



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

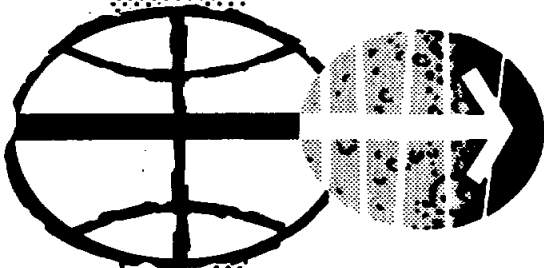
FINAL

# 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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APOLLO AS503/CSM 103

FINAL FLIGHT PLAN

November 22, 1968

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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
ARS	Atmosphere Revitalization	COMM	Communications
ASC	Ascension	COMP	Computational
ASCT	Ascent	CONFIG	Configuration
ATT	Attitude	CP	Control Point
AUX	Auxiliary	CRO	Carnarvon, Australia
AZ	Azimuth	CRYO	Cryogenic
		CSI	Coelliptic Sequence Initiation Maneuver
BAT	Battery	CSM	Command Service Module
BDA	Bermuda	C&WS	Caution and Warning System
BP	Barber Pole	CYI	Grand Canary Island
BT	Burn time		
Bio	Bio-Medical Data on Voice Downlink	DAP	Digital Auto Pilot
BiW	Black & white	D/B	Deadband
BU	Backup	DEDA	Data Entry and Display Assembly
BRKT	Bracket	DEGS	Degrees
		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
		GWM	Guam
E	Erasable	GYM	Guaymas, Mexico
ECS	Environmental Control Subsystem		
EPH	Earth Far Horizon	HA	Apogee Altitude
EI	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		
EXT	External	ID	Identification
		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		
FQ	Flight Qualification	JETT	Jettison
FT or ft	Feet		
FTP	Full Throttle Position	kwh	Kilowatt Hour
GBI	Grand Bahama	LAT	Latitude
GDC	Gyro Display Coupler	LBR	Low Bit Rate (TLM)
GDS	Goldstone, California	LBS or lbs	Pounds

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		
LLM	Lunar Landing Mission	NAV	Navigation
LLOS	Landmark Line of Sight	NCC	Corrective Combination Maneuver
LM	Lunar Module	nm	Nautical Miles
LMP	Lunar Module Pilot	NOM	Nominal
LNH	Lunar Near Horizon	NSR	Nominal Slow Rate
LOI	Lunar Orbit Insertion	NXX	Noun XX
LONG	Longitude		
LOS	Loss of Signal	OBS	Observation
LPO	Lunar Parking Orbit	O/F	Oxidizer to Fuel
LR	Landing Radar	OPER	Operate
LT	Light	ORB	Orbital
LTG	Lighting	ORDEAL	Orbit Rate Display Earth and Lunar
LV	Launch Vehicle	ORIENT	Orientation
L/V	Local Vertical	OVHD	Overhead
LVPD	Launch Vehicle Pressure Display		
		P	Pitch
M	Mandatory	PAD	Voice Update
MAD	Madrid, Spain	PCM	Pulse Code Modulation
MAN	Manual	PC	Pericyntian
MAX	Maximum	PGA	Pressure Garment Assembly
MAX Q	Maximum Dynamic Pressure	PGNCS	Primary Guidance Navigation Control Section
MCC	Midcourse Correction	PIPA	Pulse Integrating Pendulous Accelerometer
MCC-H	Mission Control Center - Houston	PM	Phase Modulated
MDC	Main Display Console	POL	Polarity or Polarizing

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
		SM	Service Module
Qty	Quantity	SPOT	Spot Meter
		SPS	Service Propulsion System
TA		SR	Sunrise
R	Roll	SRX	S-Band Receiver Mode No. X
R&B	Red & Blue	SS	Sunset
RAD	Radiator	STX	S-Band Transmit Mode No. X
RCDR	Recorder	STBY	Standby
RCS	Reaction Control Subsystem	Sw	Switch
RCU	Remote Control Unit	SXT	Sextant
RCV	Receiver	SYNC	Synchronization
RED	USNS Redstone		
REFSMMAT	Reference Stable Member Matrix	T	Trunnion
REG	Regulator	T	Time of Ephemeris Update
REQD	Required	EPHEM	
RH	Right-hand	TA	Trunnion Angle
RNDZ	Rendezvous	TAN	Tananarive
RR	Rendezvous Radar	TCA	Time of Closest Approach
RSI	Roll Stability Indicator	TBD	To Be Determined
RT	Real Time	TEC	Trans Earth Coast
RTC	Real-Time Command	TEI	Transearch Insertion
Rxx	Routine XX		

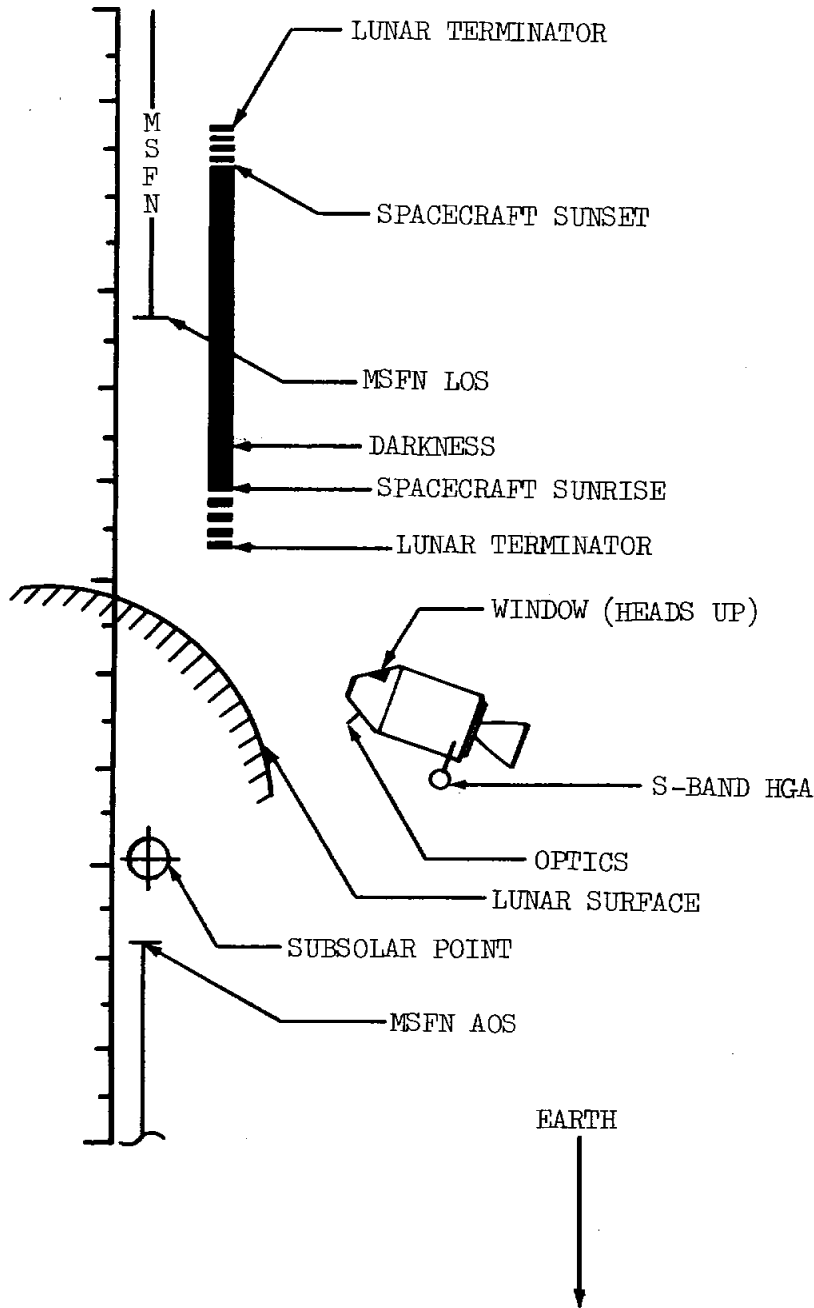


ABBREVIATIONS (Cont'd)

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		
TGT	Target	8-balls	Flight Director Attitude Indicator (FDAI)
TIG	Time of Ignition	LBS or lbs	Pounds
TLC	Trans Lunar Coast		
TLI	Translunar Insertion		
TLM	Telemetry		
TPF	Terminal Phase Final		
TPI	Terminal Phase Initiation		
TPM	Terminal Phase Midcourse		
T/R	Transmitter/Receiver		
TRANS	Translation		
TV	Television		
TVC	Thrust Vector Control		
TWR	Tower		
UMB	Umbilical		
UNDK	Undock		
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		

CAMERA NOMENCLATURE

2/80/B3 - Hasselblad No. 2/80mm Lens/Stowage Location  
16/18/20 - 16mm Camera/18mm Lens/20 Frames Per Second  
1/150/New B&W/INT - Hasselblad No. 1/150mm Lens/VSE New  
B&W Magazine/with interferometer  
C-EX - color film - external  
POL FILTER 1/4 - Polarization filter, Shutter Speed 1/4  
S0368 - Type of External Film  
2/80/H.S. - Hasselblad No. 2/80mm Lens/High Speed Film  
Cable/BRRT/R&B - Use Power Cable, Camera Mounted on Bracket  
with Red & Blue Filter



## 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 MCC<sub>1</sub>, 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 MCC<sub>2</sub> 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, MCC<sub>3</sub> 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), MCC<sub>4</sub> is scheduled. The CMP and LMP sleep period (62:00 GET) is scheduled between MCC<sub>4</sub> and LOI<sub>1</sub>.

At 69:07 GET, the LOI<sub>1</sub> 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 LOI<sub>2</sub> 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 LOI<sub>2</sub> 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 MCC<sub>5</sub> 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, MCC<sub>6</sub> 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), MCC<sub>7</sub> 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. LOI<sub>1</sub> -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 H<sub>2</sub> and O<sub>2</sub> will be scheduled R/T.
3. The S/C will remain fully poweredup 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 LOI<sub>1</sub>, 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

<u>GET</u>	<u>ALTITUDE nm</u>	<u>CSM ANTENNA</u>	<u>SIGNAL COMBINATION</u>	<u>GROUND ANT</u>	<u>COMMUNICATIONS MODE</u>
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, Update
30,000	110,000	HI GAIN	6	30' ASC	Carrier, PRN, Voice, Update
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, BU Voice
31:15	120,000	HI GAIN	.4	85' GDS	CSM Television
<u>NORMAL OPERATING MODES</u>					
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



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
+ .	+ .	$\Delta VC'$ 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
$\Delta$ VC'	XXXXX.X (fps)	NOMINAL TLI $\Delta$ V SET INTO EMS $\Delta$ V CONTROL
VI	+XXXXX (fps)	NOMINAL INERTIAL VELOCITY DISPLAYED ON DSKY AT TLI CUTOFF
R SEP	XXX (DEG)	PREDICTED SPACECRAFT IMU GIMBAL ANGLES AT COMPLETION OF S-IVB MNVR TO CSM/S-IVB SEP ATTITUDE
P SEP	XXX (DEG)	
Y SEP	XXX (DEG)	

P27 UPDATE									
PURP		V			V			V	
GET		:	:	:	:	:	:	:	
304	01	INDEX			INDEX			INDEX	
	02								
	03								
	04								
	05								
	06								
	07								
	10								
	11								
	12								
	13								
	14								
	15								
	16								
	17								
	20								
	21								
	22								
	23								
	24								
N34	HRS	X	X	X			X	X	X
	MIN	X	X	X	X		X	X	X
NAV CHECK	SEC	X	X				X	X	
N43	LAT		0					0	
	LONG								
	ALT	+	0				+	0	

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			PURPOSE
NORTH & SOUTH SET STARS			PROP/GUID
	+		WT N47
R	ALIGN	0 0 .	PRIM N48
P	ALIGN	0 0 .	Y-TRIM
Y	ALIGN	+ 0 0	HRS GETI
		+ 0 0 0	MIN N33
		+ 0 .	SEC
CELLAGE			$\Delta V_X$ NEI
			$\Delta V_Y$
			$\Delta V_Z$
	X X X		R
	X X X		P
	X X X		Y
	+	.	$\Delta A$ N44
		.	$\Delta P$
	+	.	$\Delta VT$
HORIZON/WINDOW	X X X .	.	BT
	X	.	$\Delta VC$
	X X X X		SXTS
	+	0	SFT
	+	0 0	TRN
	X X X		BSS
	X X	.	SPA
	X X X	.	SXP
OTHER	0	.	LAT N6
		.	LONG
	+	.	RTGO EMS
	+	.	VIO
	.	.	GET .05G

MANEUVER PAD

PURPOSE	XXXXXX	TYPE OF MNVR TO BE PERFORMED
PROP/GUID		PROPULSION SYSTEM (SPS/RCS)/ GUIDANCE (SCS/G&N)
WT	XXXXX (lbs)	PREMANEUVER VEHICLE WEIGHT
P TRIM	X.XX (DEG)	SPS PITCH GIMBAL OFFSET TO PLACE THRUST
Y TRIM	X.XX (DEG)	SPS YAW GIMBAL OFFSET TO PLACE THRUST
GETI	XX:XX:XX (HRS:MIN:SEC)	TIME OF MNVR IGNITION
$\Delta V_X$	XXXX.X (fps)	P30 VELOCITY TO BE GAINED COMPONENTS IN LOCAL VERTICAL COORDINATES
$\Delta V_Y$	XXXX.X (fps)	
$\Delta V_Z$	XXXX.X (fps)	
R	XXX (DEG)	IMU GIMBAL ANGLES OF MANEUVER ATTITUDE
P	XXX (DEG)	
Y	XXX (DEG)	
H <sub>A</sub>	XXXX.X (nm)	PREDICTED APOGEE ALTITUDE AFTER MANEUVER
H <sub>P</sub>	XXXX.X (nm)	PREDICTED PERIGEE ALTITUDE AFTER MANEUVER
$\Delta V_T$	XXXX.X	TOTAL VELOCITY OF MANEUVER
BT	X:XX (MIN:SEC)	MANEUVER DURATION
$\Delta V_C$	XXXX.X (fps)	PREMANEUVER $\Delta V$ SETTING IN EMS $\Delta V$ 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									R .05G
X	X	X									P .05G
X	X	X									Y .05G
											GET HOR
X	X	X									P CK
	0										LAT N6I
											LONG
X	X	X									MAX G
+											V400K N60
-	0	0									T400K
+											RTGO EMS
+											VIO
											RRT
X	X										RET.05G*
+	0	0									DL MAX*
+	0	0									DL MIN* <sup>N69</sup>
+											V <sub>L</sub> MAX*
+											V <sub>L</sub> MIN*
X	X	X									D <sub>O</sub>
X	X										RET V <sub>CIRC</sub>
X	X										RETBBO
X	X										RETEBO
X	X										RETDRO
X	X	X	X								SXTS
+										0	SFT
+										0 0	TRN
X	X	X									BSS
X	X										SPA
X	X	X									SXP
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 <sub>400K</sub>	XXXXX (fps)	INERTIAL VELOCITY AT ENTRY INTERFACE
γ <sub>400K</sub>	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 <sub>L</sub> MAX	X.XX (G's)	MAXIMUM ACCEPTABLE VALUE OF PREDICTED DRAG LEVEL (FROM CMC)
D <sub>L</sub> MIN	X.XX (G's)	MINIMUM ACCEPTABLE VALUE OF PREDICTED DRAG LEVEL (FROM CMC)
V <sub>L</sub> MAX	XXXXX (fps)	MAXIMUM ACCEPTABLE VALUE OF EXIT VELOCITY (FROM CMC)
V <sub>L</sub> 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)

## 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
<b>MISSION</b> AS503/103		<b>EDITION</b> FINAL
		<b>DATE</b> November 22, 1968
		<b>PAGE</b> 2-i



# 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	
07:00	CDR: <u>REPORT</u> S/C GO/NO GO	
08:00		IF LAUNCH AZIMUTH <90°
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	

**MISSION** AS503/103

**EDITION** FINAL

**DATE** November 22, 1968

**PAGE** 2-ii

# 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	

**MISSION** AS503/103

**EDITION** FINAL

**DATE** November 22, 1968

**PAGE** 2-iii

# FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
00:00				
00:15	POST INSERTION CONFIG  REMOVE HELMET & GLOVES  ECS POST INSERTION CONFIG  GDC ALIGN TO IMU	POST INSERTION CONFIG SM RCS CK CM RCS CK C&W CK REMOVE HELMET & GLOVES  INGRESS LEB O <sub>2</sub> MAIN REG CK	POST INSERTION CONFIG  REMOVE HELMET & GLOVES  ECS POST INSERTION CONFIG  EPS PERIODIC MONITOR ECS MONITOR CK SPS PERIODIC MONITOR PUGS TEST	
00:30	MOUNT & INITIALIZE ORDEAL  INSTALL COAS COAS HORIZON CK	JETTISON OPTICS COVER RECORD ΔAZ CORRECTION	ECS REDUNDANT COMP CK FC PURGE CK	
00:45				VOICE UPDATE: ΔAZ CORRECTION
01:00		OPTICS CK IMU REALIGN P52 OPTION 3 - REFSMMAT STAR ID _____ (cont'd)	BIOMED Sw - CENTER	

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

# FLIGHT PLAN

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

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 <input type="checkbox"/>	:	$\Delta$ TIG
X X	:	BT
<input type="checkbox"/>	.	$V_{gx}$
----- TRIM -----		
X X X	.	R
X X X	.	P
X X X	.	Y
<input type="checkbox"/>	.	$V_i$
<input type="checkbox"/>	.	h
<input type="checkbox"/>	.	h
<input type="checkbox"/>	.	$\Delta V_c$
X X X	.	FUEL
X X X	.	OX
X X X	.	UNBALANCE

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 $\Delta V$ REOD)
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				
02:15	TLI PREP EMS ΔV TEST	TLI PREP TRANS TO COUCH	TLI PREP	
02:30	GO/NO-GO FOR PYRO ARM GO/NO-GO FOR TLI GDC ALIGN AND DRIFT CK  TB-6  P47 BURN ATT CK <span style="border: 1px solid black; padding: 2px;">TLI</span>  SECO S-IVB INERTIAL SECO +20 SEC S-IVB TO LH,ORB RATE,HEADS DOWN	<span style="border: 1px solid black; padding: 2px;">GETI = 2:50:31</span>	BIOMED Sw - LEFT   FLT RCDR - RECORD   FLT RCDR - OFF	GO/NO-GO
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	S-BAND XPONDER - SEC FLT RCDR - RECORD	GO/NO-GO COMM TEST MODE: 4.2
	TRANSPOSITION FROM S-IVB +X FOR 1 fps, COAST FOR 1 MIN, -X FOR 0.5 fps, PITCH UP 4°/SEC	R13 SPOTMETER	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)	
03:30	FLY FORMATION	DOFF & STOW PGA		
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

# FLIGHT PLAN

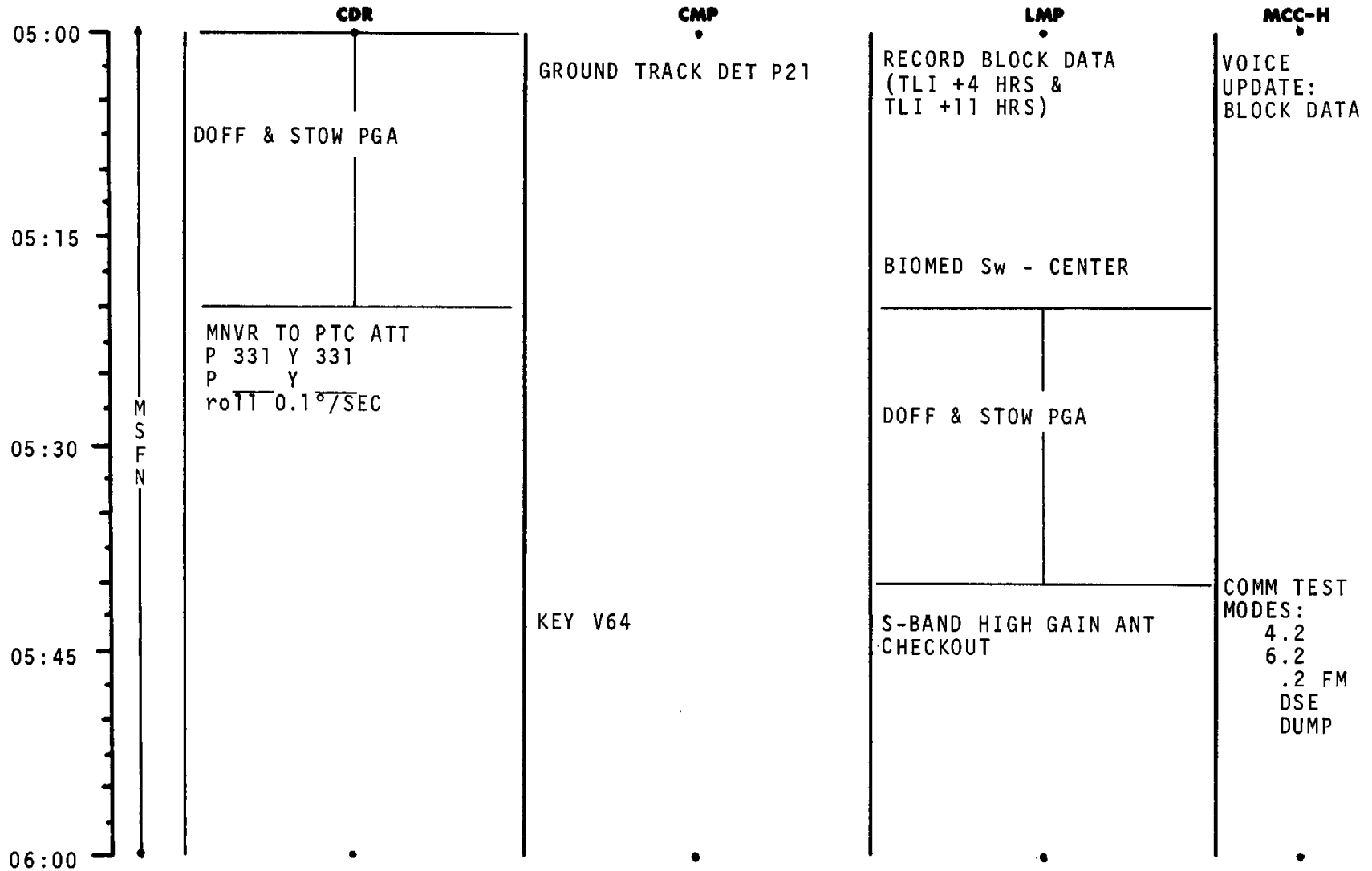
<p>04:00</p> <p>04:15</p> <p>04:30</p> <p>04:45</p> <p>05:00</p>	<p style="text-align: center;">CDR</p> <p style="text-align: center;">M S F N</p>	<p style="text-align: center;">CMP</p> <p>IMU REALIGN P52              OPTION 3 - REFSMMAT              STAR ID _____              STAR ANGLE DIFF _____              TORQUE ANGLES: _____              X _____              Y _____              Z _____</p> <p style="border: 1px solid black; padding: 2px; text-align: center;">CISLUNAR NAVIGATION P23</p> <p>TRN BIAS              1. STAR 14 ENH              STAR _____ E _____ H              1 SET - 3 MARKS              EACH</p> <p>2. STAR 15 EFH              STAR _____ E _____ H              2 SETS - 3 MARKS              EACH</p> <p>3. STAR 16 EFH              STAR _____ E _____ H              2 SETS - 3 MARKS              EACH</p>	<p style="text-align: center;">LMP</p> <p>REPORT PERSONAL              RADIATION DOSIMETER              READINGS</p>	<p style="text-align: center;">MCC-H</p>
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GDC ALIGN TO IMU

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

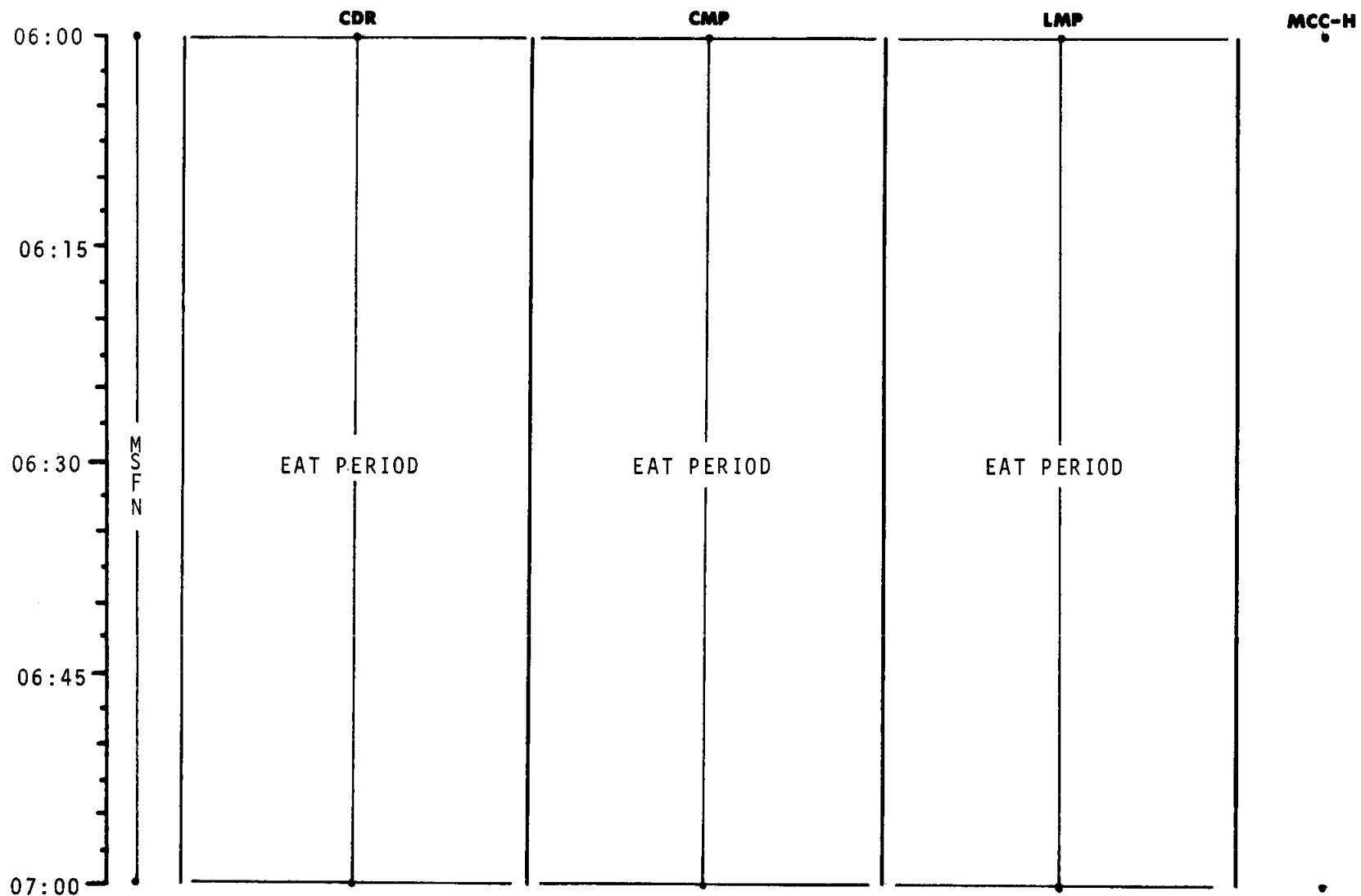


# FLIGHT PLAN



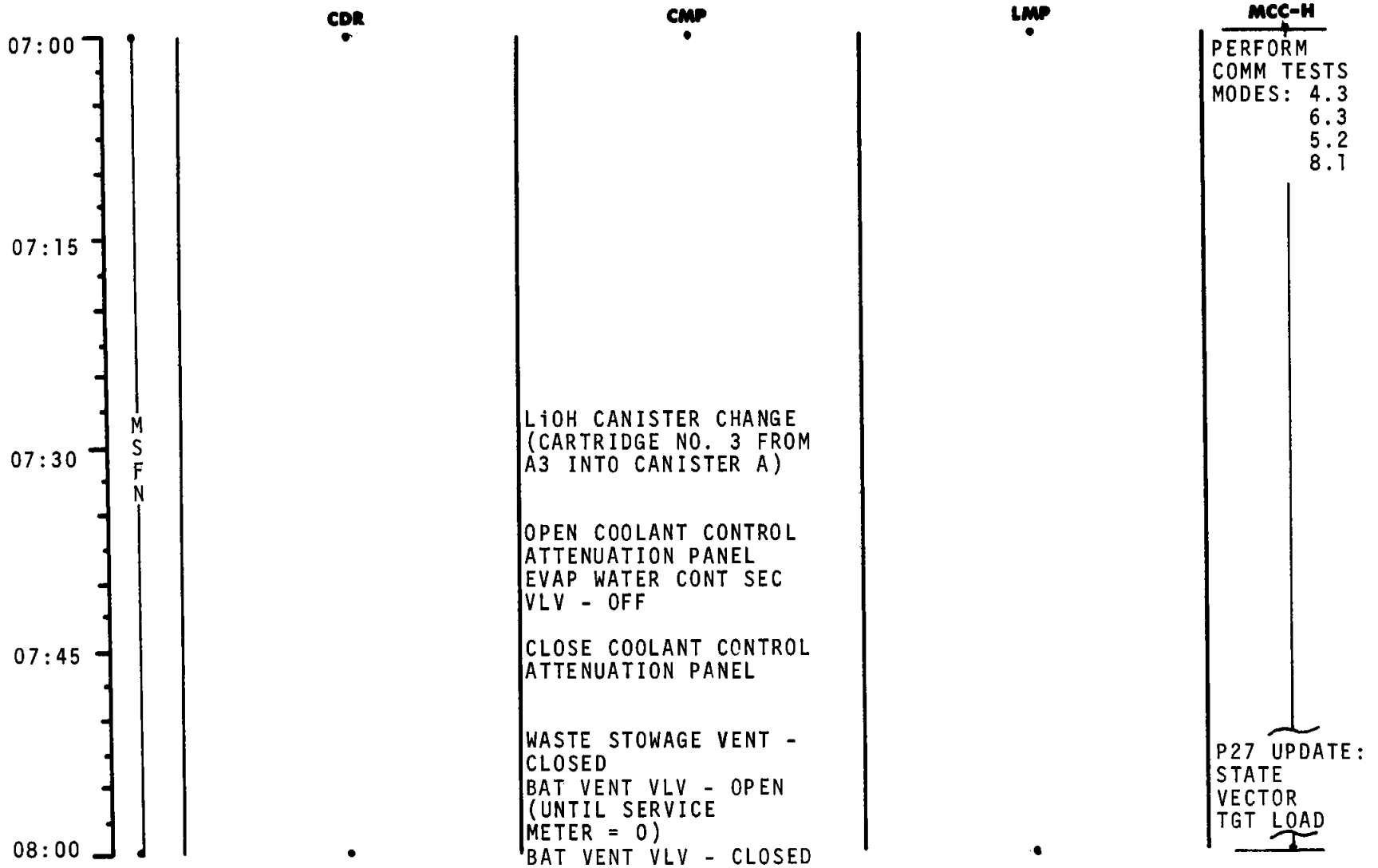
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	05:00 - 06:00	1/TLC	2-6

# FLIGHT PLAN



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

# FLIGHT PLAN



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

BURN STATUS REPORT

X X  : ΔTIG  
 X X : BT  
 : V<sub>gx</sub>

TRIM

X X X R  
 X X X P  
 X X X Y  
 V<sub>gx</sub>  
 V<sub>gy</sub>  
 V<sub>gz</sub>  
 ΔV<sub>c</sub>

X X X FUEL  
 X X X OX  
 X X X UNBALANCE

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

2-8a

# 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	V47 TRANS LM STATE VECTOR TO CSM SLOT  EXT ΔV P30 SPS/RCS THRUST P40/P41 MNVR TO BURN ATT	SXT STAR CK  TRANS TO COUCH	BIOMED Sw - RIGHT	PIPA BIAS CK
08:45	EMS ΔV TEST			
TLI +6 HRS 09:00	GDC ALIGN  MCC <sub>1</sub> 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)

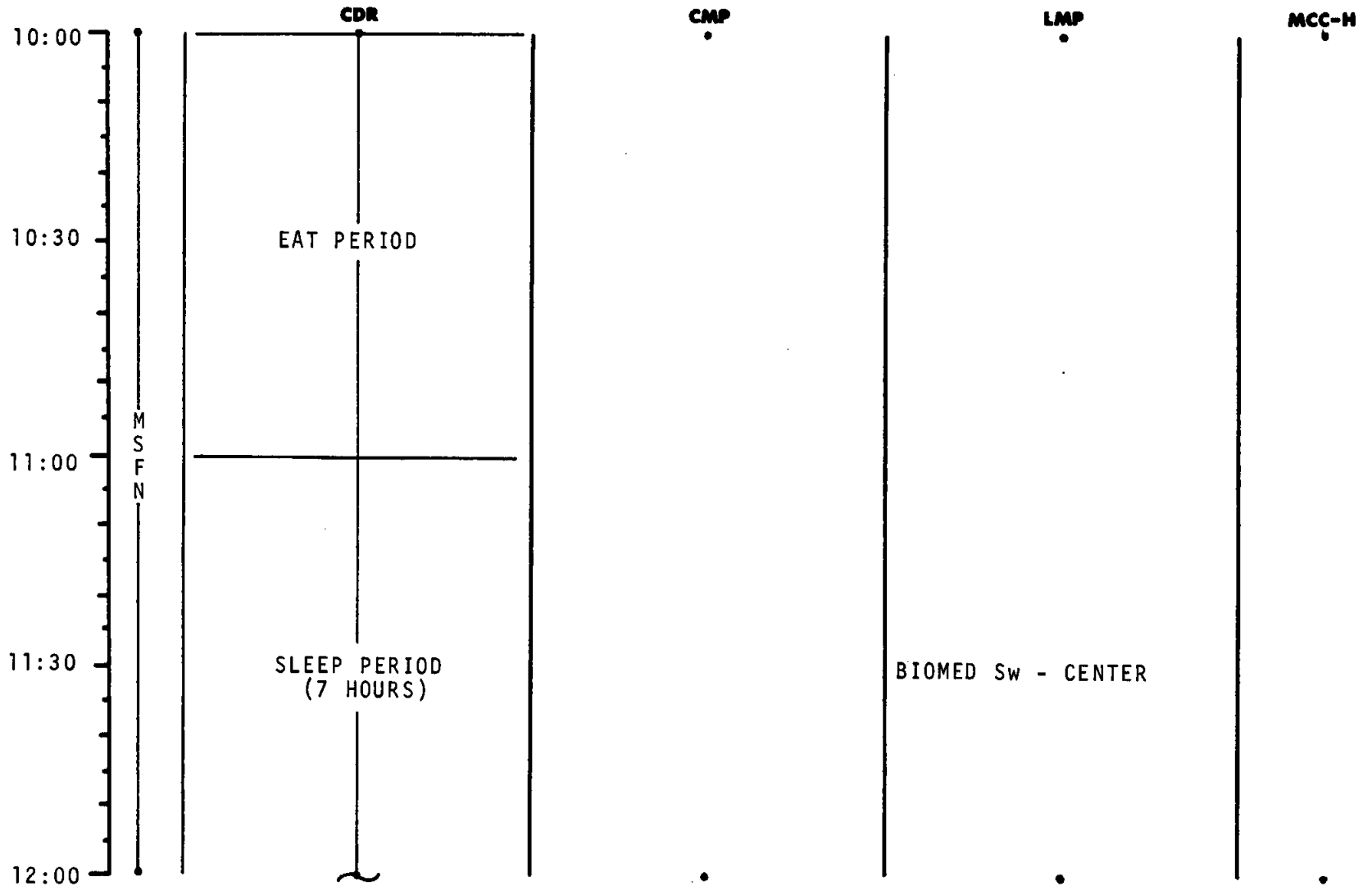
**FLIGHT PLANNING BRANCH**

# FLIGHT PLAN

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

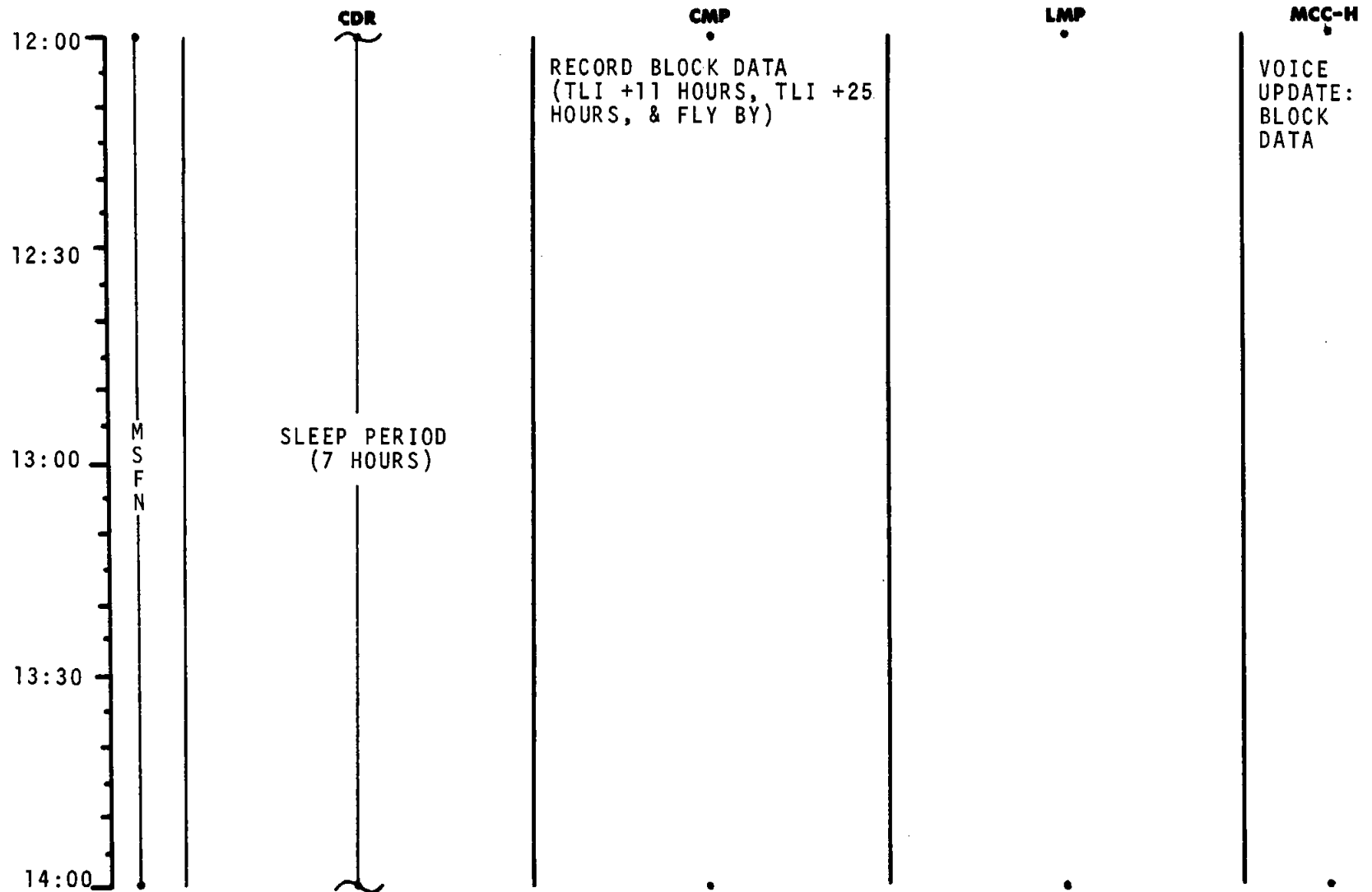
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	09:00 - 10:00	1/TLC	2-10

# FLIGHT PLAN



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

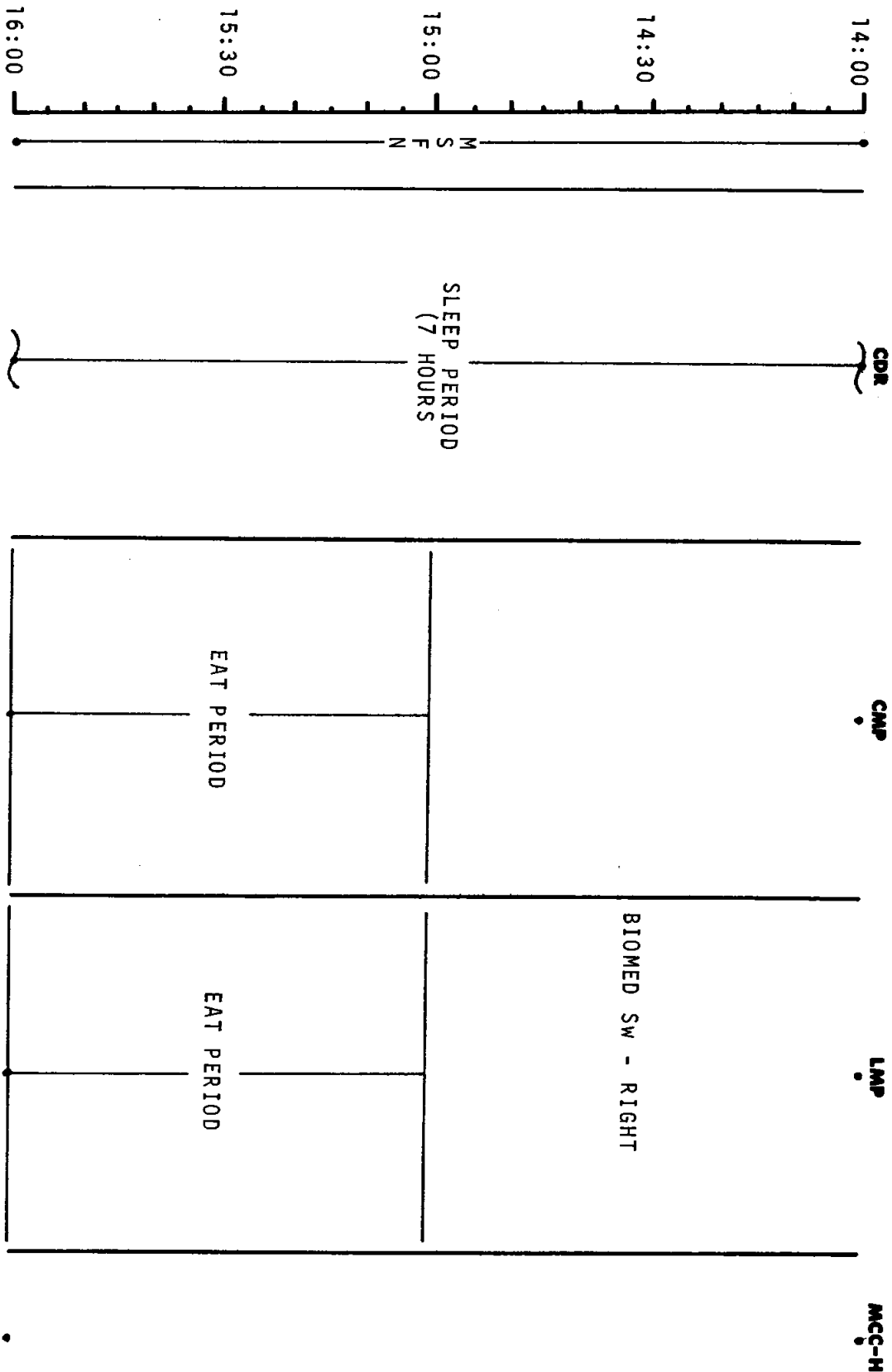
# FLIGHT PLAN



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



# FLIGHT PLAN

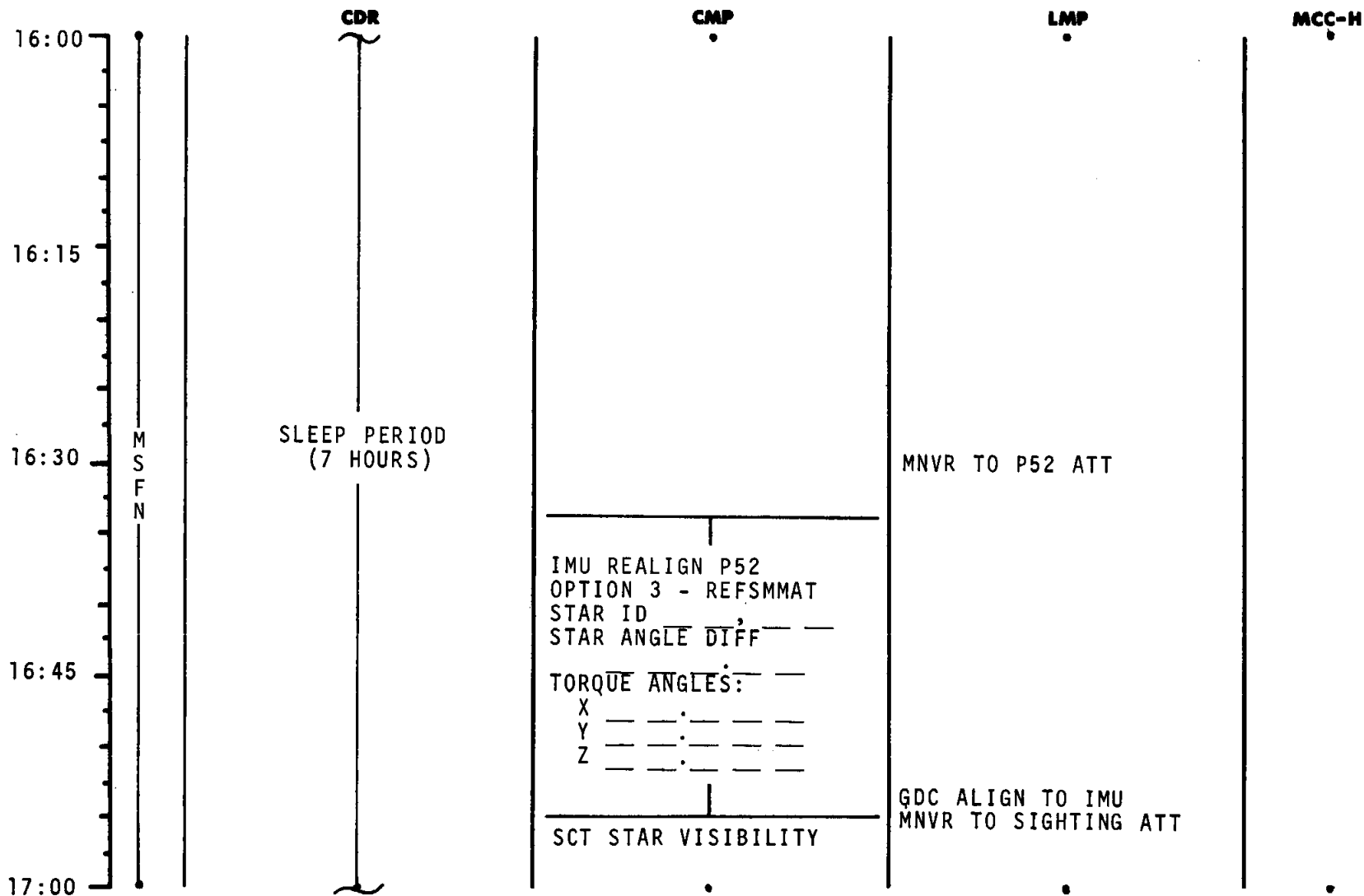


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	14:00 - 16:00	1/TLC	2-13

MSC Form 1810 (Nov 68)

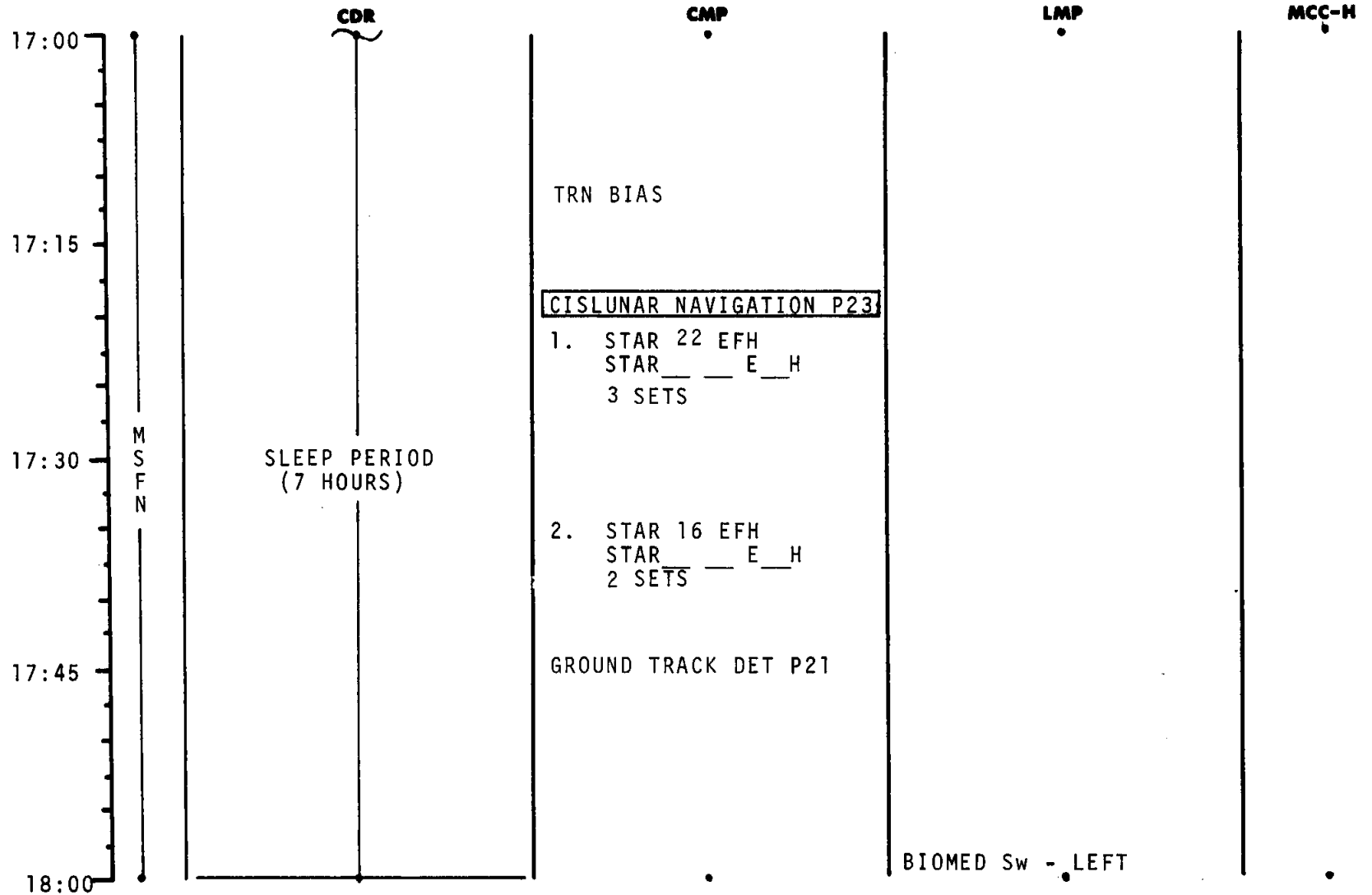
FLIGHT PLANNING BRANCH

# FLIGHT PLAN



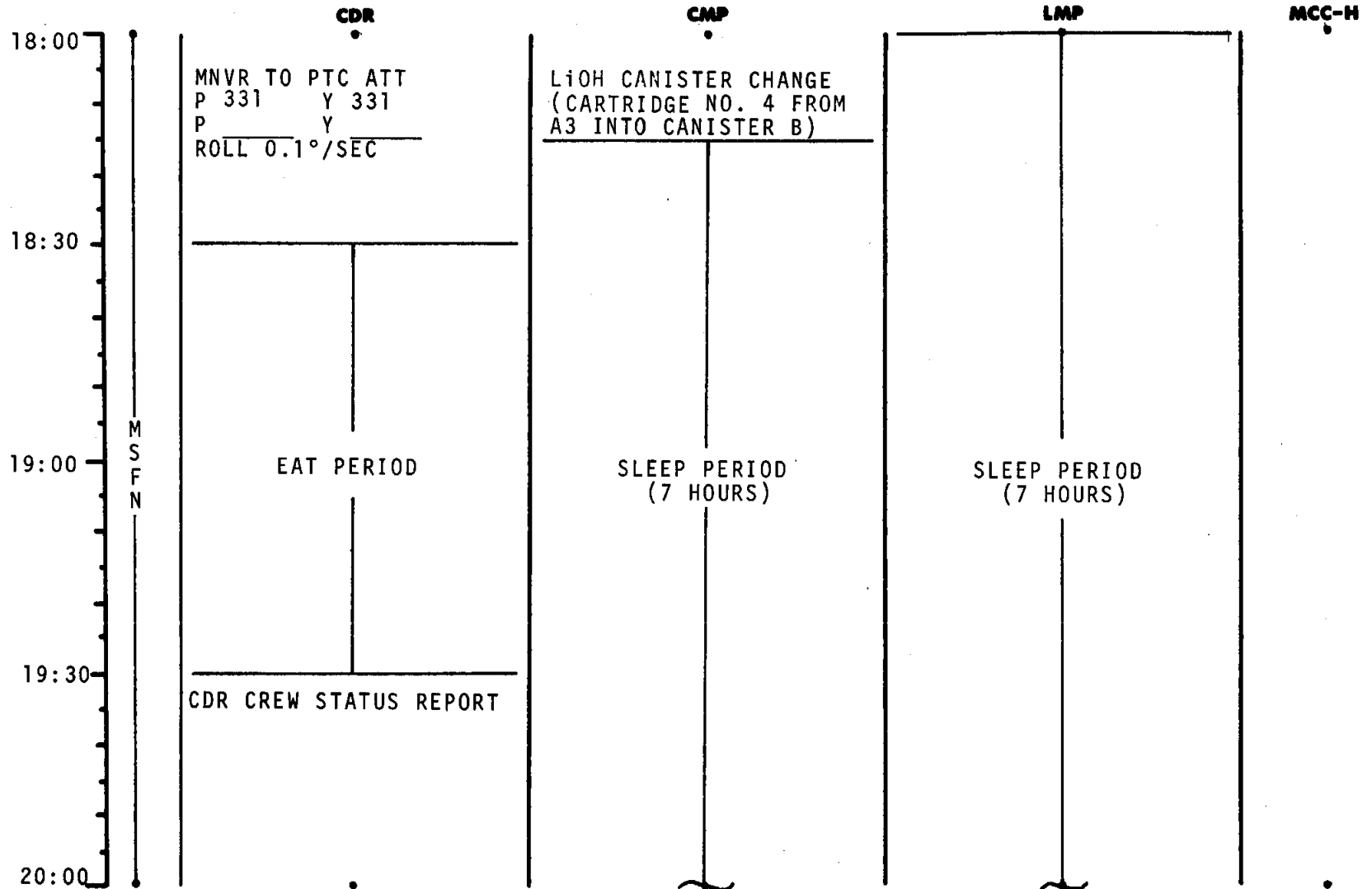
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	16:00 - 17:00	1/TLC	2-14

# FLIGHT PLAN



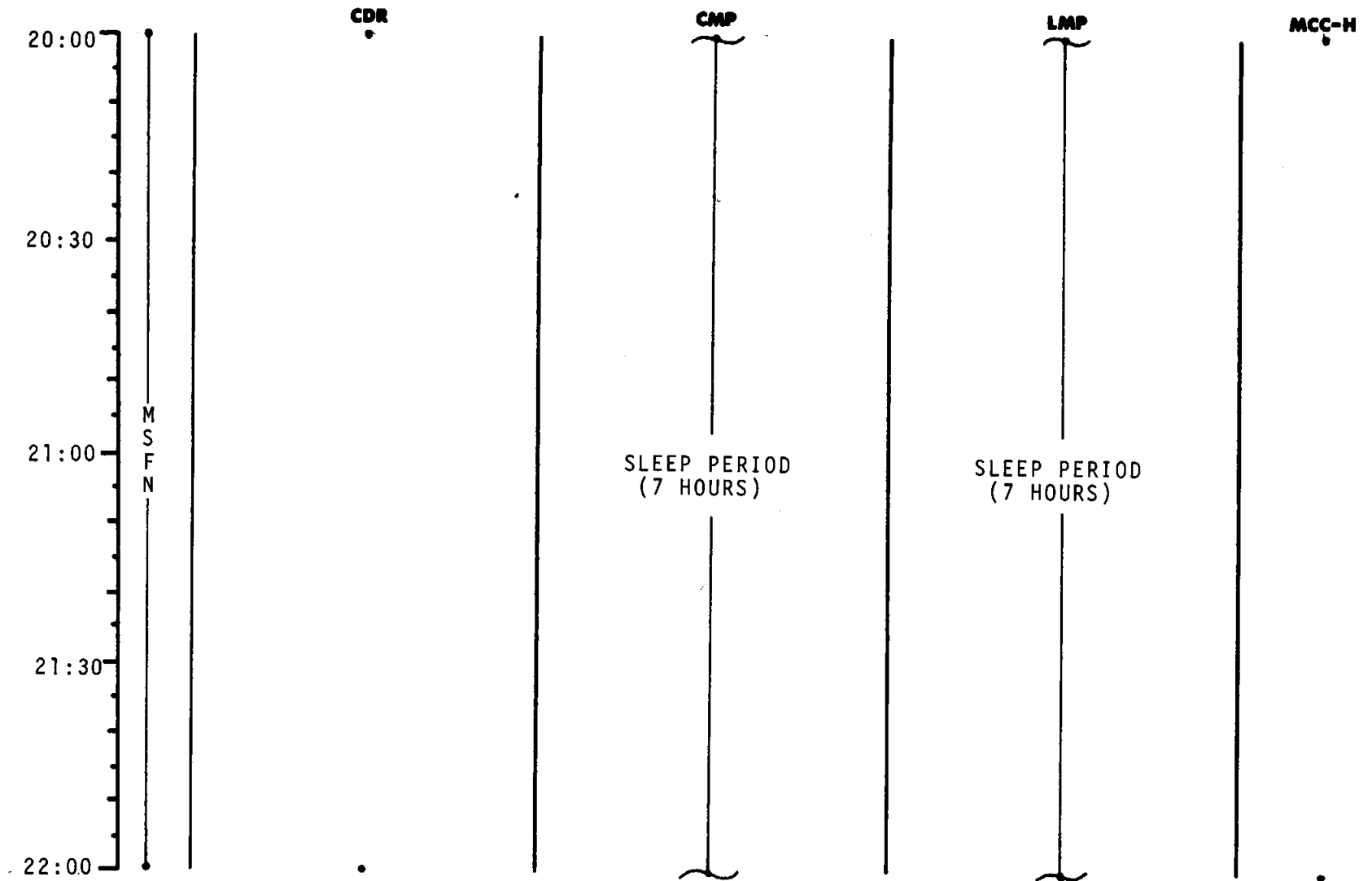
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	17:00 - 18:00	1/TLC	2-15

# 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

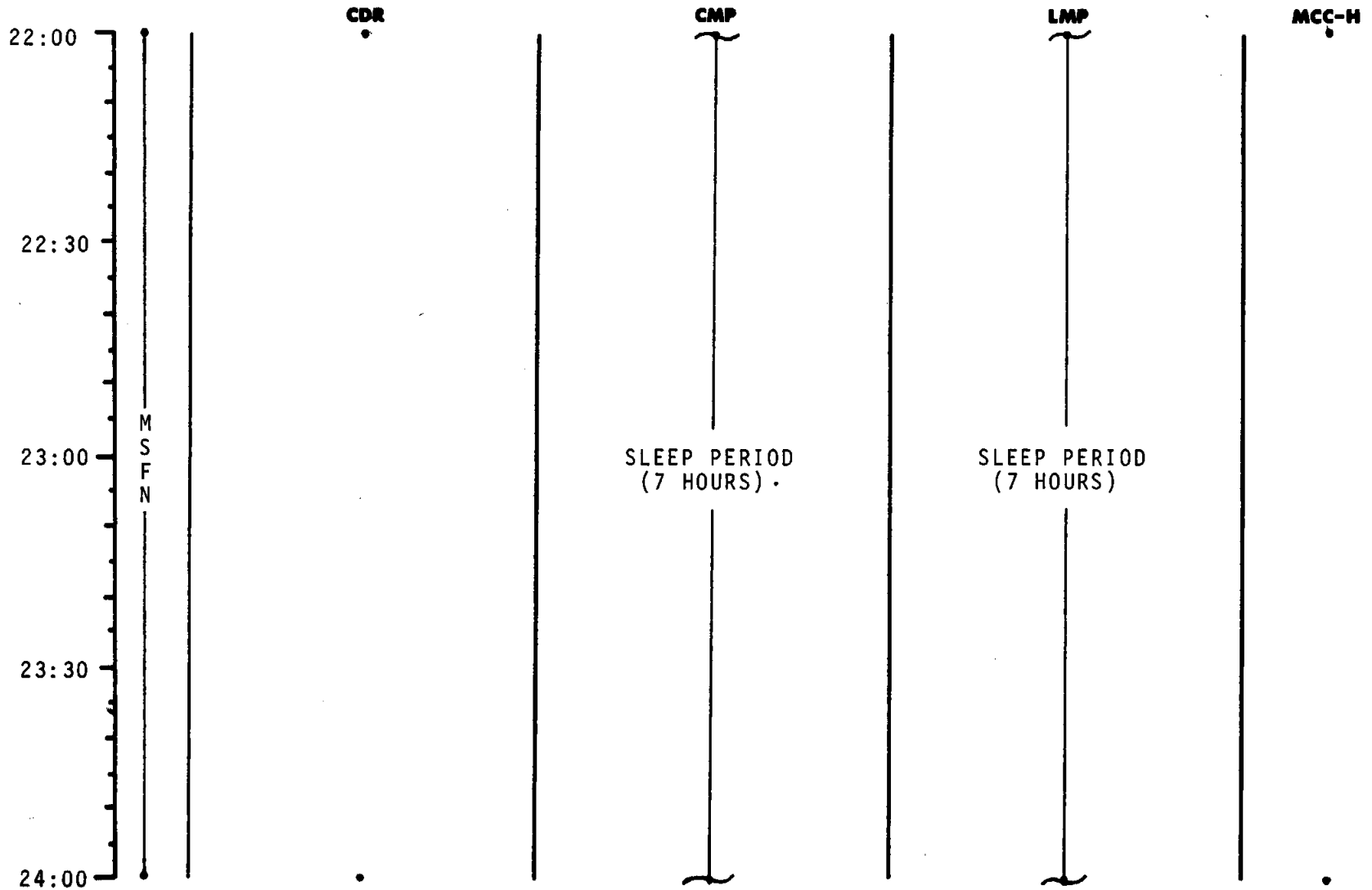


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	20:00 - 22:00	1/TLC	2-17

MSC Form 1910 (Nov 68)

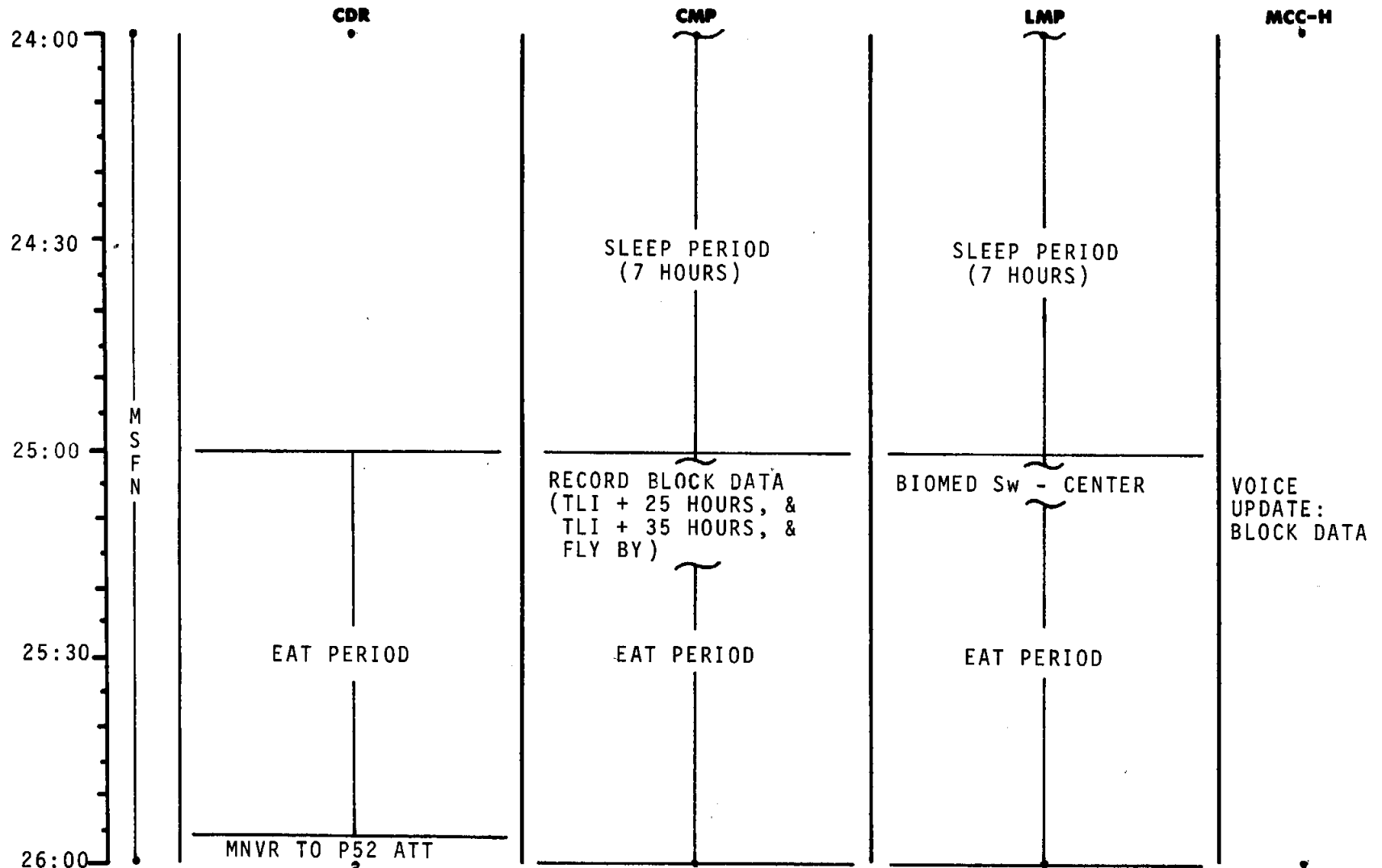
FLIGHT PLANNING BRANCH

# FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	22:00 - 24:00	1/TLC	2-18

# FLIGHT PLAN



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

# FLIGHT PLAN

26:00

26:15

26:30

26:45

27:00

M  
S  
F  
N

GDC ALIGN TO IMU  
MNVR TO SIGHTING  
ATTITUDE

CDR

CMP

LMP

MCC-H

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

CMP/LMP CREW STATUS  
REPORT

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		:		BT
<input type="checkbox"/>			.		V <sub>gx</sub>
TRIM					
X	X	X			R
X	X	X			P
X	X	X			Y
<input type="checkbox"/>			.		V <sub>gx</sub>
<input type="checkbox"/>			.		V <sub>gy</sub>
<input type="checkbox"/>			.		V <sub>gz</sub>
<input type="checkbox"/>			.		ΔV <sub>c</sub>
X	X	X			FUEL
X	X	X			OX
X	X	X			UNBALANCE

REMARKS:

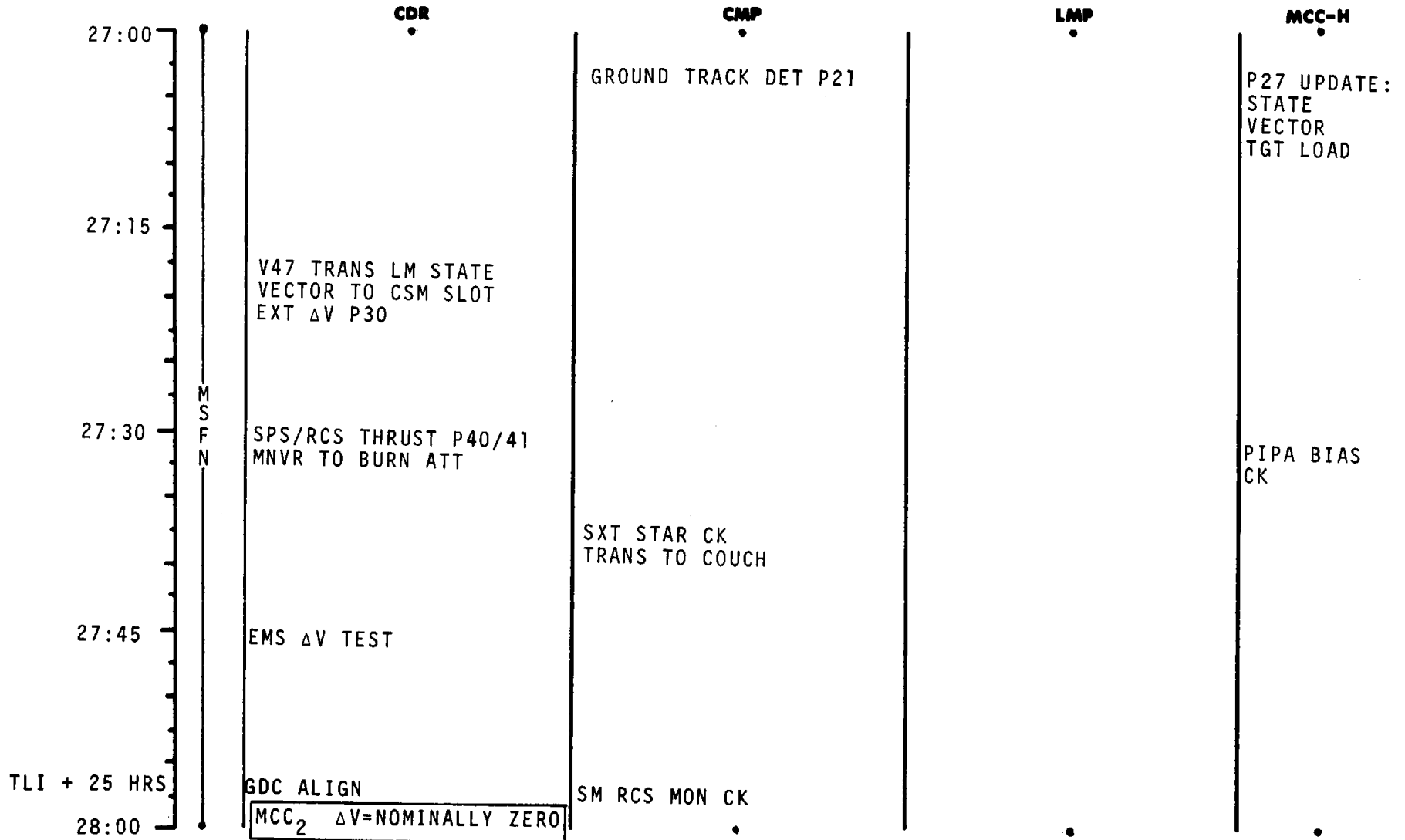
2-20a

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



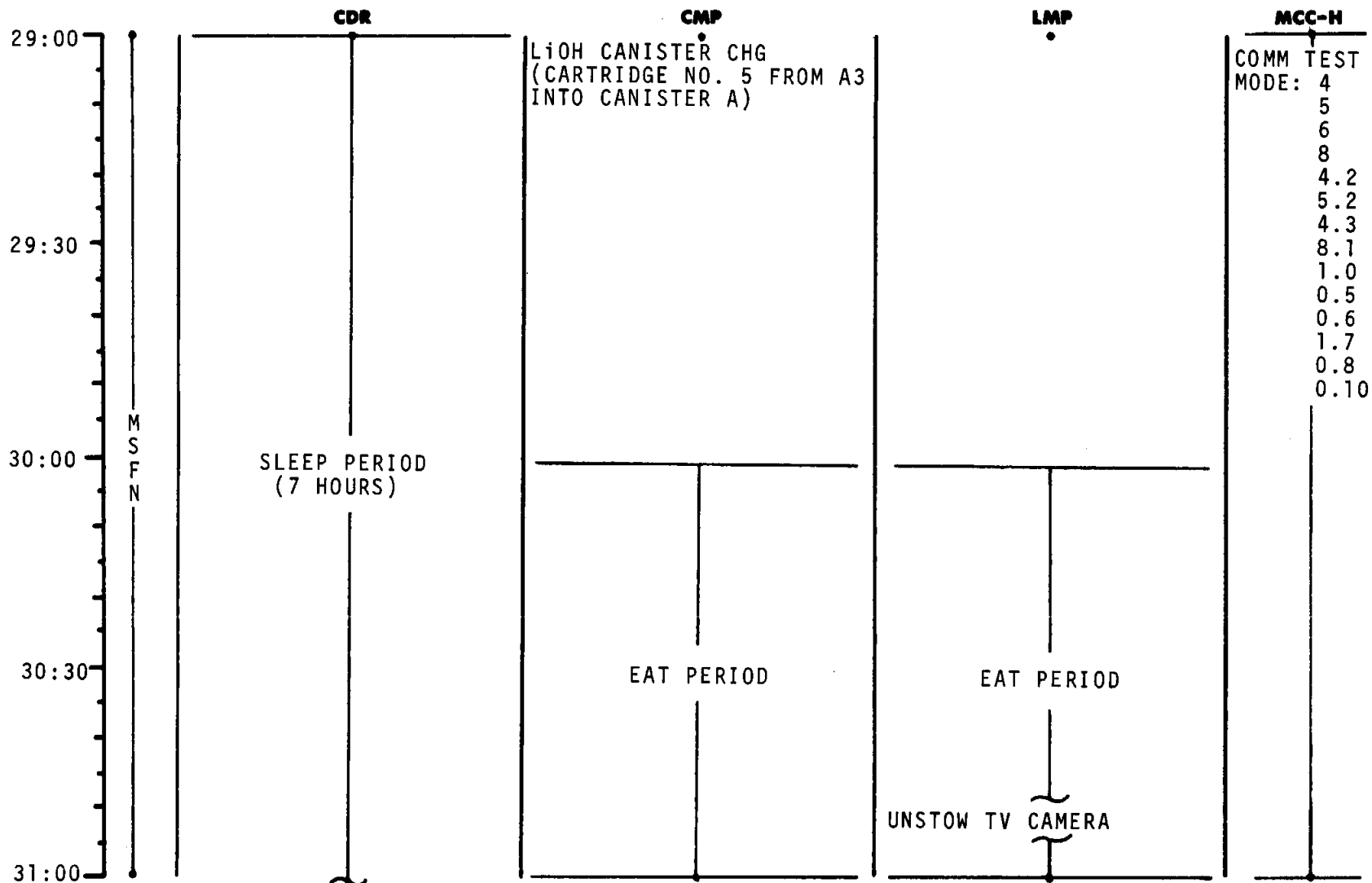
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	27:00 - 28:00	2/TLC	2-21

# FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
28:00	V66 TRANS CSM STATE VECTOR TO LM SLOT	SM RCS MONITOR CK TRN BIAS	SPS MONITOR CK INITIATE BAT CHARGE BIOMED Sw - RIGHT	
28:15	MNVR TO SIGHTING ATT MCC <sub>2</sub> BURN STATUS REPORT	CISLUNAR NAVIGATION P23		
28:30	M S F N	1. STAR 16 EFH STAR__ __ E__ H 1 SET		
28:45		2. STAR 22 EFH STAR__ __ E__ H 1 SET		
29:00	CDR CREW STATUS REPORT	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	

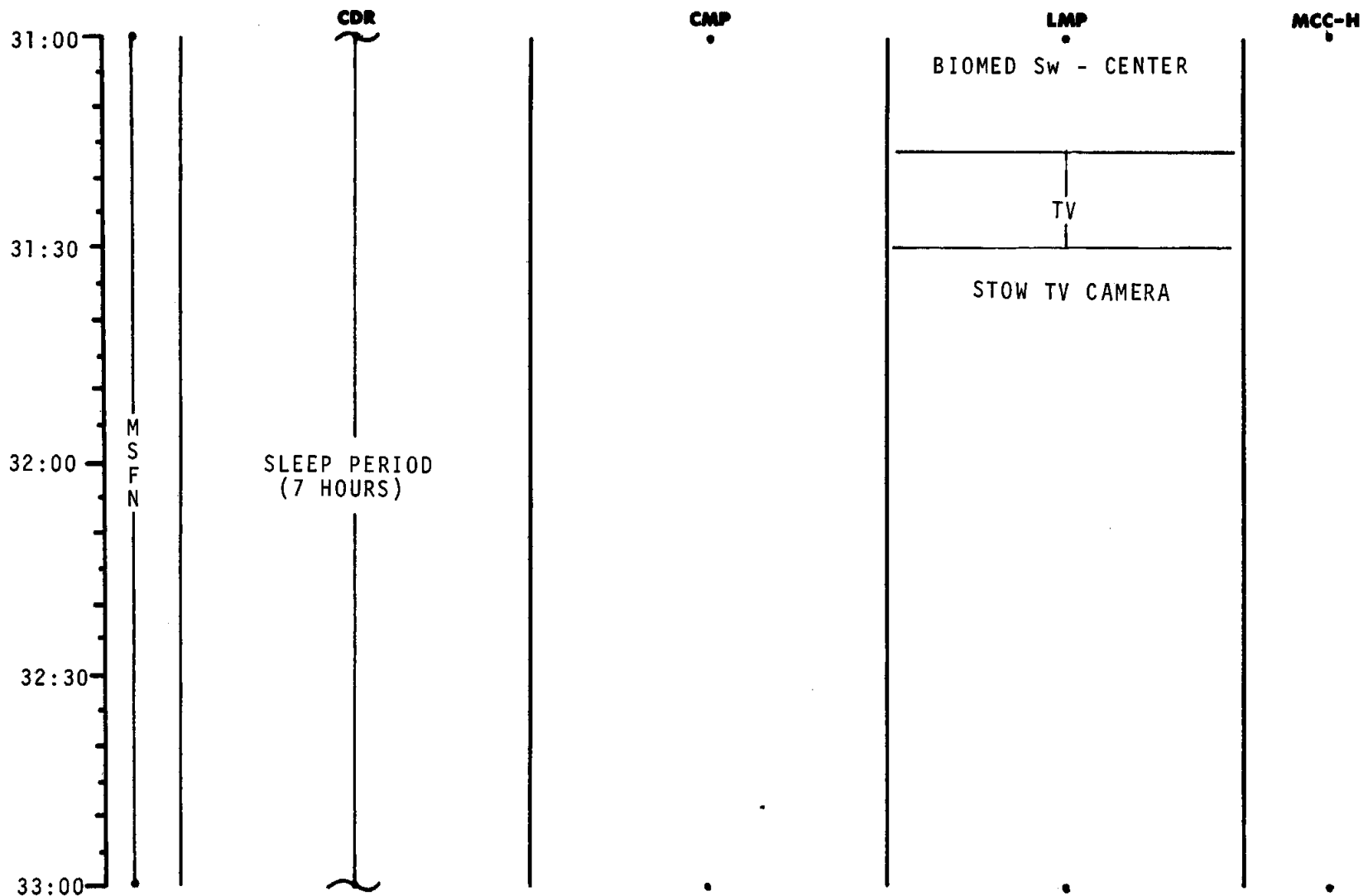
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	28:00 - 29:00	2/TLC	2-22

# FLIGHT PLAN



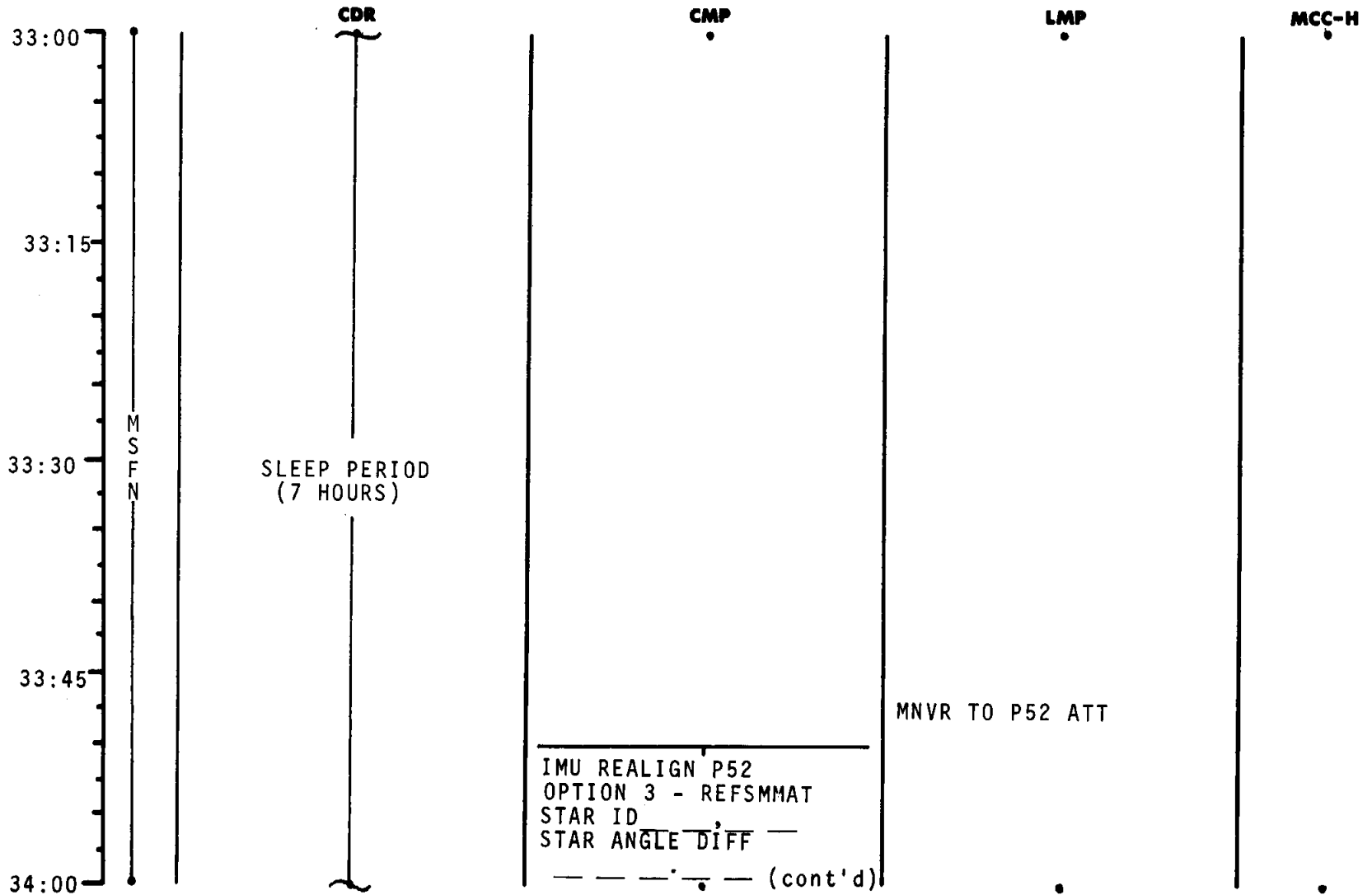
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	29:00 - 31:00	2/TLC	2-23

# FLIGHT PLAN



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

# FLIGHT PLAN



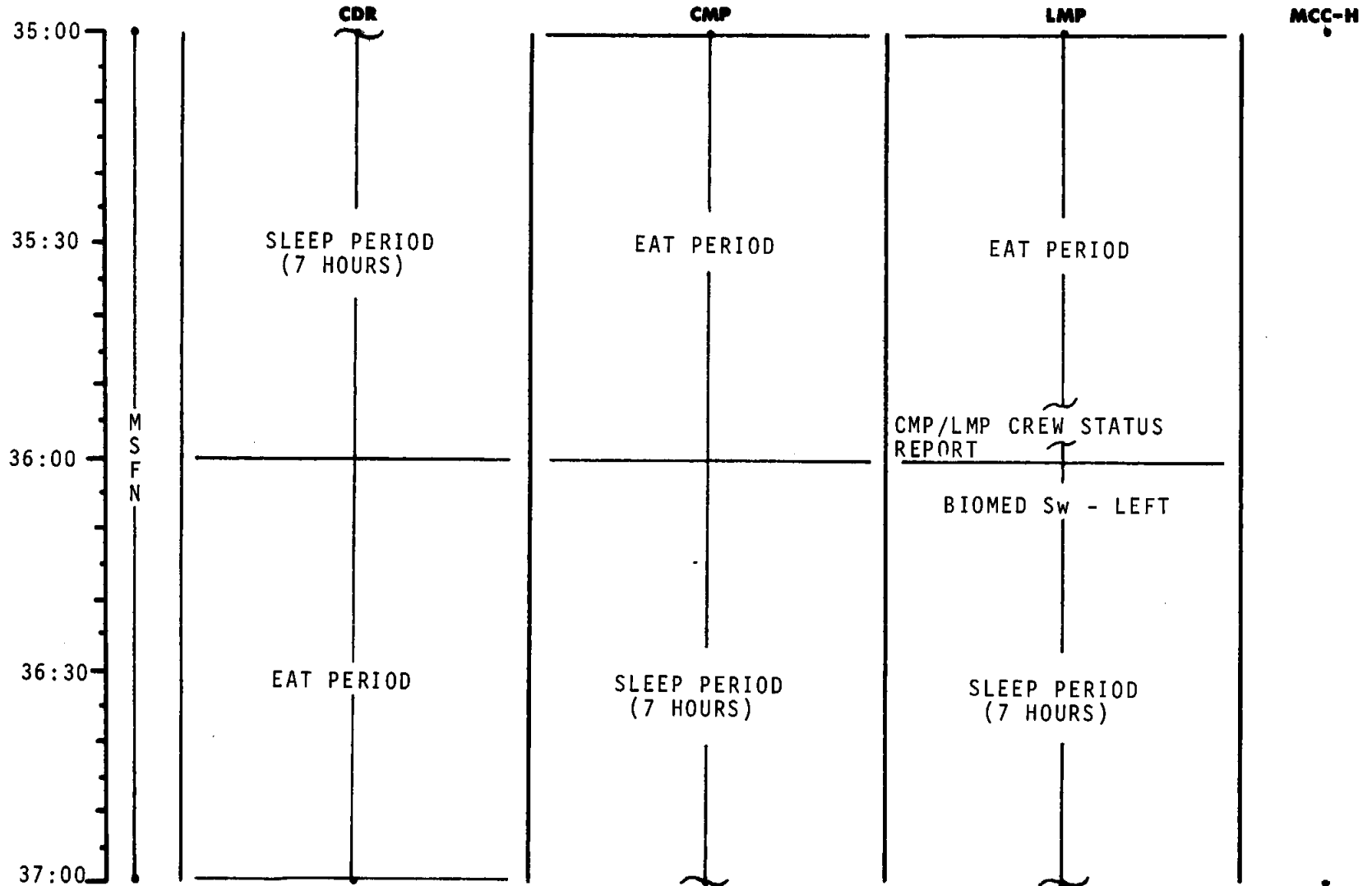
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	33:00 - 34:00	2/TLC	2-25

# FLIGHT PLAN

<p>34:00</p> <p style="text-align: center;">M S T N</p> <p>34:15</p> <p>34:30</p> <p>34:45</p> <p>35:00</p>	<p style="text-align: center;">CDR</p> <p style="text-align: center;">SLEEP PERIOD (7 HOURS)</p>	<p style="text-align: center;">CMP</p> <p>TORQUE ANGLES:</p> <p>X   —  —  —  —  —</p> <p>Y   —  —  —  —  —</p> <p>Z   —  —  —  —  —</p> <hr/> <p>SCT STAR VISIBILITY</p> <p>TRN BIAS</p> <div style="border: 1px solid black; padding: 2px; text-align: center;"> <p>CISLUNAR NAVIGATION P23</p> </div> <p>1. STAR 16 EFH STAR   —  —  E   —  H 1 SET</p> <p>2. STAR 22 EFH STAR   —  —  E   —  H 1 SET</p> <p>3. STAR 26 ENH STAR   —  —  E   —  H 1 SET</p> <p>GROUND TRACK DET P21</p> <p>RECORD BLOCK DATA (TLI + 35 HOURS, TLI + 44 HOURS, AND FLY BY)</p>	<p style="text-align: center;">LMP</p> <p>BIOMED Sw - RIGHT</p> <p>MNVR TO SIGHTING ATT</p> <p>MNVR TO PTC ATT P 331 Y 331 P   —  Y ROLL 0.1°/SEC</p>	<p style="text-align: center;">MCC-H</p> <p>VOICE UPDATE: BLOCK DATA</p>
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MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	34:00 - 35:00	2/TLC	2-26

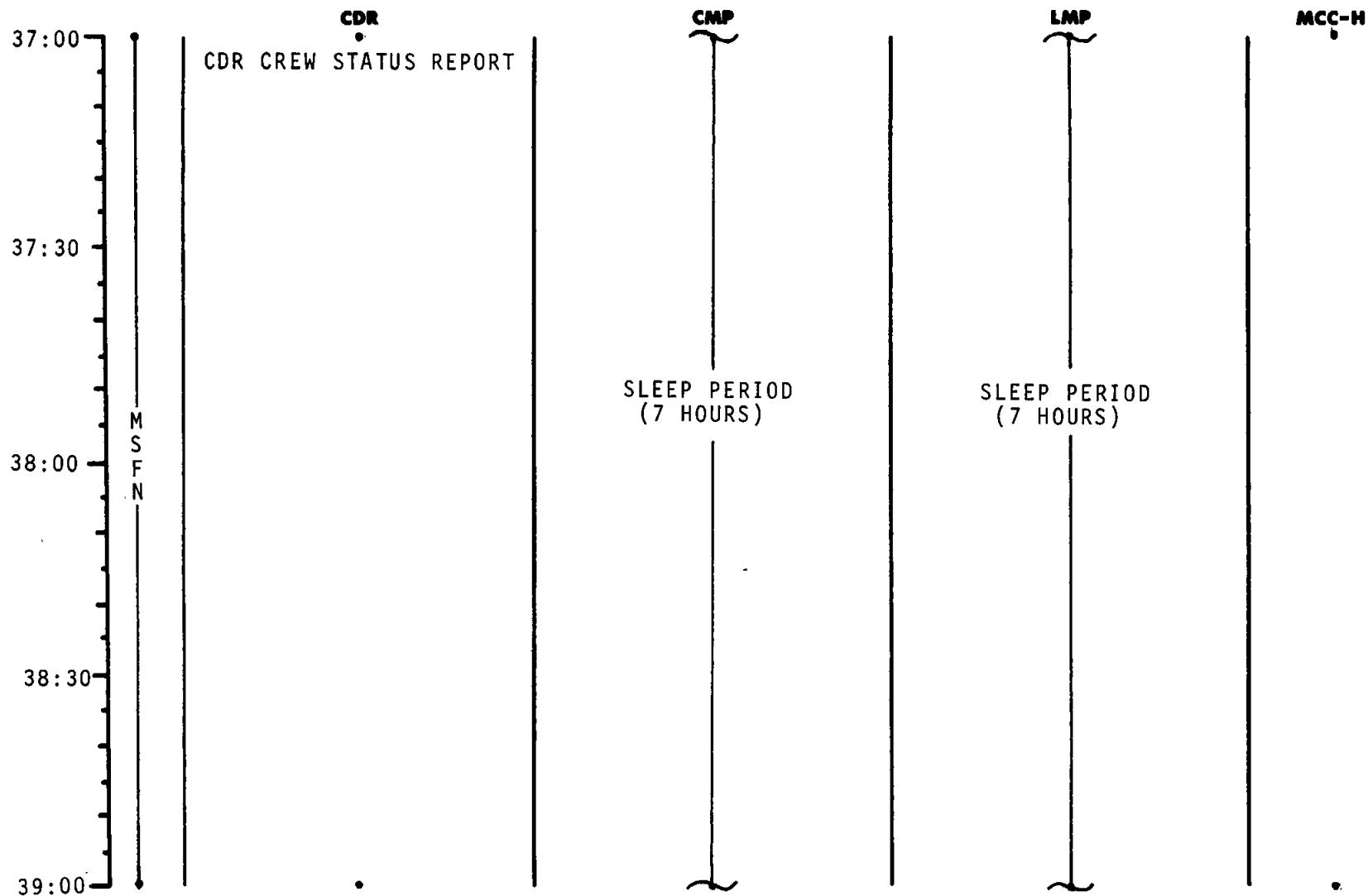
# FLIGHT PLAN



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

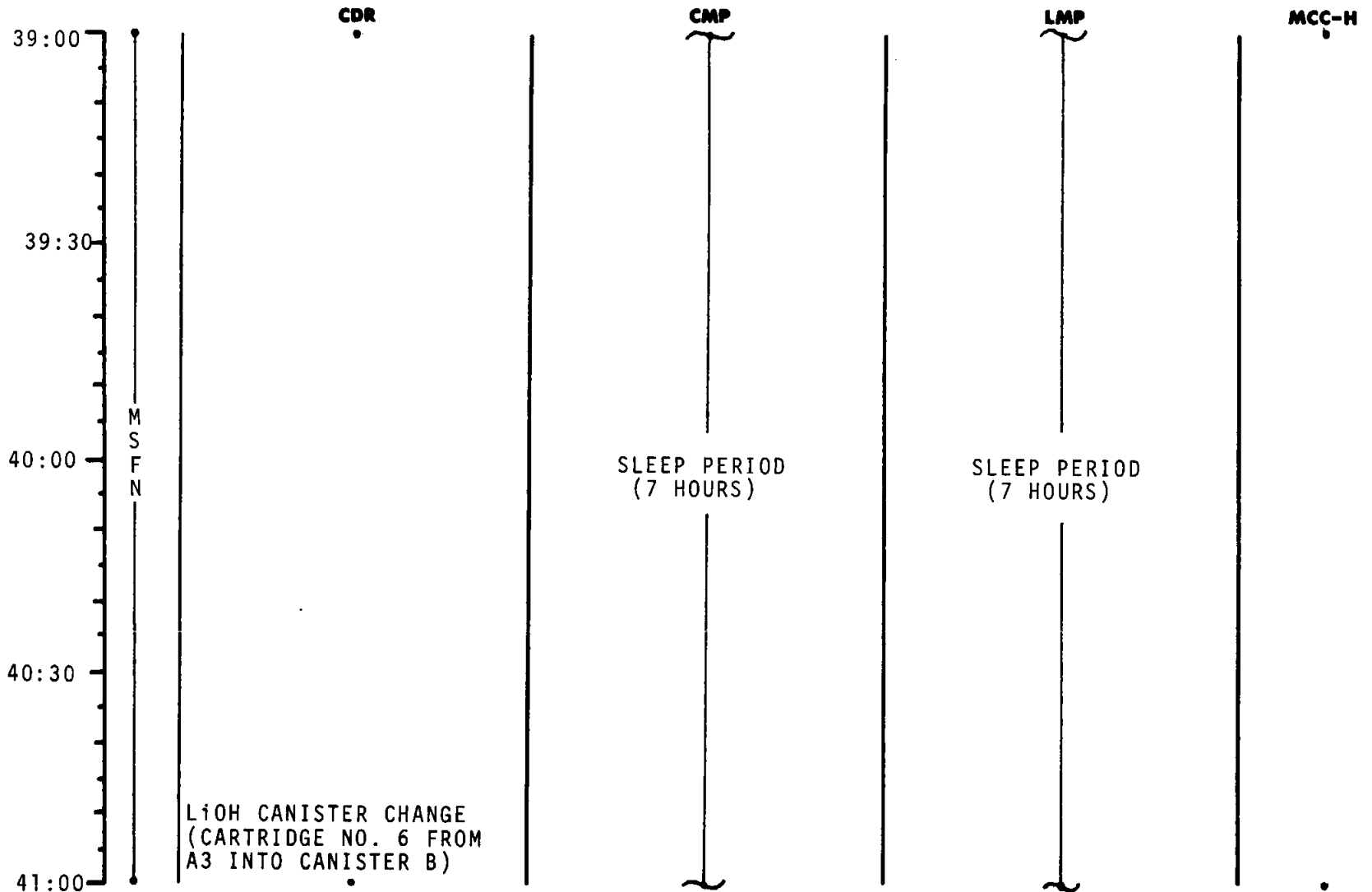


# FLIGHT PLAN



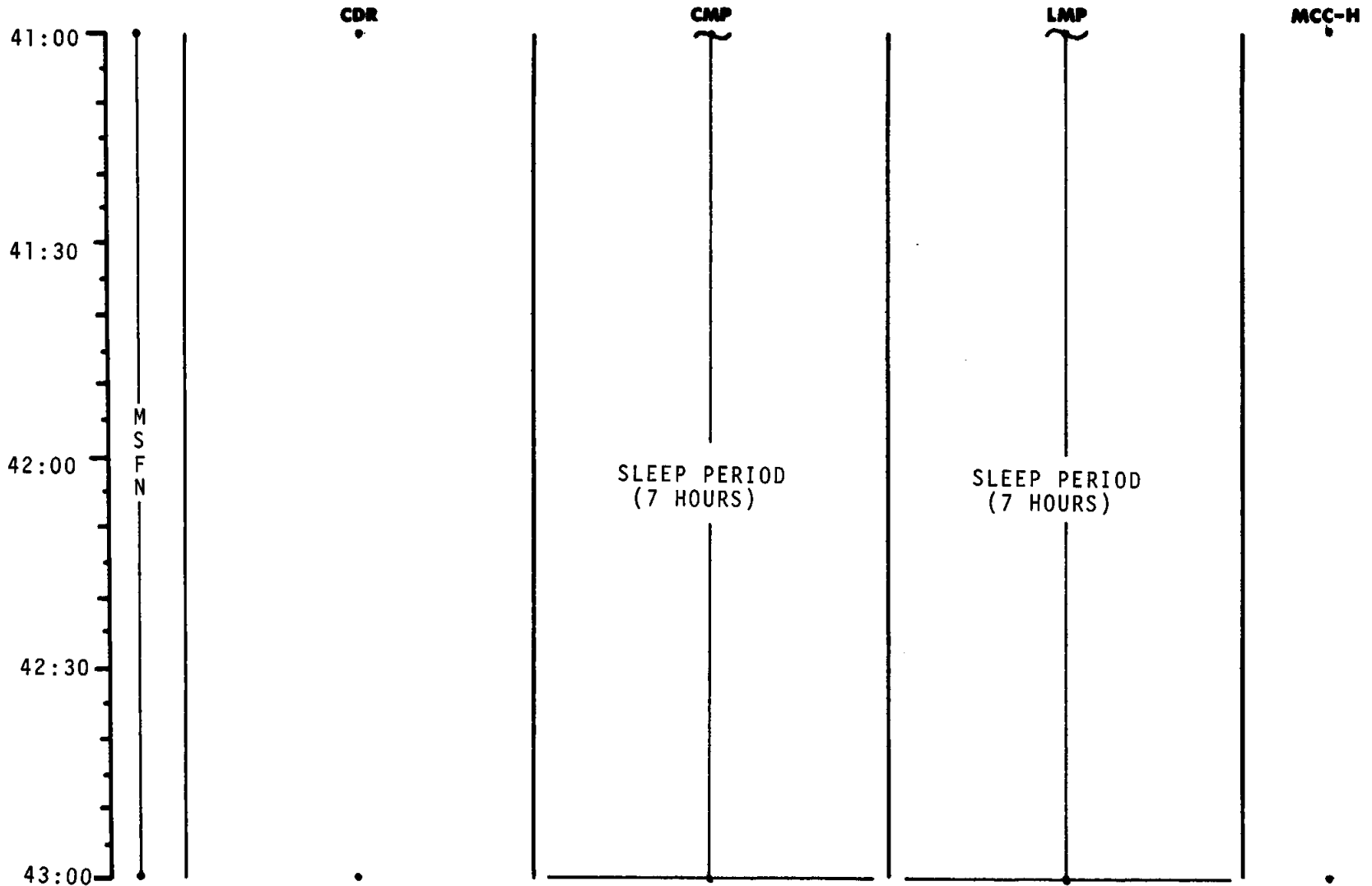
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	37:00 - 39:00	2/TLC	2-28

# FLIGHT PLAN



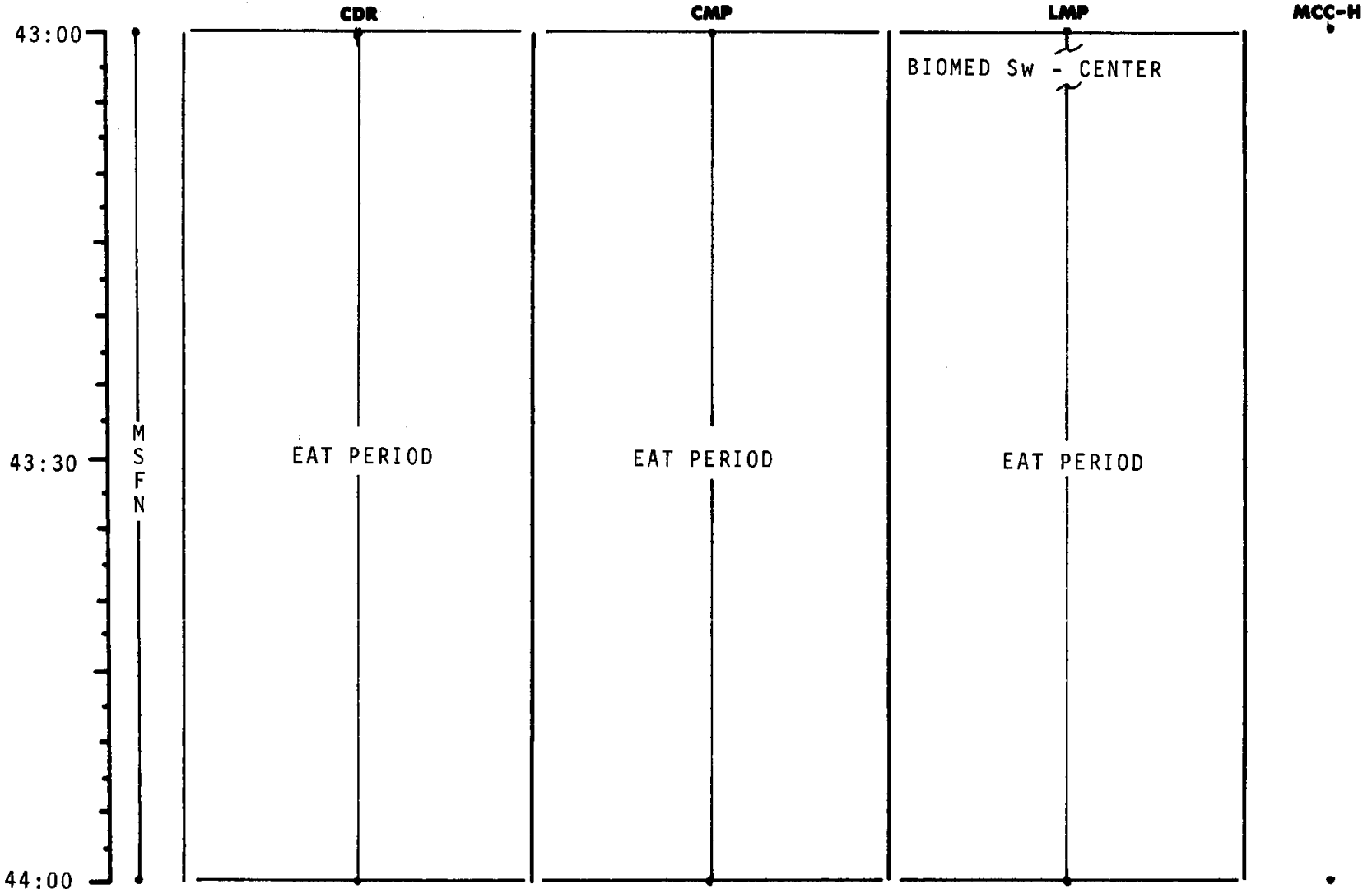
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	39:00 - 41:00	2/TLC	2-29

# FLIGHT PLAN



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

# 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	
44:30	M S F N	MNVR TO P52 ATT	RECORD BLOCK DATA (TLI + 44 HOURS, FLY BY, PC + 2 (QUICK RETURN), & PC + 2)	CMP/LMP CREW STATUS REPORT	VOICE UPDATE: BLOCK DATA
		GDC ALIGN TO IMU	IMU REALIGN P52 OPTION 3 - REFSMMAT STAR ID _____, STAR ANGLE DIFF _____  TORQUE ANGLES: _____ X _____ Y _____ Z _____		
45:00					

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



BURN STATUS REPORT

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

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

2-33a

# FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
46:00		•	•	•
		GROUND TRACK DET P21	BIOMED Sw - RIGHT RECORD MNVR PAD	P27 UPDATE: STATE VECTOR TGT LOAD VOICE UPDATE: MNVR PAD
46:15	V47 TRANS LM STATE VECTOR TO CSM SLOT EXT ΔV P30			
46:30	M S F N	SPS/RCS THRUST P40/41  MNVR TO BURN ATT	SXT STAR CK  TRANS TO COUCH	PIPA BIAS CK
46:45	EMS ΔV TEST			
LOI -22 HRS 47:00	GDC ALIGN <div style="border: 1px solid black; padding: 2px; display: inline-block;">MCC<sub>3</sub> ΔV=NOMINALLY ZERO</div>	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

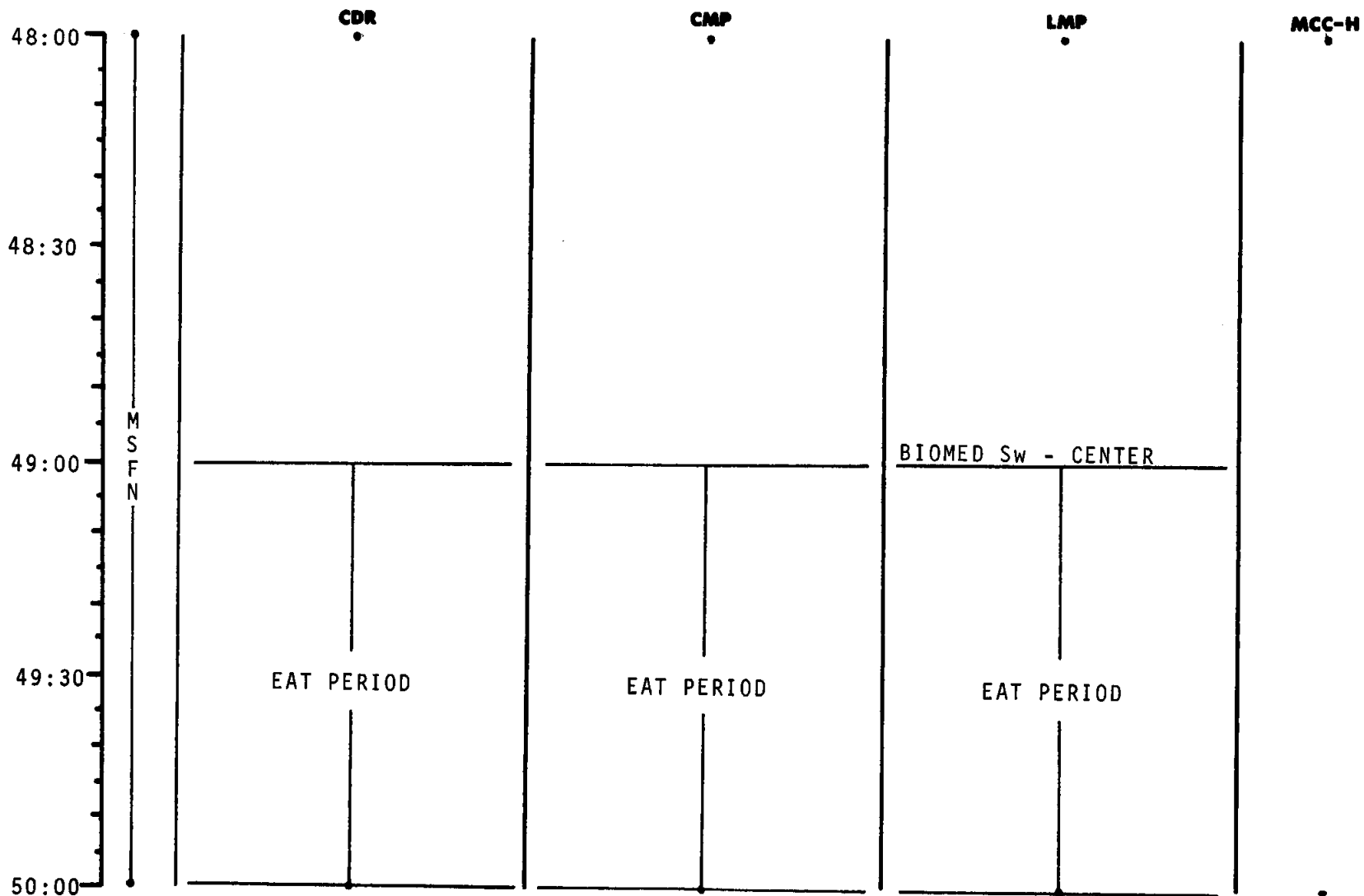


# FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
47:00	MNVR TO SIGHTING ATT	SM RCS MON CK	SPS MON CK INITIATE BAT CHARGE	
	V66 TRANS CSM STATE VECTOR TO LM SLOT			
47:15	MCC <sub>3</sub> BURN STATUS REPORT	TRN BIAS		
		CISLUNAR NAVIGATION P23		
		1. STAR 16 EFH STAR__ __ E__H 1 SET		
47:30		2. STAR 22 EFH STAR__ __ E__H 1 SET		
		3. STAR 26 ENH STAR__ __ E__H 1 SET		
47:45	MNVR TO PTC ATT P 331 Y 331 P ____ Y ____ ROLL 0.1°/SEC	GROUND TRACK DET P21		
48:00				

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

# FLIGHT PLAN

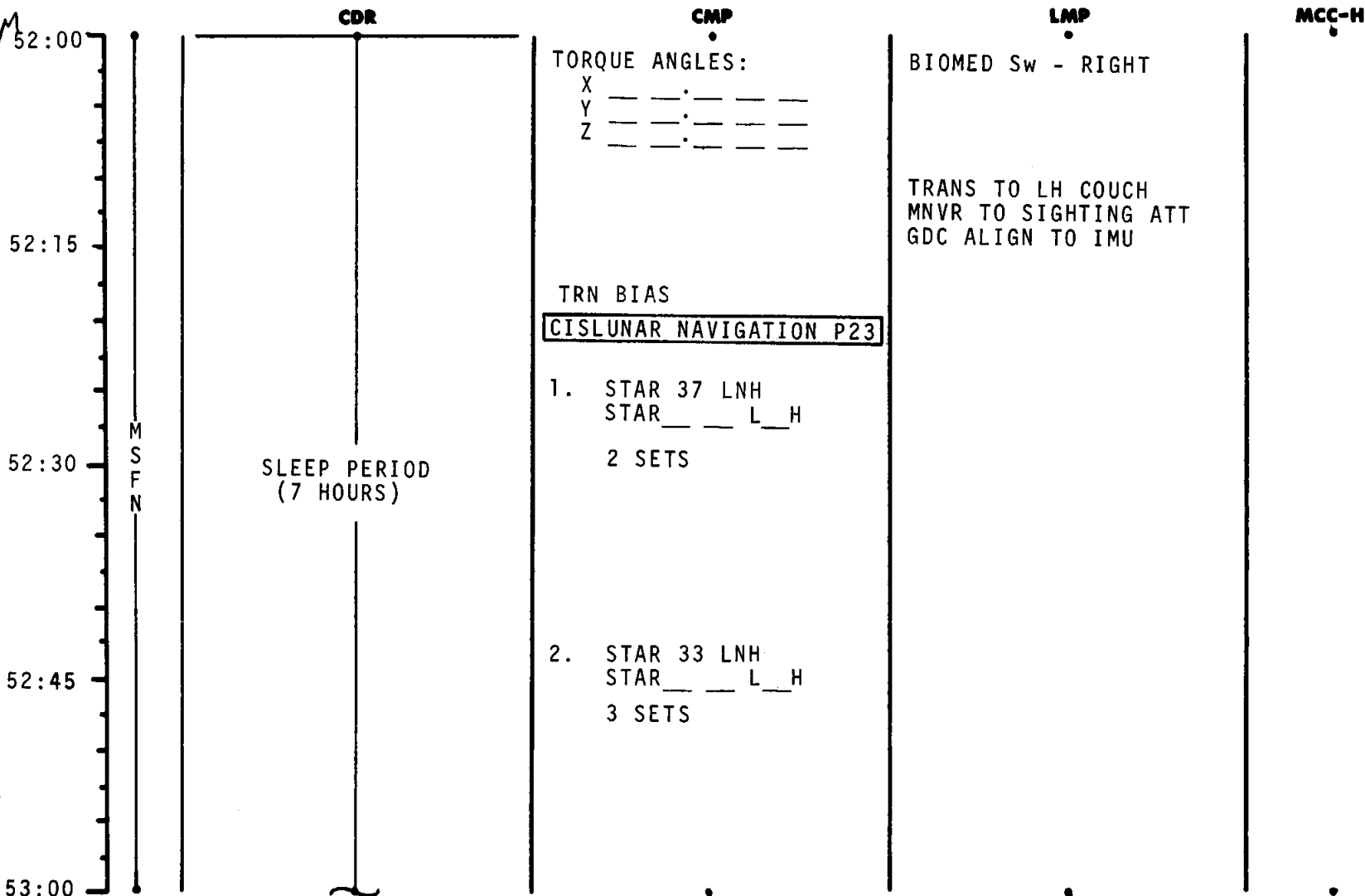


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	48:00 - 50:00	3/TLC	2-36



# FLIGHT PLAN

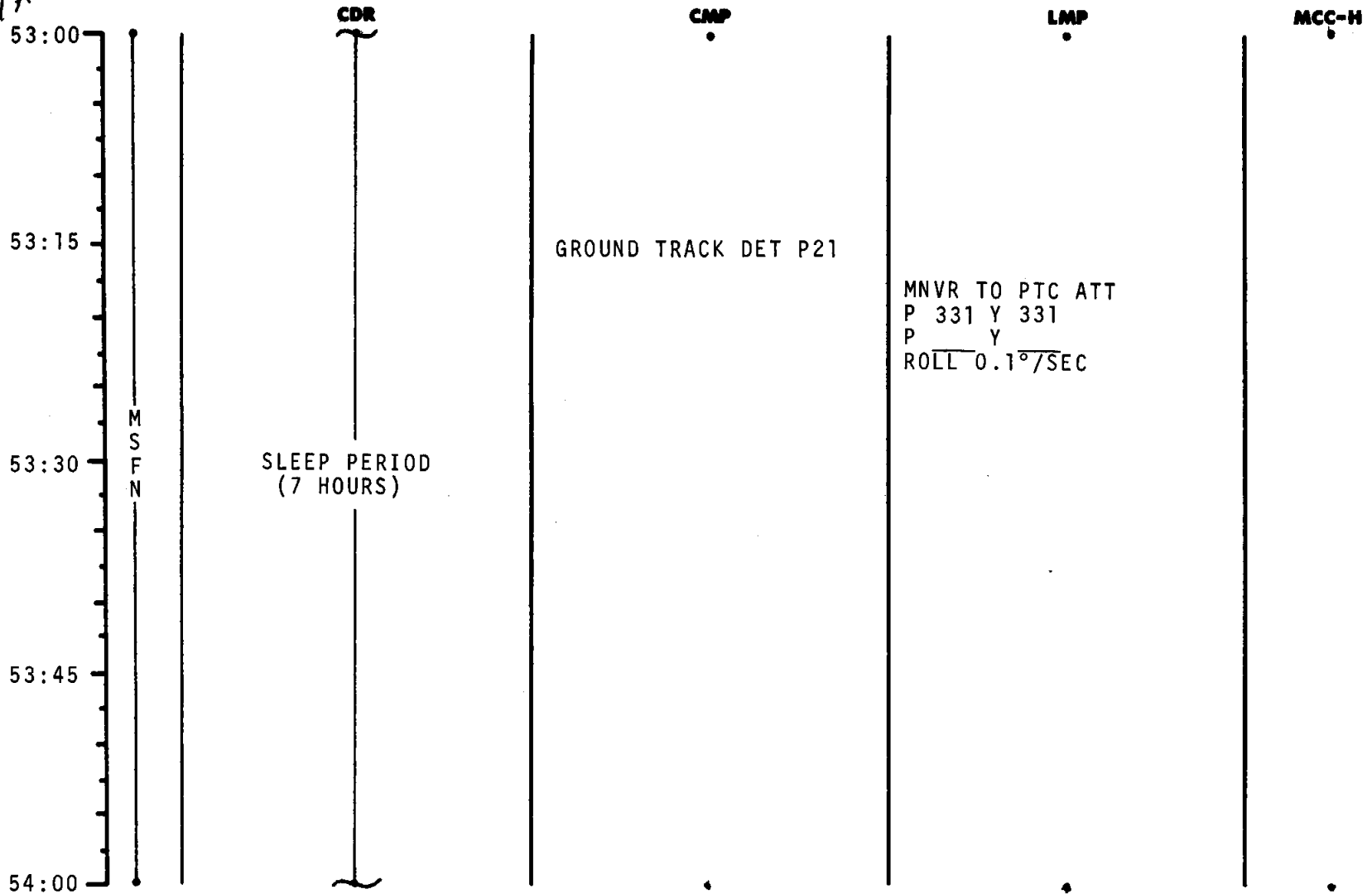
MON 23  
10:51AM



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

# FLIGHT PLAN

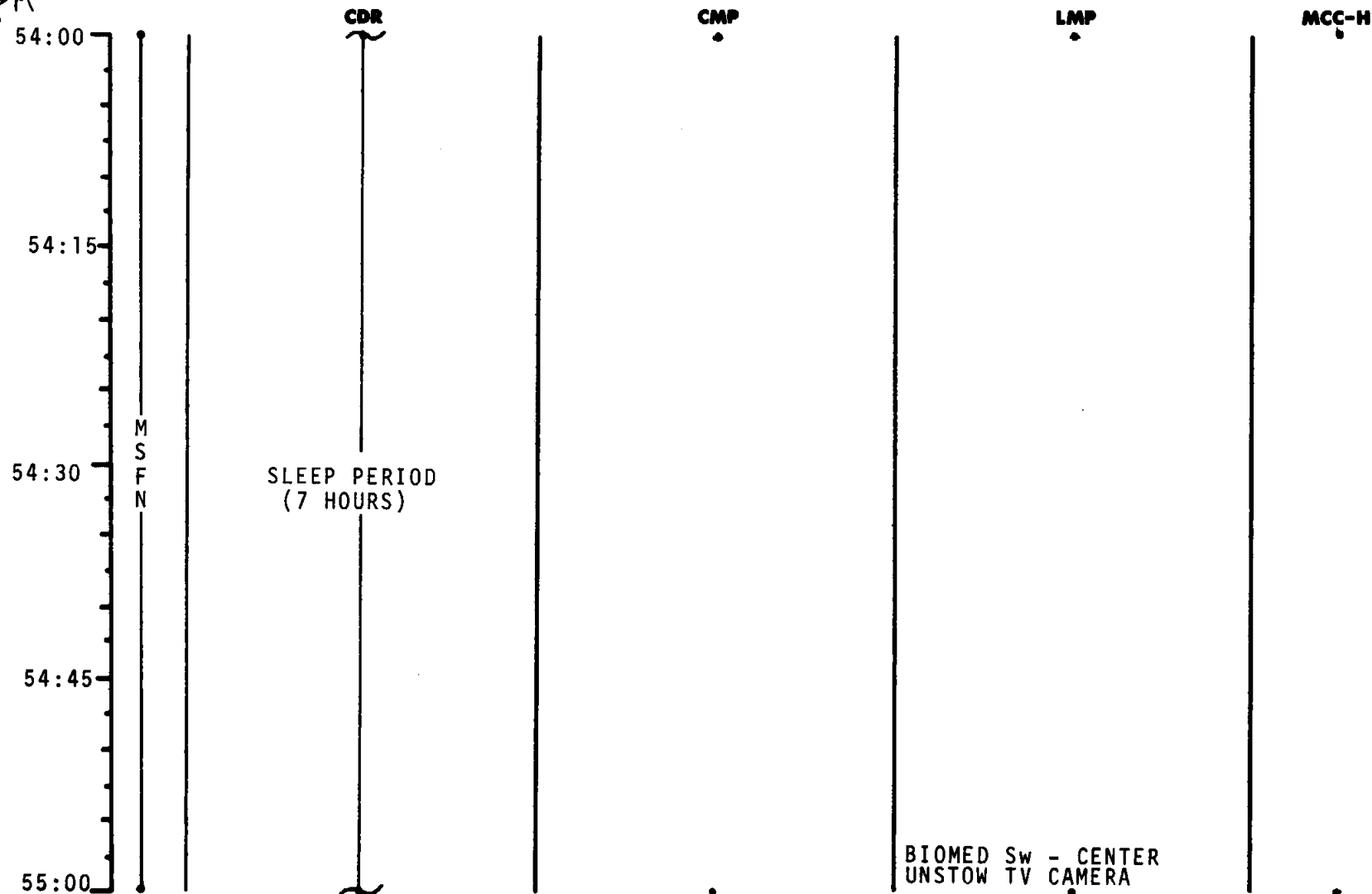
11:51 AM



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

# FLIGHT PLAN

MON  
12:51 PM



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

# FLIGHT PLAN

MDA  
1:51 PM

2:00 PM

55:00

55:15

55:30

55:45

56:00

M  
S  
F  
N

CDR

SLEEP PERIOD  
(7 HOURS)

CMP

LMP

MCC-H

TV

STOW TV CAMERA

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

# FLIGHT PLAN

MON  
2:51 PM

3:51 PM

4:51

56:00

56:30

57:00

57:30

58:00

M  
S  
F  
N

CDR

SLEEP PERIOD  
(7 HOURS)

CMP

EAT PERIOD

LMP

EAT PERIOD

MCC-H

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	56:00 - 58:00	3/TLC	2-42



# FLIGHT PLAN

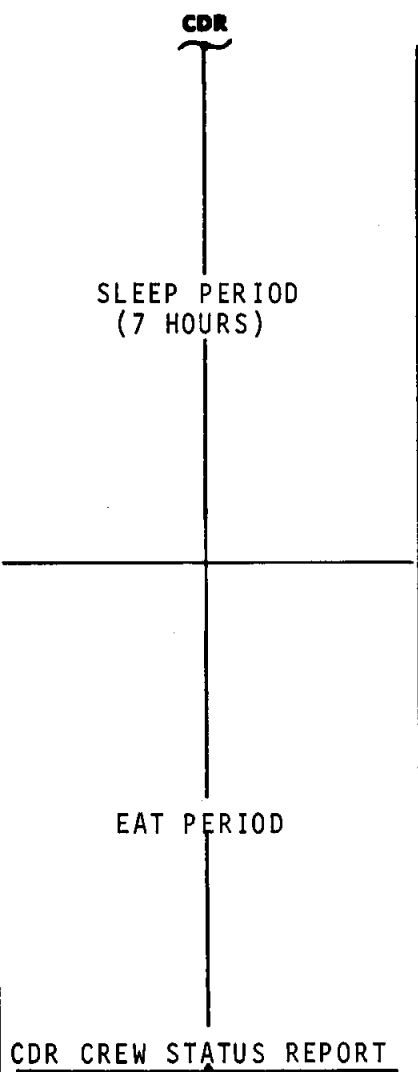
*MAN*  
4:51 PM

*5:51*

*0:16*

58:00  
58:30  
59:00  
59:30  
60:00

M  
S  
F  
N



CMP  
↓

LMP  
↓

MCC-H  
↓

BIOMED SW - LEFT

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	58:00 - 60:00	3/TLC	2-43

BURN STATUS REPORT

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

MOP  
6:51 PM

# FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
60:00	MNVR TO P52 ATT			
60:15		<hr/> IMU REALIGN P52 OPTION 1 - PREFERRED STAR ID _____ STAR ANGLE DIFF _____  TORQUE ANGLES: _____ X _____ Y _____ Z _____ <hr/>		
60:30	EXT ΔV P30 SPS/RCS THRUST P40/41 MNVR TO BURN ATT			
60:45	EMS ΔV TEST	SXT STAR CK		PIPA BIAS CK
61:00	GDC ALIGN TO IMU MCC <sub>4</sub> 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

# FLIGHT PLAN

MON  
7:51 PM

61:00	<b>CDR</b> •	V66 TRANS CSM STATE VECTOR TO LM SLOT	<b>CMP</b> •	SM RCS MON CK	<b>LMP</b> •	SPS MON CK INITIATE BAT CHARGE ECS REDUNDANT COMP CK	<b>MCC-H</b> •
61:15		MNVR TO PTC ATT P 122 Y 315 P Y ROLL 0.1 °/SEC					
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

MON  
8:51

CDR

CMP

LMP

MCC-H

62:00  
62:30  
63:00  
63:30  
64:00

M  
S  
F  
N

SLEEP PERIOD  
(6 HOURS)

SLEEP PERIOD  
(6 HOURS)

9:61

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

# FLIGHT PLAN

CDR

CMP

LMP

MCC-H

MON  
10:57 PM

64:00

64:30

65:00

65:30

M  
S  
F  
N

11:51

SLEEP PERIOD  
(6 HOURS)

SLEEP PERIOD  
(6 HOURS)

TUE AM  
12:51

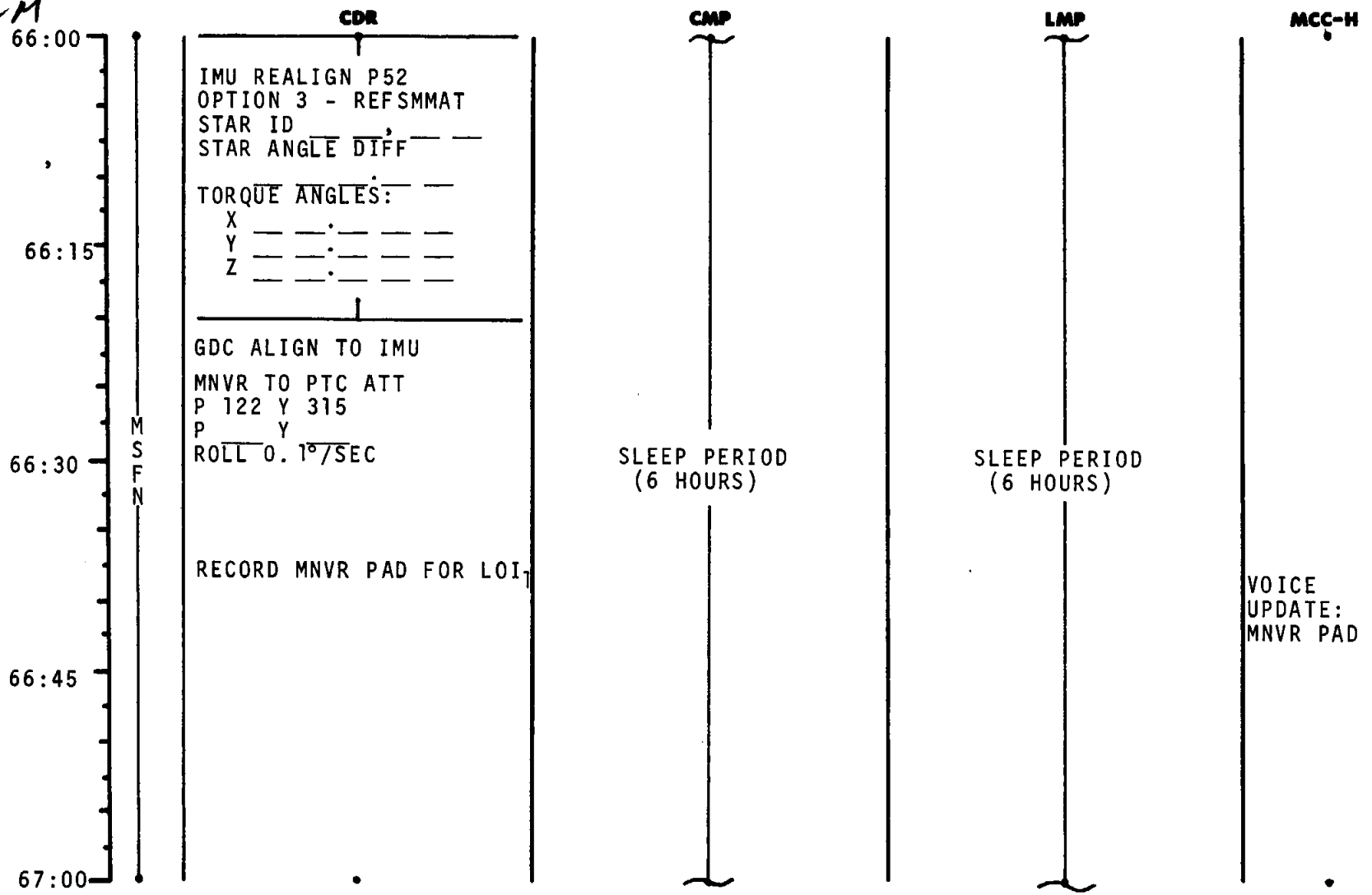
66:00

MNVR TO P52 ATT

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	64:00 - 66:00	3/TLC	2-47

TUE  
12:51 AM

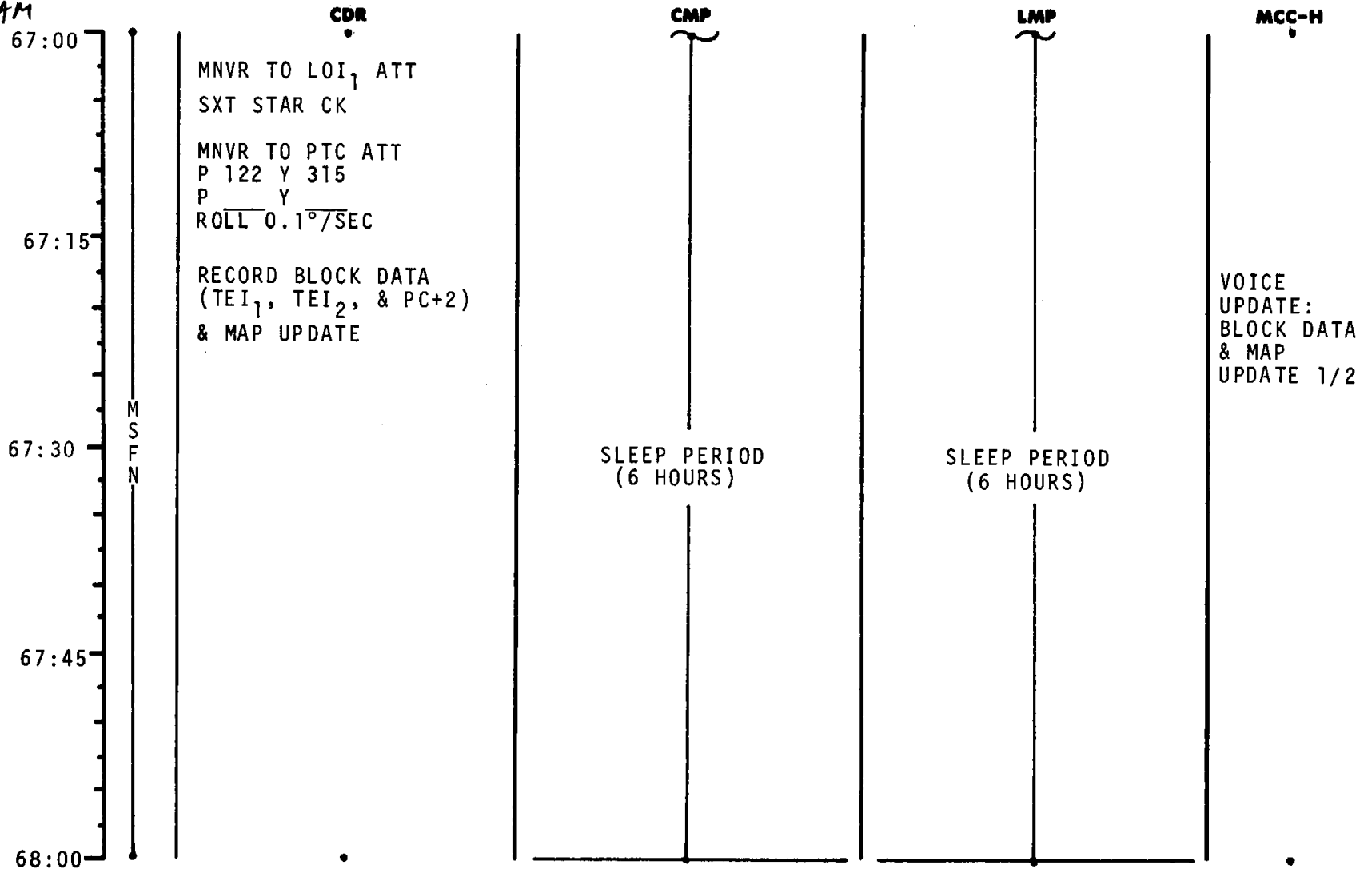
# FLIGHT PLAN



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

TUE  
1:51 AM

# FLIGHT PLAN



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



TVE  
2:51 AM

# FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
68:00	GO/NO GO FOR LOI <sub>1</sub>	GROUND TRACK DET - P21 (LOI ALTITUDE DET)	CMP/LMP CREW STATUS REPORT	GO/NO GO
	MNVR TO P52 ATT	IMU REALIGN P52 OPTION 3 - REFSMMAT AND GYRO DRIFT TEST STAR ID STAR ANGLE DIFF	RECORD MANEUVER PAD	P27 UPDATE: STATE VECTOR TARGET LOAD
68:30	EXTERNAL ΔV P30 EMS CK SPS THRUST P40 MNVR TO BURN ATT	TORQUE ANGLES: X Y Z	PRE LOI SYSTEMS CKS: C&W CK CM RCS CK SM RCS CK SPS PERIODIC MONITOR EPS PERIODIC MONITOR ECS PERIODIC MONITOR	VOICE UPDATE: MNVR PAD
	GDC ALIGN TO IMU	SXT STAR CK TRANSFER TO COUCH		
68:57				
69:00				

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

BURN STATUS REPORT

X X <input type="checkbox"/>	:	$\Delta$ TIG
X X	:	BT
<input type="checkbox"/>	.	$V_{gx}$
----- TRIM -----		
X X X		R
X X X		P
X X X		Y
<input type="checkbox"/>	.	$V_{gx}$
<input type="checkbox"/>	.	$V_{gy}$
<input type="checkbox"/>	.	$V_{gz}$
<input type="checkbox"/>	.	$\Delta V_c$
X X X		FUEL
X X X		OX
X X X		UNBALANCE

REMARKS:

LOI<sub>1</sub>  
BURN CHART

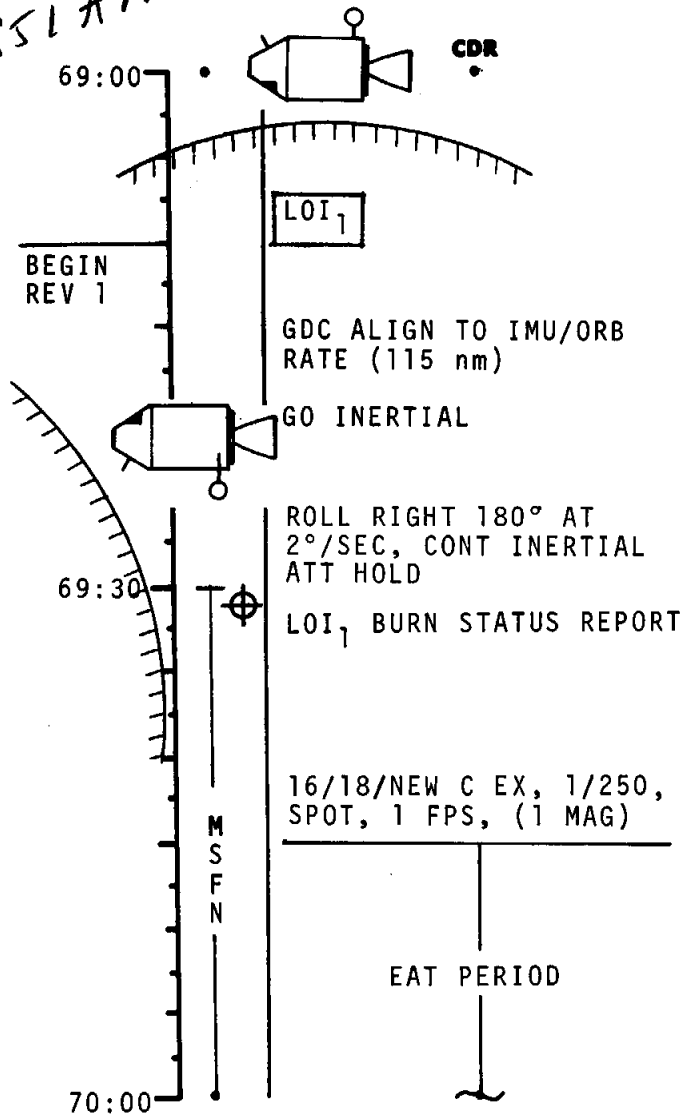
	P or Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
LOI <sub>1</sub>	10°/SEC TAKEOVER	10° TAKEOVER	B/T+6 SEC	NO TRIM

LOI<sub>1</sub> 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

2-50a

TUE  
3:51 AM



# FLIGHT PLAN

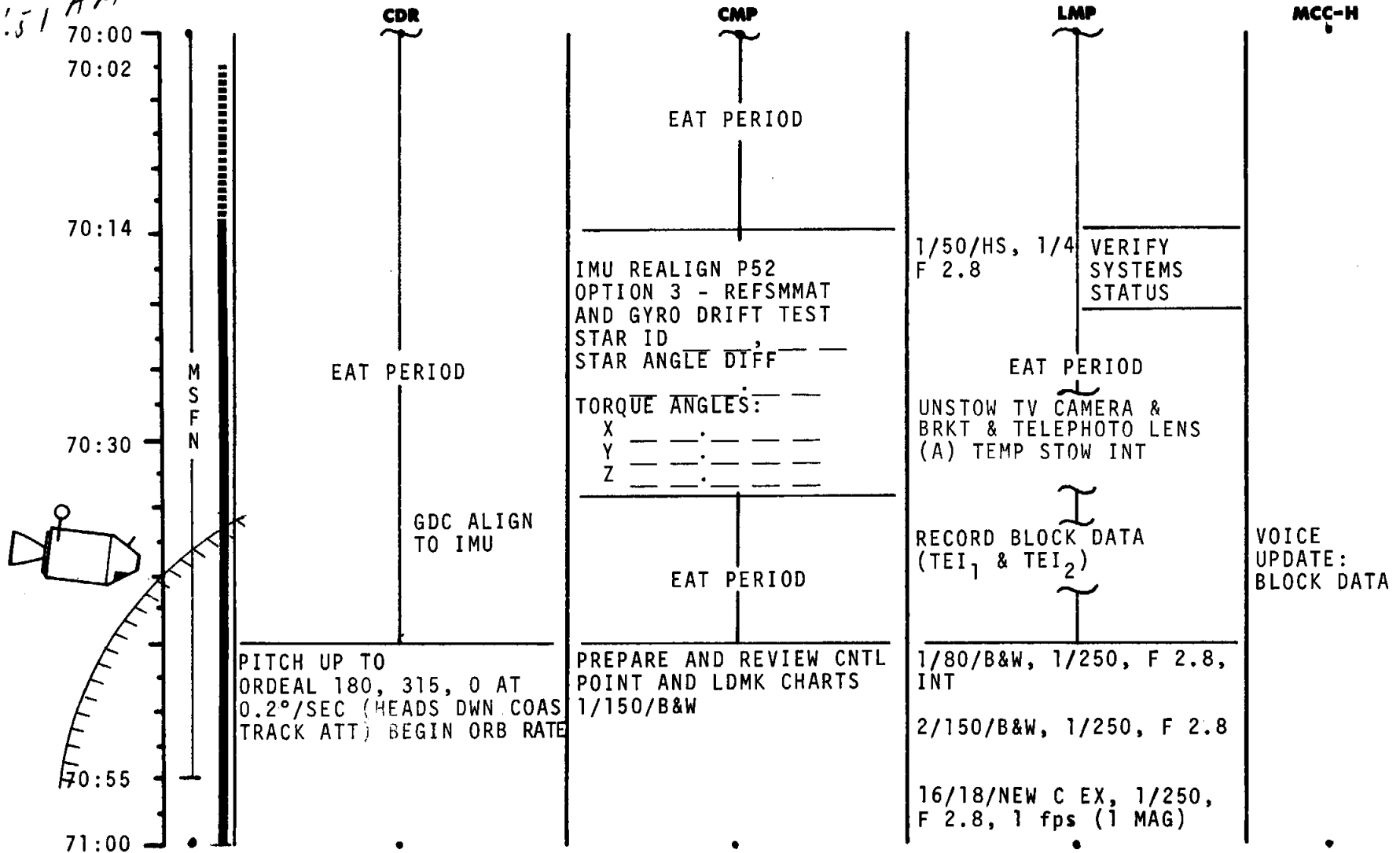
CDR	CMP	LMP	MCC-H
SM RCS MONITOR CK	GETI = 69:07:30 ΔV = 2991 fps BT = 4 MIN 5.8 SEC	BIOMED Sw - CENTER	
V66 TRANS CSM STATE VECTOR TO LM SLOT	SM RCS MONITOR CK	SPS MONITOR CK	
SM RCS MONITOR CK	2/80/B3 + 1/150/A8, R&B FILTER/U4, SPOT/R13, INT/U4, 2 B&W FILM PACKS 1A8	INITIATE BAT CHARGE CAMERA PREP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

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

TUE

4:51 AM

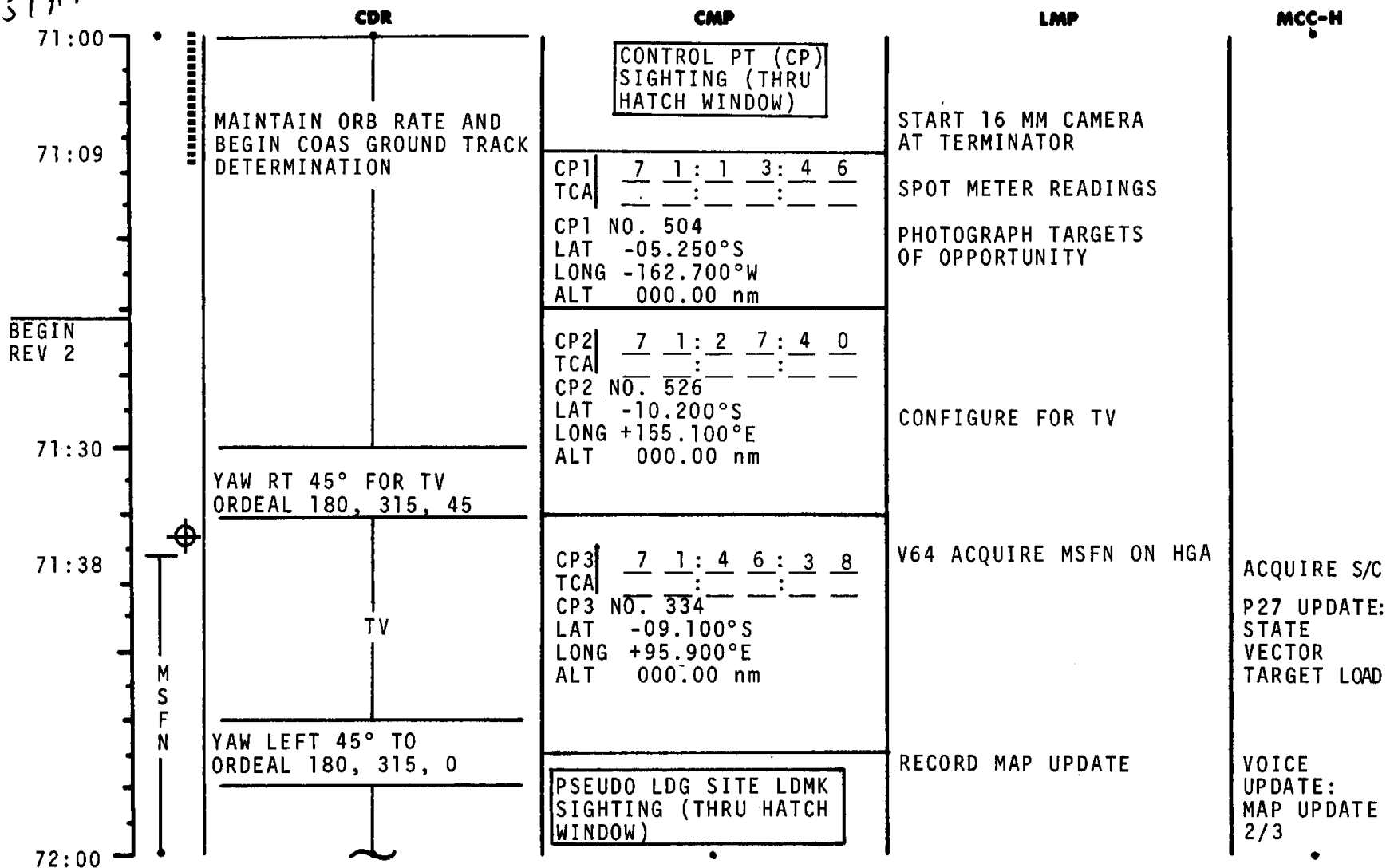
# FLIGHT PLAN



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

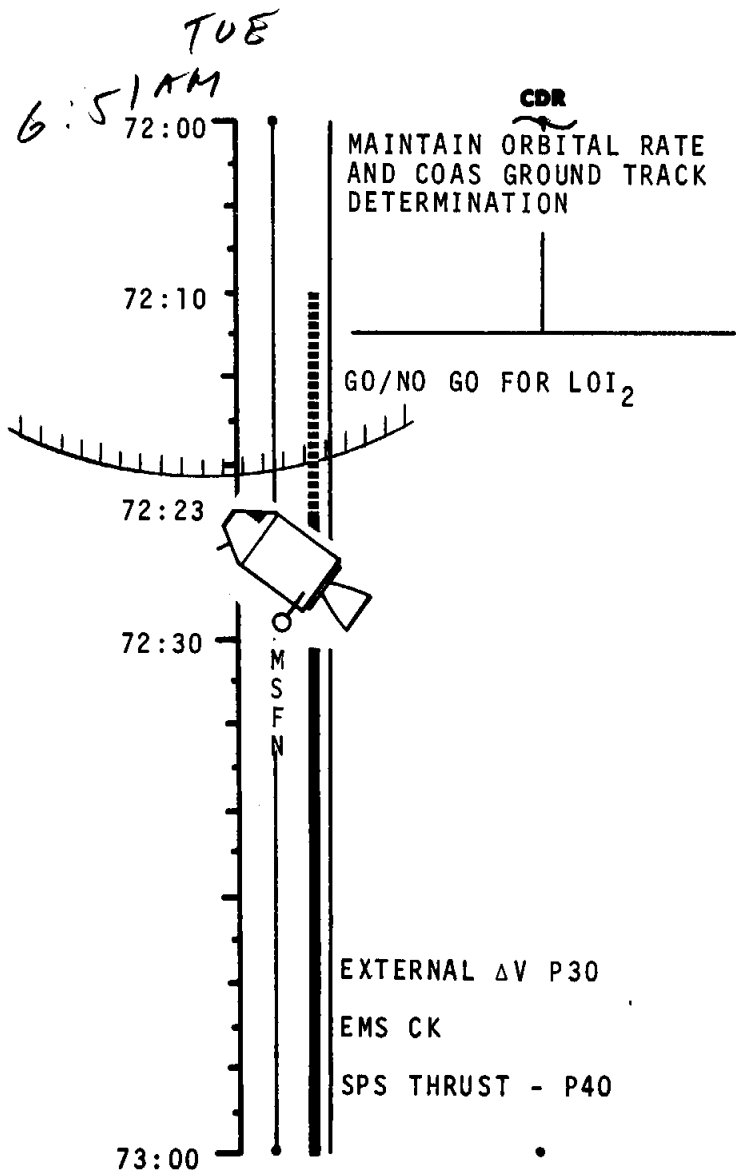
TVE  
5:51 AM

# FLIGHT PLAN



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

# 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

LIQH 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 (TEI<sub>3</sub>, TEI<sub>3</sub> NO  
LOI<sub>2</sub>).

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

LOI<sub>2</sub>  
BURN CHART

BURN STATUS REPORT

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

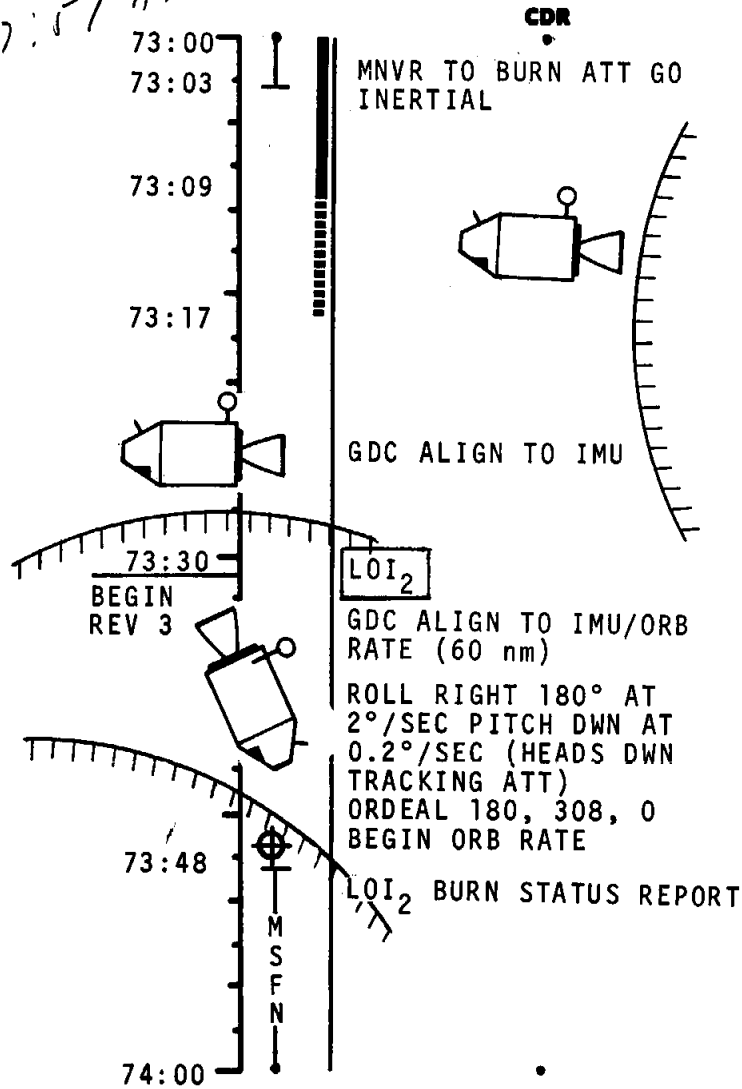
REMARKS:

	P or Y RATES	ATT DEVIATION	SHUTDOWN TIME	RESIDUALS
LOI <sub>2</sub>	10°/SEC TAKEOVER	10° TAKEOVER	B/T +1 SEC	NO TRIM

2-54a

# FLIGHT PLAN

FUE  
7:51 AM



CDR

CMP

LMP

MCC-H

SXT STAR CK  
TRANSFER TO COUCH

SM RCS MONITOR CK

GETI = 73:30:54
$\Delta V = 138.5$ fps
BT = 9.7 SEC

V66 TRANS CSM STATE VECTOR TO LM SLOT  
SM RCS MONITOR CK

REST PERIOD  
(2 HOURS)

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

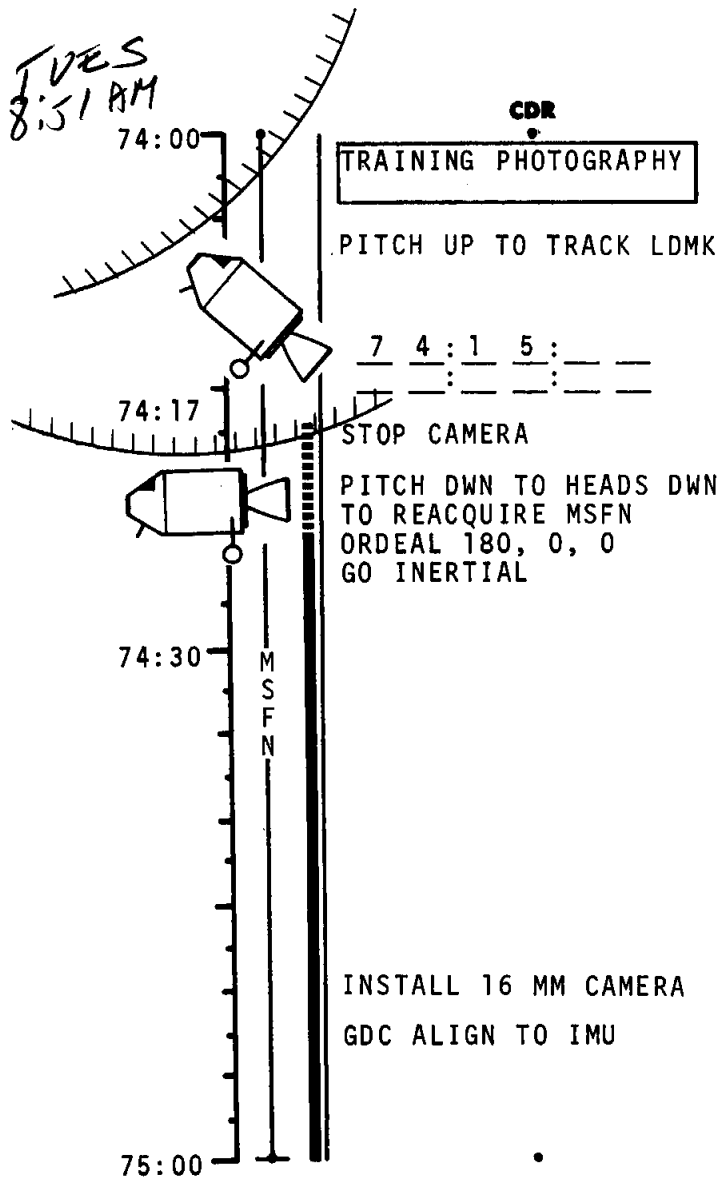
V64 ACQUIRE MSFN ON HGA

BIOMED Sw - RIGHT

ACQUIRE S/C  
PIPA BIAS  
CK

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  
(TEI<sub>3</sub> & TEI<sub>4</sub>)

**MCC-H**

VOICE  
UPDATE:  
MAP UPDATE  
3/4

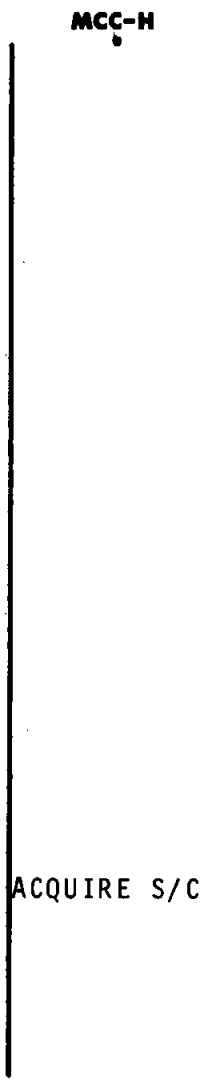
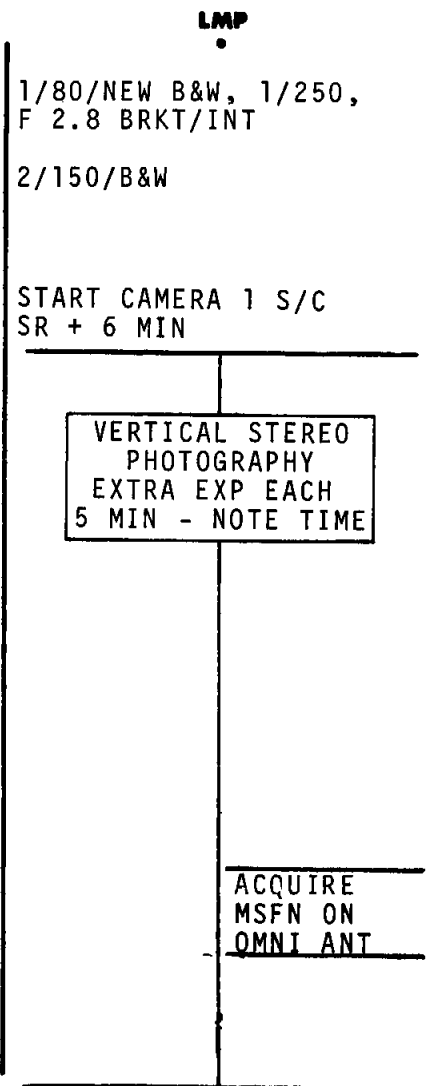
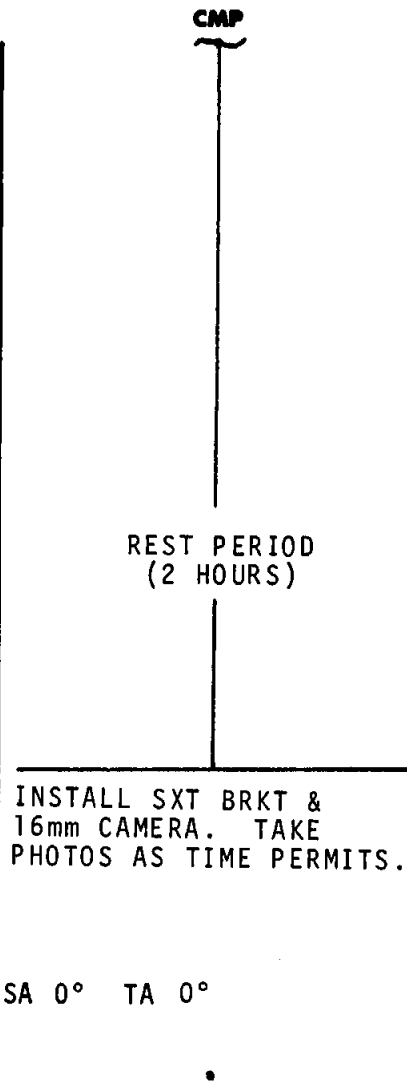
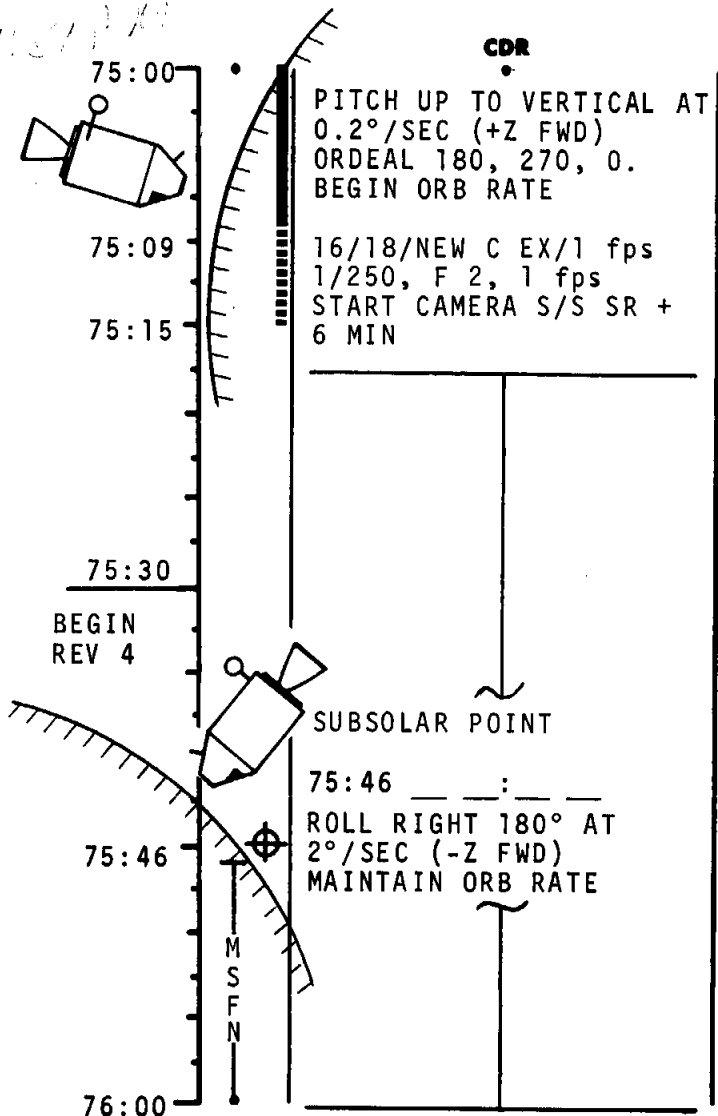
DUMP DSE

VOICE  
UPDATE:  
BLOCK DATA

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	74:00 - 75:00	4/LP0	2-56

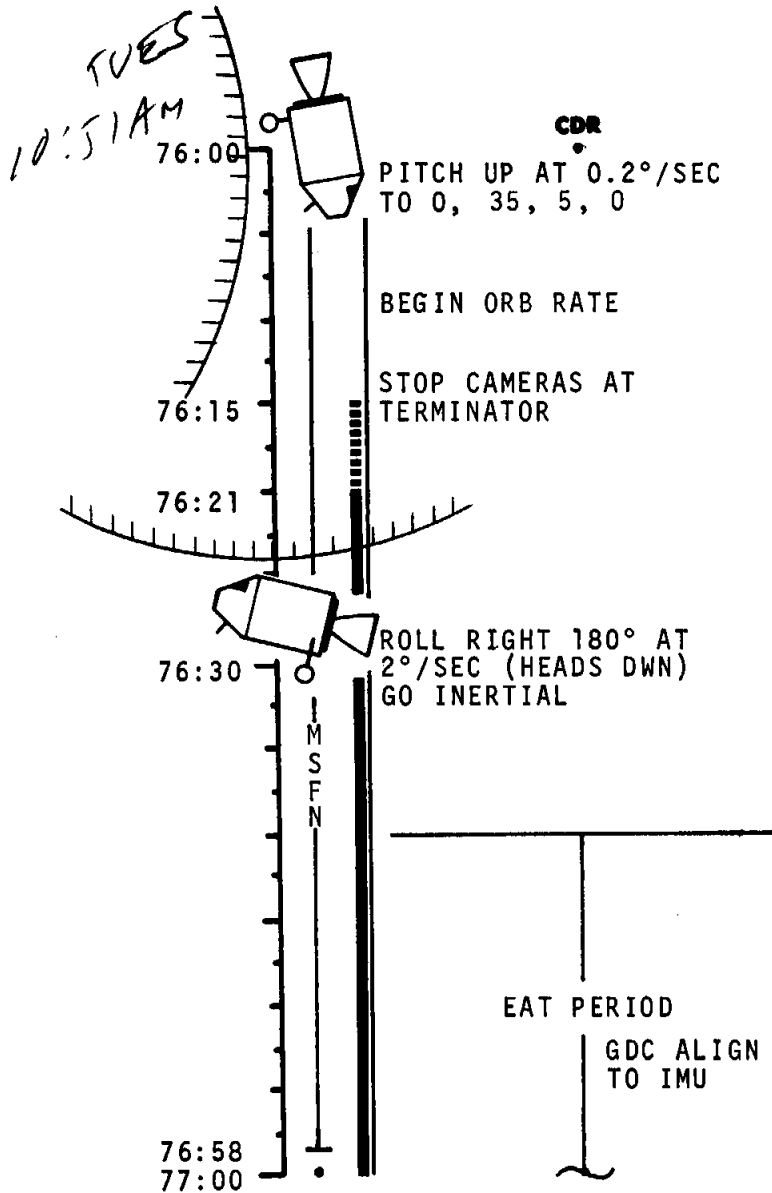
# FLIGHT PLAN

*EVE*  
*91.517 M*



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 _____ STAR ANGLE DIFF _____					
TORQUE ANGLES:					
X	---	:	---	:	---
Y	---	:	---	:	---
Z	---	:	---	:	---

**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: (TEI<sub>4</sub> & TEI<sub>5</sub>)

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

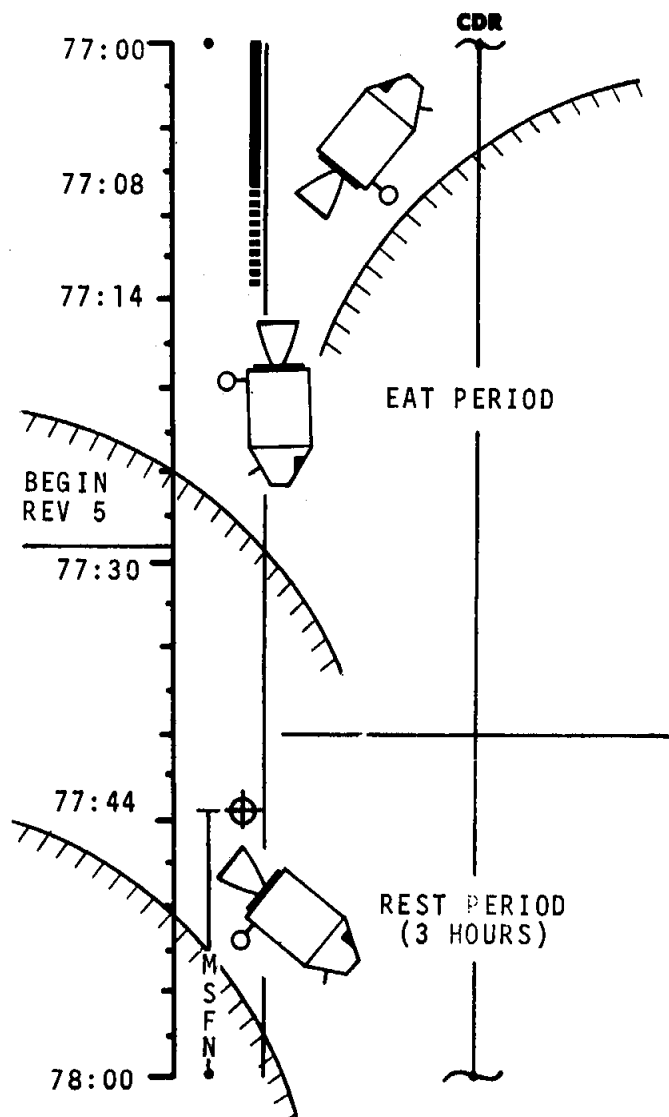
ACQUIRE S/C

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



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

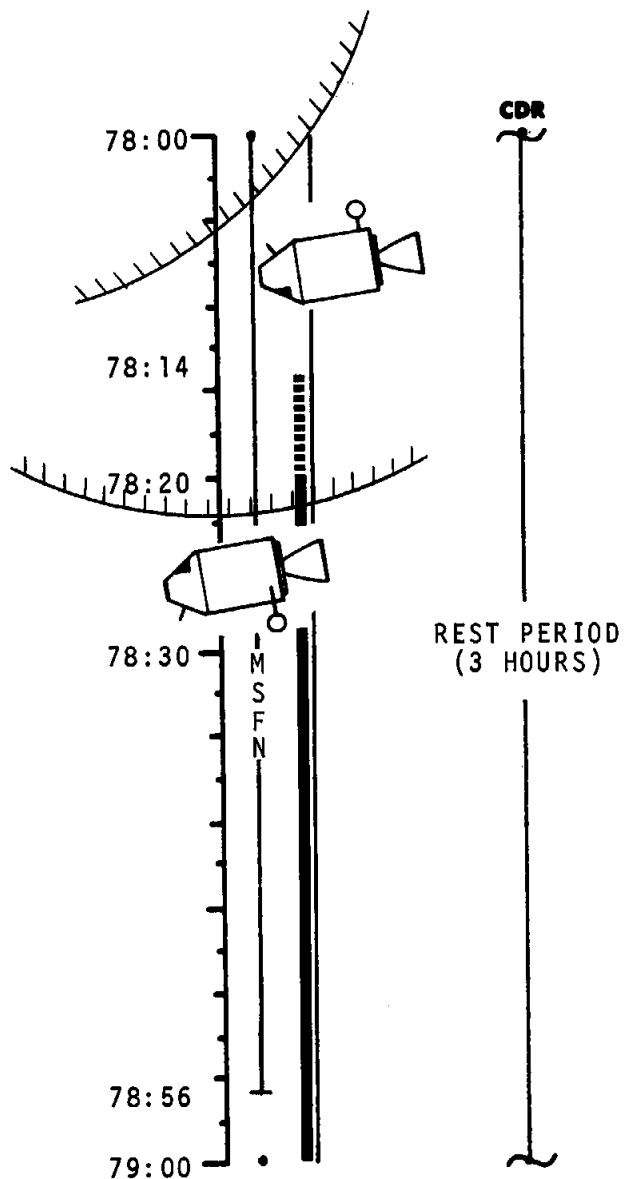
MCC-H

---

ACQUIRE S/C

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	77:00 - 78:00	4/LP0	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 \_\_\_:\_\_\_:\_\_\_ nm

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  
(TEI<sub>6</sub>), & MAP UPDATE

VERIFY SYSTEMS STATUS

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

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

**MCC-H**

ACQUIRE S/C

P27 UPDATE:

STATE

VECTOR

VOICE

UPDATE:

BLOCK DATA

& MAP

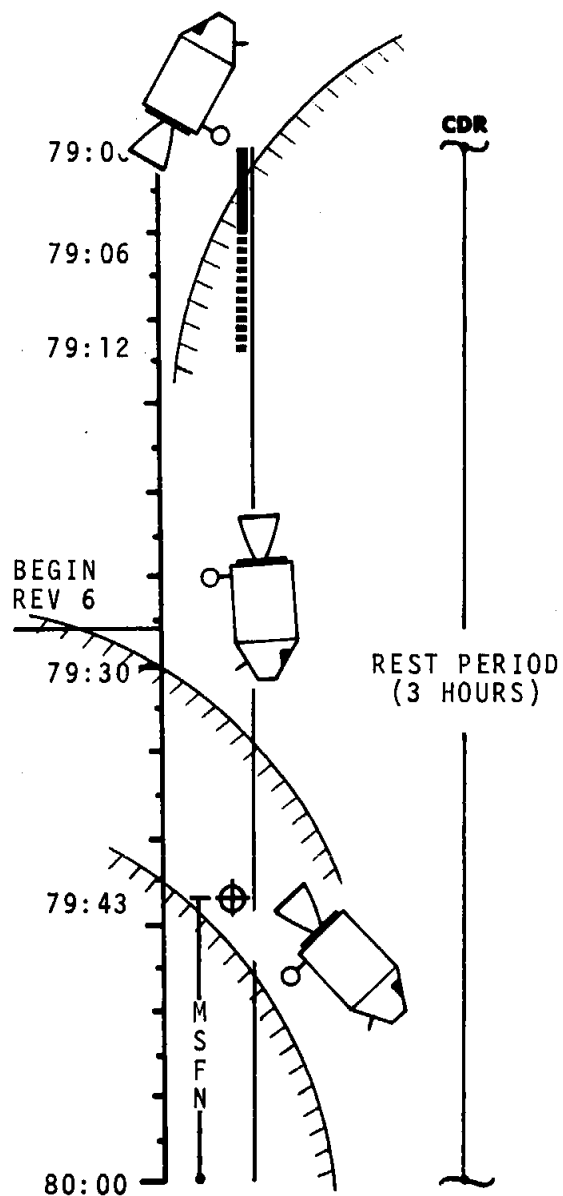
UPDATE

5/6

DUMP DSE

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

# FLIGHT PLAN



**CMP**  
 REVIEW CONTROL POINT MAP

**CNTL POINT SIGHTING**

P22 - AUTO OPTICS  
 IPI \_\_\_\_\_:\_\_\_\_\_:\_\_\_\_\_  
 TCA \_\_\_\_\_:\_\_\_\_\_:\_\_\_\_\_  
 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

**PSEUDO LGD SITE SIGHTING**

**LMP**

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

PITCH DWN 0.3°/SEC AT ACC

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

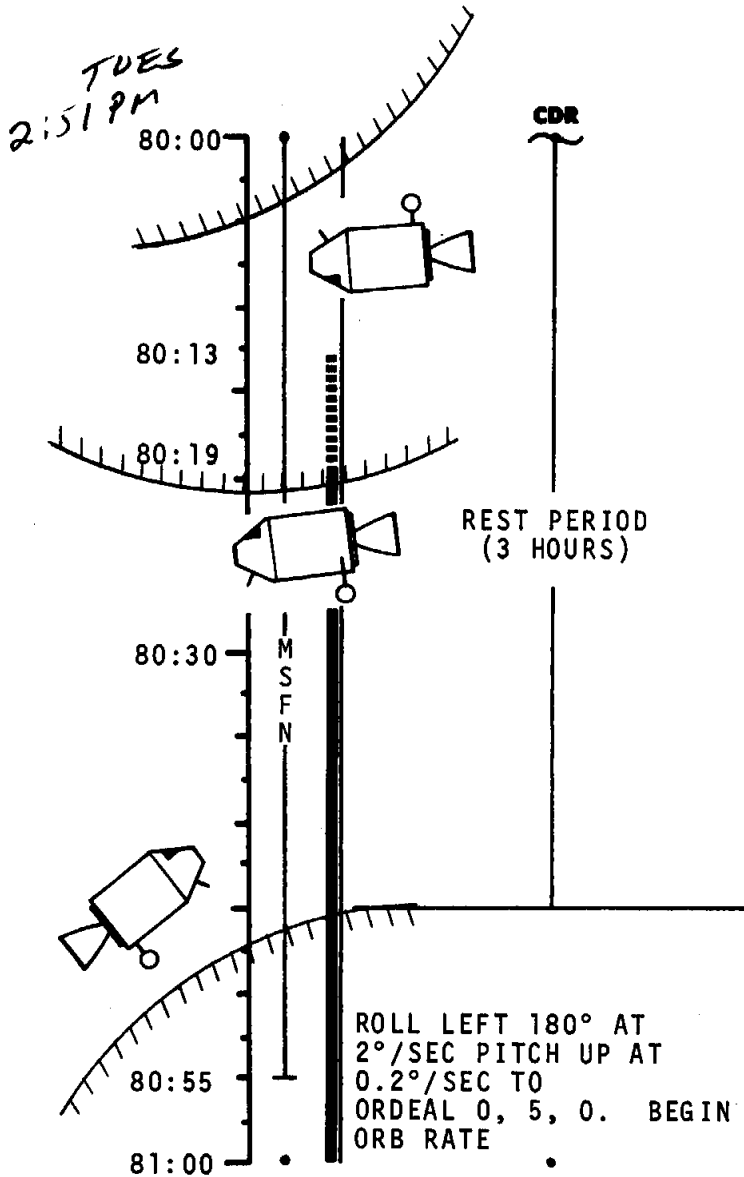
ACQUIRE MSFN ON OMNIS

REPORT NEW COORDINATES

**MCC-H**

ACQUIRE S/C

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  
 (TEI<sub>7</sub>) & 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

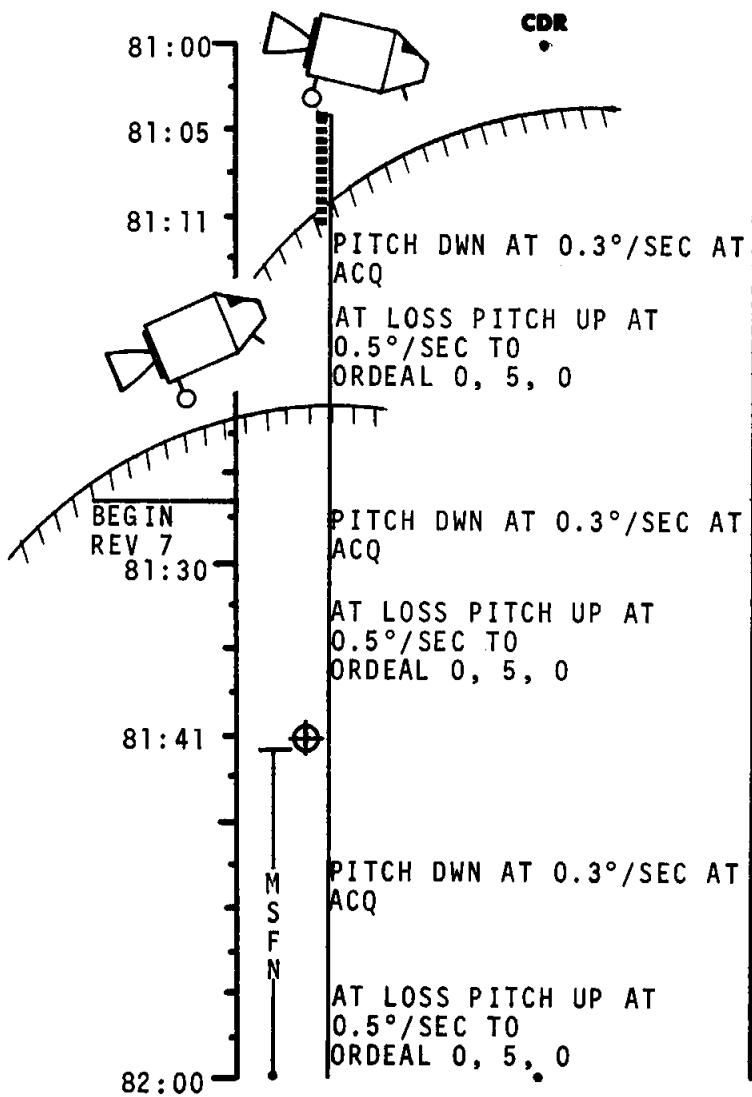
EAT PERIOD

**MCC-H**

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

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

# FLIGHT PLAN



<b>CMP</b>	
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	

<b>LMP</b>	
BIOMED Sw - LEFT	
EAT PERIOD	
NEW COORDINATES	
LAT	°
LONG/2	°
ALT	nm
EAT PERIOD	
NEW COORDINATES	
LAT	°
LONG/2	°
ALT	nm
EAT PERIOD	
NEW COORDINATES	
LAT	°
LONG/2	°
ALT	nm

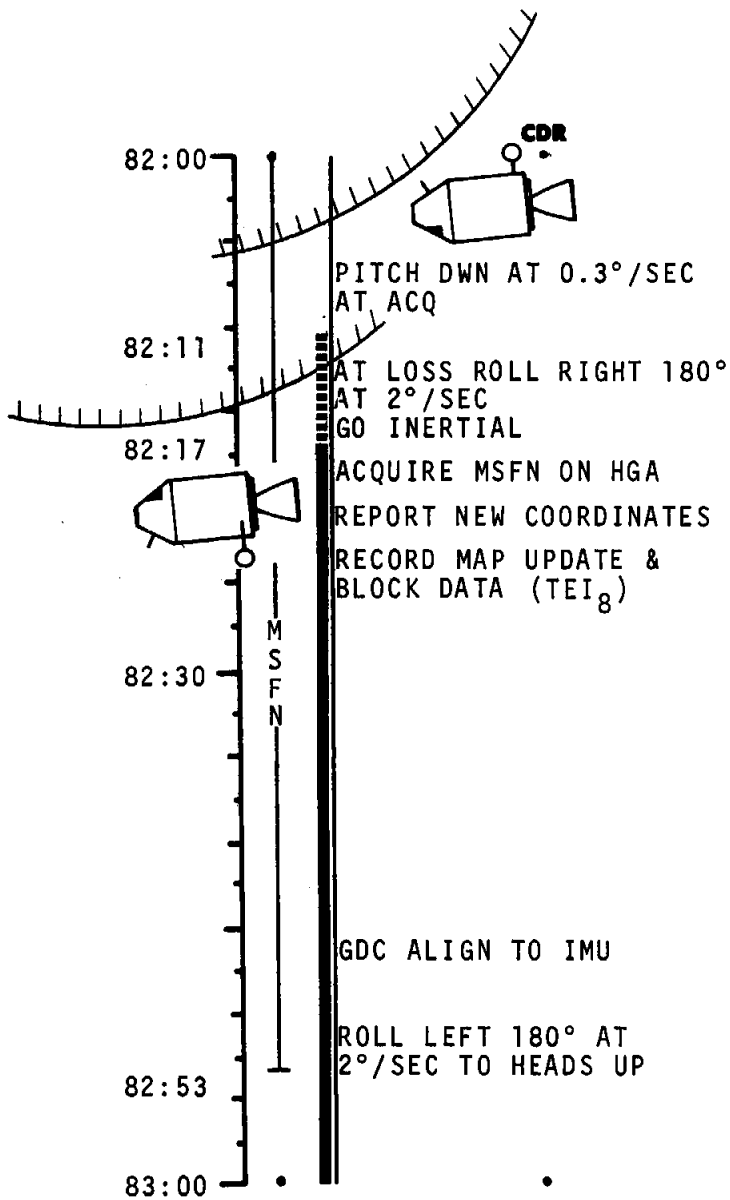
**MCC-H**

ACQUIRE S/C

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	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

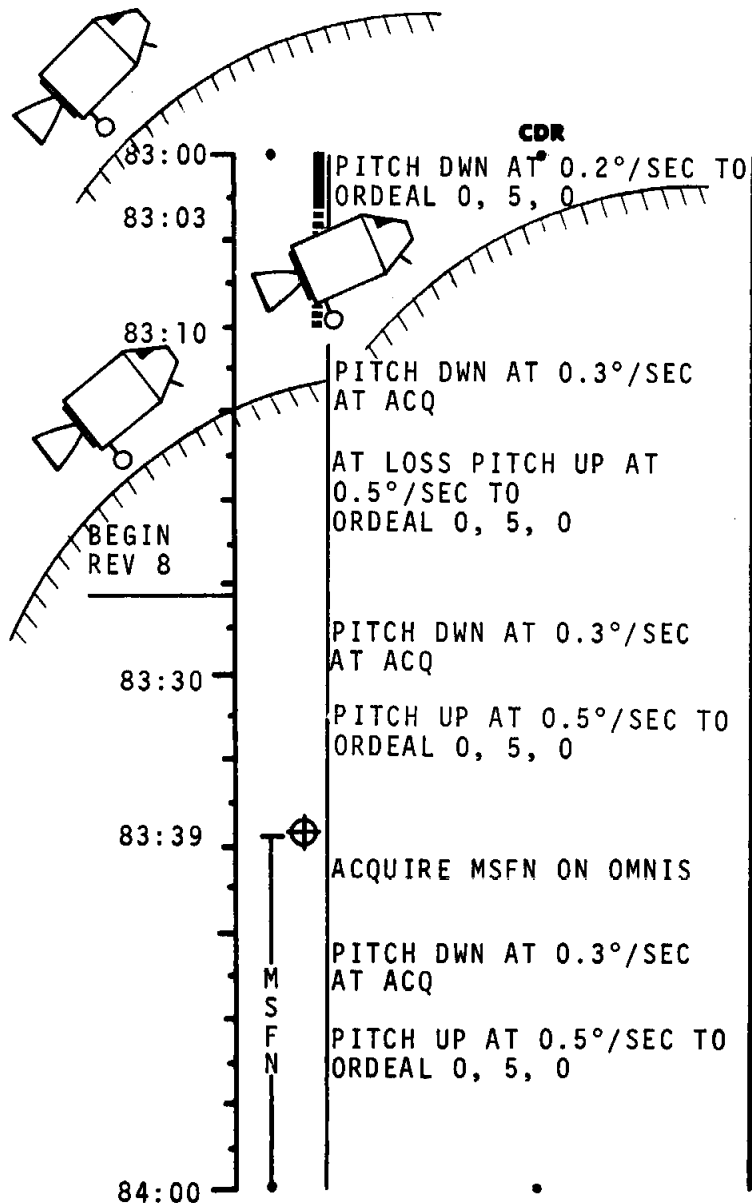
REST PERIOD  
 (2 HOURS)

MCC-H

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



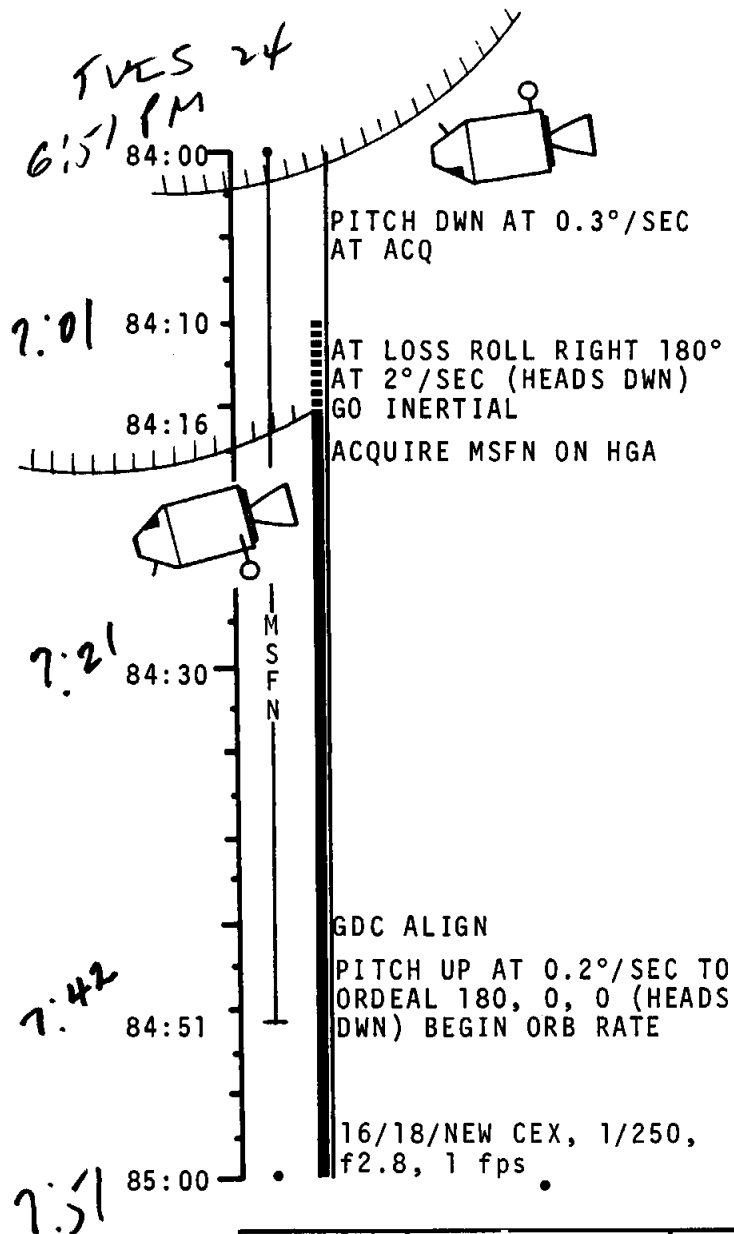
CMP	
CNTL PT SIGHTINGS (3)	
P22 AUTO OPTICS	
IPI	— — : — — : — —
TCA	— — : — — : — —
CP1 NO.	504
LAT	-05.250°S
LONG/2	-81.350°
ALT	+000.00 nm
P22 AUTO OPTICS	
IPI	— — : — — : — —
TCA	— — : — — : — —
CP2 NO.	526
LAT	-10.200°S
LONG/2	+77.550°
ALT	+000.00 nm
P22 AUTO OPTICS	
IPI	— — : — — : — —
TCA	— — : — — : — —
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 DIFF ---

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

REST PERIOD  
(2 HOURS)

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

REST PERIOD  
(2 HOURS)

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

BIOMED Sw - RIGHT

VERIFY SYSTEMS STATUS

RECORD MAP UPDATE &  
BLOCK DATA (TEI<sub>g</sub>)

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

SR -12 MIN START DARK

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

SR -4 MIN START CORONA

MCC-H

ACQUIRE S/C

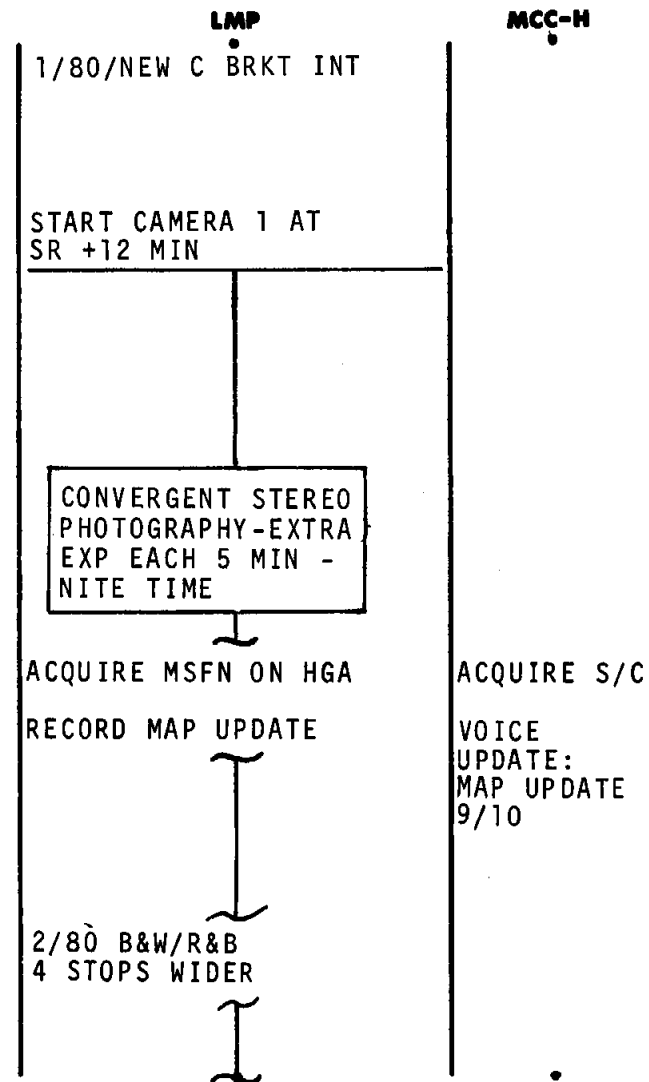
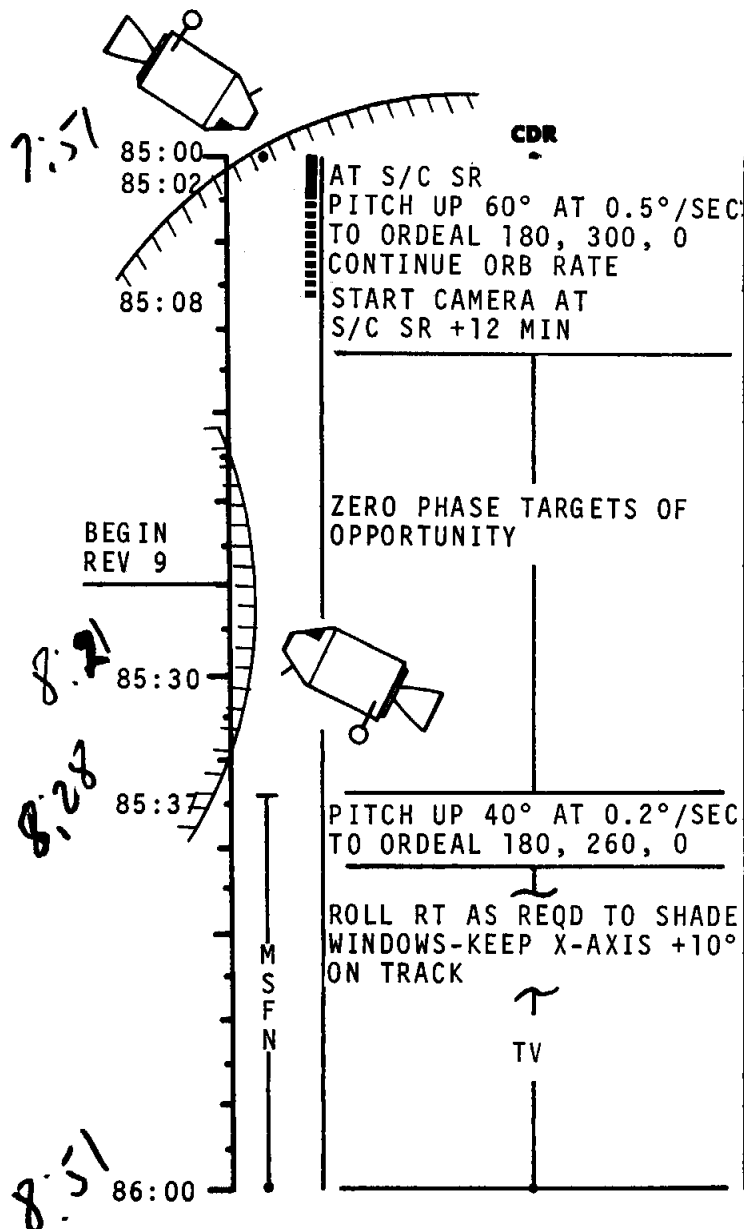
P27 UPDATE:  
STATE  
VECTOR

DUMP DSE

VOICE  
UPDATE:  
MAP UPDATE  
8/9  
BLOCK DATA

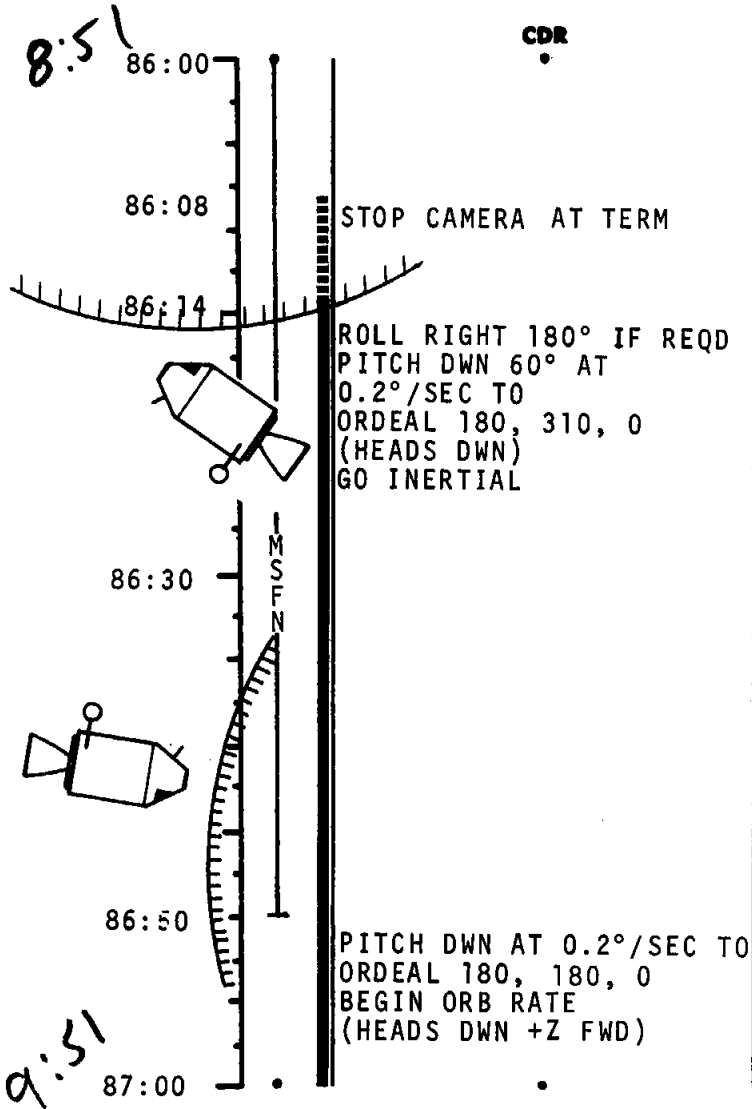
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	84:00 - 85:00	4/LP0	2-66

# FLIGHT PLAN



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

# FLIGHT PLAN



CDR

CMP

LMP

MCC-H

REST PERIOD  
(2 HOURS)

STOP CAMERA AT TERM  
2/80/HS, 1/4 f2.8

RECORD BLOCK DATA  
(TEI<sub>10</sub>) & MNVR PAD

P27 UPDATE:  
STATE  
VECTOR

VOICE  
UPDATE:  
BLOCK DATA  
MNVR PAD

DUMP DSE

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

VERIFY SYSTEMS STATUS

TORQUE ANGLES: \_\_\_\_\_  
X \_\_\_\_\_  
Y \_\_\_\_\_  
Z \_\_\_\_\_

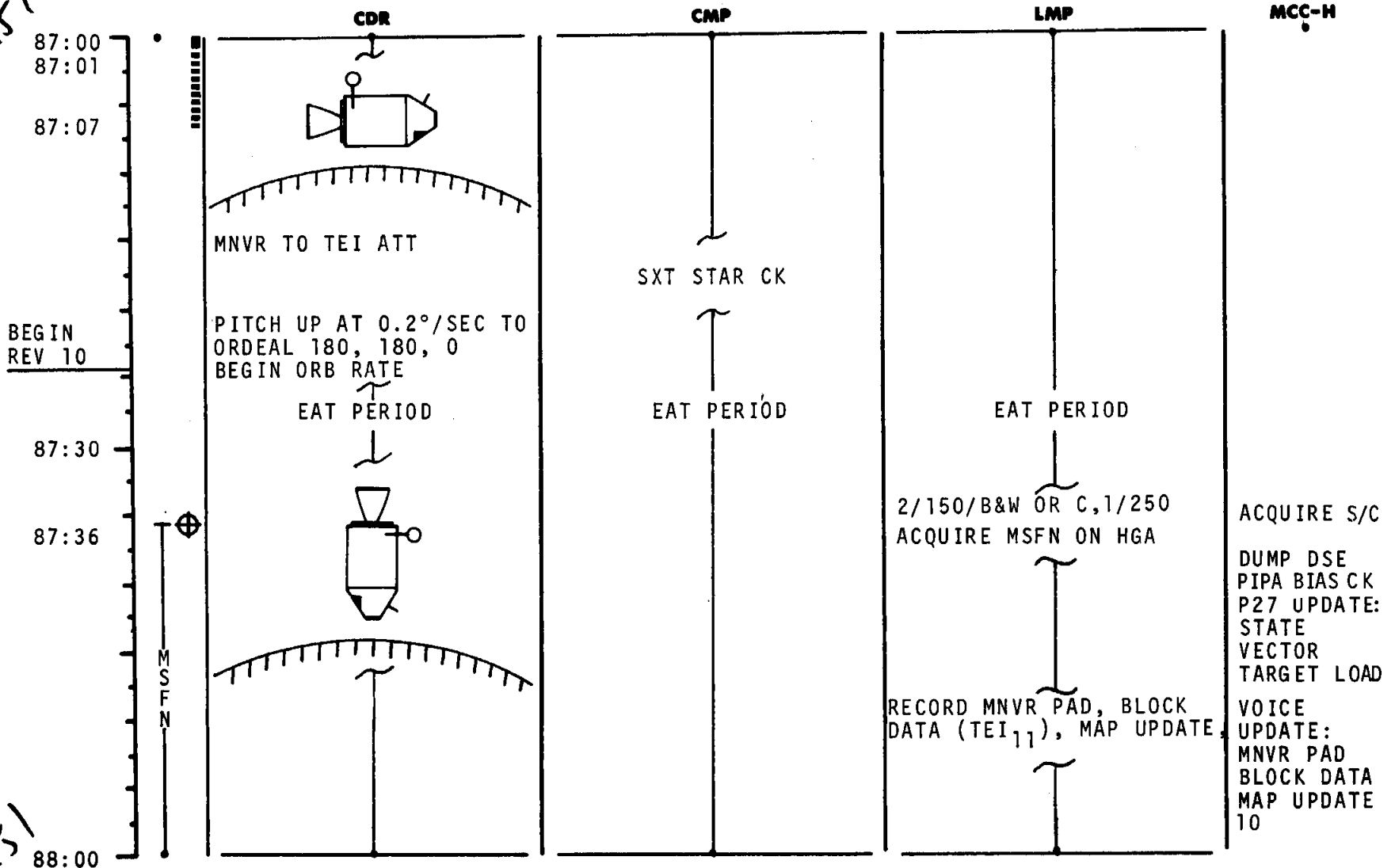
1/80/NEW B&W 1/250,  
f2.8 INT (CDR)  
2/150/C, 1/250

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

# FLIGHT PLAN

9:51

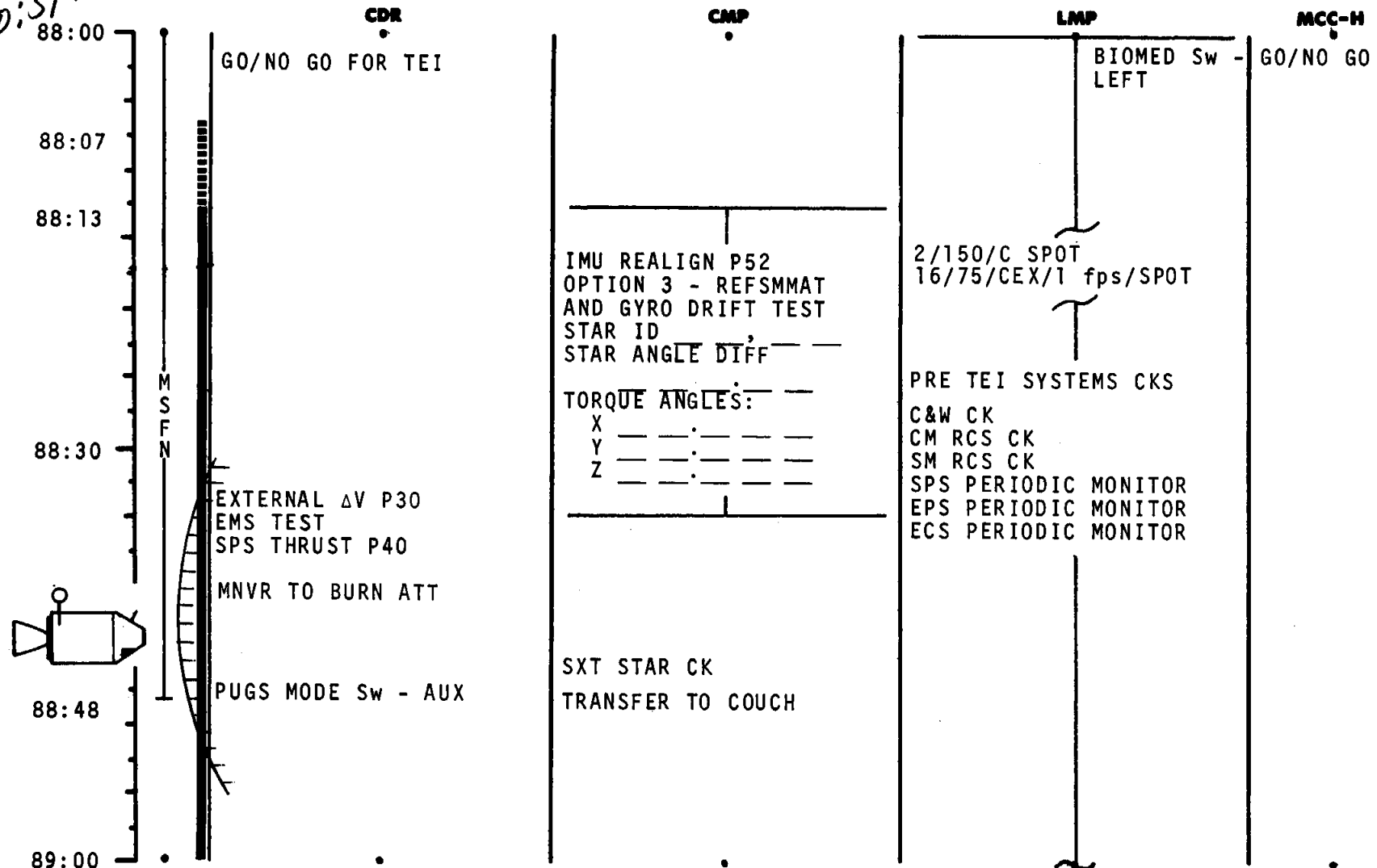
10:51



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	87:00 - 88:00	4/LP0	2-69

TUES  
10:51 PM

# FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	88:00 - 89:00	4/LP0	2-70

BURN STATUS REPORT

X	X		:		ΔTIG
X	X		:		BT
					V <sub>gx</sub>
TRIM					
X	X	X			R
X	X	X			P
X	X	X			Y
					V <sub>gx</sub>
					V <sub>gy</sub>
					V <sub>gz</sub>
					ΔV <sub>c</sub>
X	X	X			FUEL
X	X	X			OX
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 & ΔV <sub>c</sub> = -40 fps	TRIM TO 2.0 fps
TEI ABORT MODES-SYSTEMS PROBLEMS:15-MIN ABORT CHART OTHERWISE				
TEI V <sub>go</sub>	B/T	TRAJECTORY	ABORT MODE	
2850-950	0 -2:00	LUNAR ORBIT	MODE III AFTER 1 REV	
950-600	2:00-2:20	UNSTABLE	5-HR COAST, MODE I	
600-0	2:20-2:54	HYPERBOLIC	COAST OUT OF SPHERE - P37	

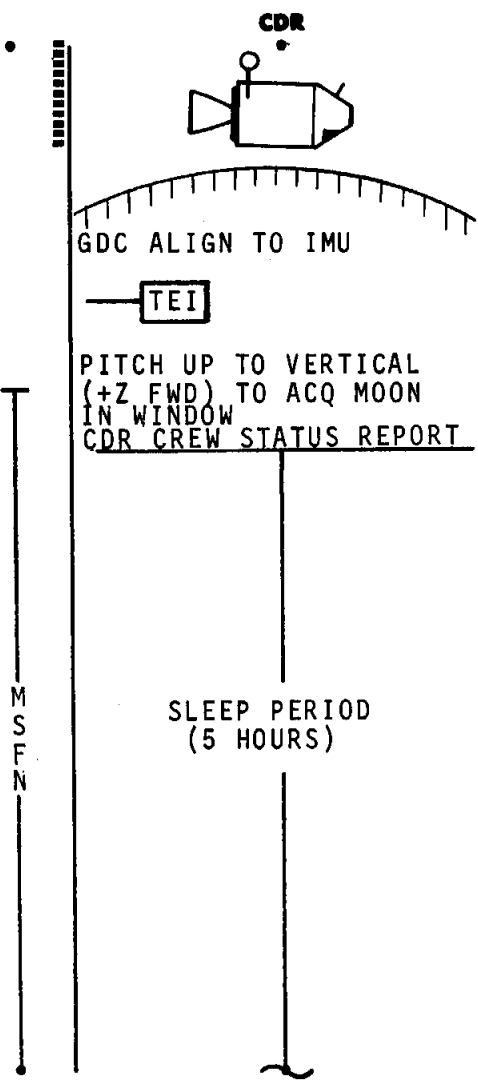
2-70a



# FLIGHT PLAN

11:51 AM  
89:00  
25-WED  
12:06 AM  
89:15

89:00  
89:30  
89:45  
90:00



**CMP**

SM RCS MON CK

GETI = 89:15:07
$\Delta V = 3532$ fps
BT = 3 MIN 26 SEC

SM RCS MON CK

TRANS CSM STATE VECTOR TO LM SLOT

REINITIALIZE W MATRIX

R<sub>1</sub> +00094

R<sub>2</sub> +00571

R<sub>3</sub> +00003

**LMP**

SPS MON CK

ACQUIRE MSFN WITH HGA

TEI BURN STATUS REPORT

INITIATE BAT CHARGE

BIOMED Sw - CENTER

**MCC-H**

ACQUIRE S/C

DUMP DSE

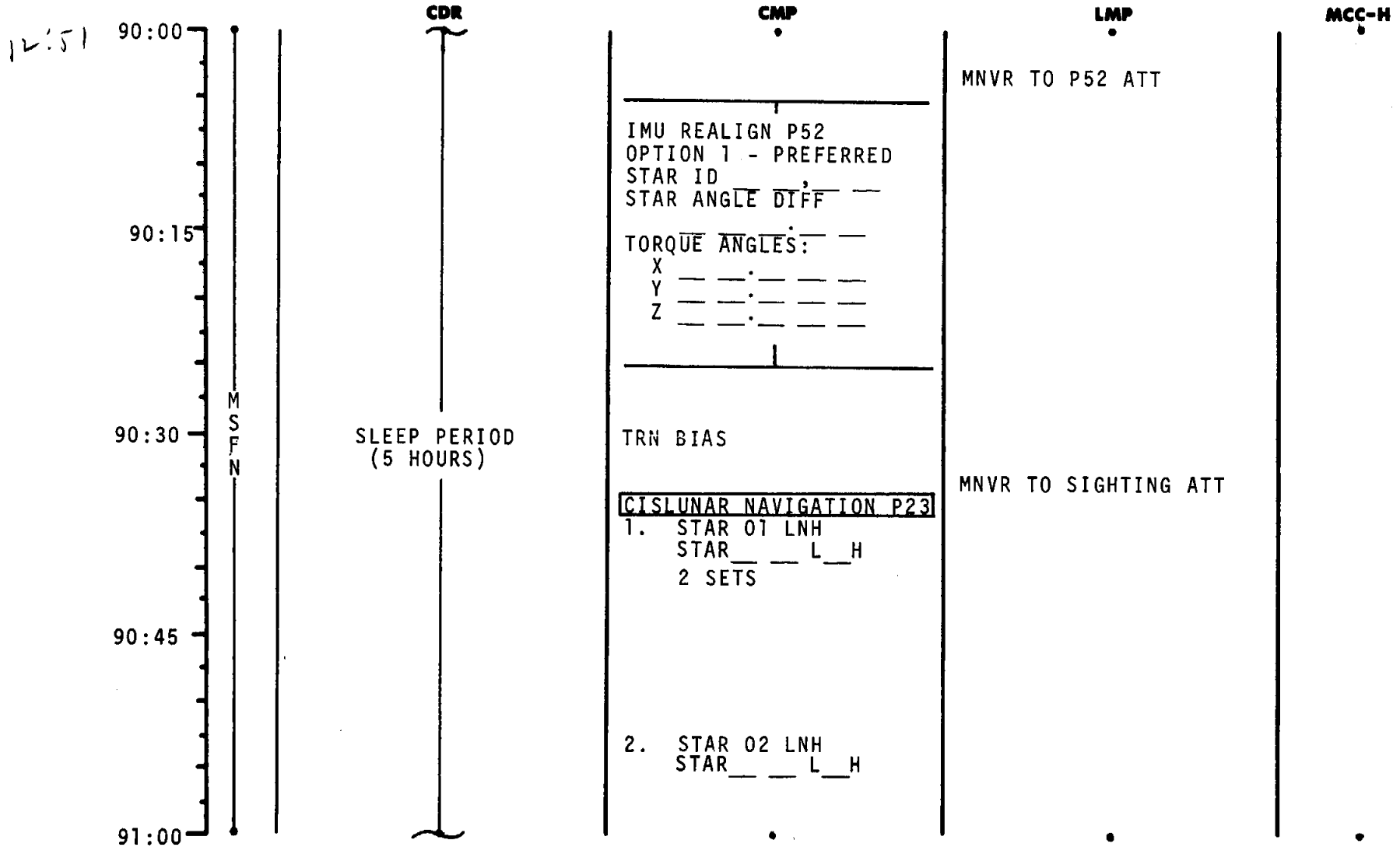
UPDATE

ENTRY

REFSMMAT

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

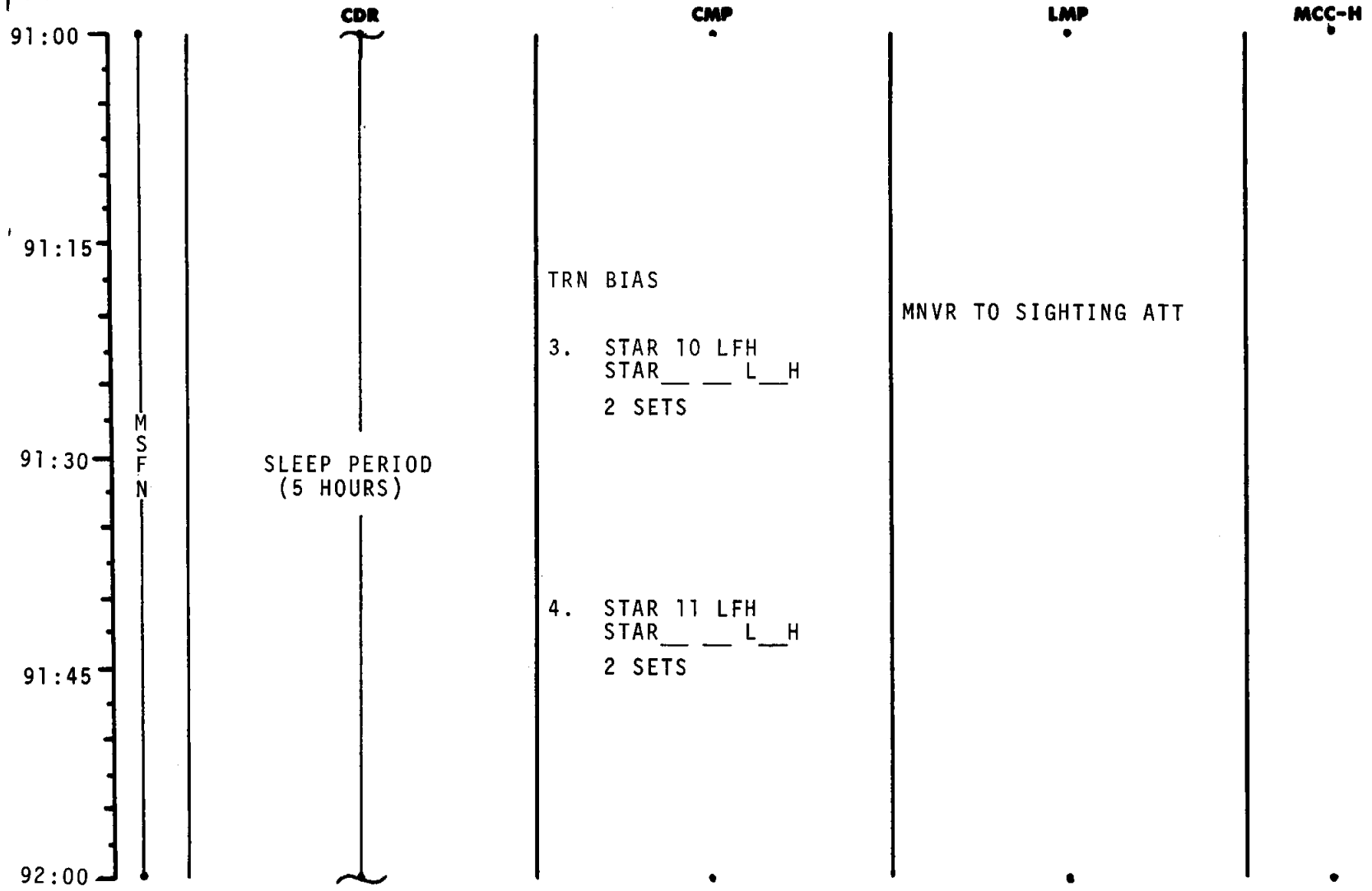
# FLIGHT PLAN



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

# FLIGHT PLAN

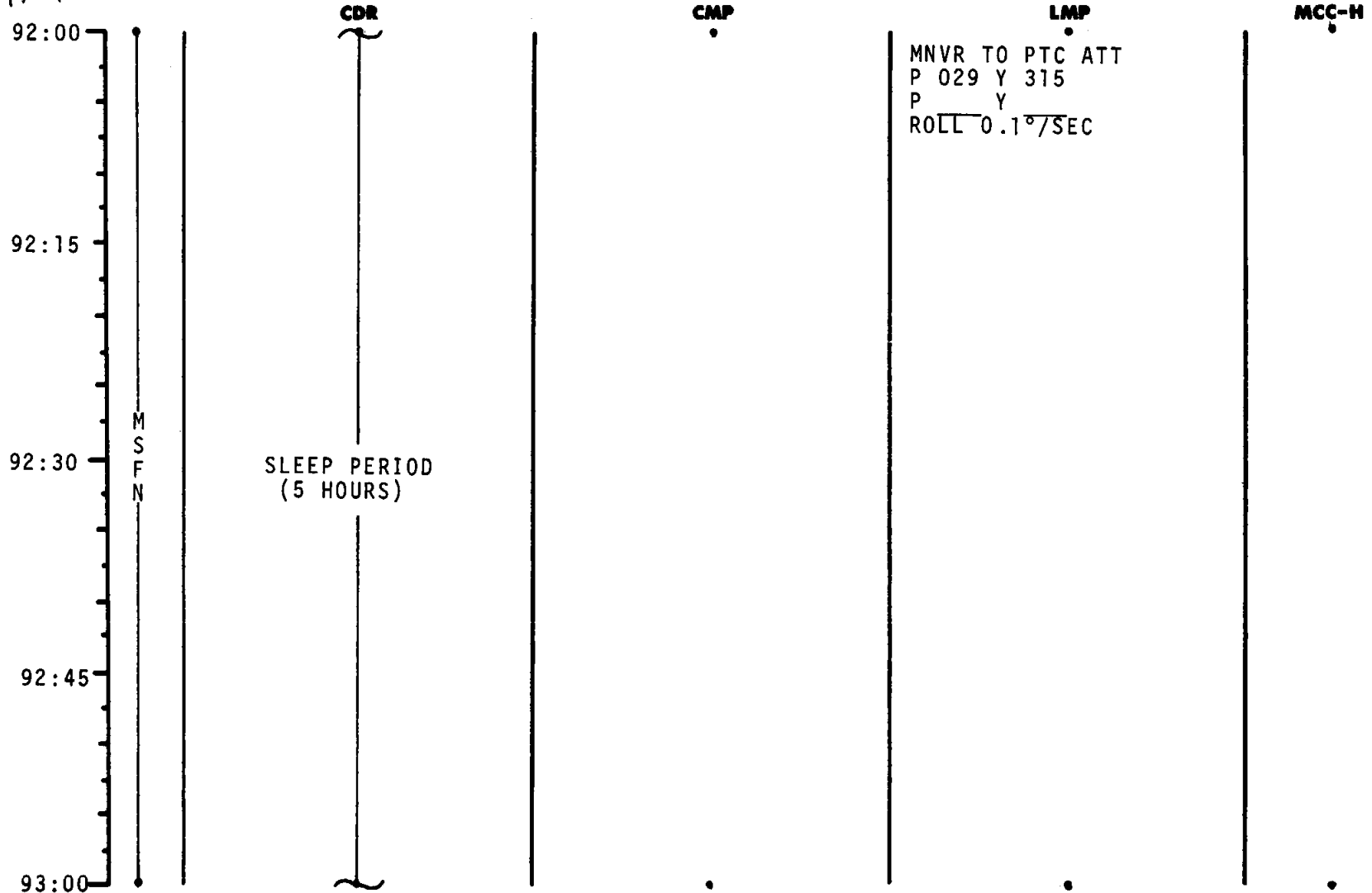
11:51 AM



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

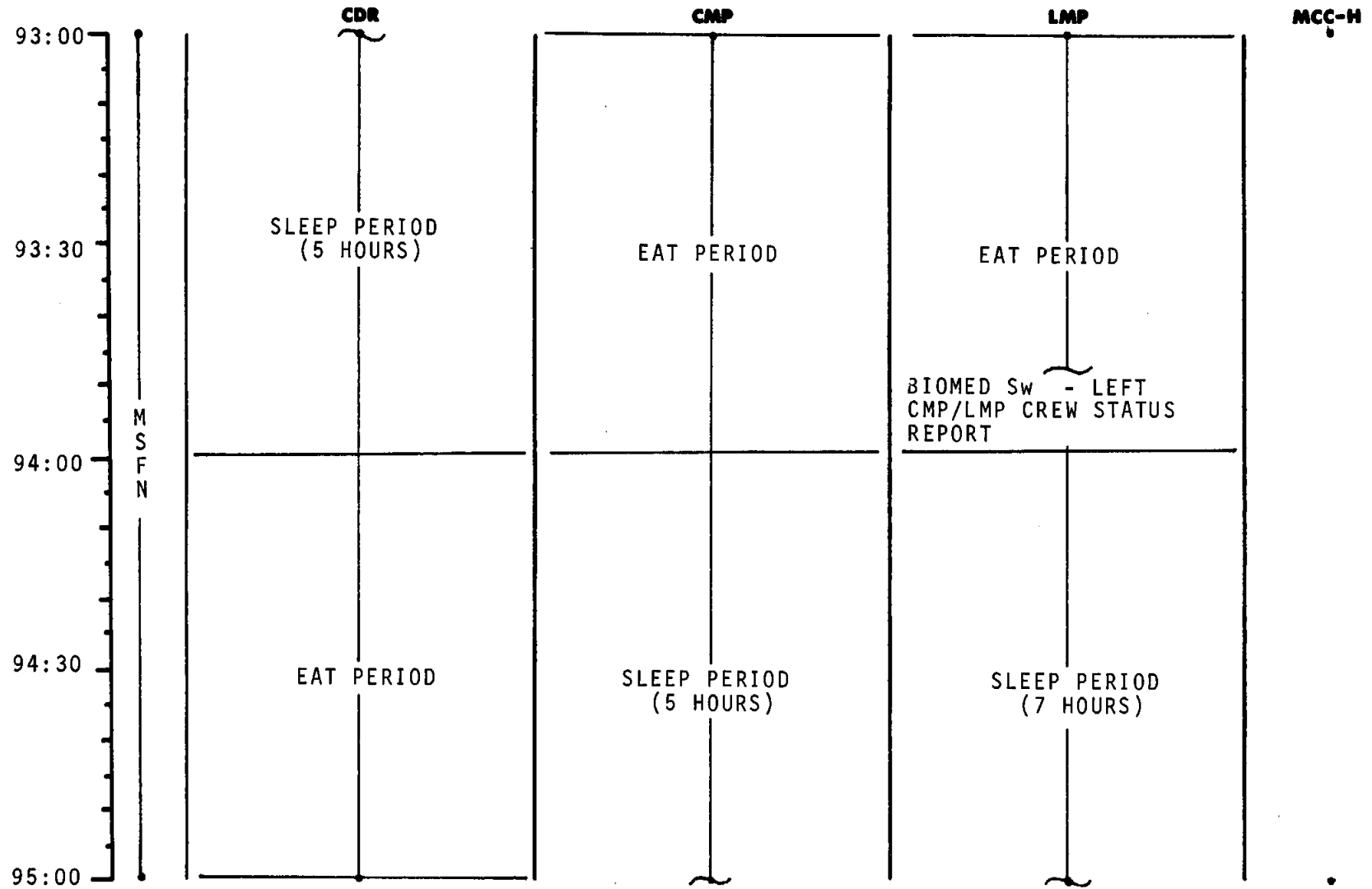
WED 25  
2:51 AM

# FLIGHT PLAN



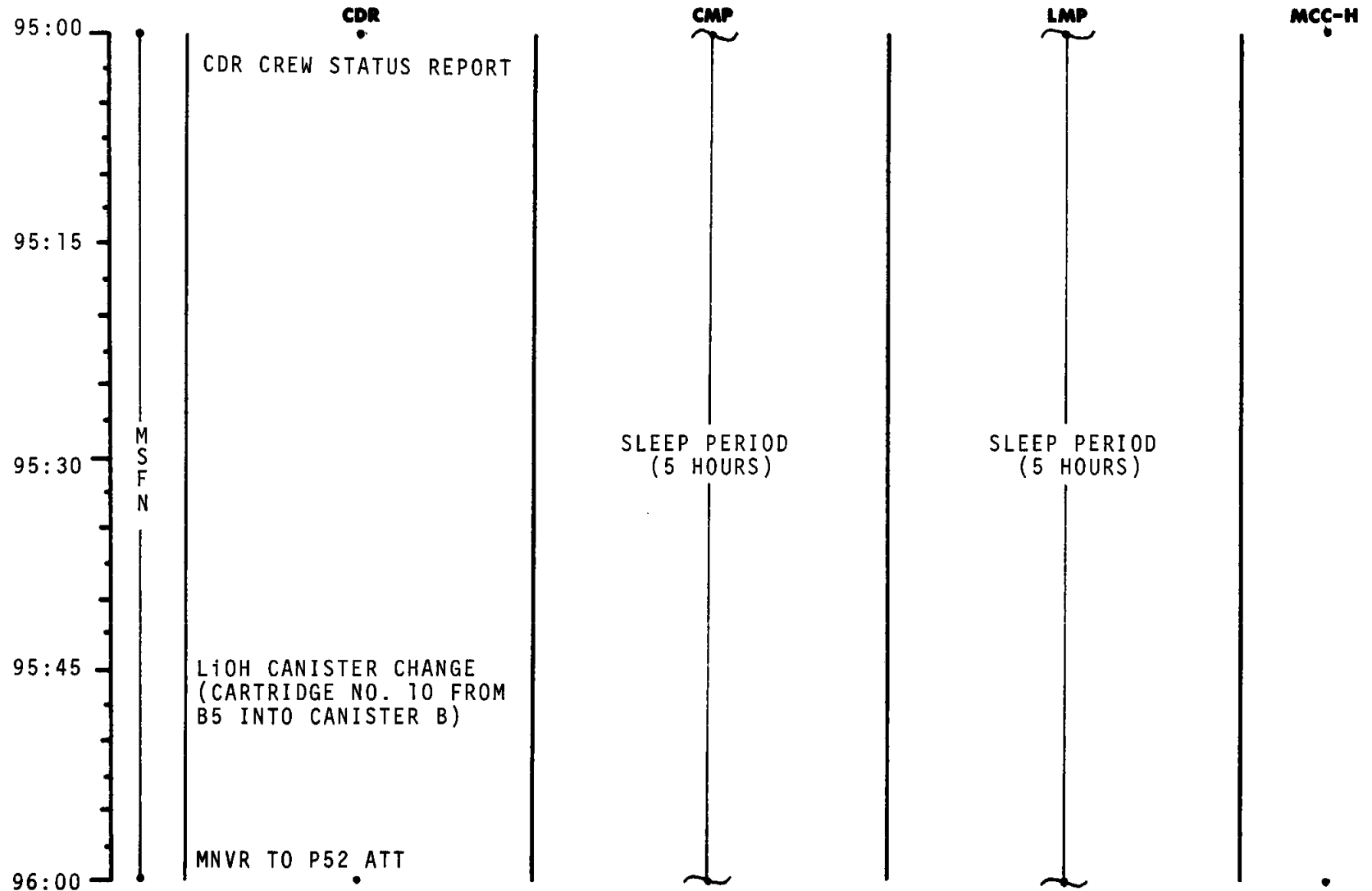
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	92:00 - 93:00	4/TEC	2-74

# FLIGHT PLAN



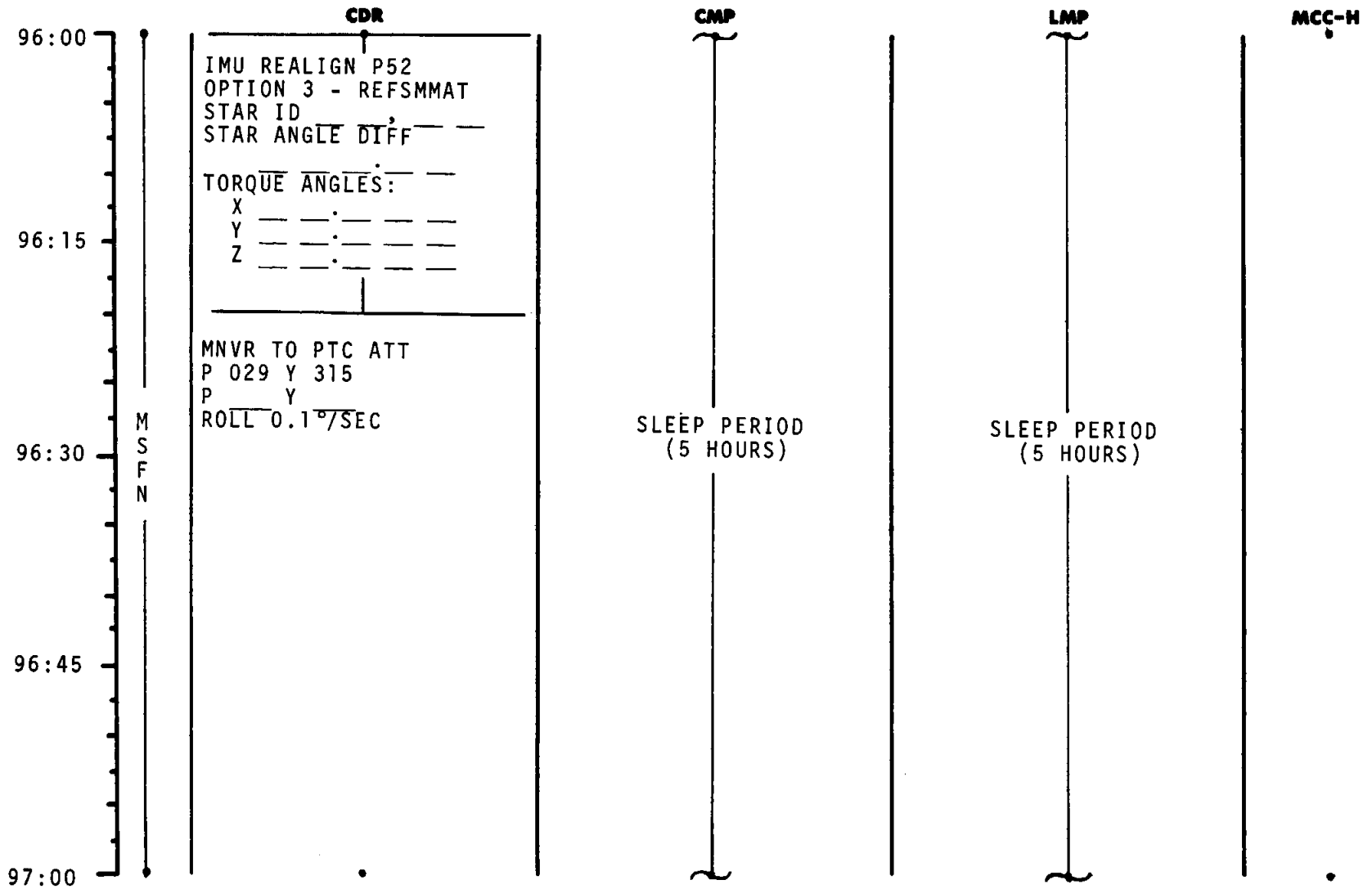
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	93:00 - 95:00	4/TEC	2-75

# FLIGHT PLAN



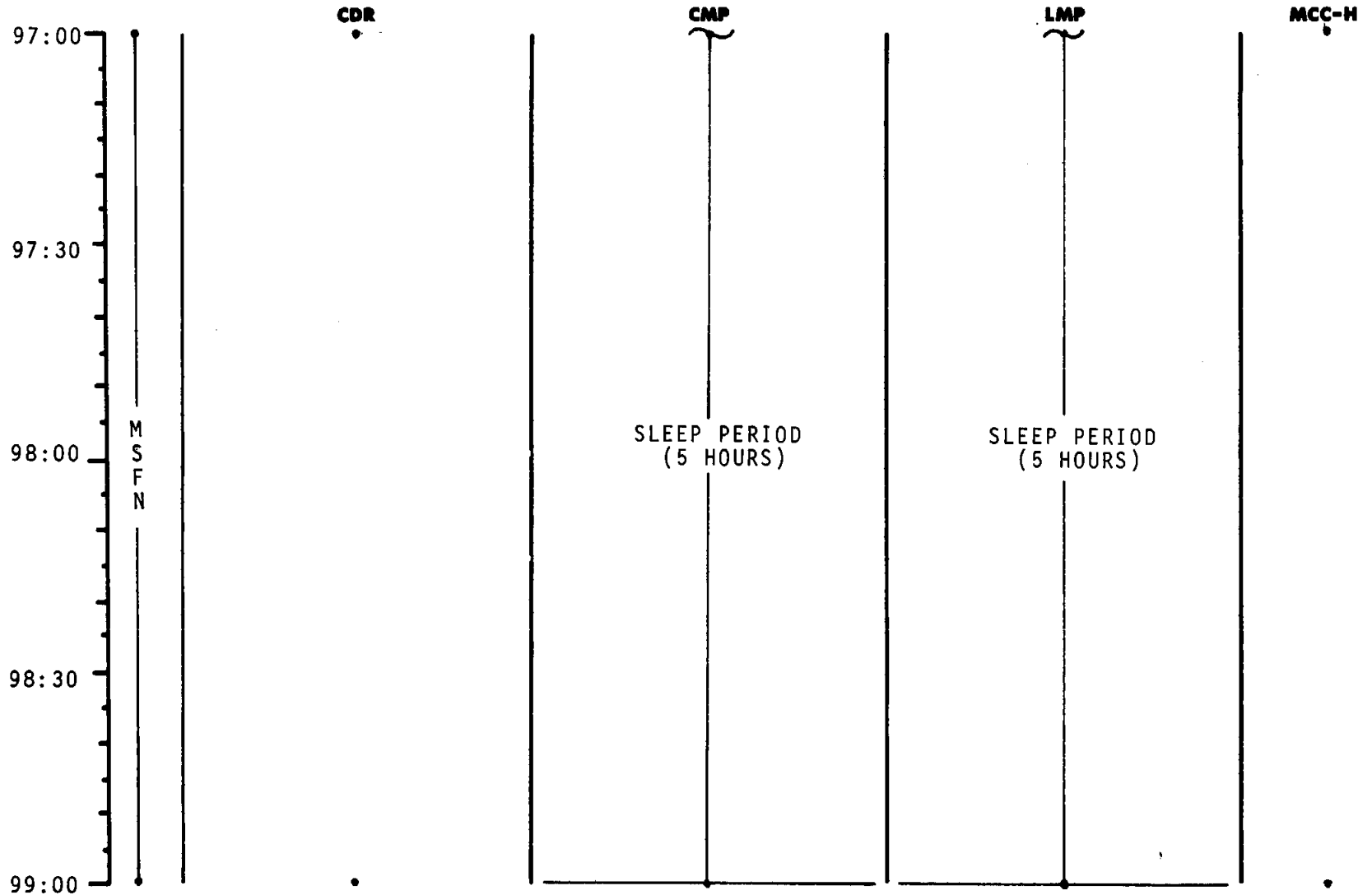
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	95:00 - 96:00	4/TEC	2-76

# FLIGHT PLAN



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

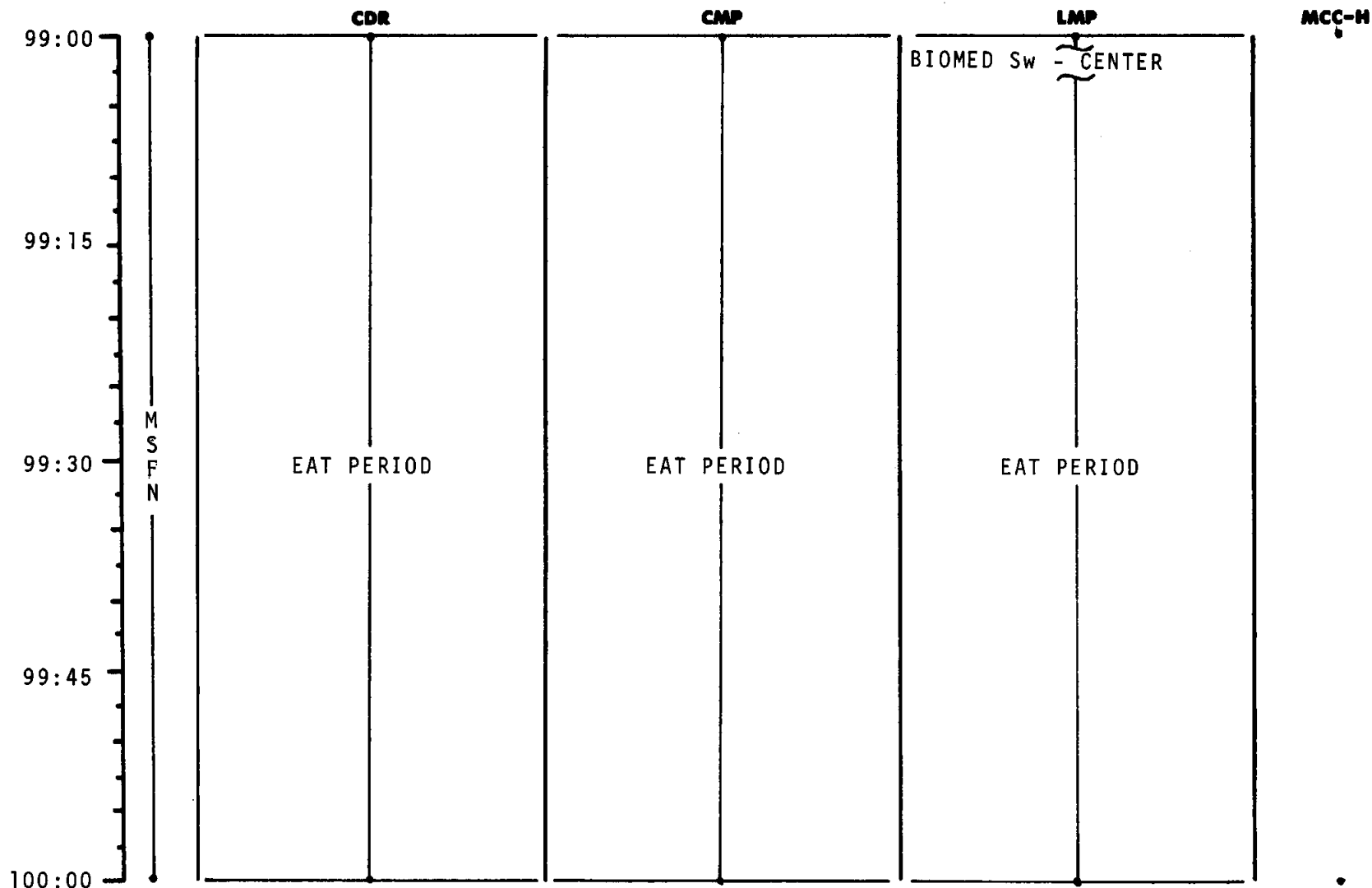
# FLIGHT PLAN



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



# FLIGHT PLAN



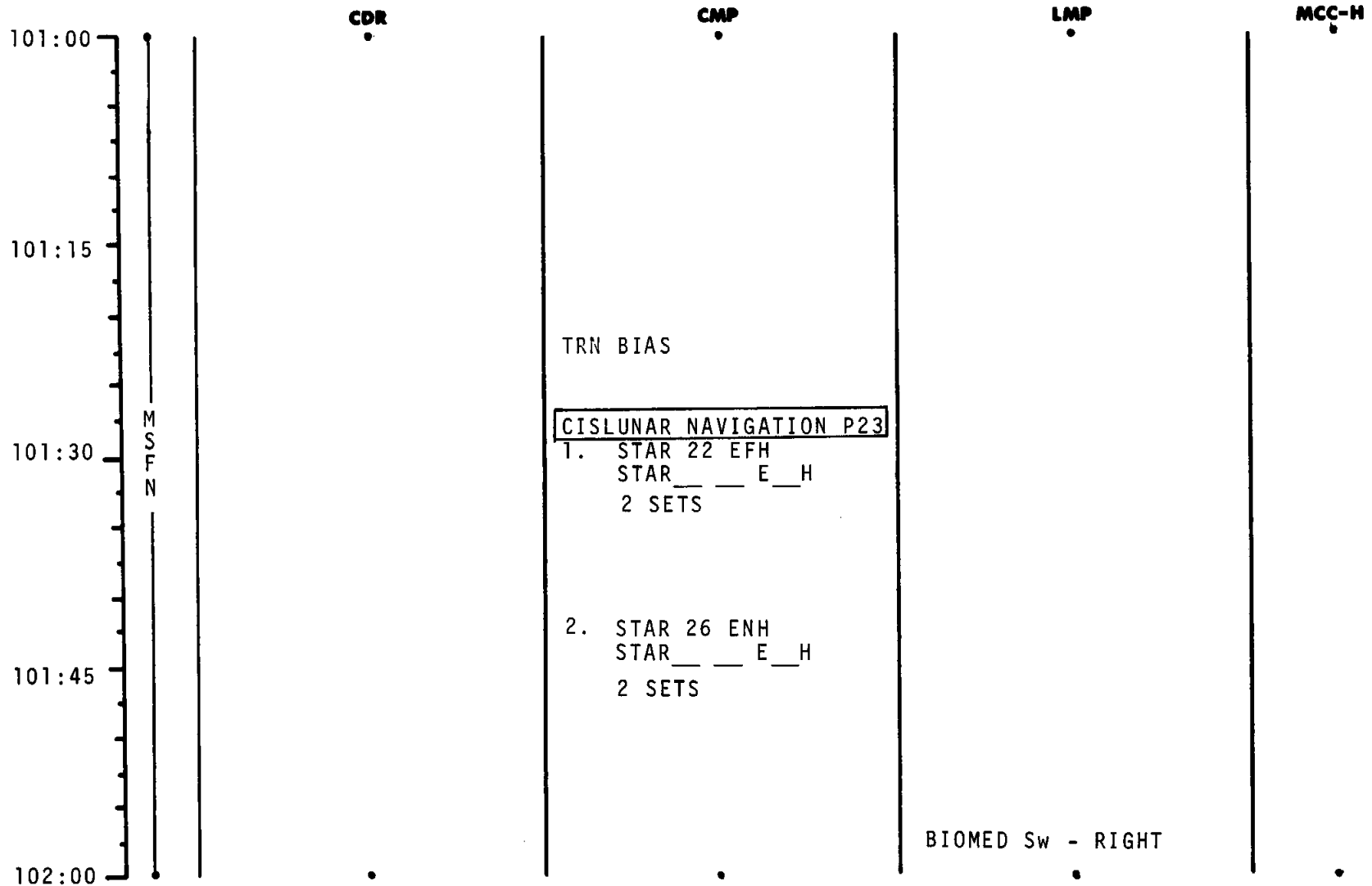
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	99:00 - 100:00	5/TEC	2-79

# 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				
100:30	MNVR TO SIGHTING ATT	TRN BIAS		
100:45		<div style="border: 1px solid black; padding: 2px;">CISLUNAR NAVIGATION P23</div> 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		
101:00	MNVR TO SIGHTING ATT			

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

# FLIGHT PLAN



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

# FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
<p>102:00</p> <p style="text-align: center;">M S F N</p> <p>102:15</p> <p>102:30</p> <p>102:45</p> <p>103:00</p>	<p>MNVR TO P52 ATT</p>	<p>3. STAR 31 ENH            STAR ___ E ___ H            2 SETS</p> <hr/> <p>IMU REALIGN P52            OPTION 3 - RESFMMAT            STAR ID            STAR ANGLE DIFF ___</p> <p>TORQUE ANGLES: ___</p> <p>X ___ . ___ ___</p> <p>Y ___ . ___ ___</p> <p>Z ___ . ___ ___</p>	<p>RECORD MNVR PAD</p>	<p>P27 UPDATE            STATE            VECTOR            TGT LOAD            RESFMMAT</p> <p>VOICE            UPDATE:            MNVR PAD</p>

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  :  $\Delta TIG$   
 X X : BT  
 :  $V_{gx}$

---

TRIM

X X X R  
 X X X P  
 X X X Y  
  $V_{gx}$   
  $V_{gy}$   
  $V_{gz}$   
  $\Delta V_c$

X X X FUEL  
 X X X OX  
 X X X UNBALANCE

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 fbs

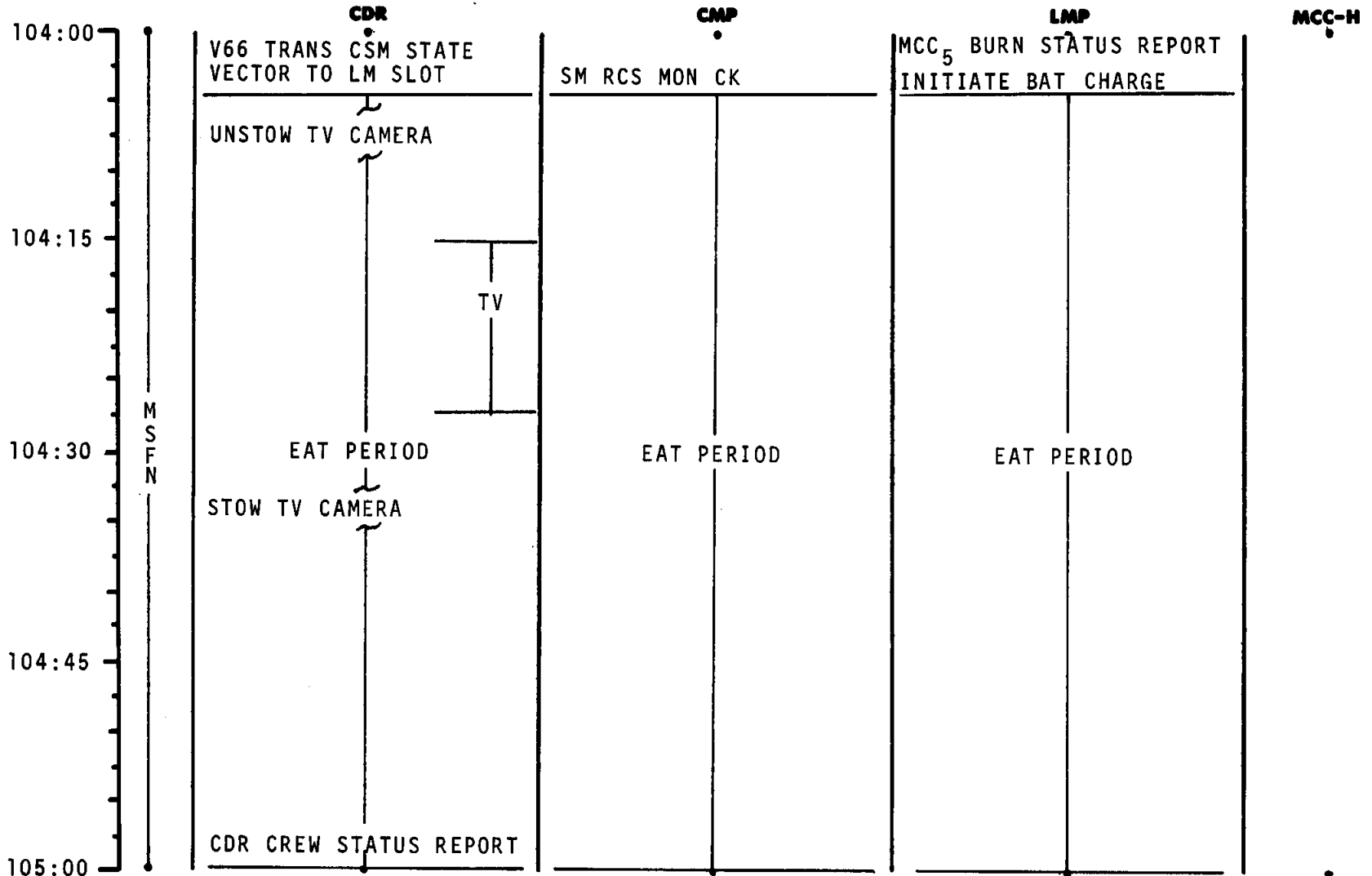
2-82a

# FLIGHT PLAN

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

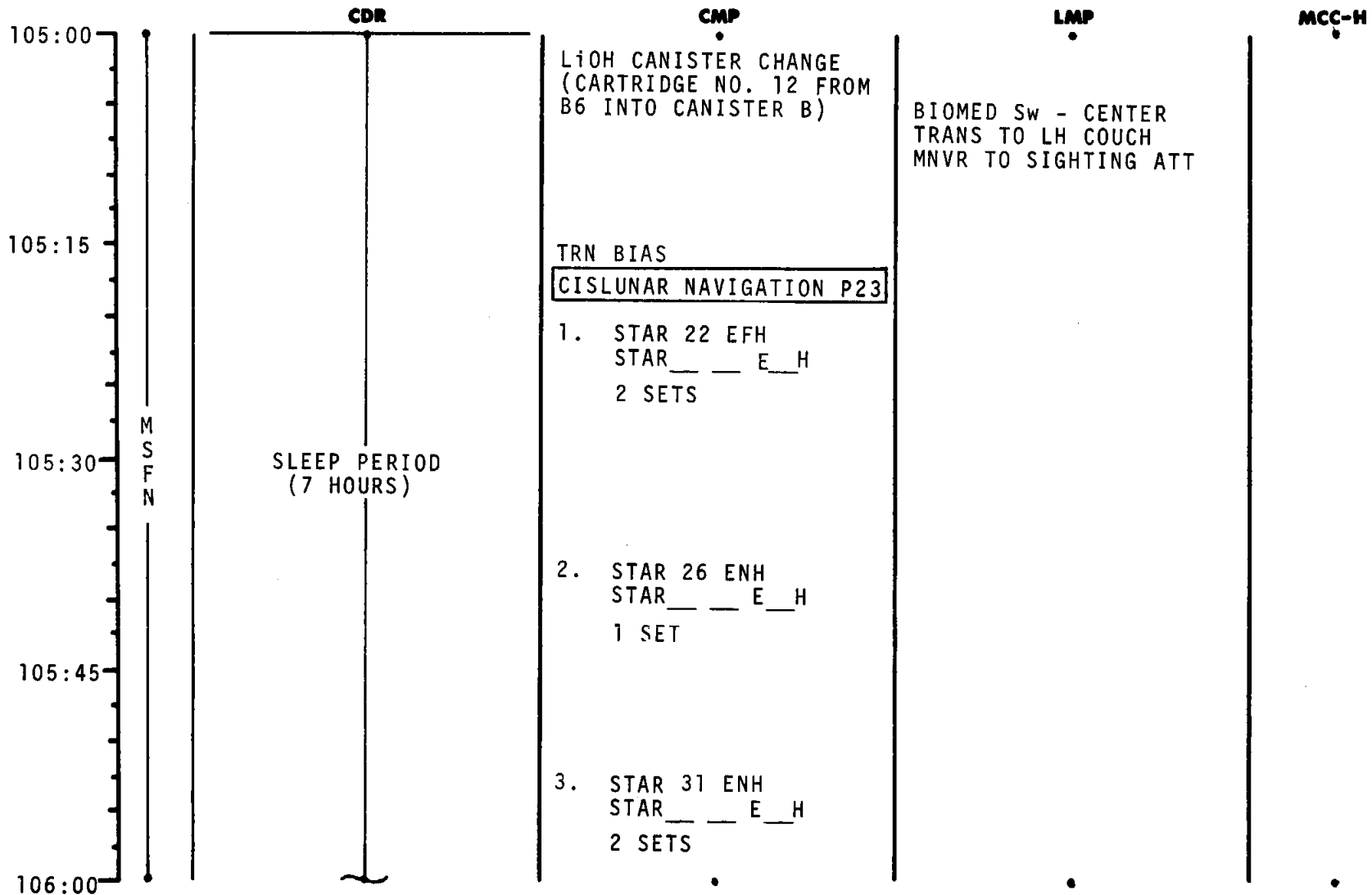
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	103:00 - 104:00	5/TEC	2-83

# FLIGHT PLAN



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

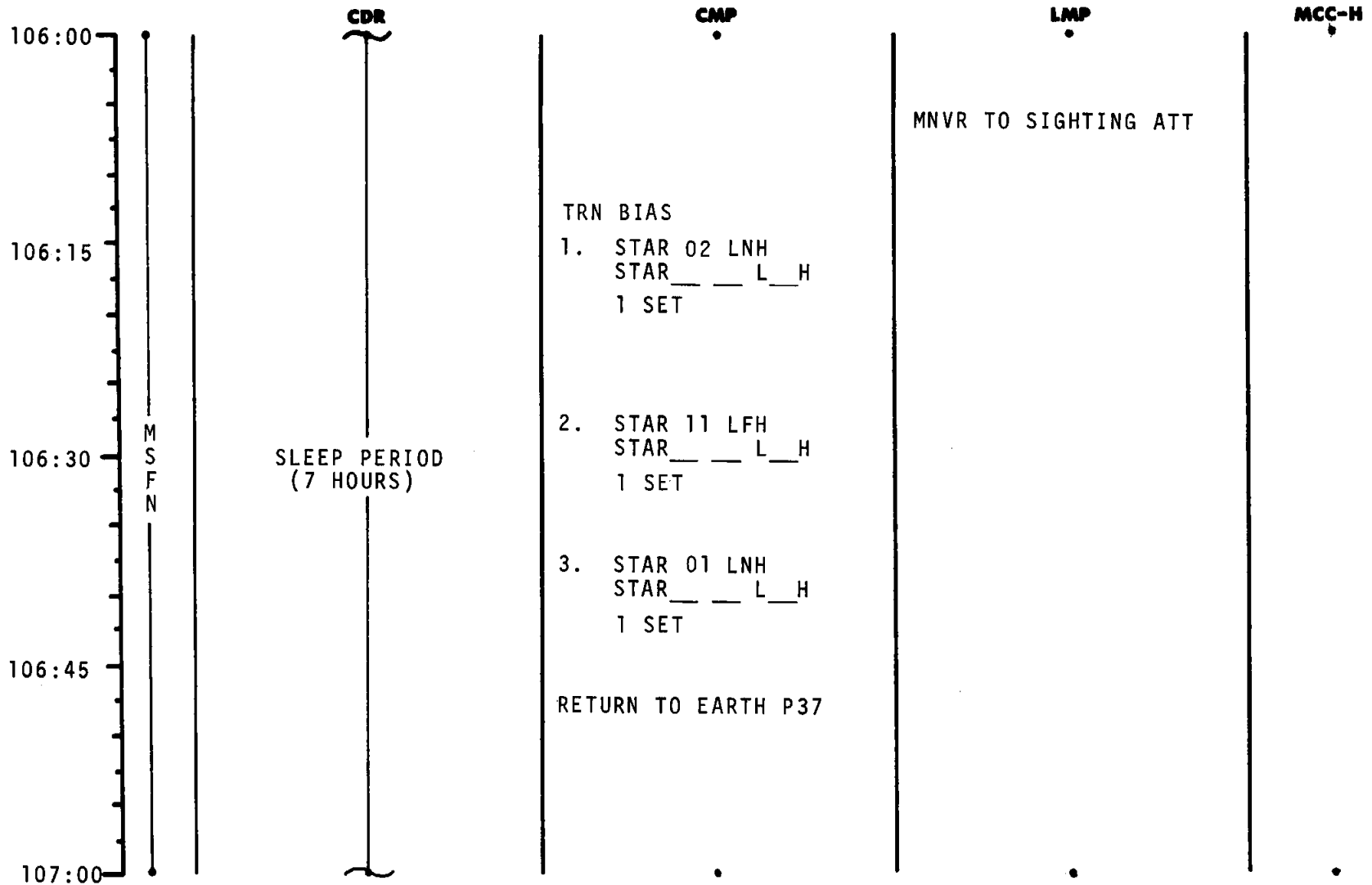
# FLIGHT PLAN



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

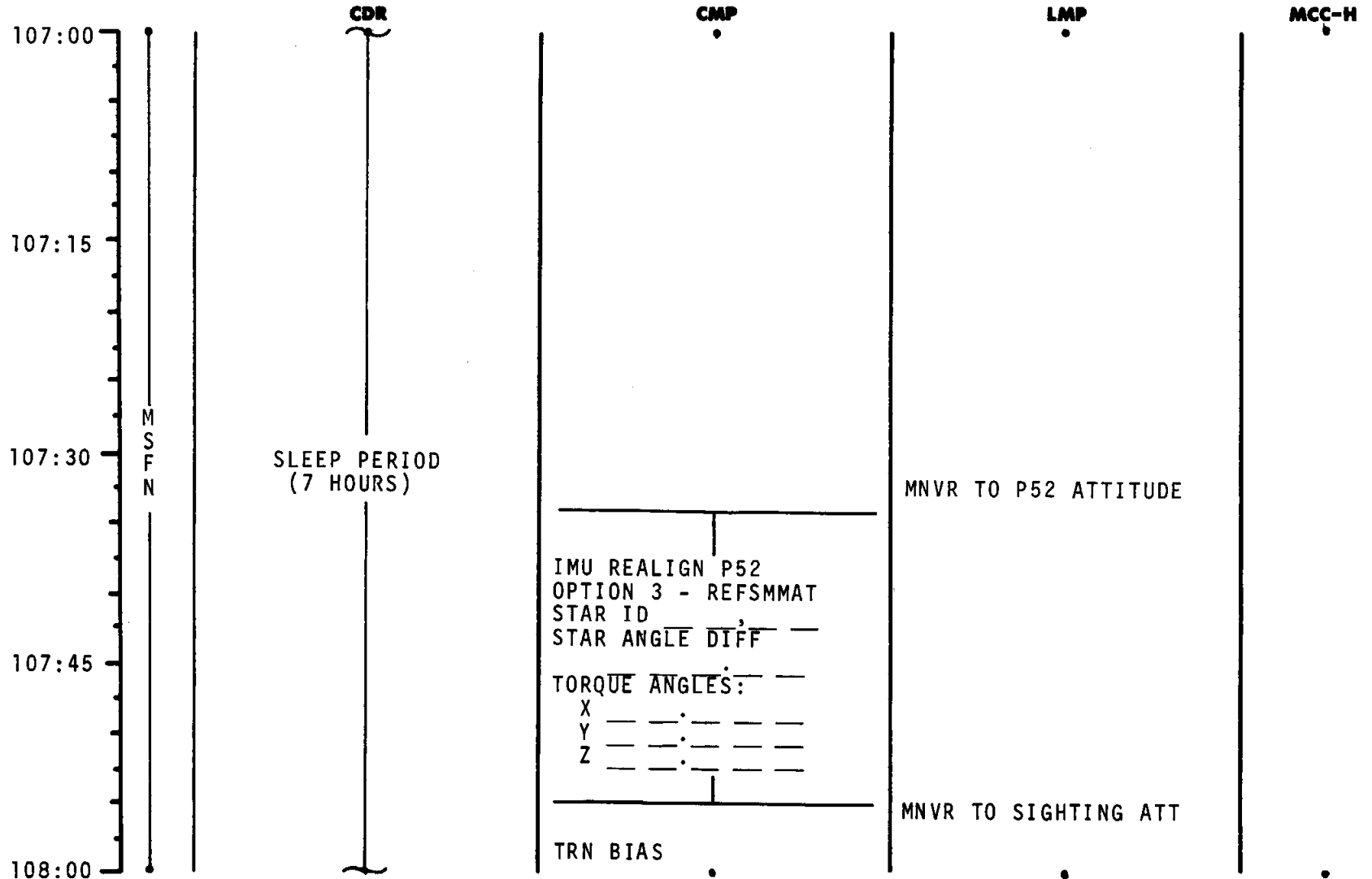


# FLIGHT PLAN



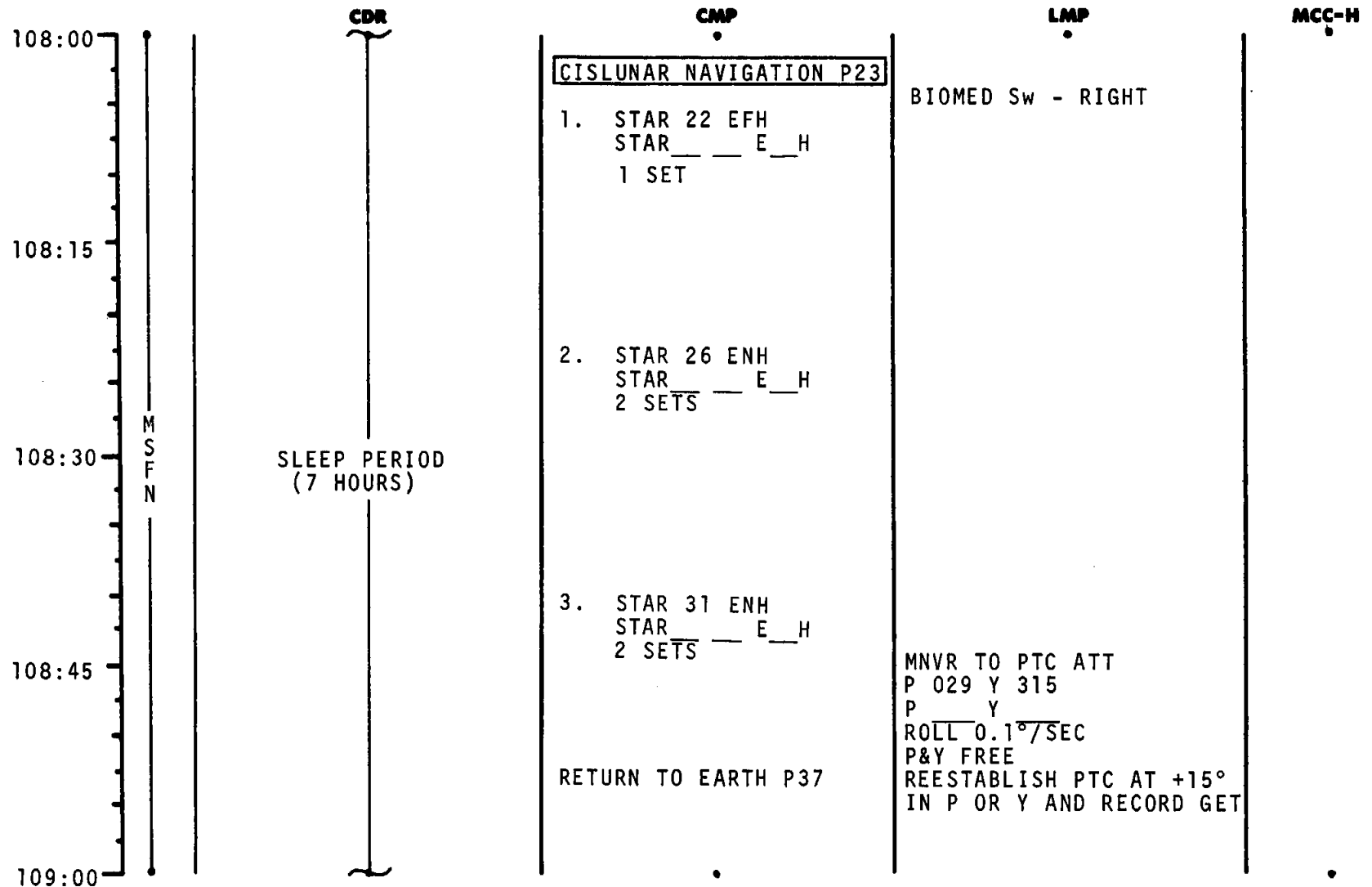
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	106:00 - 107:00	5/TEC	2-86

# FLIGHT PLAN



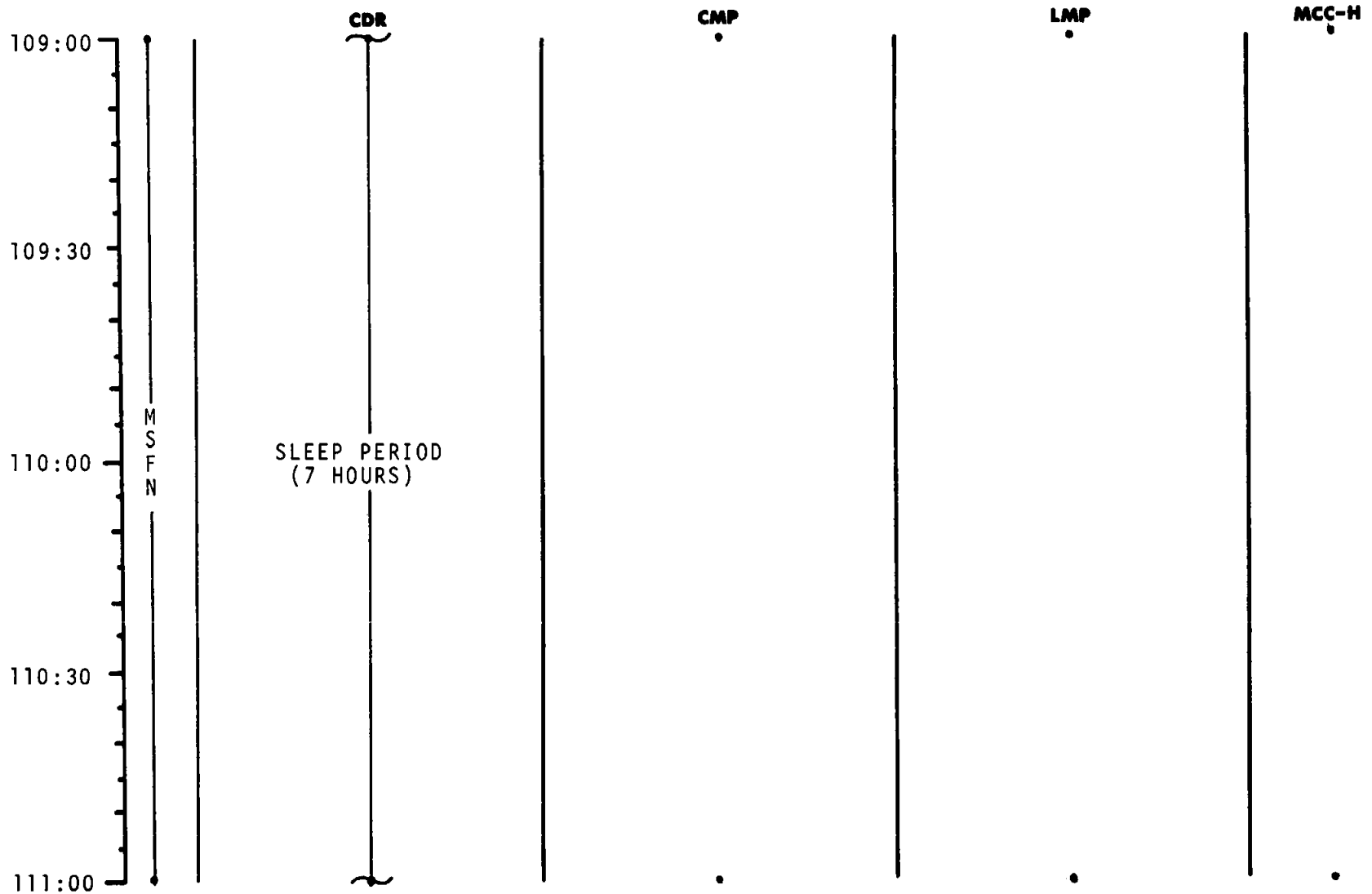
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	107:00 - 108:00	5/TEC	2-87

# FLIGHT PLAN



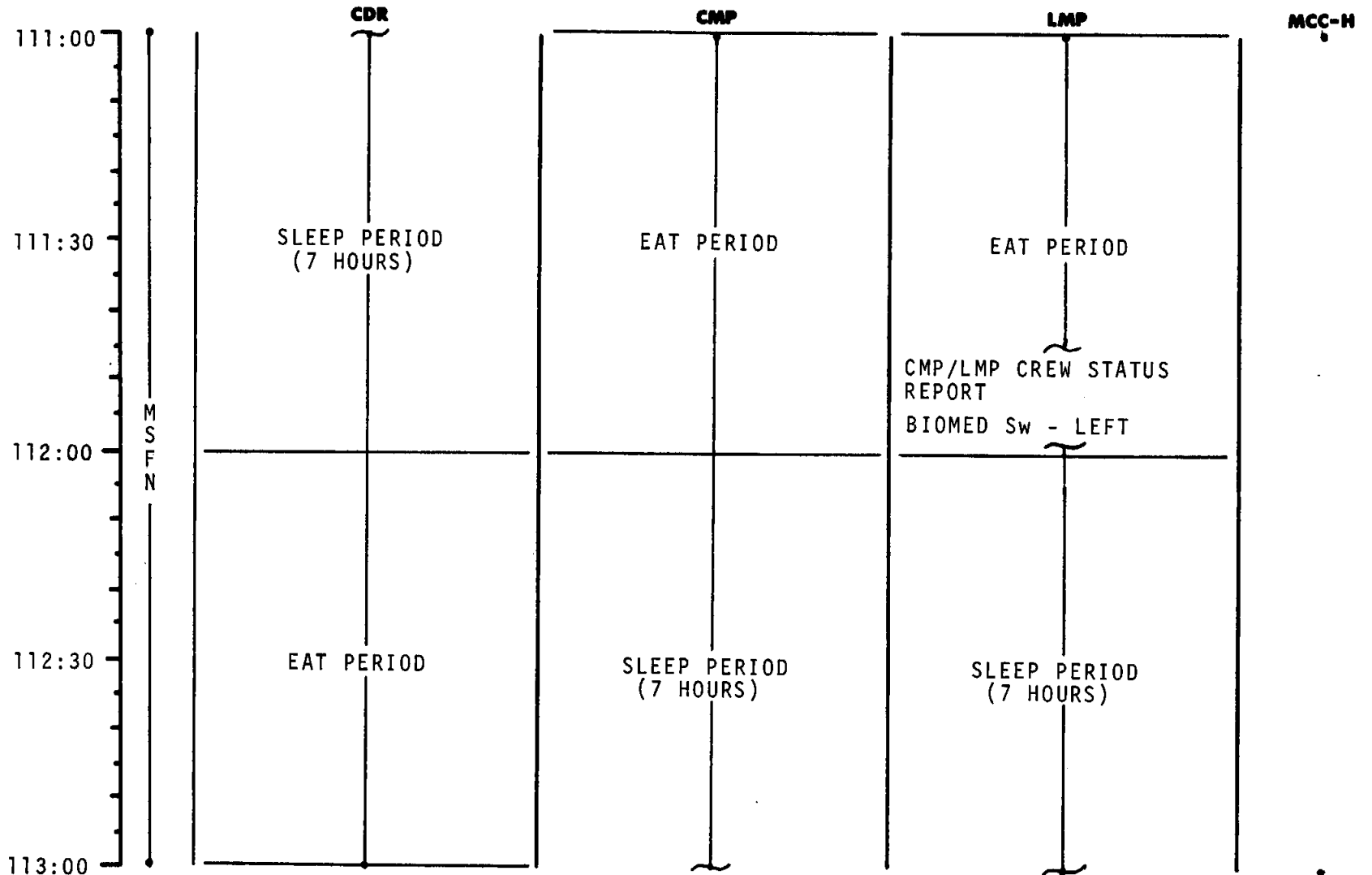
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	108:00 - 109:00	5/TEC	2-88

# FLIGHT PLAN



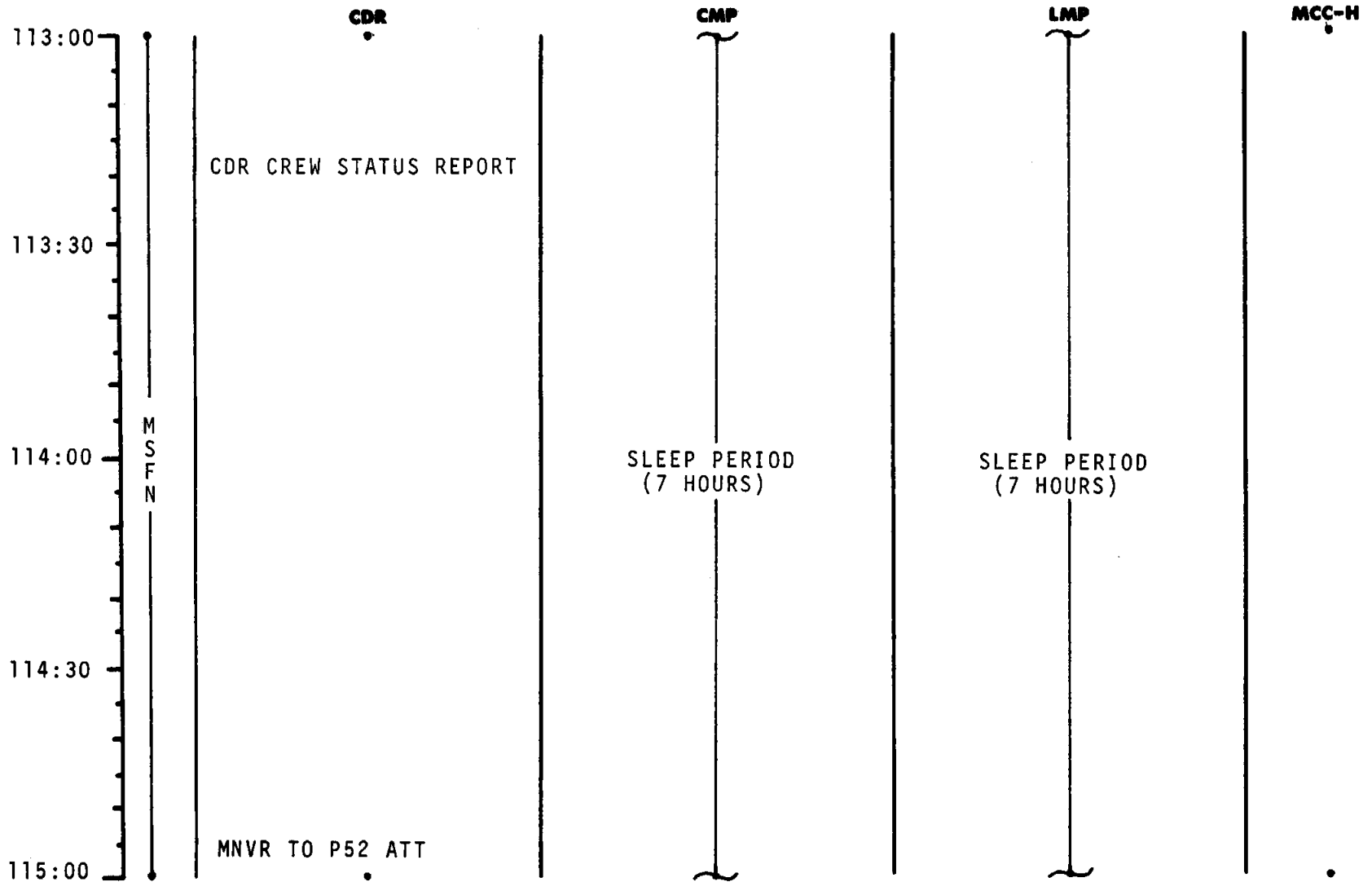
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	109:00 - 111:00	5/TEC	2-89

# FLIGHT PLAN



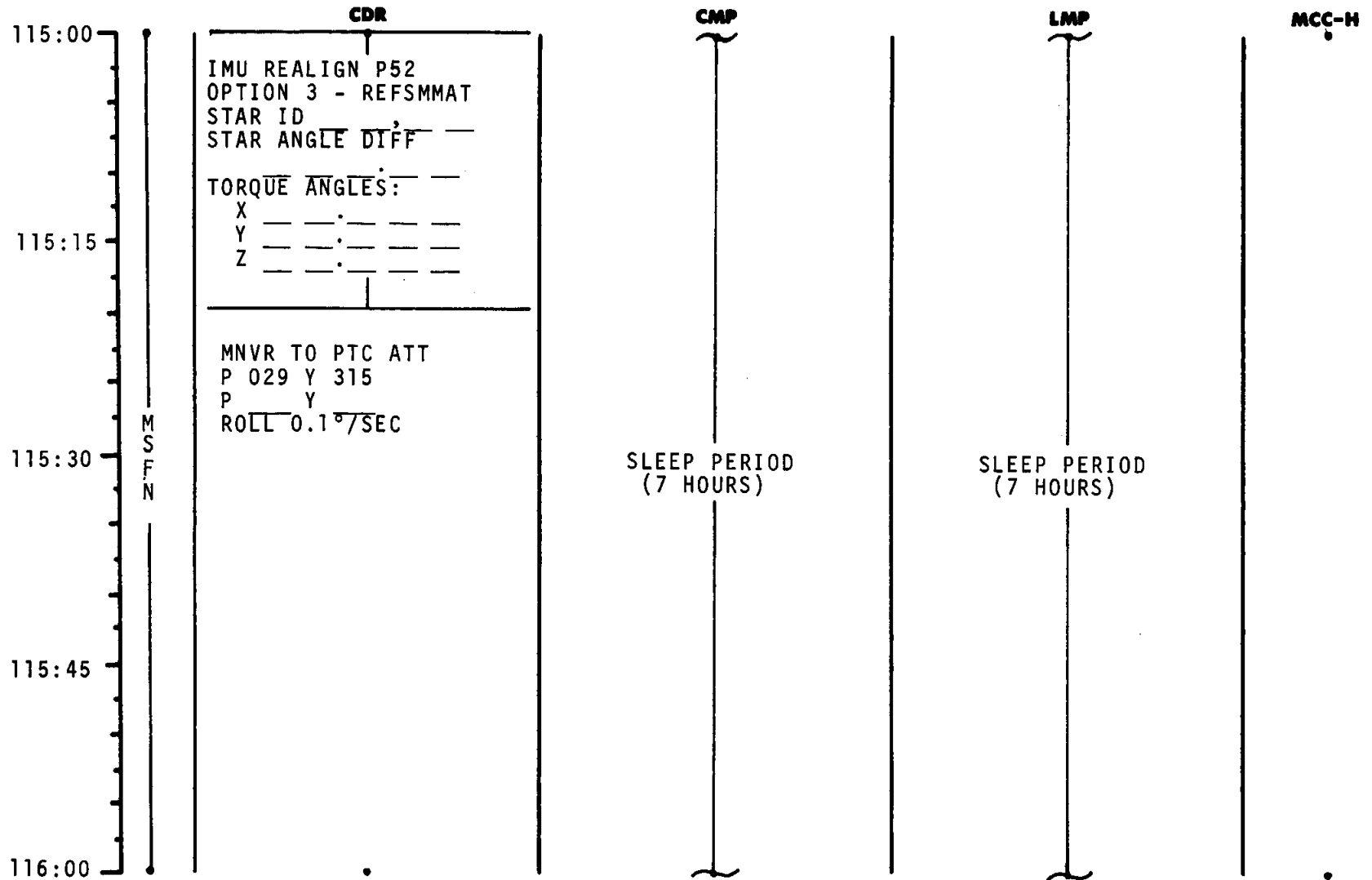
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	111:00 - 113:00	5/TEC	2-90

# FLIGHT PLAN



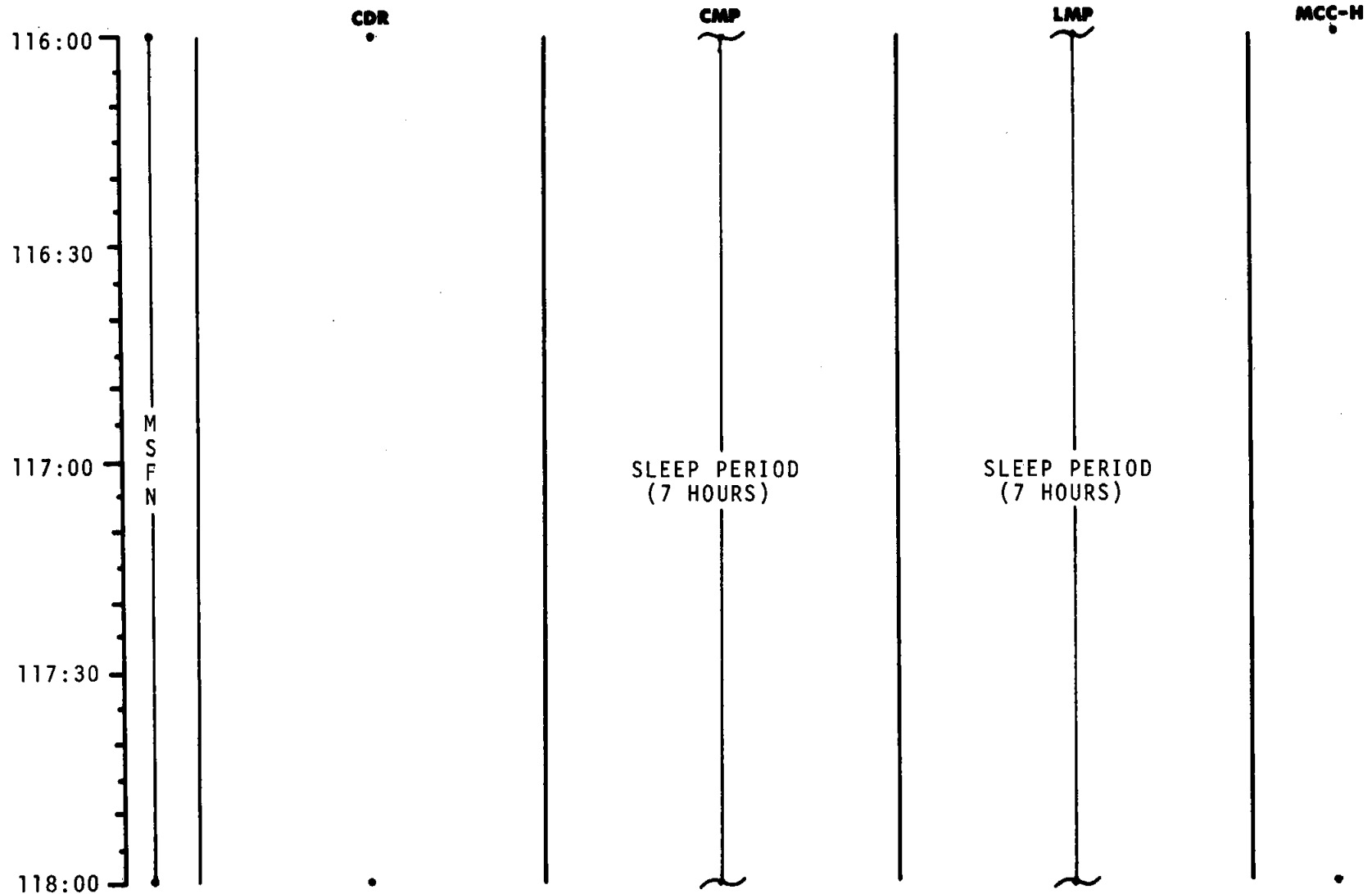
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	113:00 - 115:00	5/TEC	2-91

# FLIGHT PLAN



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

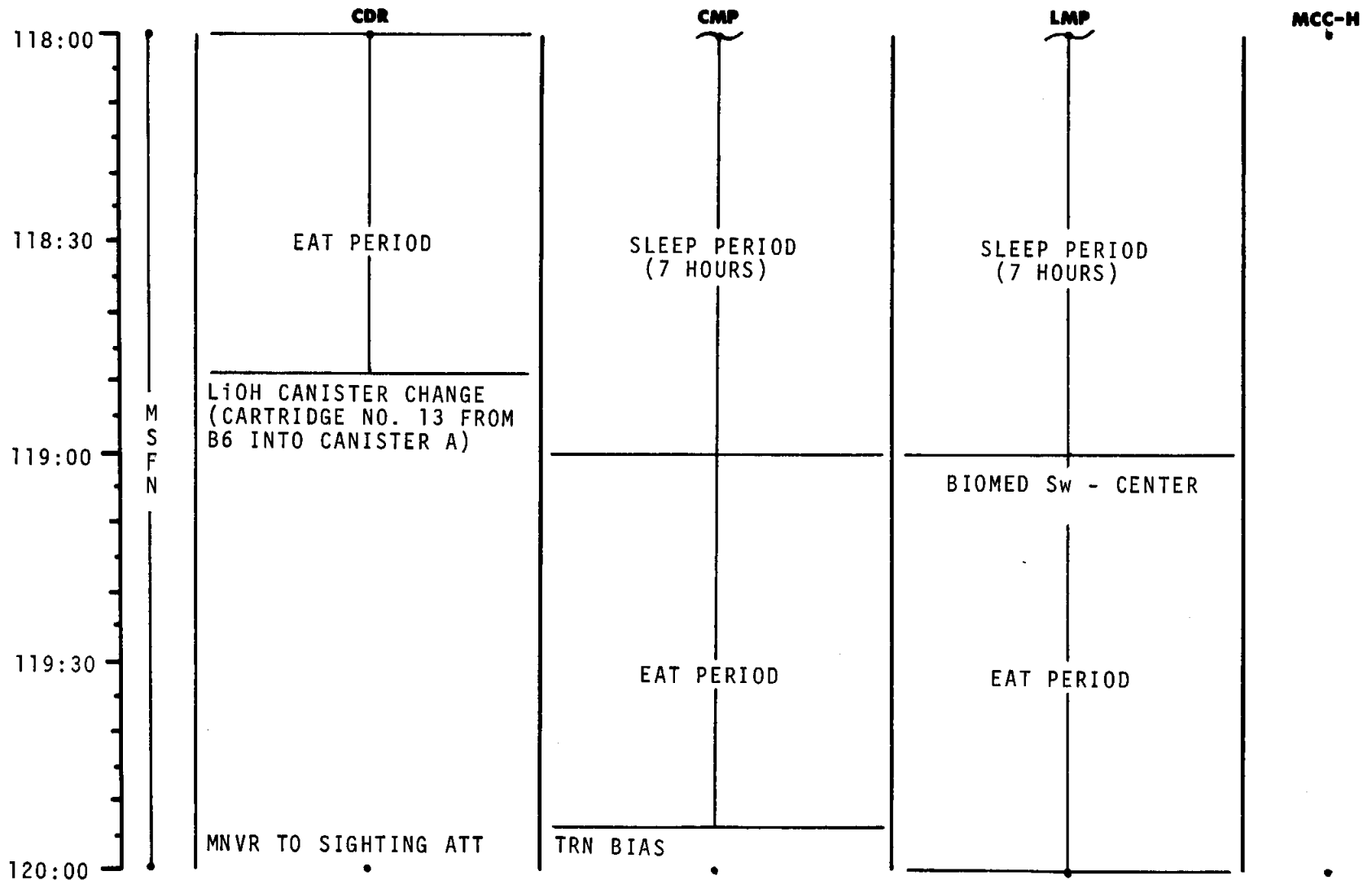
# FLIGHT PLAN



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

# FLIGHT PLAN

120:00  
120:15  
120:30  
120:45  
121:00

M  
S  
F  
N

CDR

CMP

LMP

MCC-H

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

CMP/LMP CREW STATUS  
REPORT

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<sub>gx</sub>

TRIM

X X X R

X X X P

X X X Y

: V<sub>gx</sub>

: V<sub>gy</sub>

: V<sub>gz</sub>

: ΔV<sub>c</sub>

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 fns

# 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		
TEI + 33 HRS	GDC ALIGN	TRANS TO COUCH		PIPA BIAS CK
122:00	MCC <sub>6</sub> ΔV=NOMINALLY ZERO	SM RCS MON CK		

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

# FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
122:00	V66 TRANS CSM STATE VECTOR TO LM SLOT	SM RCS MON CK	MCC <sub>6</sub> BURN STATUS REPORT INITIATE BAT CHARGE	
122:15			BIOMED Sw - RIGHT	
122:30	MNVN TO SIGHTING ATT	TRN BIAS		
		CISLUNAR NAVIGATION P23		
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

# 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		

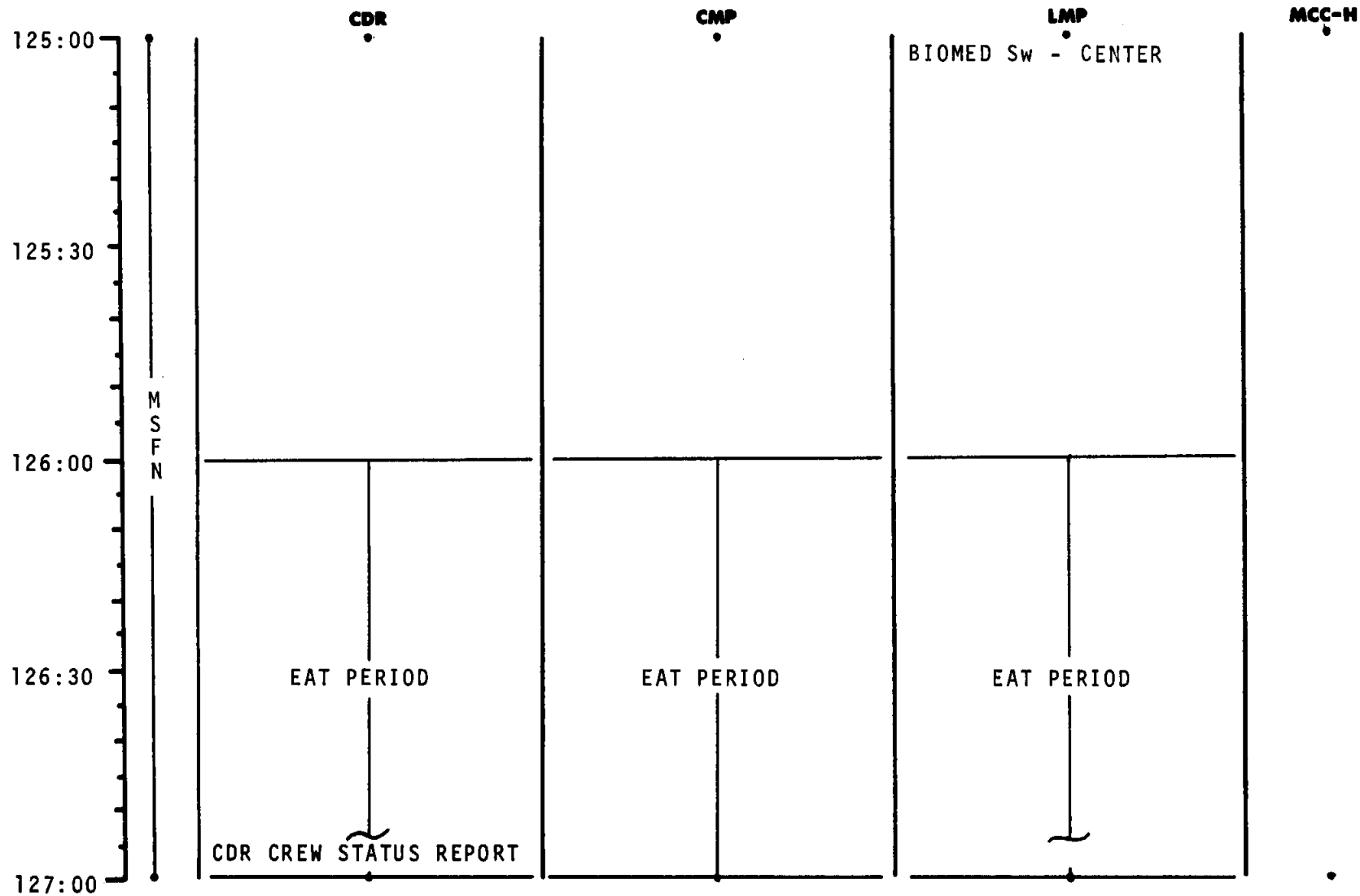
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	123:00 - 124:00	6/TEC	2-98

# FLIGHT PLAN

	CDR	CMP	LMP	MCC-H
124:00				
124:15		3. STAR 31 ENH STAR ___ E ___ H 2 SETS		
124:30	MSFN MNVR TO PTC ATT P 029 Y 315 P Y ROLL 0.1°/SEC	RETURN TO EARTH P37		
124:45				
125:00				

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

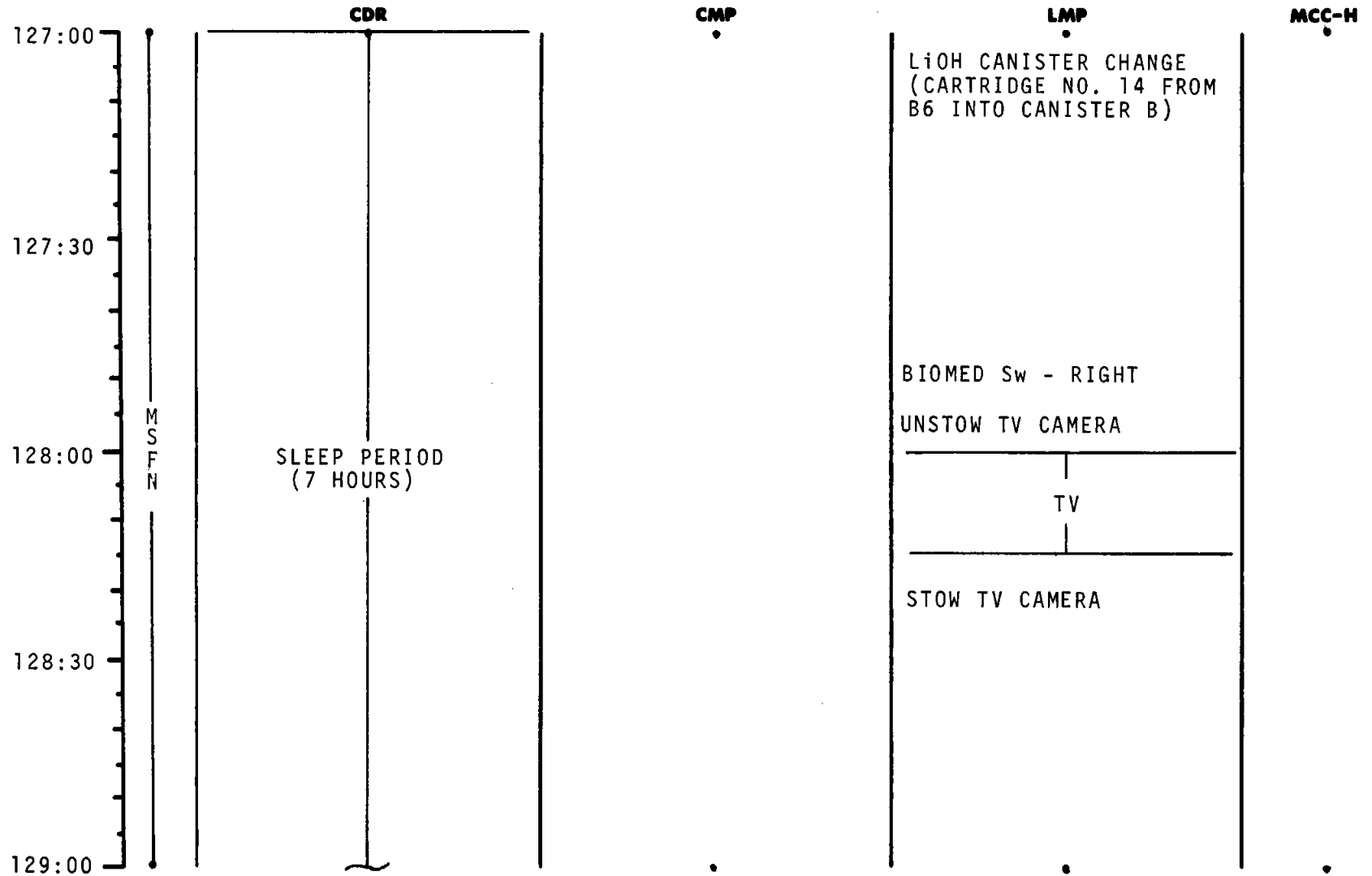
# FLIGHT PLAN



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

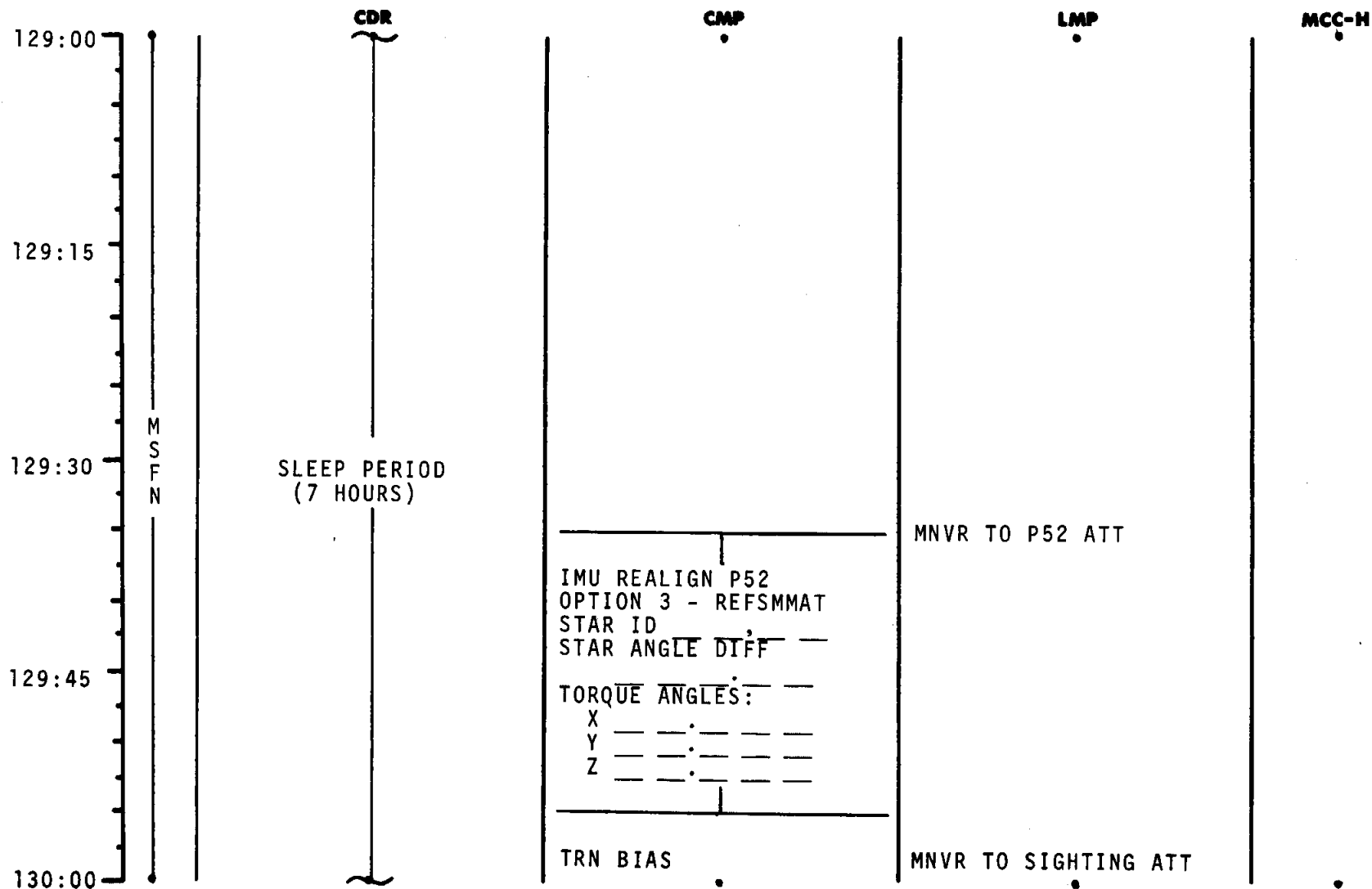


# FLIGHT PLAN



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

# FLIGHT PLAN



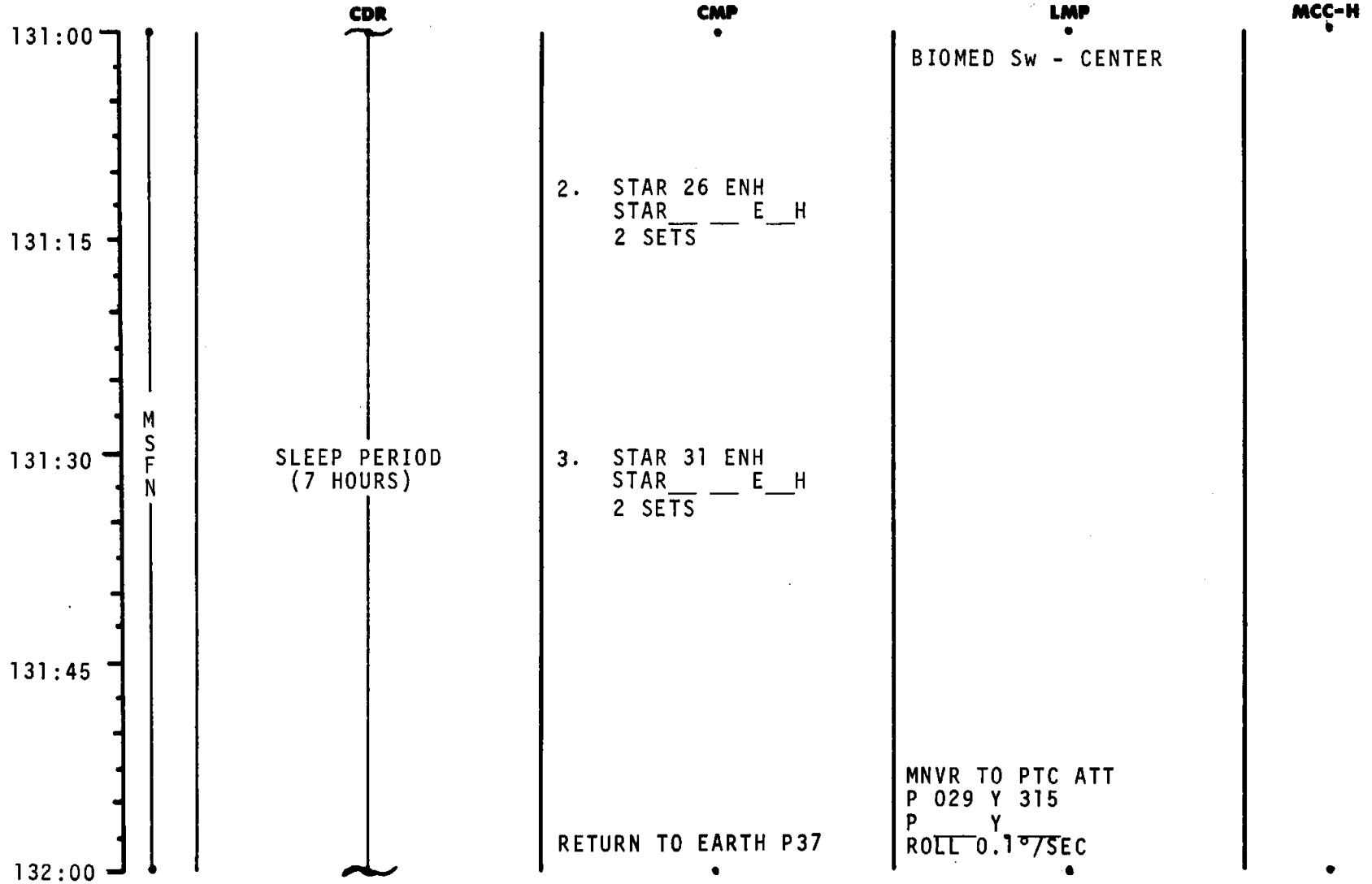
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	129:00 - 130:00	6/TEC	2-102

# FLIGHT PLAN

<p>130:00</p> <p>130:15</p> <p>130:30</p> <p>130:45</p> <p>131:00</p>	<p><b>MSFN</b></p>	<p><b>CDR</b></p> <p>SLEEP PERIOD (7 HOURS)</p>	<p><b>CMP</b></p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>CISLUNAR NAVIGATION P23</p> <p>1. STAR 02 LNH STAR__ __ L__H 2 SETS</p> </div> <p>TRN BIAS</p> <p>1. STAR 22 EFH STAR__ __ E__H 2 SETS</p>	<p><b>LMP</b></p> <p>MNVR TO SIGHTING ATT</p>	<p><b>MCC-H</b></p>
-----------------------------------------------------------------------	--------------------	-----------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------	---------------------

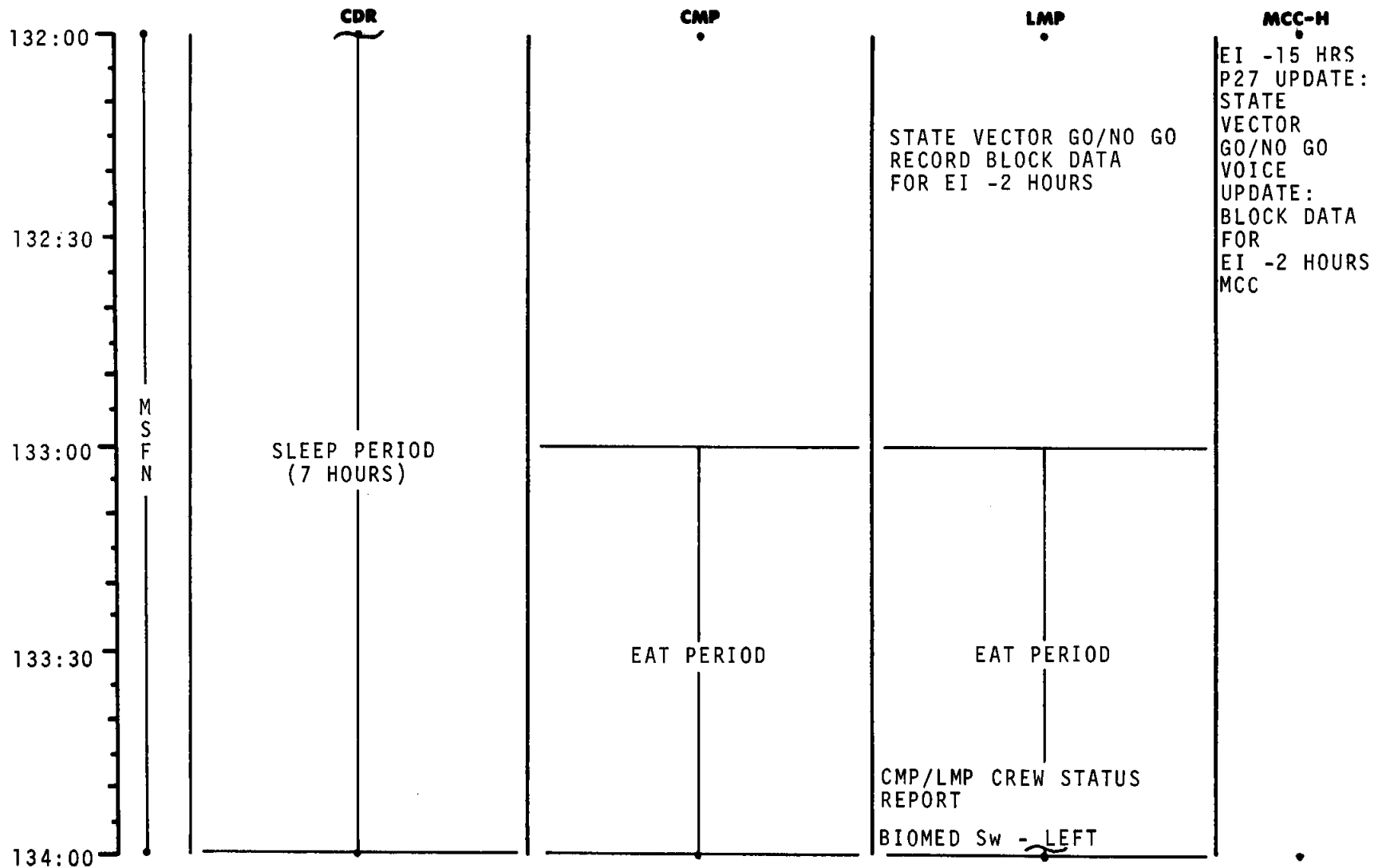
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	130:00 - 131:00	6/TEC	2-103

# FLIGHT PLAN



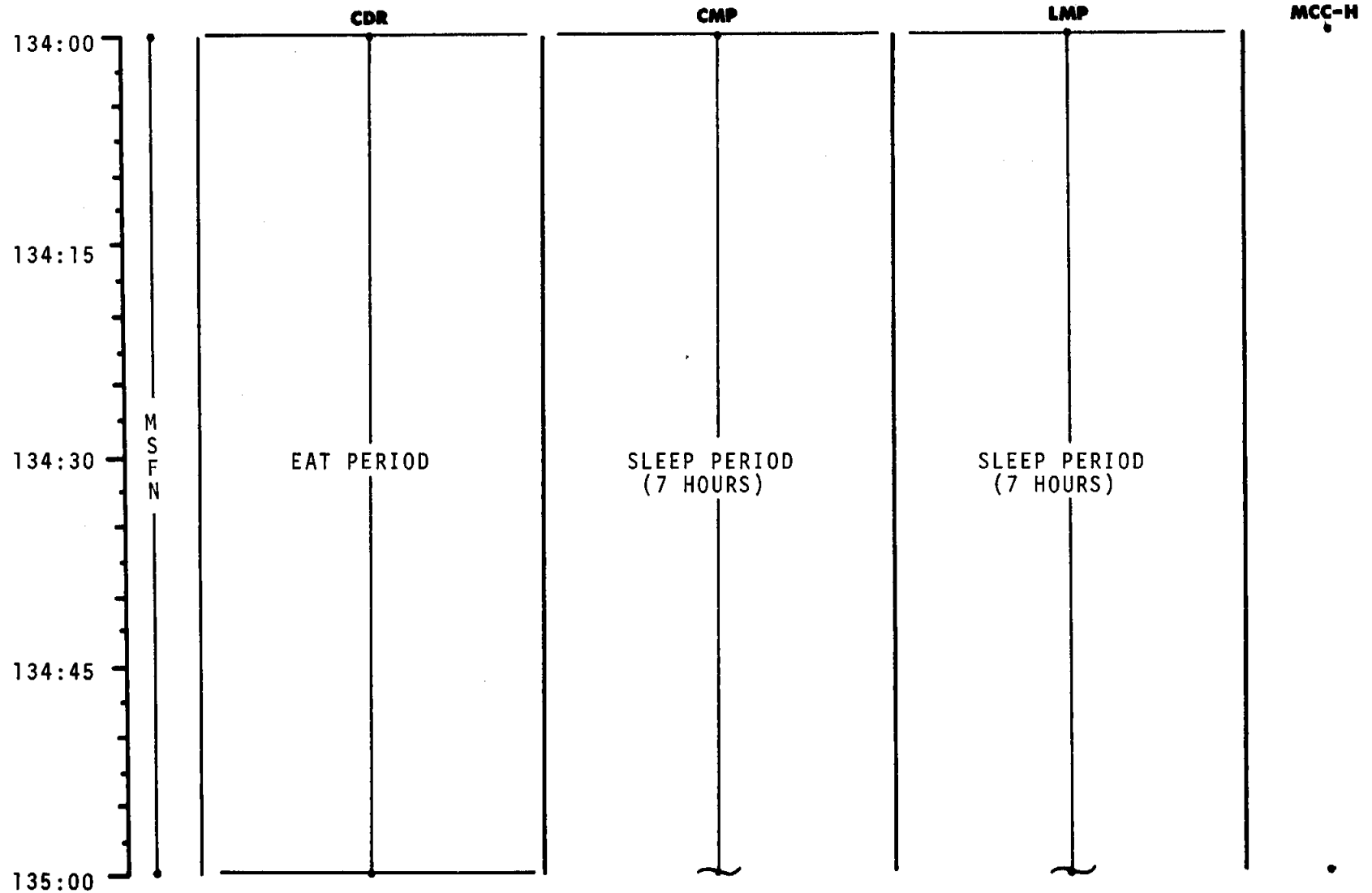
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	131:00 - 132:00	6/TEC	2-104

# FLIGHT PLAN



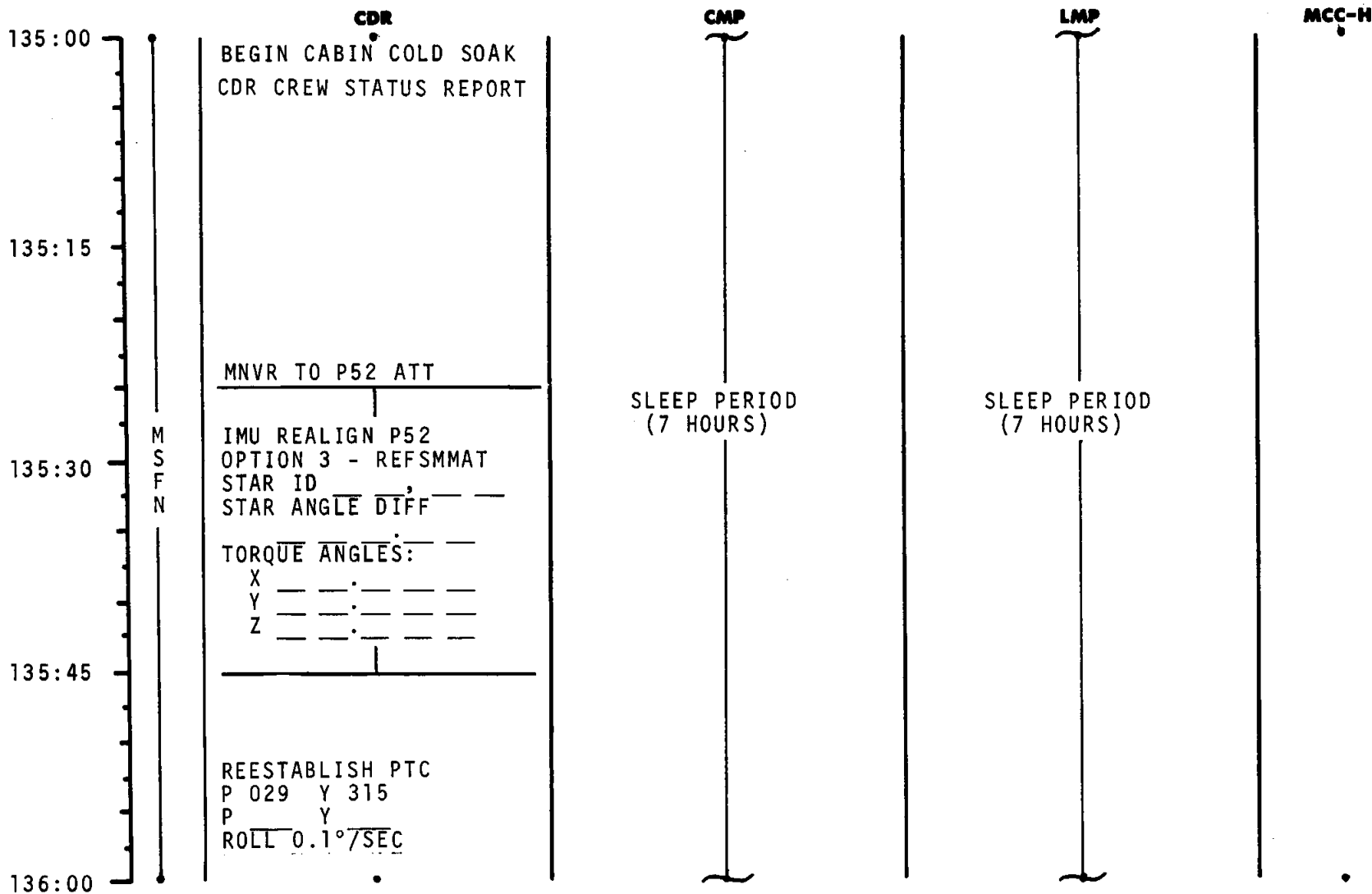
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	132:00 - 134:00	6/TEC	2-105

# FLIGHT PLAN



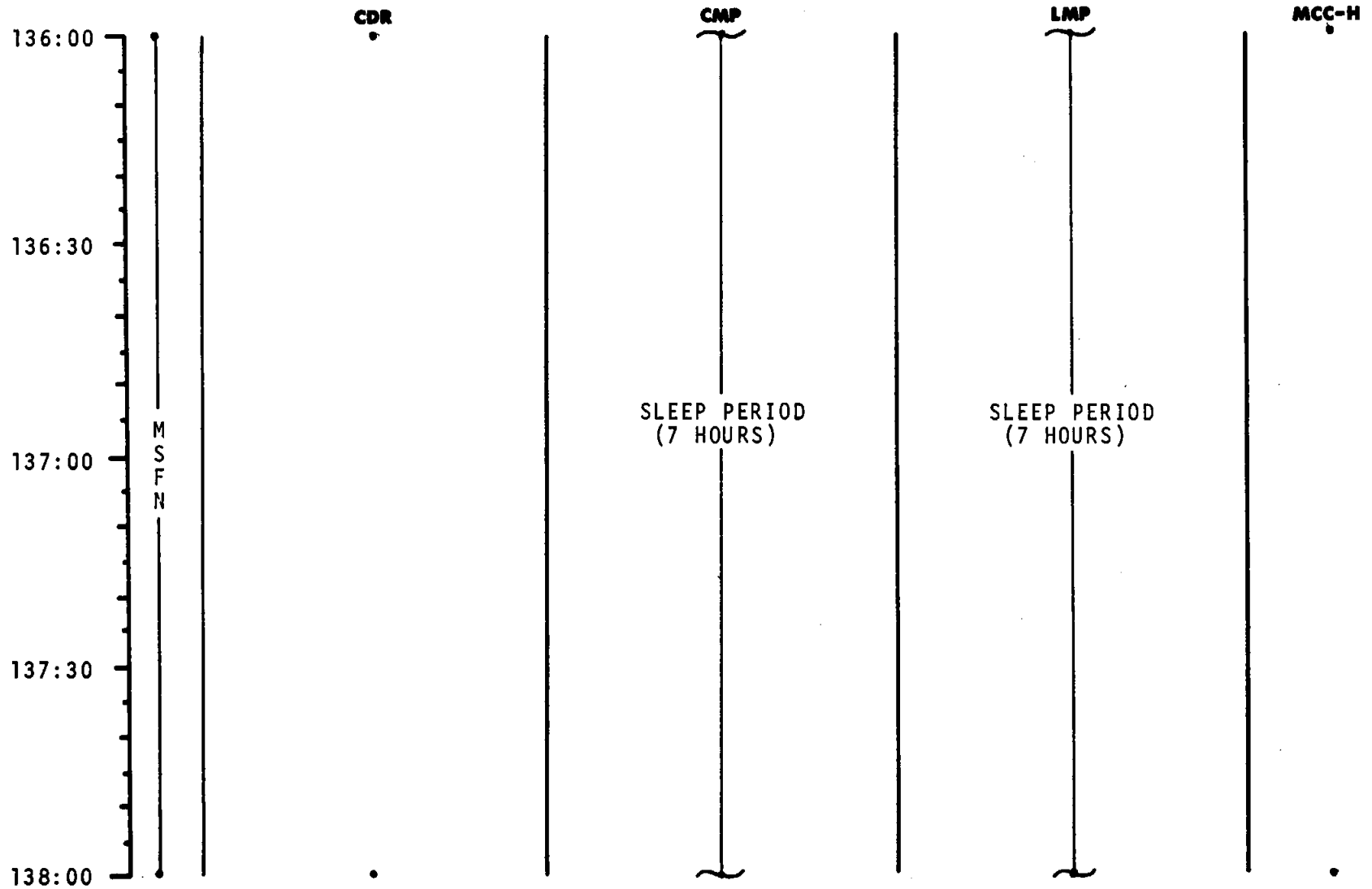
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	134:00 - 135:00	6/TEC	2-106

# FLIGHT PLAN



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

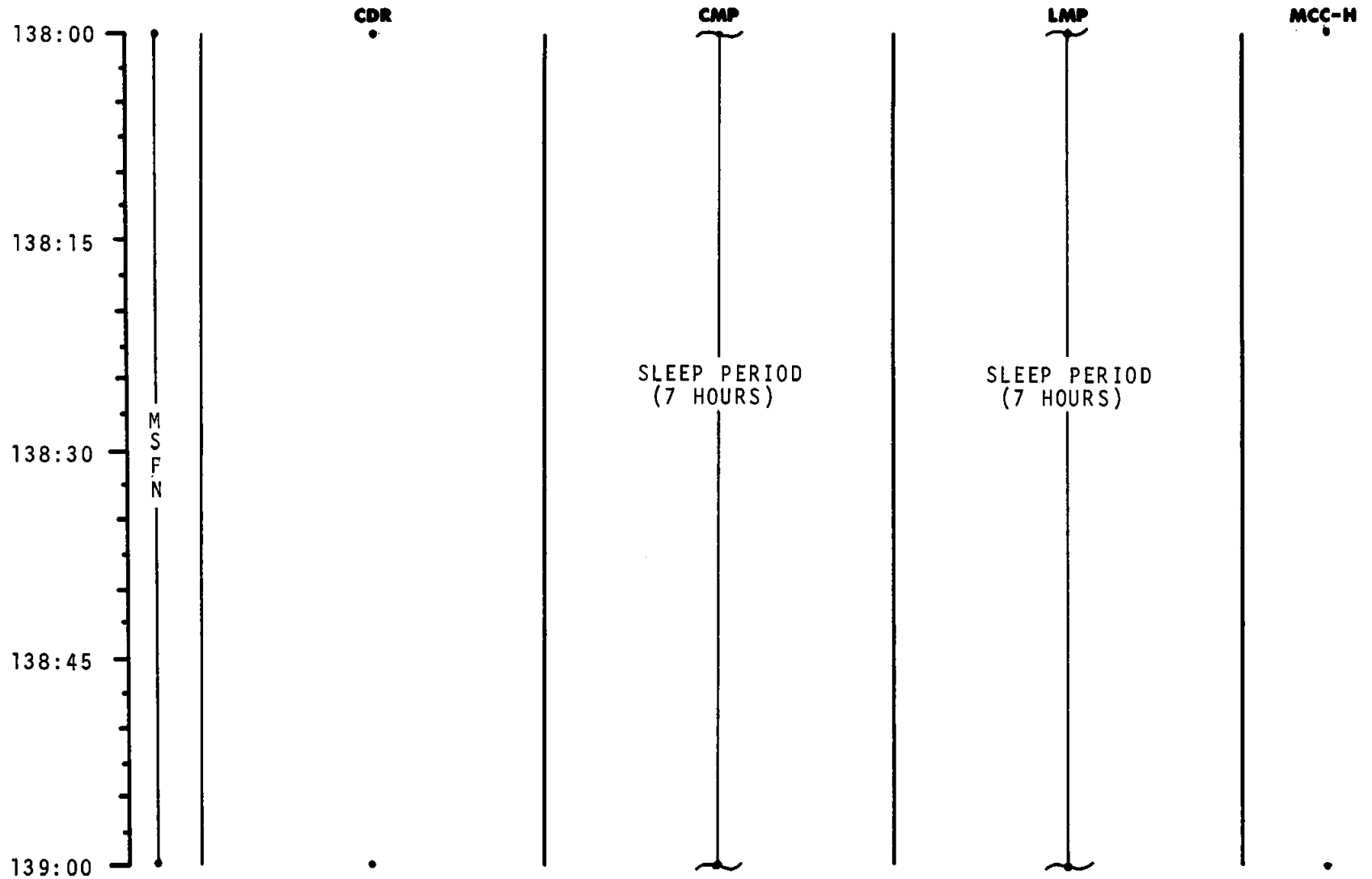
# FLIGHT PLAN



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

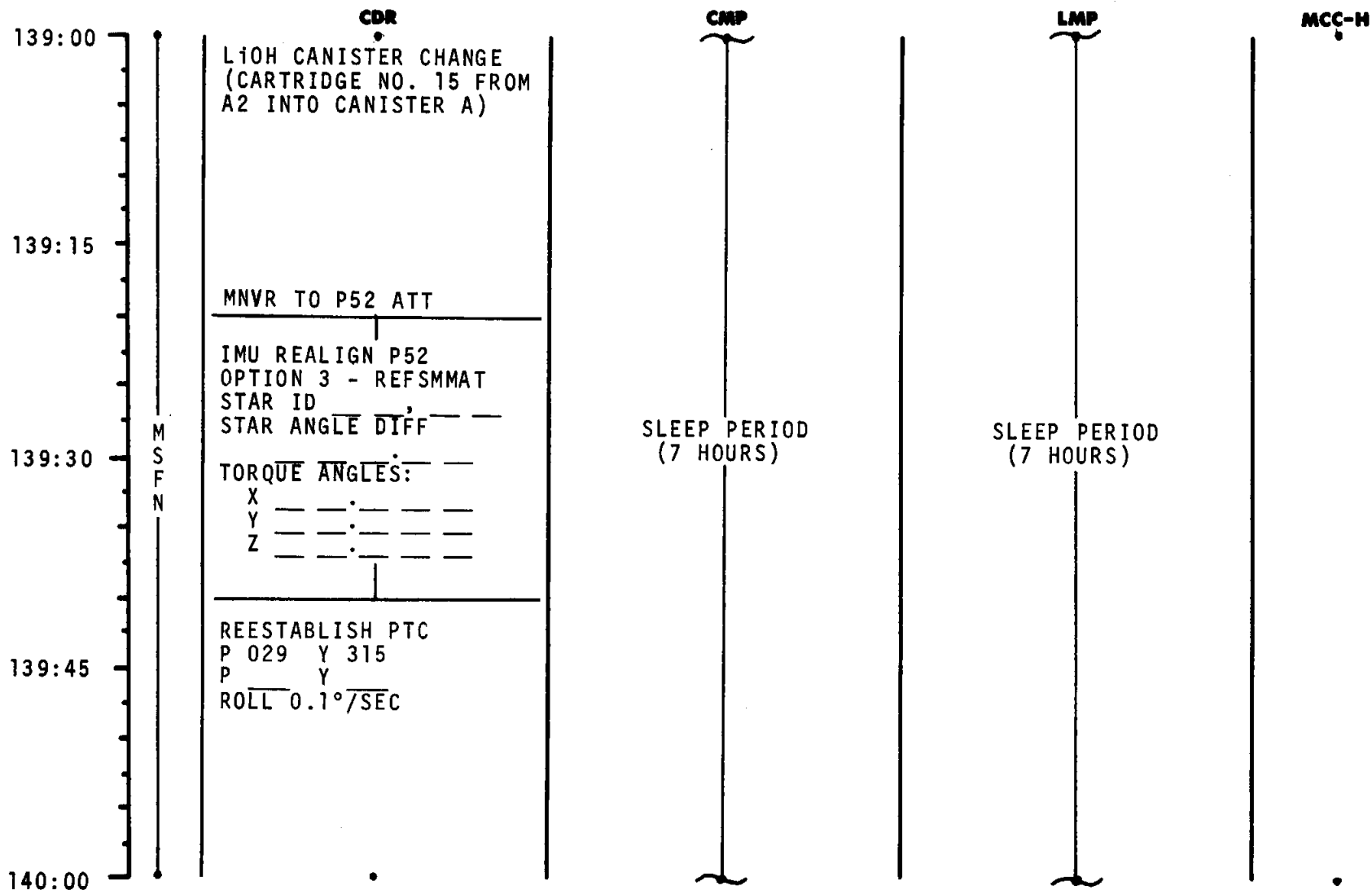


# FLIGHT PLAN



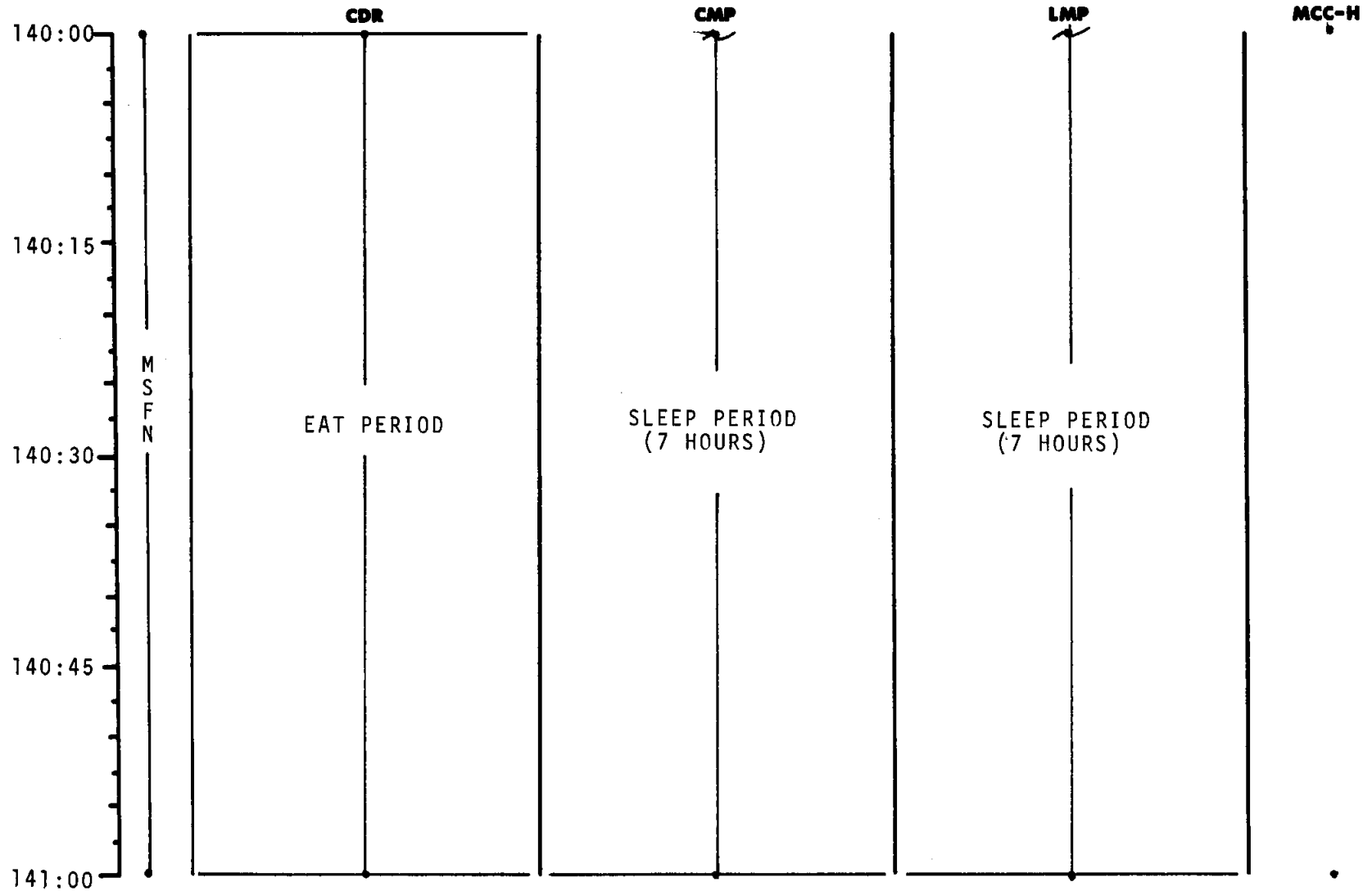
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	138:00 - 139:00	6/TEC	2-109

# 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

# FLIGHT PLAN

141:00	CDR •		CMP •		LMP •	MCC-H •
		MNVR TO SIGHTING ATT		LOSS OF COMM CONTINGENCY TRN BIAS		BIOMED Sw - RIGHT
				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		
	M S F N					
				EAT PERIOD		EAT PERIOD
141:15						
141:30						
141:45						
142:00						

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





**BURN STATUS REPORT**

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

REMARKS:

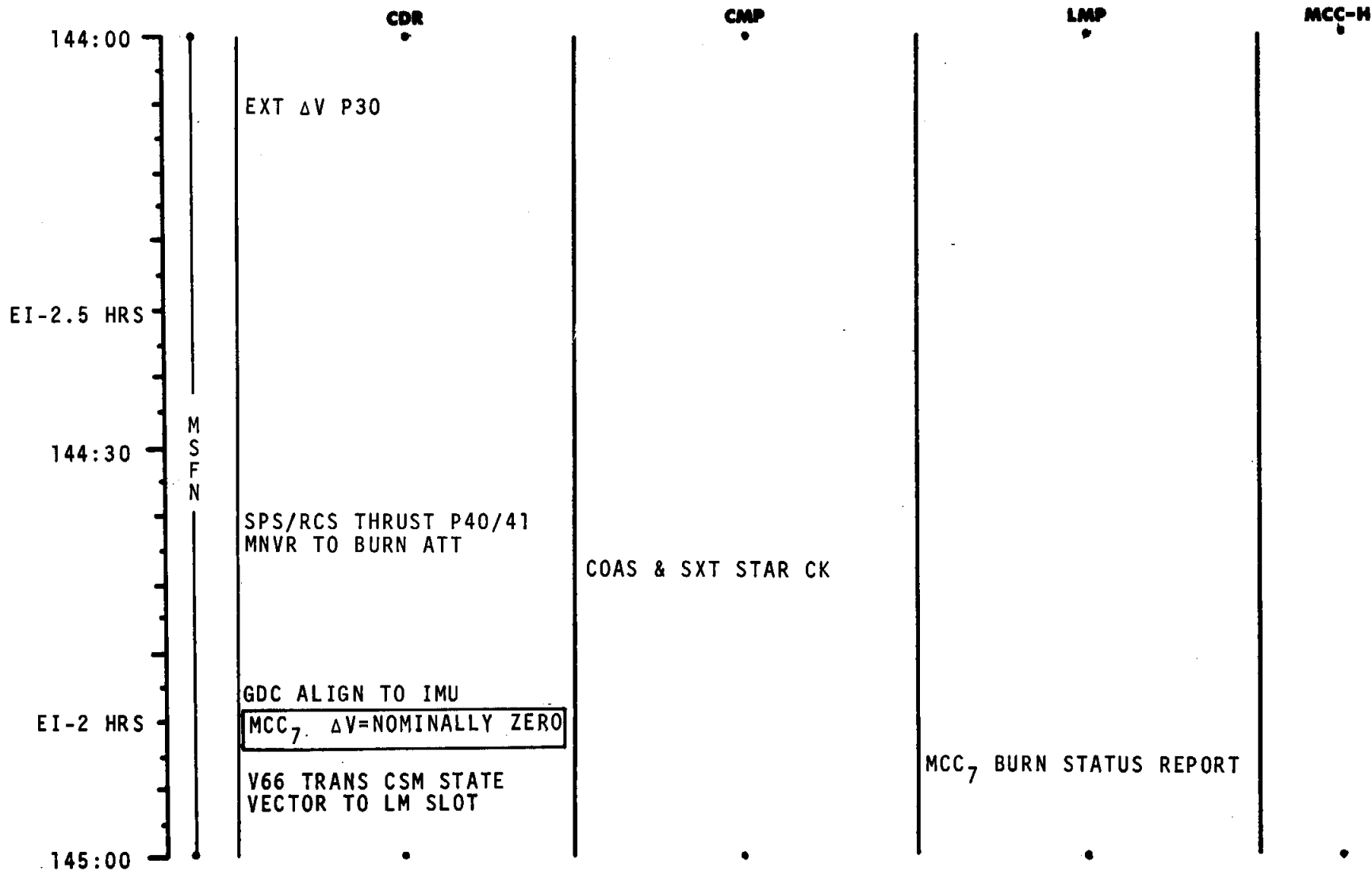
**MCC'S**

**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

2-114a

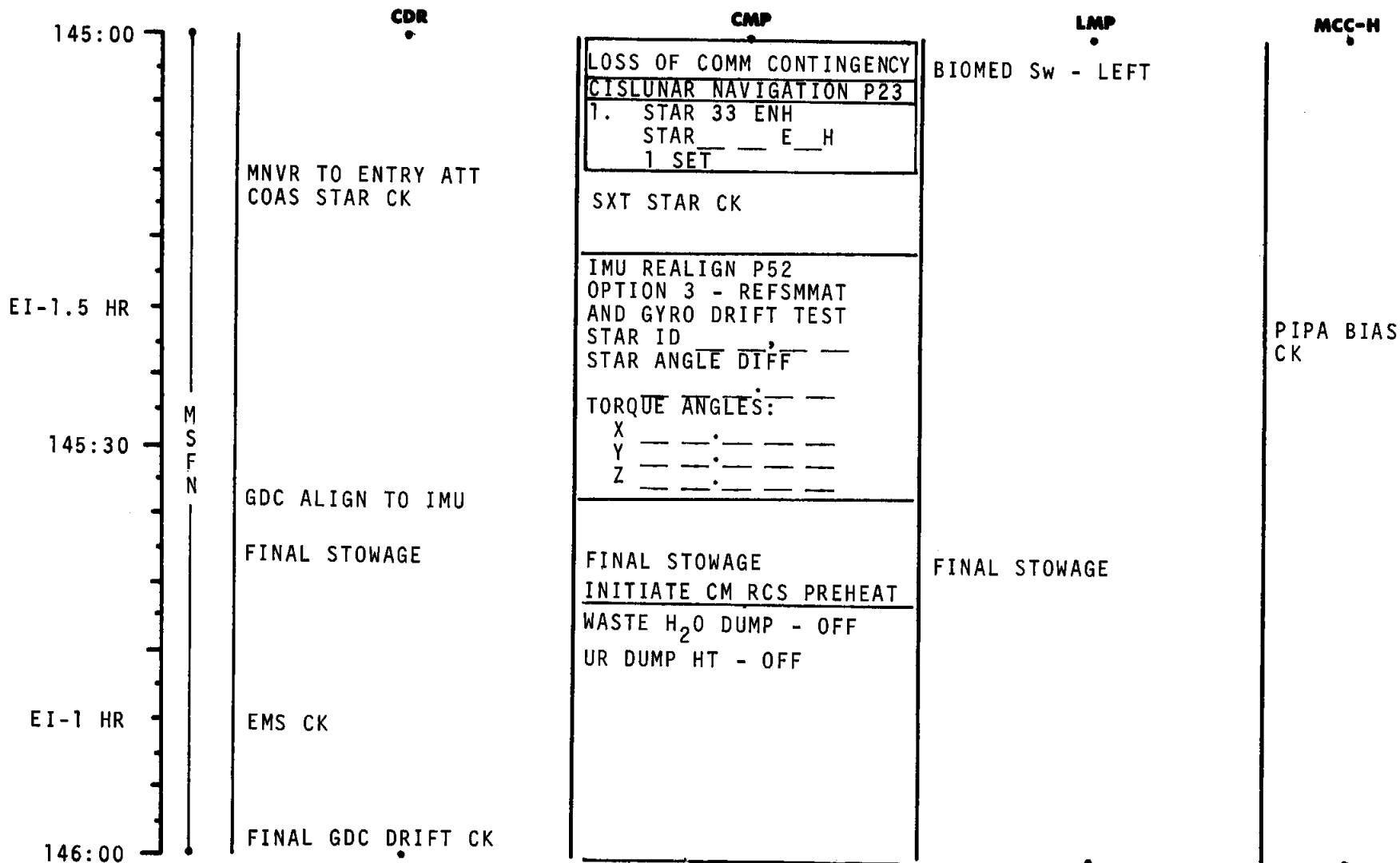
# FLIGHT PLAN



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

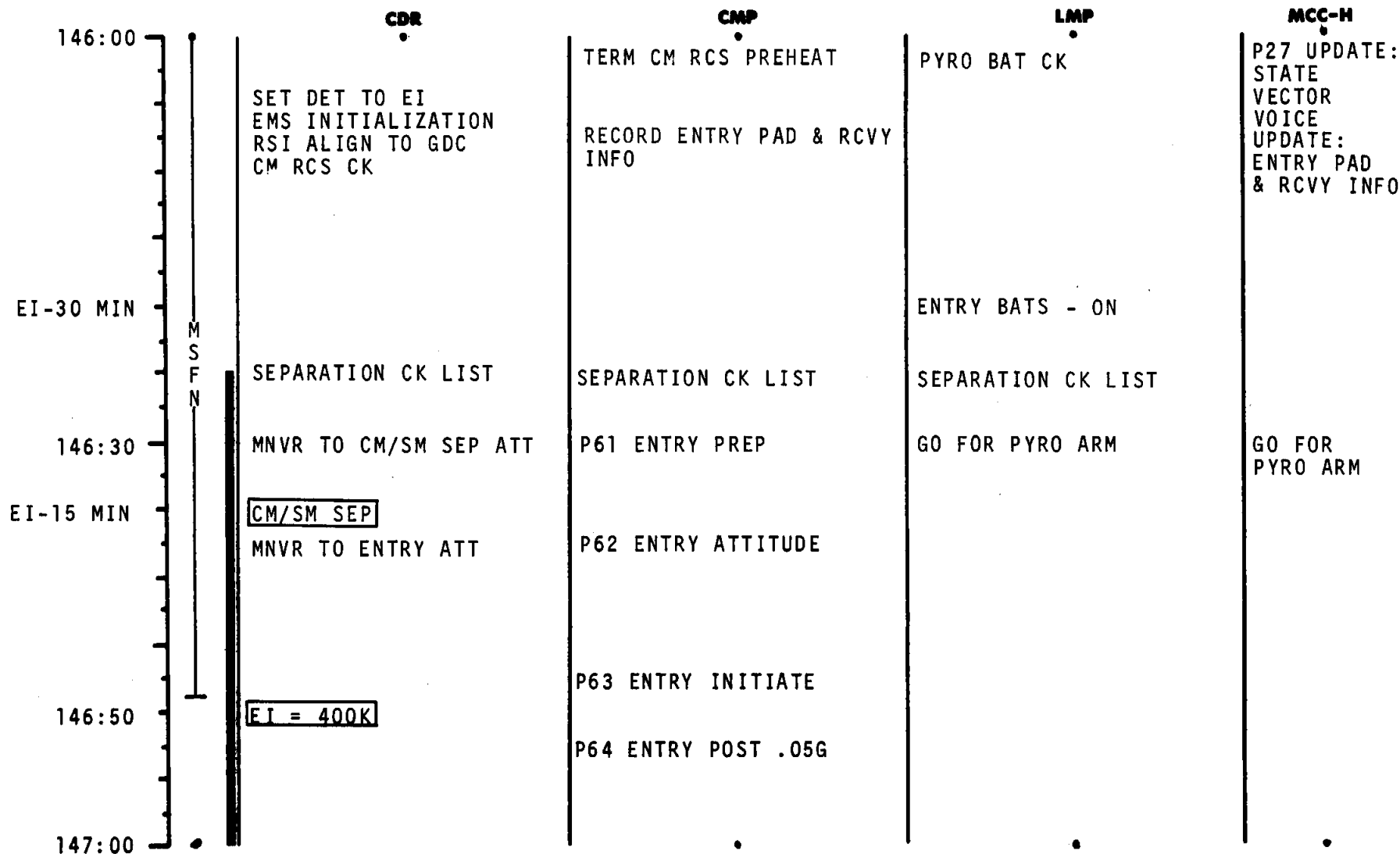


# FLIGHT PLAN



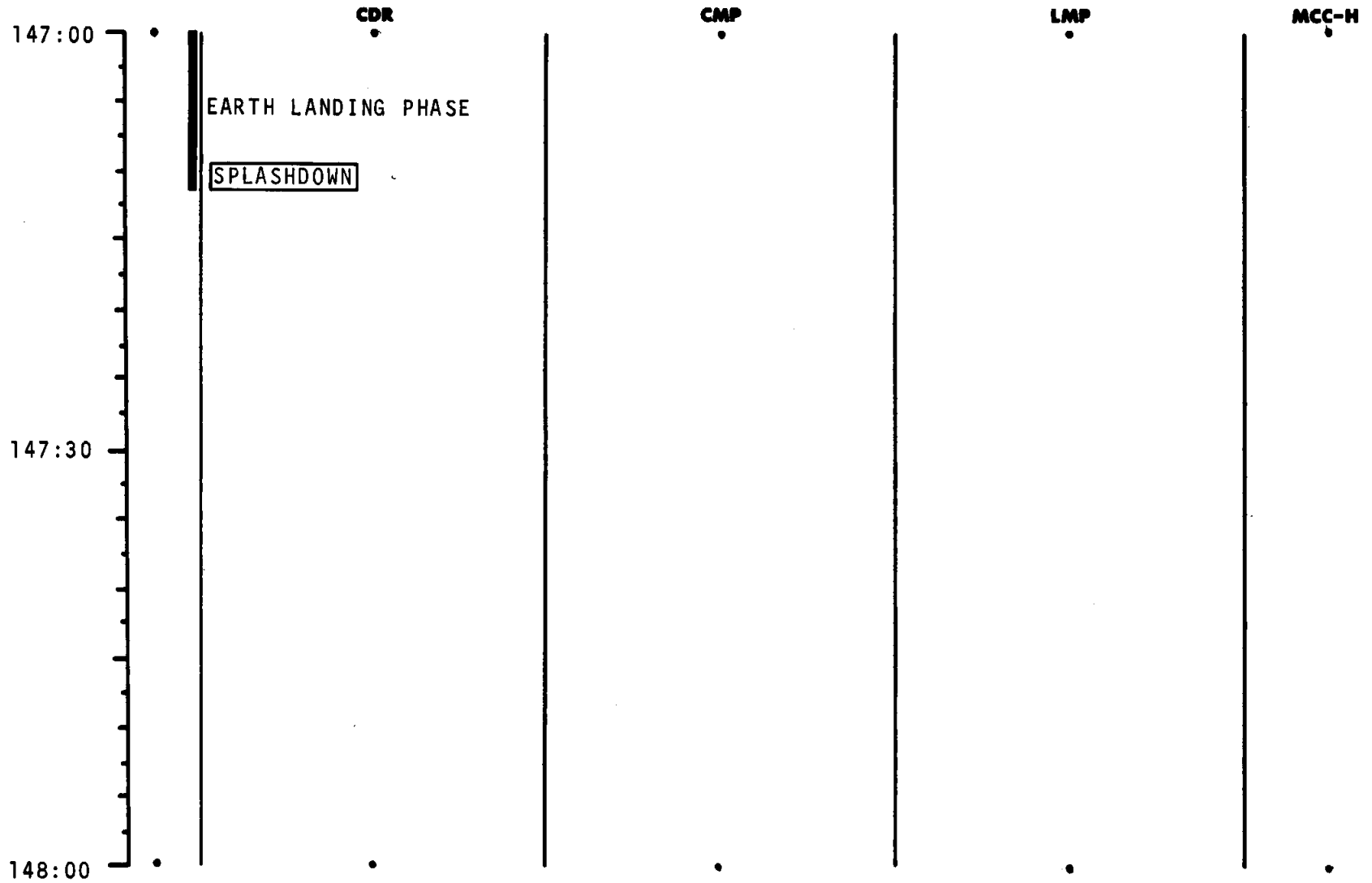
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	145:00 - 146:00	7/TEC	2-116

# FLIGHT PLAN



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

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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### 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

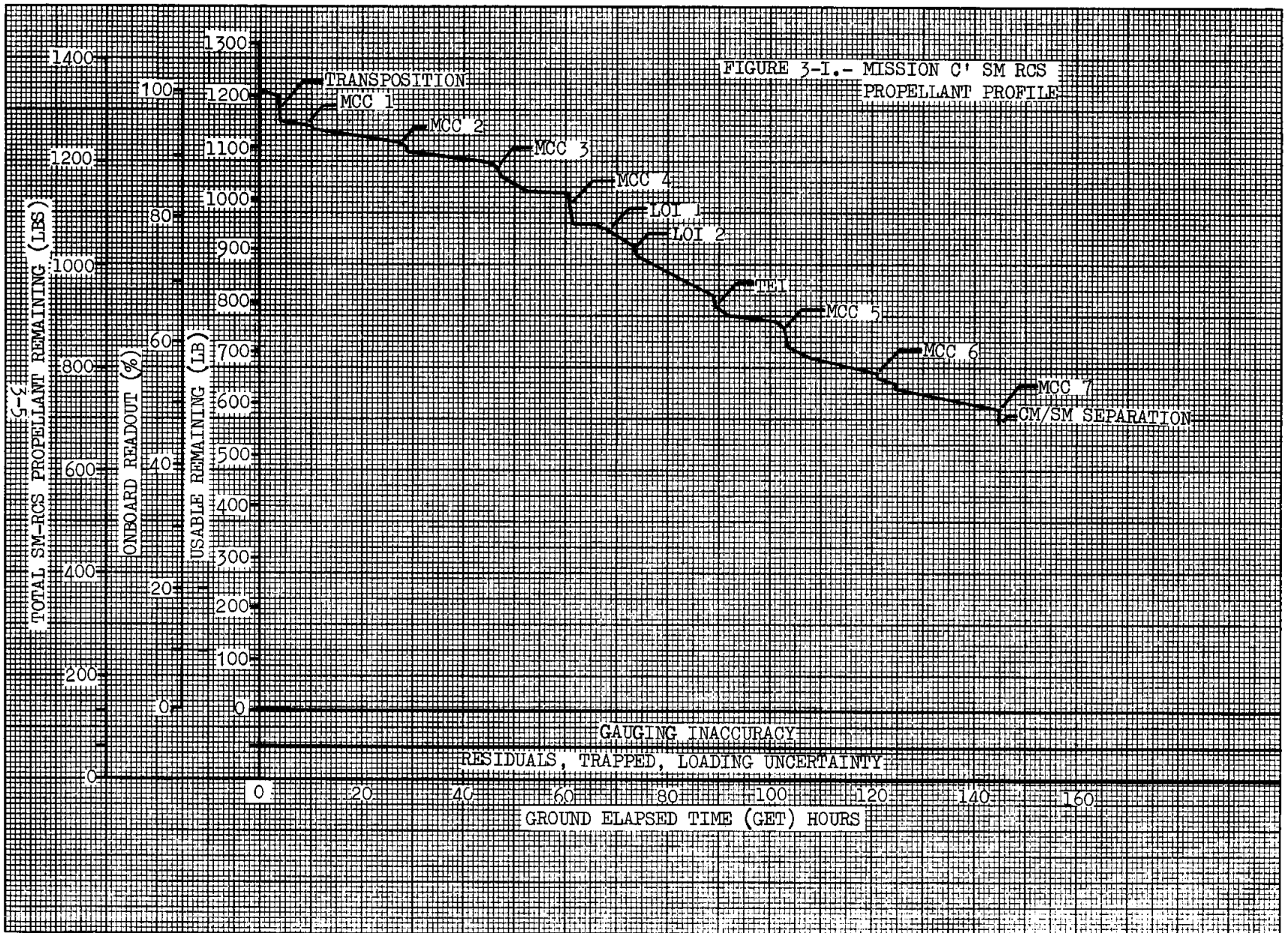
\*This quantity is based on the flight plan and results from the use of approximately 460 lbs of RCS for attitude orientation and control. This is considered unusable for mission planning and represents a dispersion to the nominal profile.

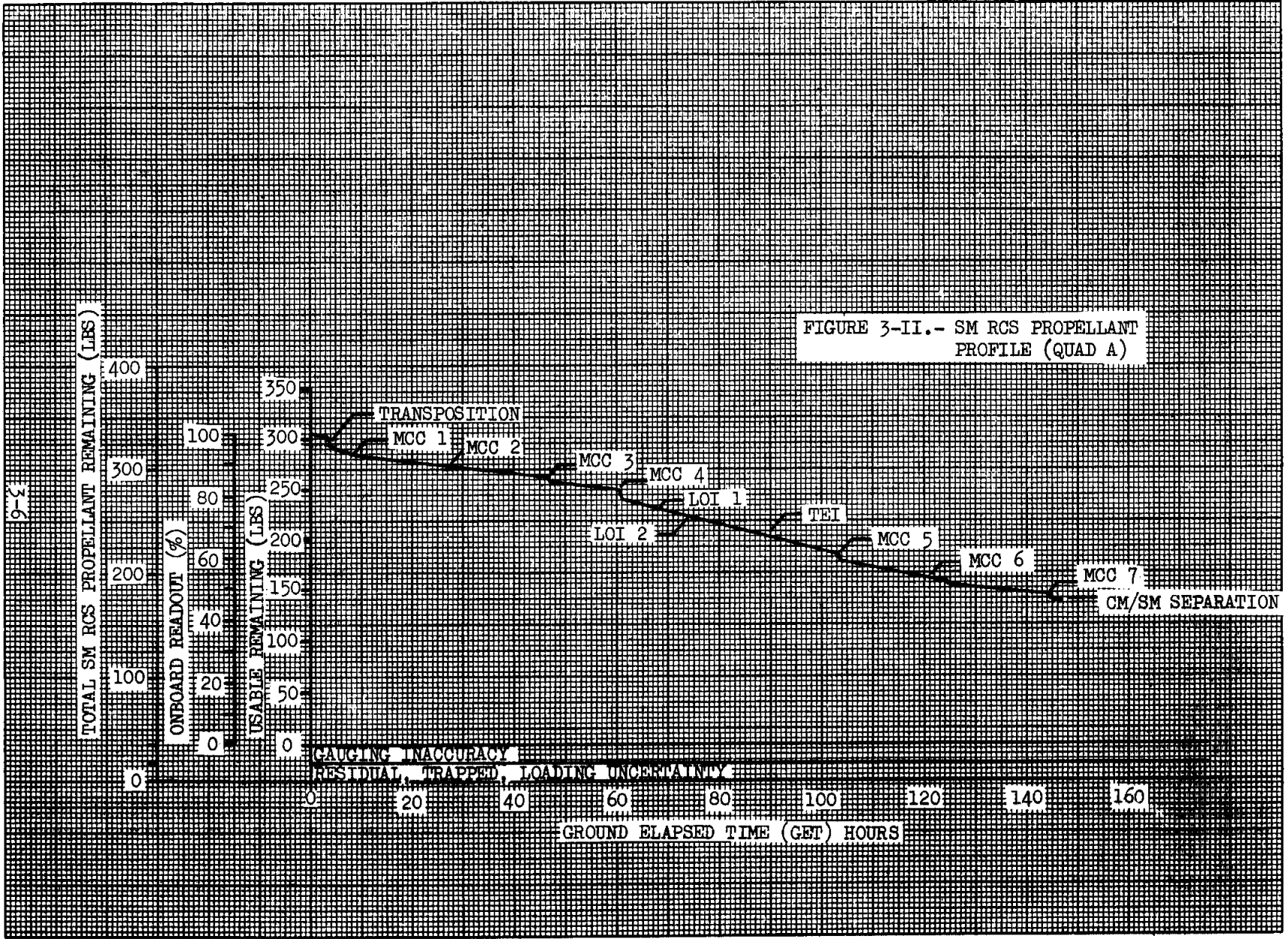
TABLE 3-II

SM RCS USAGE SUMMARY

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







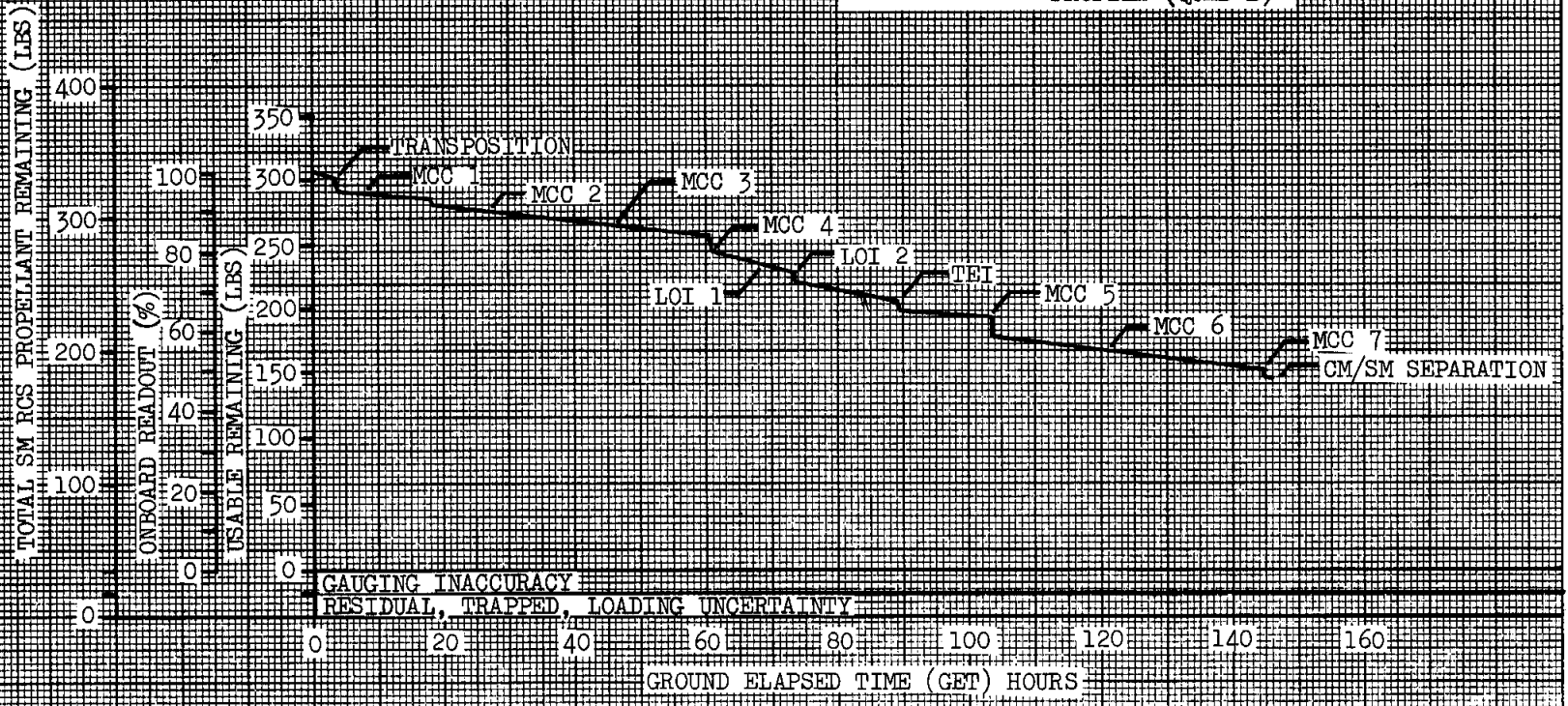
3-6

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

GAUGING INACCURACY  
RESIDUAL, TRAPPED, LOADING UNCERTAINTY

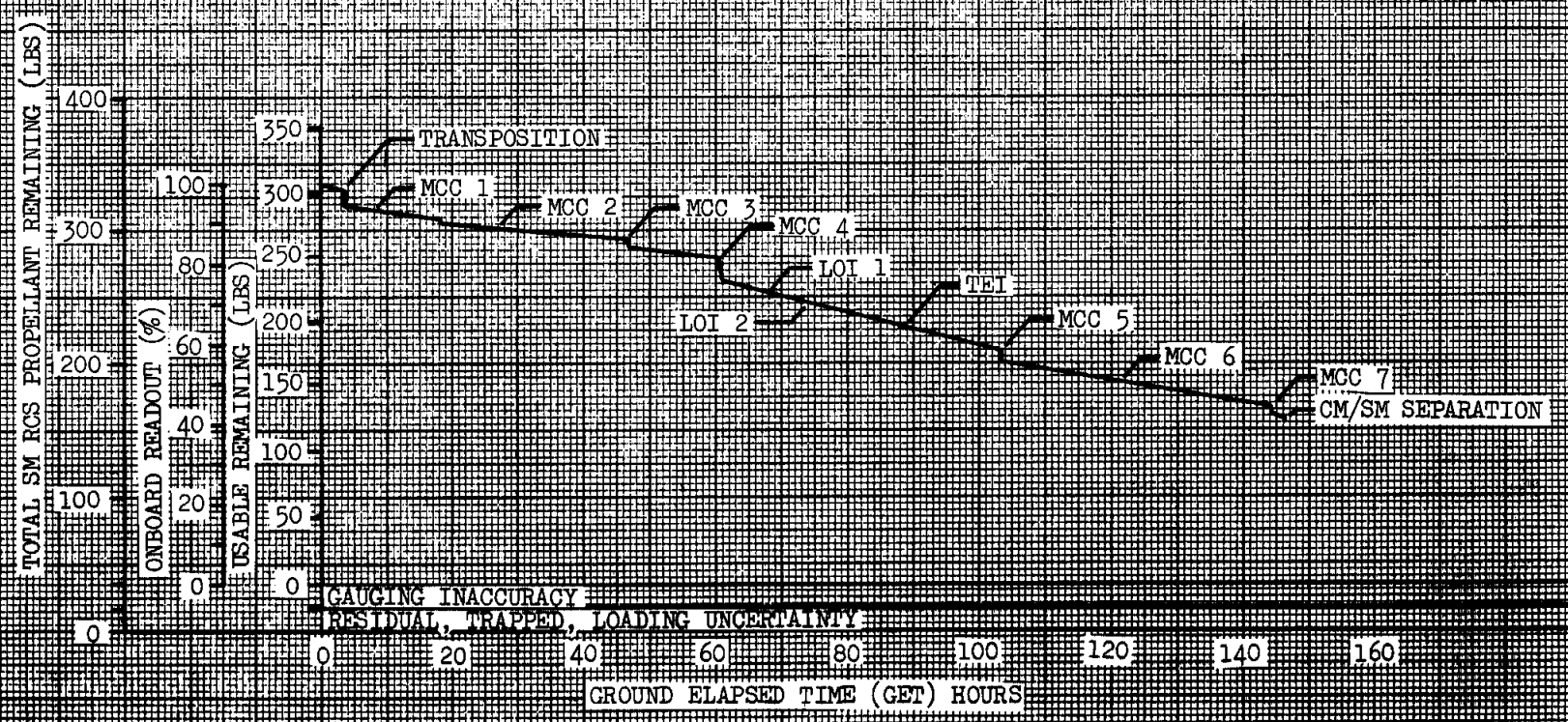
GROUND ELAPSED TIME (GET) HOURS

FIGURE 3-III.- SM RCS PROPELLANT PROFILE (QUAD B)



L-4

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



8-5

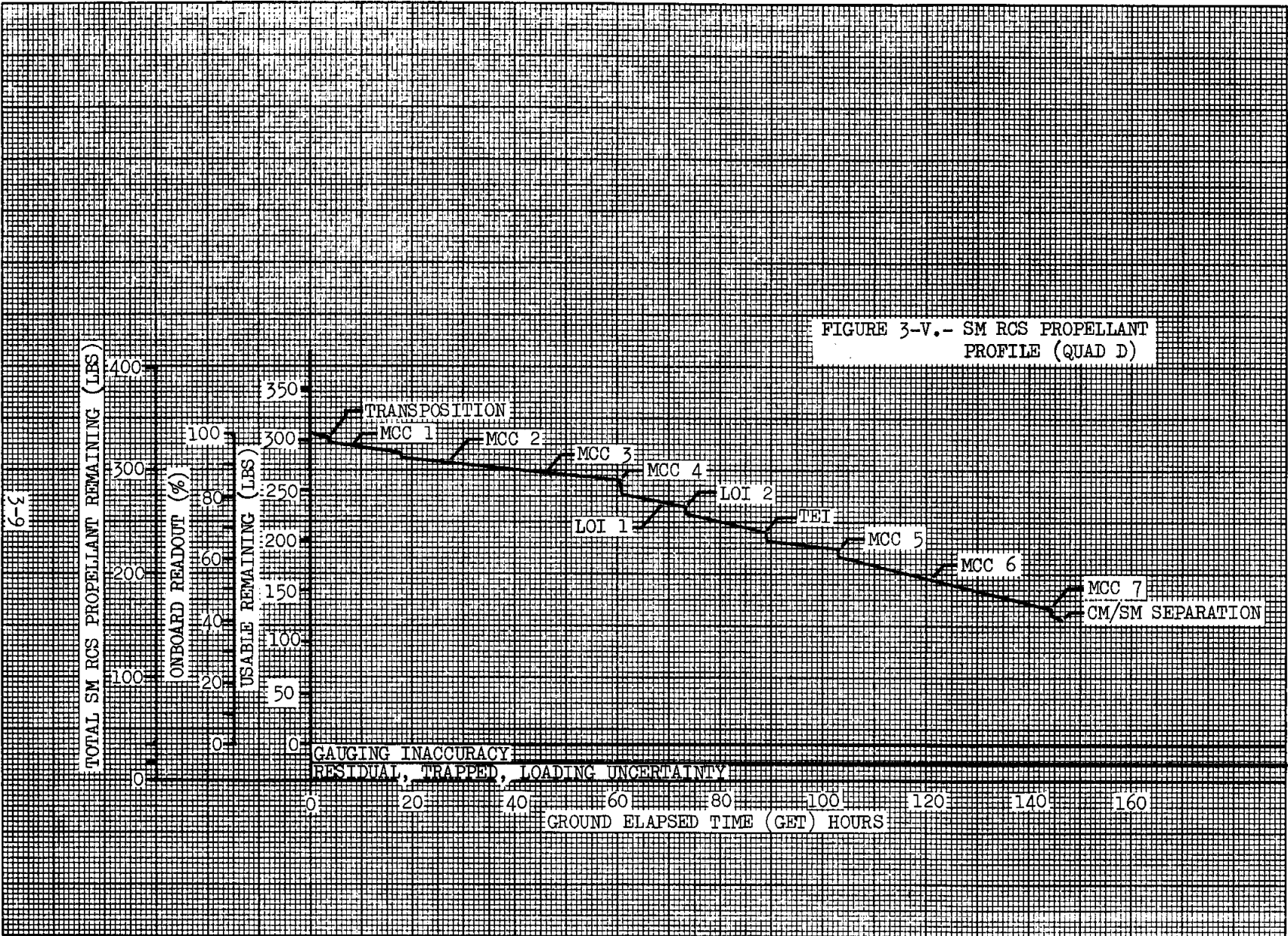


TABLE 3-III

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 PGNC5	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.
3.8	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	PS2 IMU ALIGN	63809.	1.1	1278.2	95.
8.5	MIDCOURSE CORRECTION 3 AXIS ORIENT PCNCS	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 3AXIS 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 (8)
9.8	EST. 0.3 DEG/SEC ROLL	63802.	.3	1270.9	94.
9.8	PITCH AND YAW CONTROL	63792.	9.1	1261.8	94.
16.6	PS2 IMU ALIGN	63791.	1.1	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	1258.6	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 PGNC	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	1252.6	93.
18.0	PITCH AND YAW CONTROL	63773.	10.4	1242.2	92.
26.0	P52 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 PGNC.	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	1231.6	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	PS2 IMU ALIGN	63752.	1.1	1221.7	91.
34.3	CISLUNAR NAVIGATION STAR/EARTH HORIZON ORIENT	63751.	.8	1220.4	91.
34.3	MIN. IMPULSE MARKING	63751.	.4	1220.4	91.
34.3	NAV SIGHTING SET 2	63750.	.8	1219.4	91.
34.3	MINIMUM IMPULSE MARKING	63750.	.4	1219.2	90.
34.3	NAV SIGHTING SET 3	63749.	.8	1218.1	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 3 AXIS 0.2 DEG/SEC	63748.	.8	1217.1	90.
34.9	ATTITUDE HOLD 0.5 DEG DB BGNC5	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 PGNC	63726.	1.1	1195.5	89.
46.6	ATT HOLD 0.5 DEG DB PGNC	63726.	.4	1195.1	89.
47.0	RCS +X TRANS PGNC 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	1169.6	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 PGNC	63698.	.8	1167.7	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	P52 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 3 AXIS 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.	8.8	1144.6	85.

SM-RCS PROPELLANT BUDGET					
TIME (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM-RCS LEFT (8)
60.0	PS2 IMU ALIGN	63674.	.9	1143.7	85.
60.5	MIDCOURSE CORRECTION 3 AXIS ORIENT PGNC5	63673.	.9	1142.7	85.
60.5	ATT HOLD 0.5 DEG DB PGNC5	63673.	.4	1142.4	85.
61.0	RCS -X TRANS PGNC5 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 PGNC5	63620.	.8	1089.6	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	PS2 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 LOI] 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 PGCS	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	PS2 IMU ALIGN	63604.	.9	1073.9	80.
✓68.4	LUNAR ORBIT INSERTION BURN 1 3-AXIS ORIENT PGCS	63604.	.9	1073.0	80.
68.4	ATT HOLD .5 DEG DB PGCS	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	1064.6	79.
70.3	PS2 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 TRACK	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	P52 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 PGNC5	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	ILLAGE 2 JET B AND D	46952.	15.7	1027.7	76.
73.5	SPS BURN BUILD UP	46949.	.0	1027.7	76.
73.5	STEADY STATE BURN 9.7 SEC PGNC	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	PS2 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 (LBS)
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	995.6	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	981.6	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 (HR)	EVENT	S/C WT (LBS)	SM-RCS USED (LBS)	SM-RCS LEFT (LBS)	SM- RCS LEFT (#)
84.7	ESTABLISH ORB RATE	46182.	1.5	954.7	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	P52 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	945.8	70.
88.3	P52 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 (HR)	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 PGNC5	46155.	15.7	927.1	69.
89.1	SPS BURN BUILD UP	46152.	.0	927.1	69.
89.1	STEADY STATE BURN 206 SEC PGNC5	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	920.6	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	914.6	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 PGCS	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	P52 IMU ALIGN	32209.	.7	905.0	67.
96.3	ORIENT FOR PTC 3 AXIS 0.2 DEG/SEC	32209.	.7	904.3	67.
96.3	ATTITUDE HOLD 0.5 DEG DB PGCS	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	P52 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	890.8	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 (8)
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.	1.0	882.2	65.
					PGNCS
103.5	ATTITUDE HOLD .5 DEG DB	32186.	.8	881.4	65.
					PGNCS
103.5	RCS +X TRANS	32149.	37.1	844.3	63.
					PGNCS 10 FPS
105.0	P52 IMU ALIGN	32148.	.7	843.6	63.
105.2	CISLUNAR NAVIGATION STAR/EARTH HORIZON ORIENT	32147.	1.0	842.6	63.
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	836.5	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	P52 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 PGNC	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 PG_NCS	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 PG_NCS	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 PG_NCS	32107.	.8	802.4	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	P52 IMU ALIGN	32100.	.7	795.2	59.
121.5	MIDCOURSE CORRECTION 3 AXIS ORIENT PGNC	32099.	.7	794.5	59.
121.5	ATT HOLD .5 DEG DB PGNC	32098.	.4	794.1	59.
121.5	SM-RCS -X TRANS 2FPS	32091.	7.5	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 3 AXIS 0.2 DEG/SEC	32078.	.7	773.8	57.
124.5	ATT HOLD .5 DEG DB PGNC5	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 PGNC5	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	742.6	55.
135.7	ORIENT FOR PTC 3AXIS 0.2 DEG/SEC	32046.	.7	741.9	55.
135.7	ATT HOLD .5 DEG DB PGNC5	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 (lb)	
139.5	ATTITUDE HOLD 0.5 DEG DB PG <sub>NCS</sub>	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	728.7	54.	
142.2	NAV SIGHTING SET 2	32032.	.9	727.3	54.	
142.2	MINIMUM IMPULSE MARKING	32031.	.4	726.9	54.	
143.7	P52 IMU ALIGN	32031.	.7	726.1	54.	
144.4	MIDCOURSE CORRECTION	32030.	.7	725.4	54.	
144.4	ATT HOLD .5 DEG DB PG <sub>NCS</sub>	32030.	.3	725.2	54.	
144.4	RCS +X TRANS PG <sub>NCS</sub> 5 FPS	32011.	18.6	706.6	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	P52 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 FGNC	32007.	.4	702.6	52.
146.6	CM/SM SEPARATION DELTA VEL=3 FPS	19526.	10.8	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>	Propellant (Lbs)
Loaded	40785
Trapped	-441
Outage	- 18
Unbalance Meter	<u>-100</u>
Available for $\Delta V$	40226
Required for $\Delta V^1$	<u>-31253</u>
Nominal Remaining	8973

<sup>1</sup>Includes 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><math>\Delta V</math></u>	<u>Propellant Required</u>
TLMC <sup>2</sup>	120.	780.0
LOI	2991.	16074.7
Circularization	138.5	648.5
TEI	3531.7	13537.7
TEMC	62	<u>211.9</u>
		31252.7

<sup>2</sup>2 starts

TABLE 3-VI

CRYOGENIC CONSUMPTION ANALYSIS SUMMARY

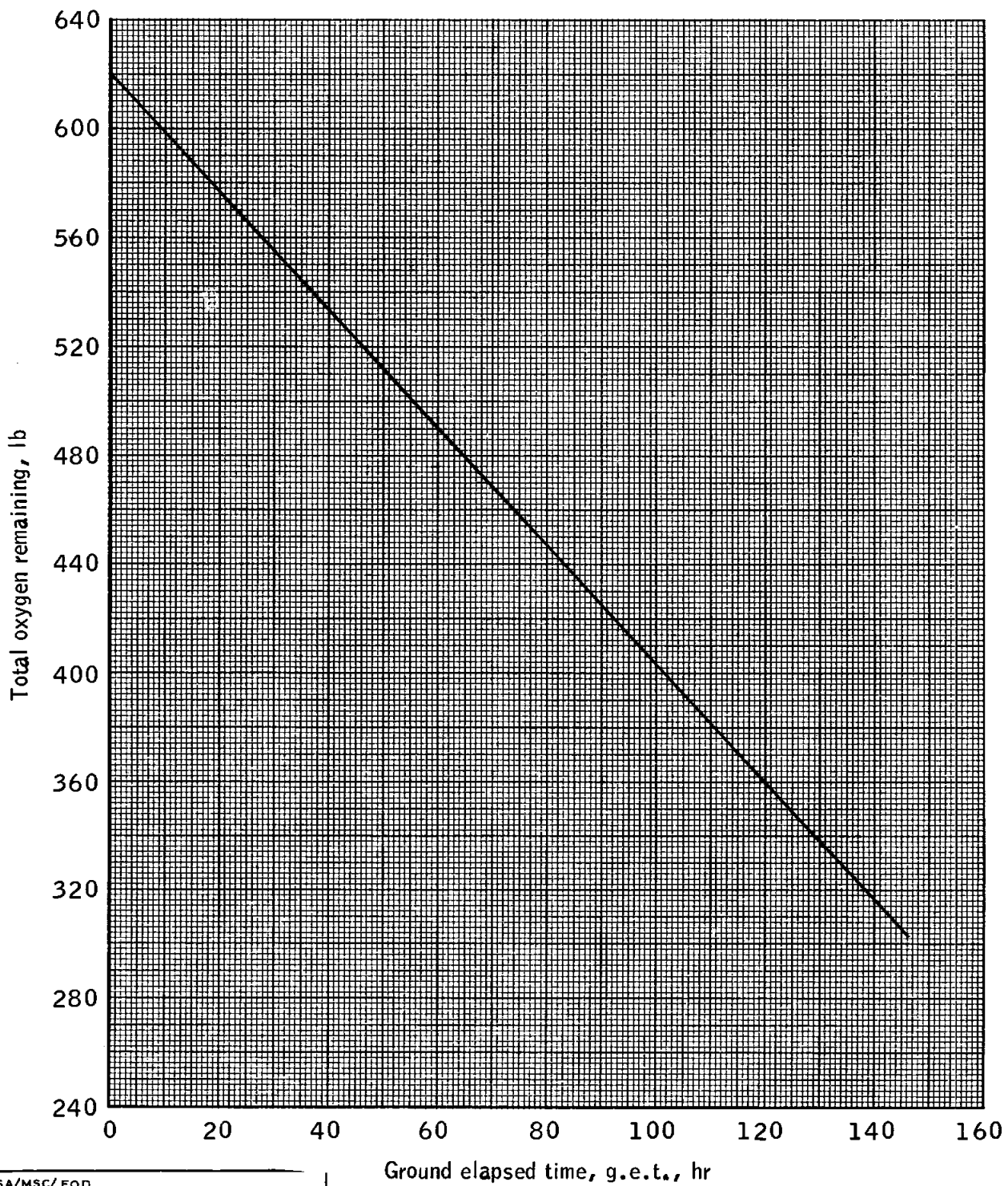
	<u>O<sub>2</sub> (lbs)</u>	<u>H<sub>2</sub> (lbs)</u>
Loaded	653.0	58.4
Residual & Instrumentation Error	30.0	3.9
Available for mission	623.0	54.5
Mission requirements	344.0	33.9
Margin	279.0	20.6

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

1. Figure - Nominal Mission O<sub>2</sub> Profile.
2. Figure - Nominal Mission H<sub>2</sub> Profile.

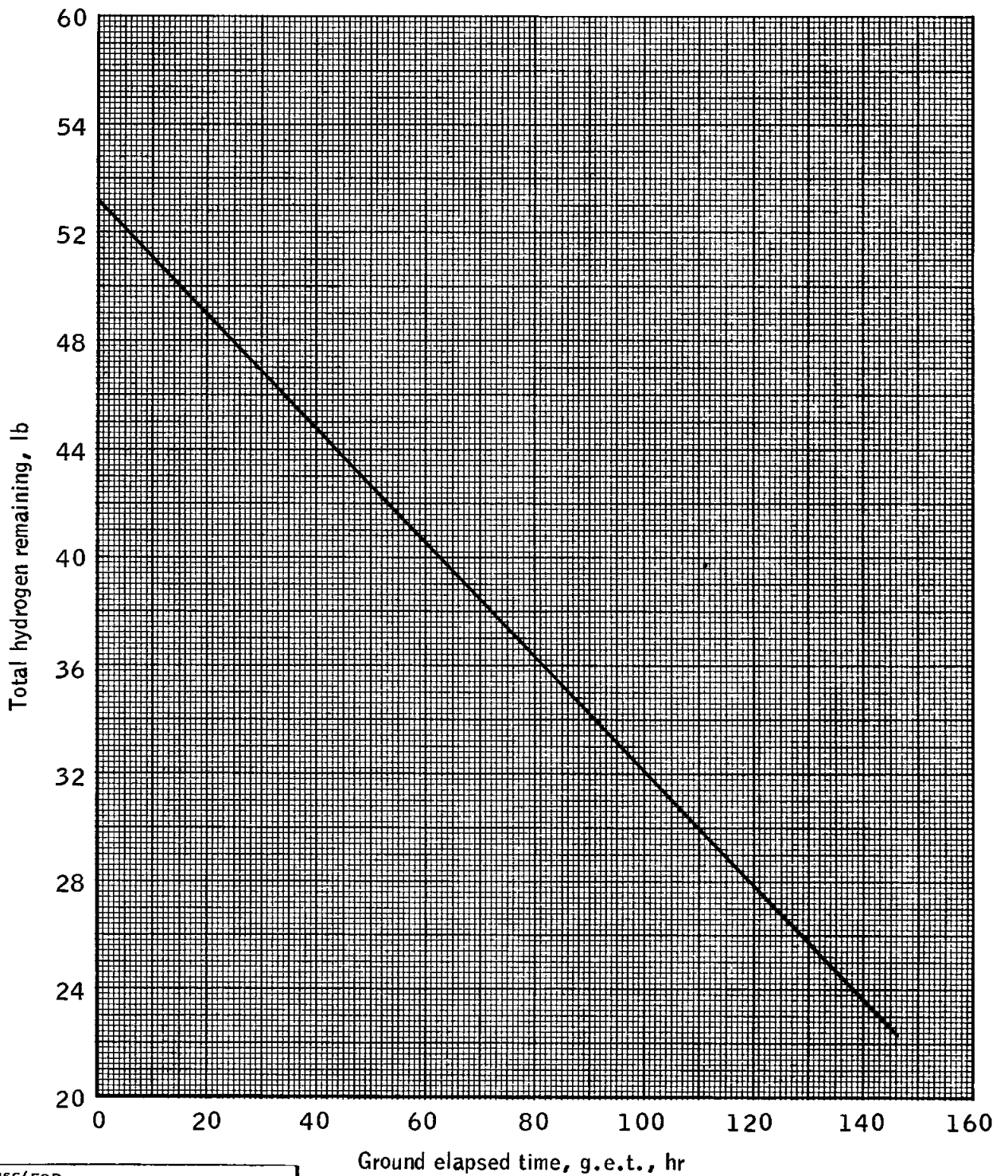
The following ground rules and assumptions were used for the construction of the mission H<sub>2</sub> and O<sub>2</sub> profiles.

1. 10 fuel cell purges.
2. Cabin O<sub>2</sub> leak rate of 0.2 lb/hr.
3. Metabolic O<sub>2</sub> rate of 0.23 lb/hr for 3 crewmen.
4. Waste management O<sub>2</sub> rate of 0.051 lb/hr.
5. Water tank O<sub>2</sub> 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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BY <u>Scott</u>	PLOT NO. <u>386</u>

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



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



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 <sub>2</sub> O PRODUCTION
	AC	DC						H <sub>2</sub>	O <sub>2</sub>	
	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

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 <sub>2</sub> O PRODUCTION
	AC	DC						H <sub>2</sub>	O <sub>2</sub>	
	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 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	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

TEST OBJECTIVE/MISSION ACTIVITY  
CROSS REFERENCE

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

TEST OBJECTIVE/MISSION ACTIVITY  
CROSS REFERENCE

DTO/FTO NUMBER	TEST OBJECTIVE	MISSION ACTIVITY	SECTION PAGE NO.
P20.105	LOI Maneuver		
P20.105-1	Crew/Spacecraft/MSFN Preparation and Execution of LOI Maneuver	Lunar Orbit Insertion	4-27
P20.105-2	Procedures and Timeline Adequacy for LOI Maneuver	Lunar Orbit Insertion	4-27
P20.106	TEI Maneuver		
P20.106-1	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	Crew Activities Lunar Distance		
P20.107-1	Crew Procedures for Lunar Orbit Mission	Miscellaneous Tests	4-36
P20.107-2	Crew Procedures and Timeline Adequacy - Lunar Mission	Miscellaneous Tests	4-36
S20.108	CSM Consumables Lunar Mission		
S20.108-1	EPS Use, Performance and Fuel Cell Management	Miscellaneous Tests	4-36
S20.108-2	Water and Oxygen Requirements Data	Miscellaneous Tests	4-36
S20.108-3	LiOH Cartridge Requirements Data	Miscellaneous Tests	4-36
S20.108-4	SPS, SM/RCS and CM/RCS Propellant Requirements Data	Miscellaneous Tests	4-36
S20.108-5	Crew Food Requirements Data	Miscellaneous Tests	4-36
P20.109	Passive Thermal Control Modes		
P20.109-1	PTC Procedures and RCS Use - Roll with Attitude Hold	Passive Thermal Control Modes	4-22
P20.109-2	PTC Procedures and RCS Use - Roll without Attitude Hold	Passive Thermal Control Modes	4-22
P20.109-3	Communication Procedures Adequacy for PTC Mode	Telecommunications	4-22, 38
P20.109-4	PTC Procedures and RCS Use - Yaw without Attitude Hold	Passive Thermal Control Modes	4-22
P20.110	Ground Support Lunar Distance		
P20.110-1	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	Lunar Landmark Tracking		
P20.111-1	Error Uncertainties in Lunar Landing Site Location	Lunar Landmark Tracking	4-29
P20.111-2	Obtain Data to Calibrate MSFN at Lunar Distance	Lunar Landmark Tracking	4-29
P20.111-3	Determine Minimum Sun Angle to Clearly Identify Landmarks	Lunar Landmark Tracking	4-29
P20.111-4	Lunar Landmark Tracking in Earthshine	Lunar Landmark Tracking	4-29
P20.111-5	Adequacy of CSS and OSS for Obtaining Landmark Sightings	Lunar Landmark Tracking	4-29
P20.111-6	Crew Ability to Coordinate Sightings and Vehicle Maneuvers	Lunar Landmark Tracking	4-29
P20.111-7	RCS Propellant and Time Required for Landmark Sighting	Lunar Landmark Tracking	4-29
P20.112	TLI Burn		
P20.112-1	Crew/Ground Capability for TLI at First Opportunity	Pre-TLI and TLI	4-10
P20.112-2	TLI Preparation and Execution Procedure Demonstration	Pre-TLI and TLI	4-10,11
P20.112-3	TLI Procedures and Timeline Adequacy	Pre-TLI and TLI	4-10,11
P20.112-4	CSM Cabin Vibration Environment during TLI Burn	Translunar Injection	4-11
P20.112-5	Crew Monitoring of GNCS and LV Displays - TLI Burn	Translunar Injection	4-11
P20.114	Midcourse Correction Capability		
P20.114-1	Procedures and Timeline Adequacy for MCC'S	Midcourse Corrections	4-19
P20.114-2	GNCS, SPS and RCS Performance on MCC'S	Midcourse Corrections	4-19
P20.114-3	Ground Capability to Update State Vector and Target for MCC	Midcourse Corrections	4-19
S20.115	Lunar Mission Photography from the CSM		
S20.115-1	Overlapping Photos from Terminator to Terminator-Lunar Orbit	Photography	4-31
S20.115-2	Photos of Earth and Lunar Landmarks	Photo, S/E Landmark Nav.	4-20
S20.115-3	Photos of Earth and Lunar Horizons	Photo, S/E Landmark Nav., S/L Landmark Nav.	4-16,24,31
S20.115-4	Photos of General and Scientific Interest	Photography	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. FDAI 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)

PRE-TLI

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  $\Delta V$  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

- Pl.34-1 Star/Earth Horizon Navigation Sighting Accuracy
- Pl.34-2 Verify and Update Horizon Lighting Constraints
- Pl.34-3 OSS Adequacy for Navigation Sightings in Deep Space
- Pl.34-4 Crew Ability to Identify Horizon Locator and Coordinate Optics/Maneuvers
- Pl.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

- Pl.33-1 Star/Lunar Horizon Navigation Sighting Accuracy
- Pl.33-2 OSS Adequacy for Navigation Sightings in Deep Space
- Pl.33-3 Crew Capability to Coordinate Optics/Maneuvers
- Pl.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

- Sl.35-2 Obtain Data - Star Visibility During TL and TE Coast
- Sl.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 FDAI'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  $10^\circ$  preceding the terminator to about  $15^\circ$  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 ( $\Delta R$ ,  $\Delta V$ ) 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  $20^\circ$  from local vertical. From the far side terminator to  $90^\circ$  sun elevation at the nadir, the camera axis will be inclined  $20^\circ$  forward along the orbital plane. At  $90^\circ$ , the camera axis will be aligned  $20^\circ$  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  $\pm 1$  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)

## ENTRY

### 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, FDAI 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>	<u>Communications Mode</u>	
	<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>	<u>Communications Mode</u>	
	<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 + 10% NM with cooled 30-foot dish (HAW, CWM, ASC, CRO)
- c. At 70 K + 10% NM with uncooled 30-foot dish (others)



<u>Signal Combination</u>	<u>Communications Mode</u>	
	<u>Uplink</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>Communications Mode</u>	
	<u>Uplink</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:

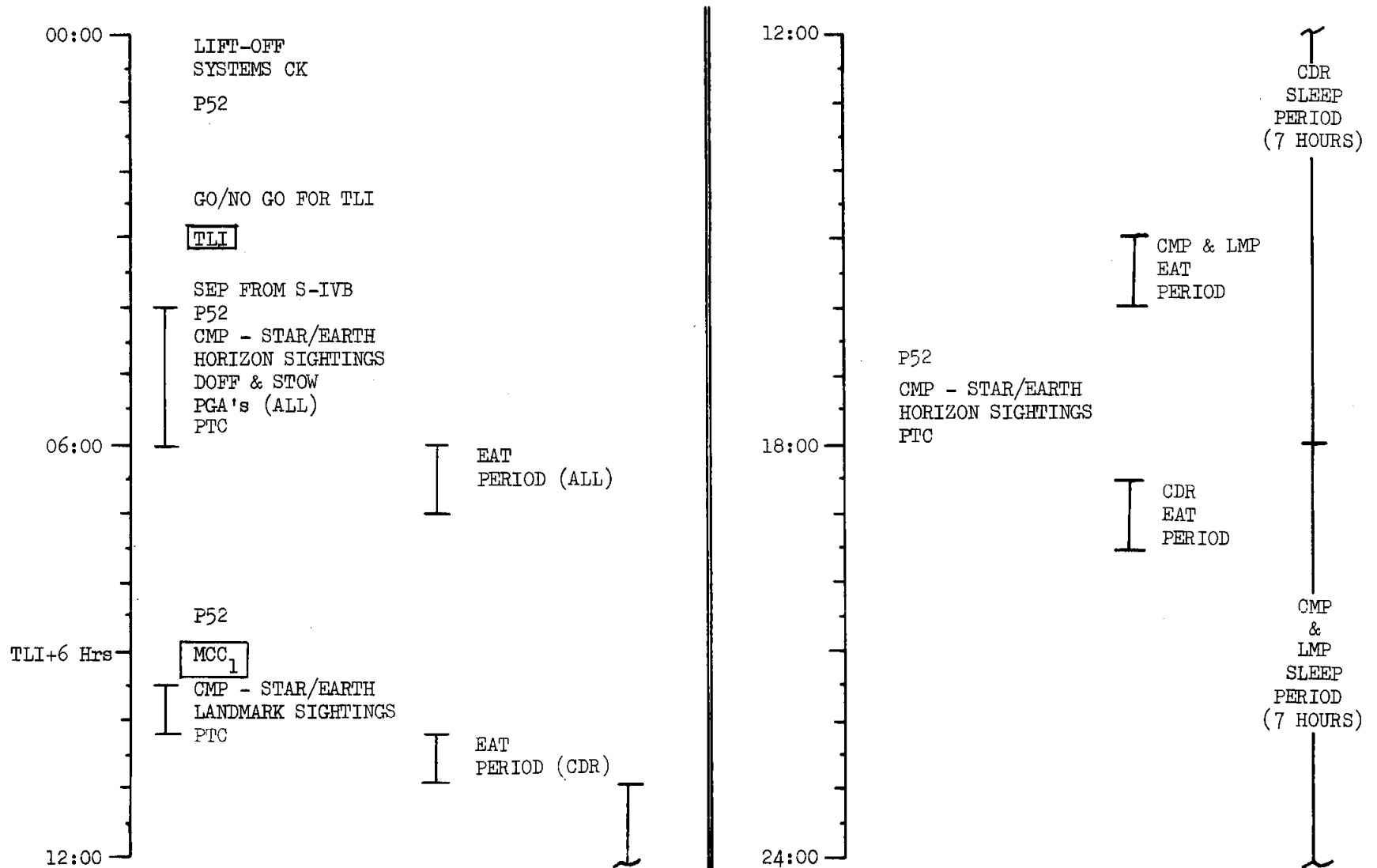
To obtain food, water, sleep and radiation data during the Apollo 8 mission and exercise data postflight.

### 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:

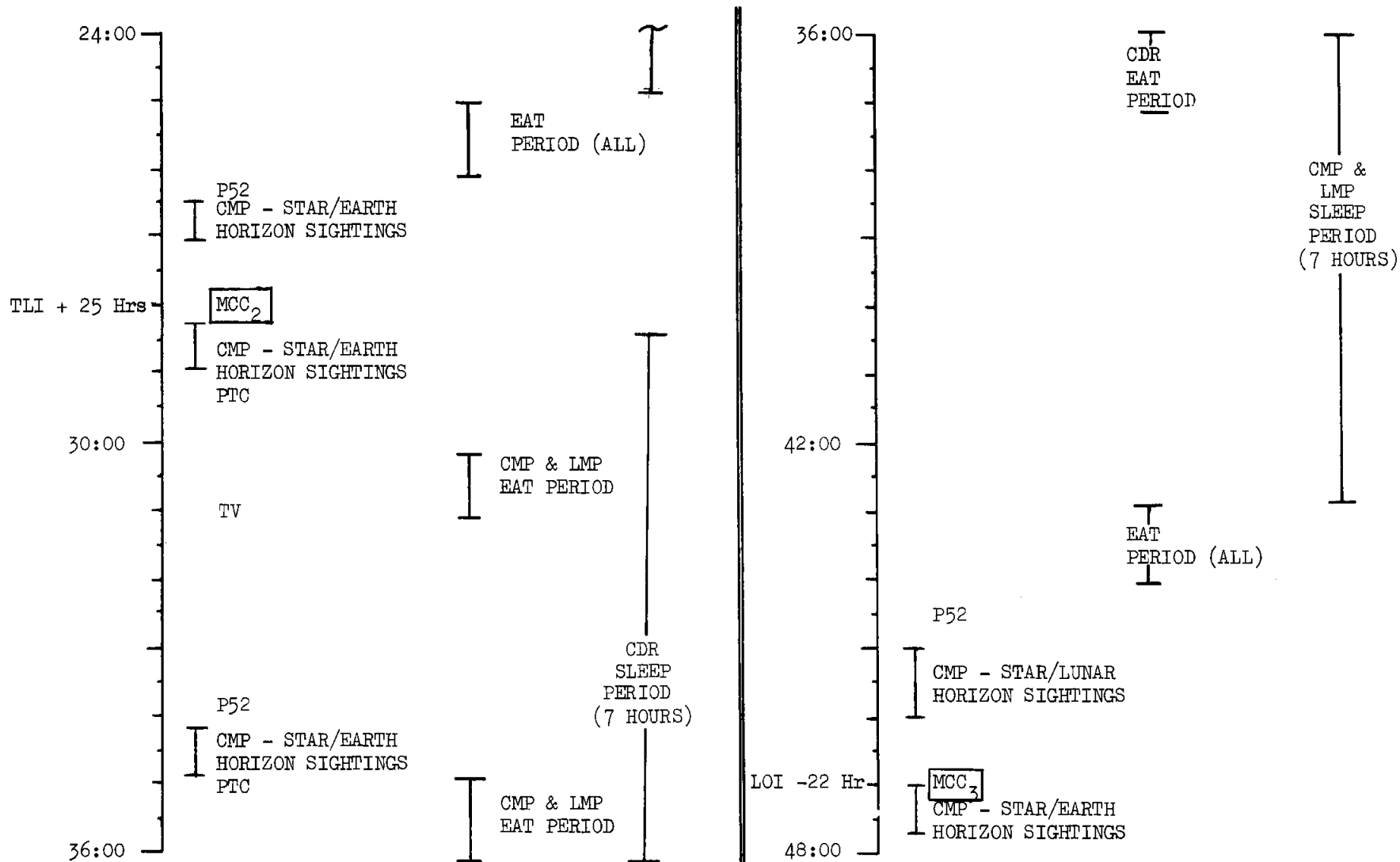
1. Food - a daily record of each crew member reflecting the meal identification code together with the description or serial number(s) of only those items not consumed from a scheduled meal.
2. Water - a daily log containing the number of aliquots from the water gun each astronaut drank. Water used for 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.

# FLIGHT PLAN



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

# FLIGHT PLAN

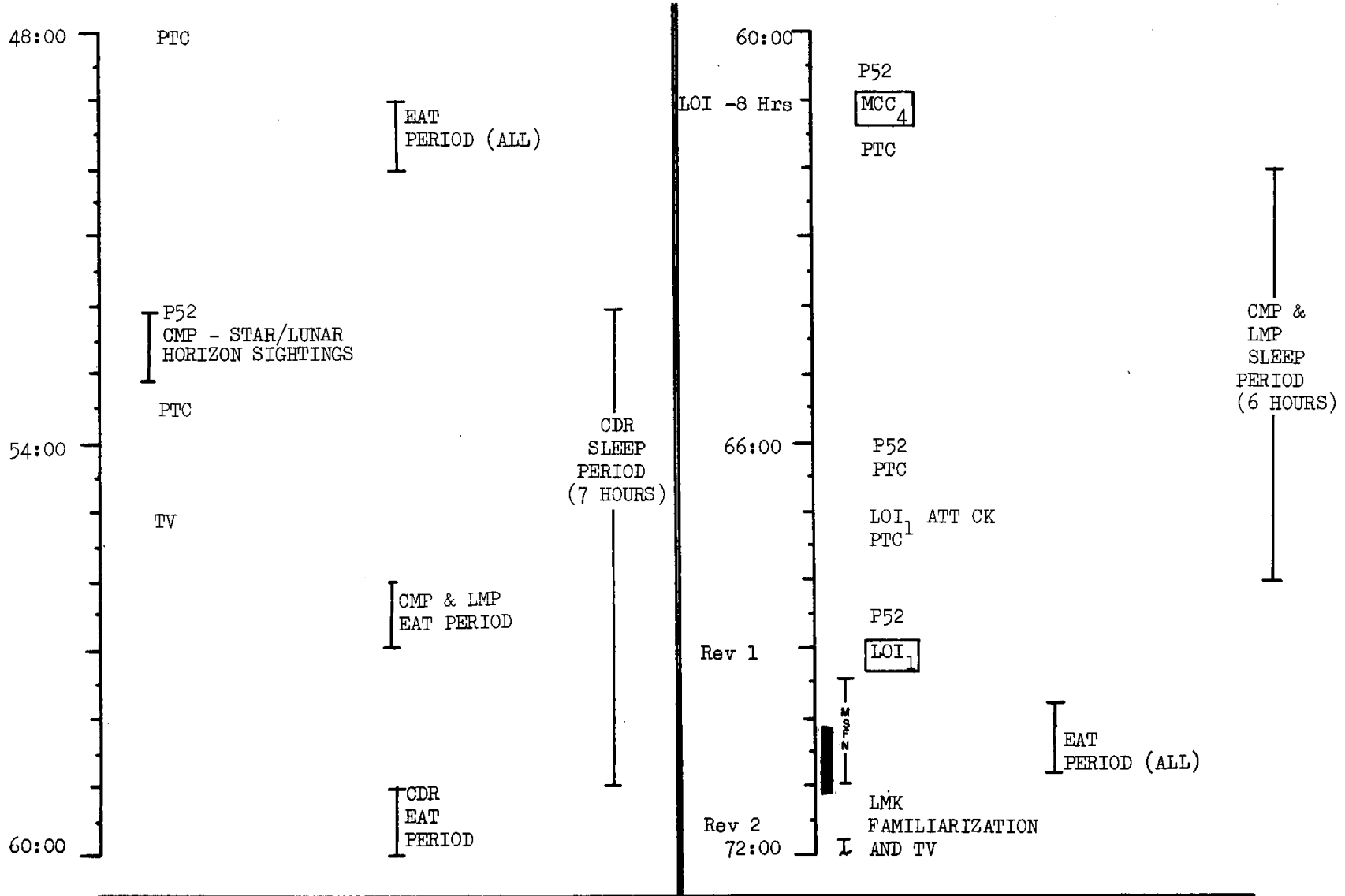


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	24:00 - 48:00	2	5-2

MSC FORM 1186 (SEP 67)

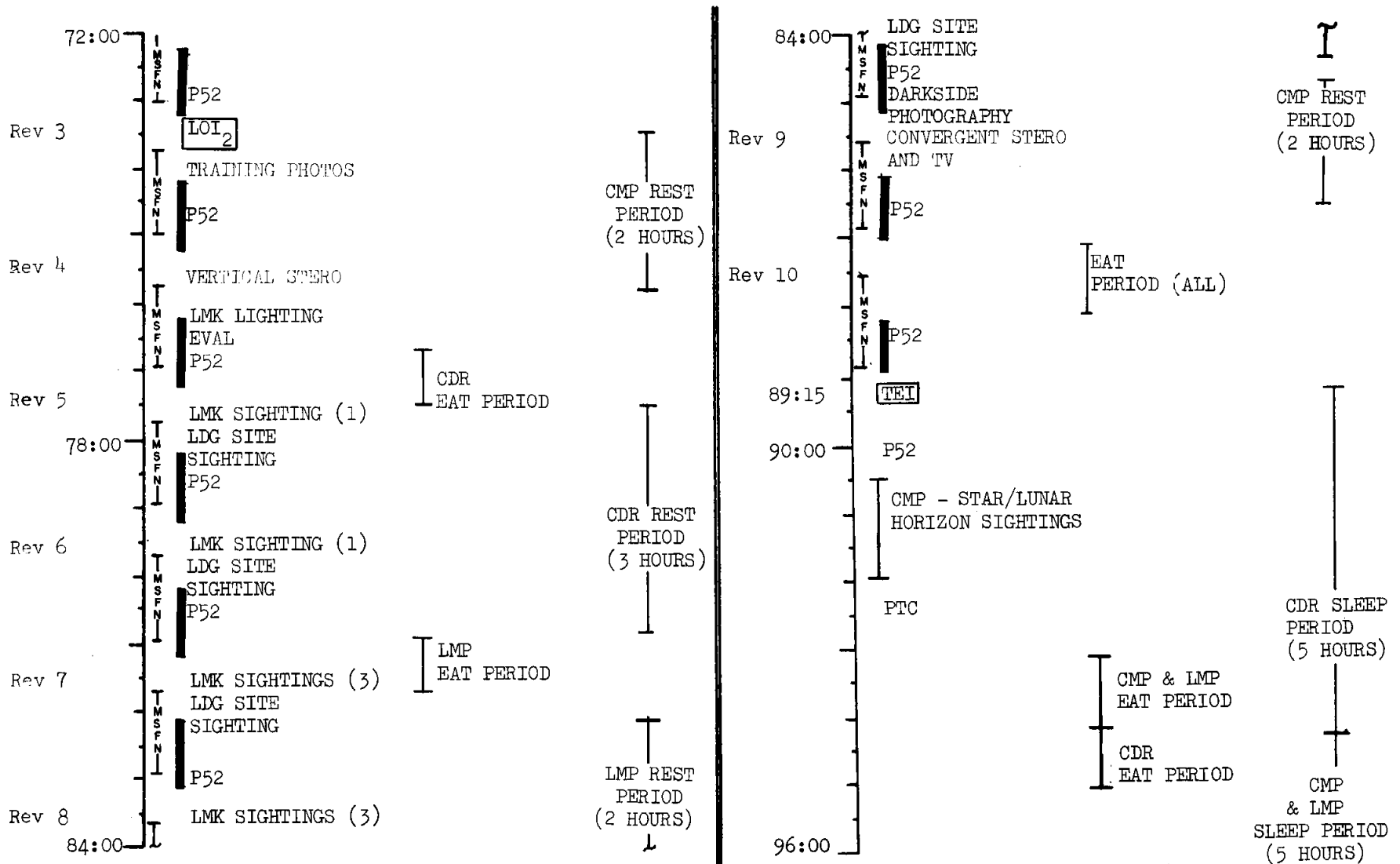
FLIGHT PLANNING BRANCH

# FLIGHT PLAN



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

# FLIGHT PLAN

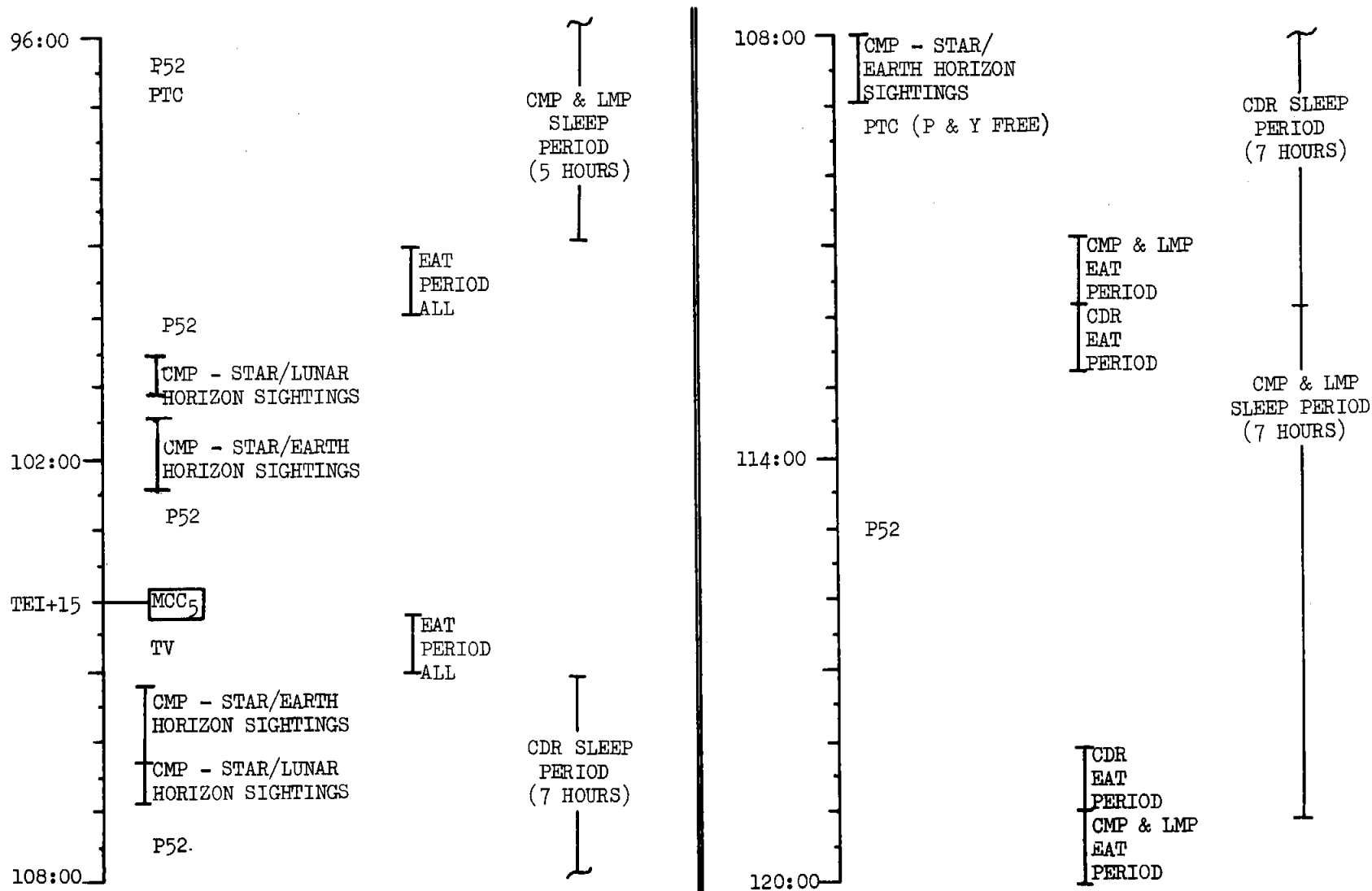


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	72:00 - 96:00	4	5-4

MSC FORM 1186 (SEP 67)

FLIGHT PLANNING BRANCH

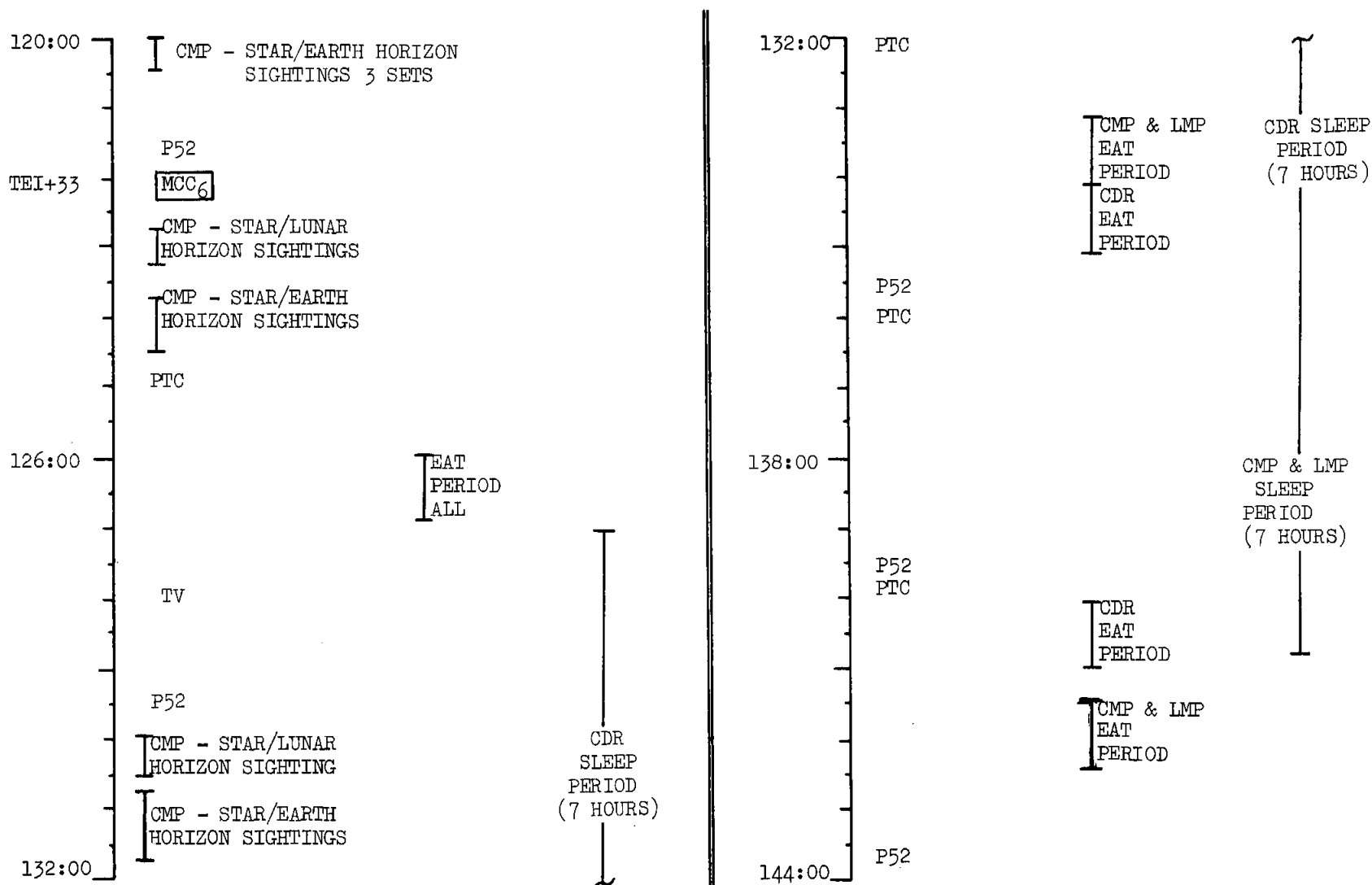
# FLIGHT PLAN



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

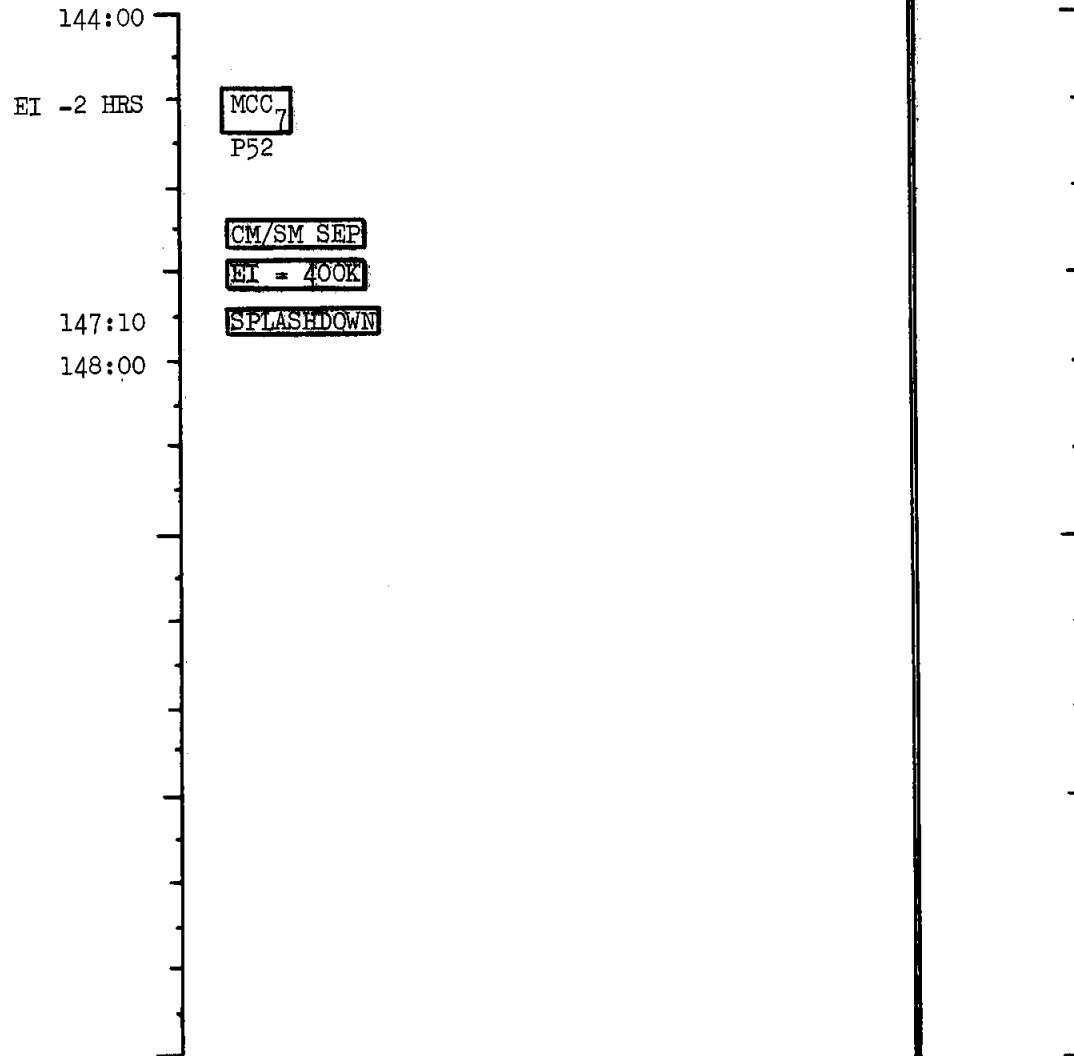


# FLIGHT PLAN



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

# FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS503/103	FINAL	November 22, 1968	144:00 to 146:50	6	5-7