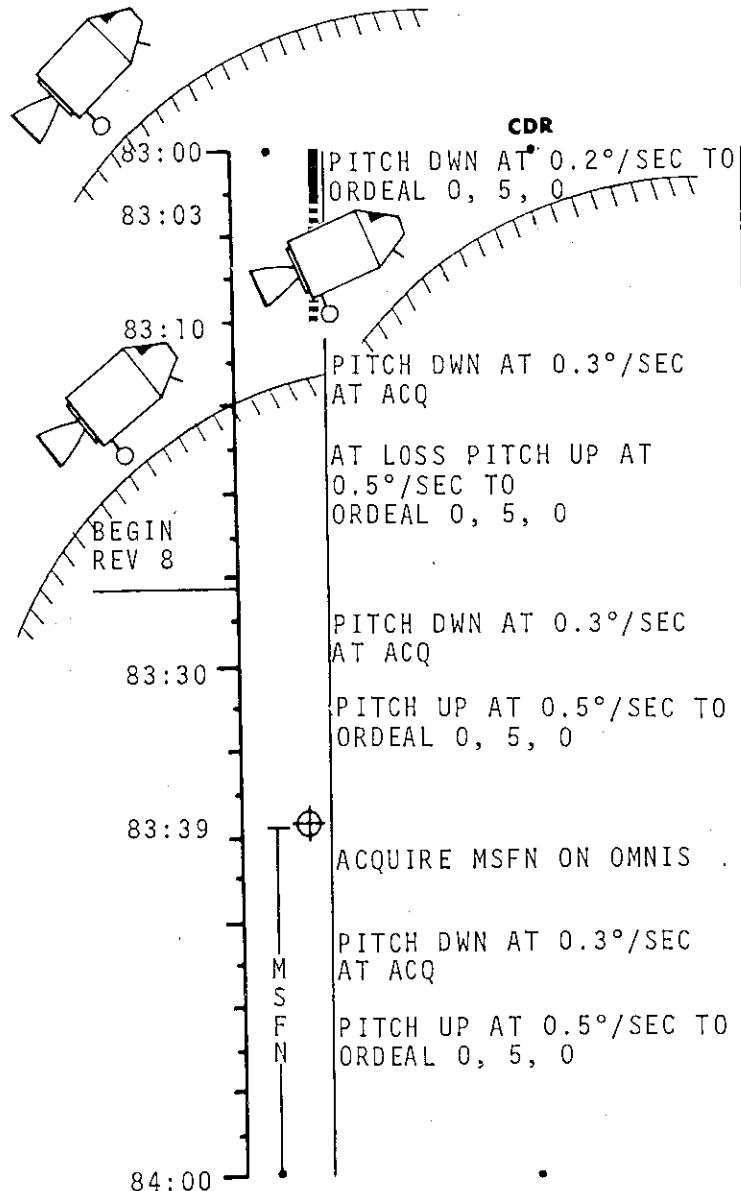
LMP

MCC-H

REST PERIOD
(2 HOURS)

ACQUIRE S/C
P27 UPDATE:
STATE
VECTOR
VOICE
UPDATE:
MAP UPDATE
7/8
BLOCK DATA
DUMP DSE

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	82:00 - 83:00	4/LPO	2-64



FLIGHT PLAN

CMP

CNTL PT SIGHTINGS (3)

P22 AUTO OPTICS
 IPI _____ : _____ :
 TCA _____ : _____ :
 CP1 NO. 504
 LAT -05.250°S
 LONG/2 -81.350°
 ALT +000.00 nm

P22 AUTO OPTICS
 IPI _____ : _____ :
 TCA _____ : _____ :
 CP2 NO. 526
 LAT -10.200°S
 LONG/2 +77.550°
 ALT +000.00 nm

P22 AUTO OPTICS
 IPI _____ : _____ :
 TCA _____ : _____ :
 CP3 NO. 334
 LAT -09.100°S
 LONG/2 +47.950°
 ALT +000.00 nm

PSEUDO LDG SITE SIGHTING

P22 AUTO OPTICS

LMP
 REST PERIOD
 (2 HOURS)

NEW COORDINATES
 LAT _____ . _____ °
 LONG/2 _____ . _____ °
 ALT _____ . _____ nm

NEW COORDINATES
 LAT _____ . _____ °
 LONG/2 _____ . _____ °
 ALT _____ . _____ nm

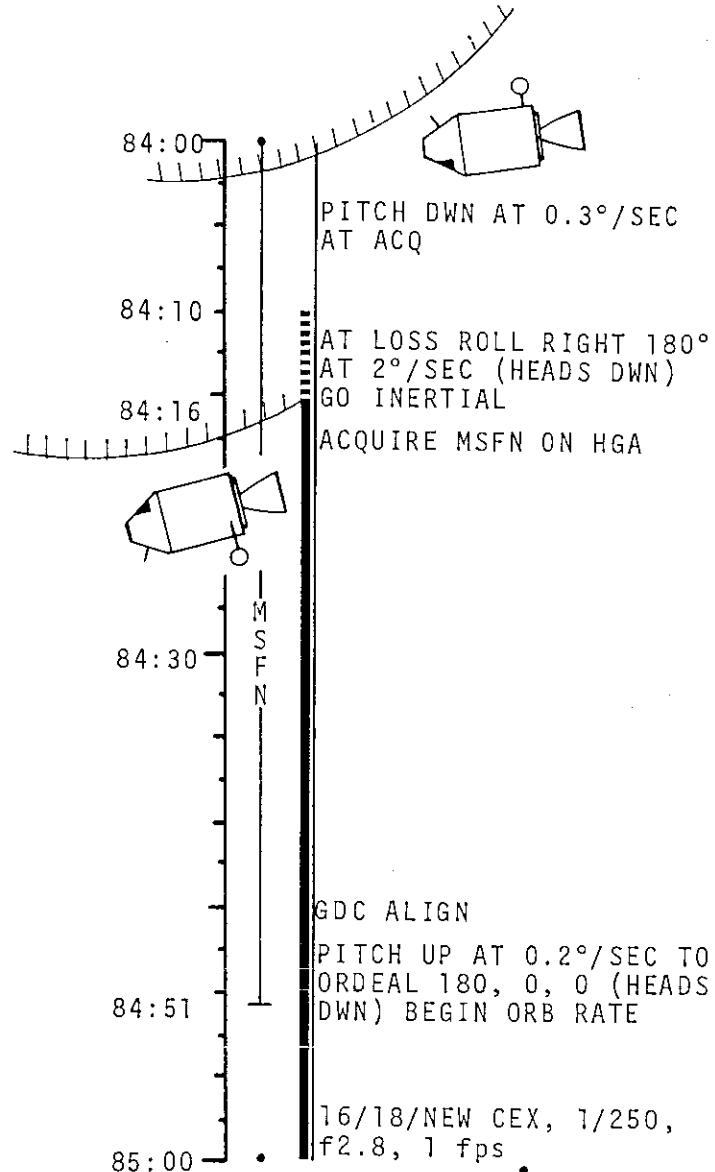
NEW COORDINATES
 LAT _____ . _____ °
 LONG/2 _____ . _____ °
 ALT _____ . _____ nm

MCC-H

ACQUIRE S/C

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	83:00 - 84:00	4/LPO	2-65

FLIGHT PLAN



CMP
*
IPI | _____ : _____ : _____
TCA | _____ : _____ : _____
LDMK NO. B1
LAT +02.512°N
LONG/2 +17.512°
ALT +000.99 nm

LIOH CANISTER CHANGE
(CARTRIDGE 10 FROM B5
INTO CANISTER B)

IMU REALIGN P52
OPTION 3 - REFSMMAT
AND GYRO DRIFT TEST
STAR ID ,
STAR ANGLE DTE

TORQUE ANGLES:

X — — — .
Y — — — : — — —
Z — — — ; — — —

**REST PERIOD
(2 HOURS)**

LMP
I
NEW COORDINATES
LAT ____.
LONG/2 ____.
ALT ____.
nn

REST PERIOD
(2 HOURS)

2/150/NEW B&W, 1/250
(R&B)

BIOMED SW - RIGHT

VERIFY SYSTEMS STATUS

RECORD MAP UPDATE &
BLOCK DATA (TEI₉)

1/80/H.S. B, f2.8, P01

SR - 12 MIN START DARK

1/80 B&W, 1/4, f4, POL

SR -4 MIN START CORON

MCC-H

ACQUITRE S/C

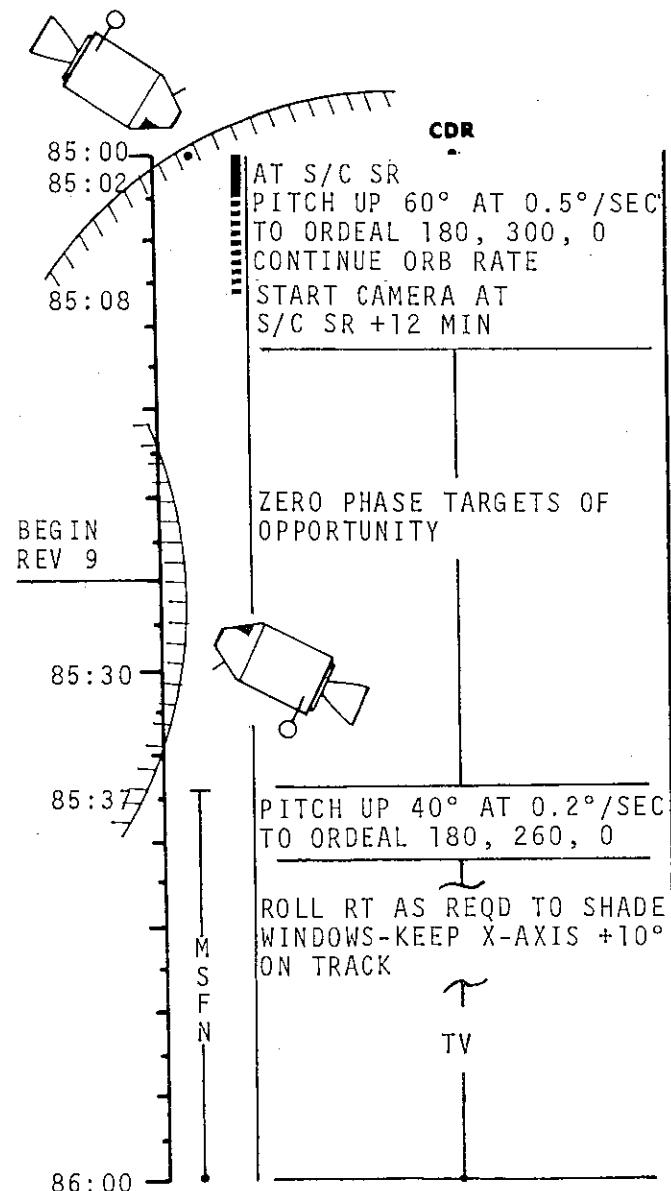
P27 UPDATE:
STATE
VECTOR

DUMP DSE

VOICE
UPDATE:
MAP UPDATE
8/9
BLOCK DATA

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	84:00 - 85:00	4/LPO	2-66

FLIGHT PLAN



CMP

REST PERIOD
(2 HOURS)

LMP

1/80/NEW C BRKT INT

START CAMERA 1 AT
SR +12 MIN

CONVERGENT STEREO
PHOTOGRAPHY-EXTRA
EXP EACH 5 MIN -
NITE TIME

ACQUIRE MSFN ON HGA
RECORD MAP UPDATE

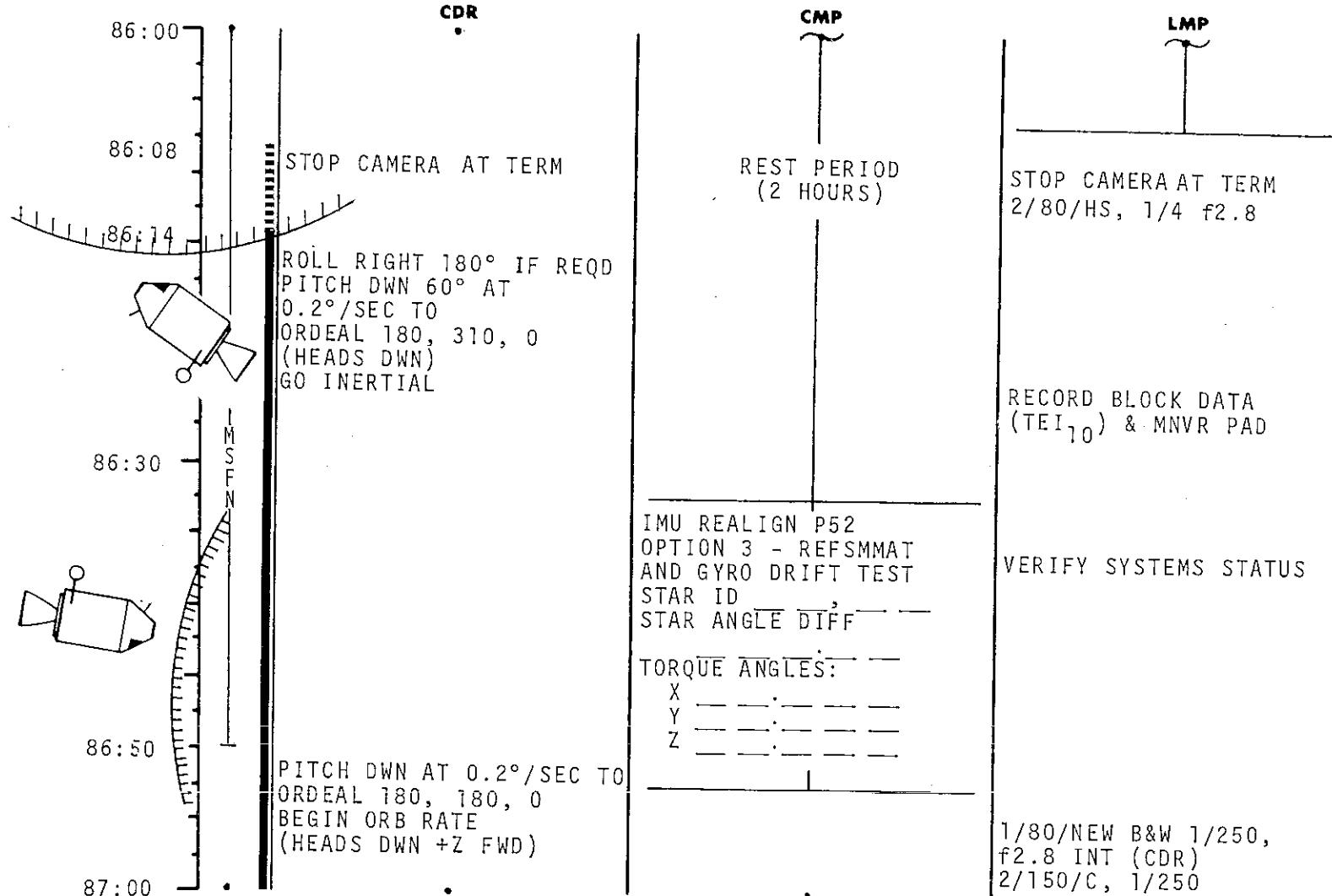
2/80 B&W/R&B
4 STOPS WIDER

MCC-H

ACQUIRE S/C
VOICE
UPDATE:
MAP UPDATE
9/10

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	85:00 - 86:00	4/LPO	2-67

FLIGHT PLAN

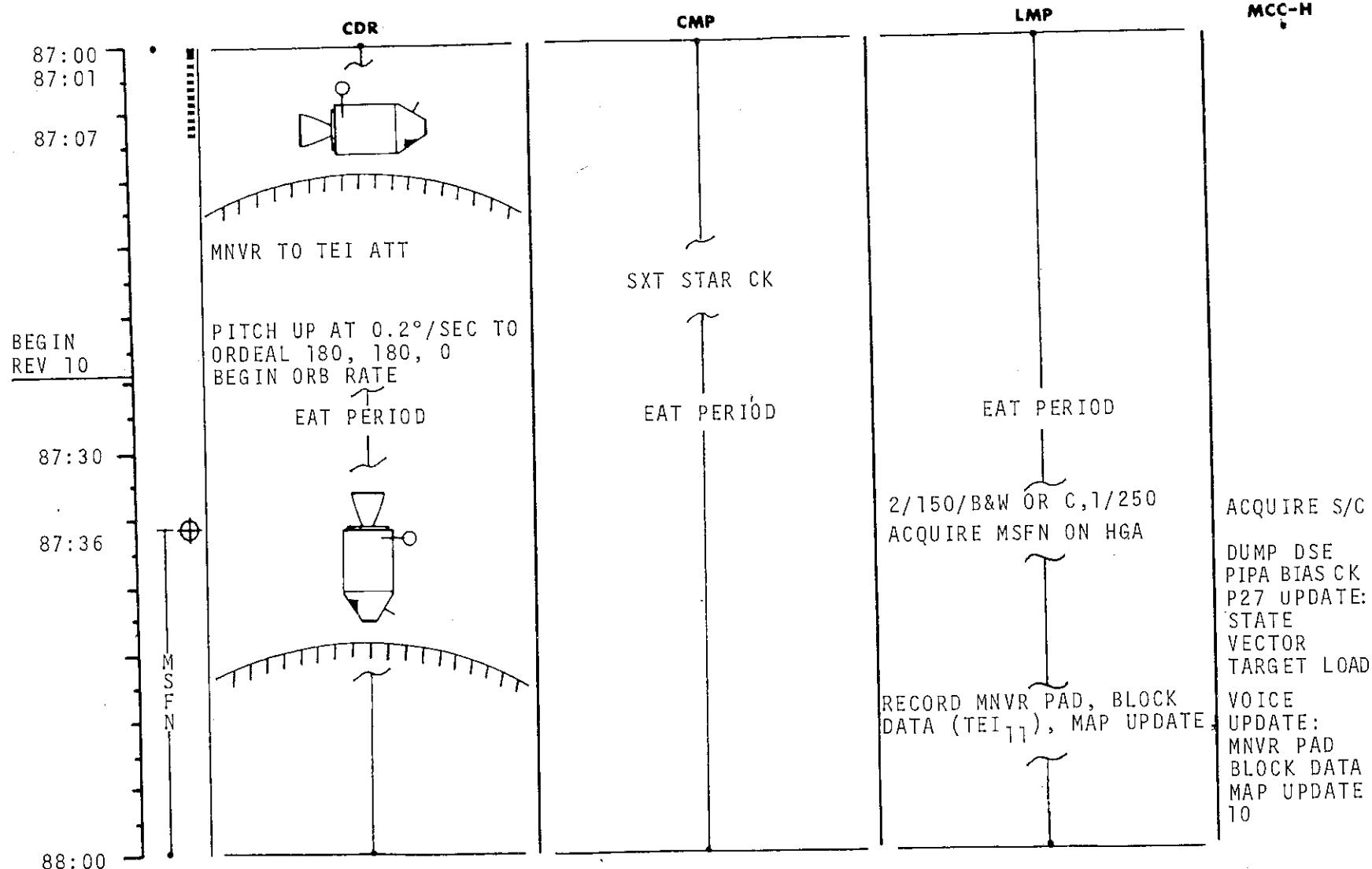


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	86:00 - 87:00	4/LPO	2-68

MSC Form 1910 (Nov 68)

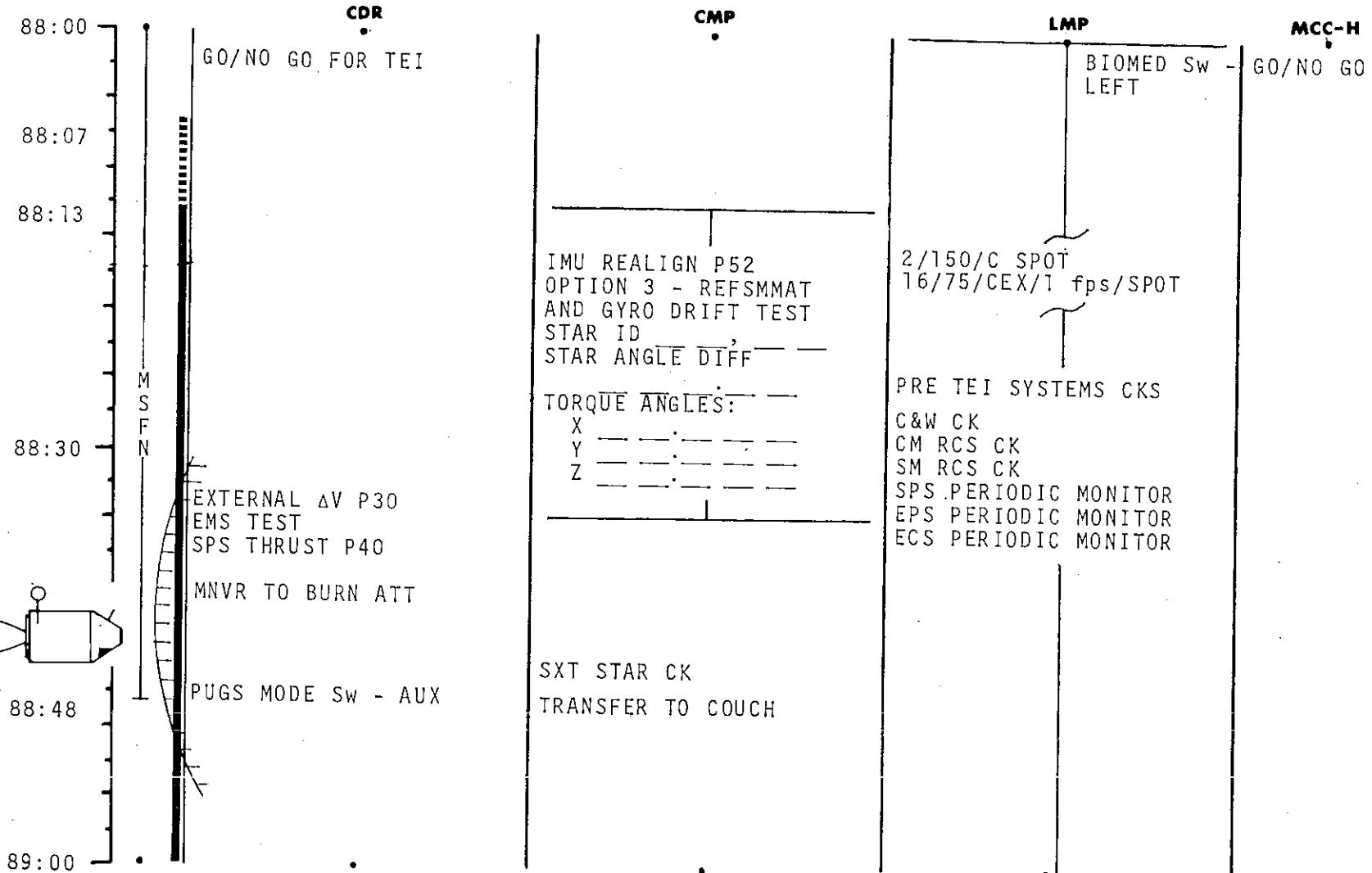
FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	87:00 - 88:00	4/LPO	2-69

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	88:00 - 89:00	4/LPO	2-70

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

BURN STATUS REPORT

X	X		.	ΔTI
X	X		.	BT
			.	V _g x
		TRIM	.	
X	X	X	.	R
X	X	X	.	P
X	X	X	.	Y
			.	V _g x
			.	V _g y
			.	V _g z
			.	ΔV _c
			.	FUE
X	X	X	.	OX
X	X	X	.	UNI
X	X	X	.	

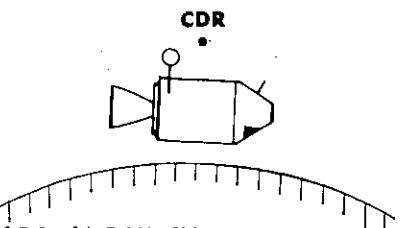
UNBALANCE

REMARKS:

TEI
BURN CHART

	P or Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
TEI	10°/SEC TAKEOVER	10° TAKEOVER	B/T+2 SEC & $\Delta V_c = -40$ fps	TRIM TO 2.0 fps
TEI ABORT MODES-SYSTEMS PROBLEMS:15-MIN ABORT CHART OTHERWISE				
TEI V _{go}	B/T	TRAJECTORY	ABORT MODE	
2850-950 950-600 600-0	0 -2:00 2:00-2:20 2:20-2:54	LUNAR ORBIT UNSTABLE HYPERBOLIC	MODE III AFTER 1 REV 5-HR COAST, MODE I COAST OUT OF SPHERE - P37	

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
89:00				
89:15	GDC ALIGN TO IMU TEI	SM RCS MON CK GETI = 89:15:07 ΔV = 3532 fps BT = 3 MIN 26 SEC	SPS MON CK	ACQUIRE MSFN WITH HGA
	PITCH UP TO VERTICAL (+Z FWD) TO ACQ MOON IN WINDOW CDR CREW STATUS REPORT	SM RCS MON CK	TEI BURN STATUS REPORT	ACQUIRE S/C
89:30	SLEEP PERIOD (5 HOURS)	TRANS CSM STATE VECTOR TO LM SLOT REINITIALIZE W MATRIX R_1 +00094 R_2 +00571 R_3 +00003	INITIATE BAT CHARGE	BIOMED Sw - CENTER
89:45				DUMP DSE UPDATE ENTRY REFSMMAT
90:00				

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	89:00 - 90:00	4/TEC	2-71

MSC Form 1910 (Nov 68)

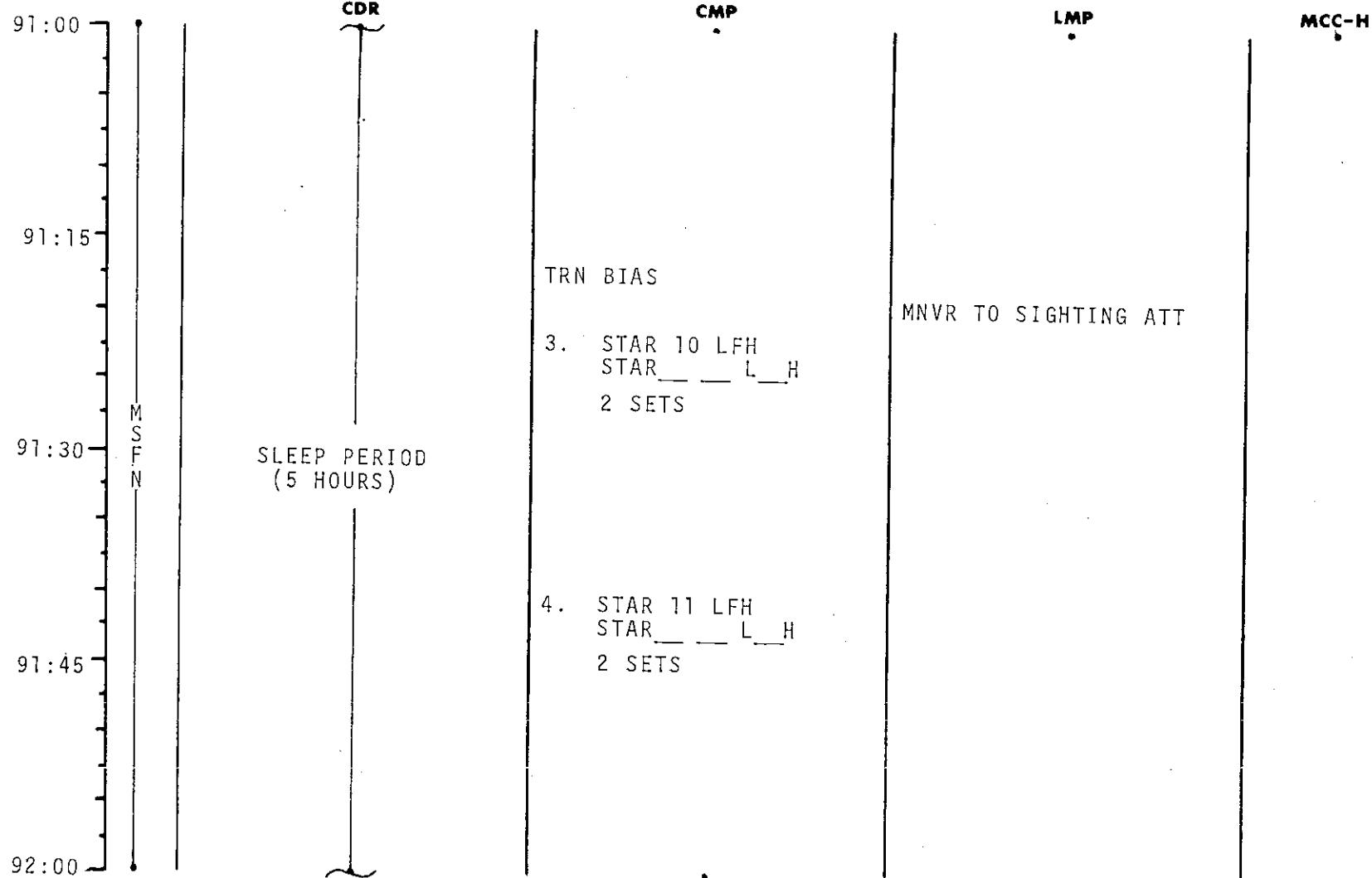
FLIGHT PLANNING BRANCH

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
90:00			MNVR TO P52 ATT	
90:15		IMU REALIGN P52 OPTION 1 - PREFERRED STAR ID _____ STAR ANGLE DIFF _____ TORQUE ANGLES: X _____ Y _____ Z _____		
90:30	SLEEP PERIOD (5 HOURS)	TRN BIAS	MNVR TO SIGHTING ATT	
90:45		CISLUNAR NAVIGATION P23 1. STAR 01 LNH STAR _____ L _____ H 2 SETS		
91:00		2. STAR 02 LNH STAR _____ L _____ H		

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	90:00 - 91:00	4/TEC	2-72

FLIGHT PLAN

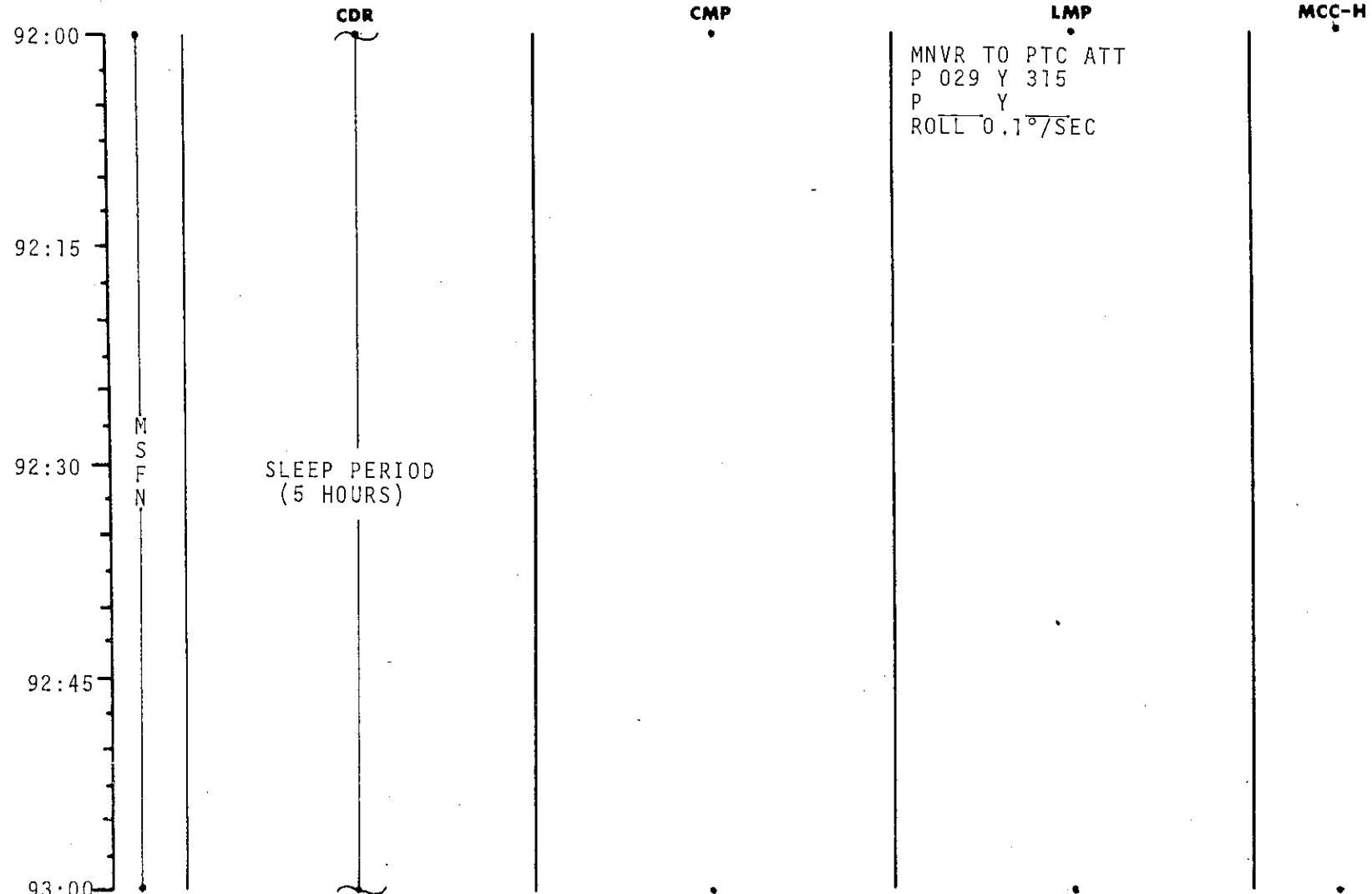


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	91:00 - 92:00	4/TEC	2-73

MSC Form 1910 (Nov 68)

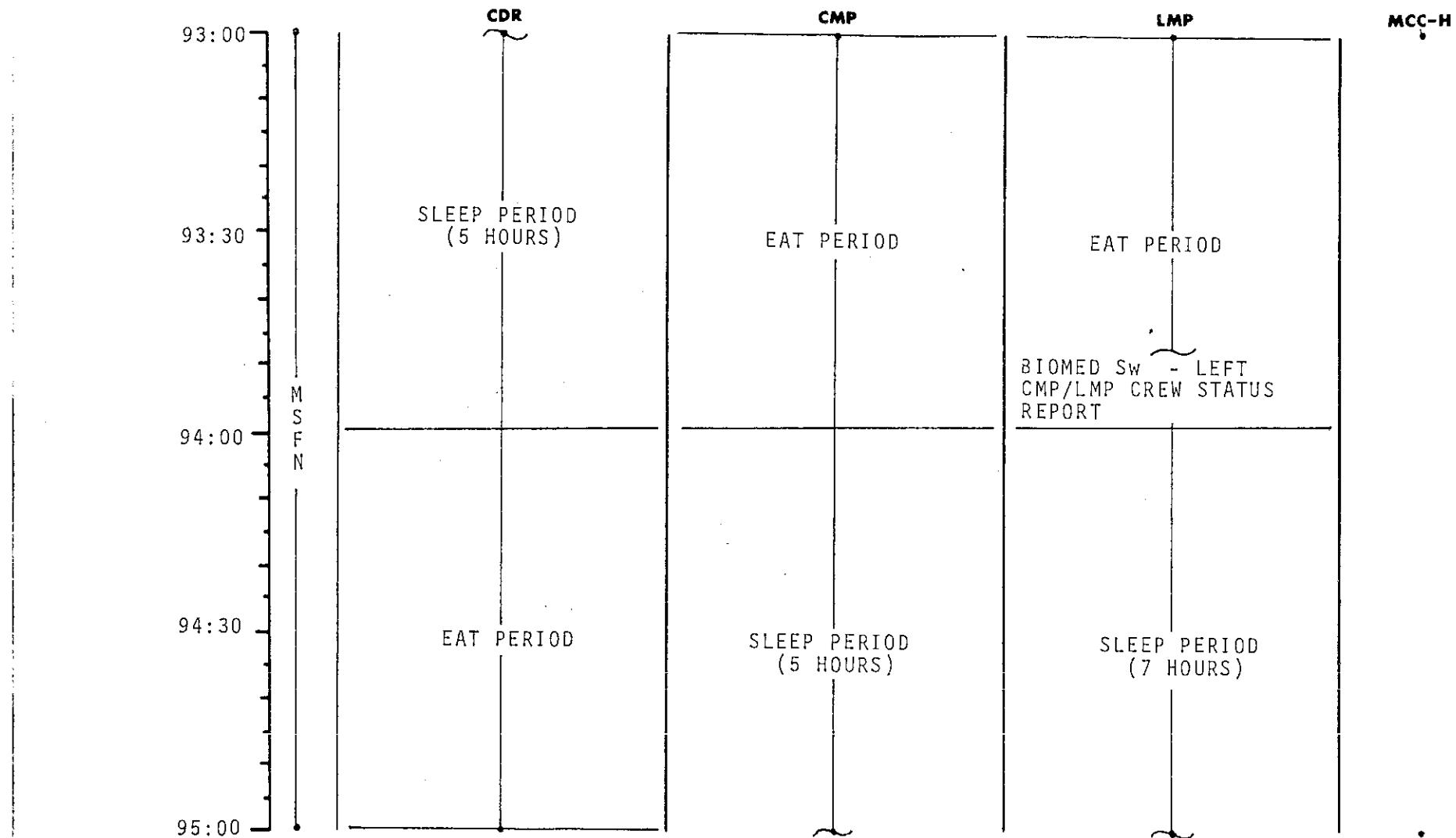
FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	92:00 - 93:00	4/TEC	2-74

FLIGHT PLAN

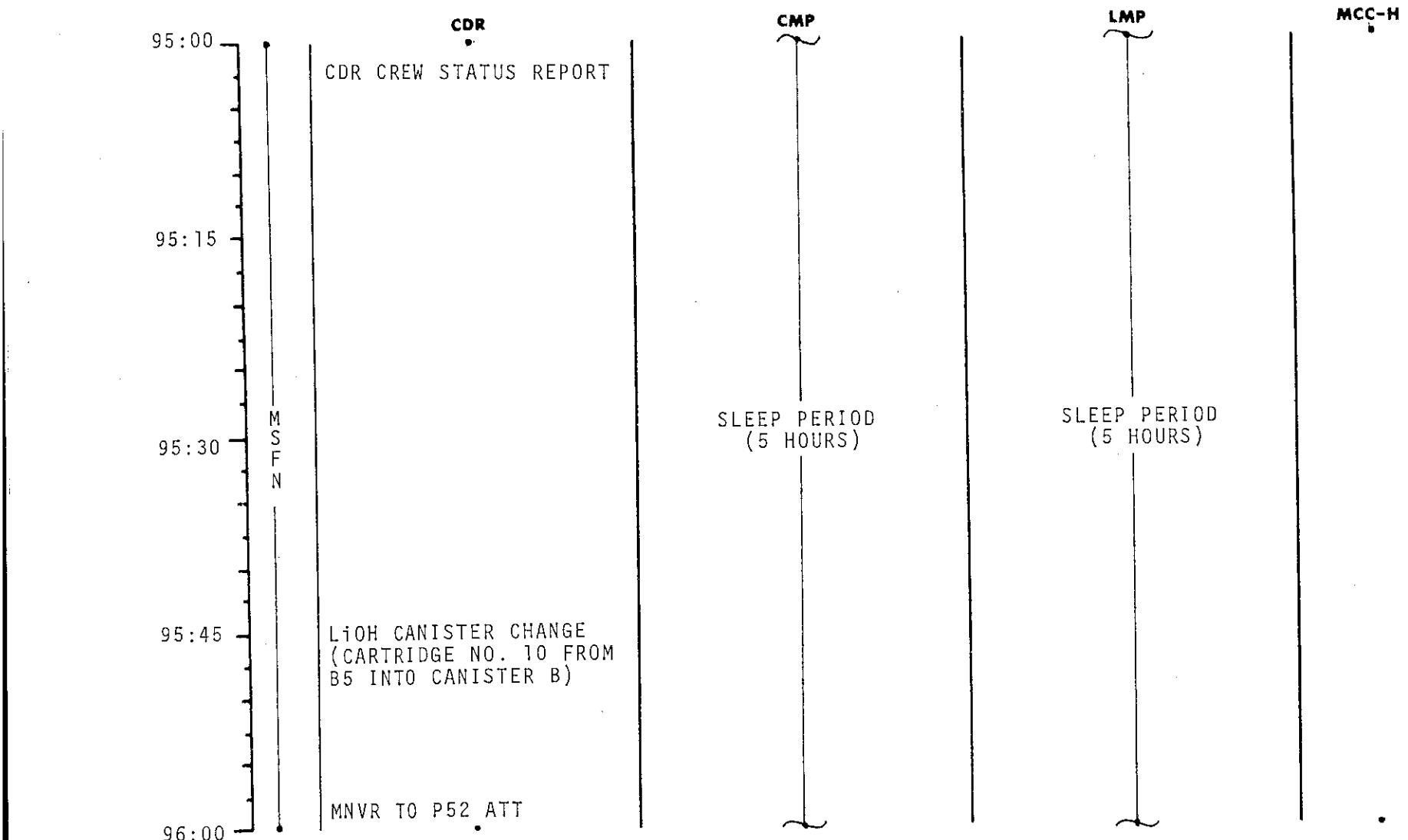


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	93:00 - 95:00	4/TEC	2-75

MSC Form 1910 (Nov 68)

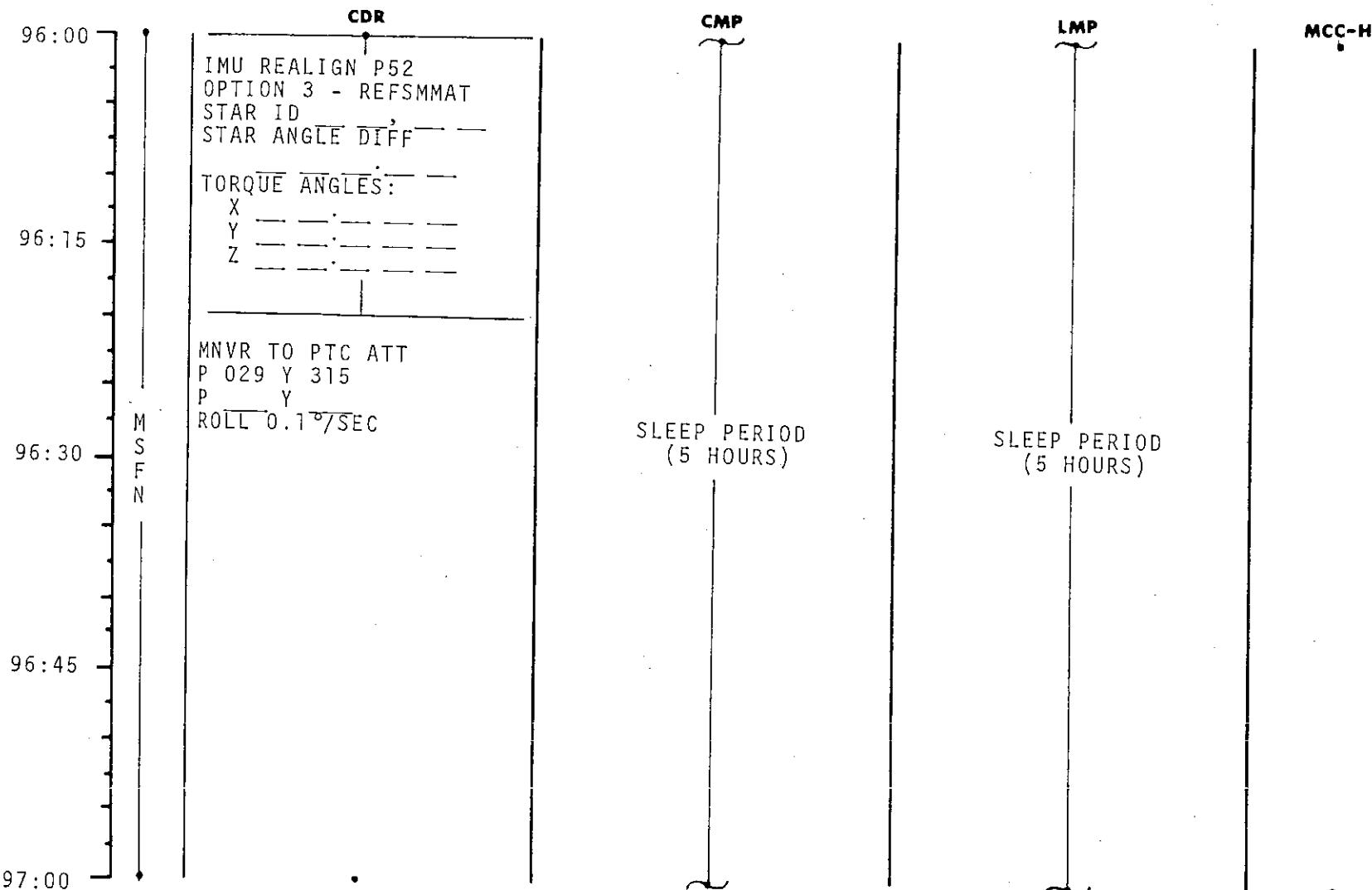
FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	95:00 - 96:00	4/TEC	2-76

FLIGHT PLAN

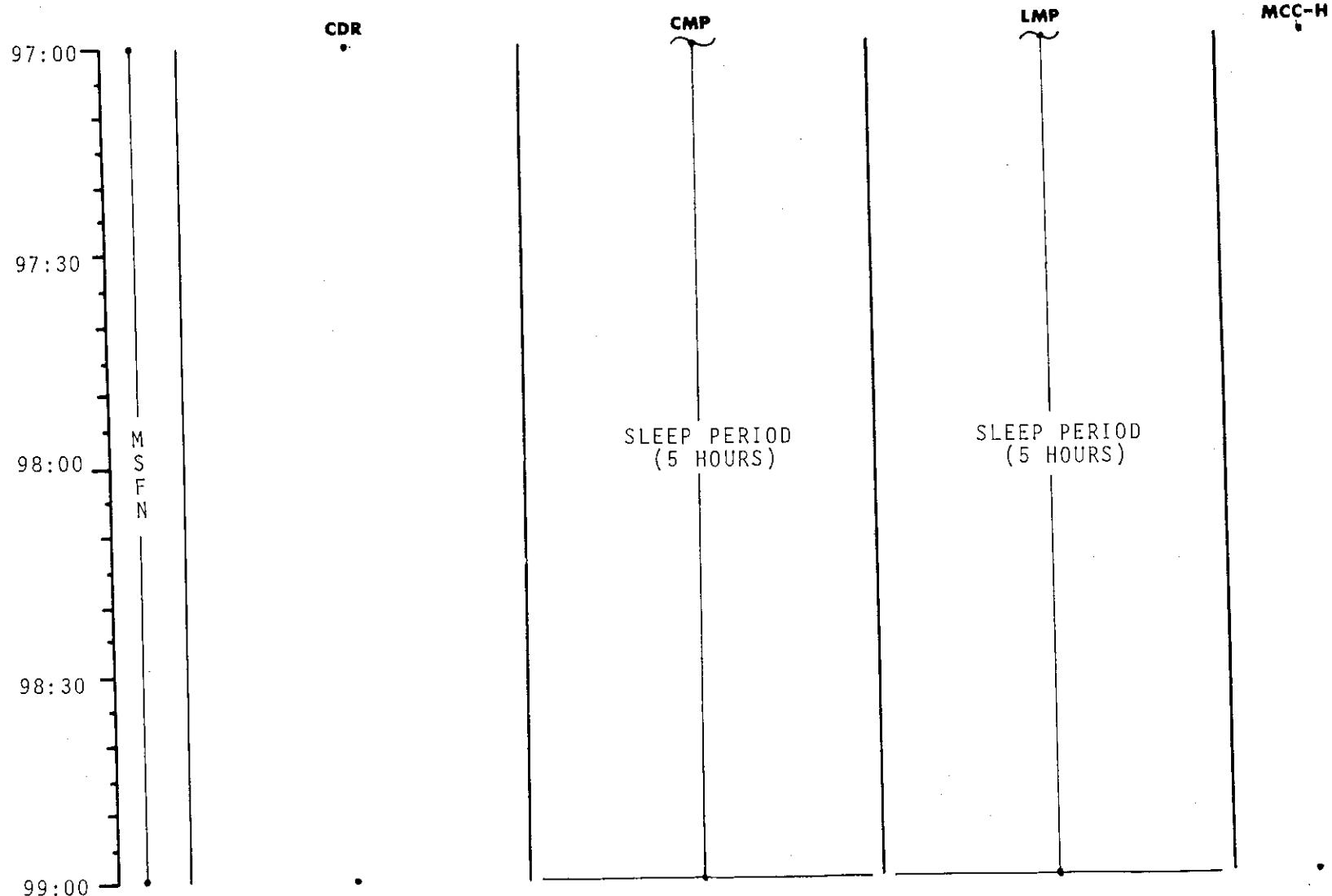


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	96:00 - 97:00	5/TEC	2-77

MSC Form 1910 (Nov 68)

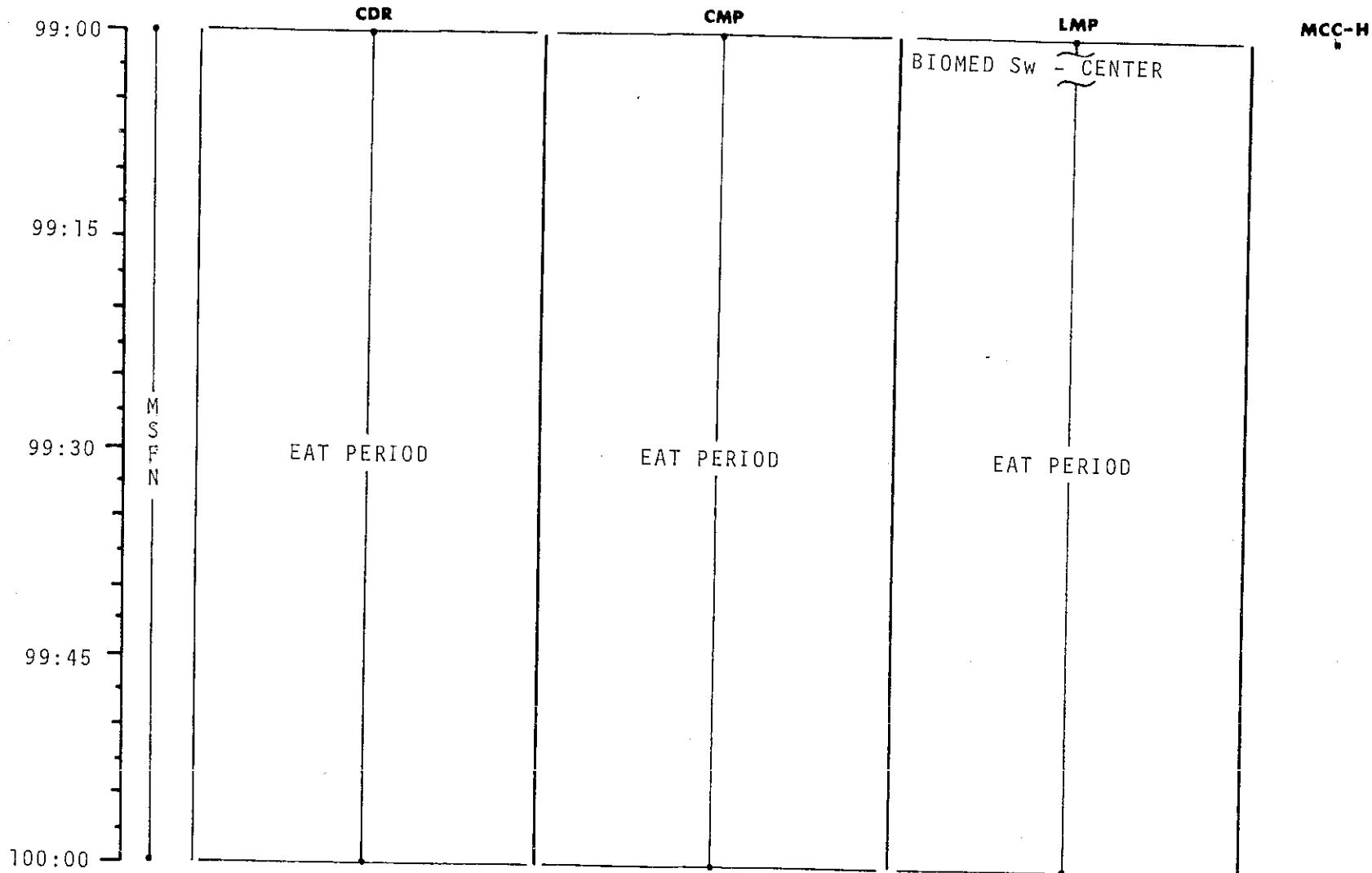
FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	97:00 - 99:00	5/TEC	2-78

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	99:00 - 100:00	5/TEC	2-79

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
100:00	MNVR TO P52 ATT	IMU REALIGN P52 OPTION 3 - REFSMMAT STAR ID _____ STAR ANGLE DIFF _____ TORQUE ANGLES: X _____ Y _____ Z _____	CMP/LMP CREW STATUS REPORT	
100:15		TRN BIAS		
100:30	M S F N MNVR TO SIGHTING ATT	CISLUNAR NAVIGATION P23 1. STAR 02 LNH STAR _____ L _____ H 1 SET		
100:45		2. STAR 11 LFH STAR _____ L _____ H 1 SET		
101:00	MNVR TO SIGHTING ATT	3. STAR 01 LNH STAR _____ L _____ H 1 SET		

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	100:00 - 101:00	5/TEC	2-80

FLIGHT PLAN

101:00

CDR

101:15

CMP

LMP

MCC-H

101:30

MSFN

TRN BIAS

CISLUNAR NAVIGATION P23

1. STAR 22 EFH
STAR ____ E ____ H
2 SETS

2. STAR 26 ENH
STAR ____ E ____ H
2 SETS

101:45

102:00

BIOMED Sw - RIGHT

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	101:00 - 102:00	5/TEC	2-81

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN

102:00 -

CDR

102:15

CMP

3. STAR 31 ENH
STAR ____ ← E → H
2 SETS

LME

MCC-H

102:30

MSEN

MNVR TO P52 ATT

102:45

IMU REALIGN P52
OPTION 3 - RESFMMAT
STAR ID
STAR ANGLE DIFF

103:00

RECORD MNVR PAD

P27 UPDATE
STATE
VECTOR
TGT LOAD
REFSMMAT

VOICE
UPDATE:
MNVR PAD

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	102:00 103:00	5/TEC	2-82

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

FUEL

X X X OX

X X X UNBALANCE

REMARKS:

2-82a

MCC'S

BURN CHART

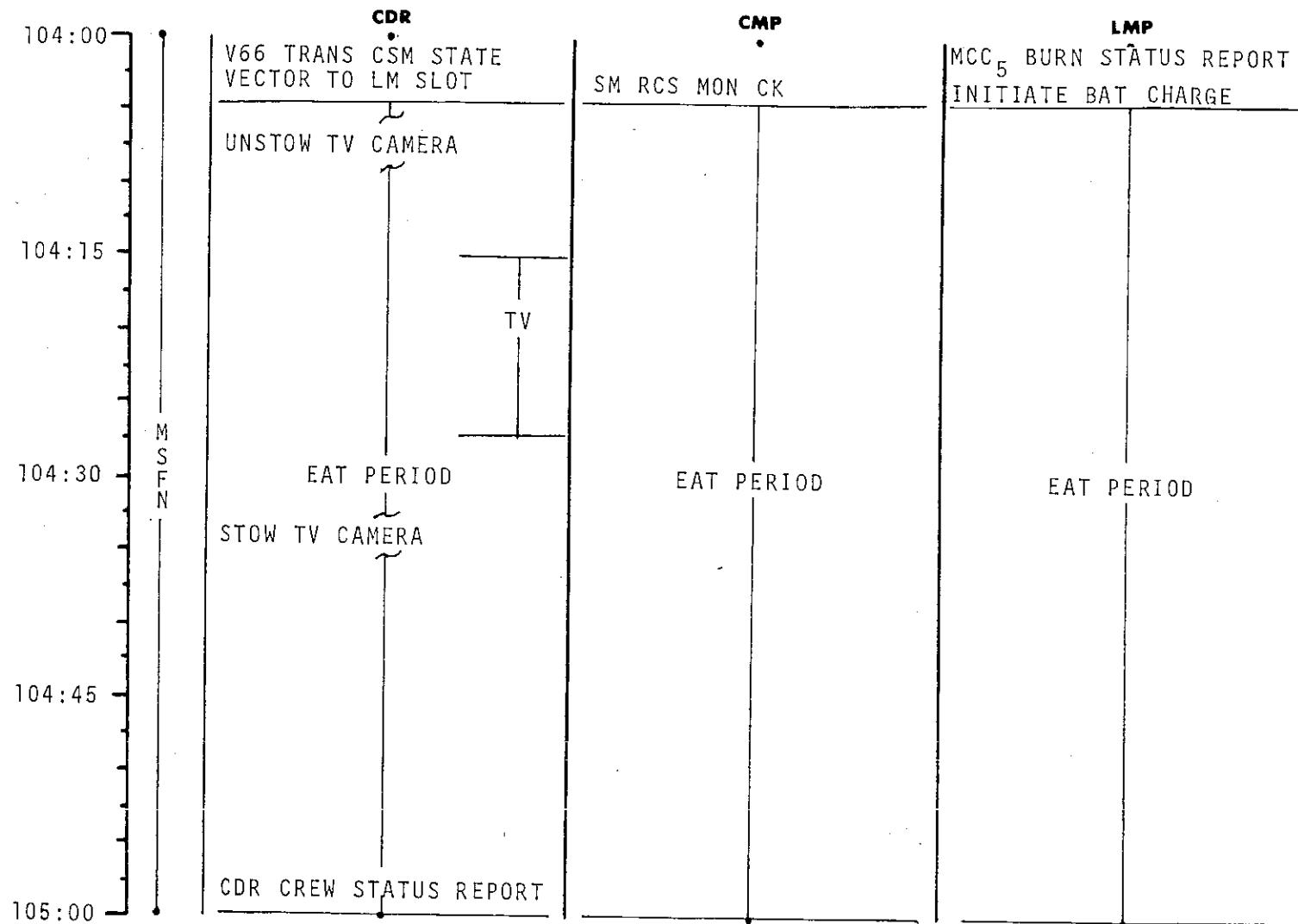
	P or Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC(ALL)	10°/SEC TAKEOVER	10° TAKEOVER	B/T +1 SEC	TRIM TO 0.2 fps

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
103:00				
103:15	V47 TRANS LM STATE VECTOR TO CSM SLOT EXT ΔV P30			
103:30	SPS/RCS THRUST P40/41 MNVR TO BURN ATT	SXT STAR CK		
103:45	EMS TEST	TRANS TO COUCH		PIPA BIAS CK
TEI+15	GDC ALIGN TO IMU	SM RCS MON CK		
104:00	MCC 5 ΔV=NOMINALLY ZERO			

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	103:00 - 104:00	5/TEC	2-83

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	104:00 - 105:00	5/TEC	2-84

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
105:00		LIOH CANISTER CHANGE (CARTRIDGE NO. 12 FROM B6 INTO CANISTER B)		
105:15		TRN BIAS CISLUNAR NAVIGATION P23	BIOMED SW - CENTER TRANS TO LH COUCH MNVR TO SIGHTING ATT	
105:30	SLEEP PERIOD (7 HOURS)	1. STAR 22 EFH STAR ____ E ____ H 2 SETS		
105:45		2. STAR 26 ENH STAR ____ E ____ H 1 SET		
106:00		3. STAR 31 ENH STAR ____ E ____ H 2 SETS		

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	105:00 - 106:00	5/TEC	2-85

FLIGHT PLAN

106:00

CDR

106:15

CMP

LMP

MCC-H

106:30

M
S
F
N

SLEEP PERIOD
(7 HOURS)

106:45

RETURN TO EARTH P37

107:00

MNVR TO SIGHTING ATT

TRN BIAS

1. STAR 02 LNH
STAR ____ L ____ H
1 SET

2. STAR 11 LFH
STAR ____ L ____ H
1 SET

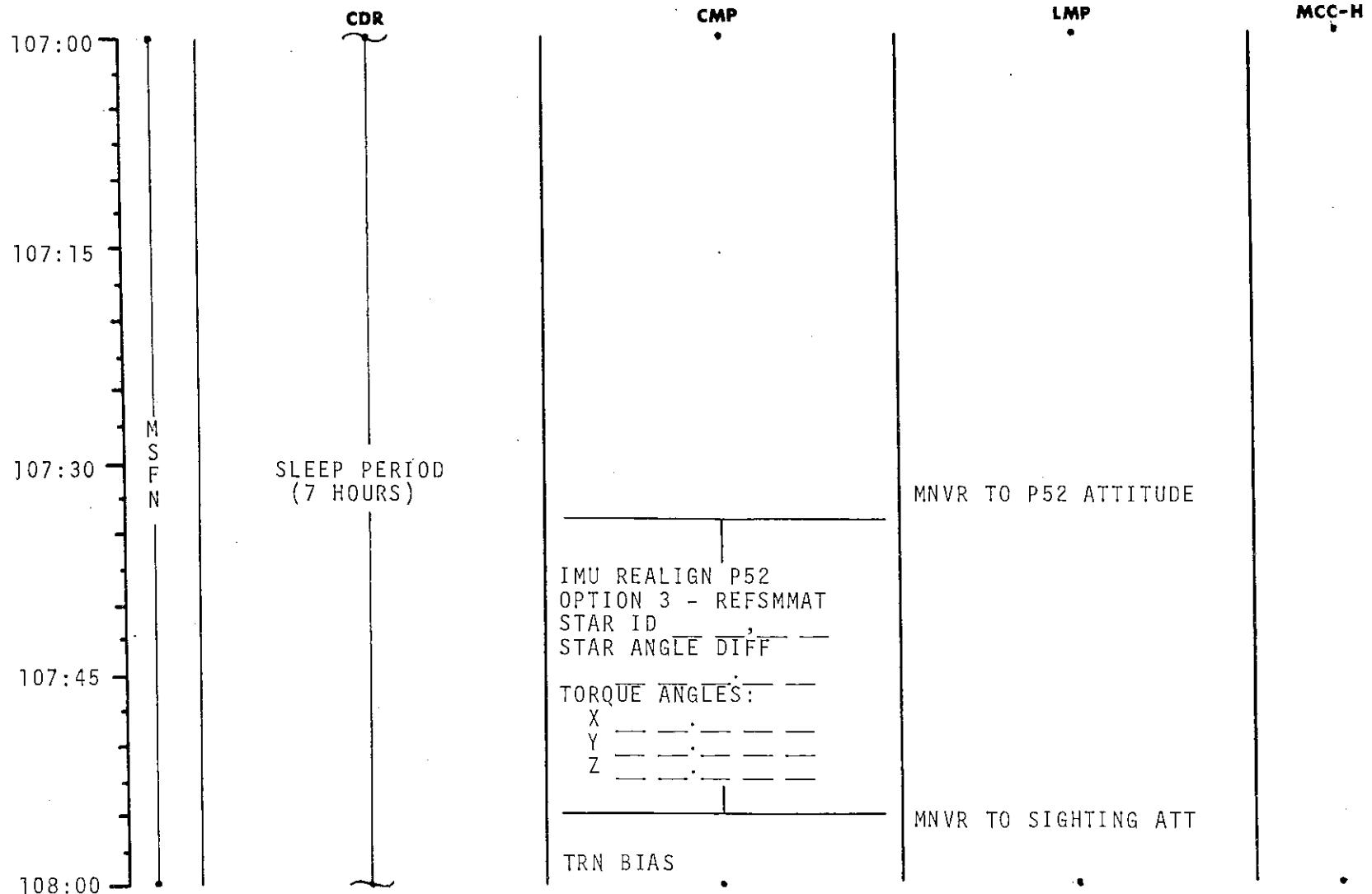
3. STAR 01 LNH
STAR ____ L ____ H
1 SET

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	106:00 - 107:00	5/TEC	2-86

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	107:00 - 108:00	5/TEC	2-87

FLIGHT PLAN

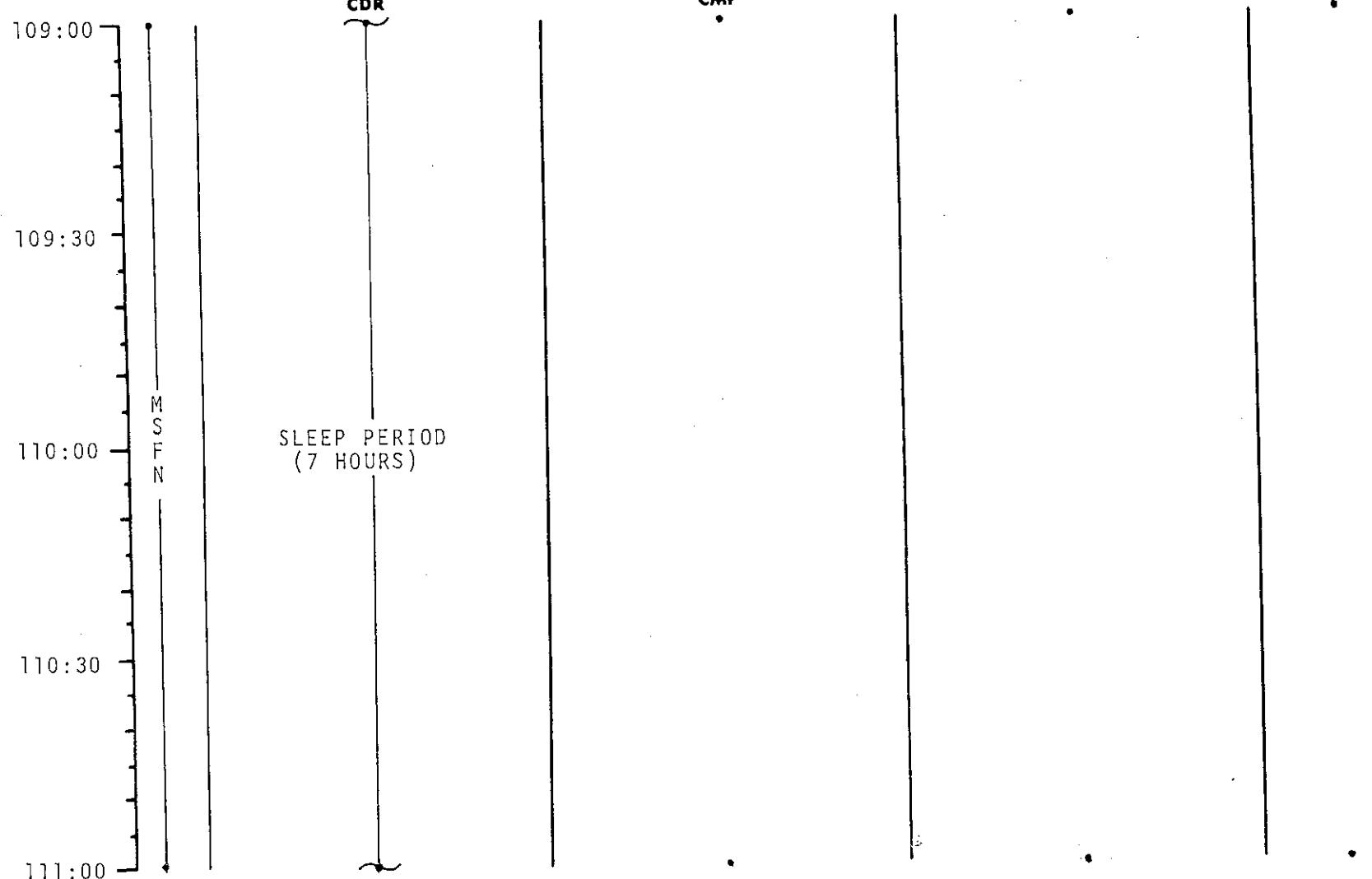
	CDR	CMP	LMP	MCC-H
108:00		CISLUNAR NAVIGATION P23		
108:15		1. STAR 22 EFH STAR E H 1 SET	BIOMED SW - RIGHT	
108:30	SLEEP PERIOD (7 HOURS)	2. STAR 26 ENH STAR E H 2 SETS		
108:45		3. STAR 31 ENH STAR E H 2 SETS	MNVR TO PTC ATT P 029 Y 315 P Y ROLL 0.1°/SEC P&Y FREE REESTABLISH PTC AT +15° IN P OR Y AND RECORD GET	
109:00		RETURN TO EARTH P37		

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	108:00 - 109:00	5/TEC	2-88

MSC Form 1910 (Nov 68)

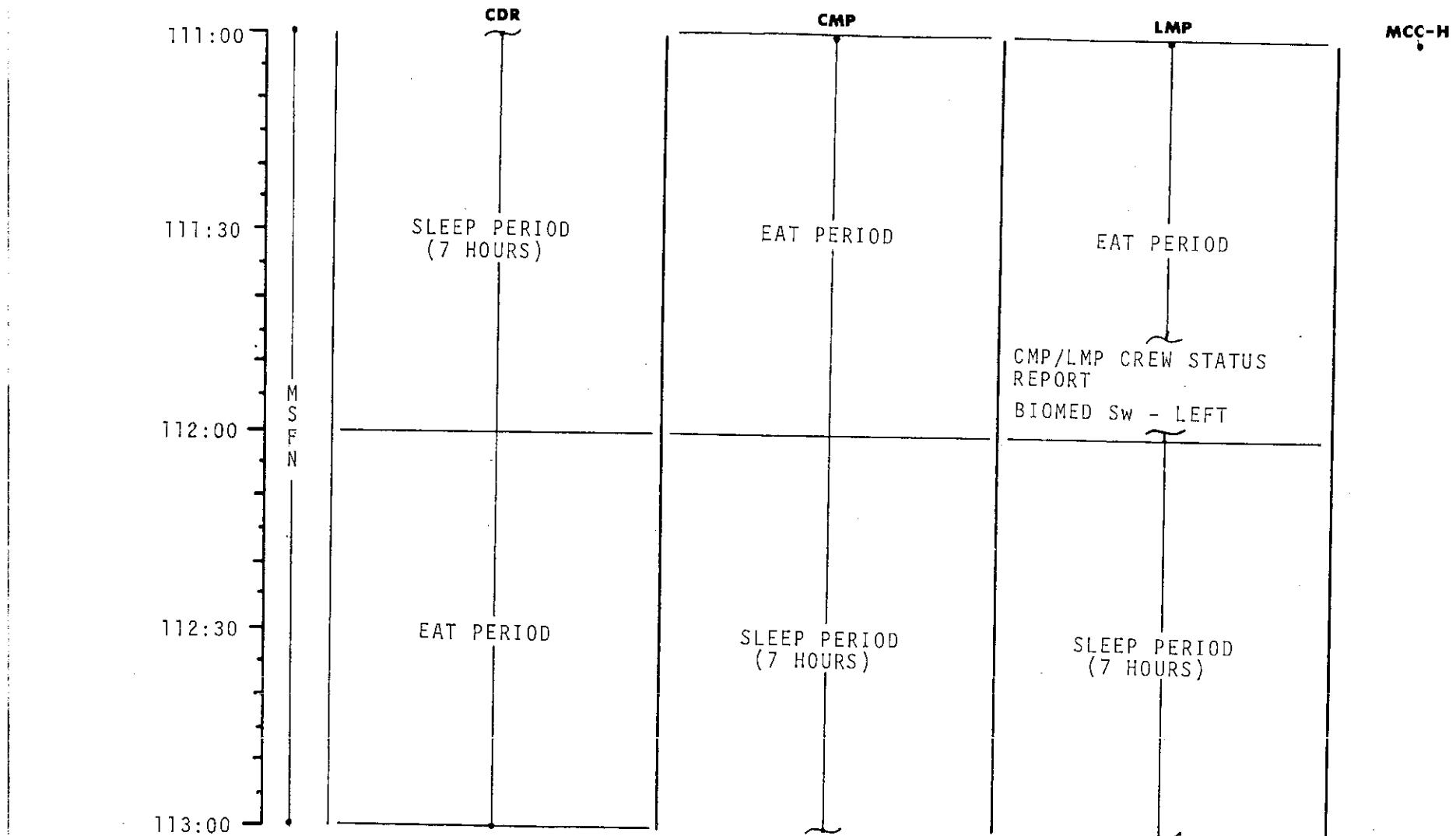
FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	109:00 - 111:00	5/TEC	2-89

FLIGHT PLAN

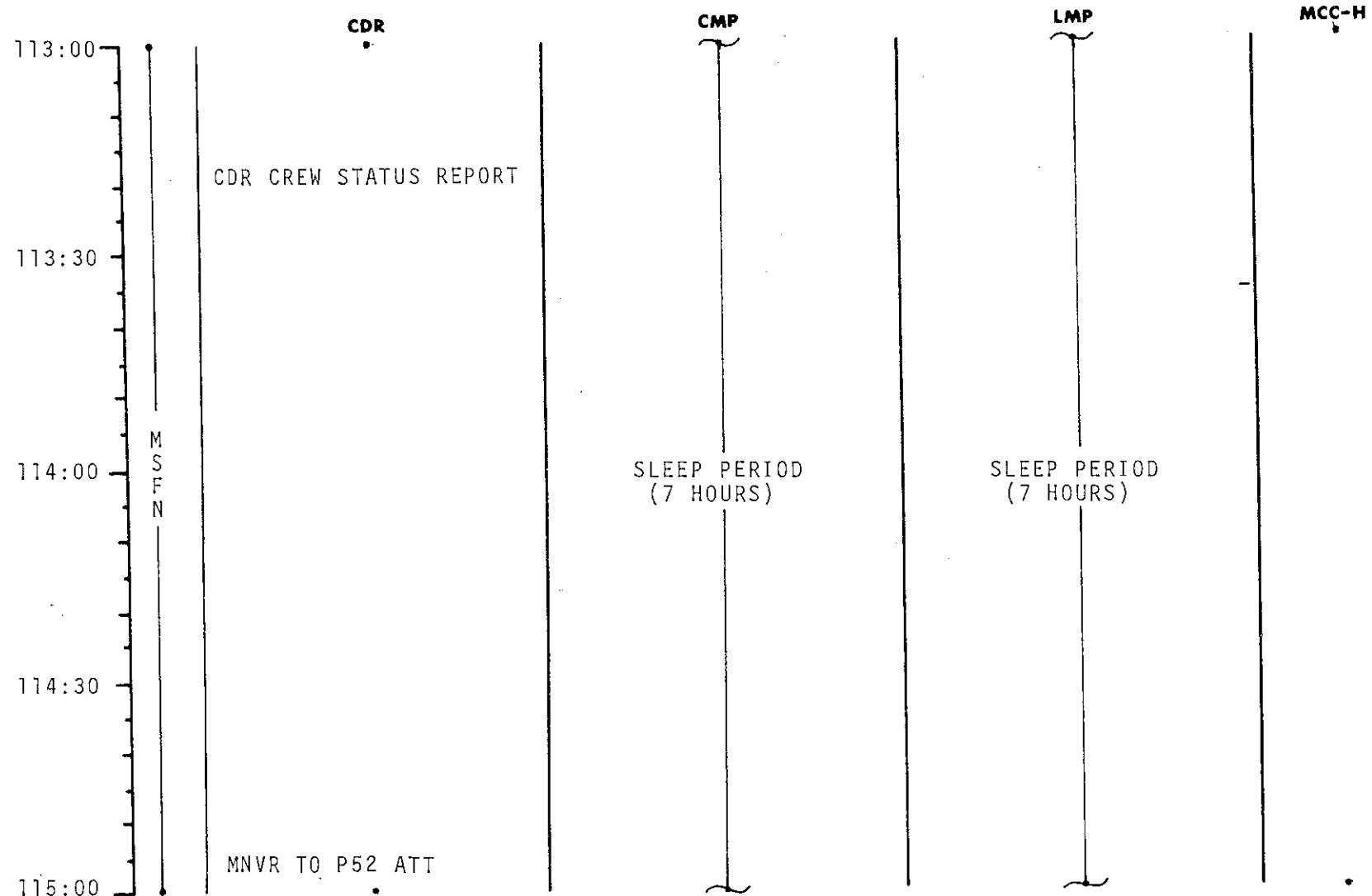


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	111:00 - 113:00	5/TEC	2-90

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	113:00 - 115:00	5/TEC	2-91

FLIGHT PLAN

115:00

CDR

IMU REALIGN P52
OPTION 3 - REFSMMAT
STAR ID _____
STAR ANGLE DIFF _____

115:15

TORQUE ANGLES:

X _____
Y _____
Z _____

115:30

M
S
F
N

MNVR TO PTC ATT
P 029 Y 315
P . Y
ROLL 0.1°/SEC

115:45

116:00

CMP

SLEEP PERIOD
(7 HOURS)

LMP

SLEEP PERIOD
(7 HOURS)

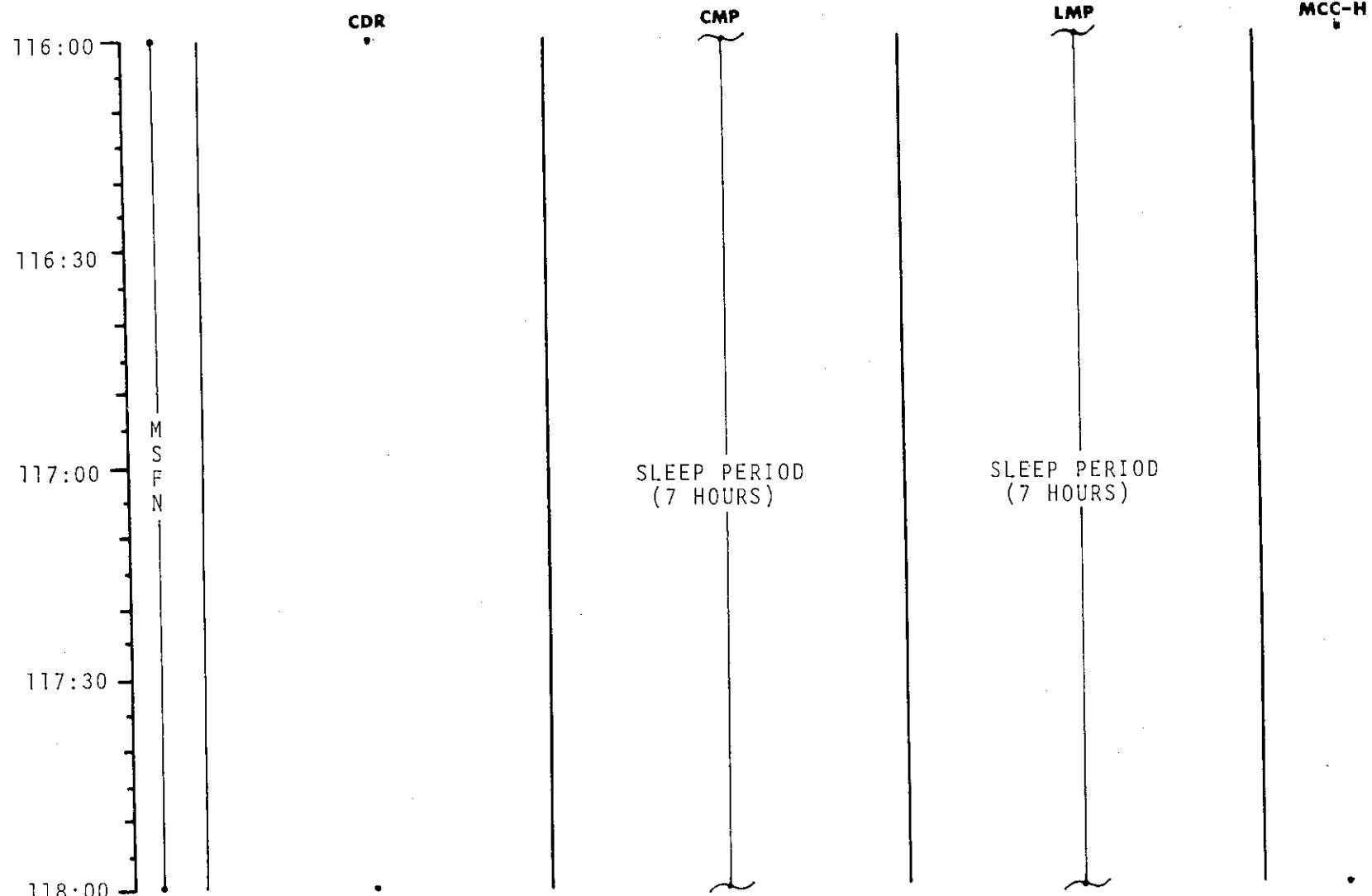
MCC-H

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

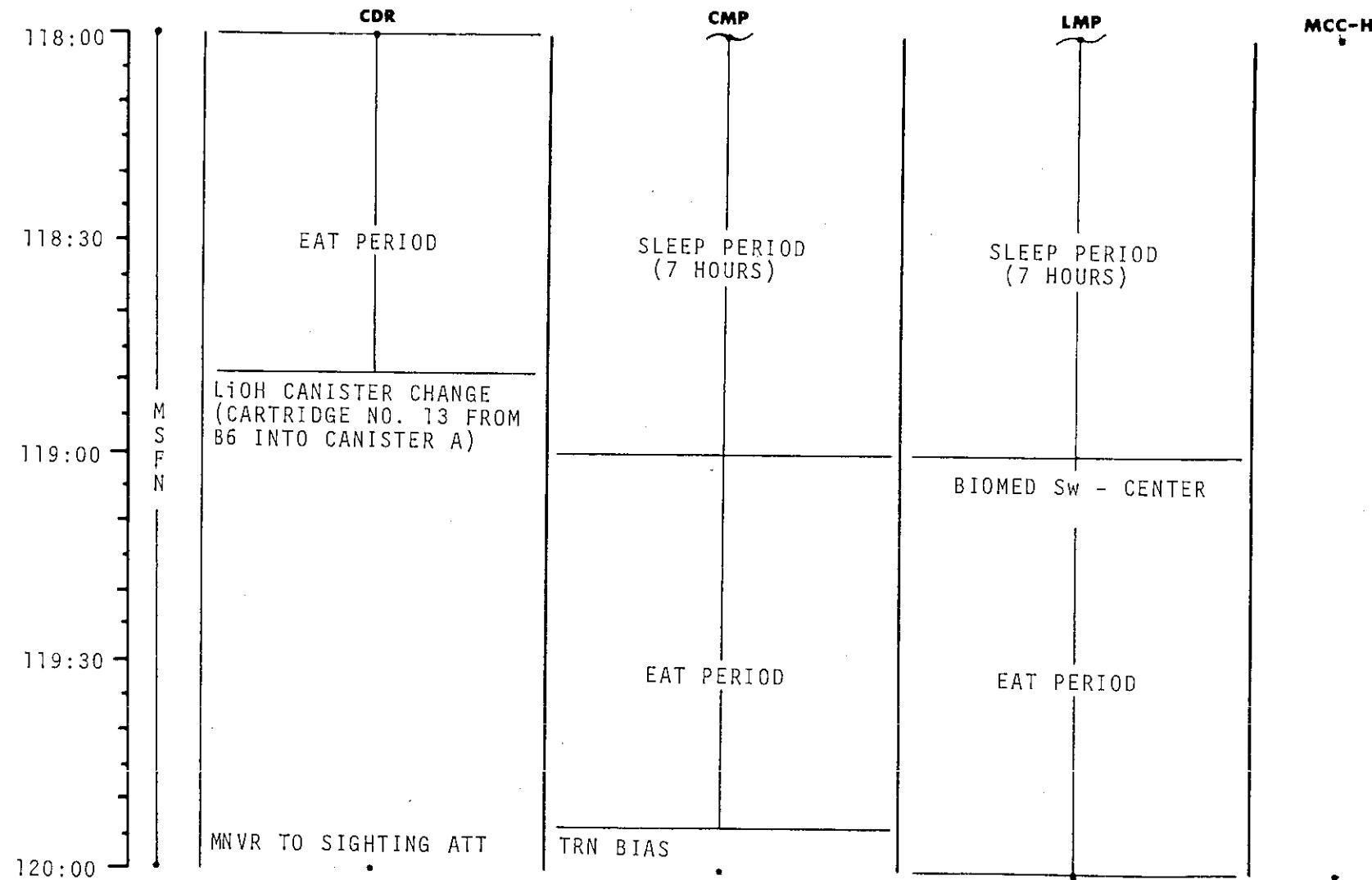
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	115:00 - 116:00	5/TEC	2-92

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	116:00 - 118:00	5/TEC	2-93

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	118:00 - 120:00	5/TEC	2-94

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN

CDR

120:00

120:15

120:30

120:45

121:00

M
S
F
N

CMP

CISLUNAR NAVIGATION P23

1. STAR 22 EFH
STAR ____ E ____ H
1 SET
2. STAR 26 ENH
STAR ____ E ____ H
1 SET
3. STAR 31 ENH
STAR ____ E ____ H
1 SET

LMP

CMP/LMP CREW STATUS
REPORT

MCC-H

RECORD MNVR PAD

P27 UPDATE:
STATE
VECTOR
TGT LOAD
VOICE
UPDATE:
MNVR PAD

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	120:00 - 121:00	6/TEC	2-95

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 UNBALANCE

REMARKS:

2-95a

MCC'S
BURN CHART

	P or Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC(ALL)	10°/SEC TAKEOVER	10° TAKEOVER	B/T +1 SEC	TRIM TO 0.2 fbs

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
121:00	MNVR TO P52 ATT			
121:15		IMU REALIGN P52 OPTION 3 - REFSMMAT STAR ID _____, STAR ANGLE DIFF _____ TORQUE ANGLES: X _____ Y _____ Z _____		
121:30	V47 TRANS LM STATE VECTOR TO CSM SLOT EXT ΔV P30 SPS/RCS THRUST P40/41 MNVR TO BURN ATT			
121:45	EMS TEST	SXT STAR CK TRANS TO COUCH		PIPA BIAS CK
TEI + 33 HRS	GDC ALIGN MCC ₆ ΔV=NOMINALLY ZERO	SM RCS MON CK		
122:00				

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	121:00 - 122:00	6/TEC	2-96

FLIGHT PLAN

122:00	CDR V66 TRANS CSM STATE VECTOR TO LM SLOT	CMP SM RCS MON CK	LMP MCC ₆ BURN STATUS REPORT INITIATE BAT CHARGE	MCC-H
122:15			BIOMED Sw - RIGHT	
122:30	M S F N MNVR TO SIGHTING ATT	TRN BIAS <div style="border: 1px solid black; padding: 2px;">CISLUNAR NAVIGATION P23</div>		
122:45		1. STAR 02 LNH STAR _____ L ____ H 2 SETS		
123:00		2. STAR 01 LNH STAR _____ L ____ H 1 SET		

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	122:00 - 123:00	6/TEC	2-97

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
123:00		RETURN TO EARTH P37		
123:30	MNVR TO SIGHTING ATT			
123:30	M S F N	TRN BIAS		
123:45		CISLUNAR NAVIGATION P23		
124:00		1. STAR 22 EFH STAR _____ E H 2 SETS		
		2. STAR 26 ENH STAR _____ E H 1 SET		

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	123:00 - 124:00	6/TEC	2-98

FLIGHT PLAN

124:00

CDR

124:15

CMP

124:30

M
S
F
N

MNVR TO PTC ATT
P 029 Y 315
P Y
ROLL 0.1°/SEC

124:45

125:00

LMP

MCC-H

3. STAR 31 ENH
STAR E H
2 SETS

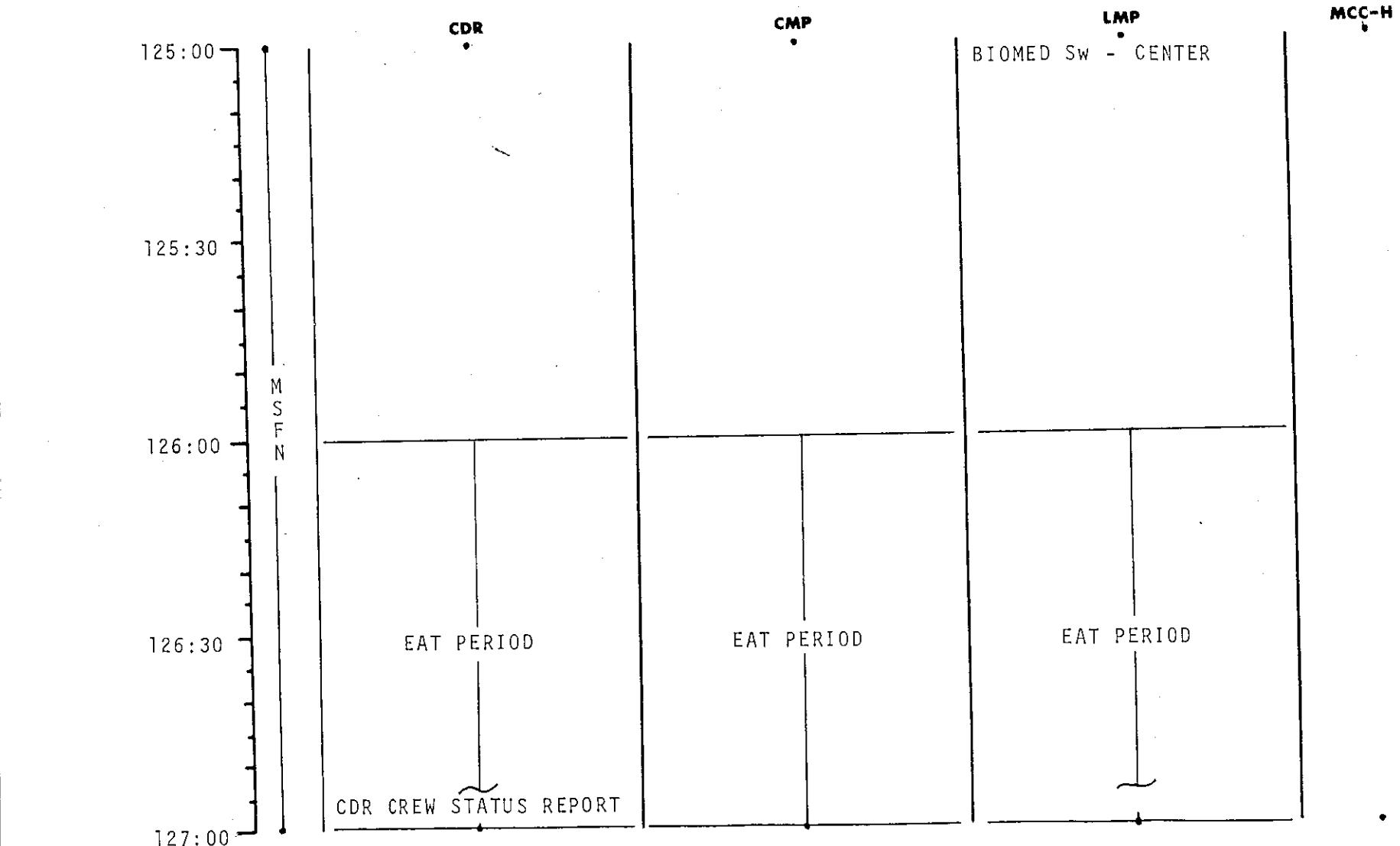
RETURN TO EARTH P37

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	124:00 - 125:00	6/TEC	2-99

MSC Form 1910 (Nov 68)

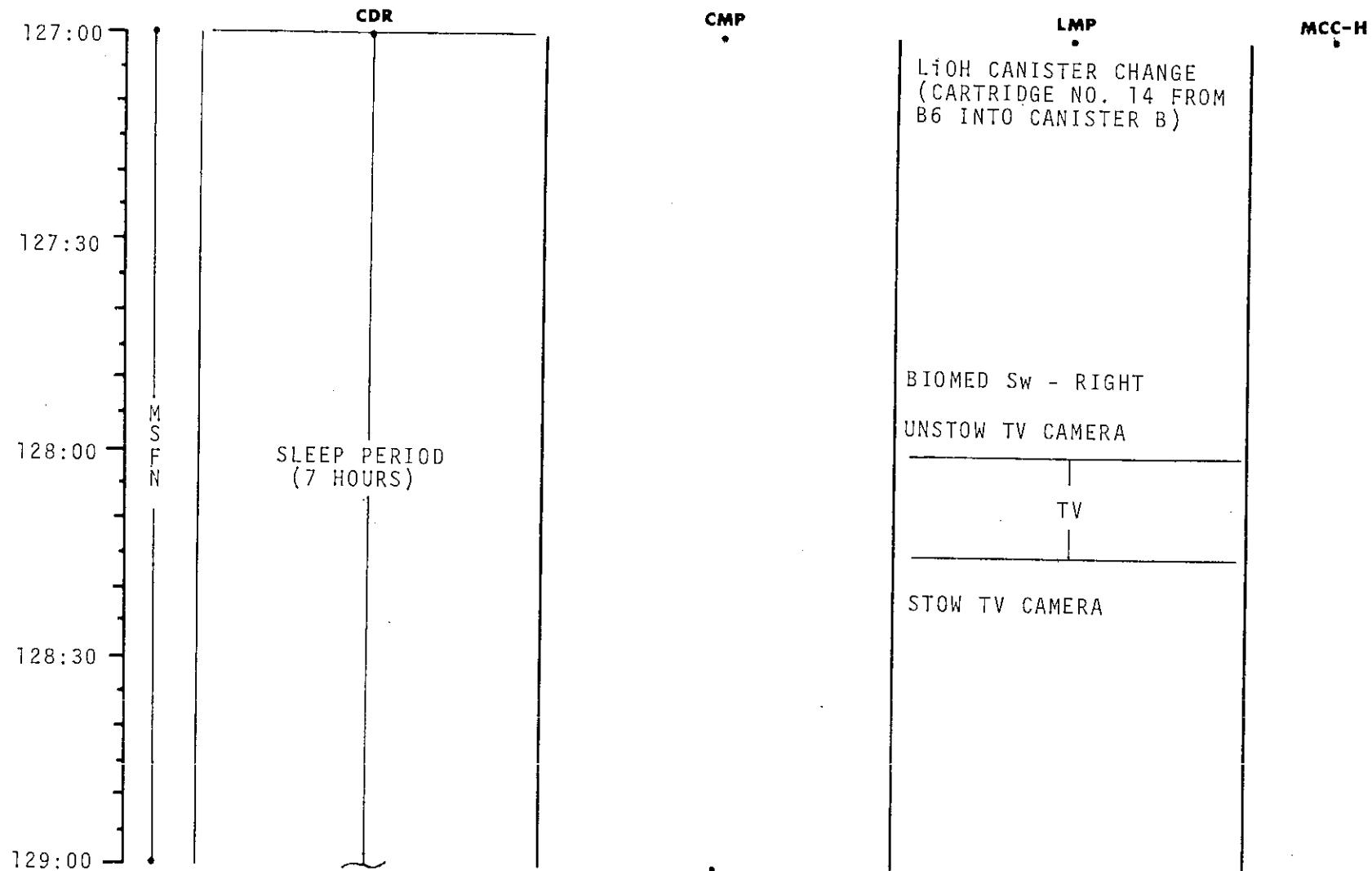
FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	125:00 - 127:00	6/TEC	2-100

FLIGHT PLAN

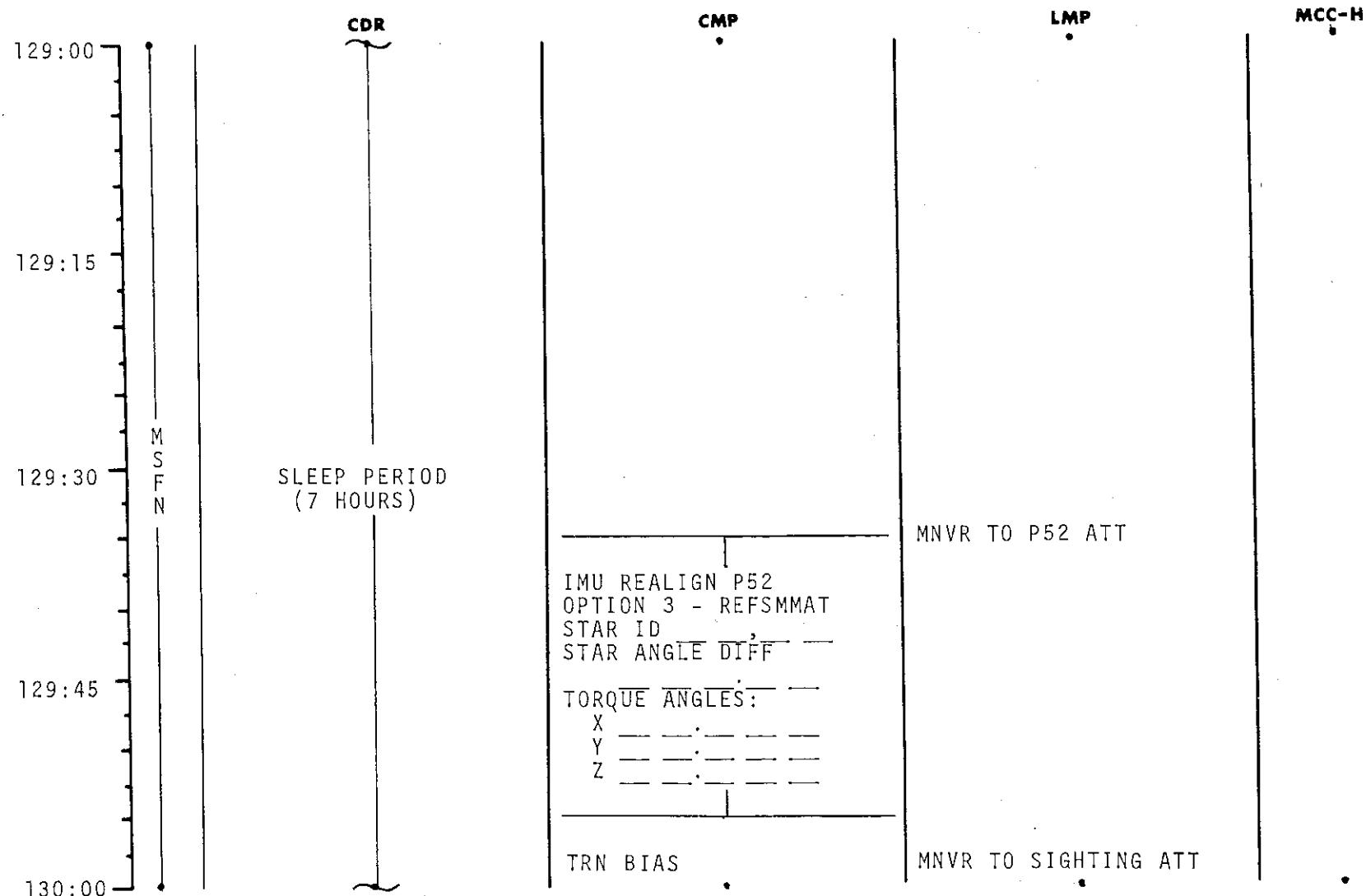


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	127:00 - 129:00	6/TEC	2-101

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	129:00 - 130:00	6/TEC	2-102

FLIGHT PLAN

130:00

CDR

130:15

CMP

LMP

MCC-H

CISLUNAR NAVIGATION P23

1. STAR 02 LNH
STAR — L H
2 SETS

130:30

M
S
F
N

SLEEP PERIOD
(7 HOURS)

130:45

TRN BIAS

131:00

MNVR TO SIGHTING ATT

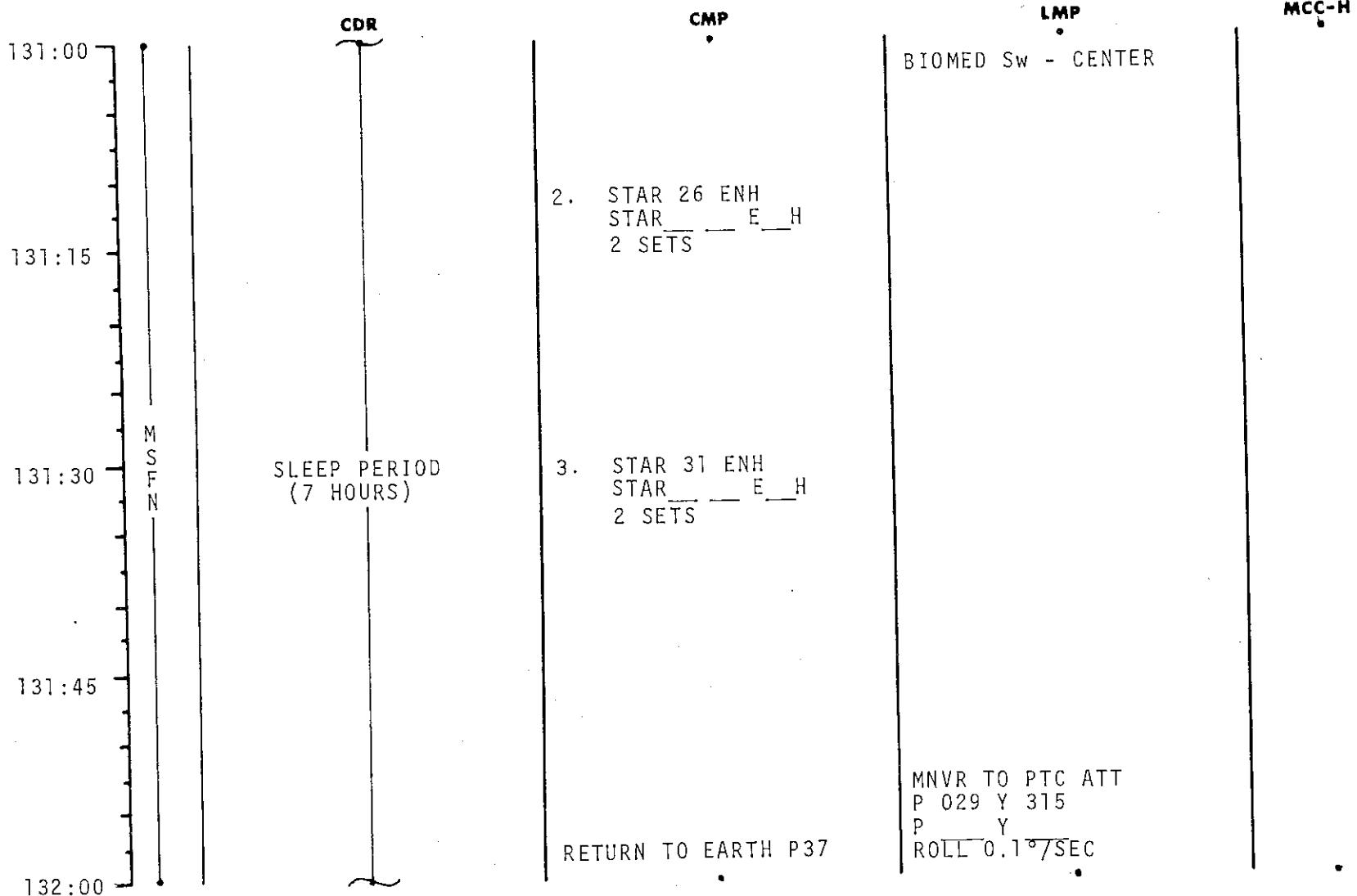
1. STAR 22 EFH
STAR — E H
2 SETS

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	130:00 - 131:00	6/TEC	2-103

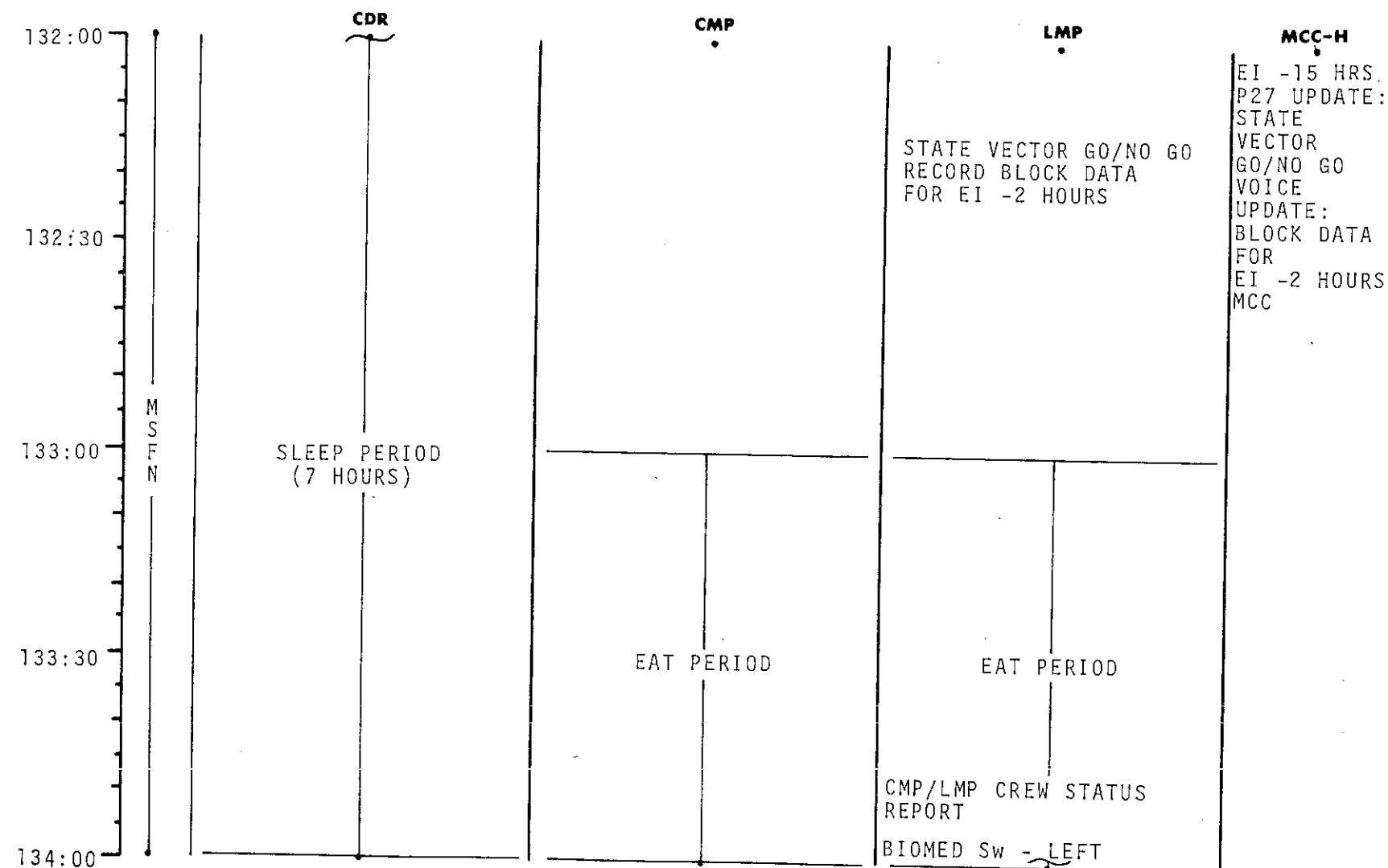
MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN



FLIGHT PLAN

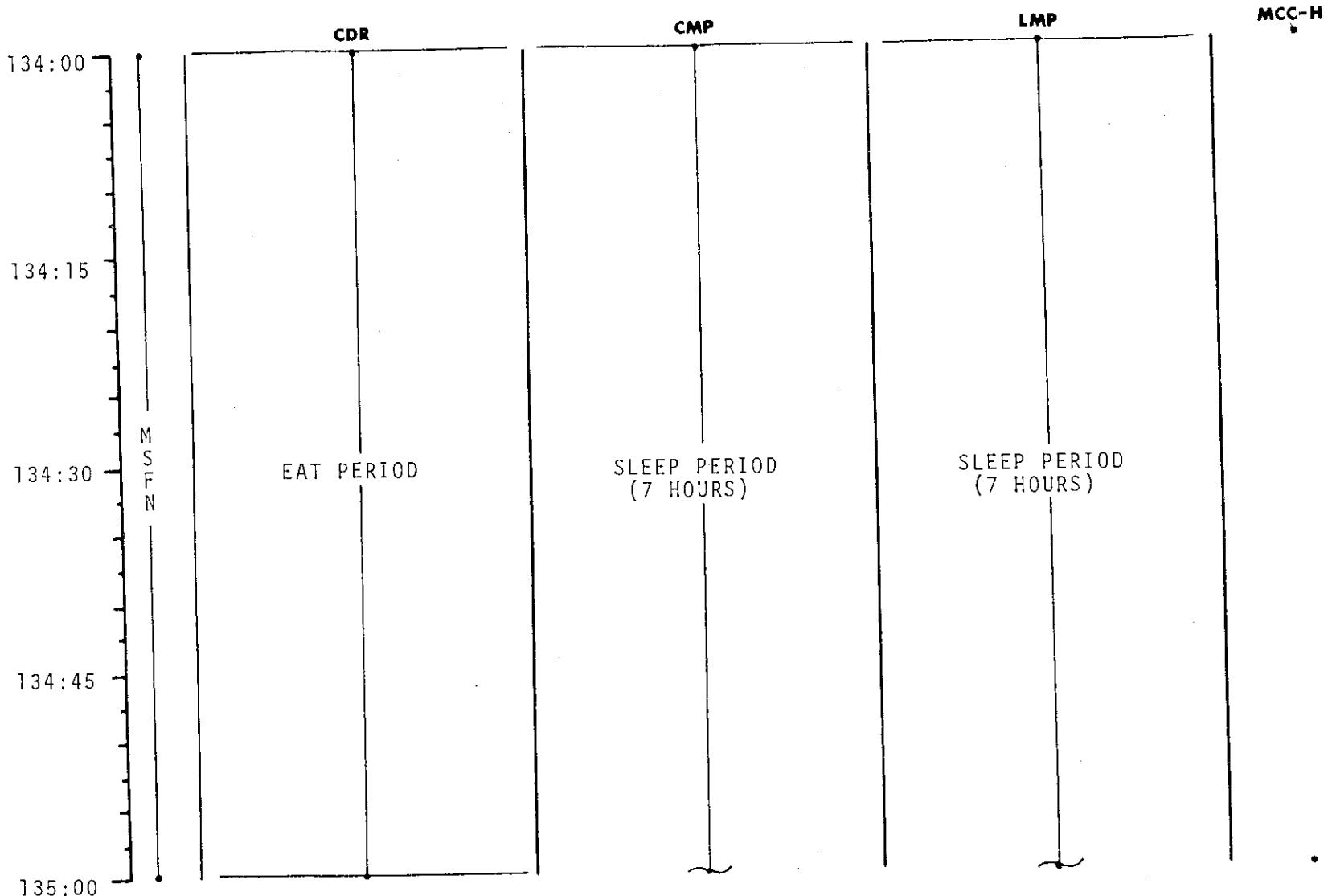


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	132:00 - 134:00	6/TEC	2-105

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	134:00 - 135:00	6/TEC	2-106

FLIGHT PLAN

135:00

CDR

BEGIN CABIN COLD SOAK
CDR CREW STATUS REPORT

135:15

MNVR TO P52 ATT

135:30

M
S
F
N
IMU REALIGN P52
OPTION 3 - REFSMMAT
STAR ID
STAR ANGLE DIFF

TORQUE ANGLES:

X
Y
Z

135:45

REESTABLISH PTC
P 029 Y 315
P Y
ROLL 0.1°/SEC

136:00

CMP

SLEEP PERIOD
(7 HOURS)

LMP

SLEEP PERIOD
(7 HOURS)

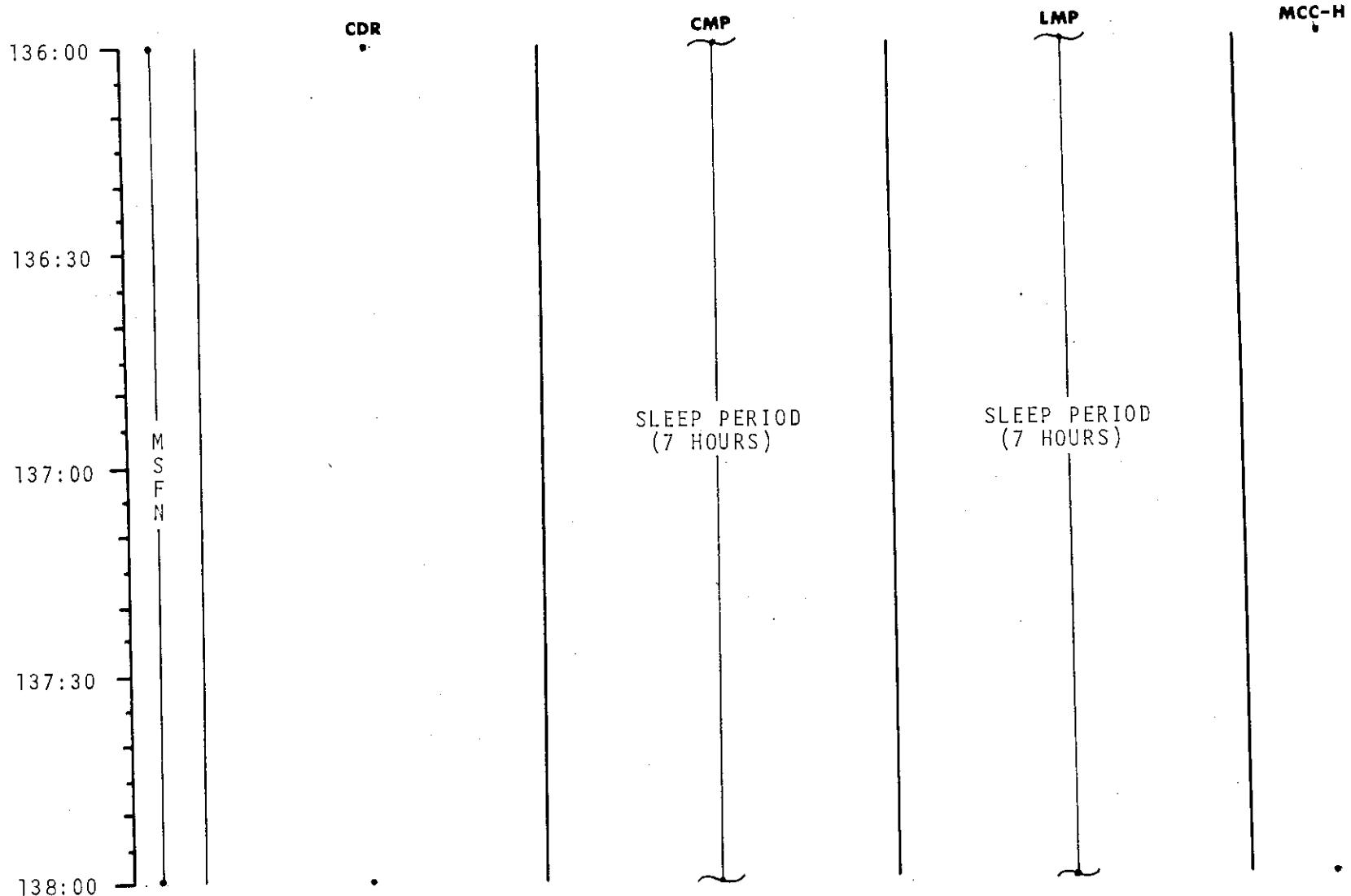
MCC-H

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

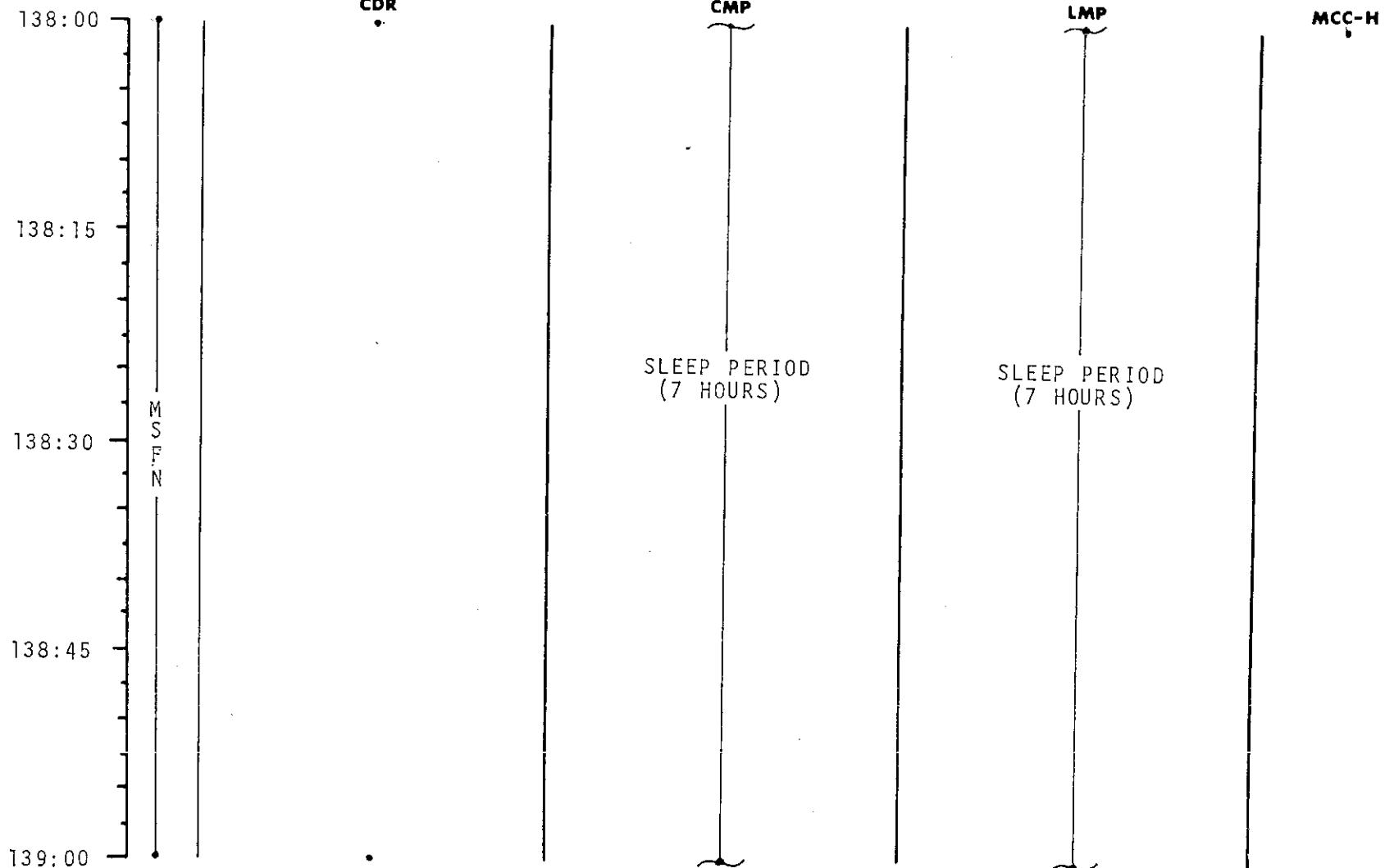
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	135:00 - 136:00	6/TEC	2-107

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	136:00 - 138:00	6/TEC	2-108

FLIGHT PLAN

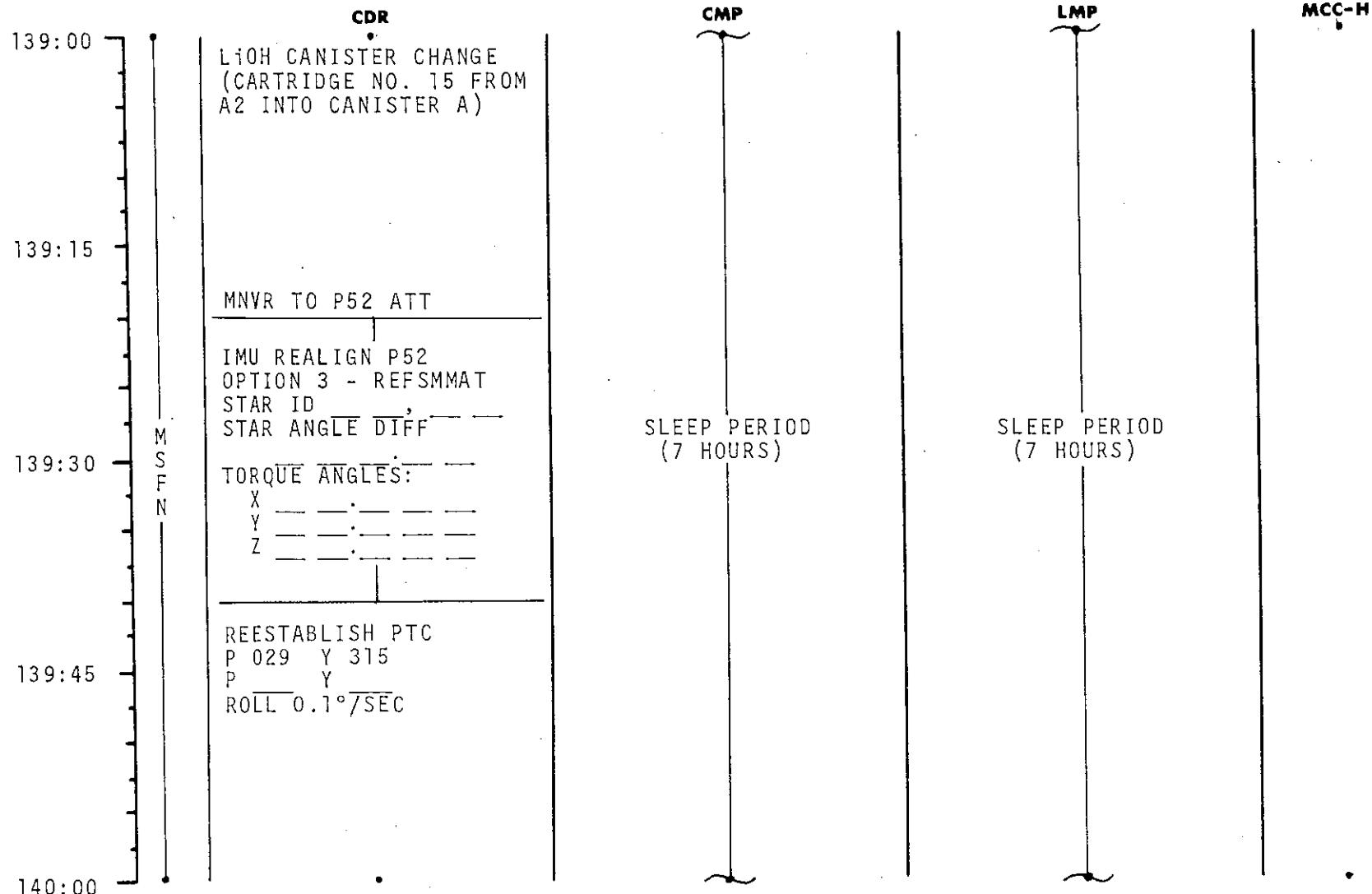


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	138:00 - 139:00	6/TEC	2-109

MSC Form 1910 (Nov 68)

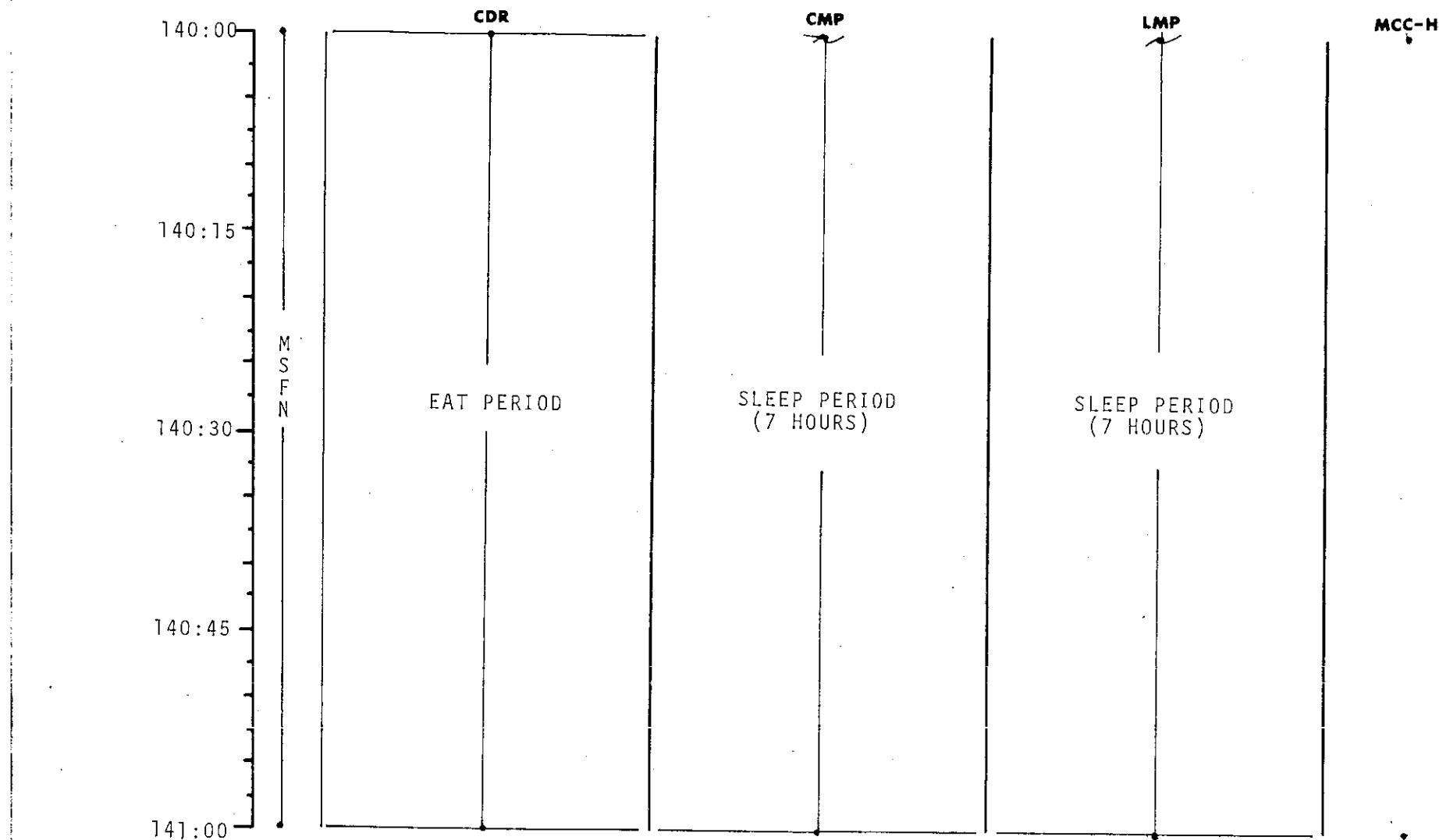
FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	139:00 - 140:00	6/TEC	2-110

FLIGHT PLAN

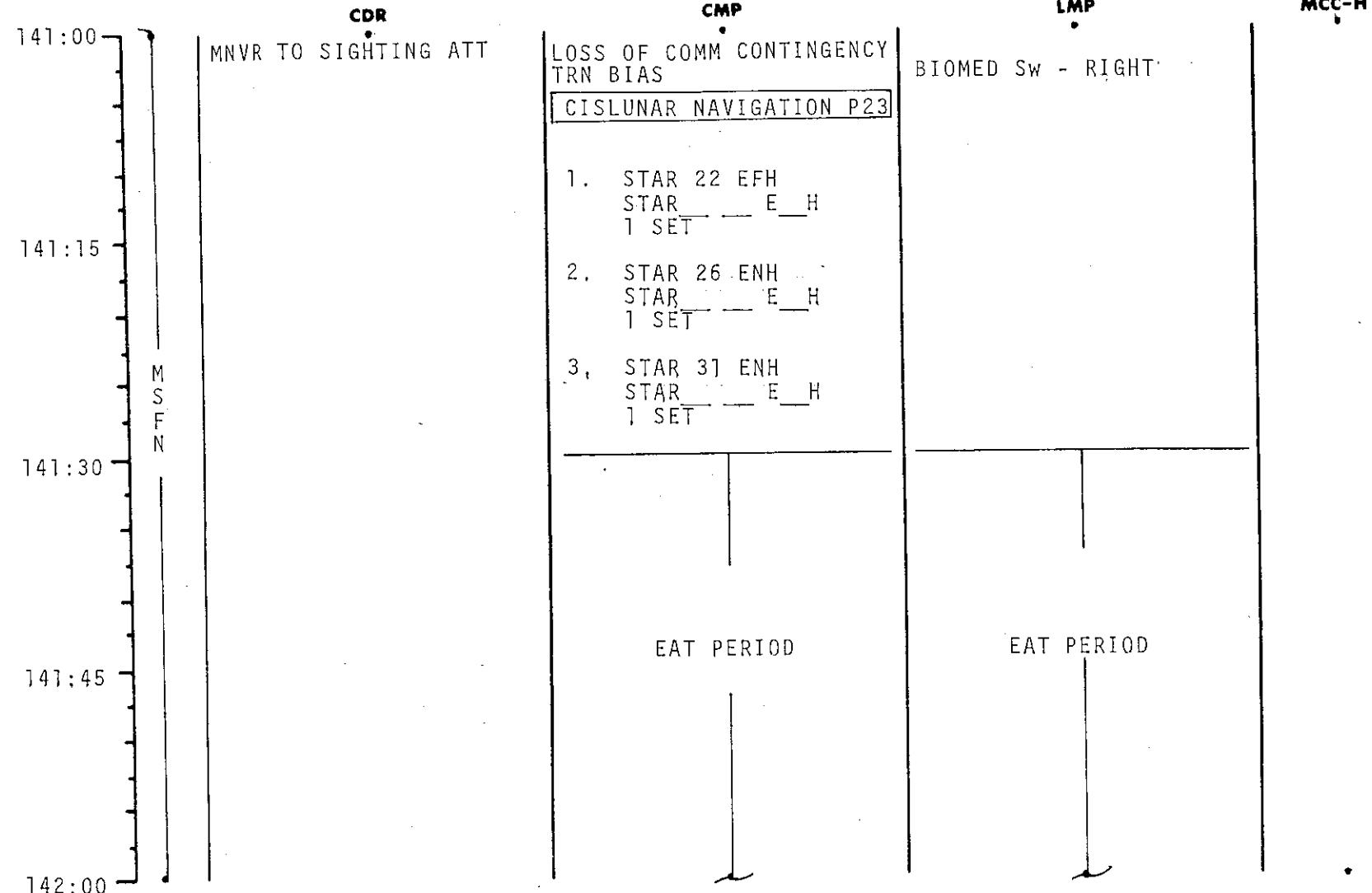


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	140:00 - 141:00		2-111

MSC Form 1910 (Nov 68)

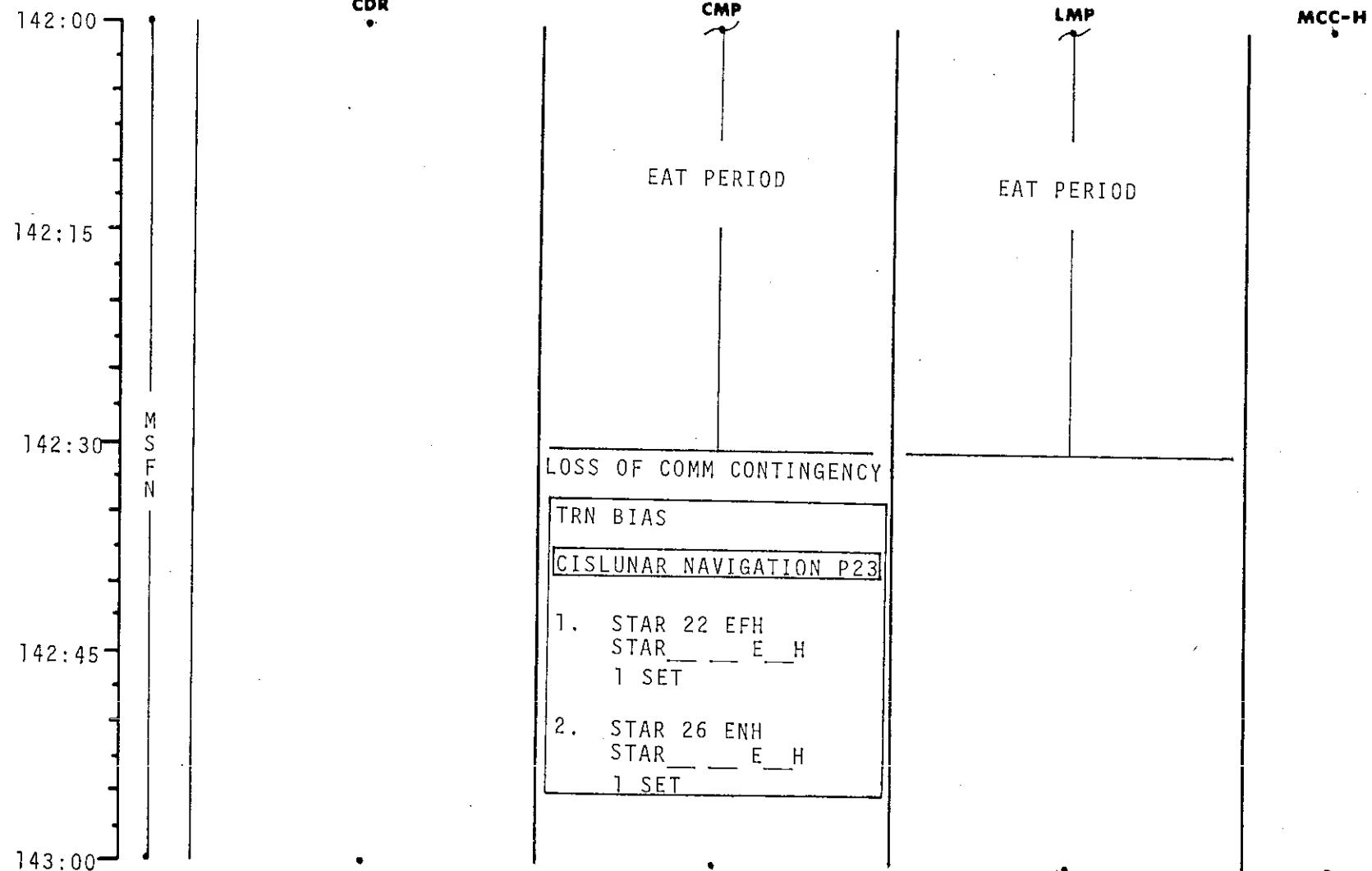
FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	141:00 - 142:00		2-112

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	142:00 - 143:00		2-113

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
143:00				
EI-3.5 HRS				P27 UPDATE: STATE VECTOR (LM & CSM SLOTS) REFSMMAT
143:30	M S P N	MNVR TO P52 ATT	RECORD MNVR AND ENTRY PAD	VOICE UPDATE: MNVR PAD ENTRY PAD
EI-3 HRS		IMU REALIGN P52 OPTION 3 - REFSMMAT STAR ID _____, STAR ANGLE DIFF _____ TORQUE ANGLES: X _____ Y _____ Z _____ CMC SELF CK DSKY COND LT TEST	ECS CK EPS CK SPS CK SM/CM RCS CK C&W CK	
144:00				

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	143:00 - 144:00	6/TEC	2-114

BURN STATUS REPORT

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

2-114a

REMARKS:

MCC'S

BURN CHART

	P or Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
MCC(ALL)	10°/SEC TAKEOVER	10° TAKEOVER	B/T +1 SEC	TRIM TO 0.2 fps

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
144:00	EXT AV P30			
EI-2.5 HRS				
144:30	SPS/RCS THRUST P40/41 MNVR TO BURN ATT	COAS & SXT STAR CK		
EI-2 HRS	GDC ALIGN TO IMU MCC ₇ ΔV=NOMINALLY ZERO			MCC ₇ BURN STATUS REPORT
145:00	V66 TRANS CSM STATE VECTOR TO LM SLOT			

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	144:00 - 145:00	7/TEC	2-115

FLIGHT PLAN

145:00

CDR

MNVR TO ENTRY ATT
COAS STAR CK

EI-1.5 HR

145:30

M
S
F
N

GDC ALIGN TO IMU
FINAL STOWAGE

EI-1 HR

EMS CK

146:00

FINAL GDC DRIFT CK

CMP

LOSS OF COMM CONTINGENCY
CISLUNAR NAVIGATION P23
1. STAR 33 ENH
STAR _____ E _____ H
1 SET

SXT STAR CK

IMU REALIGN P52
OPTION 3 - REFSMMAT
AND GYRO DRIFT TEST
STAR ID _____
STAR ANGLE DIFF _____

TORQUE ANGLES:

X	—	—	—	—
Y	—	—	—	—
Z	—	—	—	—

FINAL STOWAGE
INITIATE CM RCS PREHEAT
WASTE H₂O DUMP - OFF
UR DUMP HT - OFF

BIOMED SW - LEFT

MCC-H

PIPA BIAS
CK

FINAL STOWAGE

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	145:00 - 146:00	7/TEC	2-116

MSC Form 1910 (Nov 68)

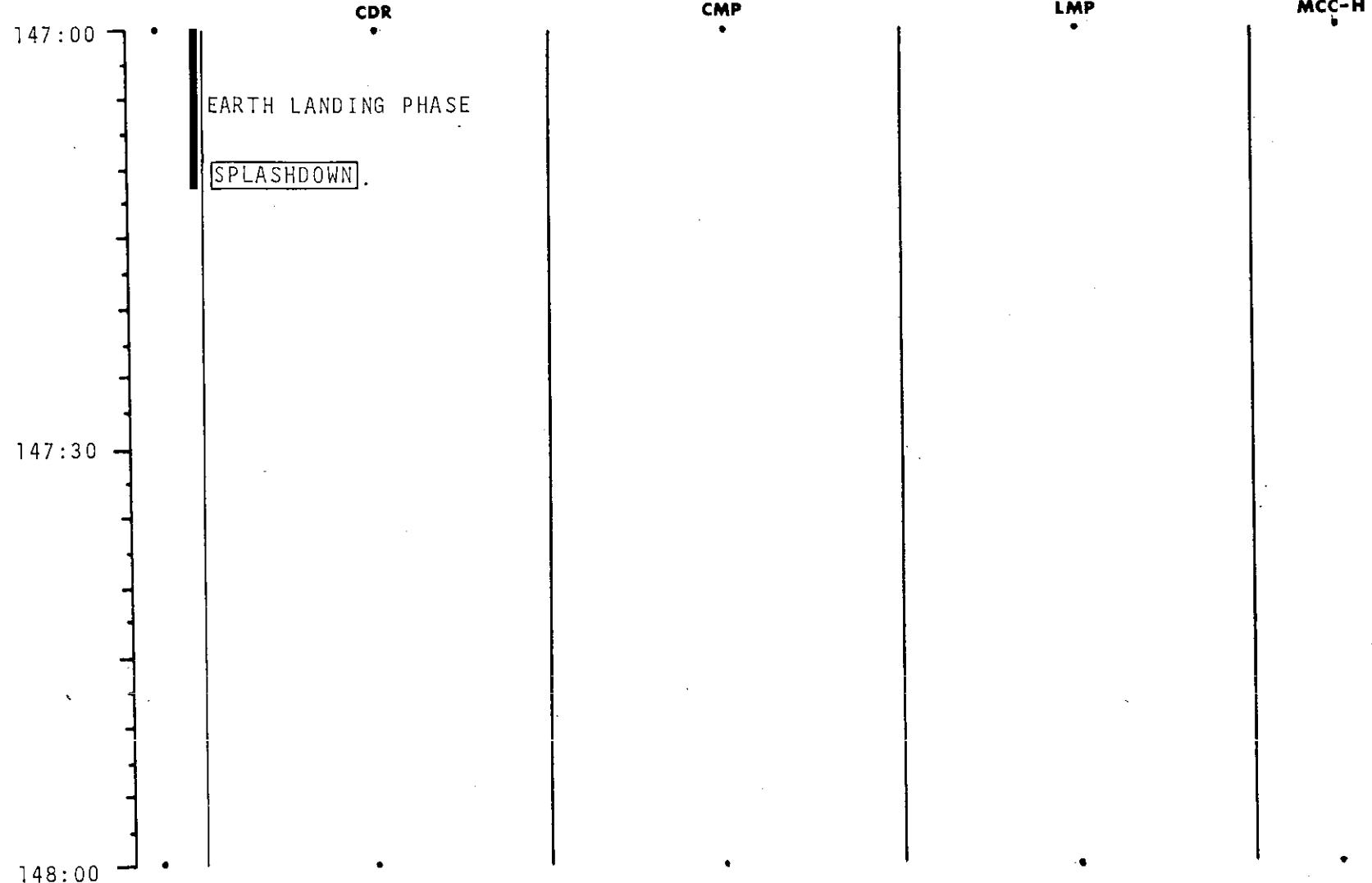
FLIGHT PLANNING BRANCH

FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
146:00	SET DET TO EI EMS INITIALIZATION RSI ALIGN TO GDC CM RCS CK	TERM CM RCS PREHEAT RECORD ENTRY PAD & RCVY INFO	PYRO BAT CK	P27 UPDATE: STATE VECTOR VOICE UPDATE: ENTRY PAD & RCVY INFO
EI-30 MIN	M S F N		ENTRY BATS - ON	
	SEPARATION CK LIST	SEPARATION CK LIST	SEPARATION CK LIST	
146:30	MNVR TO CM/SM SEP ATT	P61 ENTRY PREP	GO FOR PYRO ARM	GO FOR PYRO ARM
EI-15 MIN	CM/SM SEP MNVR TO ENTRY ATT	P62 ENTRY ATTITUDE		
		P63 ENTRY INITIATE		
146:50	EI = 400K	P64 ENTRY POST .05G		
147:00				

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	146:00 - 147:00	7/TEC	2-117

FLIGHT PLAN



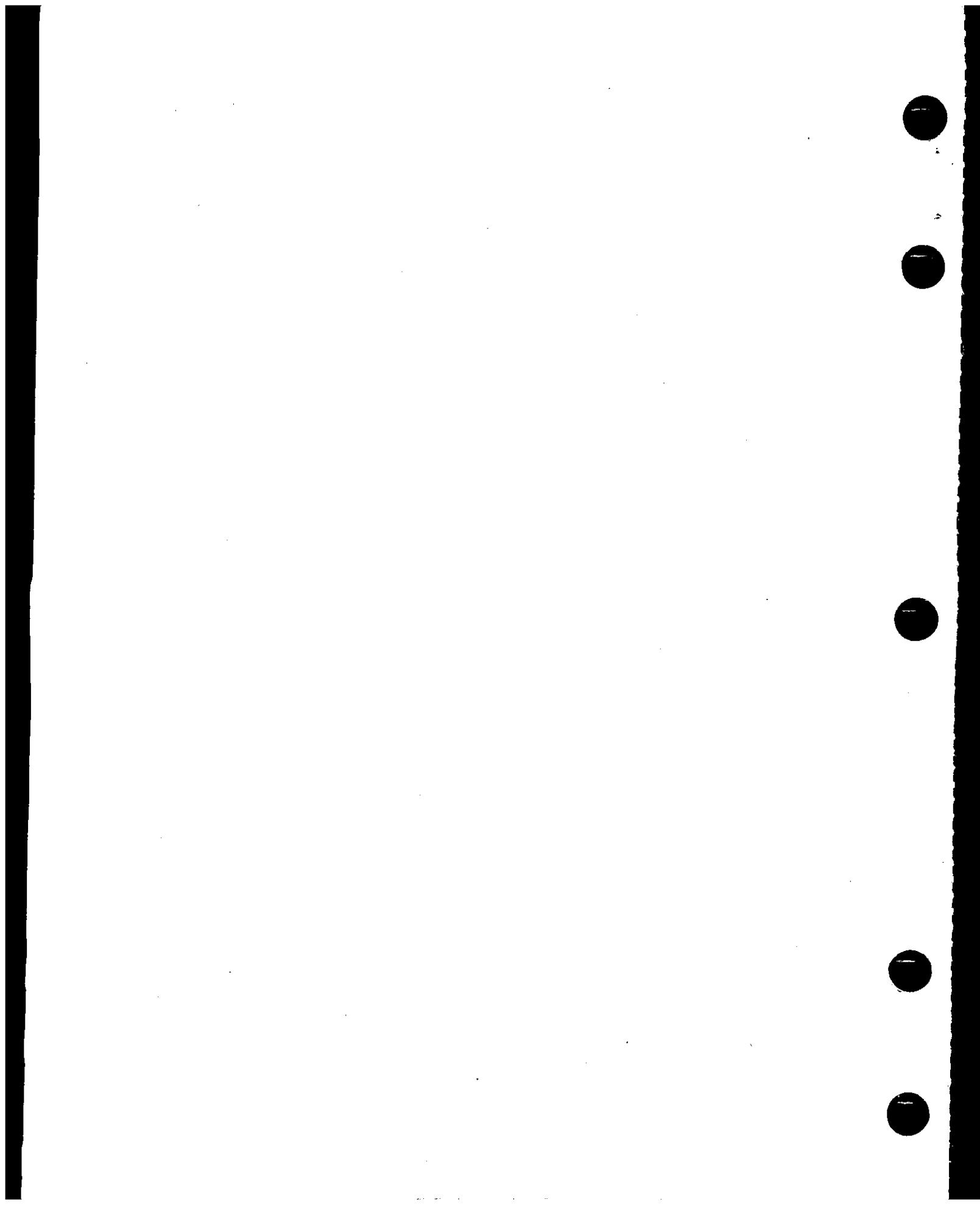
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	147:00 - 148:00	7/TEC	2-118

MSC Form 1910 (Nov 68)

FLIGHT PLANNING BRANCH

SECTION III

SECTION III - 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 RCS and cryogenics consumable analysis presented herein.

AS503/103 PROPELLANT BUDGET

The results of the SM, CM, and SPS propellant budget analysis are summarized in the following tables and figures:

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TABLE 3-II	SM-RCS USAGE SUMMARY	3-4
TABLE 3-III	SM-RCS PROPELLANT BUDGET	3-10
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FIGURE 3-I	SM RCS PROPELLANT PROFILE	3-5
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FIGURE 3-V	SM RCS PROPELLANT PROFILE (QUAD D)	3-9

Ground Rules and Assumption

The ground rules and assumptions listed below were used in the construction of the SM-RCS budget.

1. Data Source: Data for SM-RCS engine performance and propellant requirements were obtained from Part 4, Volume I of the CSM/LM Spacecraft Operational Data Book; May 1968.
2. Maneuvers: Since it is impossible to predict in all cases what maneuvers rates or angles will be required, it was assumed that all maneuvers were 3 axis at rates from 0.2 deg/sec to 0.5 deg/sec (unless otherwise noted). Angles were varied as a function of the maneuver requirements. It was also assumed that all IMU alignments

required 3 axis orientations with allowances for minimum impulse control, which may seem conservative, but would allow for unscheduled attitude maneuvers. An increase in passive thermal control (PTC) requirements was made to allow for active control of the non spin axis. Predicted costs are 1.3 lbs/hr translunar and 1.4 lbs/hrs transearth with a total increase of 100 lbs to the budget. Navigation sightings, like the IMU alignments, were predicted at the same cost for all cases. Realizing that some navigation sightings will be easier to accomplish than others, a nominal cost of approximately 1.2 lbs to 1.4 lbs per set was predicted. Lunar orbit maneuvers were budgeted to the lunar orbit attitude timeline. Midcourse translations were budgeted as SM-RCS corrections of 3 fps and 7 fps translunar and 10 fps, 5 fps, and 2 fps transearth. The 7 fps correction could possibly be replaced by a SPS burn since it is 2 fps above the minimum SPS burn time for translunar corrections.

3. Flow Rates: A propellant flow rate of 0.361 lbs/sec/engine was assumed for steady state operation. A minimum impulse burn has been predicted at a maximum 0.005 lbs per pulse.

TABLE 3-I
SM-RCS PROPELLANT LOADING

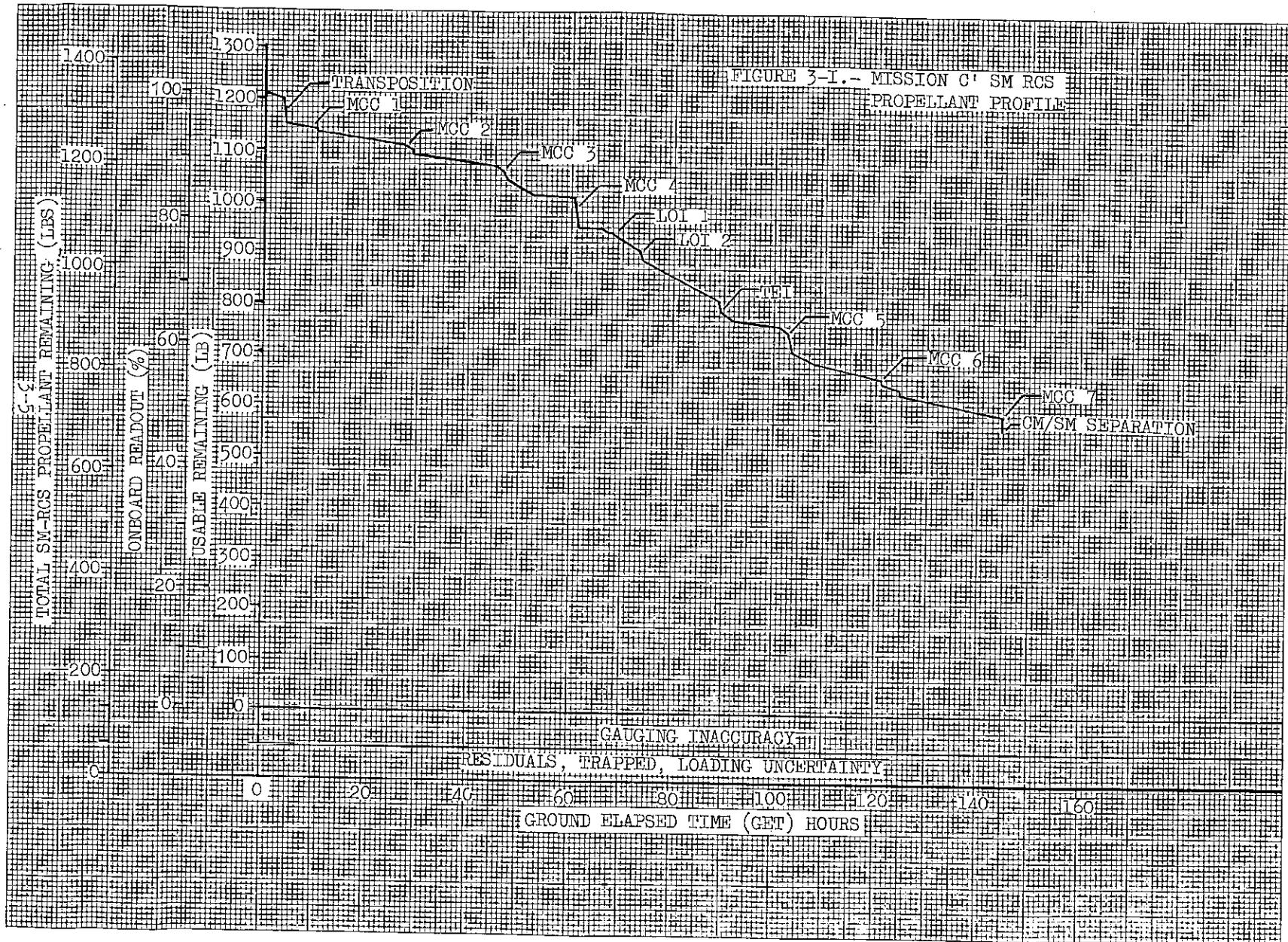
	<u>SM-RCS-LBS</u>
Nominal Loaded	1347.6
Unusable (trapped)	<u>26.8</u>
Total Deliverable	1320.8
Loading Uncertainty (temperature)	<u>36.8</u>
	1284.0
Gauging Inaccuracy	<u>72.0</u>
	1212.0
*Mixture Ratio Uncertainty	<u>82.0</u>
	1130.0
Total Used	<u>655.8</u>
Operational Margin	474.2

*This quantity is based on the flight plan and results from the use of approximately 460 lbs of RCS for attitude orientation and control. This is considered unusable for mission planning and represents a dispersion to the nominal profile.

TABLE 3-II

SM RCS USAGE SUMMARY

Day (GET, HRS)	PROPELLANT USED, LBS		PROPELLANT REMAINING, LBS	
	PER DAY	ACCUMULATIVE	TOTAL	USABLE
PRELAUNCH	5.8	5.8	1347.6	1130.0
1 (00:00 - 24:00)	99.6	105.4	1341.8	1124.2
2 (24:00 - 48:00)	79.9	185.3	1242.2	1024.6
3 (48:00 - 72:00)	110.3	295.6	1162.3	944.7
4 (72:00 - 96:00)	147.0	442.6	1052.0	834.4
5 (96:00 - 120:00)	109.1	551.7	905.0	687.4
6 (120:00 - 144:00)	89.3	641.0	795.9	578.3
7 (144:00 - 147:00)	14.8	655.8	706.6	489.0
			691.8	474.2



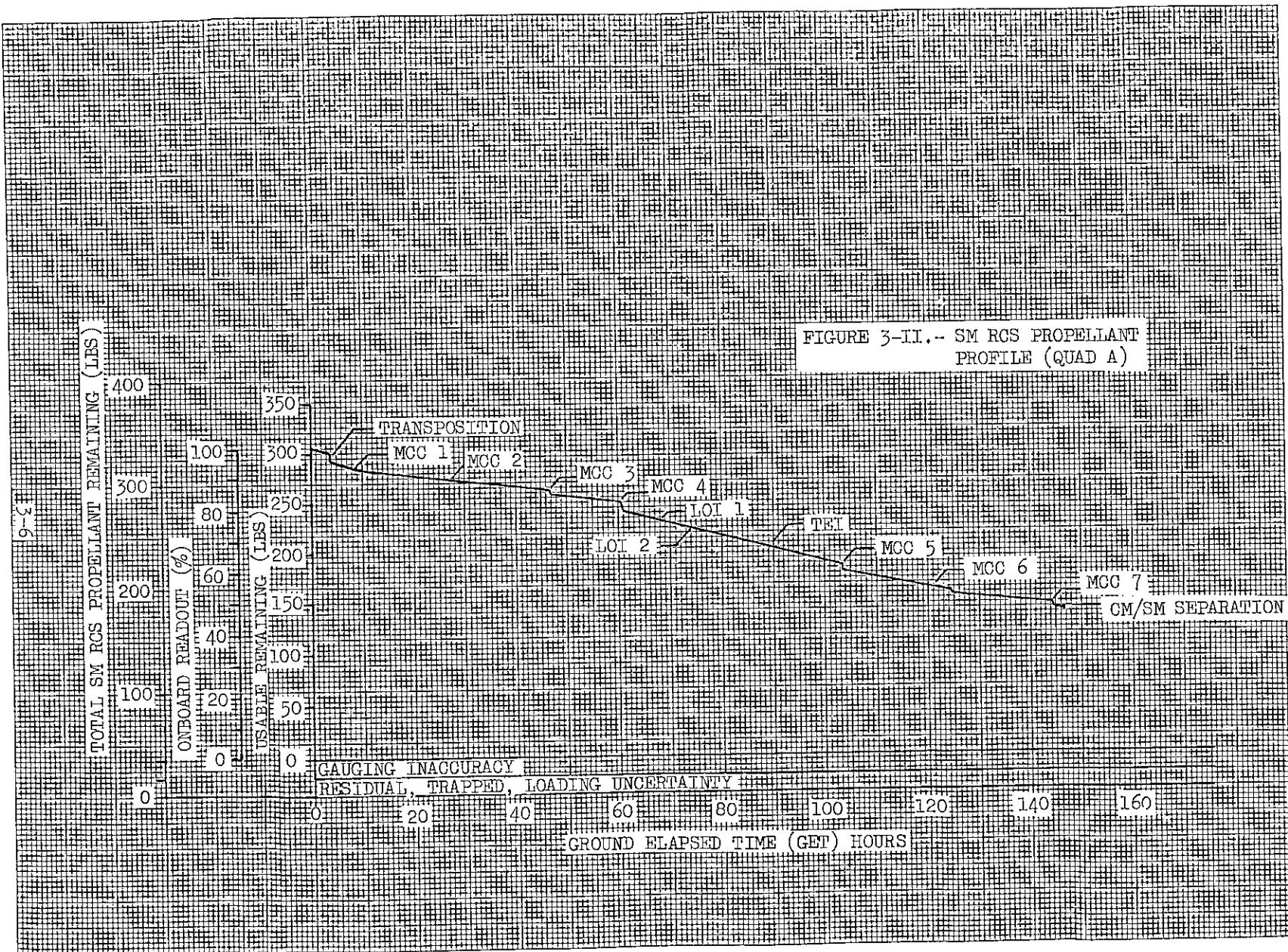


FIGURE 3-II.- SM RCS PROPELLANT PROFILE (QUAD A)

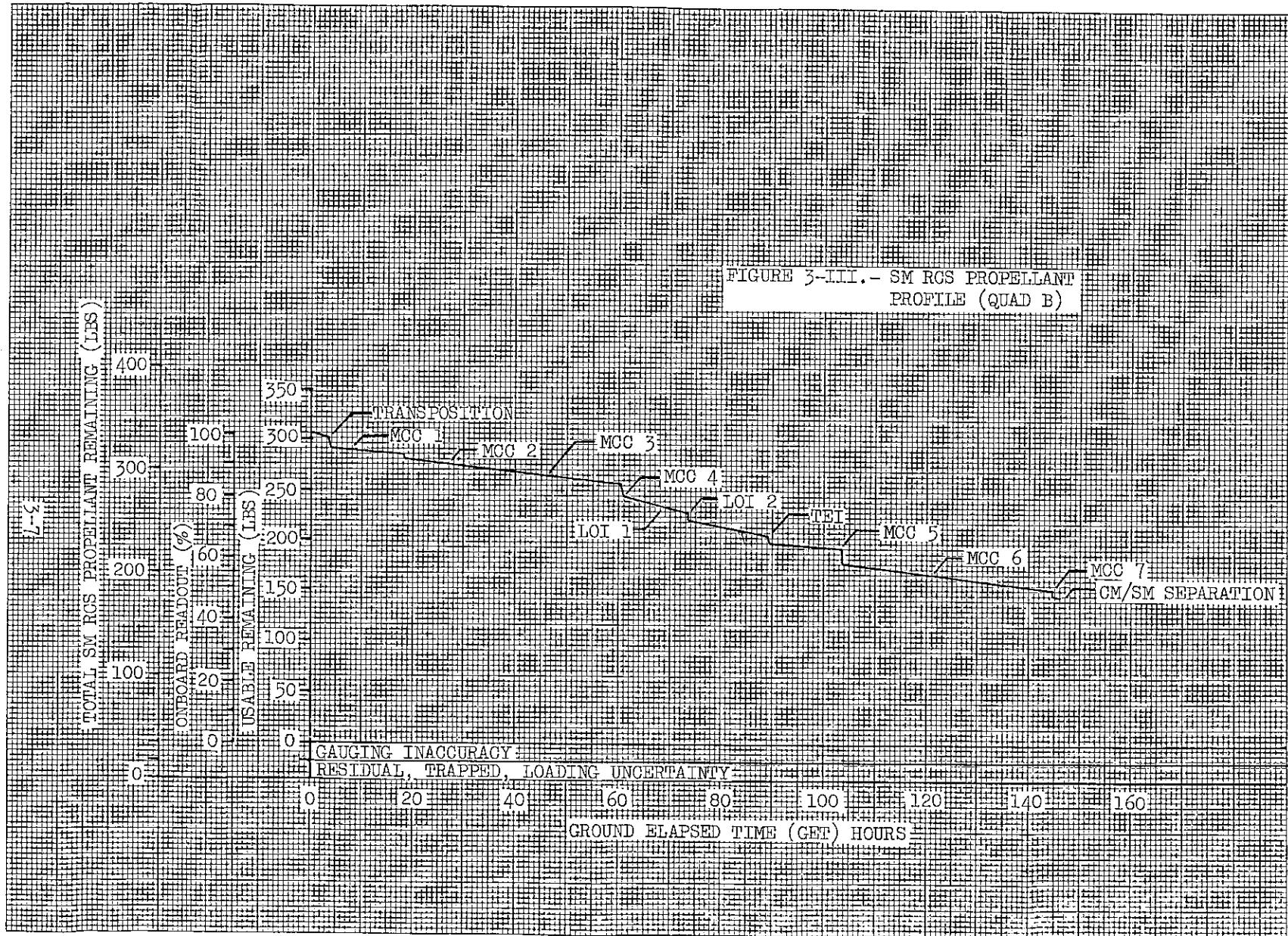
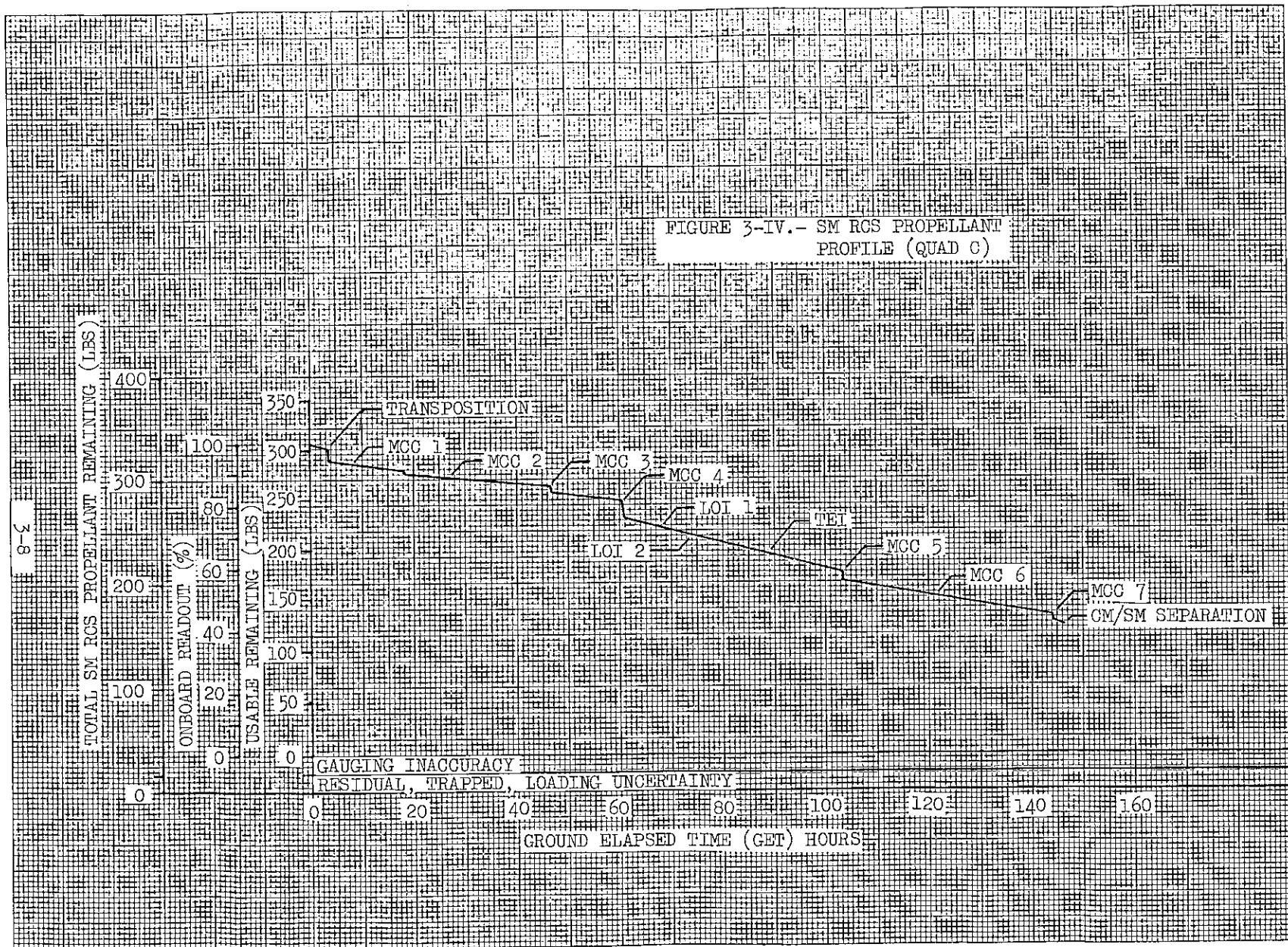


FIGURE 3-IV.- SM RCS PROPELLANT PROFILE (QUAD C)



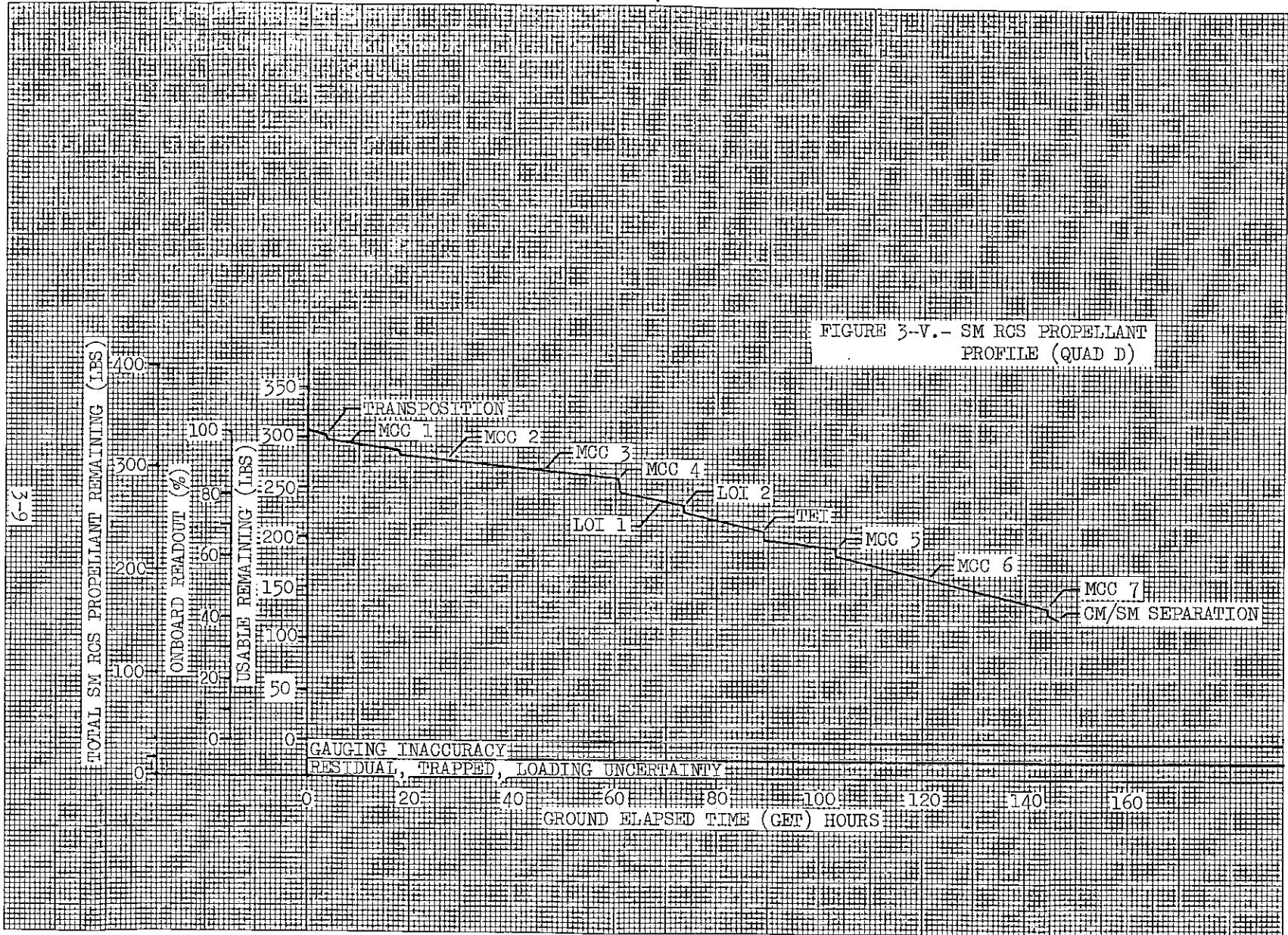


TABLE 3-III

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
• 0	APOLLO 8 CSM 103	63878.	.0	1347.6	100.
• 0	SM-RCS CHECKOUT FIRE EACH JET ONE SEC.	63872.	5.8	1341.8	100.
3.5	TRANSPOSITION +X TRANS 1 FPS PGNCS	63865.	7.5	1334.3	99.
3.5	-X 0.5 FPS	63860.	4.8	1329.5	99.
3.5	PITCH 4 DEG/SEC	63853.	6.9	1322.7	98.
3.5	FORMATION FLYING	63833.	20.0	1302.7	97.
3.6	MANEUVER TO LOCAL VERTICAL	63830.	3.2	1299.5	96.
3.8	ATTITUDE HOLD +5 DEG DB	63830.	.3	1299.2	96.
3.9	SEPARATE FROM S-IVB -X 1.5FPS	63816.	13.7	1285.4	95.
4.0	P52 IMU ALIGN	63815.	1.1	1284.4	95.
4.3	CISLUNAR NAVIGATION STAR/EARTH HORIZON ORIENT	63814.	.8	1283.5	95.
4.3	MIN. IMPULSE MARKING	63814.	.4	1283.1	95.
4.3	NAV SIGHTING SET 2	63813.	.8	1282.3	95.
4.3	MINIMUM IMPULSE MARKING	63812.	.4	1281.8	95.
4.3	NAV SIGHTING SET 3	63812.	.8	1281.0	95.

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM_RCS USED (LBS)	SM_RCS LEFT (LBS)	SM_RCS LEFT (%)
4.3	MINIMUM IMPULSE MARKING	63811.	.4	1280.4	95.
4.3	NAV SIGHTING SET 4	63810.	.9	1279.7	95.
4.3	MINIMUM IMPULSE MARKING	63810.	.4	1279.3	95.
8.0	P52 IMU ALIGN	63809.	1.1	1278.2	95.
8.5	MIDCOURSE CORRECTION 3 AXIS ORIENT PGNCs	63808.	1.1	1277.1	95.
8.5	ATT HOLD 0.5 DEG DB	63807.	.6	1276.5	95.
9.0	DELTA VEL = NOMINALLY ZERO	63807.	.0	1276.5	95.
9.1	CISLUNAR NAVIGATION STAR/EARTH HORIZON ORIENT	63806.	.6	1275.7	95.
9.1	MIN. IMPULSE MARKING	63806.	.4	1275.3	95.
9.1	NAV SIGHTING SET 2	63805.	.8	1274.5	95.
9.1	MINIMUM IMPULSE MARKING	63805.	.4	1274.0	95.
9.1	NAV SIGHTING SET 3	63804.	.8	1273.2	94.
9.1	MINIMUM IMPULSE MARKING	63803.	.4	1272.8	94.
9.8	ORIENT FOR PTC 3 AXIS 0.2 DEG/SEC	63803.	.8	1272.0	94.
9.8	ATTITUDE HOLD 0.5 DEG DB PGNCs	63802.	.8	1271.2	94.

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
9.8	EST. 0.3 DEG/SEC ROLL	63802.	.3	1270.9	94.
9.8	PITCH AND YAW CONTROL	63792.	.1	1261.8	94.
16.6	P52 IMU ALIGN	63791.	.1	1260.8	94.
17.0	CISLUNAR NAVIGATION STAR/EARTH HORIZON ORIENT	63791.	.8	1259.9	93.
17.0	MIN. IMPULSE MARKING	63790.	.4	1259.5	93.
17.0	NAV SIGHTING SET 2	63789.	.8	1258.4	93.
17.0	MINIMUM IMPULSE MARKING	63789.	.4	1258.2	93.
17.0	NAV SIGHTING SET 3	63788.	.8	1257.4	93.
17.0	MINIMUM IMPULSE MARKING	63788.	.4	1257.0	93.
17.0	NAV SIGHTING SET 4	63787.	.8	1256.1	93.
17.0	MINIMUM IMPULSE MARKING	63786.	.4	1255.7	93.
17.0	NAV SIGHTING SET 5	63785.	.8	1254.9	93.
17.0	MINIMUM IMPULSE MARKING	63785.	.4	1254.5	93.
18.0	ORIENT FOR PTC 3 AXIS 0.2 DEG/SEC	63784.	.8	1253.7	93.
18.0	ATT HOLD +5 DEG DB PGNCS	63783.	.8	1252.9	93.

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
18.0	EST. 0.3 DEG/SEC ROLL	63783.	.2	1252.4	93.
18.0	PITCH AND YAW CONTROL	63773.	10.4	1242.2	92.
26.0	PS2 IMU ALIGN	63772.	1.0	1241.2	92.
26.5	CISLUNAR NAVIGATION STAR/EARTH HORIZON ORIENT	63771.	.8	1240.4	92.
26.5	MIN IMPULSE MARKING	63771.	.4	1240.0	92.
26.5	NAV SIGHTING SET 2	63770.	.9	1239.1	92.
26.5	MINIMUM IMPULSE MARKING	63769.	.4	1238.7	92.
26.5	NAV SIGHTING SET 3	63768.	.8	1237.8	92.
26.5	MINIMUM IMPULSE MARKING	63768.	.4	1237.4	92.
27.5	MIDCOURSE CORRECTION MANEUVER TO BURN ATT	63767.	1.1	1236.3	92.
27.5	ATT HOLD .5 DEG DB PGNCS	63767.	.3	1236.1	92.
28.0	DELTA VEL = NOMINALLY ZERO	63767.	.0	1236.1	92.
28.1	CISLUNAR NAVIGATION STAR/EARTH HORIZON ORIENT	63766.	.8	1235.3	92.
28.1	MIN. IMPULSE MARKING	63765.	.4	1234.8	92.
28.1	NAV SIGHTING SET 2	63765.	.8	1234.0	92.

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
28.1	MINIMUM IMPULSE MARKING	63764.	.4	1233.4	92.
28.1	NAV SIGHTING SET 3	63763.	.9	1232.7	91.
28.1	MINIMUM IMPULSE MARKING	63763.	.4	1232.3	91.
28.1	NAV SIGHTING SET 4	63762.	.8	1231.5	91.
28.1	MINIMUM IMPULSE MARKING	63762.	.4	1231.0	91.
28.9	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC	63761.	.8	1230.3	91.
28.9	ATTITUDE HOLD 0.5 DEG DB PGNCS	63760.	.8	1229.5	91.
28.9	EST. 0.3 DEG/SEC ROLL	63760.	.3	1229.2	91.
28.9	PITCH AND YAW CONTROL	63753.	6.5	1222.7	91.
33.8	P52 IMU ALIGN	63752.	1.1	1221.7	91.
34.3	CISLUNAR NAVIGATION STAR/EARTH HORIZON ORIENT	63751.	.8	1220.8	91.
34.3	MIN. IMPULSE MARKING	63751.	.4	1220.4	91.
34.3	NAV SIGHTING SET 2	63750.	.8	1219.6	91.
34.3	MINIMUM IMPULSE MARKING	63750.	.4	1219.2	90.
34.3	NAV SIGHTING SET 3	63749.	.8	1218.3	90.

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
34.3	MINIMUM IMPULSE MARKING	63749.	.4	1217.9	90.
34.9	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC	63748.	.8	1217.1	90.
34.9	ATTITUDE HOLD 0.5 DEG DB BGNCS	63747.	.8	1216.4	90.
34.9	EST. 0.3 DEG/SEC ROLL	63747.	.2	1216.1	90.
34.9	PITCH AND YAW CONTROL	63736.	11.0	1205.1	89.
44.5	P52 IMU ALIGN	63735.	1.1	1204.0	89.
45.1	CISLUNAR NAVIGATION STAR/LUNAR HORIZON ORIENT	63734.	.9	1203.1	89.
45.1	MIN. IMPULSE MARKING	63733.	.4	1202.7	89.
45.1	NAV SIGHTING SET 2	63732.	.8	1201.8	89.
45.1	MINIMUM IMPULSE MARKING	63732.	.4	1201.4	89.
45.1	NAV SIGHTING SET 3	63731.	.9	1200.4	89.
45.1	MINIMUM IMPULSE MARKING	63731.	.4	1200.1	89.
45.1	NAV SIGHTING SET 4	63730.	.8	1199.3	89.
45.1	MINIMUM IMPULSE MARKING	63730.	.4	1198.9	89.
45.1	NAV SIGHTING SET 5	63729.	.8	1198.1	89.

SM-RCS PROPELLANT BUDGET						
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)	
45.1	MINIMUM IMPULSE MARKING	63728.	.4	1197.7	89.	
46.4	P52 IMU ALIGN	63727.	1.1	1196.6	89.	
46.6	MIDCOURSE CORRECTION 3 AXIS ORIENT PGNCS	63726.	1.1	1195.5	89.	
46.6	ATT HOLD 0.5 DEG DB PGNCS	63726.	.4	1195.1	89.	
47.0	RCS +X TRANS PGNCS 3 FPS	63704.	22.1	1173.0	87.	
47.2	CISLUNAR NAVIGATION STAR EARTH HORIZON ORIENT	63703.	.8	1172.2	87.	
47.2	MINIMUM IMPULSE MARKING	63702.	.4	1171.8	87.	
47.2	NAV SIGHTING SET 2	63702.	.8	1171.0	87.	
47.2	MINIMUM IMPULSE MARKING	63701.	.4	1170.4	87.	
47.2	NAV SIGHTING SET 3	63700.	.8	1169.8	87.	
47.2	MINIMUM IMPULSE MARKING	63700.	.4	1169.3	87.	
47.8	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC	63699.	.8	1168.5	87.	
47.8	ATTITUDE HOLD 0.5 DEG DB PGNCS	63698.	.8	1167.8	87.	
47.8	EST. 0.3 DEG/SEC ROLL	63698.	.3	1167.5	87.	
47.8	PITCH AND YAW CONTROL	63693.	5.2	1162.3	86.	

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
51.5	PS2 IMU ALIGN	63692.	.9	1161.4	86.
52.3	CISLUNAR NAVIGATION STAR/LUNAR HORIZON ORIENT	63691.	.8	1160.4	86.
52.3	MIN. IMPULSE MARKING	63691.	.4	1160.1	86.
52.3	NAV SIGHTING SET 2	63690.	.8	1159.3	86.
52.3	MINIMUM IMPULSE MARKING	63690.	.4	1158.9	86.
52.3	NAV SIGHTING SET 3	63689.	.8	1158.1	86.
52.3	MINIMUM IMPULSE MARKING	63688.	.4	1157.7	86.
52.3	NAV SIGHTING SET 4	63687.	.8	1156.9	86.
52.3	MINIMUM IMPULSE MARKING	63687.	.4	1156.4	86.
52.3	NAV SIGHTING SET 5	63686.	.8	1155.6	86.
52.3	MINIMUM IMPULSE MARKING	63686.	.4	1155.2	86.
53.3	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC	63685.	.8	1154.4	86.
53.3	ATTITUDE HOLD 0.5 DEG DB PGNCS	63684.	.8	1153.6	86.
53.3	EST. 0.3 DEG/SEC ROLL	63684.	.2	1153.4	86.
53.3	PITCH AND YAW CONTROL	63675.	6.8	1144.4	85.

SM-RCS PROPELLANT BUDGET						
TIME (HR)	EVENT		S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
60.0	P52 IMU ALIGN		63674.	.9	1143.7	85.
~60.5	MIDCOURSE CORRECTION 3 AXIS ORIENT	PGNCS	63673.	.9	1142.7	85.
60.5	ATT HOLD 0.5 DEG DB	PGNCS	63673.	.4	1142.4	85.
✓ 61.0	RCS -X TRANS PGNCS 7 FPS		63622.	51.2	1091.2	81.
61.2	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC		63621.	.8	1090.4	81.
61.2	ATTITUDE HOLD 0.5 DEG DB	PGNCS	63620.	.8	1089.4	81.
61.2	EST. 0.3 DEG/SEC ROLL		63620.	.3	1089.3	81.
61.2	PITCH AND YAW CONTROL		63612.	7.5	1081.8	80.
66.0	P52 IMU ALIGN		63612.	.9	1080.9	80.
66.5	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC		63611.	.8	1080.2	80.
66.5	ATTITUDE HOLD 0.2 DEG DB		63610.	.8	1079.4	80.
66.5	EST. 0.3 DEG/SEC ROLL		63610.	.3	1079.1	80.
66.5	PITCH AND YAW CONTROL		63609.	.5	1078.6	80.
67.0	MANEUVER TO LOII ATT		63608.	.8	1077.8	80.
67.1	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC		63608.	.8	1077.1	80.

SM-RCS PROPELLANT BUDGET

TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
67.1	ATT HOLD +5 DEG DB PGNCS	63607.	.8	1076.3	80.
67.1	EST. 0.3 DEG/SEC ROLL	63607.	.2	1076.1	80.
67.1	PITCH AND YAW CONTROL	63605.	1.3	1074.8	80.
68.2	P52 IMU ALIGN	63604.	.9	1073.9	80.
68.4	LUNAR ORBIT INSERTION BURN 1 3-AXIS ORIENT PGNCS	63604.	.9	1073.0	80.
68.4	ATT HOLD +5 DEG DB PGNCS	63603.	.4	1072.6	80.
68.4	START TRANSIENT CONTROL NO ULLAGE	63602.	1.3	1071.3	79.
69.1	SPS BURN BUILDUP	63599.	.0	1071.3	79.
69.1	STEADY STATE BURN 245.8 SEC PGN CS	47037.	.3	1070.9	79.
69.1	TAILOFF	46996.	.0	1070.9	79.
69.1	DAMP SHUT DOWN TRANSIENT	46995.	1.1	1069.8	79.
69.1	ATTITUDE HOLD 5 DEG DB	46993.	2.1	1067.7	79.
69.5	ROLL 180 DEG	46992.	1.0	1066.7	79.
69.5	ATTITUDE HOLD 5 DEG DB	46990.	2.1	1064.5	79.
70.3	P52 IMU ALIGN	46989.	.8	1063.7	79.

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
70.6	ORIENT TO TRACKING ATTITUDE PITCH TO ORDEAL	46988.	1.1	1062.6	79.
70.6	EST ORBITAL RATE	46986.	1.5	1061.1	79.
71.1	MAINTAIN ORB RATE AND COAS GROUND TRACK	46986.	.7	1060.4	79.
71.3	COAS GROUND TRACK DETERMINATION	46985.	.7	1059.7	79.
71.5	YAW 45 DEG RT FOR TV ORDEAL	46982.	2.9	1056.8	78.
71.6	YAW 45 DEG LEFT	46979.	2.9	1053.9	78.
71.9	ORIENT FOR PSEUDO LANDING	46978.	1.1	1052.7	78.
72.0	MAINTAIN ORB RATE AND COAS GROUND TR ACK	46977.	.7	1052.0	78.
72.4	PITCH .2 DEG/SEC TO BURN ATT	46977.	.3	1051.7	78.
72.5	ATTITUDE HOLD .5 DEG DB	46973.	4.3	1047.4	78.
72.6	PS2 IMU ALIGN	46972.	.8	1046.6	78.
73.0	ROLL LEFT 180 DEG 2DEG/SEC	46971.	1.0	1045.6	78.
73.0	ATTITUDE HOLD 0.2 DEG DB	46970.	.8	1044.8	78.
✓73.5	LUNAR ORBIT INSERTION BURN 2 ORIENTATION	46969.	.8	1044.0	77.
73.5	ATT HOLD .5 DEG DB PGNCs	46968.	1.1	1042.9	77.

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
73.5	ULLAGE 2 JET B AND D	46952.	15.7	1027.2	76.
73.5	SPS BURN BUILD UP	46949.	.0	1027.2	76.
73.5	STEADY STATE BURN 9.7 SEC PGNCS	46296.	.2	1027.0	76.
73.5	TAILOFF	46255.	.0	1027.0	76.
73.5	DAMP SHUT DOWN TRANSIENT	46254.	1.1	1025.9	76.
73.7	ROLL RIGHT 180 DEG	46253.	1.1	1024.8	76.
73.8	ORIENT TO TRACKING ATTITUDE	46252.	1.1	1023.7	76.
73.8	EST ORBITAL RATE	46250.	1.5	1022.2	76.
74.1	ORIENT FOR LANDMARKS	46249.	1.1	1021.2	76.
74.3	PITCH TO ACQUIRE MSFN	46248.	1.3	1019.9	76.
74.3	ATTITUDE HOLD 5 DEG DB	46246.	2.1	1017.7	76.
74.5	P52 IMU ALIGN	46245.	.8	1016.9	75.
75.0	PITCH TO VERTICAL .2 DEG/SEC	46244.	.7	1016.2	75.
75.2	ROLL 180 DEG	46244.	.3	1015.9	75.
75.2	EST ORBITAL RATE	46243.	1.5	1014.4	75.

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
75.7	ROLL RIGHT 180 DEG 2 DEG/SEC	46241.	1.1	1013.3	75.
75.8	MAINTAIN ORB RATE	46240.	1.5	1011.8	75.
76.0	ORIENT FOR LANDMARKS, PHOTOGRAPHY	46239.	1.1	1010.7	75.
76.1	EST AND STOP SIGHTING RATE	46238.	1.3	1009.4	75.
76.4	ROLL 180 DEG 2 DEG/SEC	46236.	1.1	1008.3	75.
76.5	ATTITUDE HOLD 5 DEG DB	46236.	.4	1007.9	75.
76.6	P52 IMU ALIGN	46235.	.8	1007.1	75.
77.1	ROLL 180 DEG 2 DEG/SEC	46234.	1.1	1006.0	75.
77.1	PITCH DOWN +2 DEG/SEC	46234.	.4	1005.6	75.
77.1	EST. ORB RATE	46232.	1.5	1004.1	75.
77.2	CONTROL POINT SIGHTING	46231.	1.1	1003.0	74.
77.3	PITCH +3 DEG/SEC AT ACQ	46231.	.5	1002.6	74.
77.7	PITCH +2 DEG/SEC AT LOSS	46230.	.7	1001.9	74.
77.7	EST. ORB RATE	46229.	1.5	1000.4	74.
78.0	ORIENT FOR PSEUDO LANDING SITE LANDMARK SIGHTING	46227.	1.1	999.3	74.

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
78.0	PITCH .3 DEG/SEC AT ACQ	46227.	.5	998.9	74.
78.3	ROLL 180 DEG AT LOSS	46226.	1.1	997.8	74.
78.5	ATTITUDE HOLD 5 DEG DB	46224.	2.1	995.4	74.
78.6	PS2 IMU ALIGN	46223.	.8	994.8	74.
79.0	ROLL 180 DEG	46222.	1.1	993.8	74.
79.1	PITCH 2 DEG/SEC	46219.	2.4	991.3	74.
79.1	EST. ORB RATE	46218.	1.5	989.8	73.
79.1	CONTROL POINT SIGHTING	46217.	1.1	988.7	73.
79.1	MAINTAIN SIGHTING RATE	46217.	.1	988.6	73.
79.5	PITCH .3 DEG/SEC AT ACQ	46216.	.5	988.1	73.
79.5	PITCH .2 DEG/SEC AT LOSS	46216.	.3	987.8	73.
79.5	EST. ORB RATE	46214.	1.5	986.3	73.
80.0	ORIENT FOR PSEUDO LANDING SITE LANDMARK SIGHTING	46213.	1.1	985.2	73.
80.1	PITCH .3 DEG/SEC AT ACQ	46213.	.5	984.7	73.
80.2	ROLL 180 DEG AT LOSS	46212.	1.1	983.7	73.

SM-RCS PROPELLANT BUDGET						
TIME (HR)	EVENT		S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
80.2	ATTITUDE HOLD	5 DEG DB	46210.	2.1	981.5	73.
80.6	P52	IMU ALIGN	46209.	.8	980.7	73.
80.7	ROLL	180 DEG 2 DEG/SEC	46208.	1.1	979.6	73.
80.8	PITCH	.2 DEG/SEC	46207.	.3	979.3	73.
80.8	EST.	ORB RATE	46206.	1.5	977.8	73.
81.1	PITCH	.3 DEG/SEC AT ACQ	46205.	.5	977.3	73.
81.3	PITCH	.5 DEG/SEC AT LOSS	46205.	.7	976.6	72.
81.5	PITCH	.3 DEG/SEC AT ACQ	46204.	.4	976.1	72.
81.6	PITCH	.5 DEG/SEC AT LOSS	46204.	.7	975.4	72.
81.7	PITCH	.3 DEG/SEC AT ACQ	46203.	.5	975.0	72.
81.8	PITCH	.5 DEG/SEC AT LOSS	46202.	.7	974.3	72.
81.9	ORIENT FOR PSEUDO LANDING SITE LANDMARK SIGHTING		46201.	1.1	973.2	72.
82.1	PITCH	.3 DEG/SEC AT ACQ	46201.	.5	972.7	72.
82.3	ROLL	180 DEG 2 DEG/SEC	46200.	1.1	971.6	72.
82.3	ATTITUDE HOLD	5 DEG DB	46195.	4.3	967.3	72.

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
82.5	P52 IMU ALIGN	46195.	.8	966.5	72.
82.8	ROLL 180 DEG 2 DEG/SEC	46194.	1.1	965.5	72.
83.0	PITCH .2 DEG/SEC	46193.	.3	965.1	72.
83.1	PITCH .3 DEG/SEC AT ACQ	46193.	.5	964.7	72.
83.3	PITCH .5 DEG/SEC AT LOSS	46192.	.7	964.0	72.
83.4	PITCH .3DEG/SEC	46192.	.5	963.5	71.
83.6	PITCH .5 DEG/SEC	46191.	.7	962.8	71.
83.7	PITCH .3DEG/SEC	46191.	.5	962.4	71.
83.8	PITCH .5 DEG/SEC	46190.	.7	961.7	71.
83.9	ORIENT FOR PSEUDO LANDING SITE LANDMARK SIGHTING	46189.	1.1	960.5	71.
84.2	PITCH .3DEG/SEC	46188.	.5	960.1	71.
84.2	ROLL 180 DEG 2 DEG/SEC	46187.	1.0	959.0	71.
84.2	ATTITUDE HOLD 5 DEG DB	46185.	2.1	956.9	71.
84.5	P52 IMU ALIGN	46184.	.8	956.1	71.
84.7	PITCH .2 DEG/SEC	46184.	.3	955.7	71.

SM-RCS PROPELLANT-BUDGET					
TIME (HRS)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
84.7	ESTABLISH ORB RATE	46182.	.5	954.2	71.
85.1	PITCH UP 70 DEG AT .5 DEG/SEC	46182.	.7	953.5	71.
85.1	MAINTAIN ORB RATE	46182.	.1	953.4	71.
85.5	PITCH UP 40 DEG AT .2 DEG/SEC	46181.	.3	953.0	71.
85.7	ROLL 180 DEG	46180.	1.0	952.0	71.
86.2	ROLL 180 DEG .2DEG/SEC	46179.	1.1	950.9	71.
86.3	PITCH 60DEG .2DEG/SEC	46179.	.3	950.6	71.
86.2	ATTITUDE HOLD 5 DEG DB	46177.	2.1	948.5	70.
86.7	PS2 IMU ALIGN	46176.	.8	947.7	70.
86.9	PITCH .2 DEG/SEC	46175.	.3	947.3	70.
86.9	ESTABLISH ORB RATE	46174.	1.5	945.9	70.
88.3	PS2 IMU ALIGN	46173.	.8	945.1	70.
88.7	ROLL 180 DEG	46173.	.3	944.7	70.
89.1	TRANS-EARTH INJECTION ORIENTATION	46172.	.8	943.9	70.
89.1	ATT HOLD .5 DEG DB	46171.	1.1	942.9	70.

SM-RCS PROPELLANT BUDGET					
TIME (HRS)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
89.1	ULLAGE 2 JET B AND D QUADS 21 SEC PGNCS	46155.	15.7	927.1	69.
89.1	SPS BURN BUILD UP	46152.	.0	927.1	69.
89.1	STEADY STATE BURN 206 SEC PGNCS	32272.	.2	926.9	69.
89.1	TAILOFF	32231.	.0	926.9	69.
89.1	DAMP SHUT DOWN TRANSIENT	32230.	1.1	925.8	69.
89.2	PITCH TO VERTICAL ACQUIRE MOON	32229.	.7	925.1	69.
90.2	P52 IMU ALIGN	32229.	.7	924.4	69.
90.5	CISLUNAR NAVIGATION STAR/LUNAR HORIZON ORIENT	32228.	1.0	923.4	69.
90.5	MIN. IMPULSE MARKING	32227.	.4	923.0	68.
90.5	NAV SIGHTING SET 2	32226.	1.0	922.0	68.
90.5	MINIMUM IMPULSE MARKING	32226.	.4	921.6	68.
90.5	NAV SIGHTING SET 3	32225.	1.0	920.4	68.
90.5	MINIMUM IMPULSE MARKING	32225.	.4	920.2	68.
91.0	NAV SIGHTING SET 4	32224.	1.0	919.2	68.
91.0	MINIMUM IMPULSE MARKING	32223.	.4	918.8	68.

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
91.0	NAV SIGHTING SET 5	32222.	.9	917.9	68.
91.0	MINIMUM IMPULSE MARKING	32222.	.4	917.4	68.
91.0	NAV SIGHTING SET 6	32221.	1.0	916.5	68.
91.0	MINIMUM IMPULSE MARKING	32220.	.4	916.0	68.
91.0	NAV SIGHTING SET 7	32219.	1.0	915.1	68.
91.0	MINIMUM IMPULSE MARKING	32219.	.4	914.4	68.
91.0	NAV SIGHTING SET 8	32218.	1.0	913.7	68.
91.0	MINIMUM IMPULSE MARKING	32218.	.4	913.2	68.
92.0	ORIENT FOR PTC (YAW TEST)	32217.	.7	912.5	68.
92.0	ATT HOLD +5 DEG DB PGNCS	32216.	.8	911.7	68.
92.0	EST. 0.3 DEG/SEC YAW	32216.	.5	911.3	68.
92.0	PITCH AND ROLL CONTROL	32210.	5.6	905.7	67.
96.0	PS2 IMU ALIGN	32209.	.7	905.0	67.
96.3	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC	32209.	.7	904.3	67.
96.3	ATTITUDE HOLD 0.5 DEG DB PGNCS	32208.	.8	903.5	67.

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
96.3	EST. 0.3 DEG/SEC ROLL	32208.	.2	903.3	67.
96.3	PITCH AND YAW CONTROL	32202.	5.2	898.1	67.
100.0	PS2 IMU ALIGN	32202.	.7	897.4	67.
100.5	CISLUNAR NAVIGATION STAR/EARTH HORIZON ORIENT	32201.	1.0	896.4	67.
100.5	MIN. IMPULSE MARKING	32200.	.4	896.0	66.
100.5	NAV SIGHTING SET 2	32199.	1.0	895.0	66.
100.5	MINIMUM IMPULSE MARKING	32199.	.4	894.6	66.
100.5	NAV SIGHTING SET 3	32198.	1.0	893.6	66.
100.5	MINIMUM IMPULSE MARKING	32198.	.4	893.2	66.
101.0	MAN TO SIGHTING ATT	32197.	1.0	892.2	66.
101.5	CISLUNAR NAVIGATION STAR/EARTH HORIZON ORIENT	32196.	.9	891.3	66.
101.5	MIN. IMPULSE MARKING	32195.	.4	890.9	66.
101.5	NAV SIGHTING SET 2	32194.	1.0	889.9	66.
101.5	MINIMUM IMPULSE MARKING	32194.	.4	889.4	66.
101.5	NAV SIGHTING SET 3	32193.	1.0	888.4	66.

SM-RCS. PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
101.5	MINIMUM IMPULSE MARKING	32192.	.4	888.0	66.
101.5	NAV SIGHTING SET 4	32191.	1.0	887.1	66.
101.5	MINIMUM IMPULSE MARKING	32191.	.4	886.6	66.
102.0	NAV SIGHTING SET 5	32190.	1.0	885.7	66.
102.0	MIN. IMPULSE MARKING	32190.	.4	885.2	66.
102.0	NAV SIGHTING SET 6	32189.	1.0	884.3	66.
102.0	MINIMUM IMPULSE MARKING	32188.	.4	883.9	66.
102.8	P52 IMU ALIGN	32188.	.7	883.1	66.
103.5	MIDCOURSE CORRECTION 3 AXIS ORIENT	32187. PGNCS	1.0	882.7	65.
103.5	ATTITUDE HOLD .5 DEG DB PGNCS	32186.	.8	881.4	65.
103.5	RCS +X TRANS PGNCS 10 FPS	32149.	37.1	844.3	63.
105.0	P52 IMU ALIGN	32148.	.7	843.4	63.
105.2	CISLUNAR NAVIGATION STAR/EARTH HORIZON ORIENT	32147.	1.0	842.4	62.
105.2	MIN. IMPULSE MARKING	32147.	.4	842.2	62.
105.2	NAV SIGHTING SET 2	32146.	1.0	841.2	62.

SM_RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM_RCS USED (LBS)	SM_RCS LEFT (LBS)	SM_RCS LEFT (%)
105.2	MINIMUM IMPULSE MARKING	32145.	.4	840.7	62.
105.2	NAV SIGHTING SET 3	32144.	1.0	839.8	62.
105.2	MINIMUM IMPULSE MARKING	32144.	.4	839.3	62.
105.2	NAV SIGHTING SET 4	32143.	1.0	838.4	62.
105.2	MINIMUM IMPULSE MARKING	32142.	.4	837.9	62.
105.2	NAV SIGHTING SET 5	32141.	1.0	837.0	62.
105.2	MINIMUM IMPULSE MARKING	32141.	.4	836.4	62.
106.1	HAN TO SIGHTING ATT	32140.	1.0	835.6	62.
106.3	CISLUNAR NAVIGATION STAR/LUNAR HORIZON ORIENT	32139.	1.0	834.6	62.
106.3	MIN. IMPULSE MARKING	32139.	.4	834.1	62.
106.3	NAV SIGHTING SET 2	32138.	1.0	833.2	62.
106.3	MINIMUM IMPULSE MARKING	32137.	.4	832.7	62.
106.3	NAV SIGHTING SET 3	32136.	1.0	831.8	62.
106.3	MINIMUM IMPULSE MARKING	32136.	.4	831.3	62.
107.6	F52 IMU ALIGN	32135.	.7	830.6	62.

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
108.0	CISLUNAR NAVIGATION STAR/EARTH HORIZON ORIENT	32134.	1.0	829.7	62.
108.0	MIN. IMPULSE MARKING	32134.	.4	829.2	62.
108.0	NAV SIGHTING SET 2	32133.	1.0	828.3	61.
108.0	MINIMUM IMPULSE MARKING	32132.	.4	827.8	61.
108.0	NAV SIGHTING SET 3	32131.	1.0	826.9	61.
108.0	MINIMUM IMPULSE MARKING	32131.	.4	826.4	61.
108.0	NAV SIGHTING SET 4	32130.	1.0	825.5	61.
108.0	MINIMUM IMPULSE MARKING	32129.	.4	825.0	61.
108.0	NAV SIGHTING SET 5	32128.	1.0	824.0	61.
108.0	MINIMUM IMPULSE MARKING	32128.	.4	823.4	61.
108.8	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC	32127.	.7	822.9	61.
108.8	ATT HOLD +5 DEG DB PGNCS	32127.	.8	822.2	61.
108.8	EST. 0.3 DEG/SEC ROLL	32126.	.4	821.7	61.
108.8	PITCH AND YAW CONTROL	32120.	6.0	815.7	61.
113.0	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC	32119.	.7	815.0	60.

SM-RCS PROPELLANT BUDGET						
TIME (HR)	EVENT	S/C WT (LBS)	SM_RCS USED (LBS)	SM_RCS LEFT (LBS)	SM_RCS LEFT (%)	
113.0	ATTITUDE HOLD 0.5 DEG DB PGNCS	32119.	.8	814.3	60.	
113.0	EST. 0.3 DEG/SEC ROLL	32118.	.2	814.1	60.	
113.0	PITCH AND YAW CONTROL	32116.	2.8	811.3	60.	
115.1	PS2 IMU ALIGN	32115.	.7	810.6	60.	
115.3	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC	32114.	.7	809.9	60.	
115.3	ATTITUDE HOLD 0.5 DEG DB PGNCS	32113.	.8	809.1	60.	
115.3	EST. 0.3 DEG/SEC ROLL	32113.	.2	808.9	60.	
115.3	PITCH AND YAW CONTROL	32108.	5.0	803.9	60.	
119.0	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC	32108.	.7	803.2	60.	
119.0	ATT HOLD .5 DEG DB PGNCS	32107.	.8	802.5	60.	
119.0	EST. 0.3 DEG/SEC ROLL	32107.	.2	802.3	60.	
119.0	PITCH AND YAW CONTROL	32105.	1.4	800.9	59.	
120.0	PS2 IMU ALIGN	32105.	.7	800.2	59.	
120.0	CISLUNAR NAVIGATION STAR/EARTH HORIZON ORIENT	32104.	1.0	799.2	59.	
120.0	MIN. IMPULSE MARKING	32103.	.4	798.8	59..	

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
120+0	NAV SIGHTING SET 2	32102.	1.0	797.8	59.
120+0	MINIMUM IMPULSE MARKING	32102.	.4	797.3	59.
120+0	NAV SIGHTING SET 3	32101.	1.0	796.4	59.
120+0	MINIMUM IMPULSE MARKING	32100.	.4	795.9	59.
121+0	PS2 IMU ALIGN	32100.	.7	795.2	59.
121+5	MIDCOURSE CORRECTION 3 AXIS ORIENT PGNCS	32099.	.7	794.5	59.
121+5	ATT HOLD +5 DEG DB PGNCS	32098.	.4	794.1	59.
121+5	SM-RCS -X TRANS 2FPS	32091.	.5	786.6	58.
122+6	CISLUNAR NAVIGATION STAR/LUNAR HORIZON ORIENT	32090.	1.0	785.6	58.
122+6	MIN. IMPULSE MARKING	32090.	.4	785.2	58.
122+6	NAV SIGHTING SET 2	32089.	1.0	784.2	58.
122+6	MINIMUM IMPULSE MARKING	32088.	.4	783.8	58.
122+6	NAV SIGHTING SET 3	32087.	1.0	782.8	58.
122+6	MINIMUM IMPULSE MARKING	32087.	.4	782.4	58.
123+1	MANEUVER TO SIGHTING ATTITUDE	32086.	.9	781.5	58.

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
123.6	CISLUNAR NAVIGATION STAR/EARTH HORIZON ORIENT	32085.	1.0	780.5	58.
123.6	MIN. IMPULSE MARKING	32084.	.4	780.1	58.
123.6	NAV SIGHTING SET 2	32083.	1.0	779.1	58.
123.6	MINIMUM IMPULSE MARKING	32083.	.4	778.7	58.
123.6	NAV SIGHTING SET 3	32082.	1.0	777.7	58.
123.6	MINIMUM IMPULSE MARKING	32082.	.4	777.3	58.
123.6	NAV SIGHTING SET 4	32081.	1.0	776.3	58.
123.6	MINIMUM IMPULSE MARKING	32080.	.4	775.9	58.
123.6	NAV SIGHTING SET 5	32079.	1.0	774.9	58.
123.6	MINIMUM IMPULSE MARKING	32079.	.4	774.5	57.
124.5	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC	32078.	.7	773.8	57.
124.5	ATT HOLD .5 DEG DB PGNCs	32077.	.8	773.0	57.
124.5	EST. 0.3 DEG/SEC ROLL	32077.	.2	772.8	57.
124.5	PITCH AND YAW CONTROL	32070.	7.0	765.8	57.
129.5	PS2 IMU ALIGN	32069.	.7	765.1	57.

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
130+0	CISLUNAR NAVIGATION STAR/LUNAR HORIZON ORIENT	32068.	1.0	764+1	57+
130+0	MIN. IMPULSE MARKING	32068.	.4	763+7	57+
130+0	NAV SIGHTING SET 2	32067.	1.0	762+7	57+
130+0	MINIMUM IMPULSE MARKING	32067.	.4	762+2	57+
130+0	NAV SIGHTING SET 3	32066.	1.0	761+3	56+
130+0	MINIMUM IMPULSE MARKING	32065.	.4	760+9	56+
130+5	MANEUVER TO SIGHTING ATTITUDE	32064.	1.0	759+9	56+
130+8	CISLUNAR NAVIGATION STAR EARTH HORIZON ORIENT	32063.	1.0	758+9	56+
130+8	MINIMUM IMPULSE MARKING	32063.	.4	758+5	56+
130+8	NAV SIGHTING SET 2	32062.	1.0	757+5	56+
130+8	MINIMUM IMPULSE MARKING	32061.	.4	757+1	56+
130+8	NAV SIGHTING SET 3	32060.	1.0	756+1	56+
130+8	MINIMUM IMPULSE MARKING	32060.	.4	755+7	56+
131+4	NAV SIGHTING SET 4	32059.	1.0	754+7	56+
131+4	MIN. IMPULSE MARKING	32059.	.4	754+3	56+

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM_RCS USED (LBS)	SM_RCS LEFT (LBS)	SM_RCS LEFT (%)
131.4	NAV SIGHTING SET 5	32058.	1.0	753.3	56.
131.4	MINIMUM IMPULSE MARKING	32057.	.4	752.8	56.
131.4	NAV SIGHTING SET 6	32056.	1.0	751.9	56.
131.4	MINIMUM IMPULSE MARKING	32056.	.4	751.5	56.
131.8	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC	32055.	.7	750.7	56.
131.8	ATT HOLD +5 DEG DB PGNCS	32054.	.8	749.9	56.
131.8	EST. 0.3 DEG/SEC ROLL	32054.	.2	749.7	56.
131.8	PITCH AND YAW CONTROL	32048.	6.4	743.3	55.
135.5	P52 IMU ALIGN	32047.	.7	742.4	55.
135.7	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC	32046.	.7	741.9	55.
135.7	ATT HOLD +5 DEG DB PGNCS	32046.	.8	741.1	55.
135.7	EST. 0.3 DEG/SEC ROLL	32045.	.2	741.0	55.
135.7	PITCH AND YAW CONTROL	32040.	5.0	736.0	55.
139.4	P52 IMU ALIGN	32040.	.7	735.2	55.
139.5	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC	32039.	.8	734.5	55.

SM-RCS PROPELLANT BUDGET						
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)	
139.5	ATTITUDE HOLD .5 DEG DB PGNCS	32038.	.8	733.7	54.	
139.5	EST. 0.3 DEG/SEC ROLL	32038.	.2	733.5	54.	
139.5	PITCH AND YAW CONTROL	32034.	3.9	729.6	54.	
142.2	CISLUNAR NAVIGATION STAR/EARTH HORIZON ORIENT	32033.	1.0	728.7	54.	
142.2	MIN. IMPULSE MARKING	32033.	.4	728.2	54.	
142.2	NAV SIGHTING SET 2	32032.	.9	727.3	54.	
142.2	MINIMUM IMPULSE MARKING	32031.	.4	726.9	54.	
143.7	PS2 IMU ALIGN	32031.	.7	726.1	54.	
144.4	MIDCOURSE CORRECTION	32030.	.7	725.4	54.	
144.4	ATT HOLD .5 DEG DB PGNCS	32030.	.3	725.2	54.	
144.4	RCS +X TRANS PGNCS 5 FPS	32011.	18.6	706.4	52.	
145.0	CISLUNAR NAVIGATION STAR EARTH HORIZON ORIENT	32011.	.0	706.6	52.	
145.0	MINIMUM IMPULSE MARKING	32010.	.4	706.1	52.	
145.7	PS2 IMU ALIGN	32010.	.7	705.4	52.	
146.1	MANEUVER TO REENTRY ATTITUDE	32009.	1.0	704.4	52.	

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (%)
146.5	PITCH TO ACQUIRE HORIZON	32008.	.7	703.7	52.
146.5	YAW 45 DEG	32007.	.7	703.0	52.
146.5	ATT HOLD +5 DEG DB PGNCs	32007.	.4	702.6	52.
146.6	CM/SM SEPARATION DELTA VEL=3 FPS	19526.	40.8	691.8	51.

TABLE 3-IV
CM RCS PROPELLANT USAGE SUMMARY

Loaded, lb.	270.0
Less	
Trapped, lb.	32.4
Temperature variation allowance, lb.	6.4
Available for mission planning, lb.	231.2
Nominal Usage	
Separation and attitude hold prior to 0.05 g	12.1
Guidance commands for remainder of reentry	19.5
Operational Reserve, lb.	199.6

TABLE 3-V
Mission C Prime SPS Propellant Budget

<u>Item</u>	<u>Propellant (Lbs)</u>
Loaded	40785
Trapped	-441
Outage	- 18
Unbalance Meter	<u>-100</u>
Available for ΔV	40226
Required for ΔV^1	<u>-31253</u>
Nominal Remaining	8973

¹Includes 14.4 lbs per start for start losses

$$I_{SP} = 314.25 \pm 1.593$$

$$MR = 1.595 \pm 0.0067$$

Vehicle Wt

CSM 22955.7

<u>Burn</u>	<u>ΔV</u>	<u>Propellant Required</u>
TLMC ²	120.	780.0
LOI	2991.	16074.7
Circularization	138.5	648.5
TEI	3531.7	13537.7
TEMС	62	<u>211.9</u>
		31252.7

²2 starts

TABLE 3-VI
CRYOGENIC CONSUMPTION ANALYSIS SUMMARY

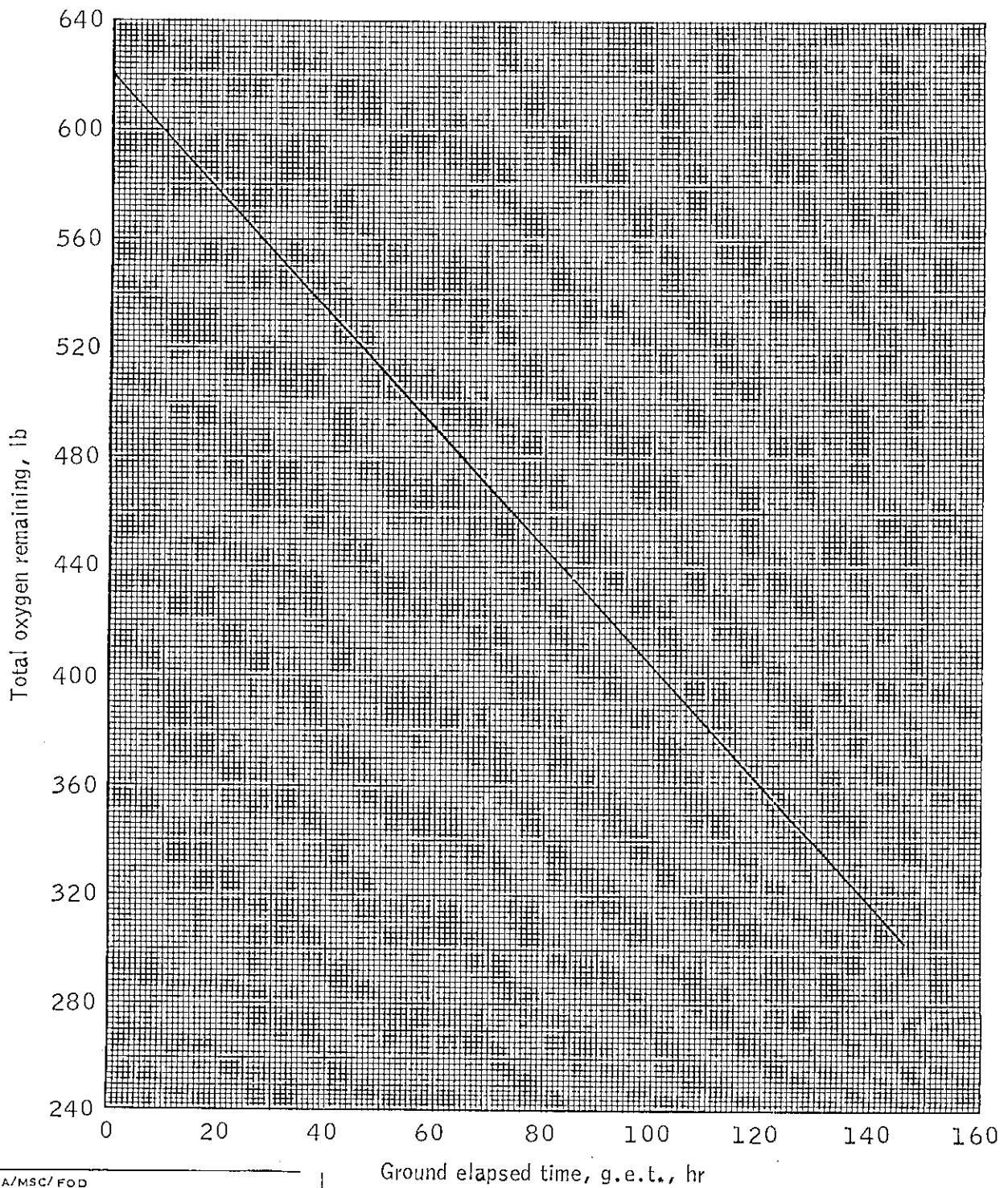
	<u>O₂ (lbs)</u>	<u>H₂ (lbs)</u>
Loaded	653.0	58.4
Residual & Instrumentation Error	30.0	3.9
Available for mission	623.0	54.5
Mission requirements	344.0	33.9
Margin	279.0	20.6

The results of the cryogenic consumption analysis are summarized in the following figures:

1. Figure - Nominal Mission O₂ Profile.
2. Figure - Nominal Mission H₂ Profile.

The following ground rules and assumptions were used for the construction of the mission H₂ and O₂ profiles.

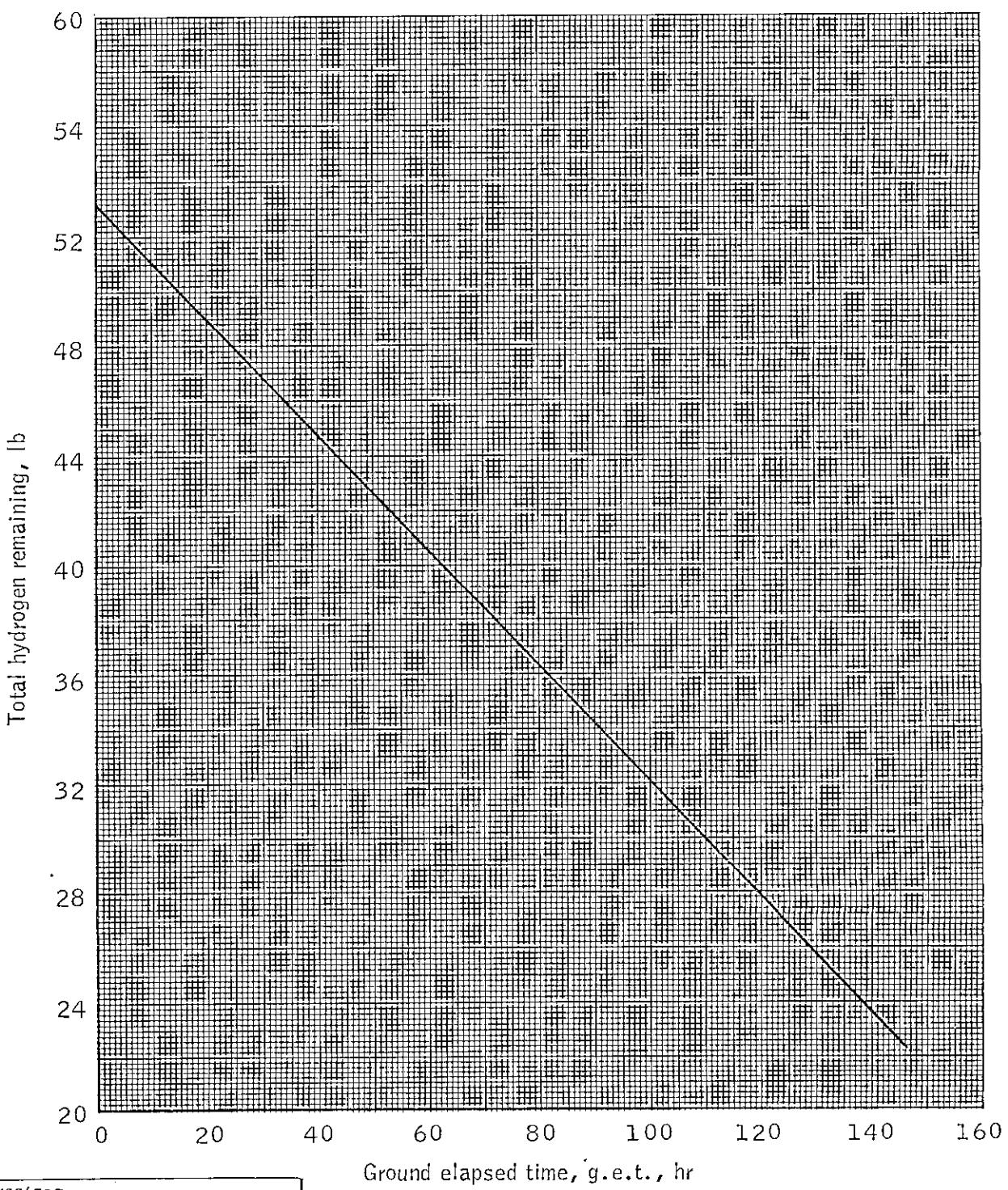
1. 10 fuel cell purges.
2. Cabin O₂ leak rate of 0.2 lb/hr.
3. Metabolic O₂ rate of 0.23 lb/hr for 3 crewmen.
4. Waste management O₂ rate of 0.051 lb/hr.
5. Water tank O₂ purge rate of 0.056 lb/hr.
6. The hydrogen consumption rate is .00257 lb/amp/hr.
7. The oxygen consumption rate is 7.936 times the hydrogen consumption rate.



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Figure 3-VI.- Oxygen profile for Apollo 8.

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MISSION PLANNING AND ANALYSIS DIVISION
BRANCH GPB DATE 11-29-68
BY Scott PLOT NO. 387

Figure 3-VII.- Hydrogen profile for Apollo 8.

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TABLE 3-VII
CREW CHECKLIST PROCEDURE/CONSUMABLES DATA SUMMARY
(AVERAGE ELECTRICAL POWER LOADS)

CREW CHECKLIST PROCEDURE	AVERAGE POWER		BUS VOLTAGE	BATTERY CURRENT	BATTERY POWER	FUEL CELL CURRENT	BUS POWER	CRYO CONSUMPTION		H ₂ O PRODUCTION
	AC	DC						H ₂	O ₂	
	WATTS	WATTS	VOLTS	AMPS	WATTS	AMPS	WATTS	LB/HR	LB/HR	LB/HR
Contingency Drift Flight										
1. Normal	676.6	1067.5	28.75	-	-	74.0	2130	0.189	1.50	1.69
2. Power Down	676.6	905.9	28.90	-	-	67.0	1940	0.174	1.38	1.55
Boost thru Separation and Formation Flying										
1. Lift-Off	770.0	1085.0	29.30	19.0	556.0	58.0	2260	0.149	1.18	1.34
2. 1st Stage Separation	779.1	1812.5	28.65	33.0	945.0	73.5	3060	0.189	1.50	1.69
3. Insertion (Earth Orbit)	734.9	1202.3	28.30	-	-	81.0	2290	0.208	1.65	1.86
4. TLI & Separation Preparation	744.6	1179.5	28.30	-	-	81.0	2290	0.207	1.65	1.85
5. Separation and Formation Flying	764.4	1193.6	28.25	-	-	82.0	2320	0.210	1.67	1.88
Power Up										
1. Stabilization and Control	767.0	1128.0	28.35	-	-	80.0	2270	0.206	1.64	1.84
2. G&N Optics	681.8	1156.6	28.45	-	-	77.5	2210	0.199	1.59	1.77
3. Stabilization and Control, and G&N Optics	772.2	1217.1	28.25	-	-	82.5	2330	0.213	1.68	1.90
G&N/SPS Orbit Change										
1. Initial Conditions	774.8	1156.8	28.30	-	-	81.0	2290	0.208	1.65	1.86
2. Ignition Preparation	788.2	1897.5	28.60	-	-	74.0	3080	0.192	1.52	1.71
3. Ignition	868.5	2458	28.05	45.0	1260	86.5	3690	0.224	1.78	2.00
Battery Charging	724.6	1116.5	28.5	-	-	77.0	2190	0.197	1.57	1.76
G&N SM RCS Orbit Change Thrusting (P41)										
1. Initial Conditions	774.8	1170.2	28.3	-	-	82.0	2320	0.210	1.66	1.87

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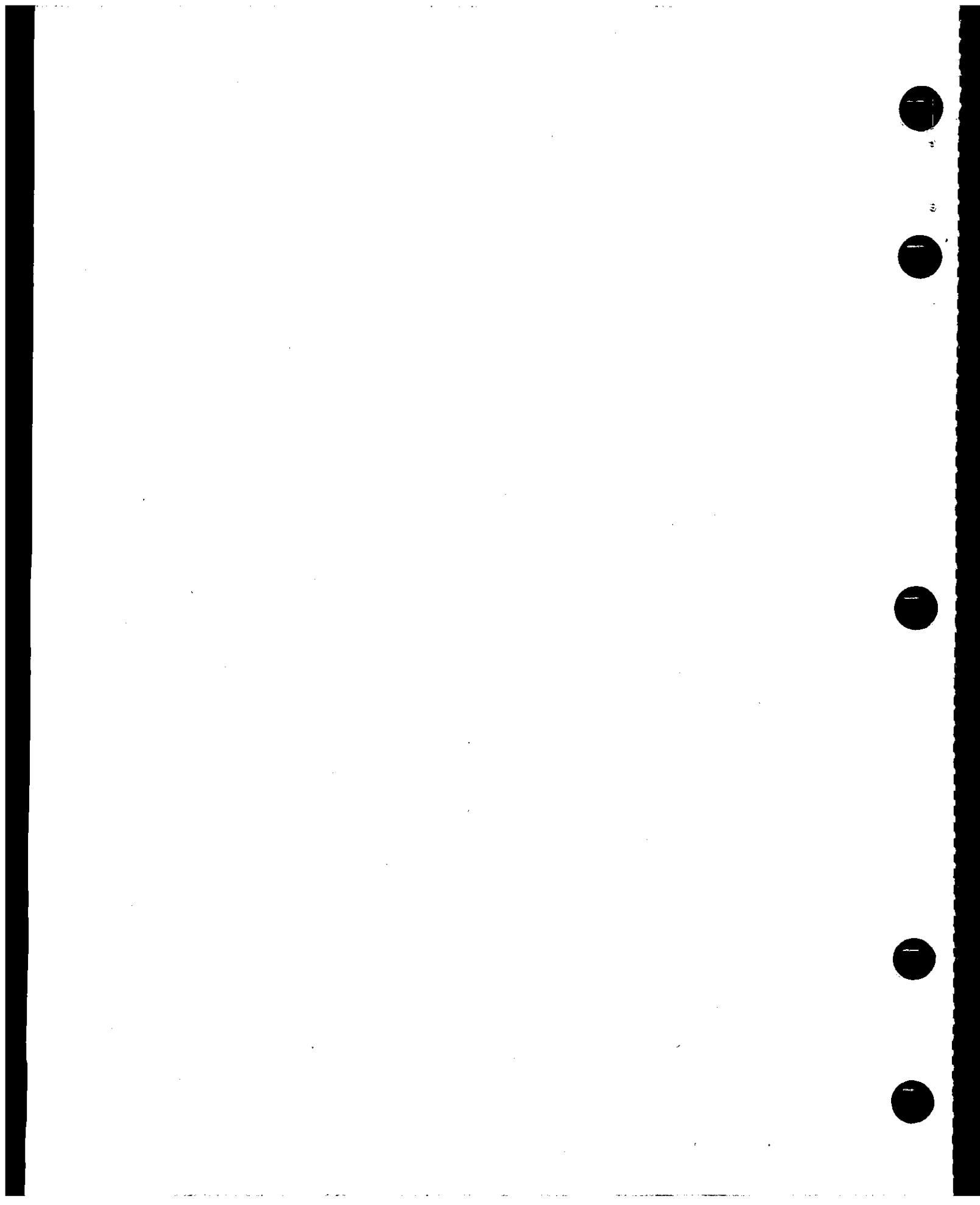
CREW CHECKLIST PROCEDURE/CONSUMABLES DATA SUMMARY
(AVERAGE ELECTRICAL POWER LOADS)

CREW CHECKLIST PROCEDURE	AVERAGE POWER		BUS VOLTAGE	BATTERY CURRENT	BATTERY POWER	FUEL CELL CURRENT	BUS POWER	CRYO CONSUMPTION		H ₂ O PRODUCTION
	AC	DC						H ₂	O ₂	
	WATTS	WATTS	VOLTS	AMPS	WATTS	AMPS	WATTS	LB/HR	LB/HR	LB/HR
2. Ignition	774.8	1602.2	27.6	-	-	97.0	2680	0.250	1.99	2.24
Entry to Landing										
1. Preparation	684.4	1089.2	29.6	23.0	680.0	52.0	2220	0.134	1.06	1.20
2. CM RCS Htrs	684.4	1659.2	29.2	34.0	993.0	62.0	2800	0.159	1.26	1.43
3. CM SM Separation	501.8	760.6	28.5	55.0	1565.0	-	1565.0	-	-	-
4. Entry	492.3	812.7	28.6	56.5	1605.0	-	1605.0	-	-	-
Post Landing	-	86.0	28.0	3.07	86.0	-	86.0	-	-	-



SECTION IV - DETAILED TEST OBJECTIVES

AT. NOTICES



SECTION 4
TEST OBJECTIVE ACTIVITIES

This section contains the activity summaries which reflect the test objectives for Mission C' as described in "Mission Requirements AS 503/CSM 103 C' Type Mission (Lunar Orbit)" dated November 16, 1968. These activity summaries are presented in the approximate sequence in which they are planned to occur during the mission. In the case of activities which are repeated in the mission plan, they are described only once in this summary. Those test objectives which do not relate to specific mission activities are grouped at the end of this section as "Miscellaneous Tests" and "Telecommunications". Test objective requirements which are not scheduled in this flight plan are identified as being not implemented, "N.I."

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 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.

A cross reference for relating Detailed and Functional Test Objectives with the activity summaries is 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 or the crew procedures.
- B. CSM data storage equipment (DSE) HBR recording is needed only when MSFN coverage is not available and when mandatory data are required.
- C. Data collected by the crew which are required only for postflight analysis, need not be voiced to MSFN in real time.

TEST OBJECTIVE/MISSION ACTIVITY
CROSS REFERENCE

DTO/FTO NUMBER	TEST OBJECTIVE	MISSION ACTIVITY	SECTION PAGE NO.
S1.27 S1.27-1 S1.27-2	GNCS Boost Monitor/Saturn V Boost Monitor - GNCS Performance Boost Monitor - Display Adequacy	Launch Launch	4-8 4-8
S1.30 S1.30-1 S1.30-2 S1.30-3	IMU Performance GNCS Accelerometer Biases During Coasting Flight GNCS/IRIG Drift Rates During Coasting Flight Overall GNCS Errors During Thrusting Maneuvers	PIPA Bias Check IMU Realignment Lunar Orbit Insertion	4-18 4-15 4-8, 27
P1.31 P1.31-1 P1.31-2	GNCS Entry Lunar Return GNCS Performance During Entry - Lunar Return EMS Capability to Monitor Entry - Lunar Return	Entry Entry	4-12, 35 4-12, 35
S1.32 S1.32-1 S1.32-2 S1.32-3 S1.32-4 S1.32-5	Midcourse Navigation/Star Earth - Landmark Star/Earth Landmark Navigation Sighting Accuracy Verify and Update Landmark Lighting Constraints OSS Adequacy for Navigation Sightings in Deep Space Crew Capability to Identify Landmarks and Coordinate Optics/Maneuvers RCS Propellant Use and Time to Accomplish Onboard Navigation	Star/Earth Landmark Navigation Star/Earth Landmark Navigation Star/Earth Landmark Navigation Star/Earth Landmark Navigation Star/Earth Landmark Navigation Star/Earth Landmark Navigation	4-11, 20 4-11, 20 4-11, 20 4-20 4-20
P1.33 P1.33-1 P1.33-2 P1.33-3 P1.33-4	Midcourse Navigation/Star-Lunar Horizon Star/Lunar Horizon Navigation Sighting Accuracy OSS Adequacy for Navigation Sightings in Deep Space Crew Capability to Coordinate Optics/Maneuvers RCS Propellant Use and Time to Accomplish Onboard Navigation	Star/Lunar Horizon Navigation Star/Lunar Horizon Navigation Star/Lunar Horizon Navigation Star/Lunar Horizon Navigation	4-24 4-24 4-24 4-24

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TEST OBJECTIVE/MISSION ACTIVITY
CROSS REFERENCE

DTO/FTO NUMBER	TEST OBJECTIVE	MISSION ACTIVITY	SECTION PAGE NO.
P1.34 P1.34-1 P1.34-2 P1.34-3 P1.34-4 P1.34-5	Midcourse Navigation/Star-Earth Horizon Star/Earth Horizon Navigation Sighting Accuracy Verify and Update Horizon Lighting Constraints OSS Adequacy for Navigation Sightings in Deep Space Crew Ability to Identify Horizon Locator and Coordinate Optics/Maneuvers RCS Propellant Use and Time to Accomplish Onboard Navigation	Star/Earth Horizon Navigation Star/Earth Horizon Navigation Star/Earth Horizon Navigation Star/Earth Horizon Navigation Star/Earth Horizon Navigation Star/Earth Horizon Navigation	4-16 4-16 4-16 4-16 4-16 4-16
S1.35 S1.35-1 S1.35-2 S1.35-3	IMU Orientation Determination/Visibility IMU Realignment in Daylight Obtain Data - Star Visibility During TL and TE Coast Degradation of Navigation/IMU Align by Vented/Ejected Particles	IMU Realignment Star Visibility Star Visibility	4-31 4-15 4-26 4-26
S3.21 S3.21-1 S3.21-2 S3.21-3 S3.21-4	SPS Evaluation SPS ISP - Adequacy of Conversion - Ground to Vacuum Results SPS Performance for LOI and TEI Burns SPS PUGS in Auxiliary Mode - Relative Accuracy Aux/Pri Thermal Effects - Long SPS Burn - Heat Protection System	LOI and TEI LOI and TEI TEI LOI and TEI	4-27,33 4-27,33 4-33 4-27,33
S4.5 S4.5-1 S4.5-2	ECS Lunar Return Entry ECS Performance During Manned Lunar Return Entry Compare ECS Data with Developed Model and Unmanned Results	Entry Entry	4-35 4-35
S6.10 S6.10-1	CSM Omni Antennas Lunar Distance S-Band Performance with Omni Antennas at Lunar Distance	Telecommunications	4-38

TEST OBJECTIVE/MISSION ACTIVITY
CROSS REFERENCE

DTO/FTO NUMBER	TEST OBJECTIVE	MISSION ACTIVITY	SECTION PAGE NO.
P6.11 P6.11-1 P6.11-2 P6.11-3	CSM/MSFN Communications Lunar Distance S-Band Performance with High Gain Antenna - TL Coast S-Band Performance with High Gain Antenna - Lunar Distance CSM HGA Oper. in Potential S/C Reflectivity Region	Telecommunications Telecommunications Not Implemented	4-38 4-38
S7.30 S7.30-1 S7.30-2	Heat Shield Lunar Return Block II Thermal Protection System During Manned Lunar Return TPS Surface Recession and Char Data Comparison	Entry Entry	4-35 4-35
P7.31 P7.31-1 P7.31-2	Spacecraft Environment Thermal Control Evaluate Thermal Control System During TL and TE Coast Thermal Control System During Lunar Orbit	Miscellaneous Tests Miscellaneous Tests	4-20, 36 4-20, 36
P7.32 P7.32-1 P7.32-2 P7.32-3	Spacecraft Dynamic Environment CSM Loads/Vibrations - Launch, TLI and Separation SLA Dynamic Response - Launch, TLI and Separation S-Band HGA Response During Deployment and SPS Burns	Launch, TLI, CSM/S-IVB Sep. Launch, TLI, CSM/S-IVB Sep. CSM/S-IVB Sep., Midcourse, LOI	4-8, 11, 12 4-8, 11, 12 4-19, 12, 27
P7.33 P7.33-1	SLA Panel Jettison SLA Panel Jettison Demonstration	CSM/S-IVB Separation	4-14 4-14
S20.104 S20.104-1 S20.104-2 S20.104-3	Transposition Separation and Transposition Maneuver Separation and Transposition Procedures and Timeline Adequacy S-Band Performance During Transposition	CSM/S-IVB Sep., Transposition CSM/S-IVB Sep., Transposition Telecommunications	4-12, 13, 14 4-12, 13 4-38

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TEST OBJECTIVE/MISSION ACTIVITY
CROSS REFERENCE

DTO/FTO NUMBER	TEST OBJECTIVE	MISSION ACTIVITY	SECTION PAGE NO.
P20.105 P20.105-1	LOI Maneuver Crew/Spacecraft/MSFN Preparation and Execution of LOI Maneuver Procedures and Timeline Adequacy for LOI Maneuver	Lunar Orbit Insertion	4-27
P20.105-2		Lunar Orbit Insertion	4-27
P20.106 P20.106-1	TEI Maneuver Crew/Spacecraft/MSFN Preparation and Execution of TEI Maneuver	Transearch Insertion	4-33
P20.106-2	Procedures and Timeline Adequacy for TEI Maneuver	Transearch Insertion	4-33
P20.107 P20.107-1	Crew Activities Lunar Distance Crew Procedures for Lunar Orbit Mission Crew Procedures and Timeline Adequacy -- Lunar Mission	Miscellaneous Tests	4-36
P20.107-2		Miscellaneous Tests	4-36
S20.108 S20.108-1	CSM Consumables Lunar Mission EPS Use, Performance and Fuel Cell Management Water and Oxygen Requirements Data LiOH Cartridge Requirements Data SPS, SM/RCS and CM/RCS Propellant Requirements Data Crew Food Requirements Data	Miscellaneous Tests Miscellaneous Tests Miscellaneous Tests Miscellaneous Tests Miscellaneous Tests	4-36 4-36 4-36 4-36 4-36
S20.108-2			
S20.108-3			
S20.108-4			
S20.108-5			
P20.109 P20.109-1	Passive Thermal Control Modes PTC Procedures and RCS Use -- Roll with Attitude Hold PTC Procedures and RCS Use - Roll without Attitude Hold	Passive Thermal Control Modes Passive Thermal Control Modes	4-22 4-22
P20.109-2	Communication Procedures Adequacy for PTC Mode	Telecommunications	4-22, 38
P20.109-3			
P20.109-4	PTC Procedures and RCS Use -- Yaw without Attitude Hold	Passive Thermal Control Modes	4-22
P20.110 P20.110-1	Ground Support Lunar Distance Ground Operation Support for Lunar Mission Without LM	Miscellaneous Tests	4-36

TEST OBJECTIVE/MISSION ACTIVITY
CROSS REFERENCE

DTO/FTO NUMBER	TEST OBJECTIVE	MISSION ACTIVITY	SECTION PAGE NO.
P20.111 P20.111-1 P20.111-2 P20.111-3 P20.111-4 P20.111-5 P20.111-6 P20.111-7	Lunar Landmark Tracking Error Uncertainties in Lunar Landing Site Location Obtain Data to Calibrate MSFN at Lunar Distance Determine Minimum Sun Angle to Clearly Identify Landmarks Lunar Landmark Tracking in Earthshine Adequacy of CSS and OSS for Obtaining Landmark Sightings Crew Ability to Coordinate Sightings and Vehicle Maneuvers RCS Propellant and Time Required for Landmark Sighting	Lunar Landmark Tracking Lunar Landmark Tracking	4-29 4-29 4-29 4-29 4-29 4-29 4-29 4-29
P20.112 P20.112-1 P20.112-2 P20.112-3 P20.112-4 P20.112-5	TLI Burn Crew/Ground Capability for TLI at First Opportunity TLI Preparation and Execution Procedure Demonstration TLI Procedures and Timeline Adequacy CSM Cabin Vibration Environment during TLI Burn Crew Monitoring of GNCS and LV Displays - TLI Burn	Pre-TLI and TLI Pre-TLI and TLI Pre-TLI and TLI Translunar Injection Translunar Injection	4-10 4-10, 11 4-10, 11 4-11 4-11
P20.114 P20.114-1 P20.114-2 P20.114-3	Midcourse Correction Capability Procedures and Timeline Adequacy for MCC'S GNCS, SPS and RCS Performance on MCC'S Ground Capability to Update State Vector and Target for MCC	Midcourse Corrections Midcourse Corrections Midcourse Corrections	4-19 4-19 4-19
S20.115 S20.115-1 S20.115-2 S20.115-3 S20.115-4	Lunar Mission Photography from the CSM Overlapping Photos from Terminator to Terminator-Lunar Orbit Photos of Earth and Lunar Landmarks Photos of Earth and Lunar Horizons Photos of General and Scientific Interest	Photography Photo, S/E Landmark Nav. Photo, S/E Landmark Nav., S/L Landmark Nav. Photography	4-31 4-20 4-16, 24, 31 4-31

TEST OBJECTIVE/MISSION ACTIVITY
CROSS REFERENCE

DTO/FTO NUMBER	TEST OBJECTIVE	MISSION ACTIVITY	SECTION PAGE NO.
S20.116 S20.116-1 S20.116-2	Exhaust Effects/CSM Windows Changes in Visual Acuity Through Windows Changes in Total Transmittance of Windows	Launch Transposition Entry	4-8,13 4-35

LAUNCH

A. TEST OBJECTIVES

S1.27-1 Boost Monitor - GNCS Performance
S1.27-2 Boost Monitor - Display Adequacy
S1.30-3 Overall GNCS Errors During Thrusting Maneuvers
P7.32-1 CSM Loads/Vibrations - S-V Boost
P7.32-2 SLA Dynamic Response - S-V Boost
S20.116-1 Changes in Visual Acuity Through Windows

B. TEST REQUIREMENTS

1. CSM insertion into earth orbit by a Saturn V vehicle [1.27, 1.30, 7.32 & 20.116]
2. FQTR operation throughout Saturn V boost [7.32]
3. Crew observations of changes in visual acuity through the windows as the result of TJM firing & S-II retro firing [20.116]

C. TEST PROCEDURES/CHECKLISTS

1. AOH paragraph 4.3.1 "Boost and Insertion"
2. FCAC L-1, L-2, & L-3 "Boost-Insertion"

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs
 - a. FDAO or DSKY display inadequacies [1.27] (M)
 - b. Apparent GNCS trajectory errors [1.27] (M)
 - c. Unexpected structural loads or vibrations [7.32] (M)
 - d. Log changes in visual acuity through windows ("Window Visibility" log) [20.116] (M)
2. Ground Support
 - a. CSM TM HBR [1.27, 7.32] (M)
 - b. Continuous tracking [1.27] (M)
 - c. BET [7.32] (M)
 - d. Dynamic pressure & angle of attack during S-IC operation [7.32] (M)
 - e. Wind data from 0 to 60,000 ft at launch time [7.32] (M)

f. Saturn V thrust variations vs. time-MSFC [7.32] (M)

g. Saturn V accel. & IU gyro data - MSFC [7.32] (M)

A. TEST OBJECTIVES

- P20.112-1 Crew/Ground Capability for TLI at First Injection Opportunity
- P20.112-2 TLI Preparation and Execution Procedure Demonstration
- P20.112-3 TLI Procedures and Timeline Adequacy

B. TEST REQUIREMENTS

- 1. Following earth orbit insertion, flight crew accomplishment of all pre-TLI activities required for a Pacific injection on the second pass
- 2. Ground operational support personnel evaluation of all spacecraft systems and making of the go/no-go decision for the TLI burn

C. TEST PROCEDURES/CHECKLISTS

- 1. AOH paragraph 4.3.2 "Post Orbital Insertion Check"
- 2. AOH paragraph 4.4.1 "Translunar Injection"
- 3. FCAC L-4, L-5, L-1, & L-2 "Post Insertion"
- 4. FCAC L-6 & L-7 "System Verification & Monitoring"
- 5. FCAC L-8 & L-9 "TLI Preparation" to GET 02:50:38

D. DATA REQUIREMENTS

- 1. Flight Crew Reports/Logs
 - a. Procedural and/or timeline difficulties or inadequacies (M)
 - b. Comments regarding feasibility of first Atlantic injection opportunity during the second revolution (M)
- 2. Ground Support
 - a. Flight Director reports of timeline and/or procedural difficulties (M)

TRANSLUNAR INJECTION

A. TEST OBJECTIVES

- P7.32-1 CSM Loads/Vibrations - TLI
- P7.32-2 SLA Dynamic Response - TLI
- P20.112-2 TLI Preparation and Execution Procedure Demo.
- P20.112-3 TLI Procedures and Timeline Adequacy
- P20.112-4 CSM Cabin Vibration Environment During TLI Burn
- P20.112-5 Crew Monitoring of GNCS & LV Displays During TLI

B. TEST REQUIREMENTS

- 1. Ground operational support and flight crew capability to execute the TLI burn [20.112]
- 2. FQTR operation throughout the S-IV burn [7.32]

C. TEST PROCEDURES/CHECKLISTS

- 1. AOH paragraph 4.4.1 "Translunar Injection"
- 2. FCAC L-9 & L-10 "TLI Preparation"

D. DATA REQUIREMENTS

- 1. Flight Crew Reports/Logs
 - a. Procedural and/or timeline difficulties or inadequacies [20.112] (M)
 - b. FDAI, DSKY & LV Tank Pressure display inadequacies [20.112] (M)
 - c. Unexpected induced resonances in cabin (Visual, audible and tactile) [20.112] (M)
 - d. Comments on adequacy of TLI monitoring [20.112] (M)
- 2. Ground Support
 - a. CSM TM HBR [7.32] (M)
 - b. Flight Director reports of procedural and/or timeline difficulties or inadequacies [20.112] (M)

CSM/S-IVB SEPARATION

A. TEST OBJECTIVES

- P7.32-1 CSM Loads/Vibrations - CSM/S-IVB Separation
- P7.32-2 SLA Dynamic Response - CSM/S-IVB Separation
- P7.32-3 S-Band High Gain Antenna Dynamic Response During Deployment
- S20.104-1 Separation and Transposition Maneuver
- S20.104-2 Separation and Transposition Procedures & Timeline Adequacy

B. TEST REQUIREMENTS

- 1. CSM/S-IVB separation, SLA panel jettison and S-band high gain antenna deployment [20.104]
- 2. FQTR operation during the period of the CSM/S-IVB separation, SLA panel jettison and S-band high gain antenna deployment [7.32]

C. TEST PROCEDURES/CHECKLISTS

- 1. AOH paragraph 4.5.1.1, "CSM/SLA Separation Through Capture Latch" through step 5
- 2. FCAC Separation TBD

D. DATA REQUIREMENTS

- 1. Flight Crew Reports/Logs
 - a. Procedural and/or timeline difficulties or inadequacies [20.104] (M)
- 2. Ground Support
 - a. CSM TM HBR [7.32] (M)
 - b. Flight Director reports of procedural and/or timeline difficulties or inadequacies [20.104] (M)

TRANSPOSITION

A. TEST OBJECTIVES

- S20.104-1 Separation and Transposition Maneuver
- S20.104-2 Transposition Procedures and Timeline Adequacy
- S20.116-1 Changes in Visual Acuity Through Windows

B. TEST REQUIREMENTS

1. After separation, a (+X) translation from the S-IVB for three seconds, a coast for one minute to approximately 70 ft., a (-X) translation for 1 1/2 seconds, and then a pitch up at 4°/sec until the spacecraft (+X) axis points at the S-IVB [20.104]
2. Determination if there are any changes in visual acuity through the windows as the result of SM RCS use [20.116]

C. TEST PROCEDURES/CHECKLISTS

1. AOH paragraph 4.5.1.1, "CSM/SLA Separation Through Capture Latch" step 6
2. FCAC Transposition TBD

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs
 - a. Procedural and/or timeline difficulties or inadequacies [20.104] (M)
 - b. Inadequacies in communications with ground operational support [20.104] (M)
 - c. Log changes in visual acuity through the windows from SM RCS use ("Window Visibility" log) [20.116] (M)
2. Ground Support
 - a. CSM TM HBR [20.104] (M)
 - b. USB tracking data processor output recording [20.104] (M)
 - c. USB TM bit stream recording [20.104] (M)
 - d. MSFN tape records of S-band received signal strength [20.104] (M)
 - e. MSFN tape recordings of CSM to MSFN and MSFN to CSM voice [20.104] (M)
 - f. Flight Director reports of procedural and/or timeline difficulties or inadequacies [20.104] (M)
 - g. BET [20.104] (M)

FORMATION FLYING

A. TEST OBJECTIVES

P7.33-1 SLA Panel Jettison Demonstration
S20.104-1 Separation and Transposition Maneuver

B. TEST REQUIREMENTS

1. Formation flying with the S-IVB to acquire the following photographs:
 - a. Sequence camera photographs of the S-IVB following transposition [20.104] (HD)
 - b. Photographs of the SLA aft portion and LTA-B showing that the panels jettisoned and of any anomaly observed [7.33] (M)

C. TEST PROCEDURES/CHECKLISTS

1. AOH paragraph 4.5.1.2 "Formation Flight With S-IVB (General)"
2. Photo checklist TBD

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs
 - a. Observed anomalies in the jettison of the SLA panels or launch vehicle instability [7.33] (M)
 - b. Disposition of any observed SLA panels [7.33] (M)
 - c. Sequence photographs of the S-IVB following transposition [20.104] (HD)
 - d. Photographs of the SLA aft portion and the LTA-B showing that the panels jettisoned and of any anomalies observed [7.33] (M)
2. Ground Support
 - a. None

IMU REALIGNMENT

A. TEST OBJECTIVES

S1.30-2 GNCS IRIG Drift Rates During Coasting Flight
S1.35-1 IMU Realignment in Daylight

B. TEST REQUIREMENTS

1. At least two sets of back-to-back IMU realignments (at least one hour apart without an intervening ΔV maneuver) to determine IRIG drift rates [1.30]
2. One IMU realignment in daylight when at an altitude of greater than 2000 NM [1.35]

C. TEST PROCEDURES/CHECKLISTS

1. AOH paragraph 4.11.1 "IMU Orientation Determination (P51)" or
2. AOH paragraph 4.11.2 "IMU Realign (P52)"
3. FCAC "P51 - IMU Orientation" or
4. FCAC "P52 - IMU Realign"

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs - None
2. Ground Support - CSM TM [1.30] (M)

STAR/EARTH HORIZON NAVIGATION

A. TEST OBJECTIVES

- P1.34-1 Star/Earth Horizon Navigation Sighting Accuracy
- P1.34-2 Verify and Update Horizon Lighting Constraints
- P1.34-3 OSS Adequacy for Navigation Sightings in Deep Space
- P1.34-4 Crew Ability to Identify Horizon Locator and Coordinate Optics/Maneuvers
- P1.34-5 RCS Propellant Use and Time to Accomplish Onboard Navigation
- S20.115-3 Photographs of Earth and Lunar Horizons

B. TEST REQUIREMENTS

1. Use of the trunnion calibration option of P23 preceding a set of sightings if more than about 30 minutes has elapsed since the previous P23 trunnion calibration [1.34]
2. Translunar - Near Earth
 - a. Five sets of star/earth horizon sightings at more than 15,000 NM and less than 50,000 NM from the center of the earth [1.34]
 - b. At least 10 sequence photographs through the special sextant camera adapter while duplicating star/horizon navigation sightings when between 10,000 and 30,000 NM from the earth on TL phase. It is desirable that these photographs be taken at varying distances [20.115] - Not Implemented
 - c. Update of the onboard state vector utilizing the navigation sighting data following each set of sightings [1.34]
3. Translunar - Midcourse
 - a. Eighteen sets of star/earth horizon sightings at more than 50,000 NM from both the earth and the moon [1.34]
 - b. Update of the onboard state vector utilizing the navigation sighting data following each set of sightings [1.34]
4. Transearth
 - a. Star/earth horizon sightings under the following conditions [1.34]
 - (1) Seventeen sets at more than 50,000 NM from the earth and moon
 - (2) Three sets at less than 50,000 NM from the center of the earth
 - b. Update of the onboard state vector utilizing the navigation sighting data following each set of sightings [1.34]

C. TEST PROCEDURES/CHECKLISTS

1. AOH paragraph 4.12.3 "Cislunar Midcourse Navigation (P23) including "Trunnion Calibration" option
2. FCAC G-20A "P23 Cislunar Midcourse Navigation Measurement"
3. Photo checklist TBD

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs
 - a. Difficulties and/or inadequacies noted in handling the optics and the spacecraft [1.34] (M)
 - b. Log navigation data on Flight Plan timeline [1.34] (M)
 - c. Photo log TBD [20.115] (M)
2. Ground Support
 - a. CSM TM HBR [1.34] (M)
 - b. BET [1.34] (M)

PIPA BIAS CHECK

A. TEST OBJECTIVES

S1.30-1 GNCS Accelerometer Biases During Coasting Flight

B. TEST REQUIREMENTS

1. MSFN collection of PIPA bias data at least five times during the mission using uninterrupted TM for at least five minutes as follows:
 - a. Prior to and following an SPS burn of at least 40 seconds
 - b. As close to entry as possible
 - c. Any two other periods in the mission
2. Onboard test performed only if communications are lost

C. TEST PROCEDURES/CHECKLISTS

1. AOH paragraph 4.10.1.13 "Measurement and Loading of PIPA Bias"
2. FCAC G-51 "Measure & Load PIPA Bias"

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs
 - a. Log PIPA bias data on Flight Plan timeline if PIPA bias tests are performed onboard
2. Ground Support
 - a. CSM TM (M)

MIDCOURSE CORRECTIONS

A. TEST OBJECTIVES

- P7.32-3 S-Band High Gain Antenna Dynamic Response During SPS burns
- P20.114-1 Procedures and Timeline Adequacy for Midcourse Corrections
- P20.114-2 GNCS, SPS & RCS Performance on Midcourse Corrections
- P20.114-3 Ground Capability to Update State Vector and Target for MCC

B. TEST REQUIREMENTS

- 1. Ground update of the CSM state vector and of the MCC target [20.114]
- 2. MCC maneuver performance [20.114]
- 3. FQTR operation during SPS ignition, cutoff and for at least five seconds during the burn [7.32]

C. TEST PROCEDURES/CHECKLISTS

- 1. AOH paragraph 4.10.1.5 "CSM-CMC Update P27"
- 2. AOH paragraph 4.14.2 "G&N/SPS Orbit Change Thrusting (P40)" or
- 3. AOH paragraph 4.14.3 "G&N SM RCS Orbit Change Thrusting (P41)"
- 4. FCAC G-21 "P27 CMC Update"
- 5. FCAC G-30 "P40 SPS Thrust" or
- 6. FCAC G-37 "P41 RCS Thrust"

D. DATA REQUIREMENTS

- 1. Flight Crew Reports/Logs
 - a. Procedural and/or timeline difficulties or inadequacies [20.114] (M)
- 2. Ground Support
 - a. CSM TM HBR [20.114] (M)
 - b. BET [20.114] (M)
 - c. Flight Director reports of procedural and/or timeline difficulties or inadequacies [20.114] (M)

STAR/EARTH LANDMARK NAVIGATION

A. TEST OBJECTIVES

- S1.32-1 Star/Earth Landmark Navigation Sighting Accuracy
- S1.32-2 Verify and Update Landmark Sighting Constraints
- S1.32-3 OSS Adequacy for Navigation Sightings in Deep Space
- S1.32-4 Crew Capability to Identify Landmarks and Coordinate Optics/Maneuvers
- S1.32-5 RCS Propellant Use and Time to Accomplish Onboard Navigation
- S20.115-2 Photographs of Earth and Lunar Landmarks

B. TEST REQUIREMENTS

- 1. Use of the trunion calibration option of P23 preceding these sets of sightings
- 2. Star/earth landmark sightings under the following conditions [1.32]:
 - a. Three sets after TLI while the spacecraft is less than 50,000 NM from the surface of the earth (TL or TE). These sightings may be made on the same landmark but three different stars will be used
 - b. One set at a sun elevation angle of less than ten degrees. One of the above sightings can be used to satisfy this requirement
- Note - Performing sightings on one landmark and one star, then making from three to five "marks" constitutes one set of sightings
- 3. Approximately ten sequence photographs through the special sextant camera adapter immediately after performing each group of star/earth landmark sightings. This photography must not jeopardize any nav sightings [20.115] - Not Implemented
- 4. Identification of the landmark closest to sunrise or sunset that is considered acceptable for landmark tracking [1.32]

C. TEST PROCEDURES/CHECKLISTS

- 1. AOH paragraph 4.12.3 "Cislunar Midcourse Navigation (P23)" including "trunion calibration" option
- 2. FCAC G-20A "P23 Cislunar Midcourse Nav Measurement"
- 3. Photo checklist TBD

D. DATA REQUIREMENTS

- 1. Flight Crew Reports/Logs
 - a. Difficulties and/or inadequacies noted in handling the optics and the spacecraft [1.32] (M)

- b. Log navigation data on Flight Plan timeline [1.32] (M)
 - c. Photo log TBD [20.115] (HD)
2. Ground Support
- a. CSM TM HBR [1.32] (M)
 - b. BET [1.32] (M)

PASSIVE THERMAL CONTROL MODES

A. TEST OBJECTIVES

- P109-1 PTC Procedures & RCS Use - Roll With Att. Hold
- P109-2 PTC Procedures & RCS Use - Roll W/O Att. Hold
- P109-3 Communications Procedures Adequacy for PTC Mode
- P109-4 PTC Procedures & RCS Use - Yaw W/O Att. Hold

B. TEST REQUIREMENTS

1. At least six uninterrupted hours of PTC in the translunar phase with the following conditions:
 - a. CSM (X) axis oriented perpendicular to the sun-spacecraft line and with the (-X) axis approximately perpendicular to the CSM-earth line of sight
 - b. Spacecraft attitude control in maximum deadband in pitch and yaw and roll free and rolling from 0.1 to 0.5 deg/sec.
2. At least six uninterrupted hours of PTC in the transearth phase with the following conditions:
 - a. CSM (X) axis oriented perpendicular to the sun-spacecraft line and with the (-X) axis approximately perpendicular to the CSM-earth line of sight
 - b. Spacecraft attitude control free in all axes with a roll rate of from 0.1 to 0.5 deg/sec
 - c. Deviation (coning) of (-X) axis from original orientation to be maintained to less than 15 degrees
3. If the above two modes are found to be inadequate during real time, at least six uninterrupted hours of PTC in the transearth phase with the following conditions:
 - a. CSM (+X) axis toward the sun with the high gain antenna boom on the earth side in the sun-earth-moon plane.
 - b. Spacecraft attitude control free with rotation about the major inertia axis at a rate of between 0.1 and 0.5 deg/sec
 - c. Deviations of rotational axis from original orientation to be maintained less than 7.5 degrees
4. Normal communications procedures evaluation during PTC

C. TEST PROCEDURES/CHECKLISTS

1. AOH paragraph TBD - meanwhile use "Special PTC Procedure"
2. "Passive Thermal Control Mode 1" (X Axis Roll, Pitch and Yaw Hold) or

3. "Passive Thermal Control Mode 2" (X Axis Roll W/O Pitch and Yaw Hold) or
4. "Passive Thermal Control Mode 3" (Yaw - Z Axis with Pitch and Roll Free)

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs
 - a. Procedural difficulties in establishing, maintaining or terminating PTC (M)
 - b. Narration of procedure and results when establishing or correcting the PTC Mode (M)
 - c. Difficulties in establishing and maintaining S-band communications during the PTC Mode (M)
 - d. Log PTC maneuver correction times & difficulties on the Flight Plan timeline where they occur (M).
2. Ground Support
 - a. CSM TM HBR (M)
 - b. BÉT (M)
 - c. MSFN records of received S-band signal strength (M)
 - d. Flight Director reports of procedural and/or timeline difficulties or inadequacies (M)

STAR/LUNAR HORIZON NAVIGATION

A. TEST OBJECTIVES

- P1.33-1 Star/Lunar Horizon Navigation Sighting Accuracy
- P1.33-2 OSS Adequacy for Navigation Sightings in Deep Space
- P1.33-3 Crew Capability to Coordinate Optics/Maneuvers
- P1.33-4 RCS Propellant Use and Time to Accomplish Onboard Navigation
- S20.115-3 Photographs of Earth and Lunar Horizons

B. TEST REQUIREMENTS

1. Use of the trunnion calibration option of P23 preceding a set of sightings if more than about 30 minutes has elapsed since the previous P23 trunnion calibration [1.33]
2. Translunar - Near Earth
 - a. Five sets of star/lunar horizon sightings at more than 15,000 NM and less than 50,000 NM from the center of the earth [1.33]
 - b. Update of the onboard state vector utilizing the navigation sighting data following each set of sightings [1.33]
3. Transearth - Near Moon
 - a. Fourteen sets of star/lunar horizon sightings at less than 50,000 NM from the center of the moon (1.33)
 - b. Update of the onboard state vector utilizing the navigation sighting data following each set of sightings [1.33]
 - c. At least 10 sequence photographs through the special sextant camera adapter while duplicating star/horizon navigation sightings when between 10,000 and 20,000 NM from the moon on the TE phase. It is desirable that these photographs be taken at varying distances [20.115] - Not Implemented
4. Transearth - Midcourse
 - a. Nineteen sets of star/lunar horizon sightings at more than 50,000 NM from the center of the moon [1.33]
 - b. Update of the onboard state vector utilizing the navigation sighting data following each set of sightings [1.33]

C. TEST PROCEDURES/CHECKLISTS

1. AOH paragraph 4.12.3 "Cislunar Midcourse Navigation (P23)" including "trunnion calibration" option
2. FCAC G-20A "P23 Cislunar Midcourse Navigation Measurement"
3. Photo checklist TBD

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs
 - a. Difficulties and/or inadequacies noted in handling the optics and the spacecraft [1.33] (M)
 - b. Log navigation data on Flight Plan timeline [1.33] (M)
 - c. Photo log TBD [20.115] (HD)
2. Ground Support
 - a. CSM TM HBR [1.33] (M)
 - b. BET [1.33] (M)

STAR VISIBILITY

A. TEST OBJECTIVES

- S1.35-2 Obtain Data - Star Visibility During TL and TE Coast
- S1.35-3 Degradation of Navigation or IMU Alignment by Vented or Ejected Materials

B. TEST REQUIREMENTS

1. Star visibility tests by observing the star field surrounding the navigation star targets of opportunity through the SCT and identifying the dimmest star in the star pattern under at least the following conditions:
 - a. Sun - SCT LOS approximately 120°
 - b. Sun - SCT LOS approximately 70°
2. Light adaptation period required prior to performing visibility tests
3. Evaluation of the effect of vented particles on the use of the optics during IMU realignments and navigation sightings

C. TEST PROCEDURES/CHECKLISTS

1. AOH paragraph 4.11.2 "IMU Realign (P52)" or
2. AOH paragraph 4.12.3 "Cislunar Midcourse Navigation (P23)"
3. FCAC G-39 "P52 IMU Realign" or
4. FCAC G-20A "P23 Cislunar Midcourse Navigation Measurement"

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs

Identify and record dimmest star during each visibility test

2. Ground Support

BET during star visibility tests (M)

LUNAR ORBIT INSERTION

A. TEST OBJECTIVES

- S1.30-3 Overall GNCS Errors During Thrusting Maneuvers
- S3.21-1 SPS Isp - Adequacy of Conversion of Gnd. to Vacuum Results
- S3.21-2 SPS Performance for LOI and TEI Burns
- S3.21-4 Thermal Effects - Long SPS Burn - Heat Protection System
- P7.32-3 S-Band High Gain Antenna Dynamic Response During SPS Burns
- P20.105-1 Crew/Spacecraft/MSFN Preparation and Execution of LOI Maneuver
- P20.105-2 Procedures and Timeline Adequacy for LOI Maneuver

B. TEST REQUIREMENTS

1. SPS operation to insert the CSM into lunar orbit in two stages as follows [20.105]:
 - a. The first burn of approximately 245 seconds in duration will insert the CSM into a 60 x 170 NM orbit
 - b. The second burn of approximately 10 seconds in duration will circularize the orbit to 60 NM
2. CSM fully loaded at liftoff [20.105]
3. FQTR ON for SPS thrust buildup, 5 sec at steady state and for thrust tailoff , during first LOI-1 only [7.32]
4. DSE recording immediately before, during, and after both burns [3.21]
5. DSE recording or TM for at least five seconds duration at approximately 15 minute intervals for about three hours after LOI-1 [3.21]
6. After LOI-1 it is HD to orient the CSM to an attitude that will result in a near constant external thermal environment to the SPS aft bulkhead during the subsequent 45 minute period. The aft bulkhead should be shielded from solar radiation during this period by orienting the (+X) axis toward the sun [3.21] N.I.
7. IMU realignment performed as soon prior to LOI-1 as practicable [20.105]

C. TEST PROCEDURES/CHECKLISTS

1. AOH paragraph 4.14.2 "G&N SPS Orbit Change Thrusting (P40)"
2. FCAC G-32 "SPS Thrusting (P40)"

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs
 - a. Procedural and/or timeline difficulties or inadequacies [20.105] (M)

- b. Feasibility of monitoring abort parameters on FDAO's [20.105] (M)
 - c. Adequacy of contact with ground operational support [20.105] (HD)
 - d. If the PU valve position is changed, record GET \pm 1 sec and new valve position [3.21] (M)
2. Ground Support
- a. CSM TM LBR [20.105] (M)
 - b. BET [3.21] (HD), [20.105] (M)
 - c. Flight Director reports of procedural and/or timeline difficulties or inadequacies [20.105] (M)

LUNAR LANDMARK TRACKING

A. TEST OBJECTIVES

- P20.111-1 Error Uncertainties in Lunar Landing Site Location
- P20.111-2 Obtain Data to Calibrate MSFN at Lunar Distance
- P20.111-3 Determine Minimum Sun Angle to Clearly Identify Lunar Landmarks
- P20.111-4 Lunar Landmark Tracking in Earthshine
- P20.111-5 Adequacy of CSS and OSS for Obtaining Landmark Sightings
- P20.111-6 Crew Ability to Coordinate Landmark Sightings and Vehicle Maneuvers
- P20.111-7 RCS Propellant and Time Required for Landmark Sighting

B. TEST REQUIREMENTS

- 1. At least 12 sets of four marks each obtained on four selected landmarks according to the following schedule:
 - a. Track a pre-selected pseudo landing site (same terrain and lighting as the lunar landing site) for four consecutive revolutions. The sun elevation angle to be five degrees on the first tracking orbit
 - b. Track three pre-selected landmarks (or others deemed acceptable by the crew). The same three landmarks to be tracked in a four orbit tracking sequence. It is highly desirable that the sun angle be greater than 60 degrees.
 - c. An attempt made to track a landmark at a sun elevation angle of three degrees
- 2. On one revolution, CMP verbal description of the terrain near the sunrise terminator as observed through the scanning telescope. The observation to be made from about 10° preceding the terminator to about 15° past the terminator in the earthlit portion of the dark side. The optics angle to be fixed and the spacecraft in an orbital rate mode.
- 3. If the observations made of the earthlit landmarks reveals that it is feasible, it is highly desirable that the crew track two landmarks (four marks each) on two successive earthlit passes.
- 4. IMU realigned during the dark pass preceding each tracking sequence
- 5. DSE Tape Recorder ON for 20 seconds following each set of marks while N49 (ΔR , ΔV) displayed
- 6. ORDEAL functioning

7. Photographic records of each of the four tracked landmarks using the special sextant camera adapter and D. A. camera at 12 Fps and taking the photographs at the same time as making the MARK during sighting. Take one photograph of each landmark on two consecutive passes (i.e., eight pictures)

C. TEST PROCEDURES/CHECKLISTS

1. AOH paragraph 4.12.2, "Orbital Navigation (P22)"
2. FCAC G-18 "P22 Orbital Navigation"
3. FCAC "Lunar Landmark Tracking" TBD
4. Reference Photographic Operation's Plan, Apollo 8

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs
 - a. Verbal description of lunar terrain during earthshine landmark lighting evaluation (M)
 - b. Comments on the effect of earthshine while tracking lunar landmarks (M)
 - c. Procedural and/or timeline difficulties or inadequacies (M)
 - d. "Landmark Tracking Log" (Flight Plan)
 - e. Photo log
 1. Film mag IP
 2. GET camera - ON
 3. Initial shutter speed
 4. Final shutter speed
 5. Estimated remaining film at beginning and end of a sequence

PHOTOGRAPHY

A. TEST OBJECTIVES

- 1.35-3 Photographs of Vented Particles Through Windows
- 20.115-1 Overlapping Photographs from Terminator to Terminator -
Lunar Orbit
- 20.115-3 Photographs of Earth and Lunar Landmarks
- 20.115-4 Photographs of General and Scientific Interest

B. TEST REQUIREMENTS

- 1. Terminator-to-terminator photographs on at least two passes as follows:
 - a. The first pass consisting of vertical photos with 55-60% forward overlap taken at 20 sec intervals
 - b. The subsequent pass consisting of photos taken with the camera axis 20° from local vertical. From the far side terminator to 90° sun elevation at the nadir, the camera axis will be inclined 20° foreward along the orbital plane. At 90°, the camera axis will be aligned 20° aft of the nadir in the orbital plane
- 2. Sequence camera photographs if possible of the following targets of opportunity:
 - a. Vertical zero phase (250 mm lens)
 - b. High angle zero phase: Apollo landing sites and geologic units (250 mm lens)
 - c. Vertical terminator (250 mm lens)
 - d. Oblique terminator (250 mm lens)
 - e. Specific feature near vertical and oblique (250 mm)
 - f. Specific area near vertical (80 mm)
 - g. Lunar exploration site:
 - (1) Near vertical or oblique as required (250 mm lens)
 - (2) Approach (250 mm lens)
 - h. Surveyor landing sites (250 mm lens)
 - i. Other features and phenomena as observed (250 mm lens)
 - j. Image motion compensation (250 mm lens)

3. Dim light and astronomical photos attempted either during TL or TE coast or during dark portion of lunar orbits
 - a. Total darkness preferred -- S/C lighting also as low as possible
 - b. Specific star fields should be taken during TL and TE coast and in lunar orbit during earthshine
4. Photos taken of the lunar surface during earthshine
5. Solar corona photos taken at sunrise or sunset in lunar orbit using the moon as an occultating disc
6. Earth photos during TL coast when the S/C is within 40,000 NM of the earth. The S/C shall be oriented with the (+X) axis toward earth for approximately 10 minutes for these photos
7. Sequence camera photographs of the lunar terrain as viewed through the rendezvous window while duplicating the Post LOI-2 approach attitude of missions F and G.
8. Photographs of vented particles through windows when observed

C. TEST PROCEDURES/CHECKLISTS

1. Photographic Operation Plan for Apollo Mission C'

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs

- a. Photos of lunar surface per Test Requirement No. 1 above (M)
- b. Photos of scientific and general interest subjects as defined by photo plan (HD)

2. Ground Support

BET (M)

TRANSEARTH INSERTION

A. TEST OBJECTIVES

- S3.21-1 SPS Isp - Adequacy of Conversion of Ground to Vacuum Results
- S3.21-2 SPS Performance for LOI and TEI Burns
- S3.21-3 SPS PUGS in Auxiliary Mode - Relative Accuracy of Aux and Pri
- S3.21-4 Thermal Effects - Long SPS Burn - Heat Protection System
- P20.106-1 Crew/Spacecraft/MSFN Preparation and Execution of TEI Maneuver
- P20.106-2 Procedures and Timeline Adequacy for TEI Maneuver

B. TEST REQUIREMENTS

- 1. SPS use for injection of the CSM into transearth coast [3.21]
- 2. DSE recording of TM for the period 40 seconds prior to, during, and two minutes after the TEI burn [3.21, 20.116]
- 3. DSE recording or TM of at least five seconds duration at approximately 15 minute intervals for about three hours after TEI [3.21]
- 4. PUGS mode switch in the AUX position during the SPS burn [3.21]
- 5. After the burn it is HD to orient the CSM to an attitude that will result in a near constant external thermal environment to the SPS during the subsequent 45 minute period. The aft bulkhead should be shielded from solar radiation during this period by orienting the (+X) axis toward the sun [3.21] - N.I.
- 6. IMU realignment performed as soon before TEI as practicable [20.106]
- 7. CMC update provided on a timeline similar to the LLM such that errors at T_{ig} can be determined and compared with predicted estimates [20.106]

C. TEST PROCEDURES/CHECKLISTS

- 1. AOH paragraph 4.14-2 "G&N SPS Orbit Change Thrusting (P40)"
- 2. FCAC G-32 "SPS Thrusting (P40)"

D. DATA REQUIREMENTS

- 1. Flight Crew Reports/Logs
 - a. Adequacy of contact with ground operational support [20.106] (HD)
 - b. If the PU valve position is changed, record GET ± 1 sec and new valve position [3.21] (M)

2. Ground Support

1. CSM TM LBR [3.21, 20.106] (M)
2. BET [3.21] (HD), [20.106] (M)
3. Flight Director reports of procedural and/or timeline difficulties or inadequacies [20.106] (M)
4. Flight Operations Plan [20.106] (M)

A. TEST OBJECTIVES

- 1.31-1 GNCS Performance During Entry - Lunar Return
- 1.31-2 EMS Capability to Monitor Entry - Lunar Return
- 4.5-1 ECS Performance During Manned Lunar Return Entry
- 4.5-2 Compare ECS Data With Development Model & Unmanned Results
- 7.30-1 Block II Thermal Protection System - Manned Lunar Return Entry
- 7.30-2 TPS Surface Recession and Char Data Comparison With Models
- 20.116-2 Changes in Total Transmittance of Windows

B. TEST REQUIREMENTS

- 1. Entry velocity at 400,000 ft. altitude at least 36,000 feet per second [7.30]
- 2. Automatic lunar return entry - nominal range 1350 NM and 2500 NM maximum for inclement weather [1.31]
- 3. DSE ON during entry "blackout" - recorder fully rewound and on HBR starting at CSM/SM separation [1.31]
- 4. Crew monitor the EMS and record voice on the DSE during entry [1.31]

C. TEST PROCEDURES/CHECKLISTS

- 1. AOH paragraph 4.17.7, "G and N Entry"
- 2. FCAC "Entry"

D. DATA REQUIREMENTS

- 1. Flight Crew Reports/Logs
 - a. Comments on adequacy of DSKY, FDAO and EMS displays to evaluate entry conditions [1.31] (HD)
 - b. Comments on crew comfort [4.5] (HD)
- 2. Ground Support
 - a. CSM TM HBR [1.31, 4.5] (M)
 - b. BET [1.31, 7.30] (M)
 - c. EMS Scroll Recovery [1.31] (M)
 - d. CM Recovery [7.30] (M)
 - e. Heat Shield core sample after recovery [7.30] (M)
 - f. All S/C window outer panes after recovery [20.116] (M)

MISCELLANEOUS TESTS

A. TEST OBJECTIVES

P7.31-1 Thermal Control System During PTC
P7.31-2 Thermal Control System During Lunar Orbit
P20.107-1 Crew Procedures for Lunar Orbit Mission
P20.107-2 Crew Procedures Timeline Adequacy - Lunar Mission
S20.108-1 EPS Use, Performance and Fuel Cell Management
S20.108-2 Water and Oxygen Requirements Data
S20.108-3 LiOH Cartridge Requirements Data
S20.108-4 SPS, SM/RCS & CM/RCS Propellant Requirements Data - Translation and Attitude Maneuvers
S20.108-5 Crew Food Requirements Data
20.110-1 Ground Operational Support for Lunar Mission Without LM

B. TEST REQUIREMENTS

1. Operation of the CSM in lunar orbit, undocked to determine the thermal properties of the spacecraft insulation [7.31]
2. Determination of the effectiveness of the thermal control system to provide a safe environment for operation of spacecraft equipment and consumables [7.31]
3. Accomplishment of all CM procedures peculiar to the lunar orbit mission in the same manner, where possible, as required for the LLM [20.107]
4. Management of the EPS during the lunar mission per the flight plan [20.108]
5. Utilization of the potable water produced during EPS operation as necessary [20.108]
6. Utilization of the oxygen supply system during the lunar mission as required [20.108]
7. Management of the replacement of LiOH cartridges during the mission per the flight plan [20.108]
8. Management of the consumption of the SPS and RCS propellants during the lunar mission as required [20.108]
9. Utilization of the food supply per the flight plan [20.108]
10. Performance of operational ground support of the spacecraft throughout the mission with emphasis on those phases being accomplished for the first time as part of a lunar orbit mission [20.110]

C. TEST PROCEDURES/CHECKLISTS

1. AOH CSM 103 SM2A-03-SC103-2

2. FCAC CSM 103

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs

- a. Narrative describing any recommended changes in procedures and/or equipment required to accomplish the procedures [20.107] (M)
 - b. Comments on any procedure requiring repeating or any procedure not completed [20.107] (M)
 - c. Water Count Log [20.108] (M)
 - d. LiOH Log [20.108] (M)
 - e. Astronaut Menus [20.108] (HD)
 - f. Comments on ECS environment comfort level [20.108] (HD)
2. Ground Support
- a. CSM TM HBR [7.31, 20.108] (M)
 - b. BET [7.31, 20.108] (M)
 - c. MSFN voice recording of CSM/MSFN communications [20.107] (HD)
 - d. Chemical analysis of recovered LiOH cartridges [20.108] (M)
 - e. Measurement of recovered water quantity [20.108] (M)
 - f. Measurement of energy remaining in recovered Entry and Post-Landing Batteries [20.108] (M)
 - g. Flight Director reports of mission support activities [20.110] (M)

TELECOMMUNICATIONS

A. TEST OBJECTIVES

- S6.10-1 S-Band Performance with Omni Antennas at Lunar Distance
(85' MSFN)
P6.11-1 S-Band Performance with High Gain Antenna During TL Coast
P6.11-2 S-Band Performance with High Gain Antenna at Lunar Distance
S20.104-3 S-Band Communications Performance During Transposition
S20.109-3 Communications Procedures During PTC

B. TEST REQUIREMENTS

1. Continuous CSM/MSFN S-band communication during transposition using CSM omni and 85' ground antennas [20.104]

<u>Signal Combination</u>	Communications Mode	
	<u>Uplink</u>	<u>Downlink</u>
4.2	Carrier, PRN, Voice	- Carrier, PRN, Voice, HBR

2. MSFN performance of various designated S-band communication mode tests of at least two minutes each as soon as practical after high gain antenna deployment (near earth) using the 85' ground antenna and the CSM high gain antenna as follows: [6.11]

<u>Signal Combination</u>	Communications Mode	
	<u>Uplink</u>	<u>Downlink</u>
4.2	Carrier, PRN; Voice	- Carrier, PRN, Voice, HBR
6.2	Carrier, PRN, Voice, - Updata	Carrier, PRN, Voice, HBR
.2		Recorded voice, LBR
4.3	Carrier, PRN, Voice	- Carrier, PRN, Voice, LBR
6.3	Carrier, PRN, Voice, - Updata	Carrier, PRN, Voice, LBR
5.2	Carrier, PRN, Updata	- Carrier, PRN, Voice, HBR
8.1	Carrier, BU Voice	- Carrier, Voice, LBR
.4		CSM television

3. MSFN performance of various designated S-band communication mode tests at lunar distance using 85' ground antenna or equivalent lunar distance using 30' ground antenna* and the CSM omni antennas [6.10]

*NOTE: The test can be accomplished under any one of the three following conditions which represent lunar distance or equivalent:

- a. Greater than 200 K NM with 85-foot dish (preferred)
- b. At 100 K \pm 10% NM with cooled 30-foot dish (HAW, CWM, ASC, CRO)
- c. At 70 K \pm 10% NM with uncooled 30-foot dish (others)

<u>Signal Combination</u>	<u>Uplink</u>	<u>Communications Mode</u>	<u>Downlink</u>
.5			Carrier, LBR
.6			Carrier, Key Subcarrier
1.7	Carrier, PRN	-	Carrier, PRN
.8			Carrier, BU Voice, LBR
.10			Carrier, BU Voice

4. MSFN performance of various designated S-band communication mode tests at lunar distance using 85' ground antenna or equivalent lunar distance using 30' ground antenna* and CSM Hi gain antenna [6.11]

<u>Signal Combination</u>	<u>Uplink</u>	<u>Communications Mode</u>	<u>Downlink</u>
.4.2	Carrier, PRN, Voice	-	Carrier, PRN, Voice, HBR
5.2	Carrier, PRN, Updata	-	Carrier, PRN, Voice, HBR
4.3	Carrier, PRN, Voice	-	Carrier, PRN, Voice, LBR
8.1	Carrier, BU Voice	-	Carrier, Voice, LBR

5. During steerable S-band antenna tests, demonstration of manual acquisition and automatic tracking using wide, medium and narrow beamwidths

C. TEST PROCEDURES/CHECKLISTS

1. AOH Section 4.7.6, "Telecommunications", paragraphs 4.7.6.1 through 4.7.6.10.
2. FCAC communications checklist TBD

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs
Comments on voice quality in flight plan [6.10, 6.11 & 20.104] (M)
2. Ground Support
 - a. CSM TM HBR [6.10, 6.11] (M)
 - b. CSM MSFN Voice records [6.10, 6.11, 20.104]

*NOTE: The test can be accomplished under any one of the three following conditions which represent lunar distance or equivalent:

- a. Greater than 200 K NM with 85-foot dish (preferred)
- b. At 100 K \pm 10% NM with cooled 30-foot dish (HAW,CWM,ASC,CRO)
- c. At 70 K \pm 10% NM with uncooled 30-foot dish (others)

- c. Flight Director reports of procedural and/or timeline difficulties or inadequacies in implementing all required communication tests [6.10, 6.11, 20.104] (HD)
- d. USB TM bit stream [6.10, 6.11, 20.104] (M)
- e. USB tracking data processor output [6.10, 6.11] (HD), [20.104] (M)
- f. MSFN records of received S-band carrier strength [6.10, 6.11, 20.104] (M)
- g. MSFN tape recordings of CSM to MSFN emergency key mode [6.10] (M)

APOLLO 8 CREW STATUS REPORTS

Purpose:

1. To enhance crew safety.
2. To acquire data on food, water, sleep and exercise requirements for future mission planning.
3. To obtain medical data required for analysis and correlation with the inflight bioenvironmental data and the pre- and postflight physical examination results.

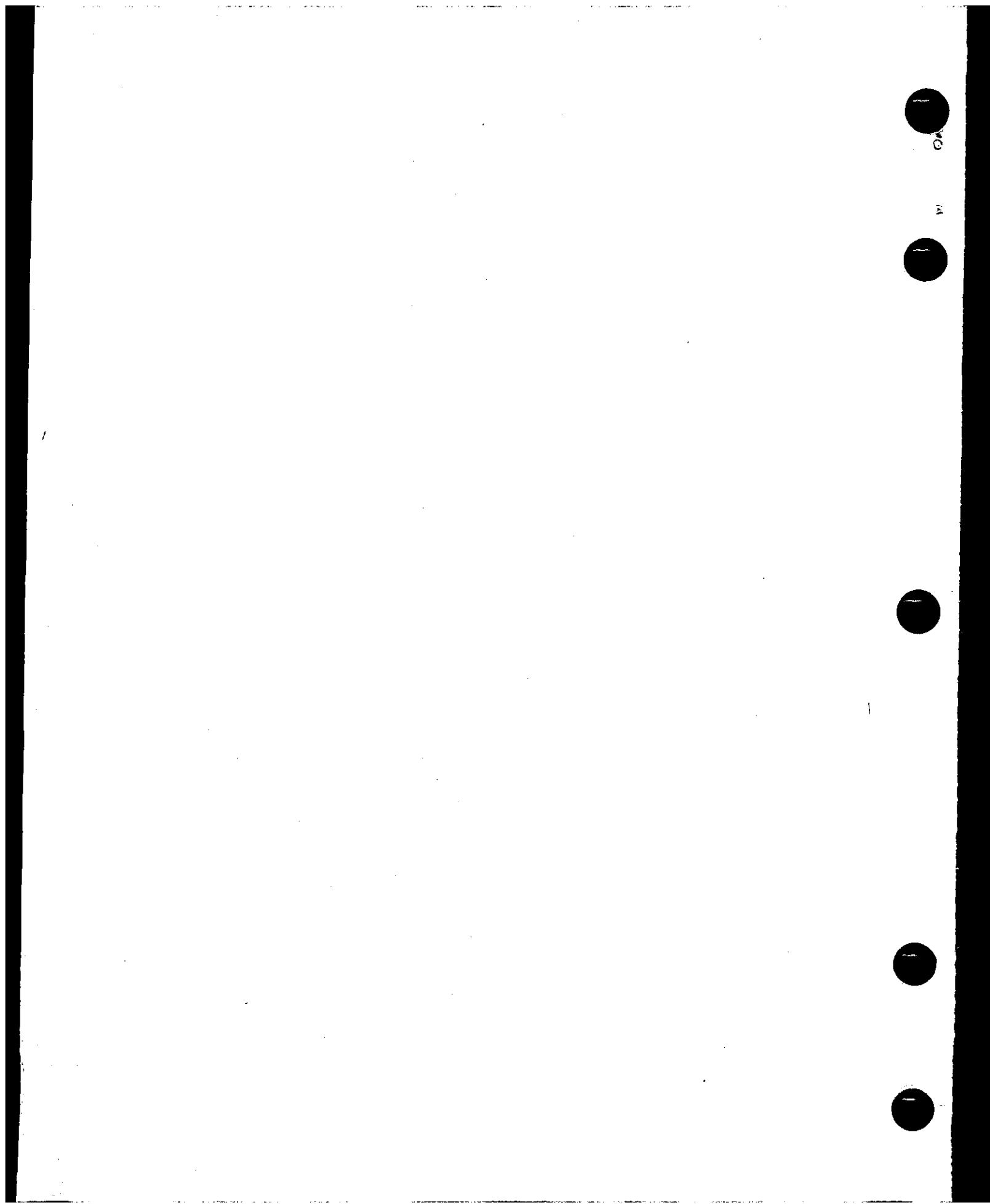
Requirements:

To obtain food, water, sleep and radiation data during the Apollo 8 mission and exercise data postflight.

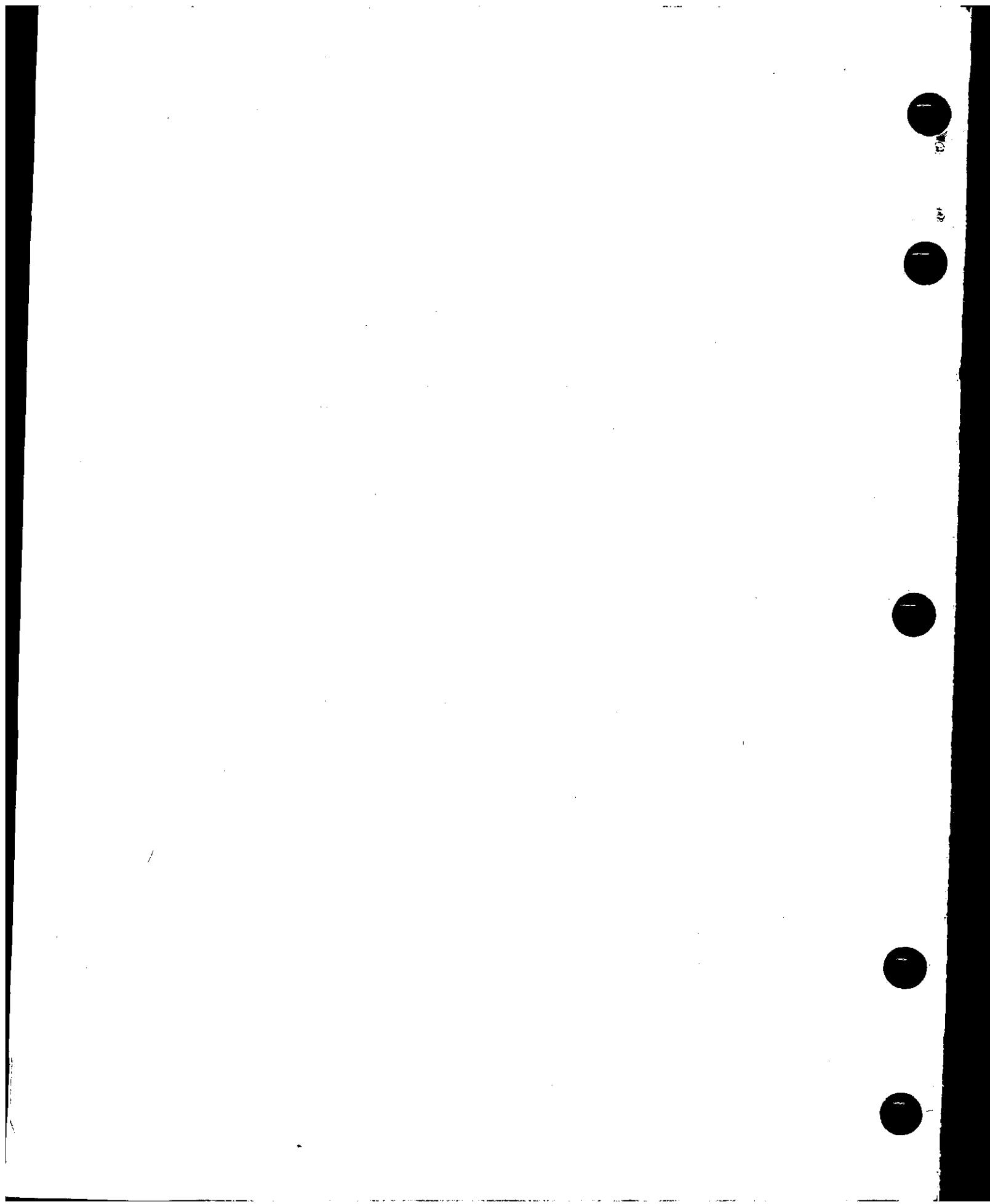
Procedures:

During the Apollo 8 mission, two crew status reports via air-to-ground communications will be made by the flight crew during each 24-hours ground elapsed time (GET). The first report will be given after the first meal of the work day and will concern the sleep obtained during the previous sleep period. The second report will be given following the final meal of the work day and will concern the food and water consumed, and the radiation dose received during the previous 24 hours GET. The following information should be transmitted:

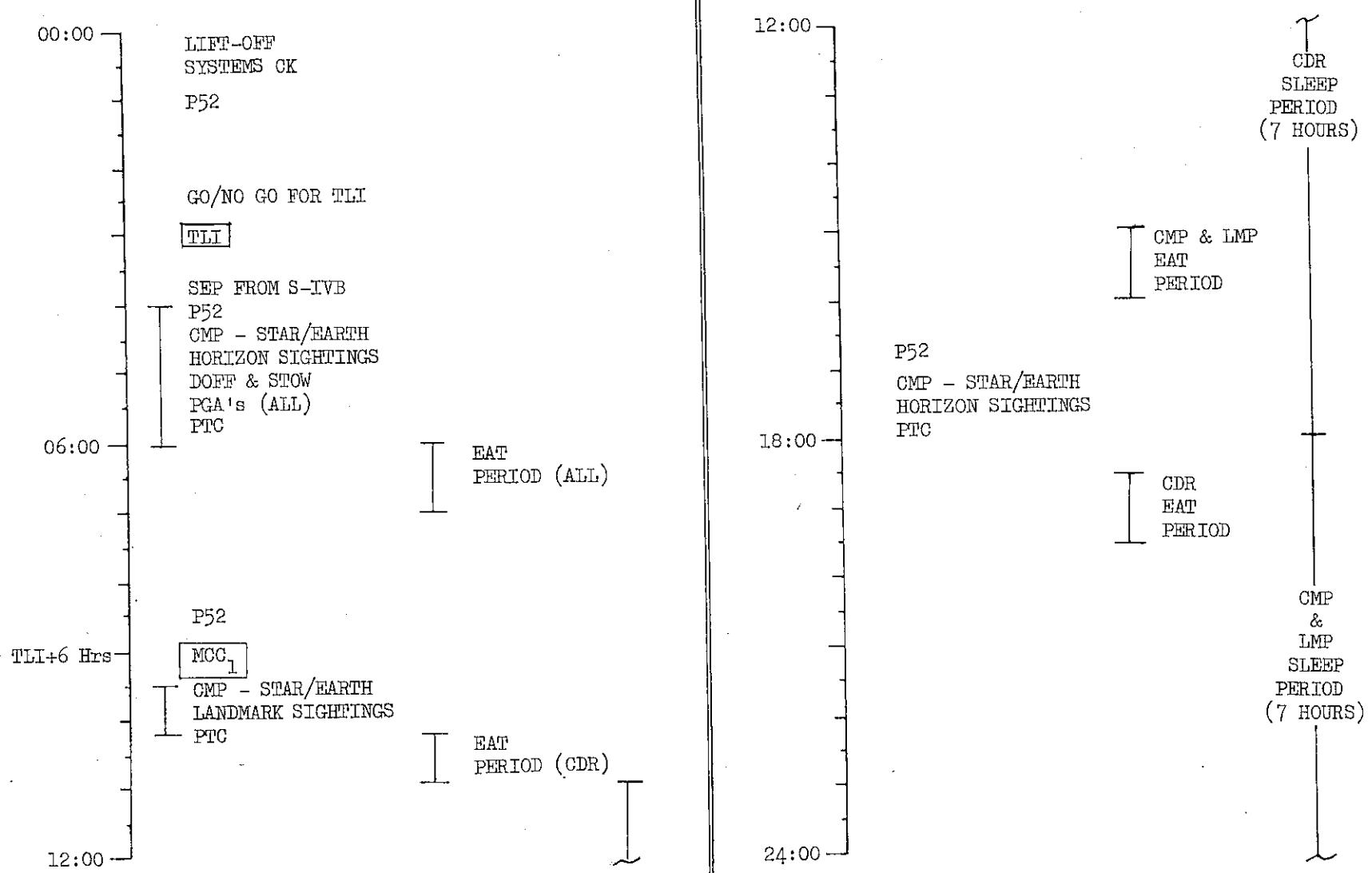
1. Food - a daily record of each crew member reflecting the meal identification code together with the description or serial number(s) of only those items not consumed from a scheduled meal.
2. Water - a daily log containing the number of aliquots from the water gun each astronaut drank. Water used for food rehydration will not be recorded.
3. Sleep - a daily notation of each crewman's best estimate as to sleep quantity and quality.
4. Radiation - a daily record of the integrated dose each crewman receives.
5. Exercise (postflight analysis only) - a daily record of the time of exercise, the type, and the duration of exercise performed by each astronaut.



SECTION V - SUMMARY FLIGHT PLAN

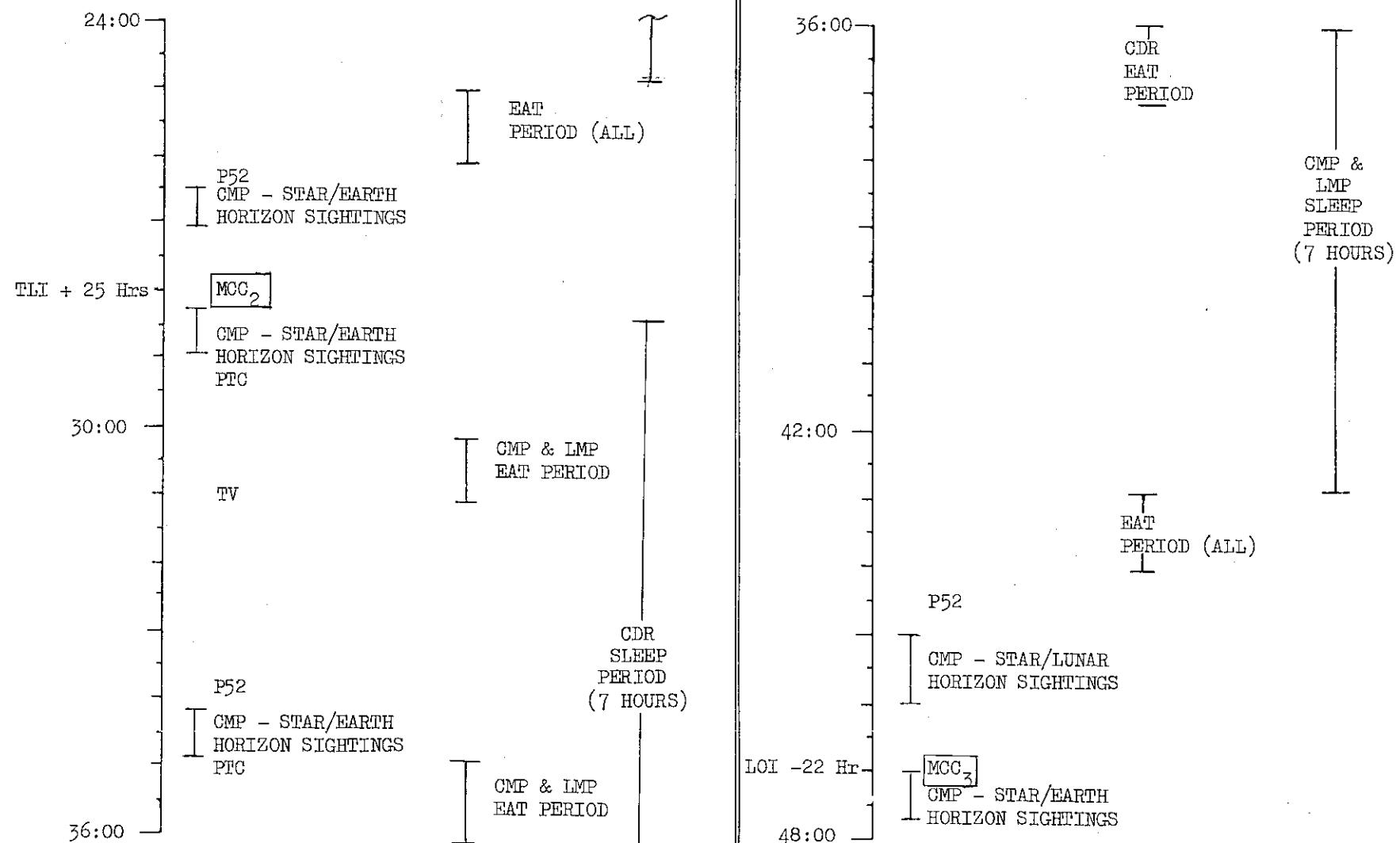


FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	00:00 -24:00	1	5-1

FLIGHT PLAN

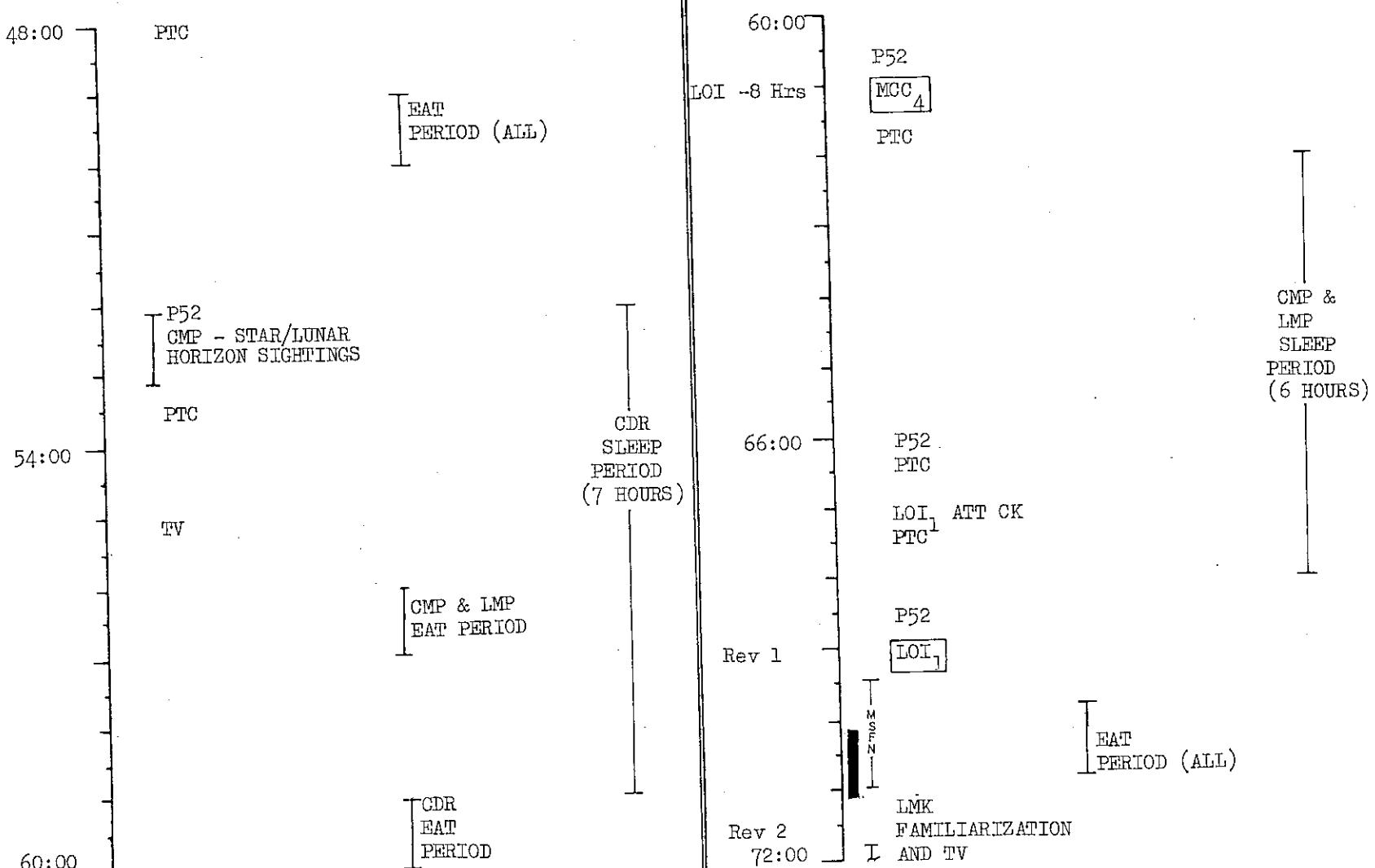


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	24:00 ~ 48:00	2	5-2

MSC FORM 1186 (SEP 67)

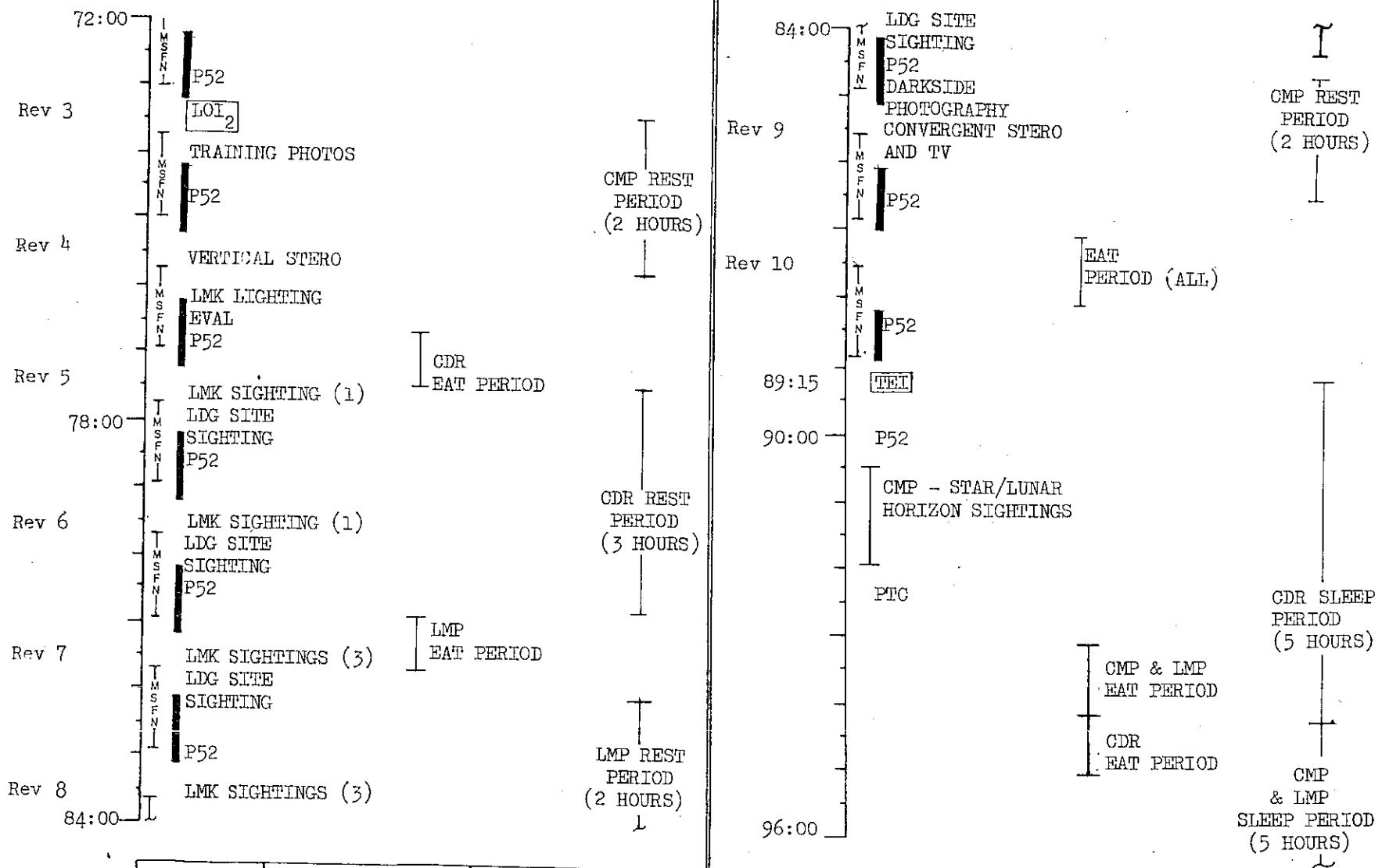
FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	48:00 - 72:00	3	5-3

FLIGHT PLAN

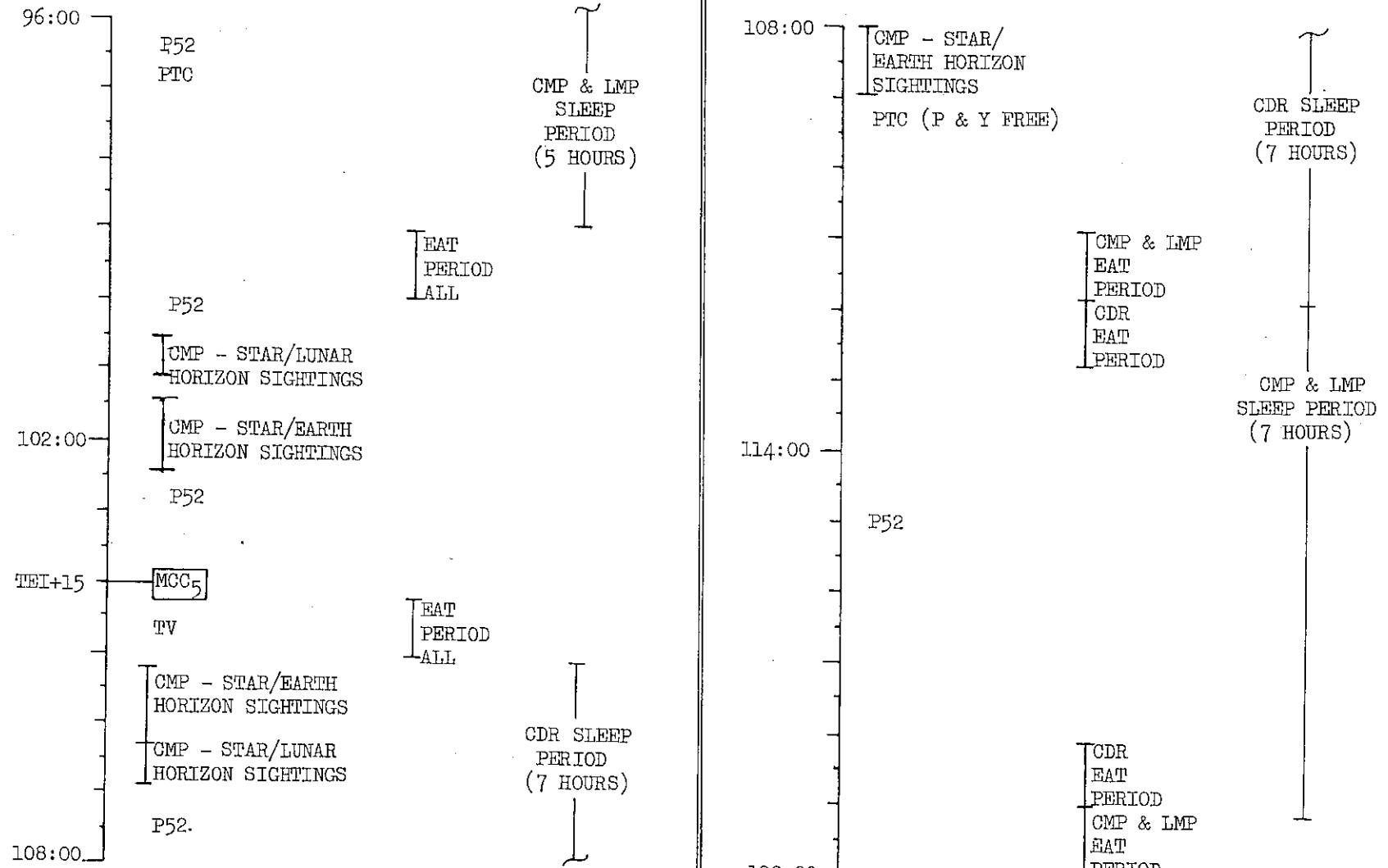


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	72:00 - 96:00	4	5-4

MSC FORM 1186 (SEP 67)

FLIGHT PLANNING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	96:00 - 120:00	5	5-5

FLIGHT PLAN

120:00 | [] CMP - STAR/EARTH HORIZON
 SIGHTINGS 3 SEES
 P52
 TEL+33 | [] MCC₆
 CMP - STAR/LUNAR
 HORIZON SIGHTINGS
 CMP - STAR/EARTH
 HORIZON SIGHTINGS
 PTC
 126:00 | [] EAT
 PERIOD
 ALL
 TV
 P52
 CMP - STAR/LUNAR
 HORIZON SIGHTING
 CMP - STAR/EARTH
 HORIZON SIGHTINGS
 132:00

132:00 | PTC
 138:00 | P52
 PTC
 144:00 | P52
 PTC
 CDR SLEEP
 PERIOD (7 HOURS)
 CMP & LMP
 EAT
 PERIOD
 CDR
 EAT
 PERIOD
 CDR SLEEP
 PERIOD (7 HOURS)
 CMP & LMP
 EAT
 PERIOD
 CDR
 EAT
 PERIOD

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	120:00 - 144:00	6	5-6

FLIGHT PLAN

144:00
ET -2 HRS
MOC 7
P52

147:10
CM/SM SEP
ET = 400K
SPLASHDOWN
148:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS 503/103	FINAL	November 22, 1968	144:00 to 146:50	6	5-7

MSC FORM 11186 (SEP 67)

FLIGHT PLANNING BRANCH

