NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FINAL

APOLLO 10 FLIGHT PLAN

AS-505/CSM-106/LM-4

APRIL 17, 1969

PREPARED BY
FLIGHT PLANNING BRANCH
FLIGHT CREW SUPPORT DIVISION

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

SECTION 1

SECTION 2

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APOLLO 10

APOLLO AS-505/CSM-106/LM-4

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APRIL 17, 1969

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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 AS-505/CSM-106/LM-4 operations and crew activities to fulfill, when possible, the test objectives defined in the Mission Requirements, F Type Mission, Change A, dated April 9, 1969.

The trajectory parameters used in this Flight Plan are for May 18, 1969 launch, with a 72° launch azimuth and were supplied by Mission Planning and Analysis Division as defined by the Apollo Mission F Spacecraft Operational Trajectory.

The Apollo 10 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. W. M. Anderson will act as co-ordinator for all proposed changes to the Apollo 10 Flight Plan.

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

ABBREVIATIONS

ACCEL	Accelerometer
ACQN	Acquisition
ACT	Activation
ACQ	Acquisition
AEA	Abort Electronics Assembly
AGS	Abort Guidance Subsystem
AH	Ampere Hours
ALT	Altitude
AMP or amp	Ampere
AMPL	Amplifier
ANG	Antigua
Ant	Antenna
AOH	Apollo Operations Handbook
AOS	Acquisition of Signal or Acquisition of Site
AOT	Alignment Optical Telescope
APS	Ascent Propulsion Subsystem
ARS	Atmosphere Revitalization
ATT	Attitude
AUX	Auxiliary
AZ	Azimuth
BAT	Battery
BDA	Bermuda
Bio	Bio-Medical Data on Voice Downlink
BP	Barber Pole
BT	Burn Time
BU	Backup
B&W	Black & White
BRKT	Bracket
CAP COM	Capsule Communicator
CAL θ	Calibration Angle
CAM	Camera
CB	Circuit Breaker
CDH	Constant Delta Altitude
CDR	Commander
CDU	Coupling Data Unit
CIRC	Circularization
CK	Check
CM	Command Module
CMC	Command Module Computer
CONT	Continue
CMD	Command
CMP	Command Module Pilot
CNTL	Control
C/O	Check out
COAS	Crew Optical Alignment Sight
COMM	Communications
CONFIG	Configuration
CONT	Continue
CP	Control Point
CRO	Carnarvon, Australia
CRYO	Cryogenic
CSI	Coelliptic Sequence Initiation Maneuver
CSM	Command Service Module
CWS	Caution and Warning System
CYI	Grand Canary Island
DAP	Digital Auto Pilot
D/B	Deadband
DCA	Digital Command Assembly
DEDA	Data Entry and Display Assembly
DEGS	Degrees
DEPL	Depletion
DET	Determination or Digital Event Timer
DIFF	Difference
DK	Dock or Docked
DOI	Descent Orbit Insertion
DPS	Descent Propulsion Subsystem
DSE	Data Storage Equipment
DSKY	Display and Key Board
DTO	Detailed Test Objective
DUA	Digital Uplink Assembly
DWN	Down
E	Erasable
EASEP	Early Apollo Scientific Equipment Package
ECS	Environmental Control System
EFH	Earth Far Horizon
EI	Earth (atmosphere) Interface
EL	Elevation
ELDMK	Earth Landmark
EMS	Entry Monitor System
ENH	Earth Near Horizon
EPO	Earth Parking Orbit
EPS	Electrical Power Subsystem
EQUIP	Equipment
EST	Eastern Standard Time
EVA	Extravehicular Activity
EVAP	Evaporator
EXT	Extravehicular Transfer
EXT	External
F	F Stop
FC	Fuel Cell
FDAI	Flight Director Attitude Indicator
FLT	Flight
FM	Frequency Modulated
FOV	Field of View
fps or FPS	Feet per second
FT or Ft	Feet
FTP	Full Throttle Position
GBI	Grand Bahama Islands, Eastern Test Range
GBM	Grand Bahama (MSFN)
GDC	Gyro Display Coupler
GDS	Goldstone, California
GET	Ground Elapsed Time
GETI	Ground Elapsed Time of Ignition
GLY	Glycol
GMT	Greenwich Mean Time
GNN	Guidance and Navigation
GNCS	Guidance Navigation Control System
GWN	Guam
GYM	Guaymas, Mexico
H2	Hydrogen
HA	Apogee Altitude
HAW	Hawaii
HBR	High Bit Rate (TLM)
HD	Highly Desirable
HGA	High Gain Antenna
HI	High
Hp	Perigee Altitude
HSK	Honeysuckle (Canberra, Australia)
HTR	Heater
HTV	USNS Huntsville
ICDU	Inertial Coupling Data Unit
ID	Identification
IGN	Ignition
IMU	Inertial Measurement Unit
INIT	Initialization
INT	Intervalometer
IP	Initial Point
IU	Instrumentation Unit
IVC	Intervehicular Communications
IVT	Intravehicular Transfer
JETT	Jettison
kwh	Kilowatt Hour
LA	Launch Azimuth
LAT	Latitude
LBR	Low Bit Rate (TLM)
LBS or lbs	Pounds
LCG	Liquid Cooled Garment
LDG	Landing
LDMK	Landmark
LEB	Lower Equipment Bay
LFH	Lunar Far Horizon
LGC	LM Guidance Computer
LH	Left-hand
L/H	Local Horizontal
LHEB	Left-hand Equipment Bay
LHFEB	Left-hand Forward Equipment Bay
LHSSC	Left Hand Side Storage Container
LION	Lithium Hydroxide
LLM	Lunar Landing Mission
LLOS	Landmark Line of Sight
LM	Lunar Module
LMP	Lunar Module Pilot
LNH	Lunar Near Horizon
LOI	Lunar Orbit Insertion
LONG	Longitude
LOS	Loss of Signal or Loss of Site
LPO	Lunar Parking Orbit
LR	Landing Radar
LT	Light
LTG	Lighting
LV	Launch Vehicle
L/V	Local Vertical
LVPD	Launch Vehicle Pressure Display
M	Mandatory
MAD	Madrid, Spain
MAN	Manual
MAX	Maximum
MAX Q	Maximum Dynamic Pressure
MCC	Midcourse Correction
MCC-H or MCC	Mission Control Center - Houston
MDC	Main Display Console
MEAS	Measurement
MER	USNS Mercury
MET	Mission Event Timer
MGA	Middle Gimbal Angle
M/I	Minimum Impulse
MIN	Minimum
MLA	Merrit Island, Florida
MNVR	Maneuver
MPS	Main Propulsion System
MSFN	Manned Space Flight Network
MTVC	Manual Thrust Vector Control
N2	Nitrogen
NAV	Navigation
NCC	Corrective Combination Maneuver
nm	Nautical Miles
NOM	Nominal
NSR	Nominal Slew Rate
NOUN	Noun XX
O2	Oxygen
OBS	Observation
O/F	Oxidizer to Fuel Ratio
OGA	Outer Gimbal Angle
OMNI	Omnidirectional Antenna
OPS	Oxygen Purge System
ORBI	Orbital
ORDEAL	Orbit Rate Display Earth and Lunar
ORIENT	Orientation
OVHD	Overhead
P	Pitch
PAD	Voice Update
PCM	Pulse Code Modulation
PC	Pericynthion
PGA	Pressure Garment Assembly
PGNCS	Primary Guidance Navigation Control Section
PIPA	Pulse Integrating Pendulous Accelerometer
PLSS	Portable Life Support Systems
PM	Phase Modulated
POL	Polarity or Polarizing
PRE	Pretoria, South Africa
PREF	Preferred
PREP	Preparation
PRESS	Pressure
PRIM	Primary
PT	Point
PROP	Proportional
PU	Propellant Utilization
PUGS	Propellant Utilization and Gaging System
PTC	Passive Thermal Control
PWR	Power
Pxx	Program XX
Qty	Quantity
R	Roll/Range
R&B	Red & Blue
RAD	Radiator
RCDR	Recorder
RCS	Reaction Control System
RCU	Remote Control Unit
RCV	Receiver
RED	USNS Redstone
REFSMMAT	Reference Stable Member Matrix
REG	Regulator
REQD	Required
RH	Right-hand
RLS	Radius of Landing Site
RNDZ	Rendezvous
RR	Rendezvous Radar
RSI	Roll Stability Indicator
RT	Real Time
RTC	Real-Time Command
Rxx	Routine XX
SA	Shaft Angle
S/C	Spacecraft
SCE	Signal Conditioning Equipment
SCS	Stabilization Control System
SCT	Scanning Telescope
SEC	Secondary
SECO	S-IVB Engine Cut-off
SEP	Separate
SEQ	Sequence
SIVB	Saturn IV B(Third Stage)
SLA	Service Module LM Adapter
SLOS	Star Line-of-Sight
SM	Service Module
SPOT	Spot Meter
SPS	Service Propulsion System
SR	Sunrise
SRC	Sample Return Container
SRX	S-Band Receiver Mode No. X
SS	Sunset
STX	S-Band Transmit Mode No. X
SWC	Solar Wind Component
Sw	Switch
SXT	Sextant
T EPHEM	Time of Ephemeris Update
TA	Trunnion Angle
TAN	Tananarive, Madagascar
TB (x)	Time Base No.
TCA	Time of Closest Approach
TDME	Transposition Docking & LM Ejection
TEC	Trans Earth Coast
TEI	Transearth Insertion
TEMP	Temperature
TERM	Terminate
TEX	Corpus Christi, Texas
TGT	Target
TIG	Time of Ignition
TLC	Trans Lunar Coast
TLI	Translunar Insertion
TLM	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
V	Velocity
VAN	USNS Vanguard
VHF	Very High Frequency
VLV	Valve
VI	Inertial Velocity
VOX	Voice Keying
Vxx	Verb xx
W/O	Without
WRT	With Respect to
WTN	USNS Watertown
XFER	Transfer
XMIT	Transmit or Transmitter
XPONDER	Transponder
Y	Yaw
ΔV	Velocity Change (Differential)
ΔVC	Velocity Change at Engine Cutoff
ΔR	Position Change (Differential)
8-balls	Flight Director Attitude Indicator (FDAI)
X	CSM YCA

SECTION 1 - GENERAL

MISSION DESCRIPTION

1. Launch and E.P.O. (Duration 2:33) T_0 - 2:33 GET

   (a) Nominal launch time is Sunday, 12:48 EDT, May 18, 1969, with a launch window duration of 4 hrs. 25 min.

   (b) Earth orbit insertion into a 100nm circular orbit at 11 min. 43 sec. after lift-off

   (c) CSM systems C/O in earth orbit

   (d) IMU realign (P52) to the pad REFSMMAT during the first night period

   (e) TLI occurs at 2:33:26 GET over the Pacific Ocean during the second revolution. (See Table 1-1 for burn data and Figure 1-3 for altitudes)

2. Translunar Coast (Duration 73:12) 2:33 - 75:45 GET

   After TLI which places the spacecraft in a free lunar return trajectory, the following major events occur prior to LOI:

   (a) TV at 3:48 p.m. May 18; 4:03 p.m. May 19; 6:48 p.m. May 20; 1:08 p.m. May 21 (EDT)

   (b) Transposition, docking and LM ejection including SIVB photography

   (c) SIVB separation and a CSM evasive maneuver at 4:28:48 GET

   (d) SIVB propulsive venting of propellants (slingshot)

   (e) Two batches of P23 cislunar navigation, star/earth horizon, consisting of five sets at 05:30 GET and five sets at 25:00 GET

   (f) The IMU will be realigned to the PTC REFSMMAT after MCC_1.

   (g) Four midcourse corrections which take place at TLI + 9 (SPS) TLI + 24, LOI - 22 and LOI - 5 hours with ΔV nominally zero (See Table 1-1) for MCC 2, 3, 4

(h) S-Band reflectivity test with the Ascention 30-ft. cooled antenna at 27:00 GET and at an altitude of 112,000nm.

(i) The HGA will be checked for the sleep Comm mode at 32:00 GET

(j) Passive thermal control (PTC) will be conducted at all periods when other activities do not require different attitudes

(k) LOI will be performed at 75:45 GET which ends the TLC phase

3. Lunar Orbit (Duration 61:35) 75:45 - 137:20 GET

LOI Day (Starts at 68:00 GET)

(a) TV at 1:08 p.m. and 9:33 p.m. May 21

(b) LOI-1

(c) Photos of targets of opportunity

(d) LOI-2

(e) Post LOI-2 LM entry and inspection. LM S-Band OMNI and steerable antenna tests

(f) Post LOI-2 Pseudo landmark tracking (two sets of sightings) (See Table 1-4)

(g) Rest period (8 hours)

DOI Day (Starts at 93:00 GET)

(a) TV at 3:01 p.m. May 22; 1:23 a.m. May 23 (EDT)

(b) Docked LM activation and checkout

(c) Docked Apollo landing site number two sighting (one set of sightings) (See Table 1-3)

(d) Undocking and separation (See Figure 1-2 Rendezvous Profile)

(e) Undocked Pre-DOI LM activities

(f) DPS DOI maneuver (See Figure 1-2 and Table 1-2)

(g) DPS phasing maneuver

(h) LM staging maneuver

(i) APS insertion maneuver

(j) LM active rendezvous
CSI
PC
CDH
TPI

(k) Docking

(l) Configure LM for APS burn to depletion and perform communications tests

(m) Unmanned LM APS burn to depletion

(n) Rest period (9 hours)

Landmark Tracking Day (Starts at 118:00 GET)

(a) TV at 7:08 p.m. May 23 (EDT)

(b) Landmark tracking for four revolutions (four landmarks per rev.) (See Table 1-4)

(c) One revolution of strip photography

(d) Rest period (3.5 hours)

TEI Day (Starts at 132:00 GET)

(a) SPS TEI maneuver at 137:20:22 GET

(b) Rest period (5.5 hours)

(c) One revolution of landmark tracking and photography

Lunar Orbit Particulars (Average Values for a 60 x 60nm Orbit)

(a) Revolutions start at 180° longitude

(b) Revolution duration - 1 hr. 58.5 min.

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

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

(e) Orbit inclination - 1.3°

(f) S/C orbital rate - 3^{o}/min. ($.05^{o}$/sec)

(g) Lighting change at fixed ground point - 1^{o}West/Rev.

(h) Ground track change - 1^{o} West/Rev.

(i) Horizon visibility $\pm$ 20^{o} selenocentric angle on the lunar surface

(j) One lunar degree on lunar surface is 16.38nm

(k) Site 3 will be visible (2.5^{o} sun angle) at Rev. 30

(l) S/C sublunar point to horizon 320nm.

4. Transearth Coast and Entry (Duration 54:25) 137:20 - 192:04

Transearth coast begins with TEI at 137:20 GET and consists of the following major events:

(a) TV at 6:33 a.m. May 24; 9:23 p.m. May 24; 7:38 a.m. May 26 (EDT)

(b) During transearth coast, 18 sets of navigation sightings will be performed. These are as follows:

151:00 GET 9 Sets - Star lunar landmark
165:00 GET 3 Sets - Minimum sun elevation
167:30 GET 3 Sets - Minimum sun elevation
171:00 GET 3 Sets - Minimum sun elevation
174:30 GET 3 Sets - Minimum sun elevation

(c) Three midcourse corrections are scheduled at TEI $\pm$ 15, EI - 15 and EI - 3 hours with ΔV nominally zero.

(d) CM/SM separation takes place at 191:35 GET and Entry Interface occurs at 191:50 GET

(e) Splashdown will occur in the Pacific Ocean at a longitude of about 165^{o} West at 192:04 GET. This will occur about one-half hour prior to sunrise local time on Monday, May 26, 12:52 EDT.

ACTIVITY DAY	1 · 2 · 3 · 4 LOI DAY · 5 DOI DAY · 6 · 7 TEI DAY · 8 · 9 · 10
REST PERIODS	
DATE/DAY	MAY 18 - SUNDAY · MAY 19 - MONDAY · MAY 20 - TUESDAY · MAY 21 - WEDNESDAY · MAY 22 - THURSDAY · MAY 23 - FRIDAY · MAY 24 - SATURDAY · MAY 25 - SUNDAY · MAY 26 - MONDAY
EDT	12:48 18 24 6 12 18 24 6 12 18 24 6 12:50 18:50 24 6 12:50 18 24 6 12:50 18 24 6 12:50 18 24 6 12:50 18 24 6 12:52
LUNAR REVOLUTION NO.	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
GET	0 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100 102 104 106 108 110 112 114 116 118 120 122 124 126 128 130 132 134 136 138 140 142 144 148 152 156 160 164 168 172 176 180 184 188 192

LM MANEUVER DATA

- DOI - DPS 99:33:59 BT: 27.7 SEC ΔV: 71.1 FPS ULLAGE: 2 JET 7.5 SEC
- PHASING - DPS 100:46:21 BT: 42.1 SEC ΔV: 195.4 FPS ULLAGE 2 JET 7.5 SEC
- INSERTION - APS 102:43:18 BT: 15.2 SEC ΔV: 207.0 FPS ULLAGE: 2 JET 3.5 SEC
- CSI - RCS 103:33:46 BT: 32.1 SE ΔV: 50.5 FPS NO ULLAGE
- CDH - RCS 104:31:42 BT: 2.4 SEC ΔV: 3.4 FPS NO ULLAGE
- TPI RCS 105:09:00 BT: 15.6 SEC ΔV: 24.6 FPS NO ULLAGE
- MCC-1 105:24:00
- MCC-2 105:39:00
- APS BURN TO DEPLETION - APS 108:39

LM (SNOOPY)

- OPEN HATCH LMP IVT TO LM
- LM STATUS CHECK, RECEIVE AND STOW EQUIP
- LM S-BAND/VHF COMM TEST
- IVT TO CSM
- LMP AND CDR IVT TO LM
- ACTIVATE EPS AND S-BAND OMNI
- ACTIVATE PGNCS AND ECS
- S-BAND STEERABLE CHECKS
- ERASABLE MEMORY DUMP
- DOCKED IMU ALIGN
- ACTIVATE ASCENT BATTERY
- PGA AND CABIN PRESSURE CHECKS
- ACTIVATE AND INITIALIZE AGS
- RCS AND RR CHECKS
- AGS CALIBRATION AND ALIGN
- DPS PRESSURIZATION AND CHECKOUT
- DEPLOY LANDING GEAR
- UNDOCK
- RR AND VHF RANGING CHECKS
- IMU/AOT REALIGN-P52
- LDG RADAR TEST
- DOI BURN - DPS
- RR TRACKING
- NEAR LUNAR SURFACE OBSERVATION AND PHOTOGRAPHY
- PHASING BURN - DPS
- IMU/AOT REALIGN - P52, COAS CALIB
- APS PRESS., PARALLEL ASCENT AND DESCENT BATS
- LM STAGING - RCS
- INSERTION BURN - APS
- IMU/AOT REALIGN
- CSI BURN - RCS
- PLANE CHANGE - RCS
- CDH BURN - RCS
- TPI BURN - RCS
- RENDEZVOUS MCC-1 AND MCC-2
- RENDEZVOUS
- DOCK
- S-BAND COMM TEST
- PREP LM AND APS BURN, IVT TO CSM
- JETTISON LM, APS BURN TO DEPLETION

CSM (CHARLIE BROWN)

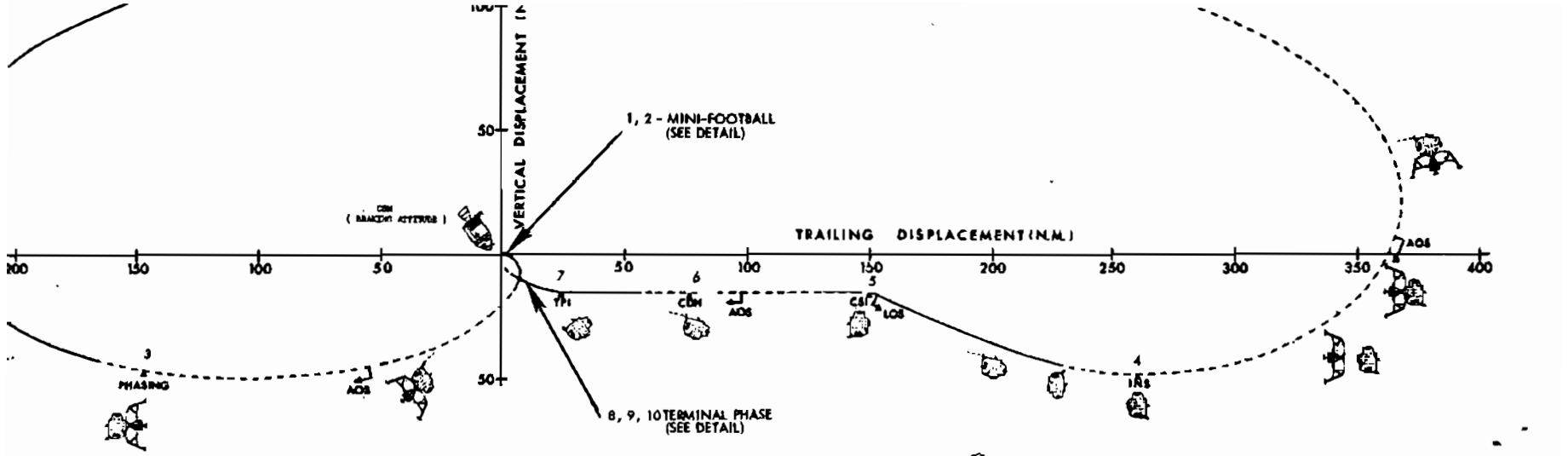
- EARTH ORBIT AND SYSTEMS CHECKOUT
- TRANSPOSITION, DOCKING AND LM EXTRACTION
- CSM/LM EVASIVE MANEUVER FROM S-IVB
- CISLUNAR NAVIGATION OPTICAL SIGHTING-STAR/EARTH HORIZON (5 SETS)
- MCC-1
- ESTABLISH PTC MODE
- MCC-2
- CISLUNAR NAVIGATION OPTICAL SIGHTING -STAR/EARTH HORIZON (5 SETS)
- S-BAND COMM REFLECTIVITY TEST
- PTC TEST
- PTC TEST
- MCC-3
- MCC-4
- LOI-1
- PHOTOGRAPHY SLEEP COMM TEST
- IMU REALIGN
- LOI-2
- IMU REALIGN
- OPEN HATCH INSPECT LATCHES
- TRANSFER EQUIP TO LM
- PSEUDO LANDMARK TRACKING
- COMM RELAY TEST
- CLOSE HATCH MAINTAIN LM PRESS
- PRE SLEEP CHECKS
- IMU REALIGN P52
- INSTALL DROGUE PROBE AND HATCH
- LANDING SITE TRACKING
- UNDOCK
- INSPECT LM AND PHOTOGRAPHY
- CSM SEPARATION MANEUVER
- RR AND VHF RANGING C/O
- IMU REALIGN P52
- SXT TRACKING/VHF RANGING
- LM PHASING BURN
- BACKUP LM INSERTION BURN
- IMU REALIGN
- BACKUP LM CSI BURN
- BACKUP LM CDH BURN
- BACKUP LM TPI BURN
- RENDEZVOUS - LM PHOTOGRAPHY
- DOCK
- PREPARE FOR LM JETTISON
- LM JETTISON
- IMU REALIGN P52
- STRIP PHOTOGRAPHY
- IMU REALIGN P52
- FIRST REV LANDMARK TRACKING
- IMU REALIGN P52
- SECOND REV LANDMARK TRACKING
- IMU REALIGN P52
- THIRD REV LANDMARK TRACKING
- IMU REALIGN P52
- FOURTH REV LANDMARK TRACKING
- IMU REALIGN P52
- PHOTOGRAPHY
- LANDMARK TRACKING
- STRIP PHOTOGRAPHY
- IMU REALIGN P52
- TEI BURN
- ESTABLISH PTC ATTITUDE
- PTC TEST
- P23 CIS LUNAR NAVIGATION STAR LUNAR LANDMARK SIGHTINGS (SET OF 9)
- MCC-5 (TEI + 15)
- P23 CIS LUNAR NAVIGATION STAR EARTH HORIZON SIGHTINGS (SET OF 3)
- STAR EARTH HORIZON SIGHTINGS (SET OF 3)
- STAR EARTH HORIZON SIGHTINGS (SET OF 3)
- STAR EARTH HORIZON SIGHTINGS (SET OF 3)
- MCC-6
- MCC-7
- ENTRY INTERFACE
- SPLASHDOWN

TV SCHEDULE (COLOR)

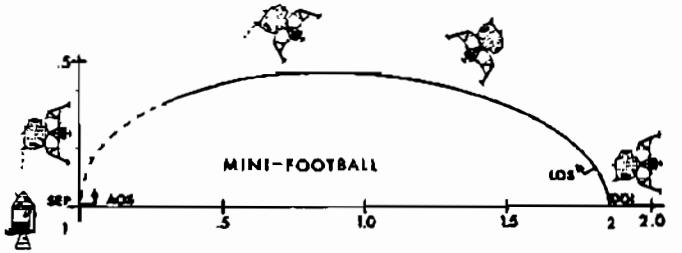
CSM MANEUVER DATA

- TLI S-IVB 2:33:26 BT: 5 MIN 22 SEC ΔV: 10,058 FPS
- EVASIVE MANEUVER - SPS (CSM/LM FROM S-IVB) 4:28:48 BT: 2.8 SEC ΔV: 19.7 FPS NO ULLAGE
- MCC-1: SPS 11:33:49 BT: 8.1 SEC ΔV: 57.0 FPS NO ULLAGE
- MCC-2 26:30
- MCC-3 53:45
- MCC-4 70:45
- LOI-1 - SPS 75:45:43 BT:6 MIN 2 SEC ΔV:2974.0 FPS NO ULLAGE
- LOI-2 - SPS 80:10:45 BT: 14.4 SEC ΔV: 138.5 FPS ULLAGE: 2 JET 17 SEC
- CSM SEP-RCS 98:35:16 BT: 6.9 SEC ΔV: 2.5 FPS NO ULLAGE
- LM JETTISON-RCS 108:09:24 BT: 5.6 SEC ΔV: 2.0 FPS NO ULLAGE
- TEI - SPS 137:20:22 BT: 2 MIN 50 SEC ΔV: 3622.5 FPS ULLAGE: 2 JET 14 SEC
- MCC-5 152:20
- MCC-6 176:50
- MCC-7 188:50

GET	0 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100 102 104 106 108 110 112 114 116 118 120 122 124 126 128 130 132 134 136 138 140 142 144 148 152 156 160 164 168 172 176 180 184 188 192
LUNAR REVOLUTION NO.	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
ALTITUDE NM x 10^3	20 61 92 117 138 156 172 188 202 — LUNAR ORBIT 209.6 - 215.8 — 196 180 150 132 108 72 28
CSM IMU REALIGNS P-52	
CSM CO_2 FILTER CHANGES	
ECS REDUNDANT COMPONENT CHKS	



"F" MISSION RENDEZVOUS TRAJECTORY
(CSM CENTERED CURVILINEAR CO-ORD.)



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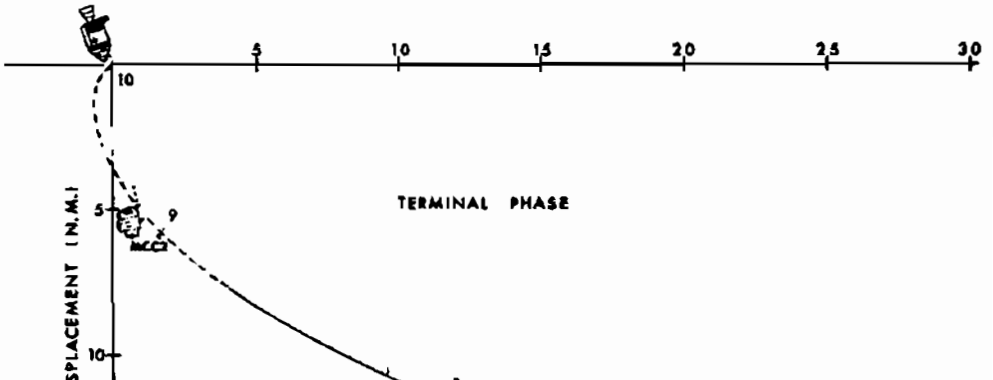


END:

NIGHT

DAYLIGHT

EVENT NO.	EVENT	GET
1	CSM SEPARATION	98:35:16
2	DOI	99:29:59
3	PHASING BURN	100:44:21
4	IRs	101:59:21
5	CSI	102:29:21
6	CDH	102:59:21
7	TPI	103:29:21
8	MCC-2	103:59:21
9	MCC-3	104:29:21
10	MCC-4	104:59:21

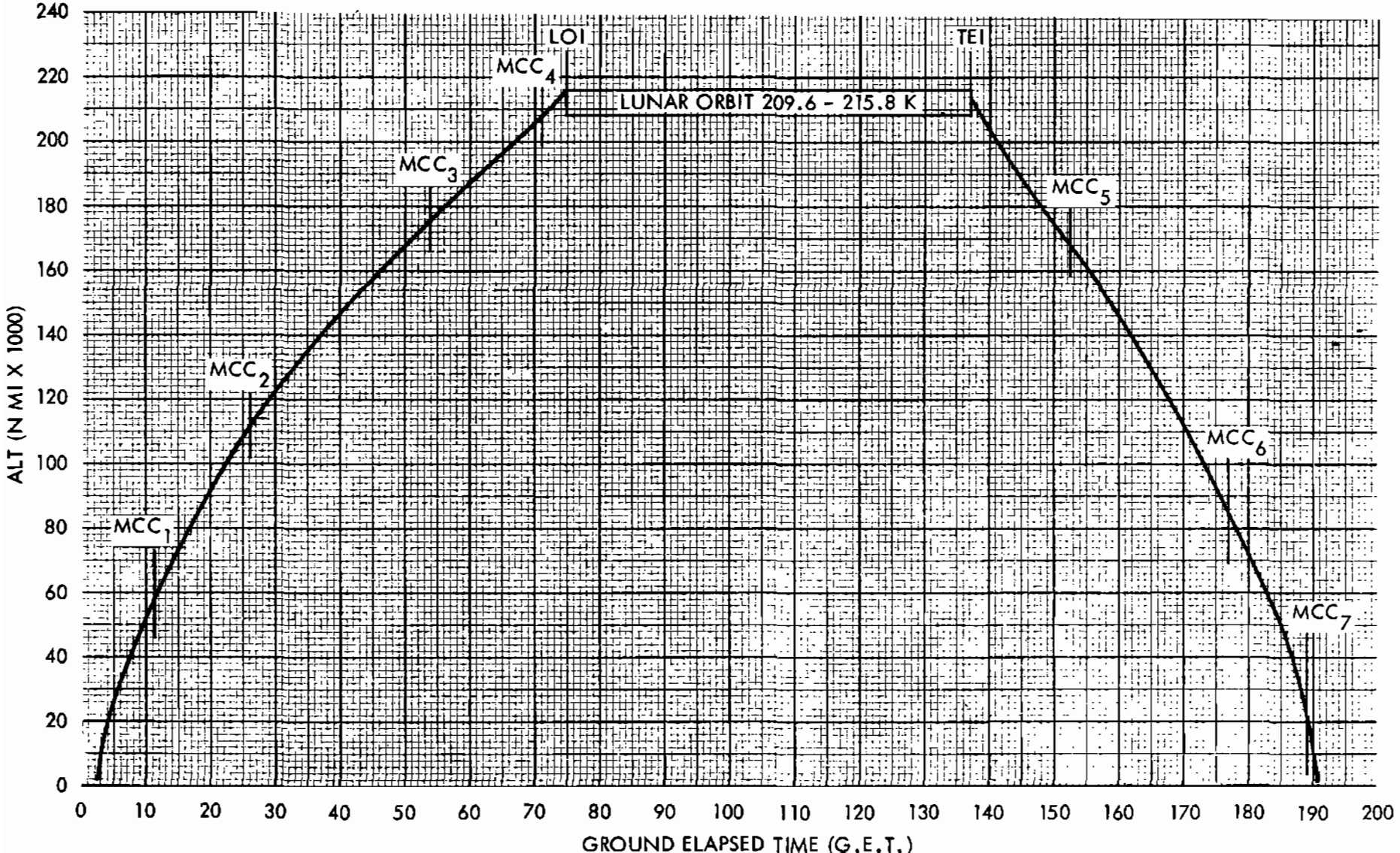

240
220
200
180
160
140
120
100
80
60
40
20
0
ALT (N MI X 1000)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
GROUND ELAPSED TIME (G.E.T.)
LOI
TEI
MCC4
LUNAR ORBIT 209.6 - 215.8 K
MCC3
MCC5
MCC2
MCC6
MCC1
MCC7

TABLE 1-1 CSM BURN SCHEDULE

Burn/Maneuver	GETI Burn Time ΔV_c	Attitude (deg) LH/LV	Attitude (deg) Inertial	Lighting at GETI	ΔV (fps)	Ullage ΔV (fps)	TVC Mode	REFSMMAT	ΔV Result (SC wt., H_P, H_A)	Remarks
S-IVB TLI	2:33:26 5 min 22 sec 10,058 fps	R: P: Y:	R: P: Y:		ΔVX: ΔVY: ΔVZ:		S-IVB I. U.	PAD		
CSM/LM Evasive Maneuver from S-IVB	4:28:48 2.8 sec 19.7 fps	R: 180.1 P: 282.6 Y: 1.8	R: 180.7 P: 163.3 Y: 0.0	Daylight	ΔVX: 5.1 ΔVY: 0.0 ΔVZ: -19.0	None		PAD	WT: 94,575	Use Bank A engine ball valves
MCC-1	11:33:49 8.1 sec 57.0 fps	R: 8.3 P: 142.6 Y: 9.2	R: 7.1 P: 3.2 Y: 10.5	Daylight	ΔVX: -42.9 ΔVY: 10.5 ΔVZ: -36.0	None		PTC	WT: 94,392	Use Bank B engine ball valves
Midcourse Corrections (MCC-2 through MCC-4)	26:33 53:45 70:45 GETI			Daylight	Nominally Zero	Nominally Not Required	G&N Auto	PTC PTC LLS-2		TLI + 24 hours LOI - 22 hours LOI - 5 hours
LOI-1	75:45:43 6 min 2 sec 2974 fps	R: 356.5 P: 162.8 Y: 345.6	R: 356.3 P: 232.0 Y: 340.5	Daylight (SS - 8:17)	ΔVX: -2912.9 ΔVY: -587.5 ΔVZ: -201.0	None	G&N Auto	LLS-2	WT: 92,427 H_P: 59.6 H_A: 170.6	
LOI-2	80:10:45 14.4 sec 138.5 fps	R: 0.1 P: 182.4 Y: 357.6	R: 0.1 P: 221.0 Y: 357.6	Daylight (SR + 20:45)	ΔVX: -138.5 ΔVY: 0.0 ΔVZ: 0.0	2 Jet 17 sec ΔV:	G&N Auto	LLS-2	WT: 68,821 H_P: 59.6 H_A: 60.2	
CSM Separation Maneuver	98:35:16 6.9 sec 2.5 fps	R: 0.0 P: 269.8 Y: 0.0	R: 0.0 P: 194.2 Y: 0.0	Daylight (SS - 14:44)	ΔVX: 0.0 ΔVY: 0.0 ΔVZ: 2.5	None	G&N	LLS-2	WT: 36,484 H_P: 59.2 H_A: 60.1	
LM Jettison	108:09:24 5.6 sec 2.0 fps	R: 180.0 P: 89.9 Y: 0.0	R: 180.0 P: 70.3 Y: 0.0	Daylight (SS - 32:36)	ΔVX: 0.0 ΔVY: 0.0 ΔVZ: -2.0	None	G&N	LLS-2	WT: 36,674 H_P: 59.3 H_A: 60.0	
TEI	137:20:22 2 min 50 sec 3622.5 fps	R: 179.9 P: 350.4 Y: 359.9	R: 180.0 P: 52.4 Y: 359.8	Daylight (SR + 13:22)	ΔVX: 3618.1 ΔVY: -34.8 ΔVZ: 1176.4	2 Jet 14 sec ΔV:	G&N Auto	LLS-2	WT: 36,575	
Midcourse Corrections (MCC-5 through MCC-7)	152:20 176:50 188:50 GETI			Daylight	Nominally Zero		G&N Auto	PTC PTC Entry		TEI + 15 hours EI - 15 hours EI 191:50 EI - 3 hours

NOTE: H_A & H_P are distances above LLS-2 (not mean radius)

TABLE 1-2 LM BURN SCHEDULE

Burn/Manuever	GETI Burn Time ΔV_c	Attitude (deg) LH/LV	Attitude (deg) Inertial	Lighting at GETI	ΔV (fps)	Ullage ΔV (fps)	TVC Mode	REFSMMAT	(SC wt., H_P, H_A)	Remarks
DOI	99:33:59 27.7 sec 71.1 fps	R: 0.0 P: 180.0 Y: 0.0	R: 358.6 P: 286.4 Y: 4.8	Darkness (SR ~ 2 min)	ΔVX: -69.6 ΔVY: 0.0 ΔVZ: - 0.3	2 Jet 7.5 sec 1.5 fps	PGNCS Auto	LLS-2	WT: 37,758 H_A: 59.5 H_P: 8.8	DPS 10% thrust 15 sec 40% thrust to burn completion Retrograde face up
Phasing	100:46:21 42.1 sec 195.4 fps	R: 0.0 P: 25.9 Y: 0.0	R: 0.7 P: 261.4 Y: 4.9	Darkness (SS + 5 min)	ΔVX: 169.1 ΔVY: 0.0 ΔVZ: -94.8	2 Jet 7.5 sec 1.6 fps	PGNCS Auto	LLS-2	WT: 31,070 H_A: 195.1 H_P: 9.2	DPS 10% thrust 26 sec 92.5% thrust to burn completion Posigrade face down
Insertion	102:43:18 15.2 sec 207 fps	R: 180.0 P: 155.6 Y: 0.0	R: 177.7 P: 62.1 Y: 355.6	Daylight (SS - 5 min)	ΔVX: -189.2 ΔVY: 0.1 ΔVZ: -83.8	2 Jet 3.5 sec	PGNCS Auto	LLS-2	WT: 8,412 H_A: 45.8 H_P: 8.6	LM staging 10 min before insertion burn Retrograde face down
CSI	103:33:46 32.1 sec 50.5 fps	R: 0.0 P: 0.0 Y: 0.0	R: 1.4 P: 106.1 Y: 355.2	Darkness (SR - 3 min)	ΔVX: 50.5 ΔVY: 0.0 ΔVZ: 0.6	None	PGNCS Auto	LLS-2	WT: 8,241 H_A: 45.2 H_P: 45.0	Retrograde face up RCS +X thrust 4 Jet
CDH	104:31:44 2.3 sec 3.4 fps	R: 0.0 P: 90.0 Y: 0.0	R: 355.2 P: 16.1 Y: 358.6	Daylight (SS - 14 min)	ΔVX: -0.7 ΔVY: 0.0 ΔVZ: 3.2	None	AGS Auto	LLS-2	WT: 8,195 H_A: 44.4 H_P: 44.2	RCS +Z thrust 2 Jet
TPI	105:09:00 15.6 sec 24.6 fps	R: 359.9 P: 26.0 Y: 0.2	R: 4.8 P: 189.5 Y: 1.1	Darkness (SR - 12 min)	ΔVX: 22.1 ΔVY: 0.0 ΔVZ: -11.1	None	PGNCS Auto	LLS-2	WT: 8,192 H_A: 61.8 H_P: 43.8	RCS +X thrust 4 Jet Posigrade face down
Rendezvous MCC-1	105:24:00	R: 0.2 P: 210.2 Y: 0.4	R: 2.2 P: 246.5 Y: 4.1	Darkness	TBD	None	TBD	LLS-2	WT: 8,169	Retrograde face up
Rendezvous MCC-2	105:39:00	R: 0.2 P: 216.7 Y: 0.4	R: 2.2 P: 246.5 Y: 4.1	Darkness	TBD	None	TBD	LLS-2	WT: 8,158	Retrograde face up
APS Burn to Depletion	108:39						AGS Auto			Start burn in PGNCS auto and switch to AGS auto

TABLE 1-3 LUNAR LANDING SITE DATA

(For General Information Only)

DAY	SITE DESIG.	LAT	LONG	SUN ELEVATION ANGLES* (72°L.AZ.)	(108°L.AZ.)
MAY 18	2(II P6)	0°44'N	23°39'E	11.4°	14.3°
MAY 20	3(II P8)	0°22'N	1°21'W	10.9°	13.7°
MAY 23	4(III P11)	3°39'S	36°42'W	10.3°	12.9°
MAY 24	5(II P13)	1°46'N	41°56'W	17.0°	19.0°
MAY 25	5(II P13)	1°46'N	41°56'W	28.0°	30.0°

*Sun El angles are for approximately 25 hours after LOI

TABLE 1-4 LANDMARK TRACKING DATA

SITE DESIG.	LAT	LONG	SUN EL.	GET (TCA)
REV. 4				
IP(F1)	1°17'N	93°50'E	71°	82:32
F1	1°36'N	86°53'E	64°	82:34
IP(B1)	1°30'N	40°06'E	18°	82:49
B1	2°31'N	35°02'E	13°	82:51
REV. 11				
IP(130)	1°53'N	28°44'E	13°	96:40
130	1°16'N	23°41'E	8°	96:42
REV. 24, 25, 26, 27**				
IP_1	0°0'N	178°26'E	4°	121:28
CP_1	0°53'N	170°09'E	12°	121:30
IP_2	0°48'N	132°29'E	50°	121:42
CP_2	1°0'N.	127°24'E	55°	121:44
IP(F1)	1°17'N	93°50'E	89°	121:54
F1	1°36'N	86°53'E	84°	121:56
IP (130)	1°53'N	28°44'E	26°	122:16
130	1°16'N	23°41'E	21°	122:18
REV 30				
IP(B1)	1°30'N	40°06'E	44°	134:02
B1	2°31'N	35°02'E	39°	134:04
IP(150)	0°18'N	3°23'E	7°	134:14
150	0°17'N	1°26'W	2.6°	134:15

**Sun El. and GET for REV 24 only

CSM FLIGHT PLAN NOTES

A. Crew

1. Crew designations are as follows:

Designation	Prime	Backup
Commander (CDR)	Stafford	Cooper
Command Module Pilot (CMP)	Young	Eisele
Lunar Module Pilot (LMP)	Cernan	Mitchell

2. Couch positions for thrusting maneuvers during the mission are listed below:

Couch Position	LIFT-OFF, TLI	TD&E SPS Burns, Entry
Left	CDR	CMP
Center	CMP	CDR
Right	LMP	LMP

3. The CDR will perform the TLI maneuver. The CMP will perform all SPS burns,transposition and docking and all work in the tunnel prior to LM extraction. The LMP will monitor CDR and CMP activities per checklist/timeline.

4. The crew will normally follow a 15-hour work,9-hour rest cycle. All crewmen will sleep simultaneously and be awake during all major burns.

5. The crew will eat together when possible during meal periods (normally of 1-hour duration). Additional activities will be held to a minimum during meals.

6. PGA's will be worn during the following periods, but will not be "hard suited".
   (a) Launch - With helmet and gloves
   (b) Earth Orbit – Without helmet and gloves
   (c) TLI - With helmet and gloves
   (d) Undocking and docking - With helmet and gloves

7. Two crew status reports will be made during each

activity day. The first report will be given after the first meal of the day and will concern the sleep obtained during the previous sleep period. The second report will be given following the final meal of the day and will concern the radiation dose received during the previous 24 hours. The following information should be transmitted or logged as appropriate:

(a) A daily report of each crewman's best estimate as to sleep quantity and quality

(b) A daily report of the integrated radiation dose each crewman receives

(c) An onboard record of food not eaten and exercise (no voice report required)

(d) Used fecal bags will be marked as to crewman and GET

(e) A daily report of all medication used by each crewman

8. General flight plan updates containing changes to the scheduled next day's activities will be voiced up once a day.

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

10. No CSM biomedical switching is required. Continuous biomedical data are automatically transmitted to the ground simultaneously for all crewmen.

11. Crewmen will sleep simultaneously. Two crewmen will normally be in the sleep stations under the couches and one in the couch. During the LOI Day sleep period, two crewmen will be in the couches because the probe and drogue will be stored in one of the sleep stations.

12. One crewman will wear headsets at all times during the mission.

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

14. Periodic spacecraft systems monitoring is a continuing task and is not scheduled in the flight plan timeline.

B. Maneuvers

1. CSM/LM and CSM attitude maneuvers will normally be at a rate of

0.2^{o}/sec. or 0.5^{o}/sec. unless other rates are required to support mission objectives or time critical events.

Note: At 0.2^{o}/sec. 15 minutes is required to maneuver 180^{o}. At 0.5^{o}/sec, 6 minutes is required to maneuver 180^{o}.

2. Passive thermal control mode will be initiated after MCC_1 and maintained throughout the mission (except in lunar orbit) until at least three hours before entry except for interruptions for mid-course corrections, communications orientation, and/or performance of mission objectives (maximum interruption of three hours). PTC will not be initiated until approximately TLI + 12 hours.

3. In order to conserve SM RCS, the SPS engine will be used to "back up" all LM burns. The SPS gimbal motors will not be turned on during the "back-up" maneuver preparation.

4. The first SPS burn will be on engine valves BANK "A" and the second burn will be on BANK "B".

5. The CSM will perform the final docking maneuver after the LM active rendezvous.

6. The crew will manually back up all critical engine starts and cut-offs.

C. Electrical Power System and Water Management

1. Spacecraft lift-off switch positions are listed in the Apollo Operations Handbook (Volume 2) for CSM 106.

2. The spacecraft will remain fully powered up throughout the mission (CMC, IMU and SCS in the "operate" configuration and optics powered up as required).

3. Fuel cell H_2 and O_2 purging will be scheduled as follows:
   O_2 purge - each 12 hours
   H_2 purge - each 48 hours
   This schedule may change in real time depending on the purity of the O_2 and H_2. H_2 purge line heaters are activated 20 minutes before an H_2 purge.

4. Hydrogen VAC ION pumps will be inactive throughout the mission. The fuses will be pulled.

5. The O_2 VAC ION PUMP MAIN A/MAIN B CB (2) (PANEL NO. 229) will be open for launch and will be closed at 85% - 90% QTY (before pressure about the VAC ION pump increases significantly).

6. Potable water will be chlorinated before each sleep period starting at the first sleep period.

7. No FC purges or waste water dumps will be scheduled within one hour prior to optical sightings.

8. Waste H_2O dumping will be managed to allow:
   (a) Maximum QTY:85-90%
   (b) Minimum QTY:25%
   (c) At LOI:QTY = 75%
   (d) At CM-SM SEP:QTY = 90%
   (e) No dumping after MCC-4 until after LOI
   (f) Dumps will be performed (if required) within 2 hours preceding MCC maneuvers.
   (g) In lunar orbit if dumping is required, dumps will be performed immediately prior to sleep periods.
   (h) The water dump will not be operated in the automatic mode at anytime during the mission.

9. The cryogenic heaters will be in AUTO during the mission and the fans will be operated manually. The fans will be cycled for one minute before and after each sleep cycle.

10. The batteries will be charged after TLI, LOI_2 and TEI. The tentative charging schedule is as follows:
    Battery A - GET 2:45 (interrupted for evasive maneuver)
    Battery B - GET 22:00
    Battery A - GET 87:30
    Battery B - GET 118:00
    Battery A - GET 146:00
    Battery B - GET 164:30

11. Inverter No. 1 and 2 will be used during the mission even though the C & W temperature light for inverter number one is inoperative. Inverter No. 3 will be used as the backup inverter.

D. Environmental Control System and Cabin Pressurization

1. One CO_2 odor absorber filter (LiOH canister) is changed every 12 hours or if CO_2 partial pressure is greater than 7.6mm Hg. There are 20 filters (2 in the canisters onboard and 18 stowed).

2. An ECS redundant component check is performed at 24-hour intervals (in order to prevent secondary evaporator dry out) and prior to TLI, LOI (4 to 10 hours before), and entry (2 to 10 hours before).

3. The ECS redundant component checks will include secondary evaporator operation and the secondary evaporator water control valves will be turned "OFF" at deactivation.

4. The evaporator operation will be as follows:

   (a) Launch -primary loop operation
   (b) Earth Orbit - primary loop operation and secondary loop test plus redundant operation test
   (c) Post TLI - deactivate both evaporators
   (d) LOI Minus 2 Hours - activate primary evaporator
   (e) Post TEI - deactive primary evaporator
   (f) Entry Interface Minus 1.5 hours - activate primary evaporator
   (g) Secondary evaporator may be activated (EI - 1 hour) at crew option for cold soak.

5. At lift-off the cabin will contain a 60% O_2/40% N_2 gas mixture. Cabin O_2 purge will be initiated after launch and will be terminated after transposition and docking and prior to LM pressurization.

6. After the LM is pressurized (before ejection from the SIVB), it will be isolated by placing the LM/CM pressurization valve in the OFF position (Panel 12). Eight hours of additional CM O_2 purge will be performed. A low LM leakage rate may necessitate a delta purge (to be determined in real time by MCC-H).

7. After the initial crew entry into the LM, the CM tunnel hatch will be installed during the docked lunar orbit sleep period and the probe and drogue will be stored in one of the sleep stations.

8. There is no CSM barbecue PTC mode required in lunar orbit, but a special attitude (see Communications Notes) will be maintained during the sleep period.

E. Guidance and Navigation

1. Fuel cell purges or waste water dumps will not be scheduled within one hour prior to optical sightings.

2. During lunar orbit, the CSM and LM will utilize the same landing site REFSMMAT such that the gimbal angles would be 0,0,0 at GET 100:43 with the LM sitting face forward on landing site number two and the CSM over the landing site pitched up 90° from local horizontal "heads up".

3. In order to avoid gimbal lock, the IMU will be pulse-torqued to a PTC REFSMMAT prior to setting up the PTC mode. Prior to a ΔV maneuver or midcourse navigation sightings, if yaw gimbal angle exceeds 60°, the IMU will be pulse-torqued back to the pad or landing site REFSMMAT and an IMU fine align (P52) will be performed. Pulse rate per axis is one-half degree per second. The accuracy for pulse-torquing the platform is 0.002 times the total angle.

4. During cislunar coasting flight, two IMU P-52 realignment and state vector updates are planned each day. After actual IMU

drift rates are established the P-52 realignments may be reduced to one a day.

5. The CMC will use the COLOSSUS 2 flight program.

6. The CSM tracking light will be on continuously from undocking to docking.

7. The "P23-NO COMM" navigation sightings are called out for planning purposes. These sightings will not be made unless communications with MSFN are lost.

8. During LM P-52 IMU realignments, the LM tracking light will be off and CM optical tracking of the LM will not be possible during these periods of activity.

F. Procedures

1. Crew procedures called out in the flight plan may be found in the following documents:
   (a) Apollo Operations Handbook - CSM 106 (AOH), Volume 2
   (b) Crew Checklist
   (c) Rendezvous Procedure document
   (d) Abort Summary document
   (e) Reentry Procedures document
   (f) Photography and TV Operations Plan

2. Specific procedures for accomplishing a particular DTO test are located in Section IV of this document. All DTO's and the page number location of each are listed in the applicable portion of the timeline, Section III.

G. CSM Photography

1. There are no DTO requirements for photography or TV but these will be scheduled on a non-interference basis with other mission activities.

2. Cameras and film are provided to photograph the following activities:
   (a) Transposition/Docking
   (b) LM Ejection

(d) SLA/LM/SIVB
(e) Earth Photography
(f) Lunar Surface Targets
(g) IVT (CDR)
(h) LM Undocking and Inspection
(i) Rendezvous (to within 300 ft. of CSM)
(k) IVA Photography - CM Activities
Folding, Unfolding Couch
Stowing equipment on Aft Bulkhead
Donning/Doffing Space Suits

H. The schedule for TV transmissions to earth is as follows:

T&D - 3:00 to 3:15

TLC-1 - 27:15 to 27:30

TLC-2 - 54:00 to 54:15

PRE LOI-1 - 72:20 to 72:35

POST LOI-2 - 80:45 to 81:55

UNDOCKING - 98:13 to 98:23

APS BURN TO DEPLETION - 108:35 to 108:50

AFTER 3RD LANDMARK TRACKING - 126:20 - 127:00

POST TEI - 137:45 to 138:00

TEC - 152:35 to 152:45

TEC - 186:50 to 187:05

I. SM RCS Propellant Usage

Table 1-5 shows RCS propellant usage in pounds for the SM and LM at various S/C weights and maneuver rates.

Table 1-6 gives SM RCS propellant usage for +x translation maneuvers at various S/C weights and for 2-jet, 20 second and 4 jet, 15 second ullage maneuvers.

Table 1-7 gives SM RCS propellant usage rates for steady state attitude holds at various S/C weights and deadbands.

J. Block Data Updates

Maneuver data for return to earth contingencies will be passed up to the crew as follows:

Type Data	GET	Type Data	GET
TLI + 90 MIN	1:30	TEI 10	84:40
TLI + 4 HR	1:30	TEI 22	107:00
TLI + 11	5:30	TEI 23	118:30
TLI + 25	12:00	TEI 24	120:40
TLI + 35	12:00	TEI 25	122:40
TLI + 44	12:00	TEI 26	124:30
TLI + 53	12:00	TEI 27	126:30
FLYBY	33:00	TEI 29	128:00
PC + 2	69:00	TEI 30	132:30
TEI 1	71:00	TEI 31 (PRELIM)	134:30
TEI 4	71:00	NOM TEI 31 (TGT LOAD)	136:00
TEI 5	79:00	TEI 32	136:00

TABLE 1-5 RCS PROPELLANT USAGE - LBS/MANEUVER

SPACECRAFT MANEUVERS

CSM (GNCS)				
1-AXIS (180^{o})		3-AXIS (180^{o})		S/C WT IN LBS
0.2^{o}/SEC	0.5^{o}/SEC	0.2^{o}/SEC	0.5^{o}/SEC	
2.2 lbs	5.6 lbs	3.2 lbs	7.7 lbs	94,000
1.7 lbs	4.5 lbs	2.5 lbs	6.0 lbs	70,000
1.0 lbs	2.5 lbs	1.5 lbs	3.4 lbs	47,600
0.3 lbs	0.9 lbs	0.75 lbs	1.3 lbs	38,000
0.3 lbs	0.75 lbs	0.7 lbs	1.2 lbs	28,600
LM (AGS)				
0.5^{o}/SEC	2^{o}/SEC	0.5^{o}/SEC	2^{o}/SEC	
0.4 lbs	1.3 lbs	0.8 lbs	2.6 lbs	31,000
0.2 lbs	0.75 lbs	0.4 lbs	1.5 lbs	8,400
0.2 lbs	0.7 lbs	0.4 lbs	1.4 lbs	8,000

TABLE 1-6 CSM G&N RCS TRANSLATION

20 SEC, 2 JET ULLAGE	14.0 lbs	N/A
15 SEC, 4 JET ULLAGE	19.4 lbs	N/A
1 FPS +X TRANSLATION	10.7 lbs	94,000
1 FPS +X TRANSLATION	8.0 lbs	70,000
1 FPS +X TRANSLATION	4.3 lbs	38,000
1 FPS +X TRANSLATION	3.3 lbs	28,600

TABLE 1-7 G&N RCS ATTITUDE HOLD PROPELLANT USAGE RATES - STEADY STATE CONDITIONS (LBS/HR)

0.5^{o} DEADBAND		5.0^{o} DEADBAND		10.0^{o} DEADBAND		S/C WT IN LBS
3-AXIS	2-AXIS P & Y	3-AXIS	2-AXIS P & Y	3-AXIS	2-AXIS P & Y	
(lbs/hr)	(lbs/hr)	(lbs/hr)	(lbs/hr)	(lbs/hr)	(lbs/hr)	
0.066	0.011	0.0066	0.001	0.0033	0.0005	98,000
0.216	0.152	0.022	0.015	0.011	0.007	94,000
1.015	0.195	0.10	0.020	0,05	0.01	70,000
2.04	1.01	2.20	0.101	0.10	0.05	64,000
1.95	0.55	0.20	0.055	0.10	0.028	45,600
3.0	1.3	0.30	0.13	0.15	0.065	37,600

NOTE: 3-Axis is for 2 adjacent quads

2-Axis is for 2 opposite quads

LUNAR MODULE FLIGHT PLAN NOTES

A. LM Crew

1. The LM inspection and housekeeping activities will be performed by the LMP in flight coveralls.
2. The LMP will initiate the final LM activation and checkout in coveralls. The CDR will enter the LM in his PGA (without donning helmet and gloves). The LMP will return to the CM and don his PGA (without helmet and gloves). The LMP and CDR will don helmets and gloves and perform a PGA/ARS pressure integrity check just prior to the LM cabin regulator check.
3. It should not be necessary to change the primary LM LiOH cannister during the LM manned operations.
4. One PLSS and two OPS will be carried in the LM. The PLSS will not be checked out or used during the nominal mission. The OPS's will be checked out during the housekeeping activities on LOI day.
5. The CM transfer umbilical will not be used during LM activation and checkout.
6. The LM crew will be suited (without helmet and gloves) during most of the undocked portion of the mission. For undocking and staging the LM crew will be fully suited.
7. The LM switch settings at the initial entry will be as specified in the LM AOH, Volume 2.

B. LM Guidance and Navigation

1. The LGC will use the LUMINARY-69 flight program.
2. The LM AGS will use Flight Program 5 (Mission G will use Flight Program "X"). Flight Program 5 will not have the RR filter which increases the range for RR data update to AGS. The AGS RR update range will be limited to 100nm.

3. One LGC erasable memory dump and MCC-H verification will be accomplished prior to DOI. If a significant number of errors are found, DOI will be delayed to allow for memory correction and re-verification.

4. All maneuvers during the undocked manned LM operations will be under PGNCS control except for the LM staging maneuver and the LM CDH maneuver (if required). These two maneuvers will be under AGS control.

5. The capability for MCC-H to update the LGC via uplink will normally be blocked by the LM UP-DATA LINK switch (panel 12).

6. A LM COAS star sighting will be used during the DOI maneuver to check IMU drift rates. The star should be within 2^{o} of the initial COAS position prior to the maneuver. The AOT will not be used for this purpose. The lunar horizon will not be visible during the DOI maneuver.

7. A LM COAS accuracy check will be performed after the IMU alignment prior to staging.

8. The Apollo 10 Mission timeline will not include the time required for all PADS that are required on the Apollo 11 mission for LUNAR surface aborts or insertion maneuvers.

9. The LM IMU will be manually aligned to the CSM IMU during the DOI day LM activation and checkout. P-52/AOT alignments will be performed as soon as possible prior to:
   - DOI
   - Phasing
   - Insertion

   There will be no "back-to-back" PGNCS/AOT alignments performed during the mission which are not interrupted by a DPS, APS or RCS thrusting maneuver.

10. AGS alignments to the IMU will not be performed when IMU gimbal angles are at 0^{o} or multiples of 45^{o}.

11. In order to UPLINK data, TLM should be in HBR in order to facilitate MCC-H verification of LM receipt of the data via LM-TLM.

12. The time from rendezvous TPI to the rendezvous MCC-1 is 15 minutes and the time from rendezvous MCC-1 to rendezvous MCC-2 is 15 minutes.

13. In order to perform AGS initialization, the LM TLM must be in HBR in order to obtain state vector data from the LM-TLM downlink. AGS initialization is performed prior to each engine burn.

C. LM RCS Operation and Interface Constraints

1. LM RCS "+x" two jet ullage (System B) will be used for unstaged ullage maneuvers in order to prevent asymmetrical RCS thrust caused by impingement on the descent stage.

2. During CSM/LM docked checkout operations, the SM B3(-x) and C4 (-x) thrusters will be deactivated before the LM steerable and/or RR antennas have been unstowed in order to prevent SM-RCS impingement on these antennas.

3. The RCS interconnect will be used during the APS insertion maneuver and several of the rendezvous maneuvers in order to conserve LM RCS propellant. The interconnect can only be used for +x translations.

4. The maximum +x continuous RCS firing time is 55 seconds on LM-4 (85 seconds on LM-6). For multiple pulse firings approximately one minute of "off" time for cooling offsets approximately one second of previous "on" time. (See the Spacecraft Operational Data Book for specifics).

D. LM APS Burn to Depletion

1. Prior to LM jettison the CSM will be in narrow deadband attitude control and the LM will be in wide deadband control (CSM controlling CSM/LM attitudes.)

2. LM jettison will occur at 90 degrees east longitude approximately 30 minutes prior to the APS burn.

3. The LM S-Band steerable antenna will be set at a fixed position during the APS burn and DATA will be in the HBR position.

4. The APS burn to depletion will place the ascent stage in orbit around the sun.

5. The PGNCS (under MCC-H RTC) will control the start of the ullage maneuver and RTC will be used to switch to AGS control for the remainder of the ullage maneuver and the APS start and burn.

6. Both RCS interconnects will be closed during the unmanned APS burn to depletion.

7. The probe and drogue will be stored in the LM during the APS burn to depletion.

8. The APS will be approximately 50% propellant loaded at the start of the burn in order to ensure adequate backup RCS propellant to stabilize the LM during and after the burn.

9. MSFN will attempt to track the LM and obtain TLM data after the APS burn to depletion.

E. Pasive Thermal Control Maneuvers

1. There is no requirement to perform any LM passive thermal control maneuvers during lunar orbit.

2. There will be no telemetry or crew monitoring of LM temperatures (or any other LM data) between LM pre-launch checkout and the post LOI-2 LM entry and inspection.

F. Rendezvous Radar

1. The turn-on and turn-off times for the rendezvous radar will be scheduled in such a manner as to prevent overheating of the rendezvous radar antenna.

2. Accurate RR range and range rate telemetry data will not be obtainable on the lunar farside because a HBR TLM capability is not available. This situation prevents MSFN from analyzing the

operation of the RR system on the lunar farside via DSE data playback. LM RR LGC state vector updates will be checked against MSFN computed state vectors after each AOS.

3. Rendezvous radar lock will be broken just prior to TPI in order to make a +x axis TPI burn. (This is different from the Apollo 11 Mission).

4. The RR shaft and trunion angles will be at zero during each AGS RR update.

G. Rendezvous

1. The LM tracking light will be on continuously between separation and docking except during PGNCS/AOT P-52 realignments.

H. LM Pressurization

1. The LM cabin will contain N_2 and some ambient air at launch and will bleed down to a pressure of zero psi during the launch insertion maneuver. The LM will be pressurized after transposition and docking and will then be isolated before ejection and allowed to bleed down.

I. LM Procedures

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

(a) Apollo Operations Handbook LM-4 (AOH) Volume 2
(b) Crew Checklist
(c) LM Rendezvous Procedures Document
(d) Abort Summary Document
(e) Photography and TV Operations Plan

J. Photography

There are no photographic DTO requirements, but cameras and film will be carried aboard the LM to photograph the following:

(a) Lunar surface strip over landing site
(b) Braking/formation flying
(c) Photos of CSM from LM after rendezvous

K. LM Activation and Checkout Notes

Activities will be performed during the periods as shown below:

1. Post LOI-2

LMP IVT to LM and verify CSM to LM roll calibration angle
LM entry status check
Transfer required crew equipment and housekeeping
Transfer to LM power and comm activation
S-Band/VHF B comm test
OMNI and Steerable Antenna voice/TM Tests
LM and MSFN relay Tests
Comm deactivation and transfer to CSM power
LMP IVT to CSM and close LM hatch

2. Docked Pre-DOI

IVT to LM and verify CSM/LM roll calibration angle
Transfer to LM power and EPS Activation, S-Band TLM-LBR on OMNI
Activate Mission Timer
Backup S-Band comm activation and comm check
Primary glycol loop activation
Caution and Warning system checkout
PGNCS turn on and self test
Circuit breaker activation and talkback verification
ECS activation and checkout
Suit Fan/H_2O Separator check
Glycol pump checks (1, 2, and secondary)
S-Band Steerable Antenna checks
VHF activation and checkout
LGC/CMC Clock Sync and TEPHEM update
E Memory dump
LM docked manual IMU coarse align
Install drogue and close LM hatch
Ascent batteries activation and checkout
ARS/PGA pressure integrity check
Regulator checks

AGS activation and self test
Rate Gyro check and docked manual fine align IMU
LM IMU Drift check
AGS initialization
ORDEAL initialization
DAP data load, gimbal drive and throttle tests
RCS pressurization
RCS checkout (cold and hot fire)
Rendezvous Radar activation and self test
AGS accelerometer and gyro calibration
Update and align AGS to PGNCS
DPS pressurization and checkout
Landing gear deploy

3. Undocked Pre-DOI

LM inspection by CSM and formation flying
Rendezvous Radar/VHF ranging check
IMU AOT realign (P52)
System checks
Landing radar test
Align and update AGS

4. Undocked Prior to APS Insertion Burn

IMU Realign/COAS calibration
Parallel ascent and descent batteries
LM staging
Pressurize and check the APS

CSM & LM COMMUNICATIONS AND INSTRUMENTATION NOTES

A. CSM/LM Notes - All Mission Phases

1. Table 1-8 is a matrix that shows how the CSM and LM communications will be utilized throughout the mission. The matrix consolidates all communications requirements specified in the Detailed Test Objectives and the Operational Procedures (AOH Volume 2). This matrix shows the following:
   (a) The mission phase or event where each uplink, downlink, antenna, transceiver, power amplifier and data recorder is exercised
   (b) All communications modes used for the lunar earth side (MSFN coverage) and the lunar farside (no MSFN coverage)
   (c) Which S-Band antenna (omni, CSM high gain, LM steerable) is used for each uplink or downlink signal combination.
   (d) Which uplink signal combinations are exercised for CSM and which uplink signal combinations are exercised for the LM
2. The MSFN 85-ft. antennas will normally be used for all lunar distance communication. The Goldstone 210-ft. antenna may not be available for the Apollo 10 Mission. The "uncooled" 30-ft. MSFN antennas may be used for CSM lunar distance simulation communications tests at approximately 70Knm. The "cooled" 30-ft. MSFN antennas may be used at approximately 110Knm for CSM lunar distance simulation communications tests.
3. LM to CSM VHF TLM data cannot be transmitted and received during VHF ranging periods.
4. During communications, the spacecraft will be referred to by name (Apollo 10) and MCC-H will be referred to as "Houston". Code names assigned to the CSM and LM during undocked operations are:
   CSM - Charlie Brown
   LM - Snoopy

5. Voice silence (120 seconds) will be required during the CSM PRN ranging code acquisition sequence when the downlink signal combination is in mode 8 (TLM-LBR and Back-up Voice).

6. The preferred S-Band communications mode for CSM and LM is:

   (a) Uplink Mode 6 (Voice, PRN and Updata)

   (b) Downlink Mode 2 (Voice, PRN, TLM-HBR)

7. It is desirable to have the spacecraft TLM in HBR for all MSFN CSM or LM computer updates (via the uplink) in order to facilitate MCC-H verification of the updata receipt.

B. CSM/LM Notes - Lunar Orbit Phase

1. All CSM and LM HBR data at lunar distance will normally require the use of the high gain or steerable antennas with 85-ft. MSFN antennas. HBR can also be obtained by MSFN 30-ft. "cooled" antennas.

2. After each AOS in lunar orbit, it is desirable for MSFN to use PRN as much as possible.

3. During lunar orbit, the CSM and LM S-Band systems will not be shut down on the lunar farside.

4. The LM steerable antenna and the CSM HGA will not be in view of MSFN during any CSM tracking of a landing site while the vehicles are docked. TLM-LBR and OMNI antennas will be used during this activity.

5. VHF Ranging/Data Switching will be in accordance with the rendezvous procedure. Voice silence between vehicles should be maintained for approximately 10 seconds while acquiring VHF ranging.

6. VHF A Simplex is normally used for all VHF Voice Communications except during VHF ranging when VHF Duplex is used.

7. MCC-H will not normally switch S-Band antennas. This activity will be a crew action except during crew sleep period.

C. CSM Notes - Launch and Earth Parking Orbit

1. OMNI B and VHF LEFT will be selected for launch. OMNI D will be selected by the crew during boost phase if the launch azimuth is less than 96^{0}. OMNI C will be selected if the launch azimuth is greater than 96^{0}. OMNI D will probably be the best antenna for use during earth orbit.

2. VHF Duplex B will be used for launch and VHF Simplex A will be used for earth orbit operations (switch over at CYI LOS). VHF Simplex "A" will be used during entry in order to be compatible with the recovery forces.

3. CSM FM Modes are normally used for DSE playbacks and TV. HGA will be required for FM mode operation after TLI.

4. CSM S-Band backup communication modes checks will not be made. The LM communication system will be used as the backup communication system, if necessary.

5. All CSM communications checkouts and tests may be performed during translunar coast (post TD&E to pre-LOI). The lunar sleep comm mode will be checked in lunar orbit prior to the first sleep period

6. The CM communications system switches will be configured to permit MCC-H real time control of routine communications switching and maximum crew control of the communications without the crew having to use CMD RESET.

7. The CMC updata link input will normally be blocked by the crew UP TLM ACCEPT/BLOCK switch. This will not prevent MCC-H from using real time command to control the communications system.

8. The CSM S-Band system will normally be configured as follows unless preflight tests show that the secondary systems would have higher gain:

   (a) Primary transponder - ON
   (b) Primary Power Amplifier - HI

9. The translunar and transearth sleep communications mode will be as follows:

   The CSM x-axis will be placed normal to the ecliptic plane. The CSM will be placed in GNCS $\pm$ 20^{o} pitch and yaw attitude hold. All four SM RCS quads will be used with the roll channel disabled. The CSM will be rolled at a rate of approximately one revolution per hour. During the near earth sleep periods (range less than approximately 120Knm) omni antennas B and D may be used. During the other sleep periods (beyond approximately 120Knm) the high gain antenna may be used in the auto REACQ mode (panel 2). The auto REACQ configuration will provide almost 210 degrees of HGA coverage per CSM/LM revolution or 35 minutes of MSFN coverage per hour (for a CSM spin rate of one revolution per hour). The auto REACQ configuration will also allow MCC-H to use real time control to select TLM HBR or LBR and to dump the DSE during each spacecraft revolution. The auto REACQ sleep mode will be tested before the second translunar coast sleep period.

10. The communications mode for the lunar orbit sleep period will be as follows:

    The CSM will be referenced to the landing site number two REFSMMAT and will be in an attitude which will place two RCS quads toward the sun and two RCS quads toward the lunar surface.

    The CSM will be placed in an attitude which will allow the HGA to be used.

    The CSM will be placed in a GNCS 3-axis $\pm$ 10^{o} inertial hold mode using two adjacent quads.

The HGA will be in the auto REACQ mode (panel 2). The S-Band squelch will be enabled. The S-Band system will be controlled by RTC at HCC-H and will be in TLM-HBR on the lunar earthside and LBR/DSE recording on the lunar farside. This procedure will provide approximately 75 minutes of HBR for each lunar orbit and will permit MCC-H real time control of the DSE and playback of LBR data recorded on the lunar farside. This communications mode will be tested for suitability just prior to the lunar orbit sleep period.

11. During translunar and transearth coast crew-awake PTC periods, the crew will use manual antenna switching to maintain continuous communications with MSFN via OMNI and/or HGA. The S-Band squelch will be disabled to allow the crew to use the upvoice discriminator noise as a cue to indicate when to switch to another antenna.

12. In lunar orbit the crew will acquire MSFN using the CSM high gain antenna for each AOS unless specified differently in the flight plan timeline.

13. A small portable voice recorder will be carried in the CM to be used at the discretion of the crew.

14. CSM-TV may be scheduled in real time if the Goldstone 85-ft. antenna is in view of the spacecraft. CSM-TV via the Madrid 85-ft. antenna should be scheduled approximately 15 hours in advance in order to reserve communications satellite time.

D. LM Notes

1. LM voice recorder has a maximum utilization of 10 hours. This recorder will be used during LM operations to record all LM voice data during undocked operations (8.5 hours). The recorder will be operated in the continuous mode (not VOX).

2. As many LM communications special tests as possible will be performed between docking and LM jettison.

3. During "undocked" operation several LM communications test objectives will be performed as part of the normal mission communications procedures.

4. The LM S-Band System will normally be configured as follows unless preflight tests show that the secondary systems would have higher gains:

   (a) Primary transponder - ON

   (b) Primary Power Amplifier - ON

5. In lunar orbit MSFN will acquire the LM steerable antenna for each AOS unless specified differently in the flight plan timeline.

6. LM TLM will be switched to LBR at each LOS and to HBR at AOS by the LMP unless specified otherwise in the flight plan timeline.

7. LM Bio-Med switching will be checked out for the CDR and the LMP during LM checkout and will be switched from one crew member to the other approximately every two hours after LM undocking.

8. There will be no TV transmissions from the LM.

E. CSM DSE Notes

The CSM DSE is used as follows:

1. The DSE will normally be operated via ground command. In special cases the crew may be asked to operate the DSE.
2. DSE will be operated HBR during the launch phase. These data will be dumped if real time launch data are lost.
3. During the earth orbit period when the CSM is not over a MSFN station, CSM TLM-LBR data will be recorded on the DSE and will be dumped during the pass over the US and over CRO (if possible) just prior to TLI.
4. The DSE will be used for CSM HBR and voice recording during all CSM engine burns and during the accomplishment of certain specified DTO's.
5. DSE recordings will be made in CSM LBR mode whenever possible in order to minimize the DSE dump time.
6. All critical data will be hand recorded by the crew when not in voice contact with MSFN. DSE voice recording will be used as backup for recording critical data.
7. During translunar and transearth PTC simultaneous sleep periods using the HGA auto REACQ communications mode, the DSE will be used to record LBR data when the HGA is not in the MSFN field of view.
8. During lunar orbit LM operations, the DSE will be used to record LM-TLM-LBR data during all LM phases/events that occur on the lunar farside (unless VHF ranging is required).

9. During lunar orbit, time (in the attitude hold control mode) will be provided in the flight timeline to allow for MCC-H DSE dump, rewind and start of DSE after each MSFN AOS (acquisition of signal), except where a DSE dump would interfere with DSE recording of critical CSM backup TLM data or the HGA is not visible to MSFN.

10. LM data will normally be dumped first after each AOS during LM active operations.

11. Twenty-five minutes will normally be allowed for the complete data dump cycle for CSM and LM LBR data recorded on the lunar farside. HBR data will require additional dump time depending on the length of the recording.

12. DSE will be used to record all entry data in HBR during the blackout region.

13. In lunar orbit at LOS, the crew will initiate UP TLM CMD RESET (momentarily) then NORMAL (panel 3) if the DSE motion is not noted. This situation will occur if MSFN does not get the DSE started before LOS.

F. Normal Lunar CSM Comm Configuration

S-BD XPNDR - PRIM
S-BD PWR AMPL - PRIM
S-BD PWR AMPL HI-HI
S-BD MODE VOICE - VOICE
S-BD MODE PCM - PCM
S-BD RNG - RNG
S-BD AUX TAPE - DN VOICE BU
S-BD AUX TV - OFF (CTR)
UP TLM DATA - DATA
UP TLM CMD - NORM
VHF AM A -OFF
VHF AM B - OFF
VHF AM B RCV ONLY - OFF
VHF RNG - OFF
VHF ANT - SM RIGHT
TAPE RCDR PCM - PCM/ANLG
TAPE RCDR RCD - RCD
TAPE RCDR FWD - FWD
PMP PWR - NORM
SCE - POWER - NORM
PCM BIT RATE - LOW

S-BD SQUELCH - OFF

HI GAIN ANT PWR - PWR

HI GAIN ANT TRACK - MAN

HI GAIN ANT BEAM - WIDE

HI GAIN ANT SERVO - PRIM

UP TLM SWITCHES (MDC 2 - BLOCK & PNL 122 - ACCEPT)

SECTION 2 - MANEUVER UPDATE FORMS

MANEUVER UPDATE FORMS SUMMARY

This section contains samples of the update pads which are contained in the In Flight Data File on board the spacecraft. The CSM forms are as follows:

1. TLI Maneuver
2. P37 Block Data
3. P27 Update
4. P30 Maneuver (External ΔV)
5. Entry
6. Earth Orbit Entry Update
7. Earth Orbit Block Data
8. CSM Sep
9. CSM Rescue
10. CSM Backup Insertion
11. P76 (DOI, Phasing, Insertion)
12. CSM Rendezvous Rescue (CSI, CDH, TPI)

The LM forms are:

1. P27 Update
2. AGS State Vector Update
3. P30 LM Maneuver
4. P32 CSI Update
5. P33 CDH Update
6. P34 TPI Update
7. P76 (DOI, Phasing, Insertion)

In addition, definitions of abbreviations used on the forms are presented on facing pages.

CSM

MANEUVER

UPDATE FORMS

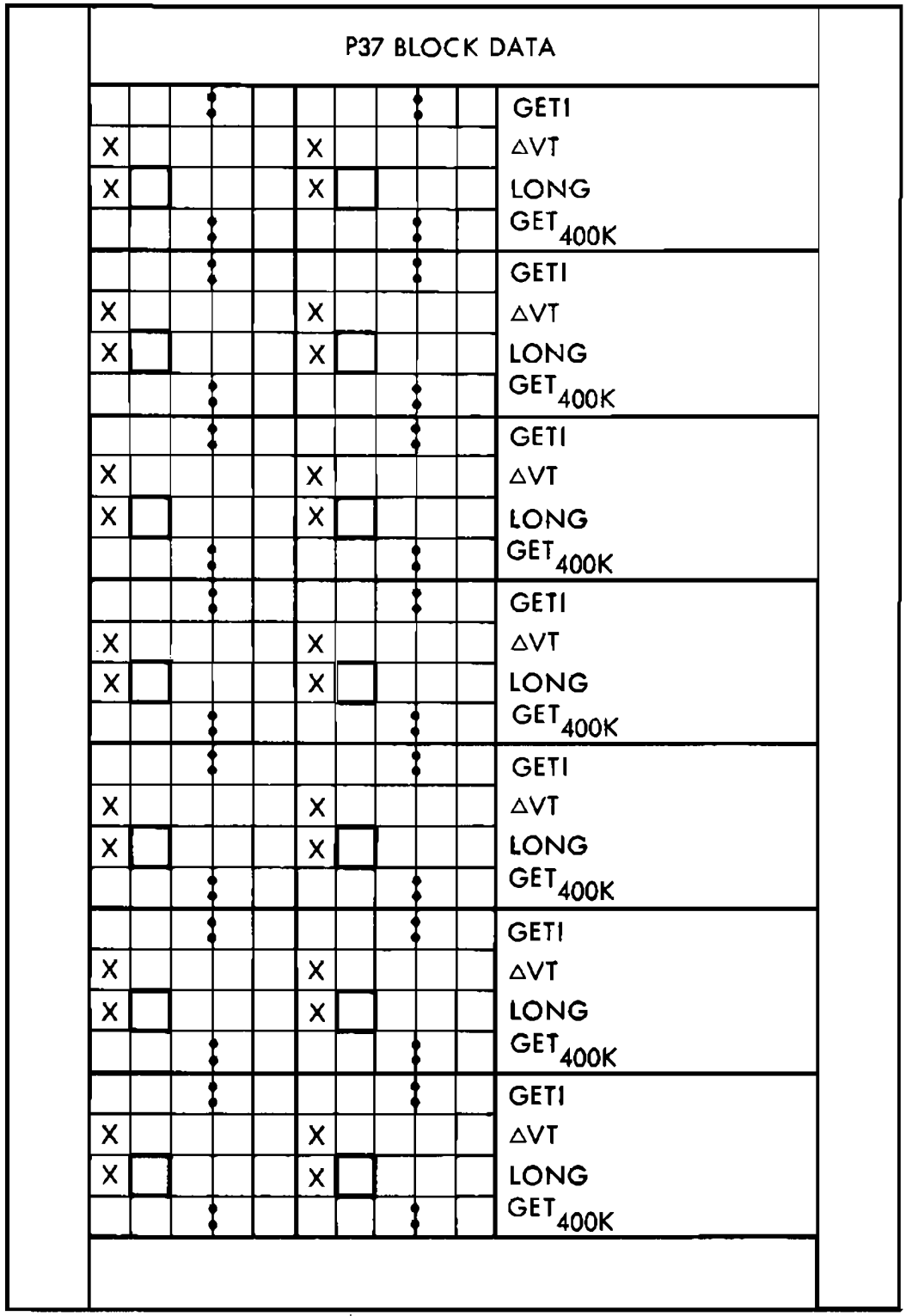
TLI

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
												ΔVC'
+						+						VI
X	X	X				X	X	X				R
X	X	X				X	X	X				P
X	X	X				X	X	X				Y

TLI 10 MIN ABORT P = __ __ __

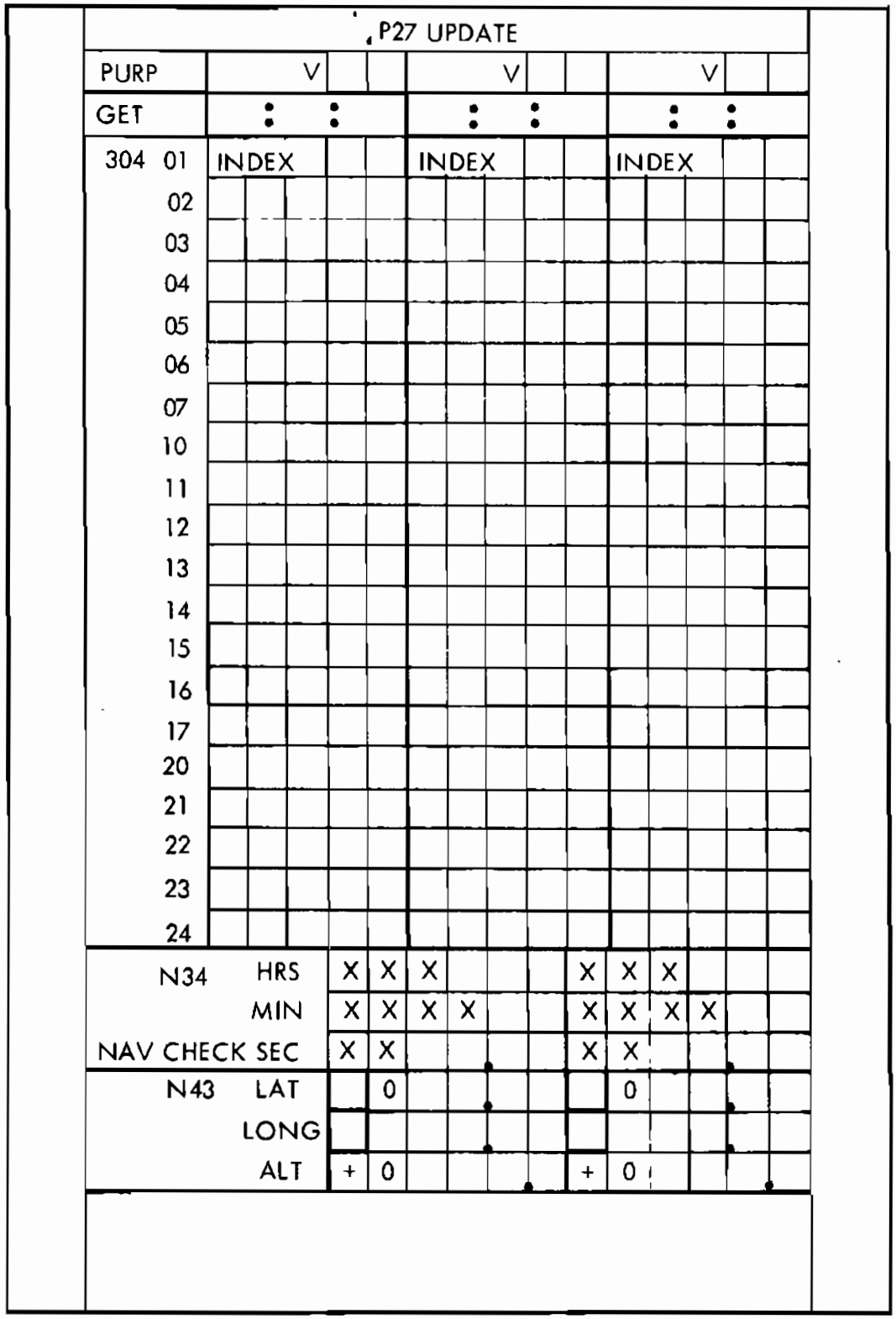
TLI PAD

TB 6p	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
P	XXX (DEG)	GIMBAL ANGLES AT TLI
Y	XXX (DEG)	IGNITION
BT	XX:XX (MIN:SEC)	DURATION OF TLI BURN
ΔVC'	XXXXX.X (fps)	NOMINAL TLI ΔV SET INTO EMS ΔV COUNTER
VI	+XXXXX (fps)	NOMINAL INERTIAL VELOCITY DISPLAYED ON DSKY AT TLI CUTOFF
R SEP	XXX (DEG)	PREDICTED SPACECRAFT IMU
P SEP	XXX (DEG)	GIMBAL ANGLES AT COMPLETION
Y SEP	XXX (DEG)	OF S-IVB MNVR TO CSM/S-IVB SEP ATTITUDE
P	XXX (DEG)	PITCH ANGLE FOR TLI + 10 MIN ABORT


P37 BLOCK DATA
GETI
ΔVT
LONG
GET400K
GETI
ΔVT
LONG
GET400K
GETI
ΔVT
LONG
GET400K
GETI
ΔVT
LONG
GET400K
GETI
ΔVT
LONG
GET400K
GETI
ΔVT
LONG
GET400K
GETI
ΔVT
LONG
GET400K
GETI
ΔVT
LONG
GET400K

P37 BLOCK DATA

GETI	XXX:XX	TIME OF IGNITION (HR. MIN.)
ΔVT	XXXX (FPS)	DELTA V REQUIRED AT GETI.
LONG	$\pm$ XXX (DEG)	LONGITUDE OF LANDING SITE
GET_{400K}	XXX:XX	TIME OF ENTRY INTERFACE


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

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

P30 MANEUVER

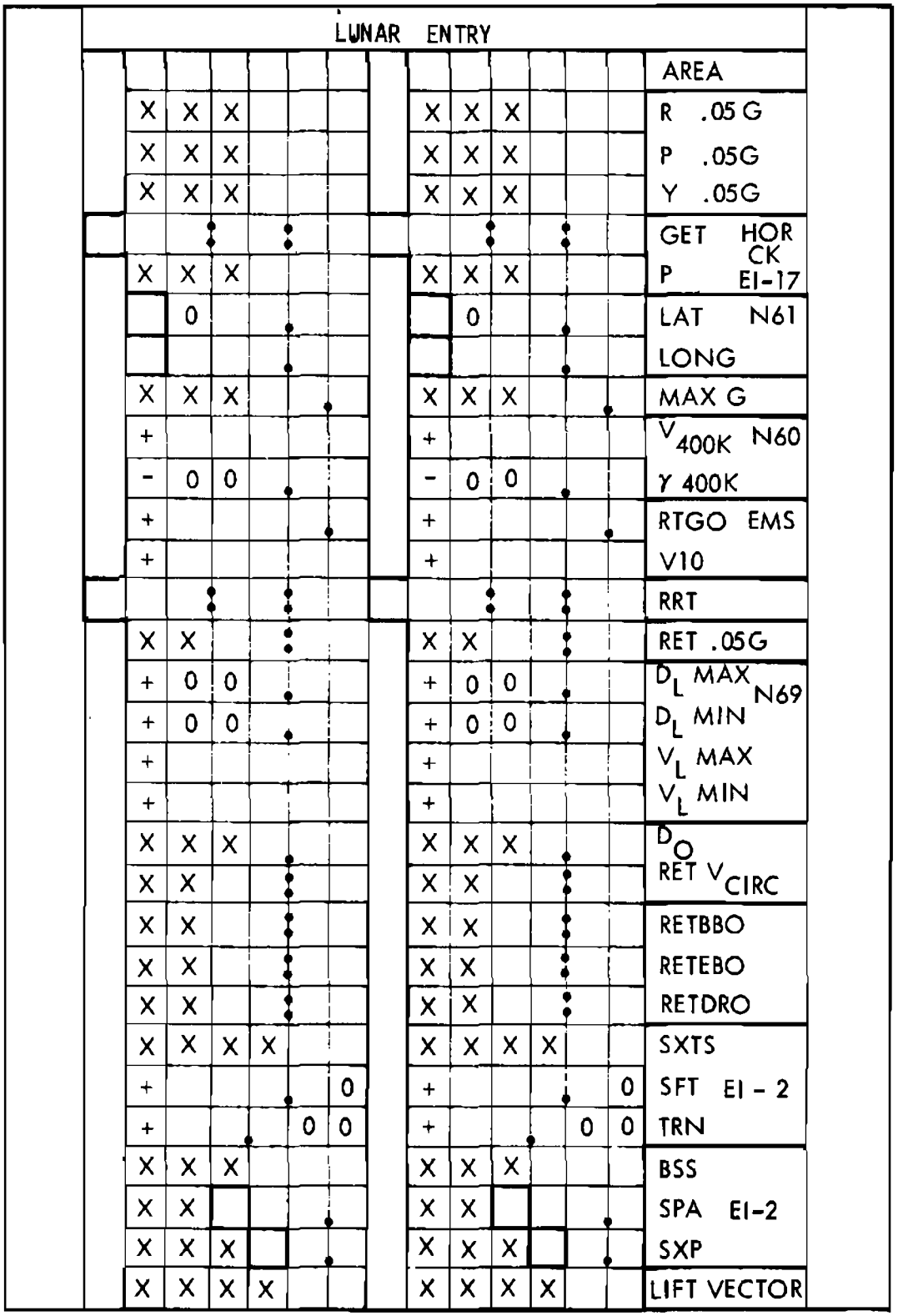
							PURPOSE	
SET STARS				/			PROP/GUID	
	+						WT	N47
R ALIGN ___ ___ ___		0	0				P_{TRIM}	N48
P ALIGN ___ ___ ___		0	0				Y_{TRIM}	
Y ALIGN ___ ___ ___	+	0	0				HRS	GET1
	+	0	0	0			MIN	N33
	+	0					SEC	
							ΔV_X	N81
ULLAGE _____							ΔV_Y	
_____							ΔV_Z	
_____								
_____	X	X	X				R	
	X	X	X				P	
	X	X	X				Y	
	+						H_A	N44
							H_P	
	+						ΔVT	
HORIZON/WINDOW ___	X	X	X				BT	
_____	X						ΔVC	
_____	X	X	X	X			SXTS	
_____	+					0	SFT	
	+				0	0	TRN	
	X	X	X				BSS	
	X	X					SPA	
	X	X	X				SXP	
		0					LAT	N61
OTHER _____							LONG	
_____	+						RTGO	EMS
_____	+						V10	
							GET	0.05G

P30 MANEUVER

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 THROUGH C.G.
Y TRIM	X.XX (DEG)	SPS YAW GIMBAL OFFSET TO PLACE THRUST THROUGH C.G.
GETI	XX:XX:XX (HRS:MIN:SEC)	TIME OF MNVR IGNITION
ΔVX ΔVY ΔVZ	XXXX.X (fps) XXXX.X (fps) XXXX.X (fps)	P30 VELOCITY TO BE GAINED COMPONENTS IN LOCAL VERTICAL COORDINATES
R P Y	XXX (DEG) XXX (DEG) XXX (DEG)	IMU GIMBAL ANGLES OF MANEUVER ATTITUDE
H_A	XXXX.X (nm)	PREDICTED APOGEE ALTITUDE AFTER MANEUVER
H_P	XXXX.X (nm)	PREDICTED PERIGEE ALTITUDE AFTER MANEUVER
ΔVT	XXXX.X	TOTAL VELOCITY OF MANEUVER
BT	X:XX (MIN:SEC)	MANEUVER DURATION
ΔVC	XXXX.X (fps)	PREMANEUVER ΔV SETTING IN EMS ΔV COUNTER
SXTS	XX (OCTAL)	SEXTANT STAR FOR MANEUVER ATTITUDE CK
SFT	XXX.X (DEG)	SEXTANT SHAFT SETTING FOR MANEUVER ATTITUDE CK
TRN	XX.X (DEG)	SEXTANT TRUNNION SETTING FOR MANEUVER ATTITUDE CK
BSS	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
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 USSAGE
HORIZON WINDOW		WINDOW MARKING AT WHICH HORIZON IS PLACED AT A SPECIFIED TIG (ATT CK)


LUNAR ENTRY
AREA
R .05 G
P .05G
Y .05G
GET HOR CK
P EI-17
LAT N61
LONG
MAX G
V_{400K} N60
γ 400K
RTGO EMS
V10
RRT
RET .05G
D_L MAX N69
D_L MIN
V_L MAX
V_L MIN
D_O
RET V_{CIRC}
RETBBO
RETEBO
RETDRO
SXTS
SFT EI - 2
TRN
BSS
SPA EI-2
SXP
LIFT VECTOR

LUNAR ENTRY PAD

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

VL MIN	+XXXXX (FPS)	MINIMUM ACCEPTABLE VALUE OF EXIT VELOCITY (FROM CMC)
DO	X.XX (G's)	PLANNED DRAG LEVEL DURING CONSTANT G
RET VCIRC	XX:XX (MIN:SEC)	TIME FROM EI THAT S/C VELOCITY BECOMES CIRCULAR
RETBBO	XX:XX (MIN:SEC)	TIME FROM EI TO THE BEGINNING OF BLACKOUT
RETEBO	XX:XX (MIN:SEC)	TIME FROM EI TO THE END OF BLACKOUT
RETDRO	XX:XX (MIN:SEC)	TIME FROM EI TO DROGUE DEPLOY
SXTS	XX (OCTAL)	SEXTANT STAR FOR ENTRY ATTITUDE CHECK
SFT	+XXX.X (DEG)	SEXTANT SHAFT SETTING FOR ENTRY ATTITUDE CHECK
TRN	+XX.X (DEG)	SEXTANT TRUNNION SETTING FOR ENTRY ATTITUDE CHECK
BSS	XXX (OCTAL)	BORESIGHT STAR FOR ENTRY ATTITUDE CHECK USING THE COAS
SPA	±XX.X (DEG)	BSS PITCH ANGLE ON COAS FOR ENTRY ATTITUDE CHECK
SXP	±X.X (DEG)	BSS X POSITION ON COAS FOR ENTRY ATTITUDE CHECK
LIFT VECTOR	XX (UP/DN)	LIFT VECTOR DESIRED AT .05G's BASED ON ENTRY CORRIDOR

EARTH ORBIT ENTRY UPDATE											
X						X					AREA
X	X	-				X	X	-			△ V TO
X	X	X				X	X	X			R .05G
X	X	X				X	X	X			P .05G
X	X	X				X	X	X			Y .05G
+						+					RTGO EMS
+						+					V10
X	X					X	X				RET .05G
	0						0				LAT N61
											LONG
X	X					X	X				RET 0.2G
											DRE (55°) N66
R	R					R	R				BANK AN
X	X					X	X				RET RB
X	X					X	X				RETBBO
X	X					X	X				RETEBO
X	X					X	X				RETDROG
X	X	X				X	X	X			(90°/fps) CHART
X	X					X	X				DRE (90°) UPDATE
POST BURN											
X	X	X				X	X	X			R.05G
+						+					RTGO EMS
+						+					V10
X	X					X	X				RET .05G
X	X					X	X				RET 0.2G
											DRE ±100 nm N66
R	R					R	R				BANK AN
X	X					X	X				RETRB
X	X					X	X				RETBBO
X	X					X	X				RETEBO
X	X					X	X				RETDROG +53 SEC TO MAIN

ENTRY UPDATE AND POSTBURN UPDATE

AREA	XXX-X	RECOVERY AREA FIRST 3 DIGITS - LANDING REVOLUTION LAST DIGIT - RECOVERY AREA AND SUPPORT CAPABILITIES
ΔV TO R,P,Y .05G	XXX (DEG)	ΔV DUE TO ENGINE TAILOFF
RTGO	XXXX.X (nm)	RANGE TO GO FROM .05G TO TARGET
VIO	XXXXX. (fps)	INERTIAL VELOCITY AT .05G
RET	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO .05G
LAT	±XX.XX (DEG)	LATITUDE OF LANDING TARGET POINT
LONG	±XXX.XX (DEG)	LONGITUDE OF LANDING TARGET POINT
RET .2G	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO .2G
DRE	±XXXXX. (nm)	DOWNRANGE ERROR AT .2G
BANK AN	XX/XX (DEG/DEG)	BACKUP BANK ANGLE FOR SCS ENTRY: ROLL RIGHT/ROLL LEFT
RETRB	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO REVERSE BACKUP BANK ANGLE
RETBBO	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO BEGINNING OF COMMUNICATIONS BLACKOUT
RETEBO	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO END OF COMMUNICATIONS BLACKOUT
RETDROG	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO DROGUE CHUTE DEPLOYMENT

ENTRY UPDATE AND POSTBURN UPDATE (cont'd)

RET MAIN	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO MAIN CHUTE DEPLOYMENT
CHART UPDATE		
90^{o}/FPS	+XX	VALUES USED TO RE-PLOT BACKUP ENTRY CHART - ΔV AND DRE @ 90^{o} BANK ANGLE
DRE (90^{o})	$\pm$XXX	
POST BURN UPDATE		
P .05G	XXX	PITCH ANGLE AT ENTRY INTERFACE
RTGO	+XXXX.X	RANGE TO GO FROM .05G TO TGT.
VIO	+XXXXX	INERTIAL VELOCITY AT 0.05G
RET(.05G)	XX:XX	TIME FROM RETROFIRE TO .05G
RET(.2G)		TIME FROM RETROFIRE TO 0.2G
DRE($\pm$100nm)		DOWNRANGE ERROR (N66)
BANK AN	XX/XX (DEG/DEG)	BACKUP BANK ANGLE FOR SCS ENTRY: ROLL RIGHT/ROLL LEFT
RETRB	CC:CC (MIN:SEC)	TIME FROM RETROFIRE TO REVERSE BACKUP BANK ANGLE
RETBBO	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO BEGINNING OF COMMUNICATIONS BLACKOUT
RETEBO	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO END OF COMMUNICATIONS BLACKOUT
RETDROG	XX:XX (MIN:SEC)	TIME FROM RETROFIRE TO DROGUE CHUTE DEPLOYMENT

EARTH ORBIT BLOCK DATA

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

REMARKS:

BLOCK DATA

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

EXTERNAL DV PADS

CSM SEP PAD

33	00		000		0	
81	+	0000.0	+	0000.0	-	0002.5
22	XXX				XXX	

CSM BACKUP INSERTION PAD INITIAL

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

CSM BACKUP INSERTION PAD UPDATE

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

NOMINAL LM IGNITION TIMES

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

RESCUE TWO PAD

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

CANNED RESCUE TWO PADS FOR:

1. PARTIAL PHASING (0 - 40)
2. PARTIAL PHASING (40 - NOM)
3. PARTIAL INSERTION

ARE INCLUDED ON RESCUE CHECKLISTS

CSM RENDEZVOUS RESCUE PADS

CSI ONE

11	00	000	0	
81				
N				

CSI TWO

11	00	000	0	
81				
N				

CDH

13	00	000	0	
81				

TPI

37	00	000	0	
81				
59				
LOS BT	XX	XX	XX	

EXTERNAL ΔV PADS

CSM SEP

33	GETI	XXX:XX:XX	TIME OF IGNITION OF SEP (HR.MIN.SEC.)
81	DELTA VX DELTA VY DELTA VZ	XX.X (FPS) XX.X (FPS) XX.X (FPS)	LOCAL VERTICAL COMPONENTS OF VELOCITY
22	R P Y	XXX. (DEG) XXX (DEG) XXX (DEG)	NEW ICDU ANGLES AT SEPARATION

CSM BACKUP INSERTION PAD (INITIAL UPDATE) AND RESCUE TWO PAD

47	WEIGHT	XXXXX	CSM WEIGHT AT IGNITION
48	TRIM ANGLES	XX.X XX.X	SPS P,Y TRIM ANGLES AT IGNITION
33	GETI	XX:XX:XX	TIME OF IGNITION (HR.MIN.SEC.)
81	SAME AS ABOVE		
22	SAME AS ABOVE		
ΔV_C		XX.X (FPS)	VELOCITY TO BE SET IN EMS COUNTER
11	GETI	XXX:XX:XX	TIME OF IGNITION OF CSI (HR.MIN.SEC.)
37	GETI	XXX:XX:XX	TIME OF IGNITION OF TPI (HR.MIN.SEC.)
N		XX	NUMBER OF HALF-REVOLUTIONS BETWEEN CSI & CDH

NOMINAL LM IGNITION TIMES

CSI 11	XXX:XX:XX	CSI IGNITION TIME
PC 33	XXX:XX:XX	PLANE CHANGE IGNITION TIME
TPI 37	XXX:XX:XX	TPI IGNITION TIME

CSM RENDEZVOUS RESCUE PADS

CSI ONE AND TWO

11	GETI	XX:XX:XX	TIME OF IGNITION OF CSI (HR.MIN.SEC)
81	DELTA VX DELTA VY DELTA VZ	XX.X (FPS) XX.X (FPS) XX.X (FPS)	LOCAL VERTICAL COMPONENTS OF VELOCITY
N		XX	NUMBER OF HALF-REVOLUTIONS BETWEEN CSI AND CDH

CDH

13	GETI	XX:XX:XX	TIME OF IGNITION OF CDH (HR.MIN.SEC)
81	DELTA VX DELTA VY DELTA VZ	XX.X (FPS) XX.X (FPS) XX.X (FPS)	LOCAL VERTICAL COMPONENTS OF VELOCITY

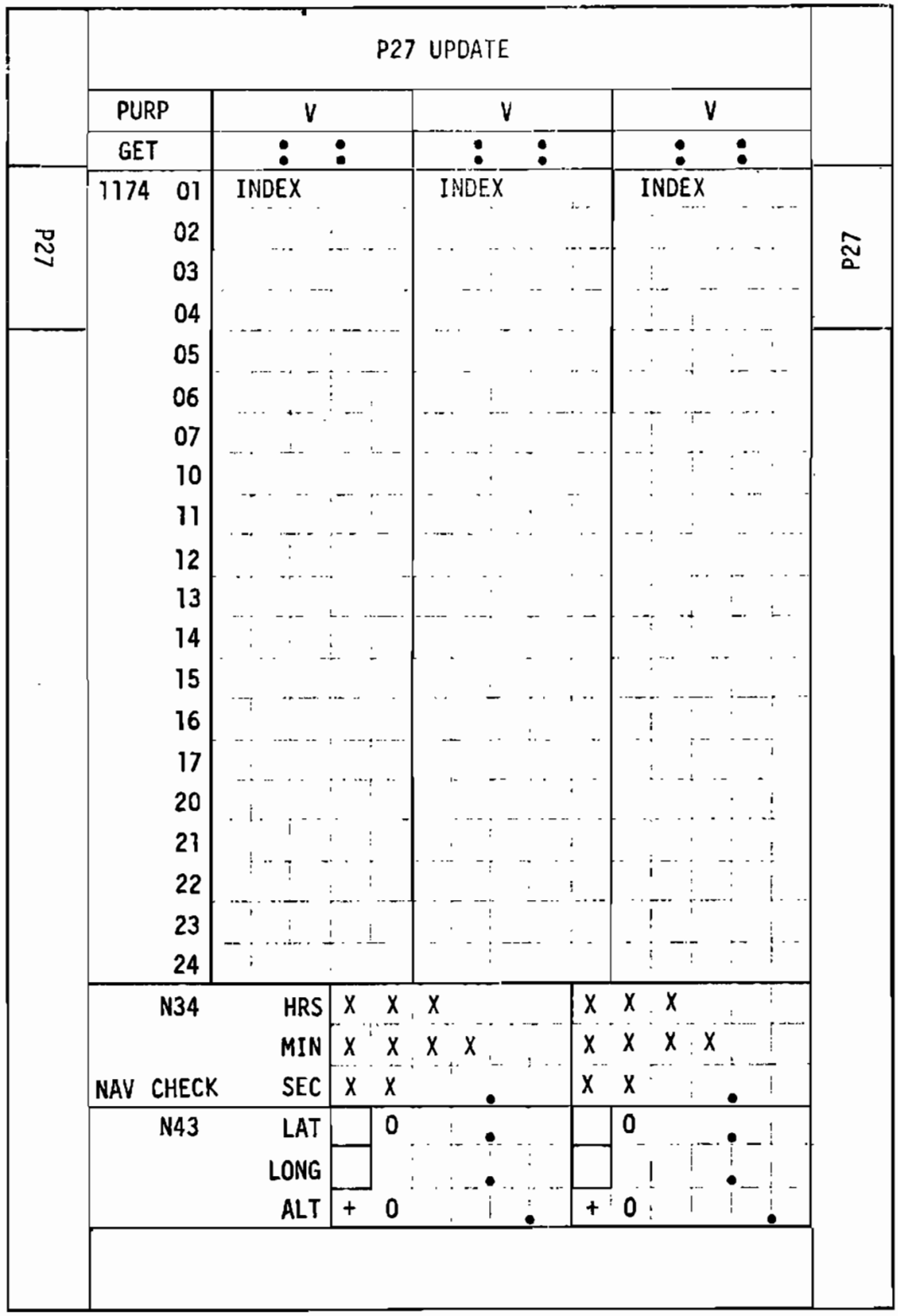
TPI

37	GETI	XX:XX:XX	TIME OF IGNITION OF TPI (HR.MIN.SEC.)
81	DELTA VX DELTA VY DELTA VZ	XX.X (FPS) XX.X (FPS) XX.X (FPS)	LOCAL VERTICAL COMPONENTS OF VELOCITY
59	DELTA V LOS 1 DELTA V LOS 2 DELTA V LOS 3	XX.X (FPS) XX.X (FPS) XX.X (FPS)	DELTA V LINE OF SIGHT COMPONENTS
LOS BT		X:XX X:XX X:XX	BURN TIME FOR LOS ΔV COMPONENTS

LM

MANEUVER

UPDATE FORMS


P27 UPDATE
PURP
V
V
V
GET
1174 01
INDEX
INDEX
INDEX
02
03
04
05
06
07
10
11
12
13
14
15
16
17
20
21
22
23
24
P27
P27
N34
HRS
MIN
SEC
NAV CHECK
X X X
X X X X
X X
N43
LAT
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

AGS STATE VECTOR UPDATE

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

REMARKS:

AGS SV

AGS SV

AGS STATE VECTOR UPDATE

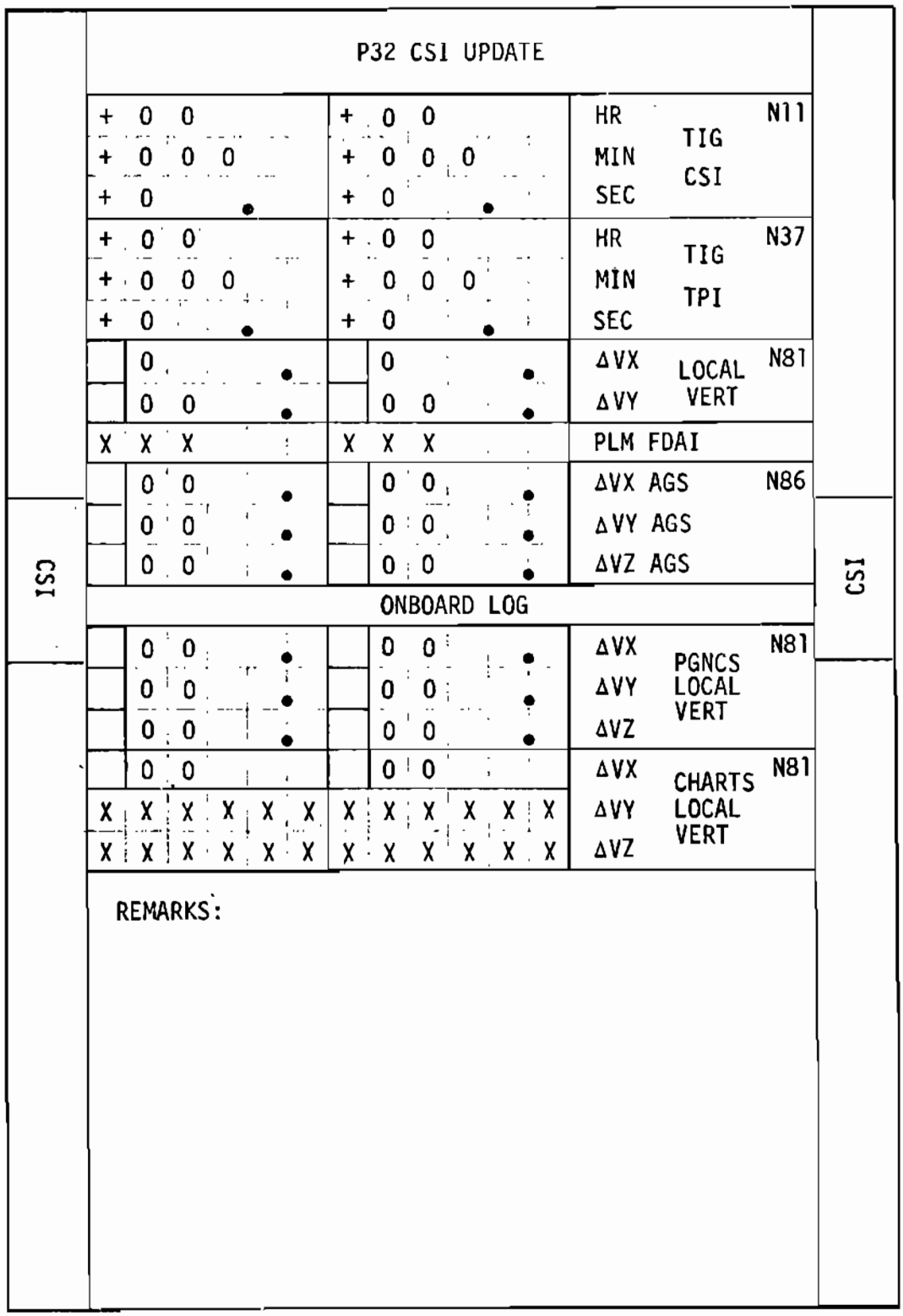
PURP		PURPOSE FOR AGS STATE VECTOR UPDATE
240	XXXXX	LM STATEVECTOR-POSITION COMPONENTS
241	XXXXX	
242	XXXXX	
260	XXXXX	LM STATE VECTOR-VELOCITY COMPONENTS
261	XXXXX	
262	XXXXX	
254	XXXXX	LM TIME FOR WHICH THE STATE VECTOR IS ACCURATE
244	XXXXX	CSM STATE VECTOR-POSITION COMPONENTS
245	XXXXX	
246	XXXXX	
264	XXXXX	CSM STATE VECTOR-VELOCITY COMPONENTS
265	XXXXX	
266		
272	XXXXX	CSM TIME FOR WHICH THE STATE VECTOR IS ACCURATE

P30 LM MANEUVER												
												PURPOSE
+	0	0				+	0	0				HR N33
+	0	0	0			+	0	0	0			MIN TIG
+	0					+	0					SEC
												ΔVX N81
												ΔVY LOCAL
												ΔVZ VERT
+						+						ΔVR
X	X	X				X	X	X				BT
X	X	X				X	X	X				R FDAI
X	X	X				X	X	X				P INER
												ΔVX AGS N86
												ΔVY AGS
												ΔVZ AGS
X	X	X				X	X	X				COAS
X	X					X	X					AZ
X	X					X	X					EL

REMARKS:

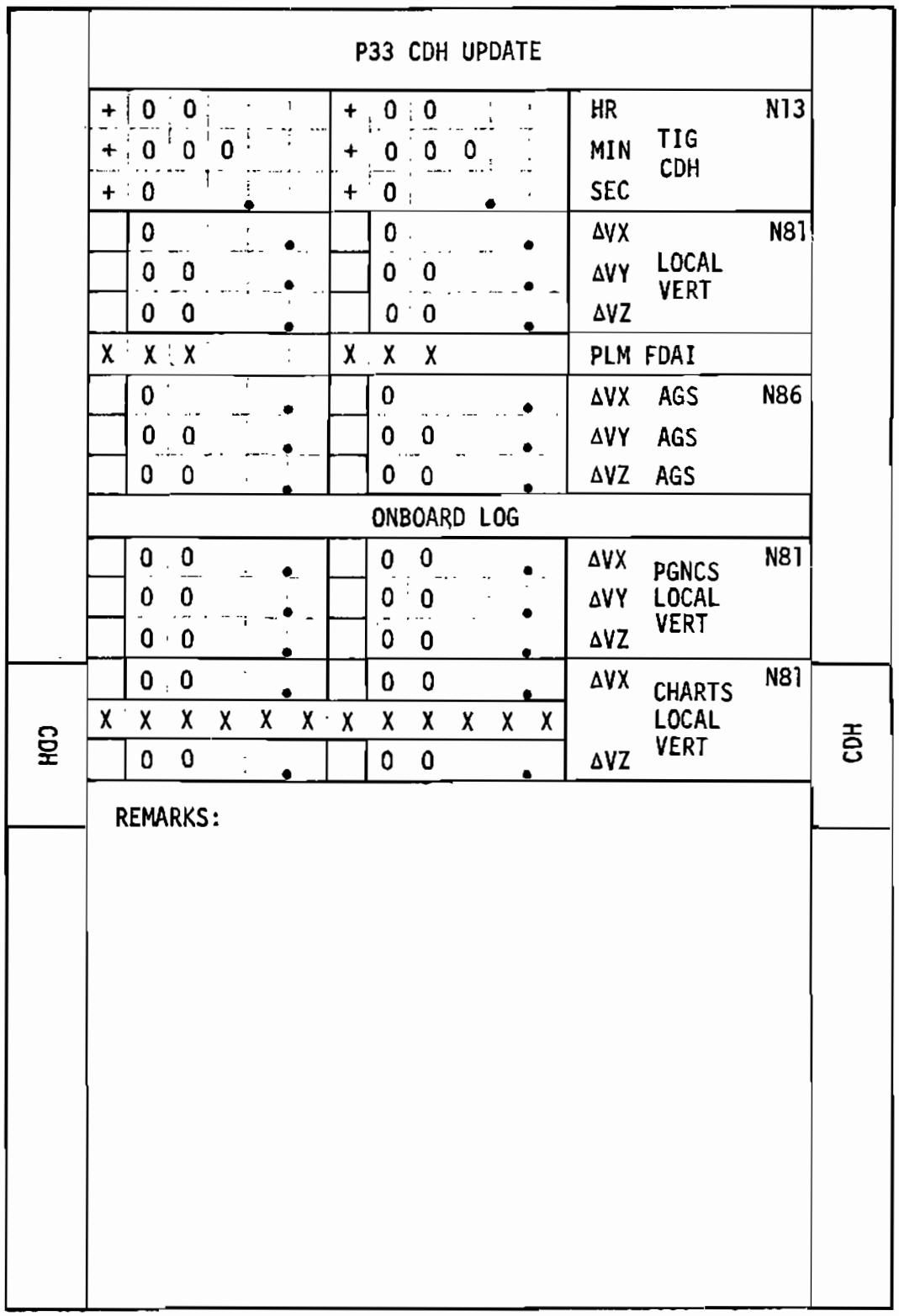
LM MANEUVER UPDATE

PURPOSE		PURPOSE OF MANEUVER (SUCH AS DOCKED DPS, PHASING, INSERTION)
TIG		IGNITION TIME FOR THE MANEUVER
HR	XXX	
MIN	XX	
SEC	XX.XX	
LOCAL VERT		
ΔVX	±XXXX.X(fps)	LOCAL VERTICAL ΔV COMPONENTS OF THE MANEUVER
ΔVY	±XXXX.X(fps)	
ΔVZ	±XXXX.X(fps)	
ΔVR	XXXX.X(fps)	TOTAL ΔV REQUIRED FOR THE MANEUVER
BT	X:XX	BURN DURATION
FDAI INER		
R	XXX (DEG)	INERTIAL FDAI ANGLES AT THE BURN ATTITUDE
P	XXX (DEG)	
ΔVX AGS	±XXXX.X(fps)	LOCAL VERTICAL ΔV COMPONENTS OF THE MANEUVER USED TO TARGET THE AGS; ROTATED THROUGH THE HALF-ANGLE OF THE BURN
ΔVY AGS	±XXXX.X(fps)	
ΔVZ AGS	±XXXX.X(fps	
COAS	XX(OCTAL)	IDENTIFIER FOR COAS STAR USED TO VERIFY SPACECRAFT ATTITUDE AT THE BURN ATTITUDE
AZ	XXX (DEG)	THE AZIMUTH AND ELEVATION ANGLES OF THE COAS STAR
EL	XXX (DEG)	


P32 CSI UPDATE
+ 0 0
+ 0 0 0
+ 0
+ 0 0
+ 0 0 0
+ 0
HR
MIN
SEC
TIG
CSI
N11
+ 0 0
+ 0 0 0
+ 0
+ 0 0
+ 0 0 0
+ 0
HR
MIN
SEC
TIG
TPI
N37
0
0 0
0
0 0
ΔVX
ΔVY
LOCAL
VERT
N81
X X X
X X X
PLM FDAI
0 0
0 0
0 0
0 0
0 0
0 0
ΔVX AGS
ΔVY AGS
ΔVZ AGS
N86
ISC
CSI
ONBOARD LOG
0 0
0 0
0 0
0 0
0 0
0 0
ΔVX
ΔVY
ΔVZ
PGNCS
LOCAL
VERT
N81
0 0
0 0
ΔVX
ΔVY
ΔVZ
CHARTS
LOCAL
VERT
N81
X X X X X X
X X X X X X
X X X X X X
X X X X X X
REMARKS:

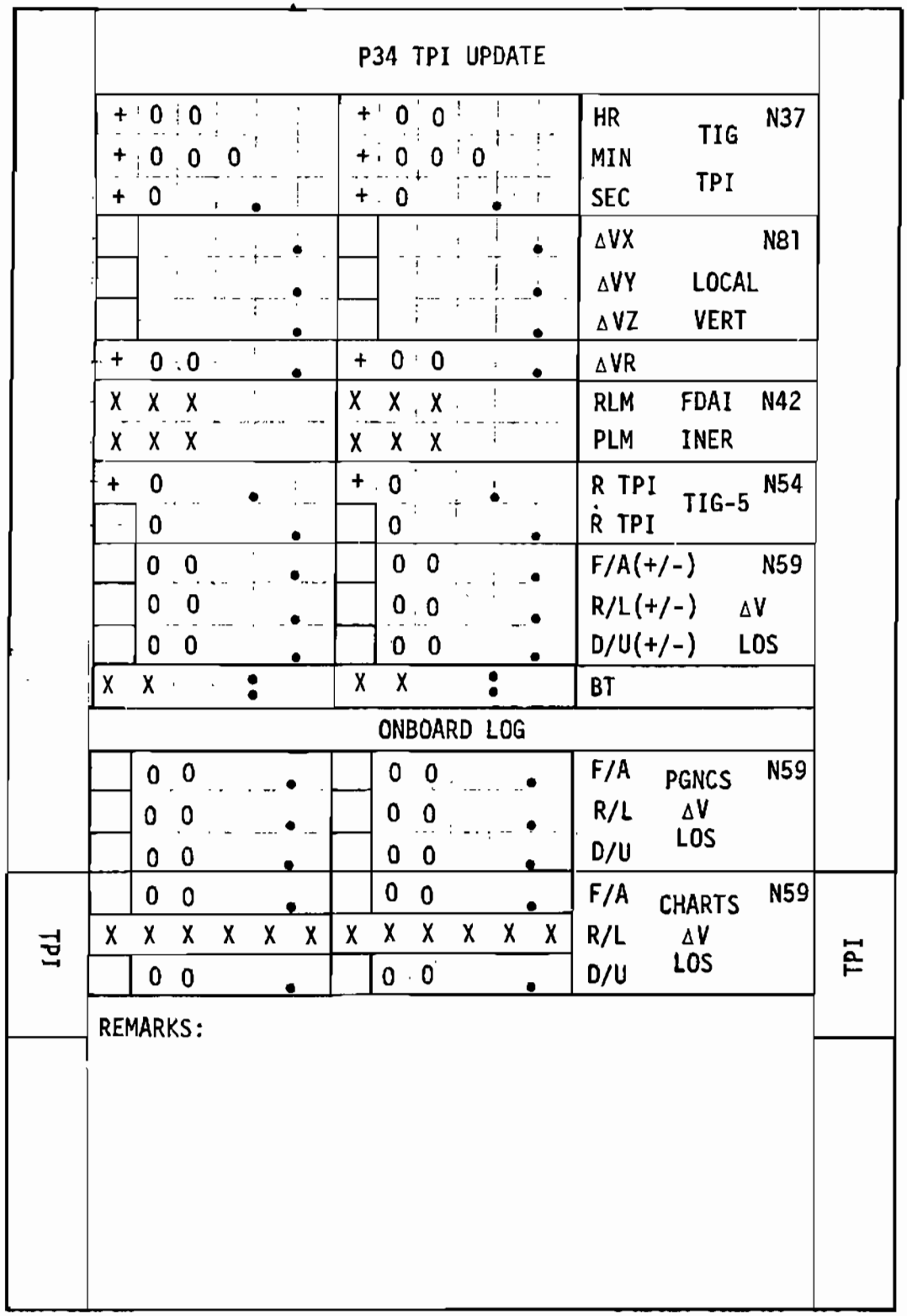
CSI UPDATE

TIG CSI		IGNITION TIME FOR THE CSI MANEUVER
HR	XXX	
MIN	XX	
SEC	XX.XX	
TIG TPI		IGNITION TIME FOR THE TPI MANEUVER
HR	XXX	
MIN	XX	
SEC	XX.XX	
LOCAL VERT		
ΔVX	±XX.X (fps)	LOCAL VERTICAL ΔV COMPONENTS OF THE CSI MANEUVER
ΔVY	±XX.X (fps)	
PLM FDAI	XXX (DEG)	LM FDAI INERTIAL PITCH ANGLE AT CSI BURN ATTITUDE
ΔVX AGS	±XX.X (fps)	LOCAL VERTICAL ΔV COMPONENTS OF CSI USED TO TARGET AGS EXT ΔV; ROTATED THROUGH THE HALF-ANGLE OF THE BURN
ΔVY AGS	±XX.X (fps)	
ΔVZ AGS	±XX.X (fps)	
	ON BOARD LOGS	
ΔVX PGNCS	±XX.X	
ΔVY LOCAL	±XX.X	
ΔVZ VERTICAL	±XX.X	
ΔVX CHARTS	±XX.X	
ΔVY LOCAL	±XX.X	
ΔVZ VERTICAL	±XX.X	


P33 CDH UPDATE
+ 0 0
+ 0 0 0
+ 0
+ 0 0
+ 0 0 0
+ 0
HR
MIN
SEC
TIG
CDH
N13
0
0 0
0 0
0
0 0
0 0
ΔVX
ΔVY
ΔVZ
LOCAL
VERT
N81
X X X
X X X
PLM FDAI
0
0 0
0 0
0
0 0
0 0
ΔVX AGS
ΔVY AGS
ΔVZ AGS
N86
ONBOARD LOG
0 0
0 0
0 0
0 0
0 0
0 0
ΔVX
ΔVY
ΔVZ
PGNCS
LOCAL
VERT
N81
0 0
0 0
ΔVX
ΔVZ
CHARTS
LOCAL
VERT
N81
X X X X X X X X X X X X
0 0
0 0
CDH
CDH
REMARKS:

CDH UPDATE

TIG CDH		IGNITION TIME FOR THE CDH MANEUVER
HR	XXX	
MIN	XX	
SEC	XX.XX	
LOCAL VERT		
ΔVX	±XX.X (fps)	LOCAL VERTICAL ΔV COMPONENTS OF THE CDH MANEUVER
ΔVY	±XX.X (fps)	
ΔVZ	±XX.X (fps)	
PLM FDAI	XXX (DEG)	LM FDAI INERTIAL PITCH ANGLE AT CDH BURN ATTITUDE
ΔVX AGS	±XX.X (fps)	LOCAL VERTICAL ΔV COMPONENTS OF CDH USED TO TARGET AGS EXT ΔV; ROTATED THROUGH THE HALF-ANGLE OF THE BURN
ΔVY AGS	±XX.X (fps)	
ΔVZ AGS	±XX.X (fps)	
	ONBOARD LOG	
ΔVX PGNCS	±XX.X (fps)	
ΔVY LOCAL	±XX.X (fps)	
ΔVZ VERTICAL	±XX.X (fps)	
ΔVX CHARTS	±XX.X (fps)	
LOCAL ΔVZ VERTICAL	±XX.X (fps)	


P34 TPI UPDATE
+ 0 0
+ 0 0 0
+ 0
+ 0 0
+ 0 0 0
+ 0
HR
MIN
SEC
TIG
TPI
N37
ΔVX
ΔVY
ΔVZ
LOCAL
VERT
N81
+ 0 0
+ 0 0
ΔVR
X X X
X X X
X X X
X X X
RLM
PLM
FDAI
INER
N42
+ 0
0
+ 0
0
R TPI
R TPI
TIG-5
N54
0 0
0 0
0 0
0 0
0 0
0 0
F/A(+/-)
R/L(+/-)
D/U(+/-)
ΔV
LOS
N59
X X
X X
BT
ONBOARD LOG
0 0
0 0
0 0
0 0
0 0
0 0
F/A
R/L
D/U
PGNCS
ΔV
LOS
N59
0 0
0 0
X X X X X X
X X X X X X
0 0
0 0
F/A
R/L
D/U
CHARTS
ΔV
LOS
N59
TPI
TPI
REMARKS:

TPI UPDATE

TIG TPI		IGNITION TIME FOR THE TPI MANEUVER
HR	XXX	
MIN	XX	
SEC	XX.XX	
LOCAL VERT		
ΔVX	±XX.X (fps)	LOCAL VERTICAL ΔV COMPONENTS OF THE TPI MANEUVER
ΔVY	±XX.X (fps)	
ΔVZ	±XX.X (fps)	
FDAI INER		
R LM	XXX (DEG)	LM FDAI ROLL & PITCH ANGLE AT TPI BURN ATTITUDE
P LM	XXX (DEG)	
R TPI	XX.XX (ft)	RANGE AT TPI TIG -5 MIN
R TPI	±XXX.X (fps)	RANGE RATE AT TPI TIG -5 MIN
ΔV LOS		
F/A	F/AXX.X(fps)	LINE-OF-SIGHT ΔV COMPONENTS OF THE TPI MANEUVER
L/R	L/RXX.X(fps)	
U/D	U/DXX.X(fps)	
BT	XX:XX	DURATION OF THE MANEUVER (MINUTES, SECONDS)
	ONBOARD LOGS	
F/A PGNCS	±XX.X (fps)	
L/R ΔV	±XX.X (fps)	
U/D LOS	±XX.X (fps)	
F/A CHARTS	±XX.X (fps)	
L/R ΔV	±XX.X (fps)	
U/D LOS	±XX.X (fps)	

P76

P76 UPDATE PAD

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

P76

P76 PAD

33	GETI	XX:XX:XX	TIME OF IGNITION (HR.MIN. SEC)
84	DELTA VX(O VEH)	XX.X (FPS)	COMPONENTS OF ΔV APPLIED ALONG LOCAL VERTICAL AXIS AT TIG
	DELTA VY(O VEH)	XX.X (FPS)	
	DELTA VZ(O VEH)	XX.X (FPS)	

SECTION 3 - DETAILED TIMELINE

FLIGHT PLAN

TIME	EVENT	REMARKS
-00:09	LCC: REPORT IGNITION	FIRST OPPORTUNITY LIFT-OFF MAY 18, 1248 EDT, 72° LA, TARGETED FOR LANDING SITE 2. LIFT-OFF: 1648 GMT 1148 EST 1148 CDT 1048 CST
00:00	LCC: CDR: REPORT LIFT-OFF	
00:02	CDR: REPORT YAW MNVR	
00:11	CDR: REPORT ROLL AND PITCH PROGRAM INITIATE	
00:30	CDR: REPORT ROLL COMPLETE	
00:42	MCC: REPORT MARK MODE IB	PROP DUMP TO RCS CMD
00:50	LMP: REPORT CABIN PRESS DECREASING	ALTITUDE 14,000 ft
01:17	MAX Q	
01:56	MCC: REPORT MARK MODE IC	ALTITUDE 100,000 ft
02:00	MCC: CDR: REPORT GO/NO GO FOR STAGING	
02:16	CDR: REPORT INBOARD OUT	
02:40	CDR: REPORT OUTBOARD OUT	
02:41	CDR: REPORT STAGING	
03:11	CDR: REPORT S-II SEP LIGHT OUT	
03:16	CDR: REPORT TWR JETT AND MODE II	
03:21	CDR: REPORT GUIDANCE	
03:53	MCC: REPORT TRAJECTORY AND GUIDANCE GO/NO GO	

FLIGHT PLAN

TIME	EVENT	REMARKS
04:00	CMP: REPORT S/C GO/NO GO	
05:00	LMP: REPORT S/C GO/NO GO	
05:50	MCC: REPORT S-IVB TO ORBIT CAPABILITY	
06:00	CDR: REPORT S/C GO/NO GO	
07 00	CDR: REPORT S/C GO/NO GO	
08:00	CDR: REPORT S/C GO/NO GO	
08:30	MCC: CDR: REPORT GO/NO GO FOR STAGING	
08:37	MCC: REPORT MODE IV	
09:00	CDR: REPORT S/C GO/NO GO	
	MCC: REPORT TRAJECTORY AND GUIDANCE GO/NO GO	
10:00	MCC: CDR: REPORT GO/NO GO FOR ORBIT	
	MCC: REPORT PREDICTED SECO	
11:43	CDR: REPORT SECO $TB_5 = 0$	IMU GIMBAL ANGLES @ INSERTION R 180° P 350° Y 0°
	S-IVB MAINTAINS COMMANDED CUTOFF INERTIAL ATTITUDE	H pad 103.3 NM

MISSON	F	EDITION	FINAL	DATE	APRIL 17, 1969	PAGE	3-2

FLIGHT PLAN

TIME	EVENT	REMARKS
SECO +10 SEC	MCC: REPORT ORBITAL GO/NO GO	INSERTION
SECO +20 SEC	S-IVB MANEUVERS TO LH AND ITITIATES ORB RATE (HEADS DOWN)	
	INSERTION CHECKLIST	
SECO +59 SEC	S-IVB INITIATES CONTINUOUS LH_2 VENTING (TERMINATES AT TB_6 + 42.2 SEC)	
12:41	BDA LOS	
16:28	CYI AOS	
	MCC UPDATE: GO FOR DSE REWIND	
23:35	CYI LOS	
	POST INSERTION ECS CONFIGURATION	

FLIGHT PLAN

TIME	EVENT	REMARKS
		CONFIGURE CAMERA FOR T & D AND S-IVB PHOTO
		CM/SEQ/18/CEX-BRKT(RH WIN)
		MIR (f11,250.∞)12 fps, 7 MIN)
32:00	S/C SUNSET	CM/EL/80/CEX-SPOT (5,250,focus)20
36:30	TAN AOS	
	MCC UPDATE: ΔAZ CORRECTION	
42:32	TAN LOS	
	CDR INSTALL COAS	
	CMP JETTISON OPTICS COVERS	
	P52 IMU REALIGN (Option 3-REFSMMAT)	REALIGNS to PAD ORIENTATION
52:11	CRO AOS	

MCC-H

NOTES

FLIGHT PLAN

01:00	HSK	USB TWO-WAY VOICE CHECK		
:10	HTV			
:20				
:30	GYM	SCS ATT REFERENCE CHECKS		
		EXTEND DOCKING PROBE		
:40	US	P27 UPDATE	UPDATE STATE VECTOR TLI PAD TLI ABORT PAD(TLI+1:30) P37 PAD (TLI+4) GO/NO GO FOR PYRO ARM	AS A GENERAL RULE, MSFN WILL ALWAYS UPLINK THE STATE VECTOR TO THE CSM SLOT AND TRANSFER IT VIA V66 TO THE LM SLOT IN THE CMC
:50	CYI	INITIATE TLI PREPARATION		
02:00				

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	01:00 - 02:00	1/1-2	3-5

FLIGHT PLANNING BRANCH

MCC-H

NOTES

FLIGHT PLAN

02:00

DON HELMETS AND GLOVES - ALL

:10

TAN

:20

UPDATE
GO/NO GO TLI

2:23:48 TB_6 (TIG - 9m 38 sec)

CRO

:30

2:33:26 S-IVB TLI — BT: 5m 22 sec
ΔV: 10,058 fps

TB_7=0 @ S-IVB C/O

TB_7+20 sec S-IVB MNVRS TO LH ATT (HDS DN)

V66 TRANSFER CSM SV TO LM SLOT

:40

APOLLO 10: POST BURN REPORT

CMP TO LH COUCH, CDR TO CENTER COUCH

UNSTOW TV (A7)

2:54 S-IVB MNVRS TO R 180° WRT LH @ 1°/SEC
P 120°
Y 040°

MSFN

:50

INERTIAL ATT @ SEP
R 358°
P 151°
Y 040°

S-IVB GOES INERTIAL

03:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL REV A	APRIL 17, 1969	02:00 - 03:00	1/TLC	3-6

FLIGHT PLA[illegible] BRANCH

MCC

NOTES

FLIGHT PLAN

UPDATE
GO NO/GO FOR
PYRO ARM AND
T & D

UPDATE
SPS EVASIVE
MNVR PAD

03:00

:10

:20

:30

:40

:50

04:00

MSFN

~ 03:00 CSM/S-IVB SEP

DOCKING PHOTOGRAPHY

TV(GDS): 3:00 - 3:15 HGA to WIDE P -53° Y 39°

~ 3:10 DOCKING (PG 4-11)

TERMINATE CABIN PURGE AND BEGIN
CSM/LM CABIN PRESSURE EQUALIZATION

CONFIGURE FOR LM EJECTION

TUNNEL PRESSURE INTEGRITY CHECK
REMOVE AND TEMPORARILY STOW FWD HATCH
CHECK DOCKING LATCHES
VENT DOCKING PROBE
CONNECT UMBILICALS
REINSTALL HATCH
TUNL VENT VALVE - LM/CM ΔP
REINITIATE CABIN PURGE FOR 8 HOURS

CONFIGURE CAMERA FOR LM EJECTION
16/18/CEX-BRKT (RH WIN) MIR
(f8,250,∞) 12 fps, 4 MIN

OBTAIN RADIATION METER from G&N SIG COND PANEL, LEB

APOLLO 10: REPORT RADIATION DOSIMETER READING AND GET_____

RESTOW METER AFTER USE

T&D MNVR - P47 MONITOR

PLUS X 0.8 FPS
COAST 35 SEC
MINUS X TO 0.3 FPS
PITCH UP 180° @ 2.0/SEC
ROLL LEFT 60° @ 0.5°/SEC
PLUS X TO NULL RELATIVE VELOCITIES

DOCK ATT R 302°
P 331°
Y 320°

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	03:00 - 04:00	1/TLC	3-7

REV A FLIGHT PLANNING BRANCH

MCC-H

FLIGHT PLAN

NOTES

04:00

UPDATE
GO/NO GO
PYRO ARM
AND LM EJECTION

:10

:20

:30

:40

:50

05:00

MSFN

INERT ATT
R 302°
P 331°
Y 320°

4:09 LM EJECTION (SPRING EJECTION AND -X RCS 3 sec 5 sec AFTER EJECTION
P30 EXTERNAL ΔV AND DAP DATA CHECK
P40 SPS THRUST

NOTE: FIRST SPS BURN WILL ALWAYS START ON BANK A AND THE SECOND BANK WILL BE ACTIVATED IF THE BURN IS >5 SEC.

4:39 CSM/LM SPS EVASIVE MNVR

NO ULLAGE
BT: 2.8 SEC
ΔV: 19.7 FPS
IN PLANE

PITCH DOWN 75° wrt LH

V66 TRANSFER CSM SV TO LM SLOT

APOLLO 10: POST BURN REPORT

INITIATE BATT A CHARGE

DOFF SUITS - ALL

4:49 S-IVB SLINGSHOT MNVR

MNVR R 002°
P 294°
Y 000°

(Places optics LOS toward earth)

BURN STATUS REPORT

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

REMARKS:

NOTE

WITH R/T TLM, ONLY ITEMS NORMALLY REQUIRED IN BURN STATUS REPORT ARE ΔV_c, FUEL, OX, AND UNBAL

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	04:00-05:00	1/TLC	3-8

REV A FLIGHT PLANNING BRANCH

MCC-H

FLIGHT PLAN

NOTES

UPDATE
P37 PAD (TLI +11)
ZERO TRN BIAS

05:00

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

20,000 NM from EARTH
6h 33m to MCC$_1$

P52 OPT ___
N71: ___, ___
N05: ___ ___.___
N93:
X ___.___ ___
Y ___.___ ___
Z ___.___ ___

P27 UPDATE (ZERO TRN BIAS)

:30

P23 CISLUNAR NAVIGATION-STAR/EARTH HORIZON
(3 MARKS EACH SET)
SET 1: ALTAIR(40)N
SET 2: ALTAIR(40)N
SET 3: ANTARES(33)F
SET 4: ANTARES(33)F
SET 5: PEACOCK(42)N

EH EARTH HORIZON
FH FAR HORIZON
NH NEAR HORIZON

INCORP P23 MARK DATA AND UPDATE ONBOARD STATE VECTOR

M S F N

06:00

PTC NOT ESTABLISHED
UNTIL GET 12:00.

:30

DEACTIVATE PRIMARY EVAPORATOR
GLY EVAP H2O FLOW - OFF
GLY EVAP STM PRESS AUTO - MAN
GLY EVAP STM PRESS INCR - INCR(58 SEC)

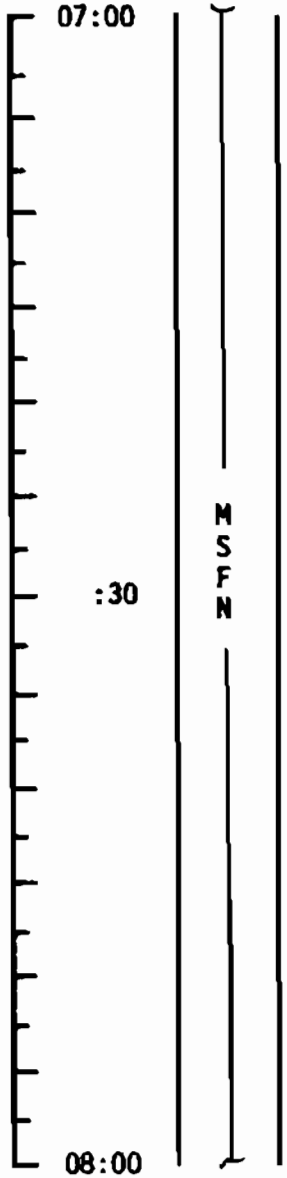
COMM BASIC EXCEPT
S-BD AUX TAPE - OFF
TAPE RCDR FWD - OFF
CREW MANAGES ANT OPS

07:00

POWER DOWN VHF
COMM BASIC COAST AWAKE

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	05:00 - 07:00	1/TLC	3-9

FLIGHT PLAN



NOTES

30,000 NM from EARTH

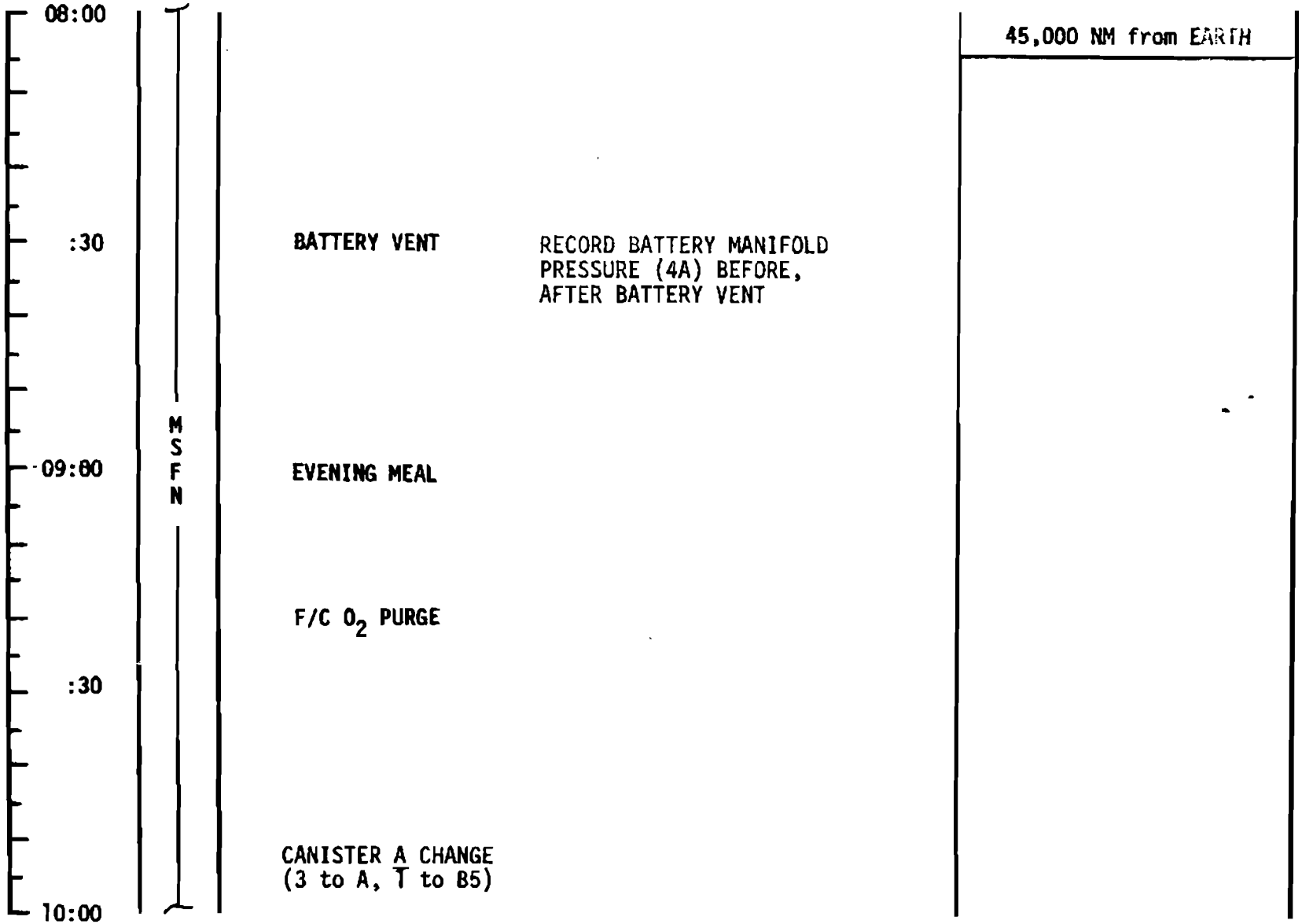
The PTC REFSMMAT will be uplinked if MCC_1 can be made with the PTC REFSMMAT. Otherwise, the PTC REFSMMAT will be uplinked after MCC_1 as shown at GET 12:00.

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	07:00-08:00	1/TLC	3-10

FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	08:00-10:00	1/TLC	3-11

MCC-H

NOTES

FLIGHT PLAN

10:00

UPDATE
GO/NO GO MCC_1
STATE VECTOR
MCC_1 TGT LOAD
MCC_1 MNVR PAD

P27 UPDATE

P30 EXTERNAL ΔV AND DAP LOAD CHECK

:30

P52 IMU REALIGN
(Option 3 - REFSMMAT)

DISCONTINUE BATT A CHARGE

M
S
F
N

11:00

P40 SPS THRUST

NOTE: SECOND SPS BURN WILL ALWAYS START ON BANK B AND THE SECOND BANK WILL BE ACTIVATED IF THE BURN IS >5 SEC.

SXT/STAR CHECK

:30

11:33 SPS MCC_1 → NO TRIM

NO ULLAGE
BT: 8.1 SEC
ΔV: 57 FPS

TLI + 9h

V66 TRANSFER CSM SV TO LM SLOT

APOLLO 10: POST BURN REPORT

UPDATE
PTC REFSMMAT

P27 UPDATE

P52 IMU REALIGN
(Option 1 - preferred)

ALIGNS IMU TO PTC REFSMMAT

12:00

48,000 NM from EARTH
2300 EDT

P52 OPT ___

N71: ____, ____

N05: ____ • ____

N93:

X ____ • ____

Y ____ • ____

Z ____ • ____

BURN STATUS REPORT

X	X	•		ΔTIG
X	X	•		BT
		•		$\hat{V}_{gx}$
			TRIM	
X	X	X		R
X	X	X		P
X	X	X		Y
				V_{gx}
				V_{gy}
				V_{gz}
				ΔV_c
X	X	X		FUEL
X	X	X		OX
X	X	X		UNBAL

REMARKS:

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	10:00 to 12:00	1/TLC	3-12

FLIGHT PLANNING BRANCH

FLIGHT PLAN

NOTES

UPDATE
P37 PAD (TLI +25, 35, 44, AND 53)

12:00

:30

13:00

:30

14:00

MSFN

ESTABLISH PTC MODE MNVR R ____
P 090°
TERMINATE CABIN PURGE
REPORT LM/CM ΔP to MSFN Y 000°

CREW OPTION TO
POINT X AXIS
NORTH or SOUTH

REPORT OMNI
SELECTED

PRESLEEP CHECKLIST

NOTE
Close POT TK IN vlv
10min after water
chlorination

CREW STATUS REPORT
ONBOARD READOUTS to MSFN
CYCLE H2, O2 FANS
CHLORINATE POTABLE WATER

VERIFY
WASTE MNGT OVBD DRAIN vlv - OFF
WASTE STOW VENT vlv - CLOSED
EMER CABIN PRESS vlv - ON
SURGE TK O2 vlv - ON
PLSS O2 vlv - OFF
LM TUNNEL VENT vlv - LM/CM ΔP
COMM BASIC EXCEPT
S-BD SQUELCH - ENABLE
S-BD NORM MODE VOICE - OFF
S-BD AUX TAPE - OFF
OMNI OPS
S-BD ANT OMNI - OMNI
S-BD ANT A - B
TAPE RCDR FWD - OFF

CREW 9 HR
REST PERIOD

PTC + 20°
DB P & Y

58,000 NM from EARTH
MONDAY MAY 19, 0100 EDT

PTC established in G&N + 20° db P & Y, R rate of 0.1°/sec, four quad control with roll disabled. S/C plus X normal to ecliptic. North (090°); South (270°)

ONBOARD READOUT

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

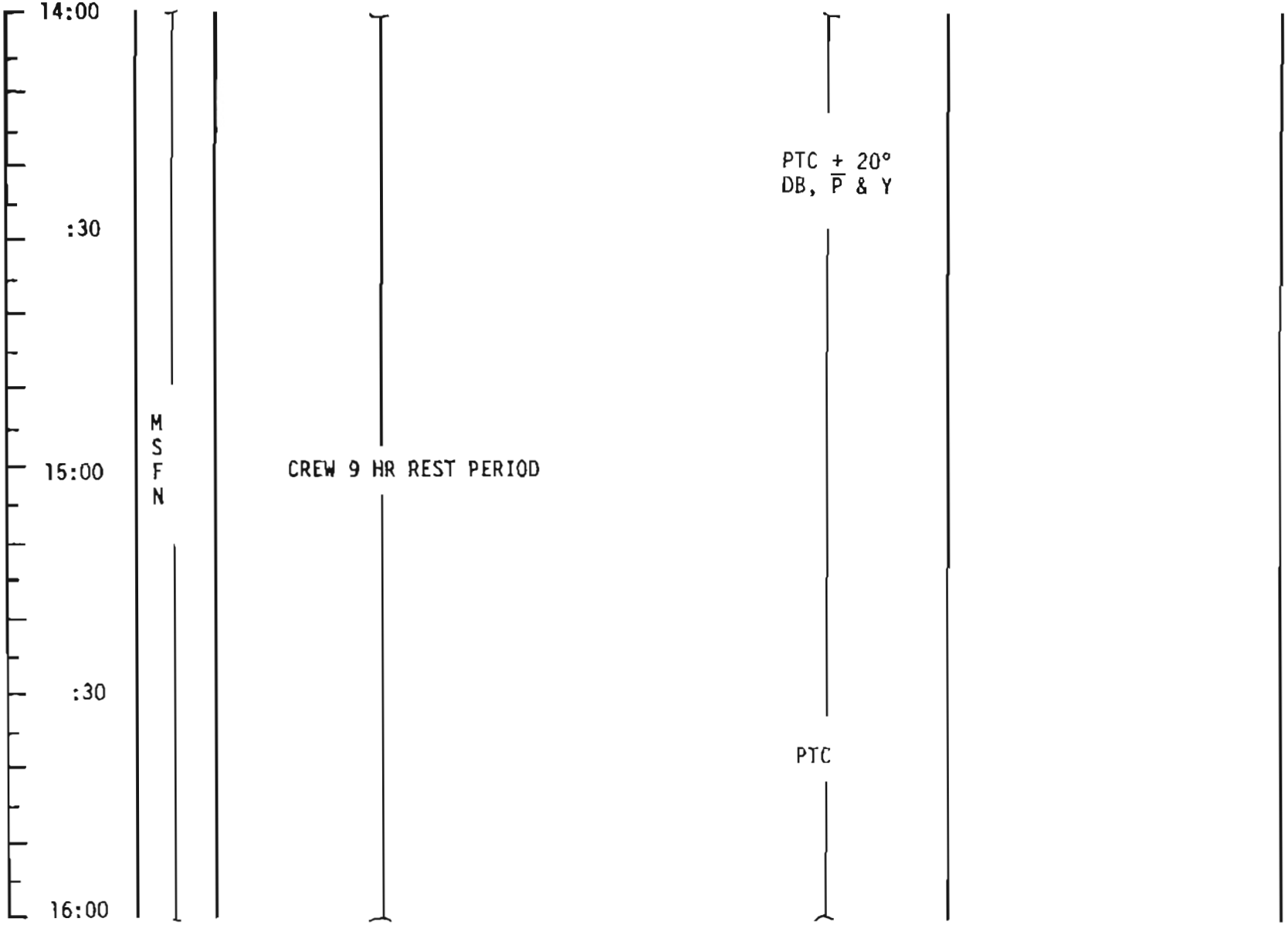
DC IND sel - MNB or A

12h 33m to MCC_2

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	12:00 to 14:00	1/TLC	3-13

NOTES

FLIGHT PLAN

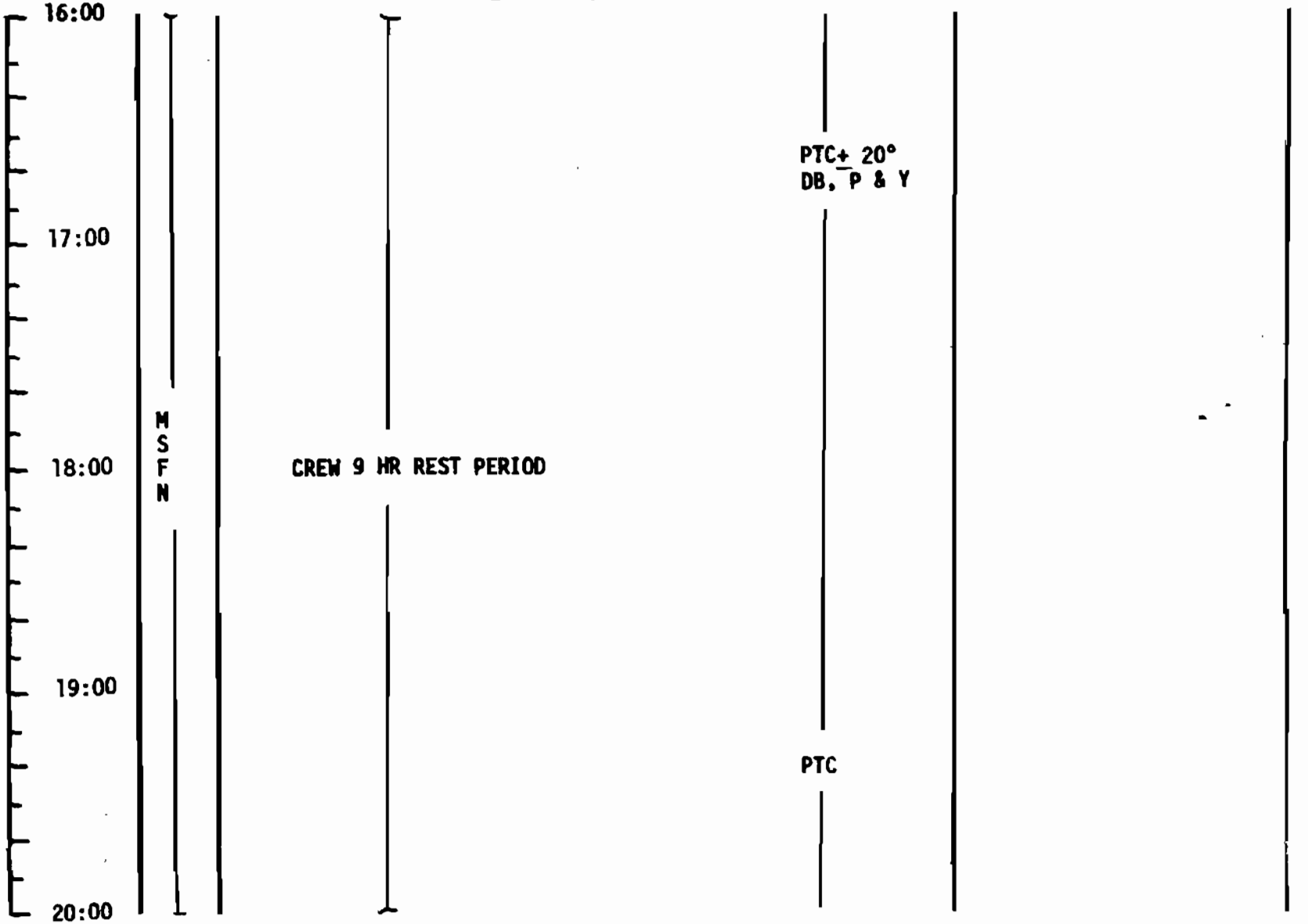


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	14:00 - 16:00	1/TLC	3-14

FLIGHT PLANN BRANCH

NOTES

FLIGHT PLAN

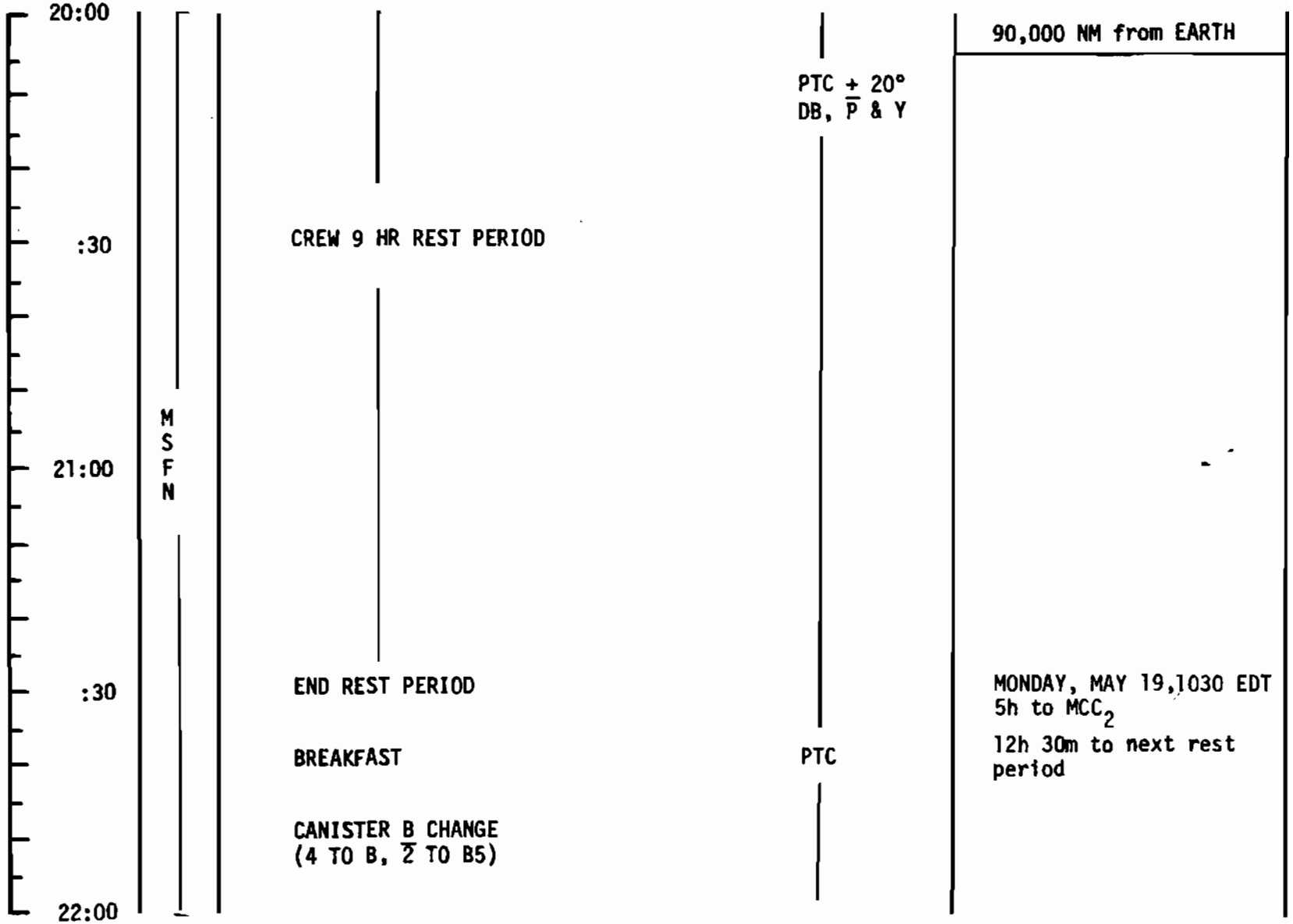


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	16:00 - 20:00	1/TLC	3-15

FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	20:00 - 22:00	1/TLC	3-16

FLIGHT PLANNING BRANCH

MCC

NOTES

FLIGHT PLAN

22:00

F/C O_2 PURGE

92,000 NM from EARTH

BREAKFAST

PTC ± 20°
DB, $\overline{P}$ & Y

INITIATE BATT B CHARGE

RECORD BATTERY PRESSURE at COMPLETION of CHARGE (DO FOR EACH BATT CHARGING)

:30

UPDATE
CONSUMABLES
FLIGHT PLAN
POSS P23
STAR/HOR DATA

POSTSLEEP CHECKLIST

CREW STATUS REPORT
CONSUMABLES UPDATE from MSFN
FLIGHT PLAN UPDATE
CYCLE H2, O2 FANS
COMM BASIC EXCEPT (COAST AWAKE CONFIGURATION)
S-BD AUX TAPE - OFF
TAPE RCDR FWD - OFF
MSFN MANAGES ANT OPS (OMNI)

CONSUMABLES UPDATE

GET: _____
RCS TOT _____
A _____
B _____
C _____
D _____
H_2 TOT _____
O_2 TOT _____

MSFN

23:00

REPORT LM/CM ΔP to MSFN

:30

PTC

ECS REDUNDANT COMPONENT CHECK

24:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	22:00 - 24:00	1/TLC	3-17

REV A FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN

24:00

:30

25:00

:30

UPDATE
GO/NO GO MCC_2
STATE VECTOR
MCC_2 TGT LOAD
MCC_2 MNVR PAD

26:00

P52 IMU REALIGN
(Option 3 - REFSMMAT)

P23 OPTICS CALIBRATION

P23 CISLUNAR NAVIGATION - STAR/EARTH HORIZON
(3 marks each SET)

SET 1: ENIF(44)N

SET 2: NUNKI(37)F

SET 3: ANTARES(33)F

SET 4: ANTARES(33)F

SET 5: FOMALHAUT(45)N

P27 UPDATE

PTC ± 20°
DB, $\overline{P}$ & Y

CREW MANAGES
ANT OPS
DURING PTC
INTERRUPTIONS

102,000 NM from EARTH

P52 OPT ___
N71: ___ ___, ___ ___
N05: ___ ___ ___ • ___ ___
N93:
X ___ ___ • ___ ___ ___
Y ___ ___ • ___ ___ ___
Z ___ ___ • ___ ___ ___

Calibrate TRN
BIAS every 30 min.
Do each calibration
several times until
agreement of 0.003°
is reached.

INCORP P23 MARK DATA
AND UPDATE ONBOARD
STATE VECTOR

FLIGHT PLAN

26:00

P30 EXTERNAL ΔV AND DAP DATA CHECK

P40/41 SPS/RCS THRUST

SXT STAR CHECK

:30

TLI + 24H

26:33 MCC_2 ——————— DO NOT TRIM

V66 TRANSFER CSM SV TO LM SLOT

APOLLO 10: POST BURN REPORT ; UNSTOW, SETUP TV

M S F N

27:00

TV(GDS): 27:15 - 27:30 HGA to NARROW

MNVR R ____
P 090°
Y 000°

RE-ESTABLISH PTC
@ 0.3°/SEC ROLL RATE.
DISABLE ROLL JETS.
10m LATER GO TO
+ 30° DB. MAINTAIN a
MINIMUM OF 4 HRS. (Pg 4-14)

:30

NOON MEAL

REPORT OMNI SELECTED

28:00

NOTES

108,000 NM from EARTH
1500 EDT

BURN STATUS REPORT

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

REMARKS:

After completion of the PTC mode test at +30° DB a decision will be made real time on the operational DB for PTC (± 20° or + 30°) and roll rate (0.1 or 0.3°/sec)

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	26:00 - 28:00	2/TLC	3-19

REV A FLIGHT PLANNING BRANCH

S-BAND REFLECTIVITY TEST

MNVR R ___ P ___ Y ___ HGA P ___ Y ___

___ ___ ___ ___ ___

COMM BASIC EXCEPT
S-BD RANGING - OFF
GO TO HGA OPS, VERIFY LOCK
ATT HOLD 0.5° db
DO STEPS 1-6 TEST 1

		TEST NO 1	2	3
1. MNVR HGA METER	P	-10°	-20°	-30°
	Y	340°	350°	360°
2. SET HGA CNTL	P	-10°	-20°	-30°
	Y	320°	330°	340°

3. HI GAIN ANT BEAM - WIDE
HI GAIN ANT TRACK - MANUAL
4. WHEN HGA METER COMPARES TO HGA CNTL
HI GAIN ANT TRACK - AUTO
HI GAIN ANT BEAM - NARROW
5. RECORD

	TEST NO. 1	2	3
HGA METER P			
Y			
% SIGNAL			

6. EVALUATE VOICE COMM
REPEAT STEPS 1-6 TEST 2
REPEAT STEPS 1-6 TEST 3
7. RETURN TO COMM COAST AWAKE
S-BD AUX TAPE - OFF
TAPE RCDR FWD - OFF

NOTE
THE S-BAND REFLECTIVITY TEST
WITH THE CSM/LM HAS BEEN DELETED.
THE TEST MAY BE SCHEDULED REAL
TIME WITH THE CSM DURING TEC.

NOTES

FLIGHT PLAN

28:00

:30

29:00

:30

30:00

MSFN

HGA PTC AUTO REAQ CHECK
COMM COAST AWAKE EXCEPT HI GAIN OPS
Y 270° P 40° (roll right)
Y 90° P -40° (roll left)
HI GAIN ANT BEAM - NARROW
HI GAIN ANT TRACK - REACQ
S-BD ANT OMNI - HI GAIN

PTC ± 30°
DB, P & Y

PTC

CLOSE O_2 VAC ION MN A/B CB(2)

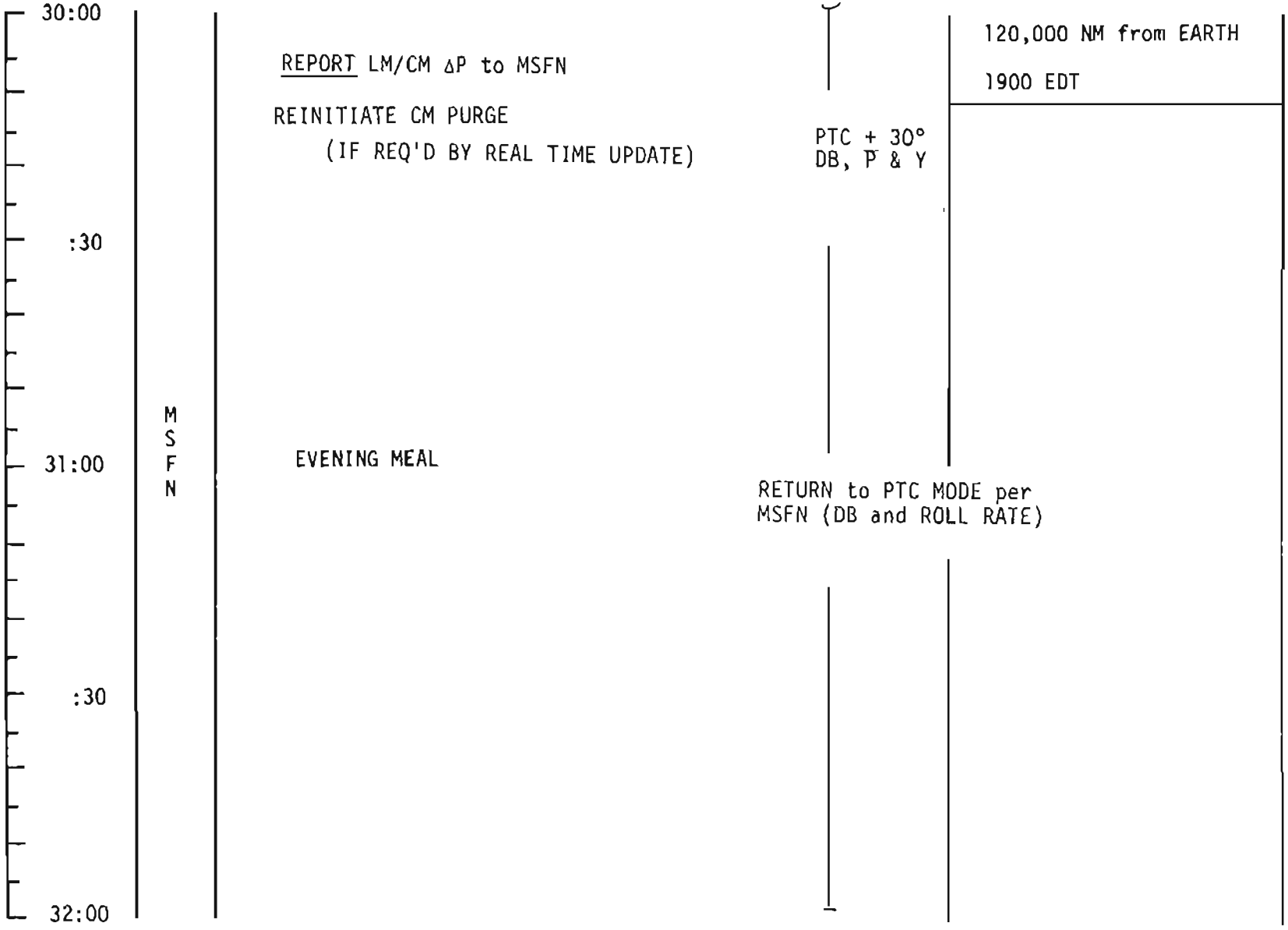
Closed at 85% to 90% total O_2 QTY

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	28:00 - 30:00	2/TLC	3-20

REV A FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	30:00 - 32:00	2/TLC	3-21

FLIGHT PLANN' RANCH

MCC

FLIGHT PLAN

NOTES

122,000 NM from EARTH

32:00

:30

33:00

:30

34:00

MSFN

PTC

UPDATE
GO/NO GO
STATE VECTOR
LUNAR FLY BY PAD

PRESLEEP CHECKLIST

CREW STATUS REPORT
ONBOARD READOUTS to MSFN
CYCLE H2, O2 FANS
CHLORINATE POTABLE WATER
VERIFY
  WASTE MNGT OVBD DRAIN vlv - OFF
  WASTE STOW VENT vlv - CLOSED
  EMER CABIN PRESS vlv - BOTH
  SURGE TK O2 vlv - ON
  PLSS O2 vlv - OFF
  LM TUNNEL VENT vlv - LM/CM ΔP
COMM BASIC EXCEPT
  S-BD SQUELCH - ENABLE
  S-BD NORM MODE VOICE - OFF
  S-BD AUX TAPE - OFF

ONBOARD READOUT

BAT C _____
PYRO BAT A _____
PYRO BAT B _____
RCS A _____
B _____
C _____
D _____
DC IND SEL to MNA or MNB

P27 UPDATE

GO TO HGA OR CONTINUE OMNI OPS PER MSFN

CANISTER A CHANGE
(5 to A, 3 to B5)

HI GAIN OPS
  Y 270 P40 (roll right)
  Y 90 P-40 (roll left)
  HI GAIN ANT BEAM - NARROW
  HI GAIN ANT TRACK - REACQ
  S-BD ANT OMNI - HI GAIN

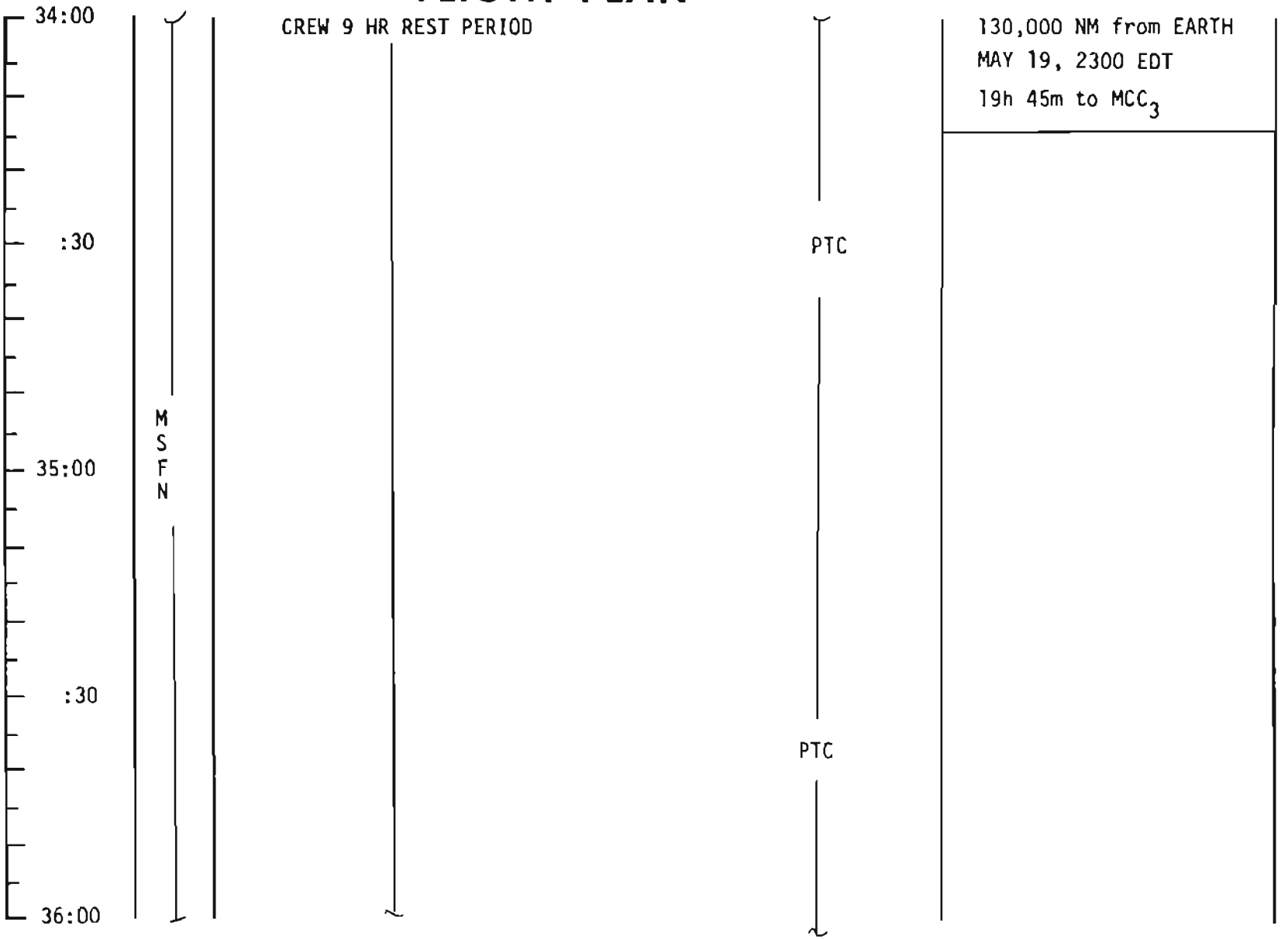
OMNI OPS
S-BD ANT OMNI - OMNI
S-BD ANT A - B
TAPE RECDR FWD - OFF

F/C O_2 PURGE

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	32:00 - 34:00	2/TLC	3-22

REV A FLIGHT PLANNING BRANCH

FLIGHT PLAN



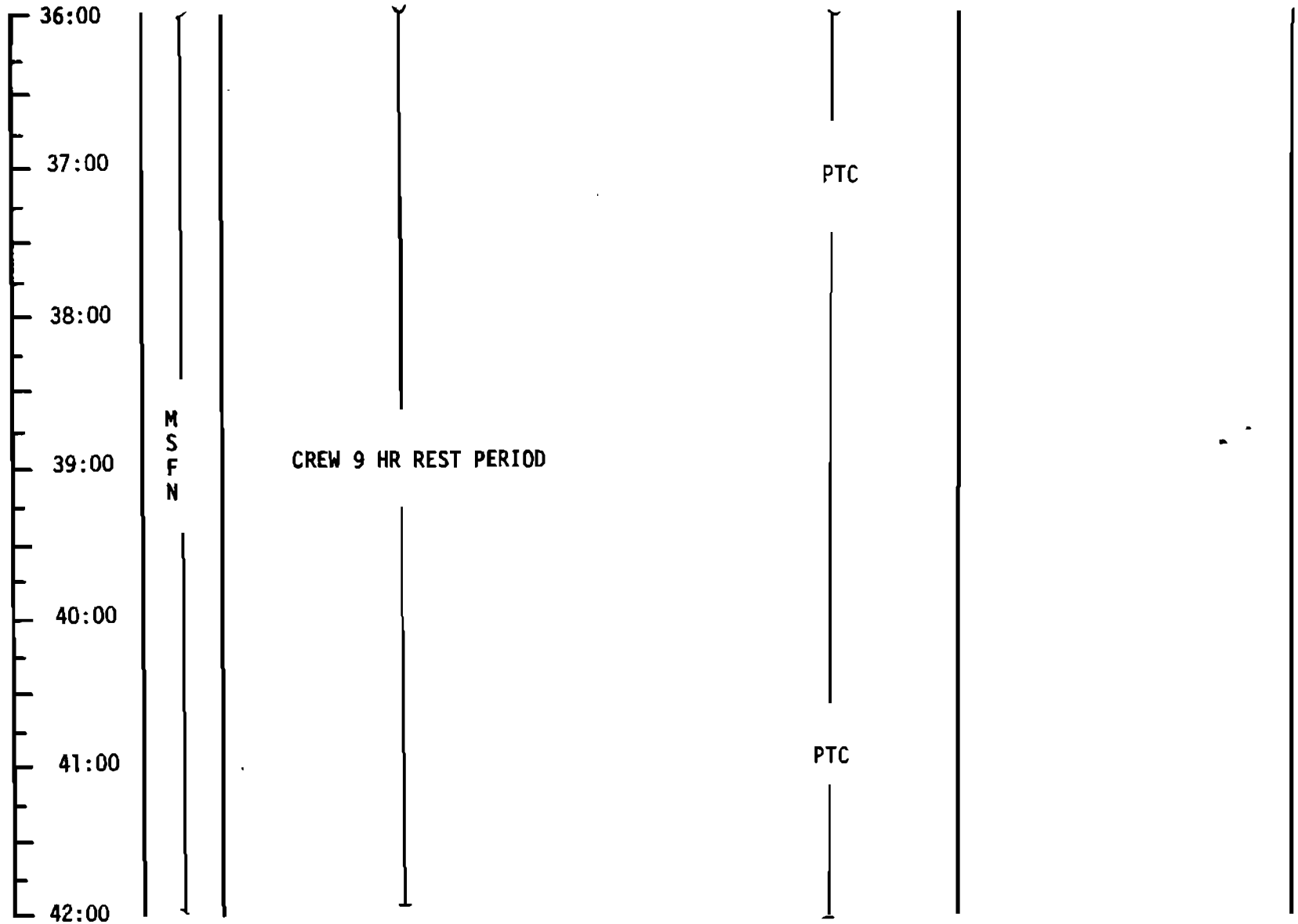
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	34:00 - 36:00	2/TLC	3-23

FLIGHT PLANNING BRANCH

MCC

NOTES

FLIGHT PLAN

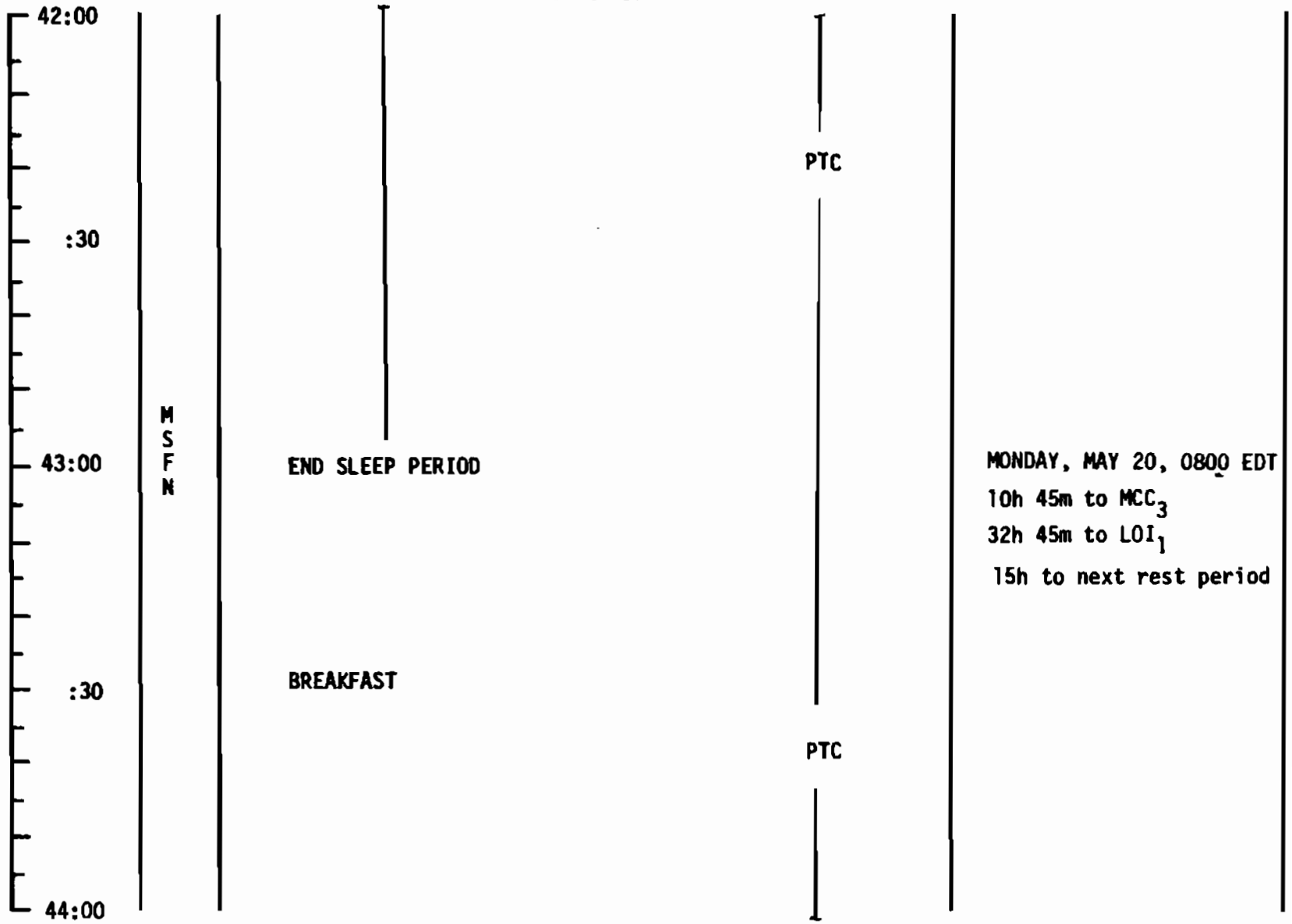


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	36:00 - 42:00	2/TLC	3-24

FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	42:00 - 44:00	2/TLC	3-25

FLIGHT PLA[illegible]NG BRANCH

MCC-I

NOTES

FLIGHT PLAN

44:00

UPDATE
CONSUMABLES
FLIGHT PLAN

POSTSLEEP CHECKLIST

CREW STATUS REPORT
CONSUMABLES UPDATE from MSFN
FLIGHT PLAN UPDATE
CYCLE H2, O2 FANS
COMM BASIC EXCEPT
  S-BD AUX TAPE - OFF
  TAPE RCDR FWD - OFF
MSFN MANAGES ANT OPS

PTC

155,000 NM from EARTH

CONSUMABLES UPDATE

GET: _____
RCS TOT _____
A _____
B _____
C _____
D _____
H_2 TOT _____
O_2 TOT _____

:30

UPDATE
STATE VECTOR

P27 UPDATE

M
S
F
N

P52 IMU REALIGN
  (Option 3 - REFSMMAT)
  (CHECK CELESTIAL BODY OPTION)

45:00

MNVR R ___
  P 090°
  Y 000°

REPORT OMNI SELECTED

:30

H_2 PURGE LINE HTRS - ON

PTC

P52 OPT ___
N71: ___ ___, ___ ___
N05: ___ ___ ___ • ___ ___
N93:
  X ___ ___ • ___ ___ ___
  Y ___ ___ • ___ ___ ___
  Z ___ ___ • ___ ___ ___

CANISTER B CHANGE
(6 to B, 4 to B5)

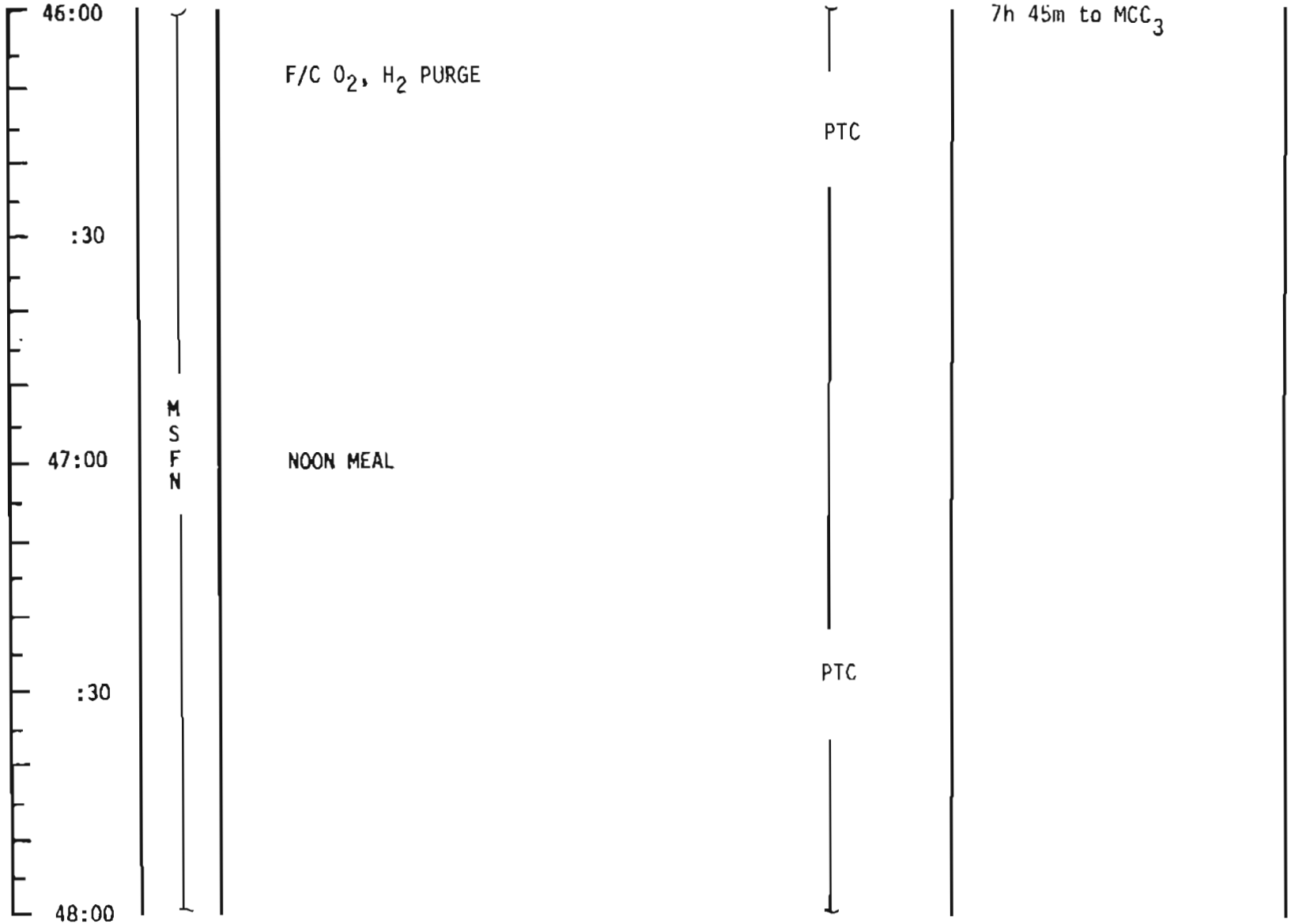
46:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	44:00 - 46:00	2/TLC	3-26

REV A FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN



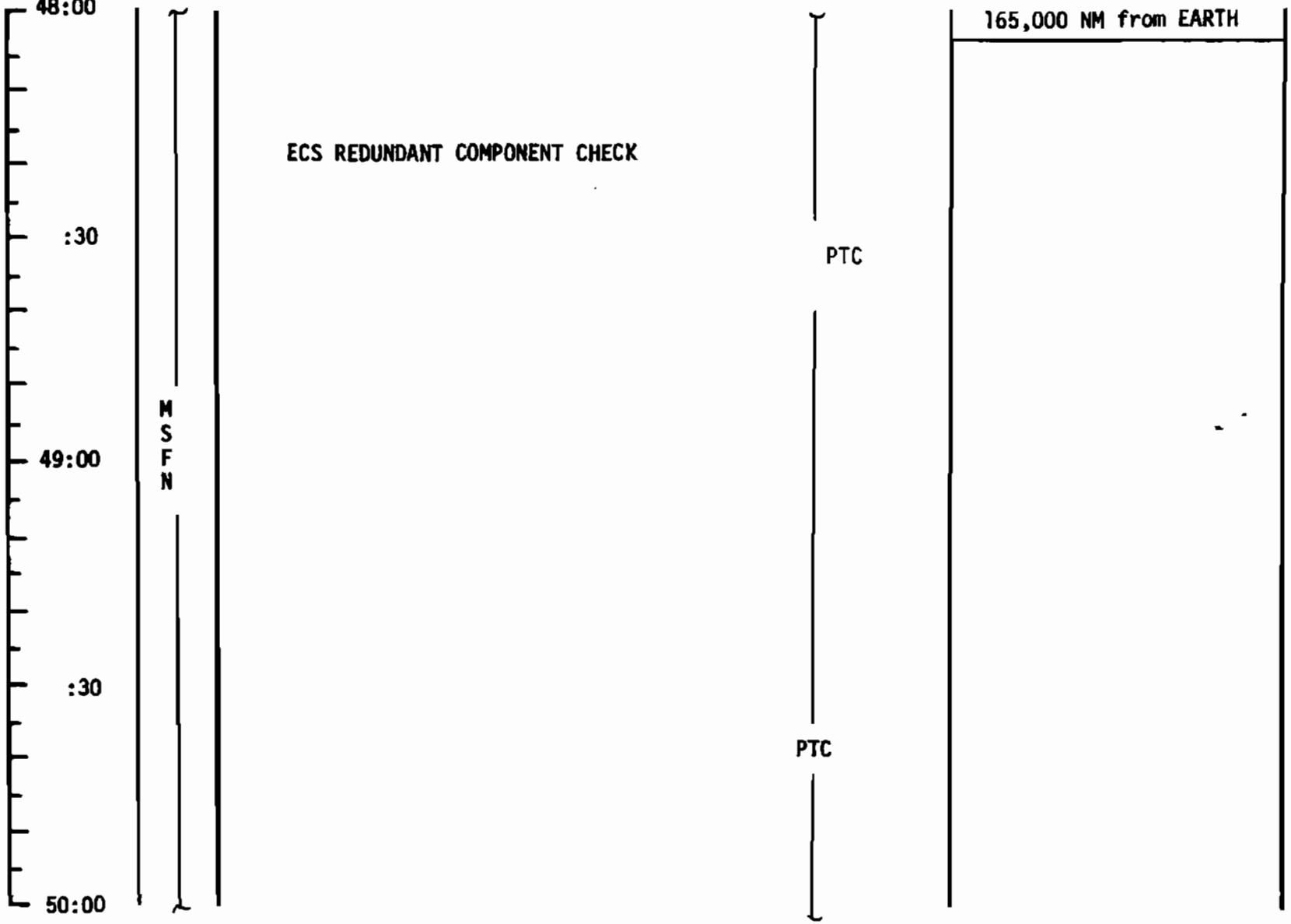
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	46:00 - 48:00	2/TLC	3-27

FLIGHT PLAN BRANCH

MCC

NOTES

FLIGHT PLAN

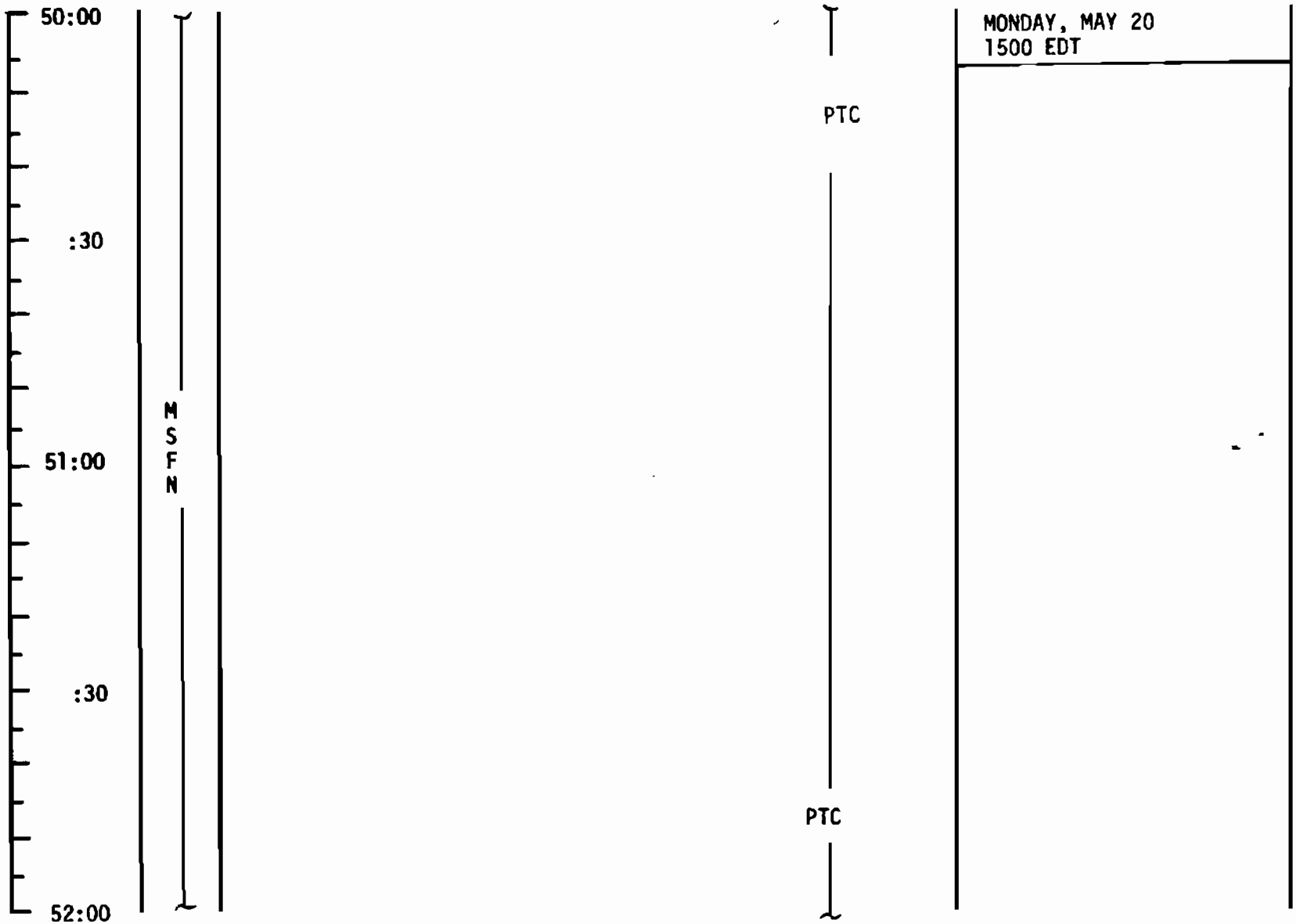


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	48:00 - 50:00	3/TLC	3-28

FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	50:00 - 52:00	3/TLC	3-29

FLIGHT PLANNING BRANCH

NOTE:

FLIGHT PLAN

UPDATE
STATE VECTOR
MCC_3 TGT LOAD
MCC_3 MNVR PAD

52:00

:30

53:00

:30

LOI
-22

54:00

MSFN

P27 UPDATE

P30 EXTERNAL ΔV AND DAP LOAD CHECK

PTC

P52 IMU REALIGN
(Option 3 - REFSMMAT)

P40/41 SPS/RCS THRUST

SXT STAR CHECK

53:45 MCC_3 —— TRIM TO 0.5 fps

V66 TRANSFER CSM SV TO LM SLOT

APOLLO 10: POST BURN REPORT

170,000 NM From EARTH
1700 EDT

P52 OPT ___

N71: ____, ____

N05: ____.____

N93:

X ____.____

Y ____.____

Z ____.____

BURN STATUS REPORT

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

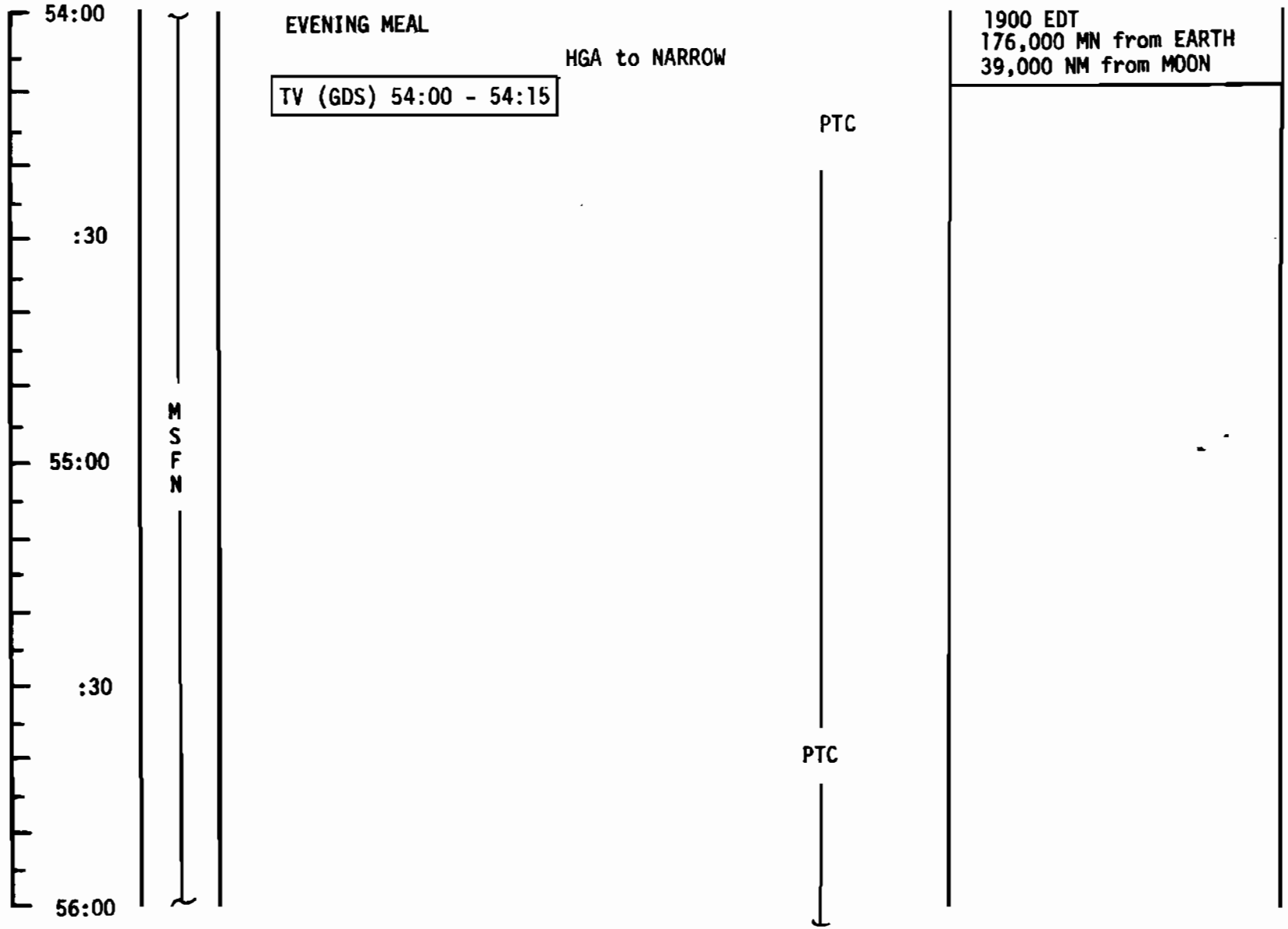
REMARKS:

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	52:00 - 54:00	3/TLC	3-30

FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	54:00 - 56:00	3/TLC	3-31

FLIGHT PLAN

NOTES

56:00

:30

57:00

:30

58:00

MSFN

PTC

180,000 NM from EARTH
35,000 NM from MOON

PRESLEEP CHECKLIST

CREW STATUS REPORT
ONBOARD READOUTS to MSFN
CYCLE H2, O2 FANS
CHLORINATE POTABLE WATER
VERIFY
  WASTE MNGT OVBD DRAIN vlv - OFF
  WASTE STOW VENT vlv - CLOSED
  EMER CABIN PRESS vlv - BOTH
  SURGE TK O2 vlv - ON
  PLSS O2 vlv - OFF
  LM TUNNEL VENT vlv - LM/CM ΔP
COMM BASIC EXCEPT
  S-BD SQUELCH - ENABLE
  S-BD NORM MODE VOICE - OFF
  S-BD AUX TAPE - OFF
OMNI OPS
  S-BD ANT OMNI - OMNI
  S-BD ANT A - B
  TAPE RCDR FWD - OFF
OR HI GAIN OPS
  Y 270 P40 (roll right)
  Y 90 P-40 (roll left)
  HI GAIN ANT BEAM - NARROW
  HI GAIN ANT TRACK - REACQ
  S-BD ANT OMNI - HI GAIN

ONBOARD READOUT

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

DC IND SEL - MNA or B

OMNI OR HGA OPS per MSFN

CANISTER A CHANGE
(7 to A, 5 to B6)

F/C O_2 PURGE

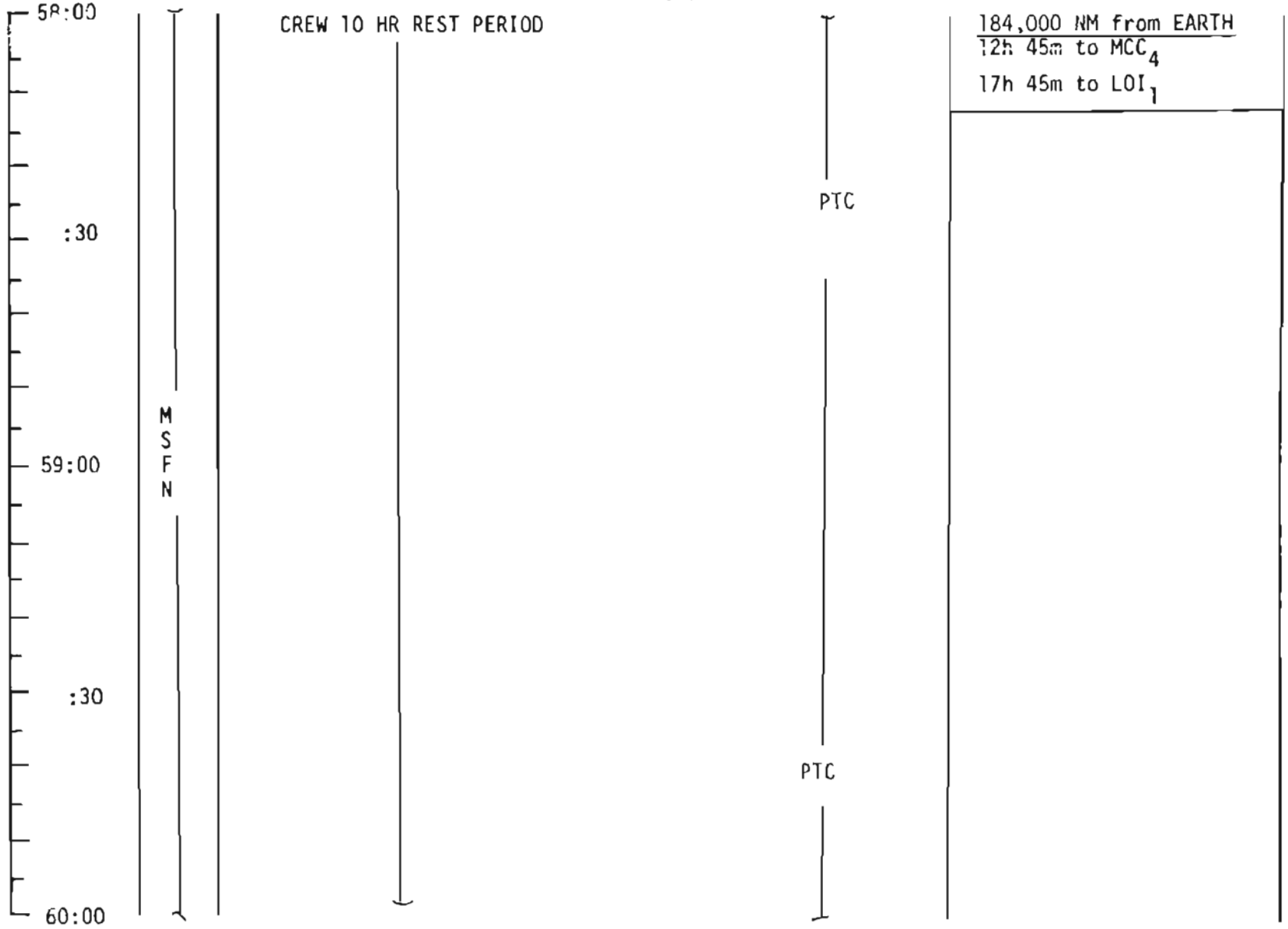
2300 EDT, TUES, MAY 20

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	56:00 - 58:00	3/TLC	3-32

REV A FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN

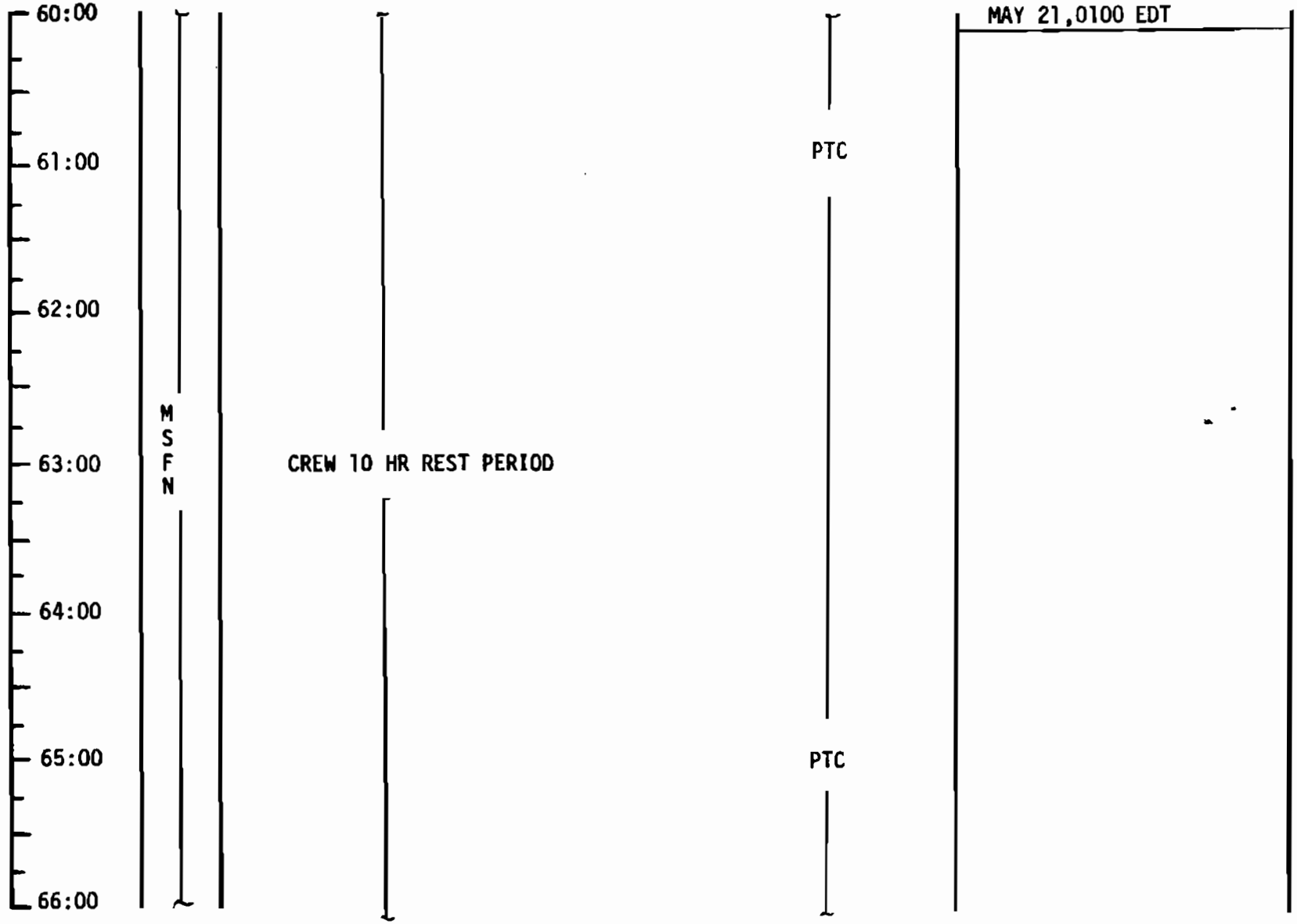


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	58:00 - 60:00	3/TLC	3-33

FLIGHT PLANN BRANCH

NOTES

FLIGHT PLAN

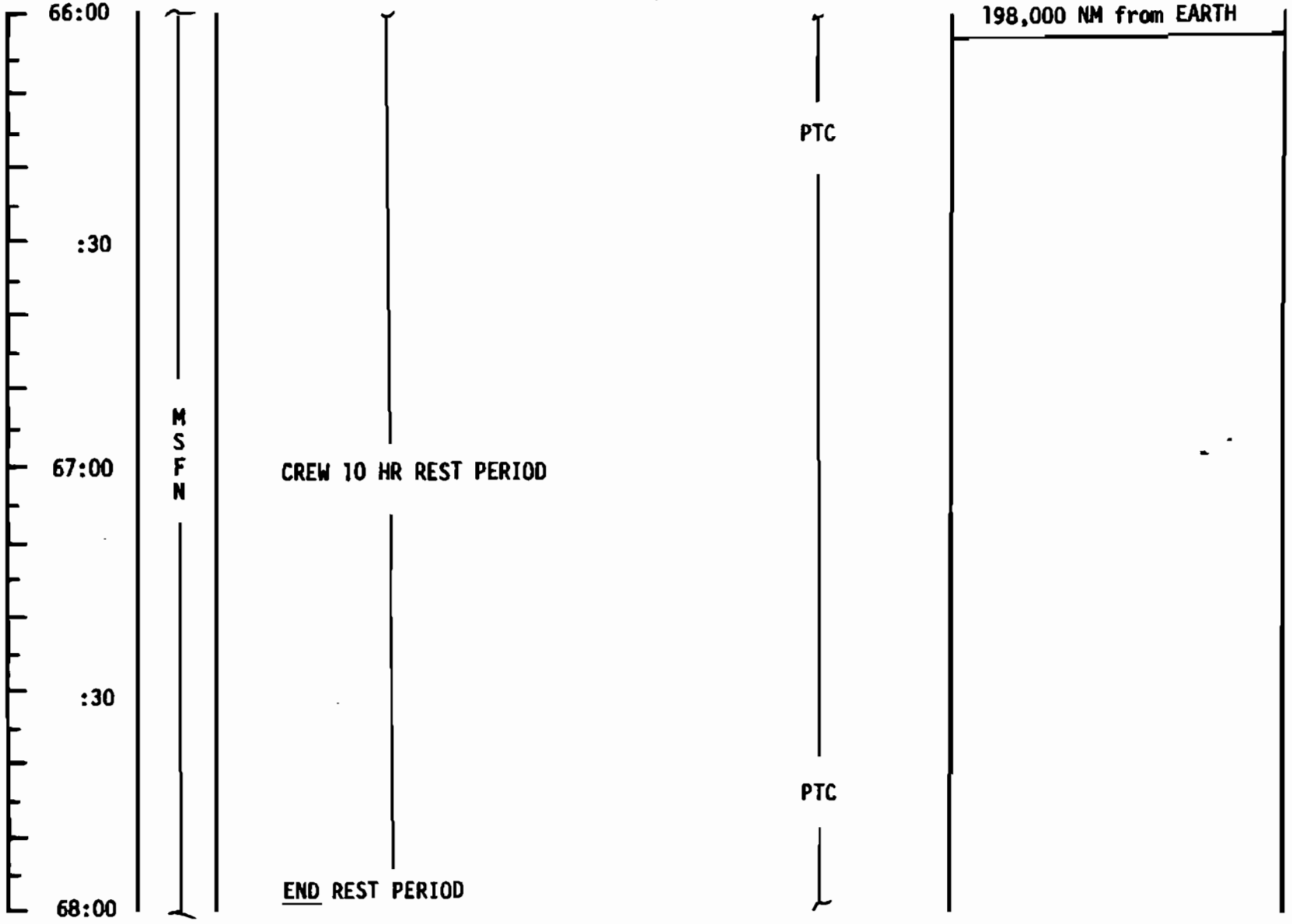


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	60:00 - 66:00	3/TLC	3-34

FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	64:00 - 68:00	3/TLC	3-35

FLIGHT PL NG BRANCH

MCC-H

FLIGHT PLAN

68:00

BREAKFAST

PTC

:30

F/C O_2 PURGE

UPDATE
CONSUMABLES
FLIGHT PLAN

69:00

POSTSLEEP CHECKLIST

CREW STATUS REPORT
CONSUMABLES UPDATE from MSFN
FLIGHT PLAN UPDATE
CYCLE H2, O2 FANS
COMM BASIC EXCEPT
  S-BD AUX TAPE - OFF
  TAPE RCDR FWD - OFF
MSFN MANAGES ANT OPS

M S F N

UPDATE
STATE VECTOR
LLS 2 REFSMMAT
MCC_4 TGT LOAD
MCC_4 MNVR PAD
PC + 2 PAD
TV ATT

P27 UPDATE

PTC

:30

P52 IMU REALIGN
(OPTION 1 - preferred)

ALIGNS IMU
TO LLS 2
REFSMMAT

70:00

P30 EXTERNAL ΔV AND DAP LOAD CHECK

NOTES

203,000 NM from EARTH
WEDNESDAY, MAY 21, 0900 EDT
2h 45m to MCC_4
7h 45m to LOI_1
12h 10m to LOI_2
14h 32m to LDMK tracking
16h to next rest period

CONSUMABLES UPDATE

GET: _____
RCS TOT _____
A _____
B _____
C _____
D _____
H_2 TOT _____
O_2 TOT _____

P52 OPT ___

N71: ___ ___
N05: ___ ___ . ___
N93:
X ___ ___ . ___ ___
Y ___ ___ . ___ ___
Z ___ ___ . ___ ___

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	68:00 - 70:00	3/TLC	3-36

NOTES

FLIGHT PLAN

70:00

CANISTER B CHANGE
(8 TO B, 6 TO B6)

P40/P41 SPS/RCS THRUST

:30

SXT STAR CHECK

LOI - 5h

70:45 MCC_4 ——————— TRIM X to 1 fps

V66 TRANSFER CSM SV TO LM SLOT

APOLLO 10: POST BURN REPORT

MSFN

71:00

TV UPDATE

R ____ HGA

P ____ P ____

Y ____ Y ____

UPDATE
PRELIM LOI_1,
MNVR PAD
TEI_1 PAD
TEI_4 PAD

:30

UNSTOW, SETUP TV

NOTE:

All attitudes in the timeline are inertial wrt LDG site 2 REFSMMAT.

ECS REDUNDANT COMPONENT CHECK

72:00

BURN STATUS REPORT

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

REMARKS:

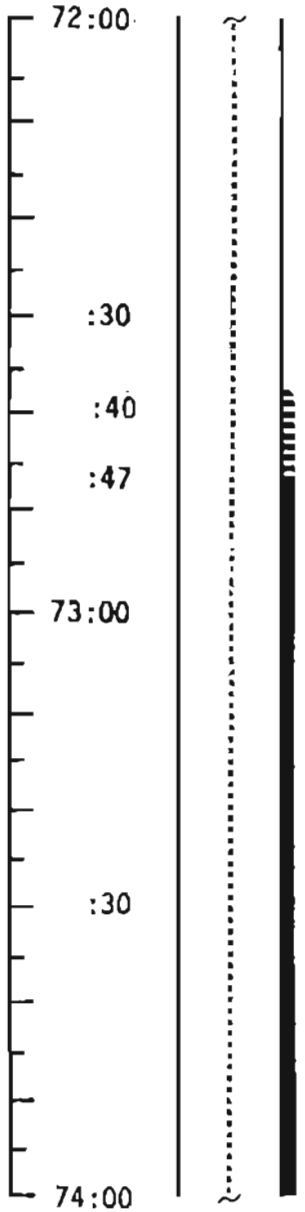
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	70:00 - 72:00	3/TLC	3-37

MCC-H

HGA COVERAGE ·····
NO HGA COVERAGE ——— (due to S/C ATT)

PLAN

NOTES



HGA to NARROW

TV (GDS): 72:20 - 72:35

AT THE CONCLUSION OF TV GO TO COMM BASIC
EXCEPT HGA
AUTO & NARROW

ENTERING LUNAR PENUMBRA

ENTERING 1h 43m of LUNAR UMBRA

NOON MEAL

ACTIVATE PRIMARY EVAPORATOR
GLY EVAP H2O FLOW - AUTO
GLY EVAP STM PRESS - AUTO

UPDATE
REV 1 MAP
UPDATE

WEDNESDAY, MAY 21,
1300 EDT

3h 45m to LOI_1
8h 10m to LOI_2
10h to LM ENTRY
10h 32m to LDMK TRACK
12h to IVT to CSM

1400 EDT

DESIRED H2O QTY
at LOI: 75%

MAP UPDATE REV 1

LOS :__ __ __:__ __:__ __

150°W:__ __ __:__ __:__ __

AOS :__ __ __:__ __:__ __

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	72:00-74:00	4/TLC	3-38

MCC-A

NOTES

FLIGHT PLAN

74:00

UPDATE
STATE VECTOR
LOI_1 TGT LOAD
LOI_1 MNVR PAD

:30

:40

UPDATE
GO|NO GO LOI_1

75:00

:30

:38

REV 1

76:00

P52 IMU REALIGN
(Option 3 - REFSMMAT)

P27 UPDATE

P30 EXTERNAL ΔV AND DAP DATA CHECK

MNVR R 356° and CK LOI_1 BURN ATT
P 232° (SXT STAR CHECK)
Y 340°

OMNI C

P40 SPS THRUST

NOTE: IF NO DSE MOTION @ LOS
GO CMD RESET then NORM

LOI, OVERBURN CRITERIA: 10 SEC

75:45 LOI_1 —— NO TRIM ——

NO ULLAGE
BT: 6m 02 SEC
ΔV: 2974 FPS
60 x 170

V66 TRANSFER CSM
SV TO LM SLOT
HOLD CUTOFF ATT UNTIL 76:00

210,000 NM from EARTH
WEDNESDAY, MAY 21,
1500 EDT

P52 OPT ___

N71: ___, ___

N05: ___ . ___

N93:

X ___ . ___

Y ___ . ___

Z ___ . ___

BURN STATUS REPORT

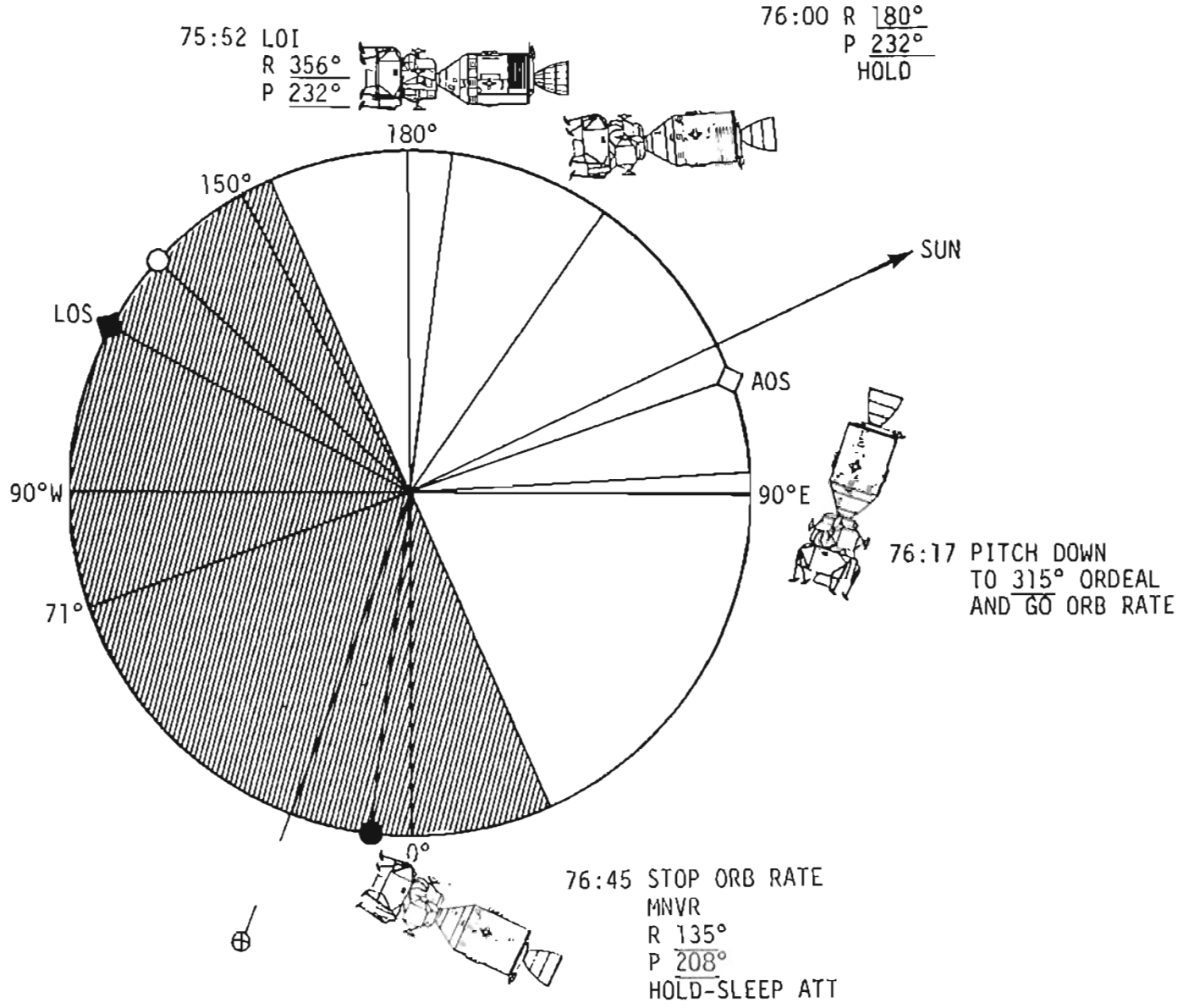
X	X		:			ΔTIG
X	X		:			BT
						V_{gx}
			TRIM			
X	X	X				R
X	X	X				P
X	X	X				Y
						V_{gx}
						V_{gy}
						V_{gz}
						ΔV_c
X	X	X				FUEL
X	X	X				OX
X	X	X				UNBAL

REMARKS:

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	74:00-76:00	4/1	3-39

REV A FLIGHT PLANNING BRANCH

REV 1

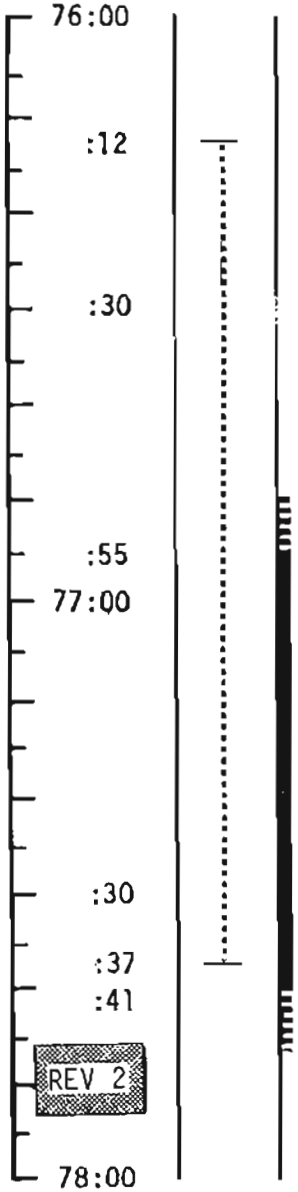


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	76:00-78:00	4	3-39

FLIGHT PLAN

NOTES

UPDATE
REV 2 MAP
UPDATE



76:00 MNVR R 180° FOR COMM
P 232°
Y 340°
HGA P -86° Y 007°

V64 ACQ MSFN

APOLLO 10: POST BURN REPORT

76:17 INITIATE ORB RATE (315° ORDEAL)
FOR SURFACE OBSERVATIONS

76:45 STOP ORB RATE at P 208° HGA P -46° SLEEP ATT
ROLL to 135° R 135° Y 237°
Y 000°

P52 IMU REALIGN
(Option 3 - REFSMMAT)

COMM BASIC EXCEP (prior to LOS) - COMM SLEEP CONFIGURATION
S-BD SQUELCH - ENABLE
HI GAIN ANT TRACK - REACQ
HI GAIN ANT BEAM - NARROW
HGA P -46° Y 237°

IF NO LOI$_1$ BURN EXPECT
AOS ABOUT 10m EARLIER

MAP UPDATE REV 2

LOS :__ __ __:__ __:__ __

150°W:__ __ __:__ __:__ __

AOS :__ __ __:__ __:__ __

P52 OPT __

N71: ____, ____

N05: ____ ____

N93:

X ____ ____

Y ____ ____

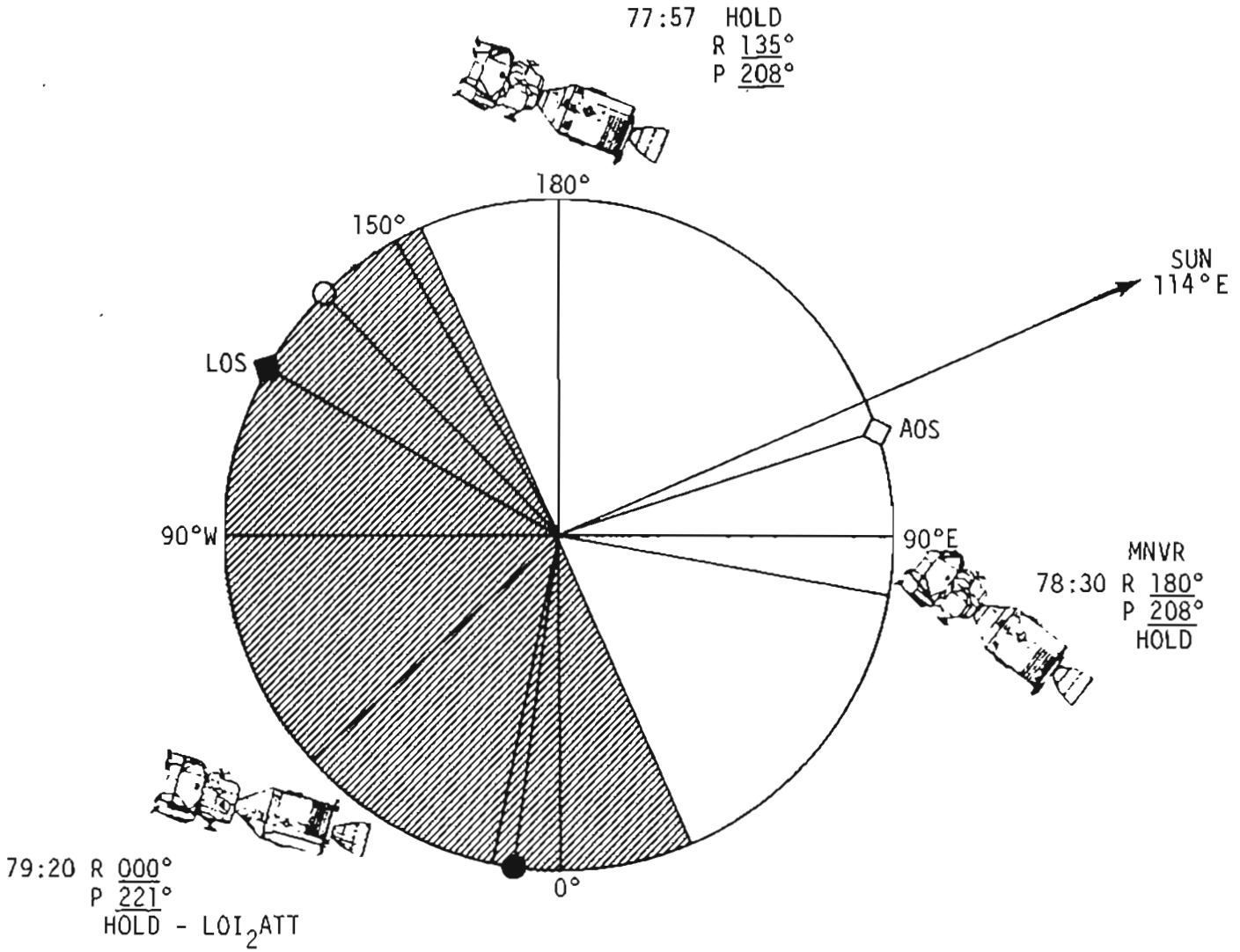
Z ____ ____

NOTE HGA REST POSITION AFTER LOS, VERIFY HGA ACQUISITION FROM THIS POSITION AT AOS

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	76:00-78:00	4/2	3-40

REV A FLIGHT PLANNING BRANCH

REV 2



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	78:00-80:00	4/2	3-40A

NOTES

FLIGHT PLAN

78:00

EVENING MEAL

:20

S-BAND SQUELCH - OFF
REPORT HGA LOS AND AOS P AND Y POSITIONS

:30

UPDATE
GO/NO GO LOI_2
STATE VECTOR
LOI_2 TGT MNVR PAD
LOI_2 MNVR PAD
TEI_5 PAD
REV 3 MAP UPDATE

P27 UPDATE

78:30 MNVR R 180° HGA FOR OBSERVATIONS
P 208° P -67°
Y 000° Y 166°

P30 EXTERNAL ΔV AND DAP CHECK

79:00

P52 IMU REALIGN
(Option 3 - REFSMMAT)

:03

MNVR LOI_2 BURN ATT R 000° OMNI ____
P 221°
Y 357°

SXT STAR CHECK @ BURN ATT

:30

NOTE: IF NO DSE MOTION @ LOS
GO CMD RESET then NORM

:50

P40 SPS THRUSTING

80:00

MAP UPDATE REV 3

LOS : : :

150°W: : :

AOS : : :

P52 OPT ___

N71: ___, ___

N05: ___ ___.___

N93:

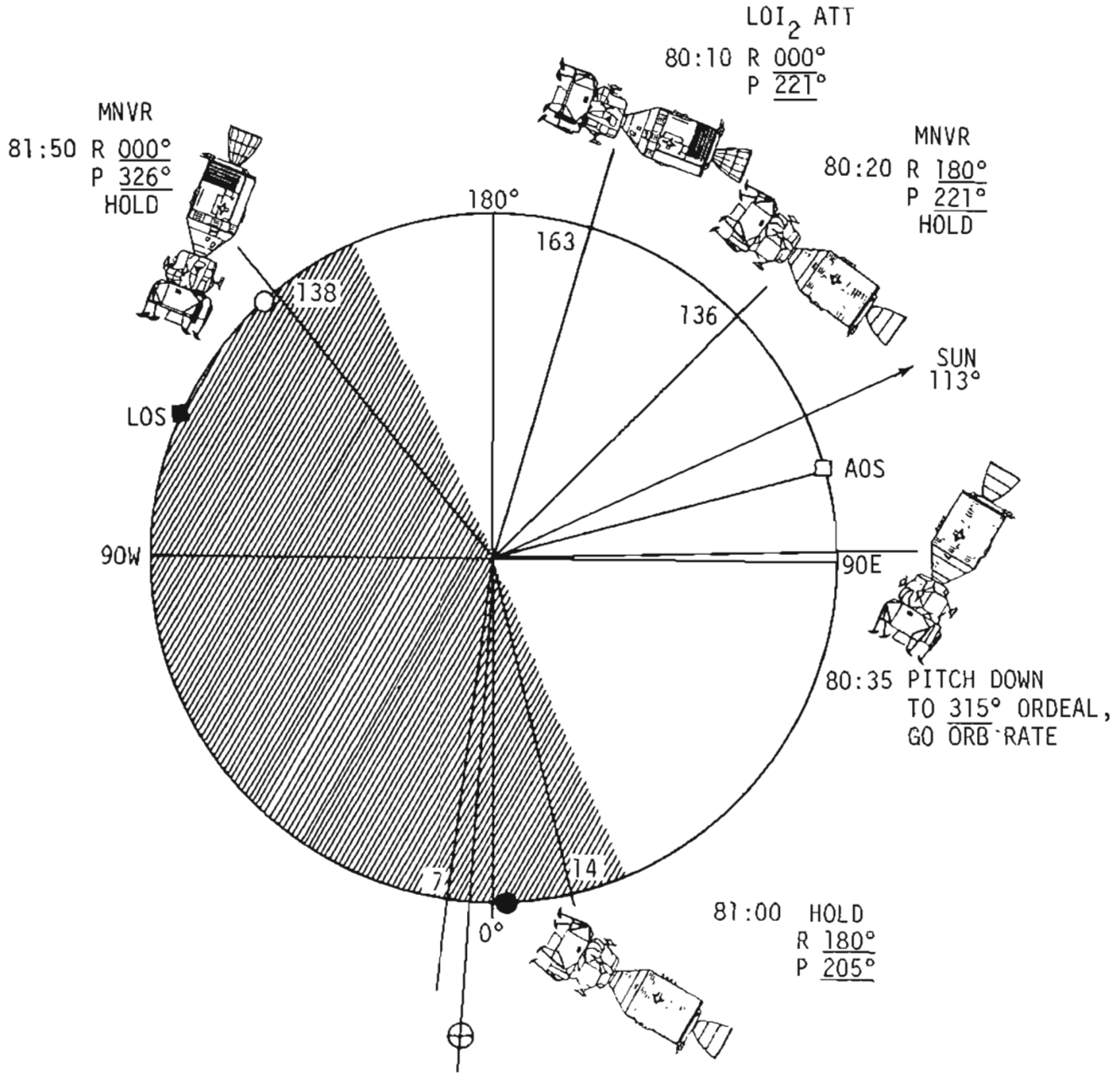
X ___ ___.___

Y ___ ___.___

Z ___ ___.___

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	78:00-80:00	4/2	3-41

REV 3

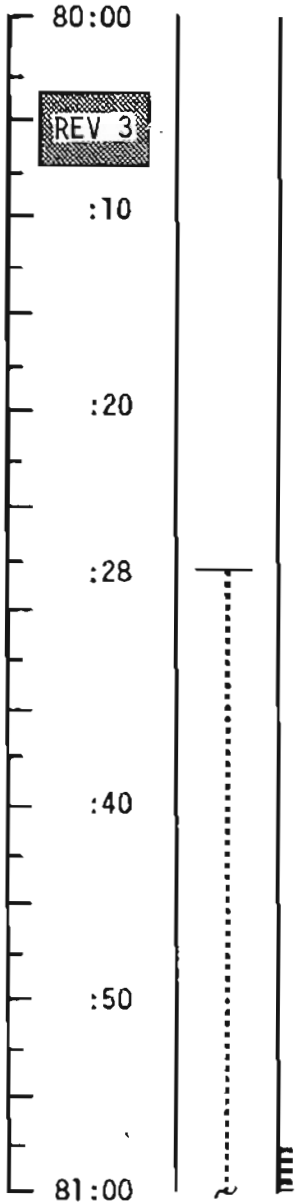


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	80:00-82:00	4/3	3-41A

REV A

NOTES

FLIGHT PLAN



LOI_2 OVERBURN CRITERIA: 1 SEC

80:10 LOI_2 — TRIM X ≤ 1 fps, Y, Z as is — ULLAGE: 2 jet 17 sec; BT: 14.4 SEC; ΔV: 138.5 FPS; 60 x 60

V66 TRANSFER CSM SV TO LM SLOT

80:20 MNVR R 180° HGA FOR COMM
P 221° P -79°
Y 358° Y 148°

V64 ACQ MSFN

APOLLO 10: POST BURN REPORT

80:35 PITCH DOWN TO 315° ORDEAL AND GO ORB RATE FOR SURFACE OBSERVATIONS

TCA F1 80:36 SUN ∢ 63°

HGA to NARROW

TV (GDS): 80:45 - 80:55

TCA B1 80:53 SUN ∢ 12°

81:00 TERMINATE ORB RATE AND GO INERTIAL

BURN STATUS REPORT

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

REMARKS:

2135 EDT

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	80:00-82:00	4/3	3-42

FLIGHT PLAN

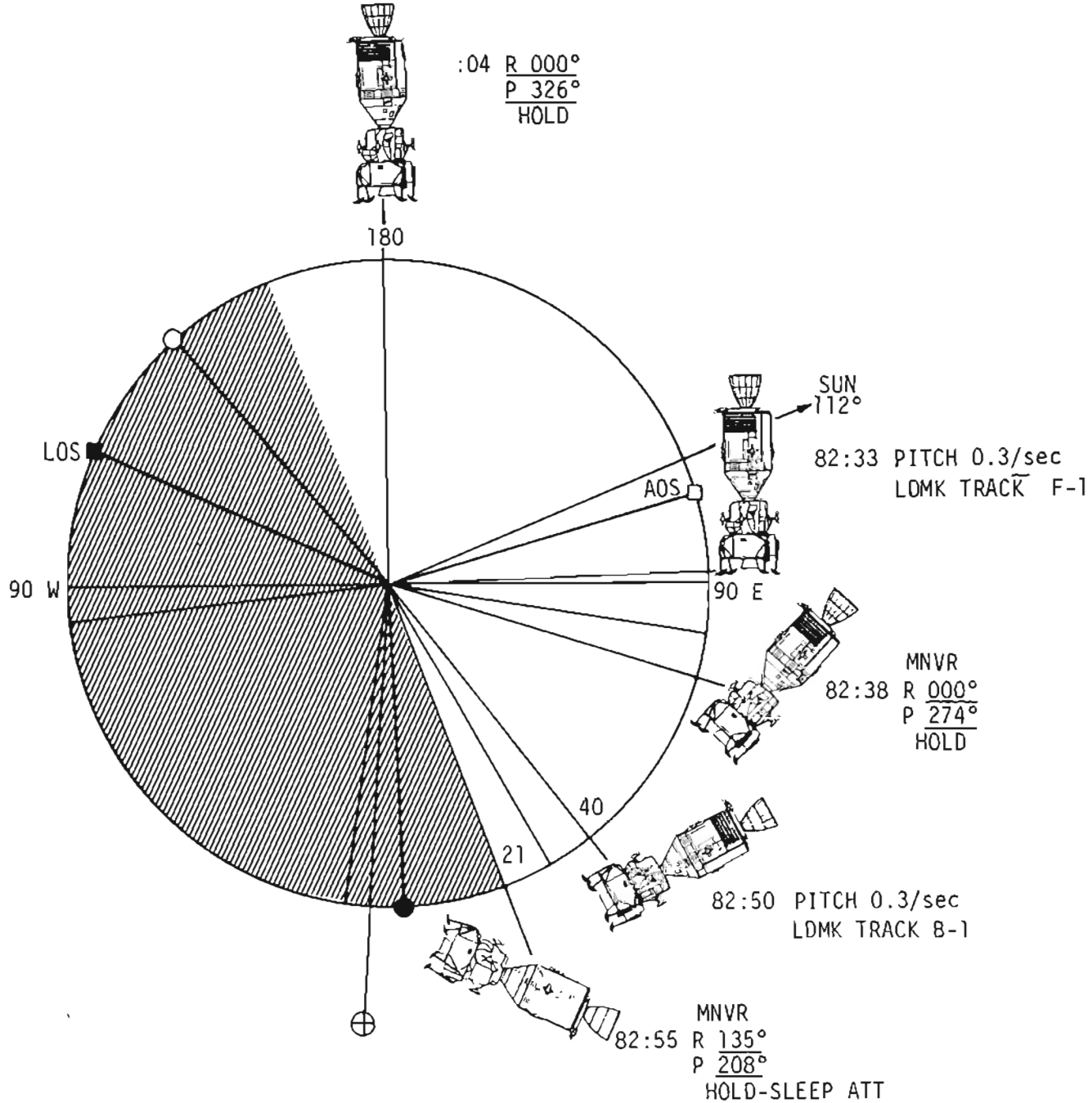
CSM	LM LMP	MCC-H
81:00		
HOLD R 180° HGA P 205° P -62° Y 000° Y 168°	CONFIGURE SEQ CAMERA FOR IVT PHOTOGRAPHY: 16/5/CIN-SPOT (NOM f2.8,60) 6fps, 1 MAG	UPDATE LDMK TRACKING PAD REV 4 REV 4 MAP UPDATE
:10		
P52 IMU REALIGN (Option 3 - REFSMMAT)	P52 OPT ___ N71: ___ ___, ___ ___ N05: ___ ___ ___ • ___ ___ N93: X ___ ___ • ___ ___ ___ Y ___ ___ • ___ ___ ___ Z ___ ___ • ___ ___ ___	
REPRESS LM	TRANSFER THE FOLLOWING TO THE LM: 1. RAD SURV METER 2. 16mm FILM (6 mags in 1 bag) 3. 70mm FILM (3 mags in 1 bag) 4. MONOCULAR 5. FLT DATA FILE ITEMS	
:20		
CANISTER A CHANGE (9 TO A, 7 TO B6)		
VERIFY TUNNEL PRESSURE		
CLEAR TUNNEL OF HATCH VISUALLY INSPECT TUNNEL & DOCKING LATCHES REMOVE & STOW PROBE & DROGUE		
:30		
	F/C O_2 PURGE	
:40		
	VERIFY DSE MOTION @ LOS	
	CSM	
	OPEN LM HATCH RELAY ROLL CAL ↓ IVT TO LM	
COPY ROLL CAL ↓ MNVR R 000° TO LDMK P 326° TRACK ATT Y 000°		
:50		
	LM ENTRY STATUS CK	
82:00		

NOTE

NO P27 UPDATE THIS PASS

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	80:00-82:00	4/3	3-43

REV 4



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	82:00-84:00	4/4	3-43A

REV A

REV 4 LDMK TRACKING PADS

P22 MAN ACQ P dn 2° R0° Y0°

T_1 __ __ __:__ __:__ __

T_2 __ __ __:__ __:__ __

F-1

R __ __ __ °P __ __ __ °Y __ __ __ °

N or S NM __ __ SA __ __ TA __ __

F-1 N89

LAT +01.600 __ __ __.__ __

LONG/2 +43.440 __ __ __.__ __

ALT +000.00 __ __ __.__ __

P22 MAN ACQ P dn 2° R0° Y0°

T_1 __ __ __:__ __:__ __

T_2 __ __ __:__ __:__ __

B-1

R __ __ __ °P __ __ __ °Y __ __ __ °

N or S NM __ __ SA __ __ TA __ __

B-1 N89

LAT +02.522 __ __.__ __ __

LONG/2 +17.518 __ __.__ __ __

ALT -001.54 __ __ __.__ __

MAP UPDATE REV 4

LOS :__ __ __:__ __:__ __

150°W:__ __ __:__ __:__ __

AOS :__ __ __:__ __:__ __

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	80:00-82:00	4/3	3-43B

CSM FLIGHT PLAN

LM
LMP

MCC-H

82:00

REV 4

:10

:20

:30

:40

:50

83:00

NOTES:
DURING P22 DO NOT PRO
ON FINAL N89
25 SEC BETWEEN MARKS

OMNI C FOR LDMK TRACK

P22 ORBITAL NAVIGATION

T_1 82:27 F-1 @ 0° EL

T_2 82:32 F-1 @ 35° EL SUN ∢ 64°

CSM PWR TO LM - OFF
VHF AM(B) - DUPLEX

REPORT ROLL CAL TO MSFN

82:35 STOP PITCH AT 272°

82:38 MNVR P 274°

T_1 82:45 B-1 @ 0° EL

T_2 82:49 B-1 @ 35° EL SUN ∢ 13°

MNVR R 135° HGA
P 208° P -45°
Y 000° Y 234°

DEACTIVATE JETS B-3, C-4
PRIOR TO LM S-BD STEERABLE
ACTIVATION
DAP LOAD 21112 11001

PERFORM HOUSEKEEPING CHORES

1. UNSNAP HELMET STOWAGE BAGS & STOW ON FLOOR
2. UNSTOW MIRROW, CHECK-LIST, DISPOSAL ASSY, & CONFIGURE FOR USE
3. STOW ISA OVER PLSS RECHG STN
4. UNSTOW 70mm & 16mm CMR's
5. CONFIGURE CMR's FOR USE
6. STOW CREW LOG

XFER TO LM PWR

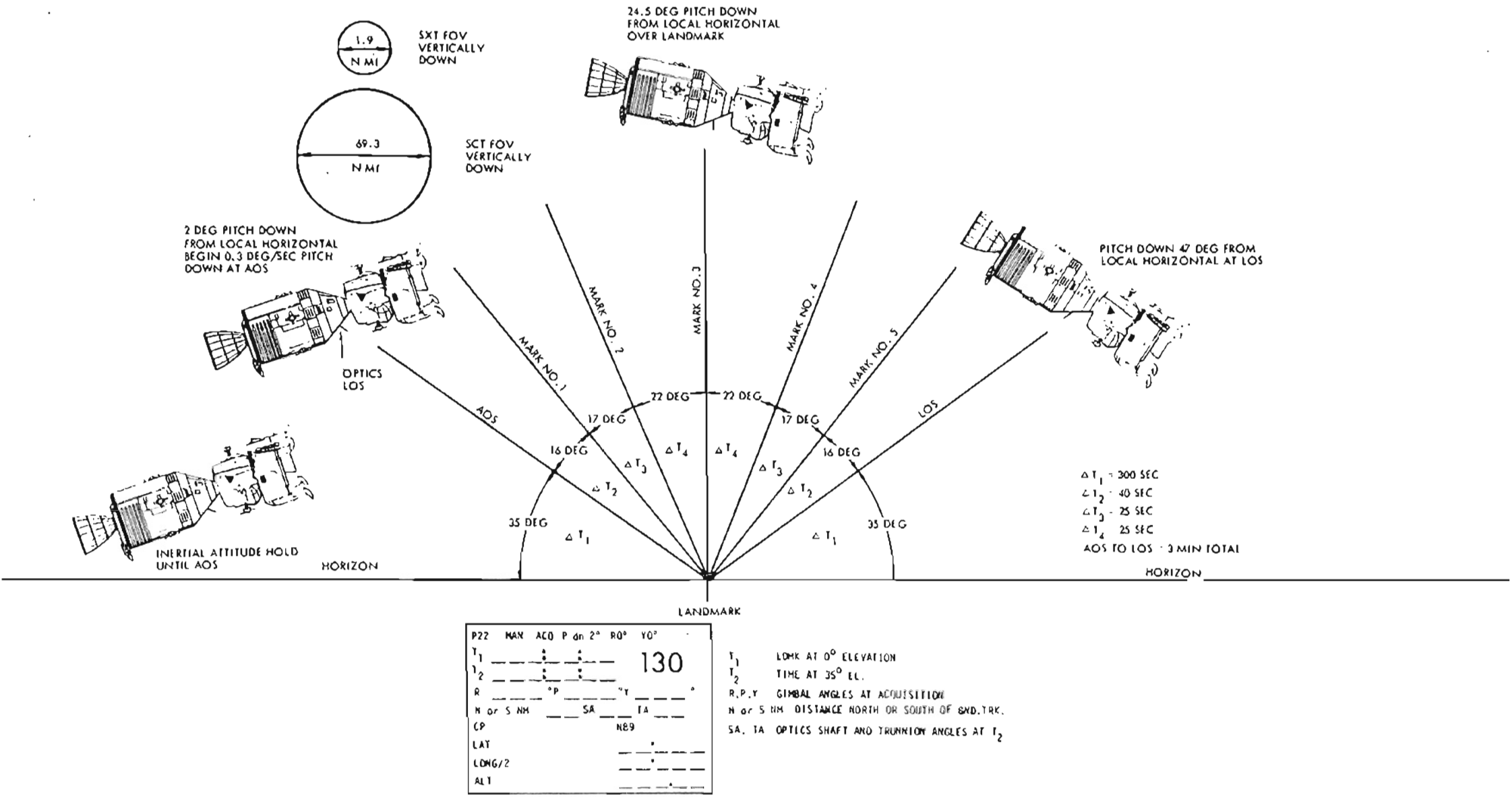
COMM ACTIVATION

S-BD/VHF A VOICE TESTS

OMNI VOICE/TM TESTS

STEER VOICE/TM TESTS

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	82:00-83:00	4/4	3-44



P22 MAN ACQ P dn 2° R0° Y0°

T_1 ___ ___ ___ ___ 130

T_2 ___ ___ ___ ___

R ___ ___ °P ___ ___ °Y ___ ___ °

N or S NM ___ SA ___ TA ___

CP N89

LAT ___ ___ ___

LONG/2 ___ ___ ___

ALT ___ ___ ___

T_1 LDMK AT 0° ELEVATION

T_2 TIME AT 35° EL.

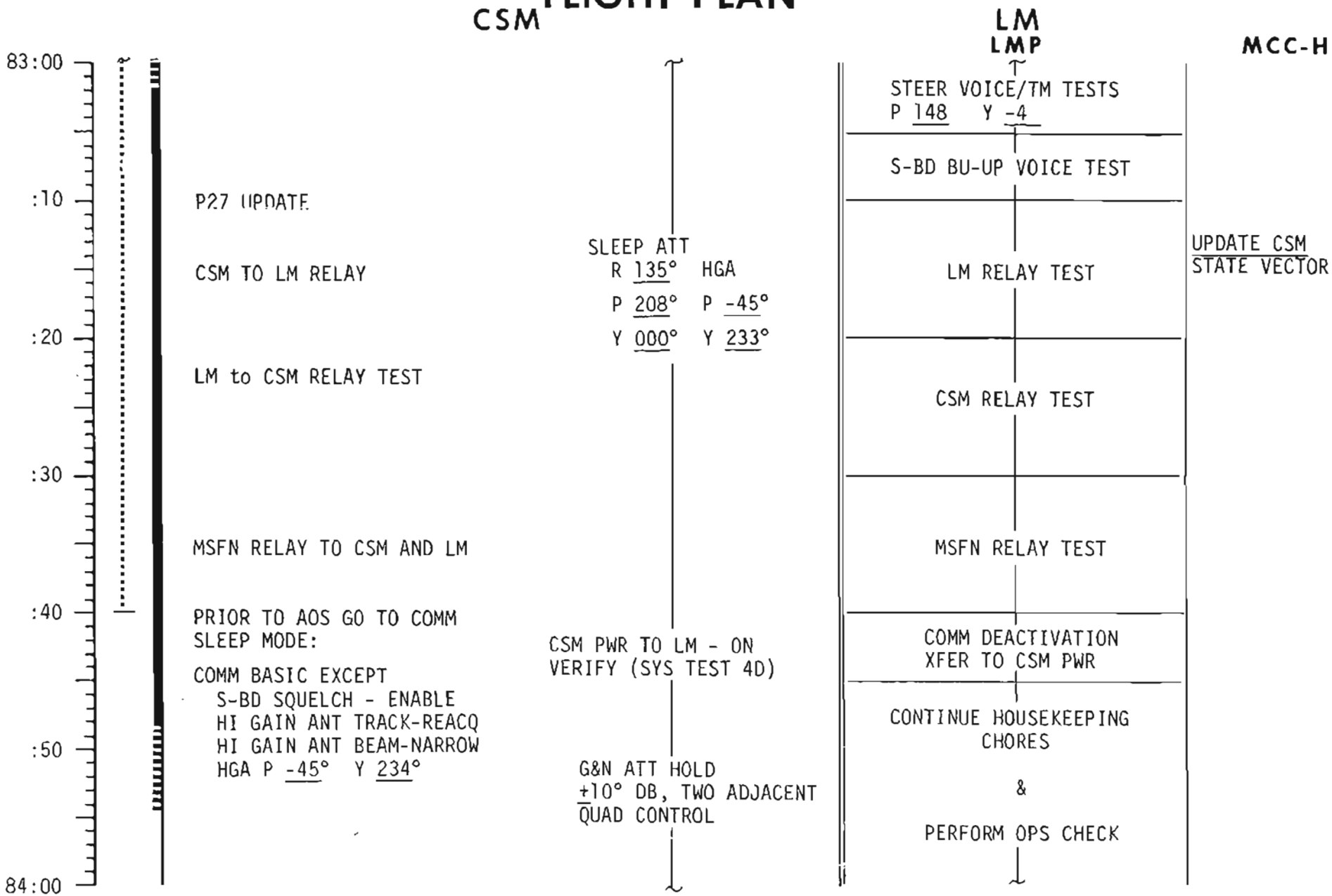
R,P,Y GIMBAL ANGLES AT ACQUISITION

N or S NM DISTANCE NORTH OR SOUTH OF GND. TRK.

SA, TA OPTICS SHAFT AND TRUNNION ANGLES AT T_2

CSM/LM TYPICAL LANDMARK TRACKING PROFILE

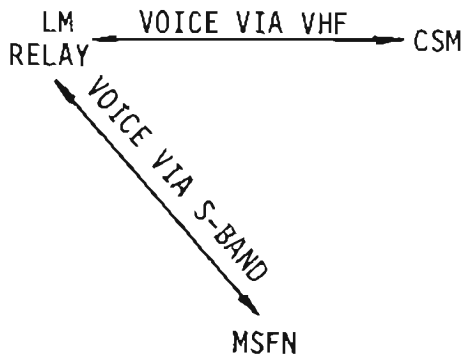
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	83:00-84:00	4/4	3-45

CSM COMM PROCEDURES
FOR CSM/LM COMM TESTS

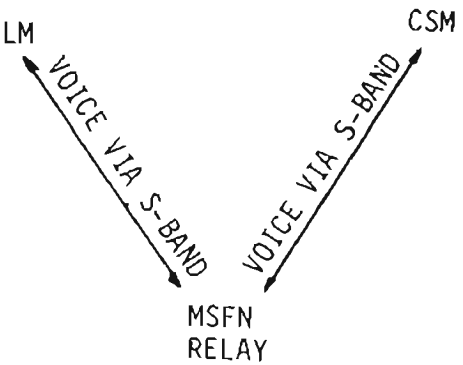
LM RELAY



CSM PROCEDURE
COMM BASIC EXCEPT
- AUDIO PANEL (in use): S-BD T/R - OFF
- VHF AM(B) - DUPLEX
- VHF AM(A) - OFF (verify)

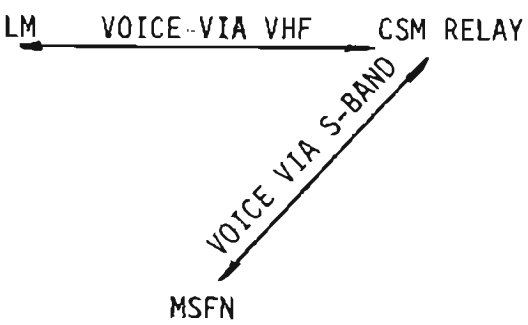
RETURN TO COMM BASIC

MSFN RELAY



CSM PROCEDURE
COMM BASIC EXCEPT
- AUDIO PANEL (in use): VHF AM - OFF

CSM RELAY



CSM PROCEDURES
COMM BASIC EXCEPT
- S-BD MODE VOICE - RELAY
- VHF AM(B) - DUPLEX

AUDIO PANEL 9
- MODE - VOX

AUDIO PANEL (panel 10)
- MODE - VOX
- AUDIO CONT - BU
- S-BD T/R - OFF
- VOX SENS - 6
- VHF AM - T/R
- INTERCOMM - OFF

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	83:00-84:00	4/4	3-45A

CSM FLIGHT PLAN

84:00

REV 5

:10

:20

:30

:40

:50

85:00

PRESLEEP CHECKLIST

CYCLE H2, O2 FANS
CHLORINATE POTABLE WATER
VERIFY
  WASTE MNGT OVBD DRAIN vlv - OFF
  WASTE STOW VENT vlv - CLOSED
  EMER CABIN PRES vlv - BOTH
  SURGE TK O2 vlv - ON
  PLSS O2 vlv - OFF
SETUP TV FOR NEXT DAY
SETUP BREAKFAST FOR NEXT DAY
INITIATE BATT A SECOND CHARGE

SLEEP ATT
R 135° HGA
P 208° P -45°
Y 000° Y 233°

IVT PHOTOGRAPHY

UNSTOW & INSTALL
FWD HATCH

P27 UPDATE

TUNL EQUALIZATION VALVE - CLOSED
TUNL VENT VALVE - LM PRESS
VERIFY VHF ALL OFF

SETUP CAMERA EQUIPMENT
FOR LM UNDOCKING AND INSPEC-
TION PHOTO:
70/80/CEX-(f8,250,50') 10
16/18/CEX-BRKT (RH WIN) MIR
(f8,250,∞) 12 fps, 2 MAG
2 MAG - CEX

G&N ATT HOLD
±10° DB, TWO ADJACENT
QUAD CONTROL

VERIFY:
  LM TUNNEL VENT vlv - LM PRESS
LMP DONN LCG
CREW STATUS REPORT
ONBOARD READOUTS to MSFN

LM
LMP

HOUSEKEEPING
&
OPS CHECK

IVT TO CSM
CLOSE LM HATCH

CSM

ONBOARD READOUT

BAT C _____
PYRO BAT A _____
PYRO BAT B _____
RCS A _____
B _____
C _____
D _____
DC IND sel-MNA or B

THURSDAY, MAY 22
0100 EDT
10h to LM IVT by LMP
12h to LLS 2 TRACKING
13h 40m to UNDOCKING

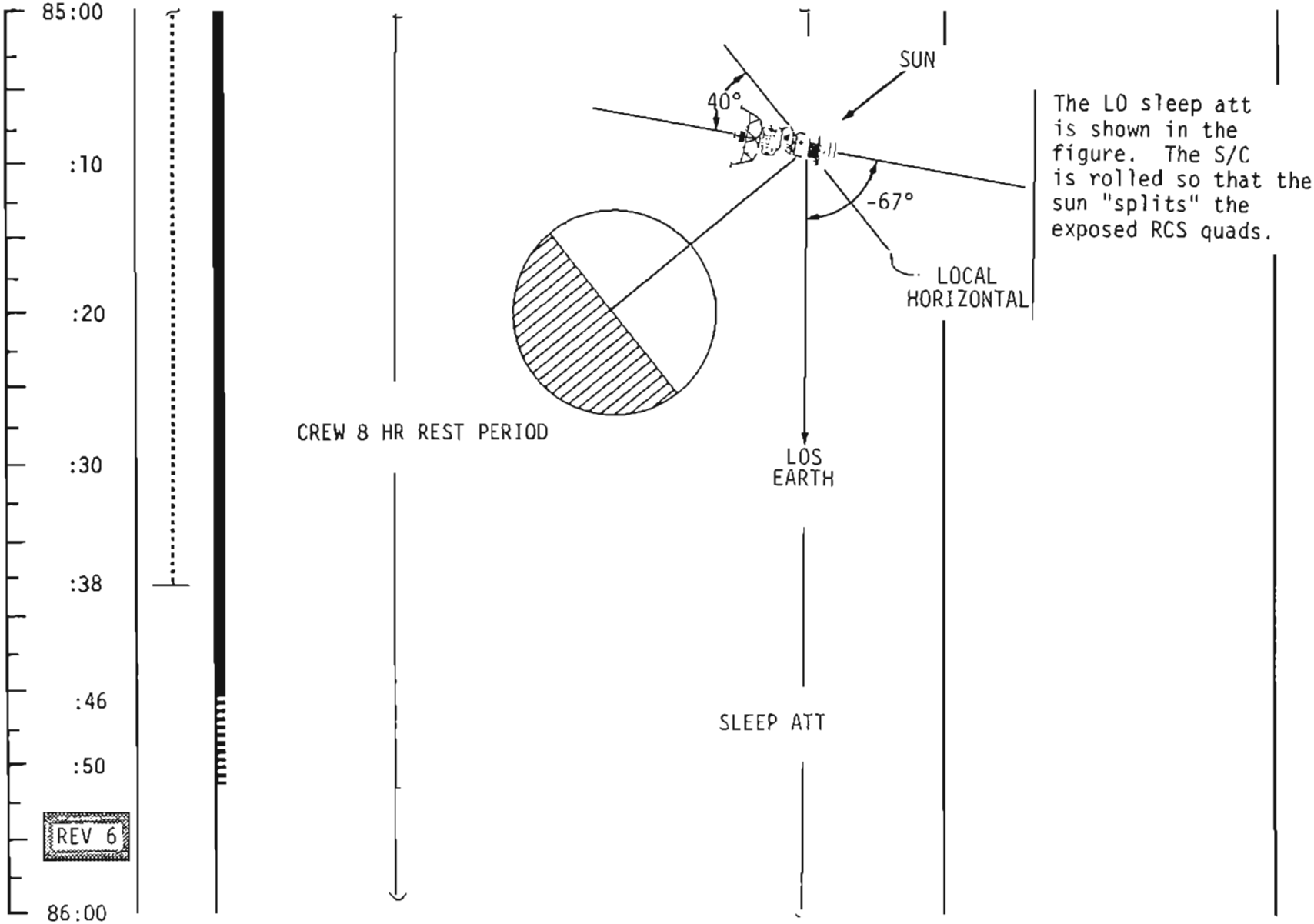
MCC-H

UPDATE
STATE VECTOR
DEBRIEF LDMK
TRACKING
TEI_{10} PAD

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	84:00-85:00	4/4	3-46

NOTES

FLIGHT PLAN



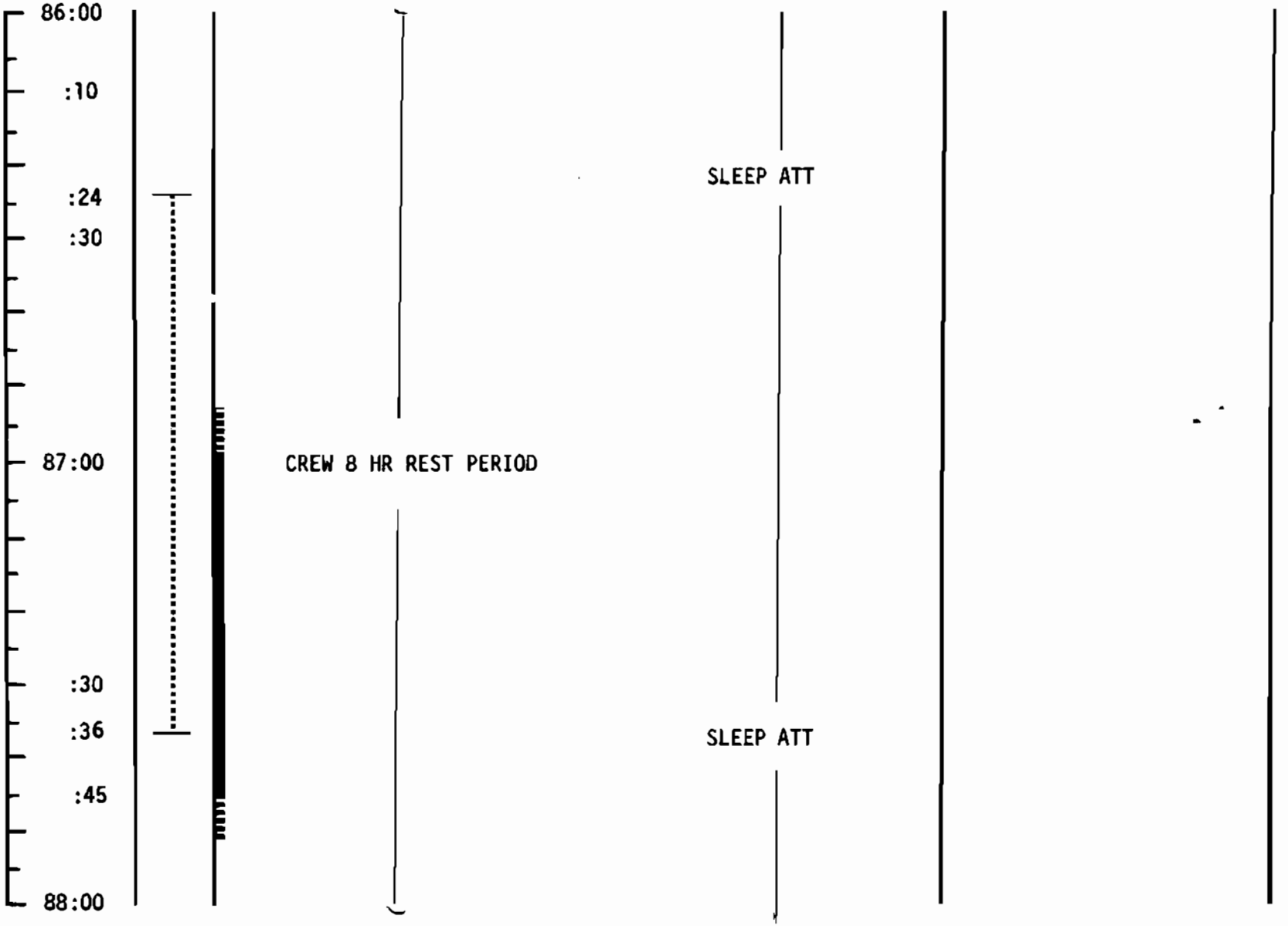
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	85:00 - 86:00	4/5	3-47

FLIGHT PLANNING BRANCH

MCC-

NOTES

FLIGHT PLAN

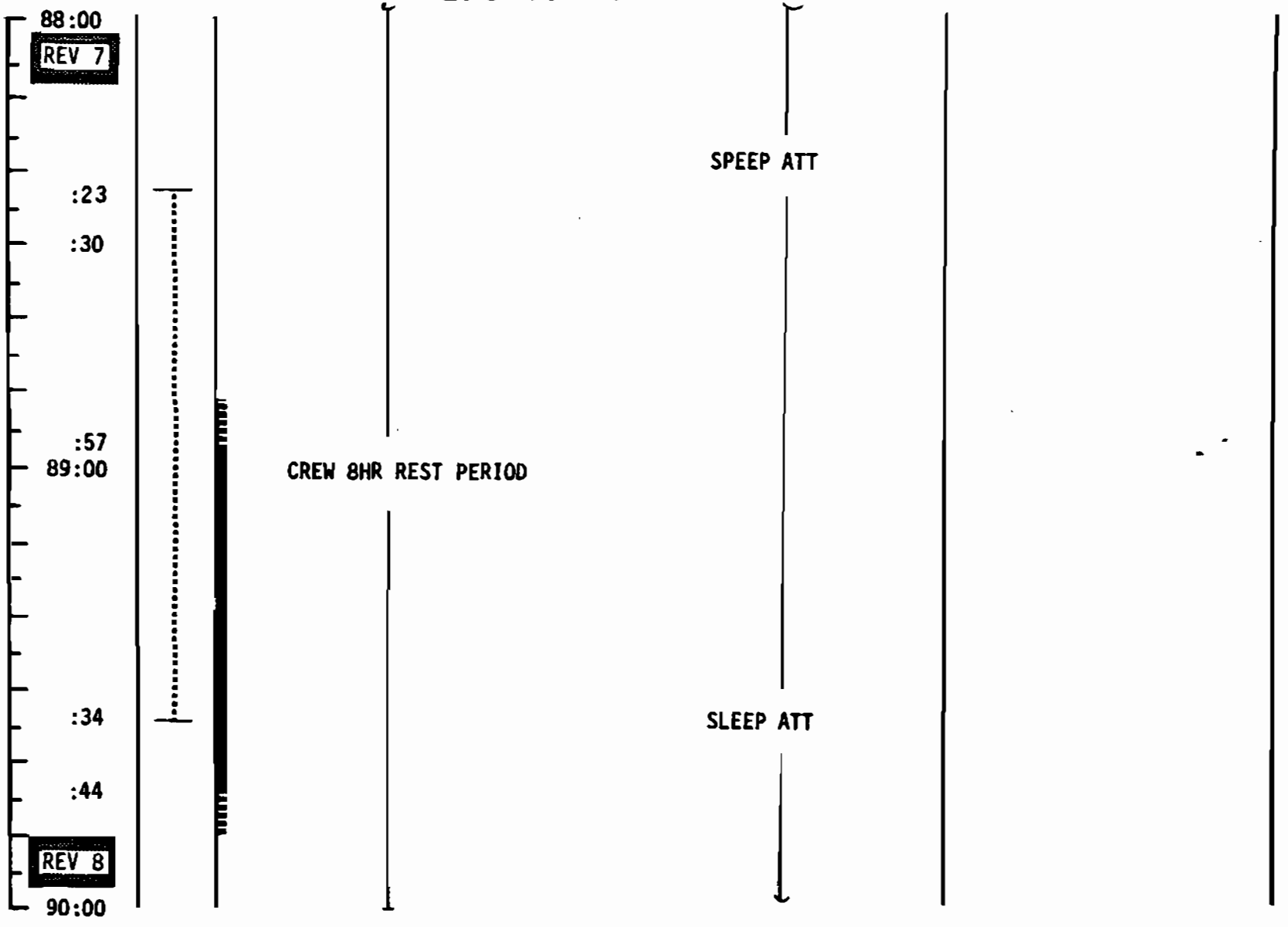


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	86:00 - 88:00	4/6	3-48

FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN

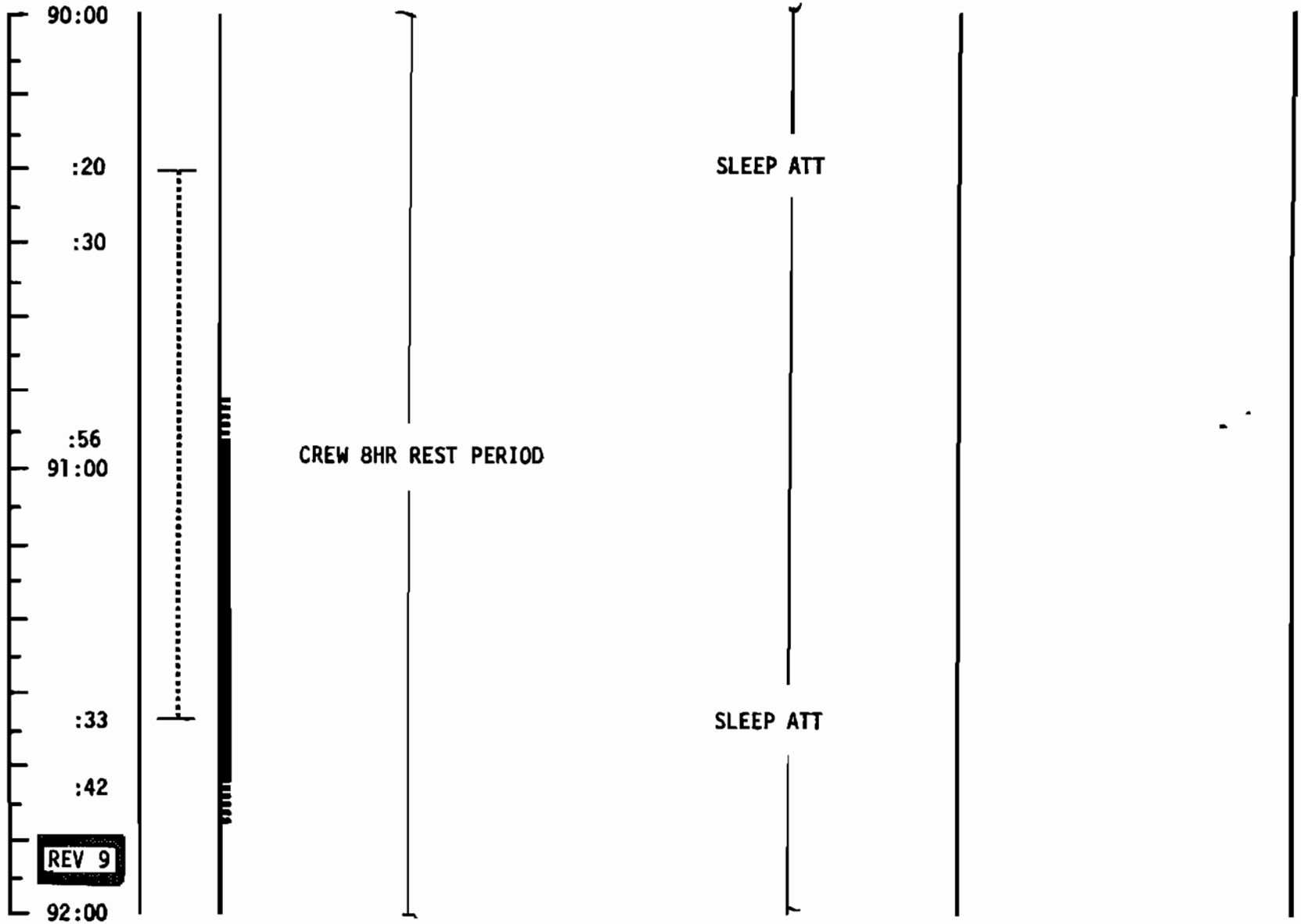


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	88:00 - 90:00	4/7	3-49

FLIGHT PLA NG BRANCH

NOTES

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	90:00 - 92:00	4/8	3-50

FLIGHT PLANNING BRANCH

MCC-H

FLIGHT PLAN

NOTES

92:00

:19

:30

:54

93:00

:30

:40

REV 10

94:00

CREW REST PERIOD

BREAKFAST

UPDATE

CONSUMABLES
FLIGHT PLAN

POSTSLEEP CHECKLIST

CREW STATUS REPORT
CONSUMABLES UPDATE from MSFN
FLIGHT PLAN UPDATE
CYCLE H2, O2 FANS
COMM BASIC
CREW MANAGES ANT OPS
H2 PURGE LINE HTRS - ON

ECS REDUNDANT COMPONENT CHECK

F/C O_2, H_2 PURGE

SLEEP ATT
R 135°
P 208°
Y 000°
HGA
P -42°
Y 228°

THURSDAY, MAY 22, 1000 EDT
3h 40m to LLS 2 TRACKING
5h 10m to UNDOCKING
6h 34m to DOI
7h 46m to PHASING
9h 43m to INSERTION
12h 09m to TPI
13h 20m to DOCKING
15h 09m to LM JETTISON
16h to next rest period.

CONSUMABLES UPDATE

GET: _____
RCS TOT _____
A _____
B _____
C _____
D _____
H_2 TOT _____
O_2 TOT _____

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
C	FINAL	APRIL 17 1969	92:00 - 94:00	4/9	3-51

FLIGHT PL NG BRANCH

FLIGHT AN

CSM

CMP

HOLD R 135° HGA
P 208° P - 42°
Y 000° Y 228°

CANISTER B CHANGE
(10 to B, 8 to B6)

V64 ACQ MSFN
P27 UPDATE

RELAY ROLL CAL TO MSFN

CMP: DON PGA-W/O
HELMET & GLOVES

P52 IMU REALIGN
(Option 1 - preferred)

LM

CDR

94:00

DON PGA W/O
HELMET & GLOVES

:10

:20

RECORD ROLL CAL ✓

:30

CSM PWR to LM - OFF

DISCONNECT & STOW
LM PWR CABLES

:40

:50

IVT TO LM
WITH HELMET & GLOVES

ACT ECS & C/O
Connect to ECS

95:00

LMP

VERIFY LM/CM ΔP
< 0.2

OPEN & STOW CM HATCH
VERIFY ROLL CAL ✓

IVT TO LM
XFER TO LM PWR

EPS ACT & C/O
DWN B.U. VOICE
ACT MISSION TIMER
PRIM GLYCOL LOOP ACT

CAUTION & WARNING C/O

CB ACT & TB
VERIFICATION

PGNCS TURN ON &
SELF TEST

MCC-H

CSM UPDATE
STATE VECTOR
LLS 2 REFSMMAT
LLS 2 TRACK PAD
MAP UPDATE REV 11

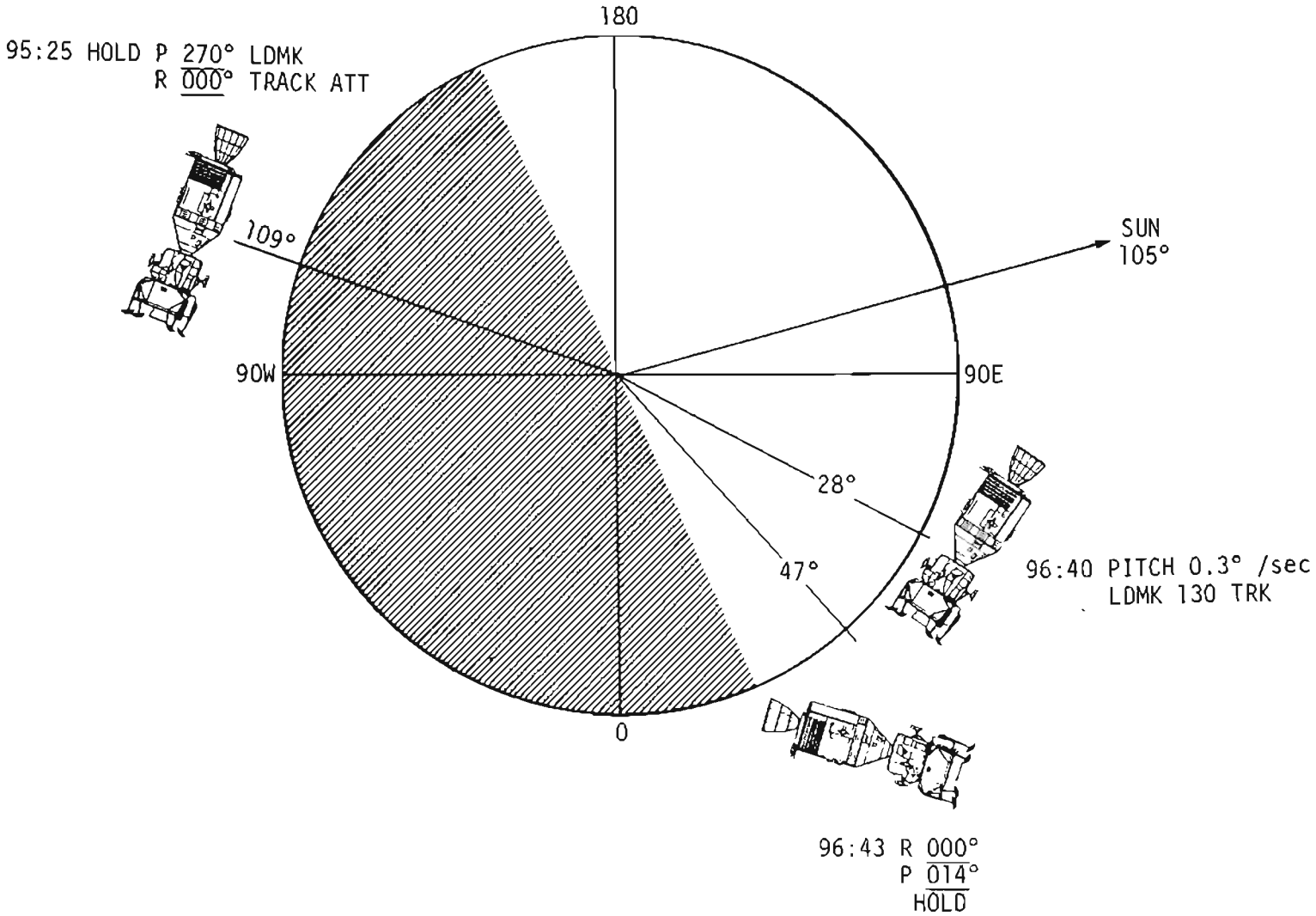
MSFN RCD OPS Source
pressure

P52 OPT ___
N71: ___ ___, ___ ___
N05: ___ ___ ___ • ___ ___
N93:
X ___ ___ • ___ ___ ___
Y ___ ___ • ___ ___ ___
Z ___ ___ • ___ ___ ___

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	94:00 - 95:00	5/11	3-52

REV A

REV 10/11



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	95:00-96:00	4/10-11	3-52A

REV A

FLIGHT PLAN

CSM

CMP

RECORD DAP UPDATE

VHF AM(B) - SIMPLEX
VHF RCV ONLY - B DATA

VHF AM(B) - OFF
VHF AM(A) - SIMPLEX

LM CLOCK SYNC: V06N65
TEPHEM: V05N01E 1706E
MNVR R 000° for LMDK TRACKING
P 270°
Y 000°

VERIFY DSE MOTION @ LOS

MIN DB ATT HOLD FOR
LM ALIGN

V06N20, READ ANGLES,
ENTER ON LM MARK
DISABLE ROLL JETS

INSTALL DROGUE, PROBE,
PRELOAD PROBE, RECOCK
DOCKING LATCHES (12),
INSTALL HATCH,
PREFORM HATCH INTEGRITY
CHECK - LEAVE TUNL VENT
VALVE IN TUNL VENT
POSITION

95:00
:10
:20
:30
:40
:50
REV 11
96:00

LM

CDR

SUIT FAN/H_2O SEP CK

GLYCOL PUMP CK

VHF B ACTIVATION
VHF B SIMPLEX CHECK
VHF A CHECK

LGC/CMC CLOCK SET &
TEPHEM UPDATE

E MEMORY DUMP (2)

PCM-LO, OMNI ANT

LM DOCKED MANUAL
IMU COARSE ALIGN

ASSIST CMP IN
DROGUE INSTALLATION
& CLOSE LM HATCH

DON HELMET & GLOVES

LMP

SEC S-BAND T/R &
PWR AMPL CK

S-BD STEER ANT CK
P 148°, Y -04°

IVT TO CSM

DON LCG & PGA
W/O HELMET & GLOVES

IVT TO LM
WITH HELMET & GLOVES
CONNECT TO LM ECS
& VHF

ASC BAT ACT & C/O

DON HELMET & GLOVES

MCC-H

UPDATE CSM
DAP UPDATE:
WTS & GIMBAL TRIM
+ _____
+ _____
_____
_____

UPDATE CSM
GO FOR MNVR
to LDMK TRACK ATT

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	95:00 - 96:00	4/10	3-53

REV A

MAP UPDATE REV 10

LOS :__ __ __:__ __:__ __

150°W:__ __ __:__ __:__ __

AOS :__ __ __:__ __:__ __

MAP UPDATE REV 11

LOS :__ __ __:__ __:__ __

150°W:__ __ __:__ __:__ __

AOS :__ __ __:__ __:__ __

P22 MAN ACQ P dn 2^0 0° Y0°

T_1 __ __ __:__ __:__ __ 130

T_2 __ __ __:__ __:__ __

R ___ °P ___ °Y ___ °

N or S NM __ __ SA __ __ TA __ __

130 N89

LAT +01.266 __ __ __ __ __

LONG/2 +11.839 __ __ __ __ __

ALT -001.73 __ __ __ __ __

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	92:00 - 94:00	4/9	3-53A

FLIGHT PLAN

CSM

CMP

ENABLE ROLL JETS
(LM/CM ΔP > 3.5)
CONTINGENCY EVA PREP

OMNI C

NOTES
DURING P22 DO NOT
PRO ON FINAL N89 DISPLAY

25 SEC BETWEEN MARKS

P22 ORBITAL NAV
(LLS 2, LDMK 130)

T_1 96:35 LDMK 130 @ 0° EL
T_2 96:40 LDMK 130 @ 35° EL
8° Sun

MNVR R 000° HGA
P 014° P -45°
Y 000° Y 353°

V64 ACQ MSFN

VERIFY LM TUNNEL VENT - OFF

LM PIPA BIAS : RATES
< 0.1° SEC
V06N20 LM DRIFT CHECK

96:00
:10
:20
:30
:40
:50
97:00

LM

CDR

ARS/PGA PRESSURE INTEGRITY CHECK

REGULATOR CK

DOFF HELMET & GLOVES

VOICE GIMBAL ANGLES TO MSFN

COPY DAP DATA PAD

RATE GYRO CHECK

COPY GYRO TORQUING ANGLE & FINE ALIGN IMU

P27 UPDATE

LM GIMBAL DRIFT CHECK

LMP

ARS/PGA PRESSURE INTEGRITY CHECK

REGULATOR CK

DOFF HELMET & GLOVES

ACQUIRE MSFN, PCM-LO
(OMNI FWD ANT)

COPY S-BD POINTING ANGLES & MAP UPDATE

AGS ACTIVATION & SELF-TEST

S-BAND STEER ANT, PCM HI
P 193° Y 64°

MCC-H

MSFN
COPY GIMBAL ANGLES
SET 1

UPDATE LM
DAP LOAD PAD
MAP UPDATE
S-BD POINTING ANGLES

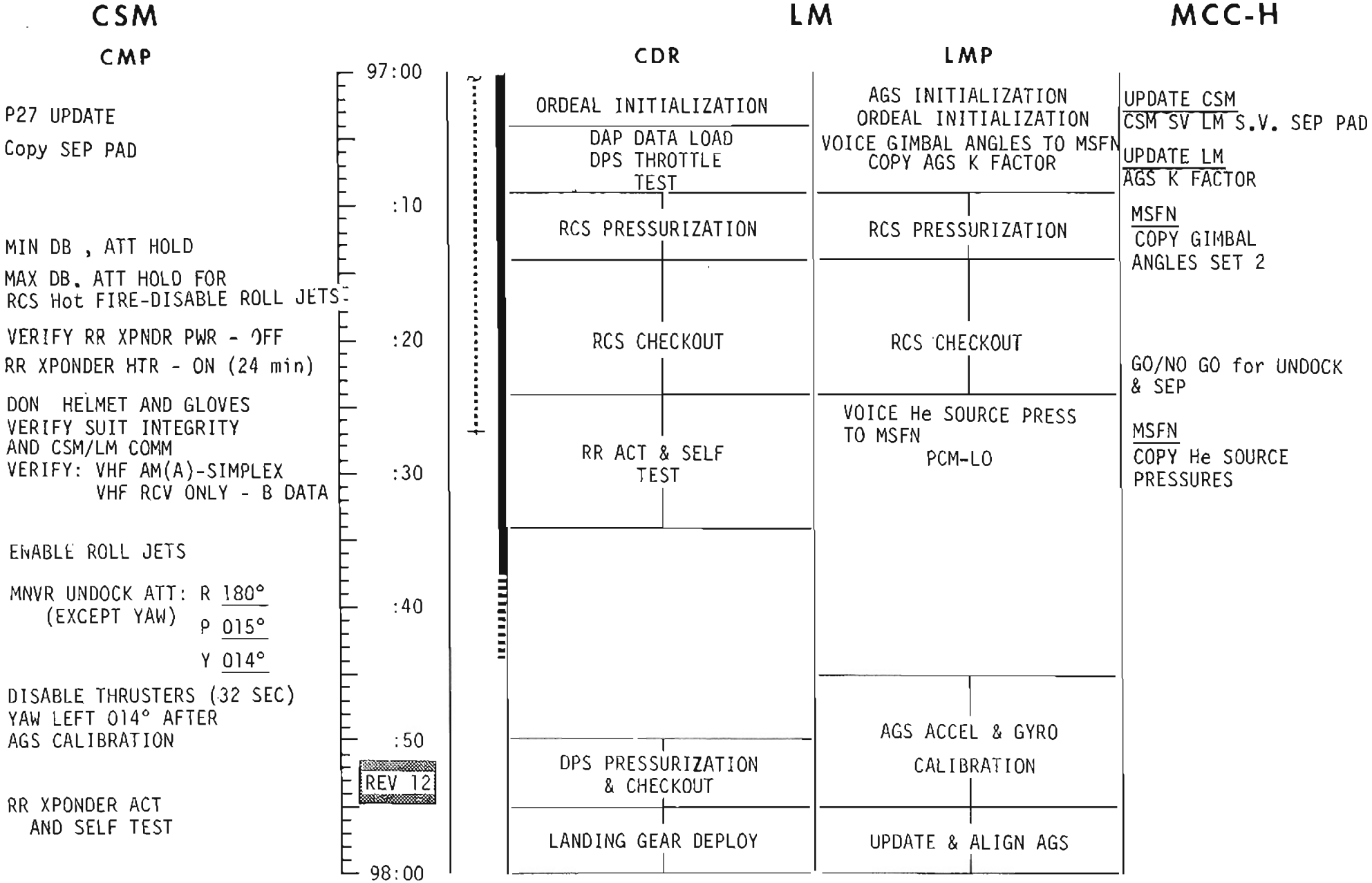
UPDATE LM
GYRO TORQUING ANGLES

UPDATE LM
LGC/CMC CLOCK SYNC
STATE VECTORS
REFSMMAT
LM PIPA BIAS (Pg 4-20

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	96:00 - 97:00	5/11	3-54

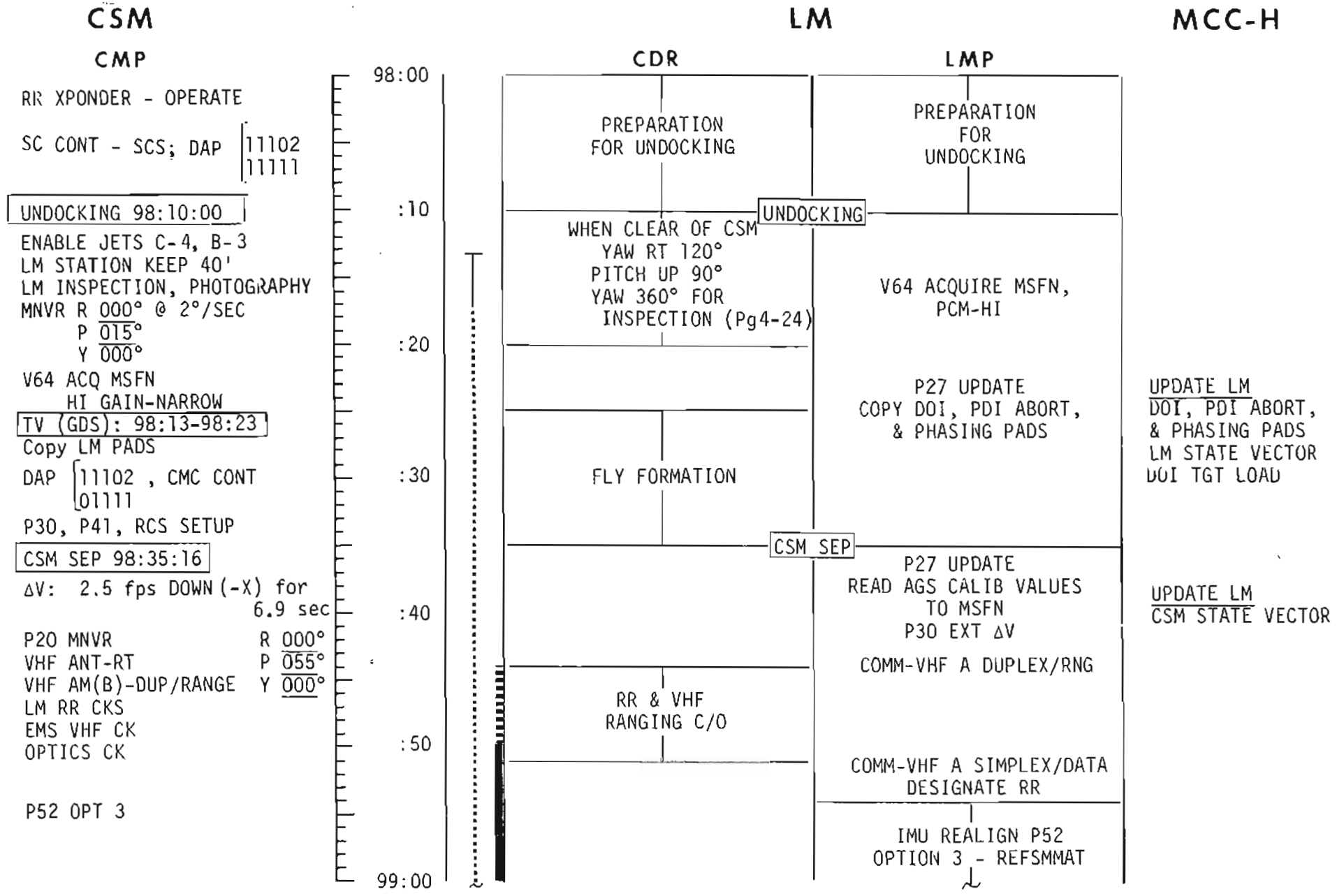
REV A

FLIGHT PLAN



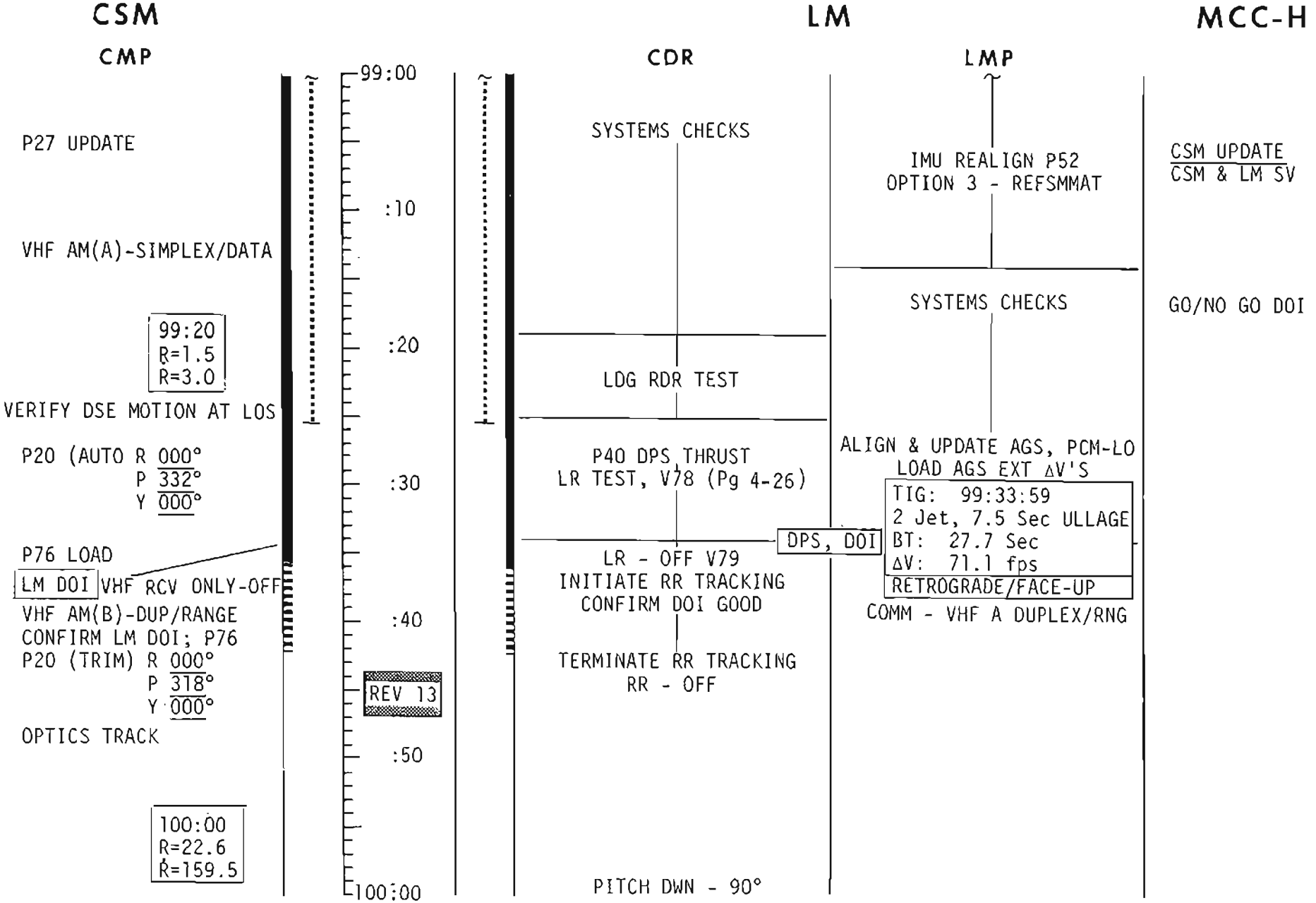
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	97:00 - 98:00	5/12	3-55

FLIGHT LAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	98:00 - 99:00	5/12	3-56

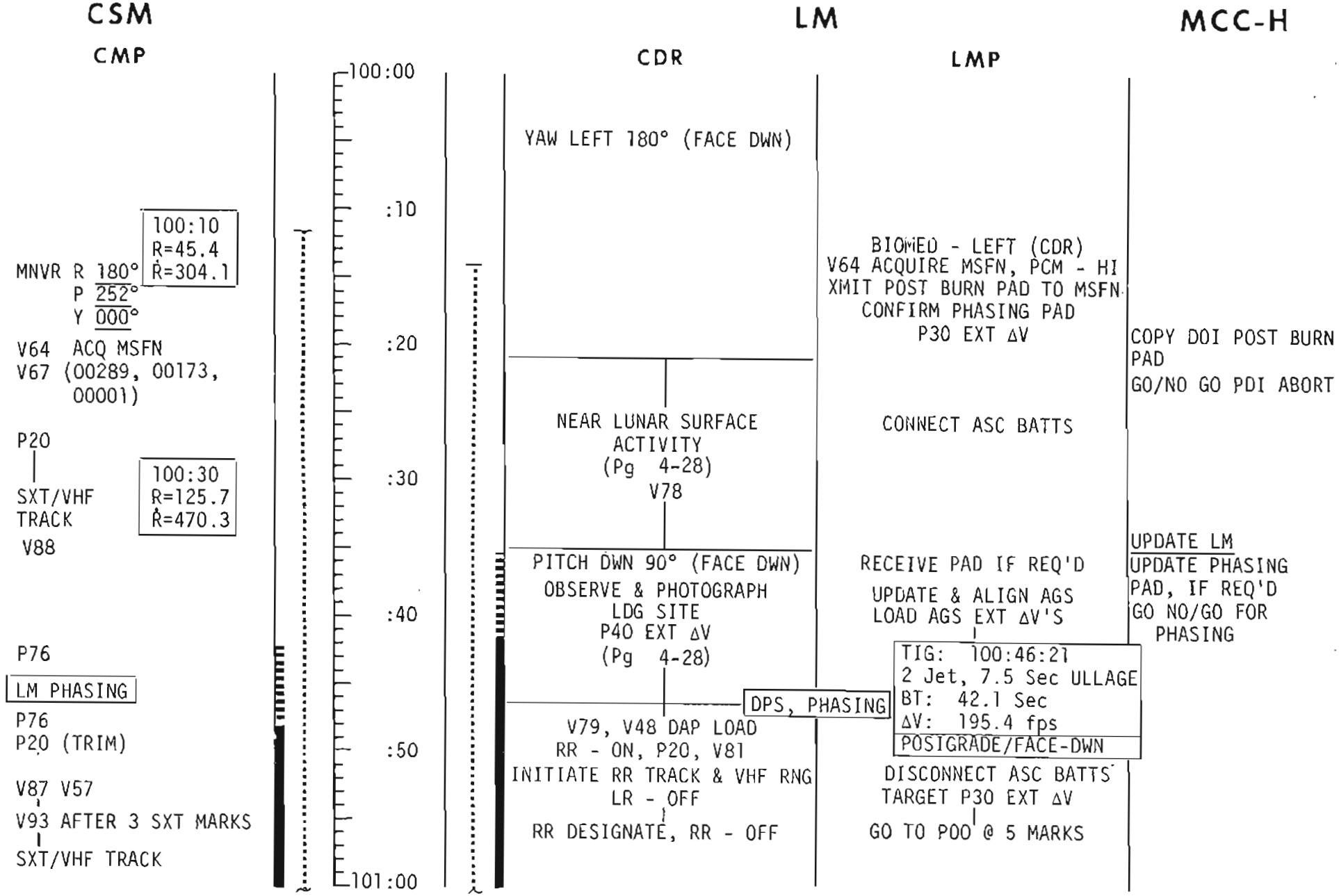
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	99:00 - 100:00	5/1?	3-57

REV A FLIGHT P ING BRANCH

FLIGHT PLAN

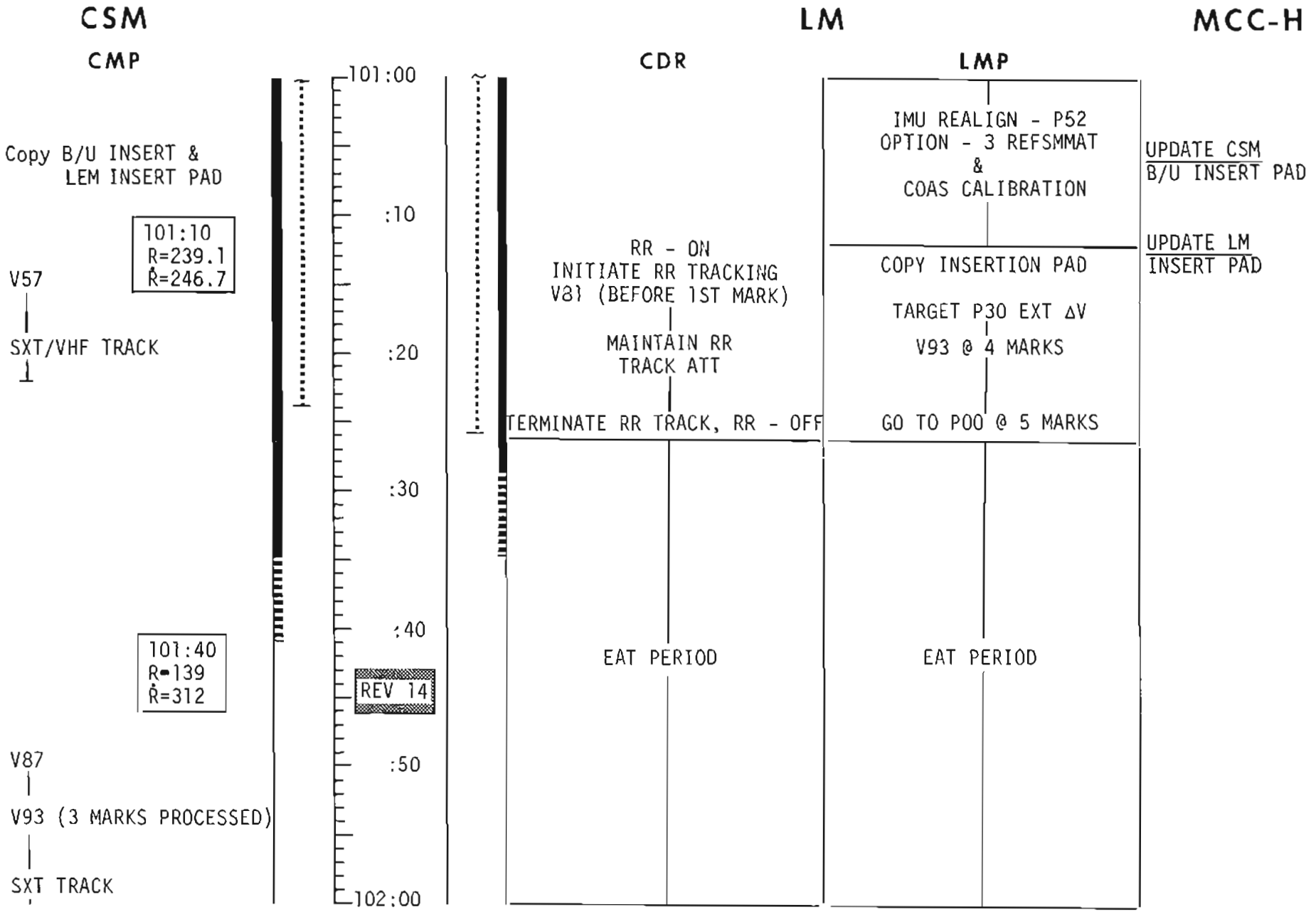


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	100:00 - 101:00	5/13	3-58

REV A

FLIGHT PLANNING BRANCH

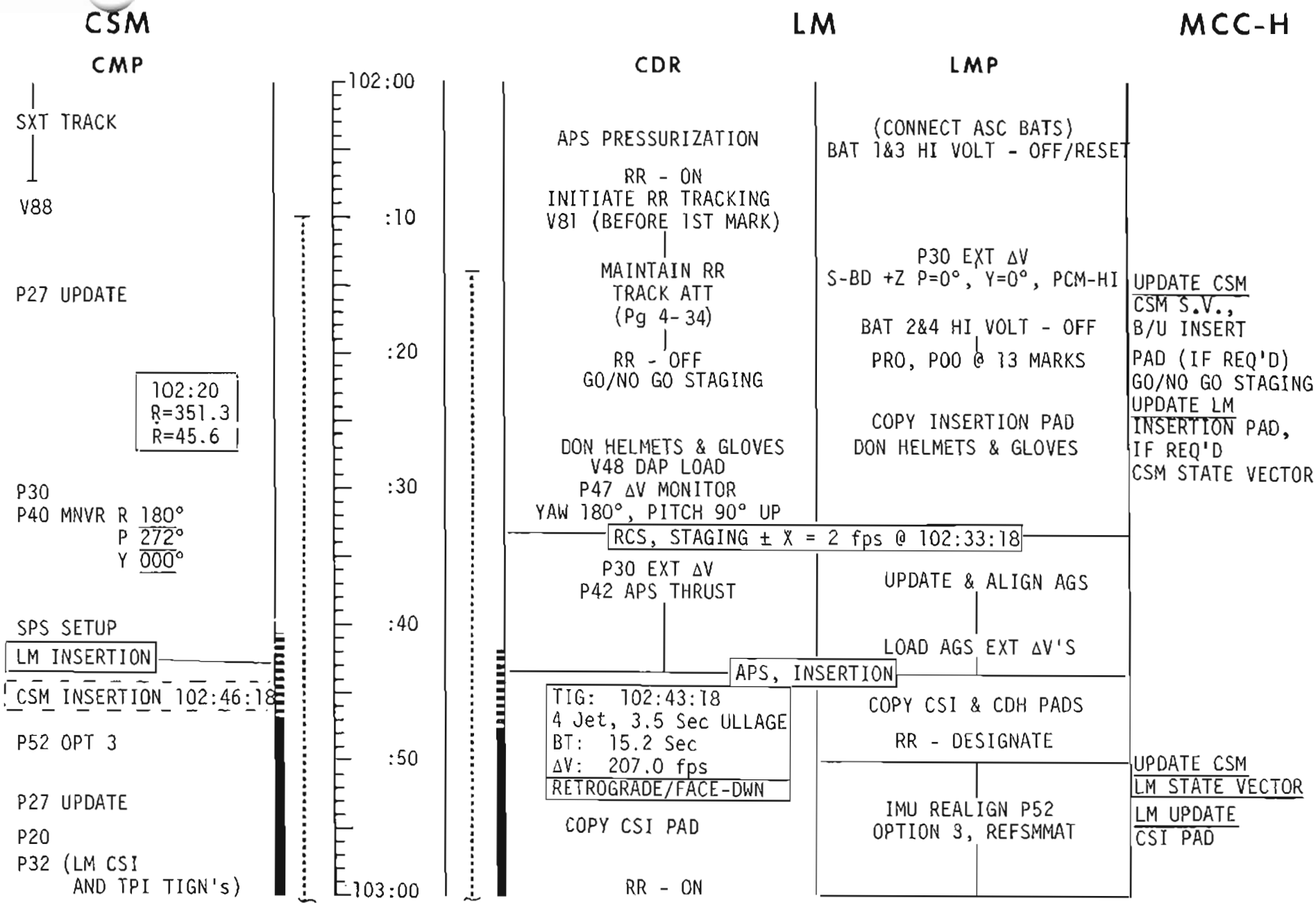
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	101:00 - 102:00	5/14	3-59

FLIGHT PLANNING BRANCH

FLIGHT PLAN

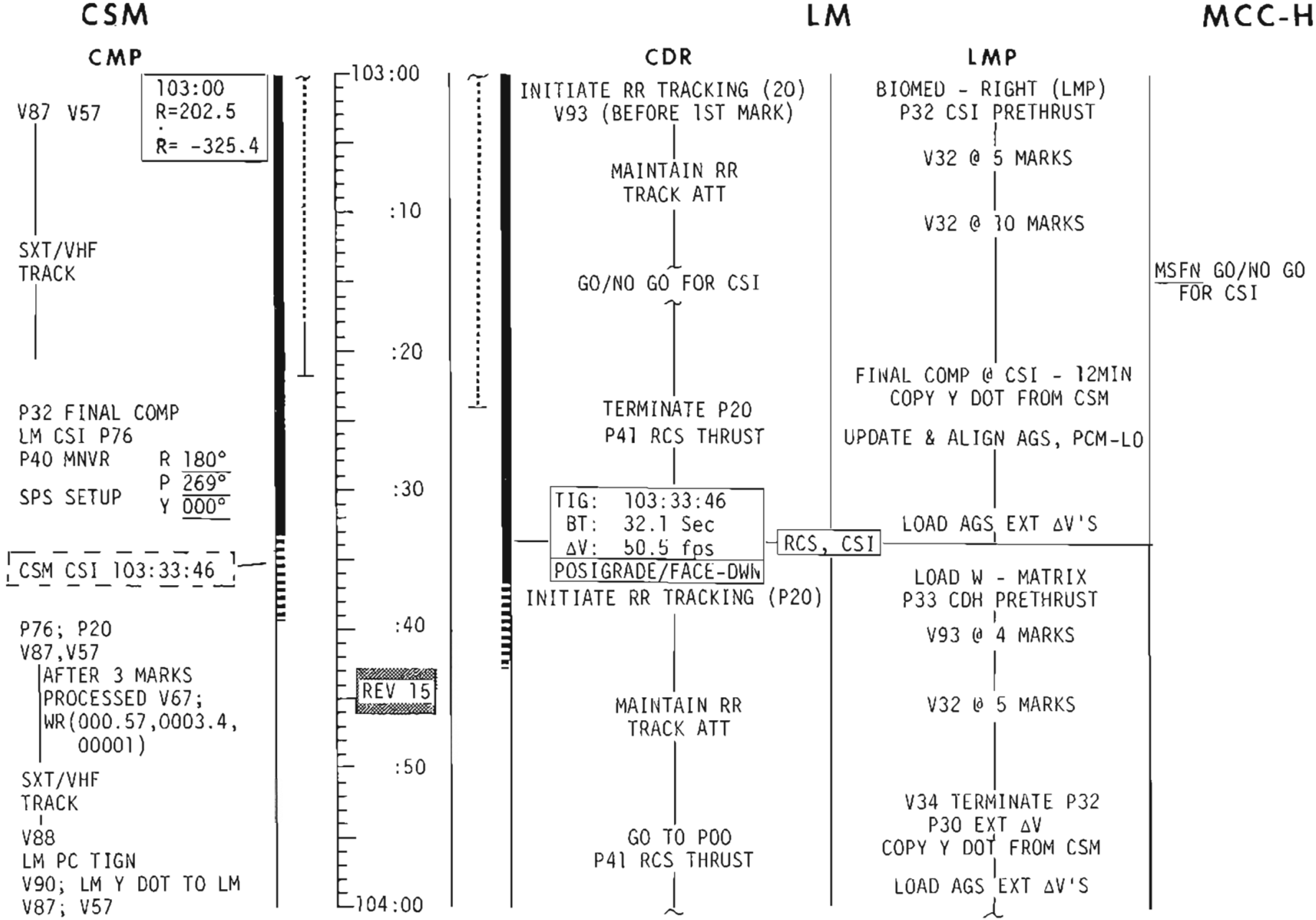


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	102:00 - 103:00	5/14	3-60

REV A

FLIGHT PLANNING BRANCH

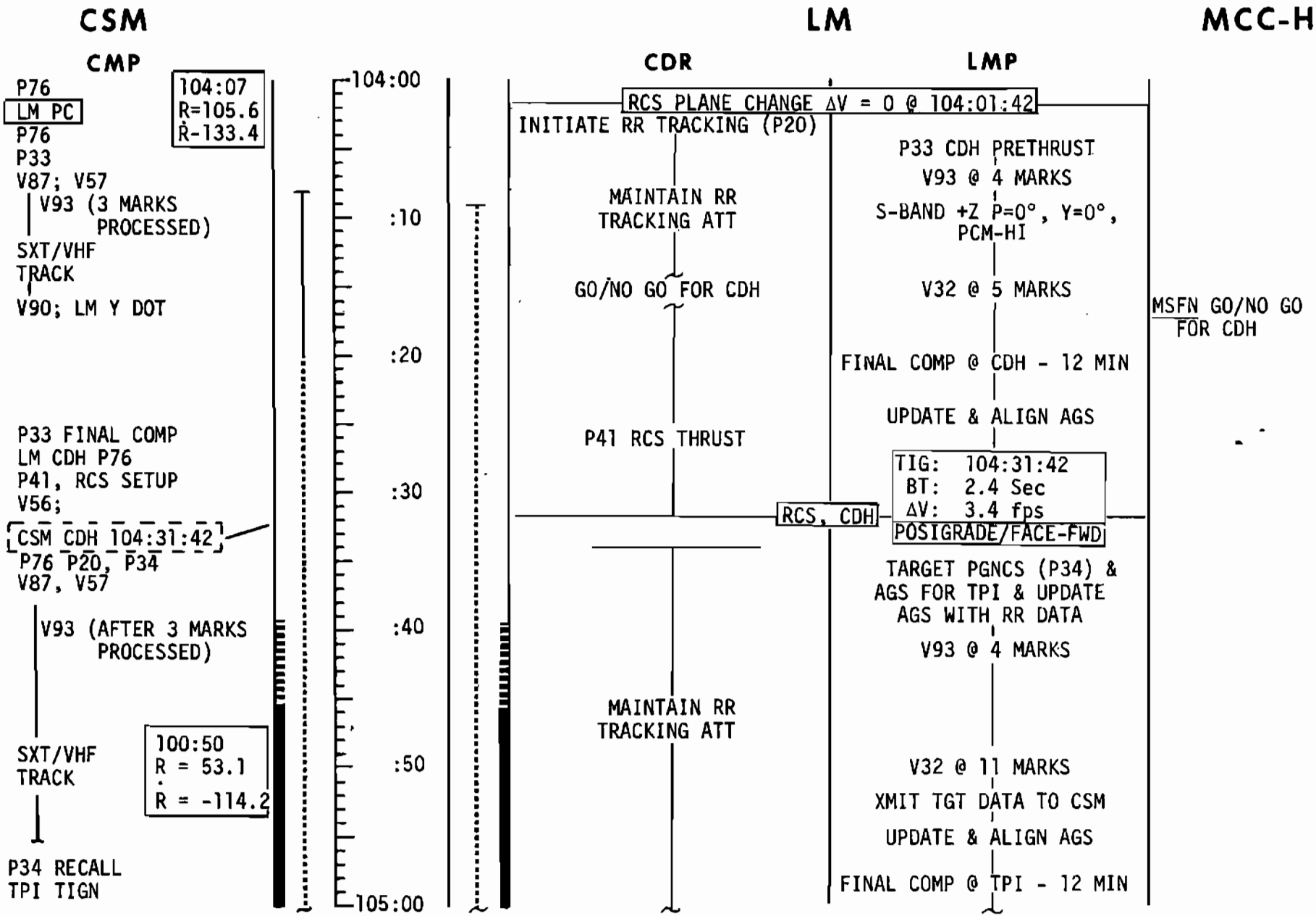
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	103:00 - 104:00	5/15	3-61

FLIGHT PL IG BRANCH

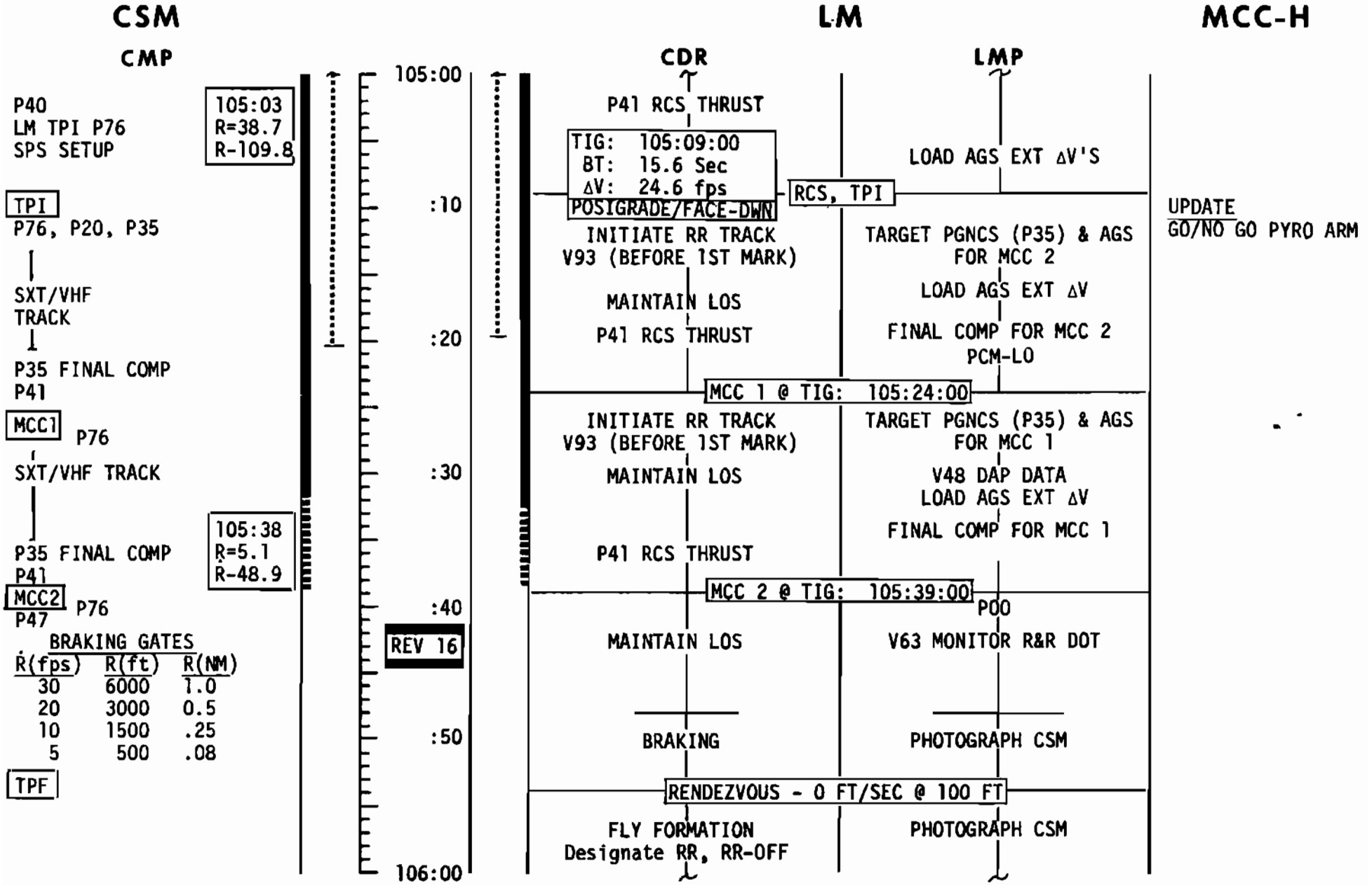
FLIG PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	104:00 - 105:00	5/15	3-62

FLIGHT PLANNING BRANCH

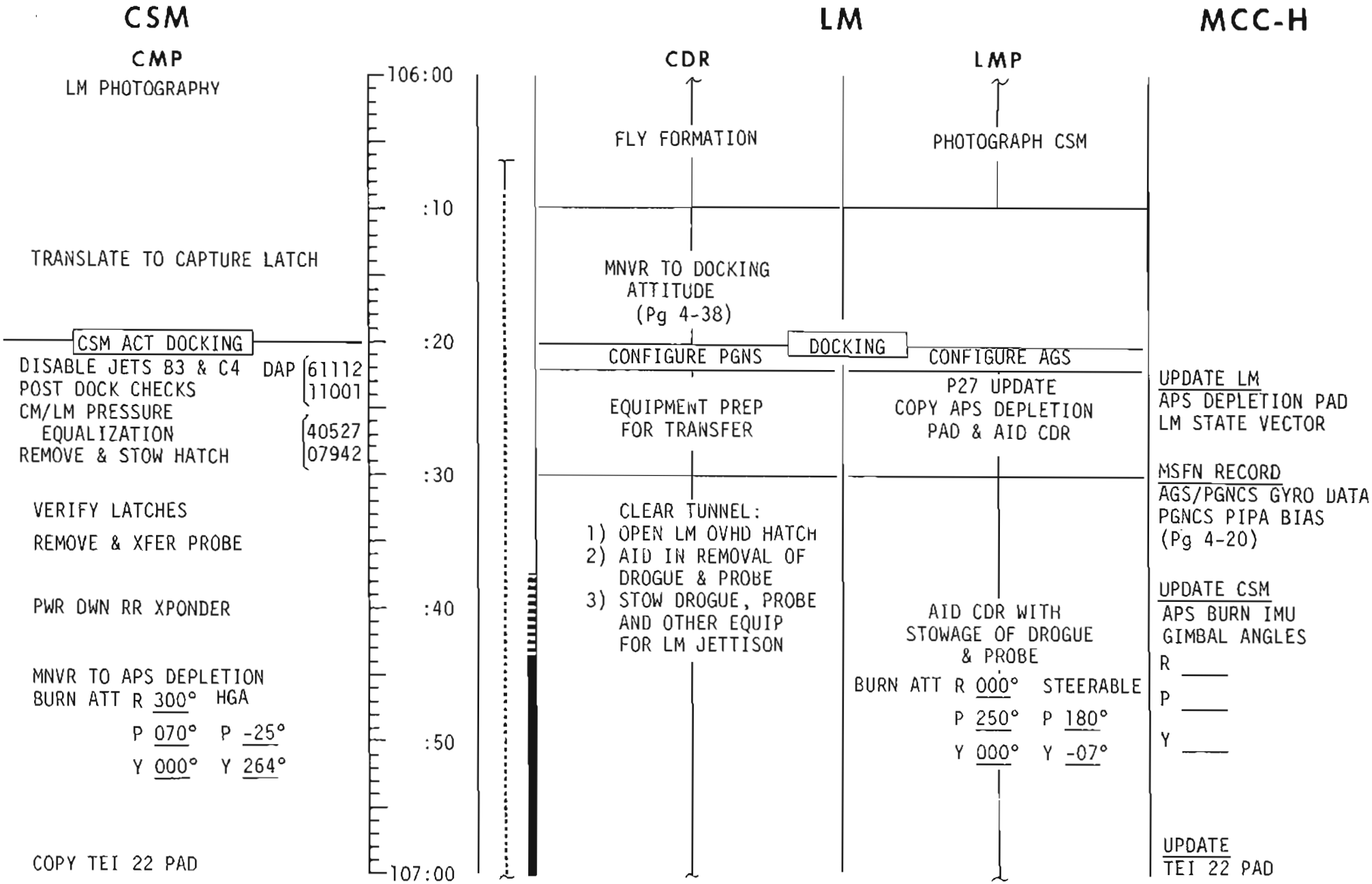
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	105:00 - 106:00	5/16	3-63

FLIGHT [illegible]NING BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	106:00 - 107:00	5/16	3-64

REV A

FLIGHT PLANNING BRANCH

FLIGHT PLAN

CSM		LM		MCC-H
CMP		CDR	LMP	
MIN DB	107:00		POSITION S-BAND STEER FOR APS BURN	
LM To CSM XFER ITEMS: 1. RAD SURV METER 2. 16mm FILM (6 mags 1 bag) 3. 70mm FILM (3 mags 1 bag) 4. MONOCULAR 5. FLT DATA FILE ITEMS 6. PPK'S 7. DSEA	:10	IVT TO CSM WITH ISA	TARGET APS BURN	
		CSM	LM CLOSE OUT	
RNDZ EQUIP STOWAGE	:20	RNDZ EQUIP STOWAGE	IVT TO CSM CLOSE LM HATCH	
F/C O_2 PURGE	:30	UNSTOW & INSTALL FWD HATCH	UNSTOW & INSTALL FWD HATCH	
POWER DOWN VHF				
EVENING MEAL	:40			
	REV 17			
	:50			
	108:00			

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	107:00 - 108:00	5/17	3-65

REV A FLIGHT P NG BRANCH

MCC-H

NOTES

FLIGHT PLAN

UPDATE
GO NO/GO
PYRO ARM

108:00

:04

:10

:20

:30

:42

:50

UPDATE
STATE VECTOR
REV 22 MAP
UPDATE

109:00

LLS 2 PHOTO PAD

(PADS ON Pg 3-71)

CANISTER A CHANGE
(11 to A, 9 to A3)

DAP [11102]; P47 for SEP

108:09 LM JETTISON AND CSM
FINAL SEP MNVR (ΔV: 2fps up (-X jets) (5.6 sec)

AFTER LM JETTISON AND PRIOR TO SEP BURN, ENABLE JETS B-3 AND C-4

DOFF SUITS - ALL

PRESLEEP CHECKLIST
(EXCEPT COMM)

- CREW STATUS REPORT
- ONBOARD READOUTS to MSFN
- CYCLE H2, O2 FANS
- CHLORINATE POTABLE WATER
- VERIFY
  - WASTE MNGT OVBD DRAIN vlv - OFF
  - WASTE STOW VENT vlv - CLOSED
  - EMER CABIN PRESS vlv - BOTH
  - SURGE TK O2 vlv - ON
  - PLSS O2 vlv - OFF
  - LM TUNNEL VENT vlv - OFF

HGA to NARROW

TV(GDS): 108:35-:50

108:39 LM APS BURN TO DEPLETION

MNVR R 135° SLEEP ATT
P 210°
Y 000°

COMM BASIC EXCEPT
S-BD SQUELCH - ENABLE
HI GAIN ANT TRACK - REACQ
HI GAIN ANT BEAM - NARROW
HGA P -39° Y 222°

P27 UPDATE

G&N ATT HOLD
±10° DB. TWO ADJACENT QUAD CONTROL

CREW 9 HR REST PERIOD

ONBOARD READOUT

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

DC IND sel - MNA or B

CONFIGURE CAMERA FOR LLS 2 PHOTO NEXT DAY:
70/80/BW-BRKT, IVL
(f4.0,125,∞) 30
16/18/CEX-BRKT (LH WIN)
(f8/f2,250,∞) 1 fps
1 MAG

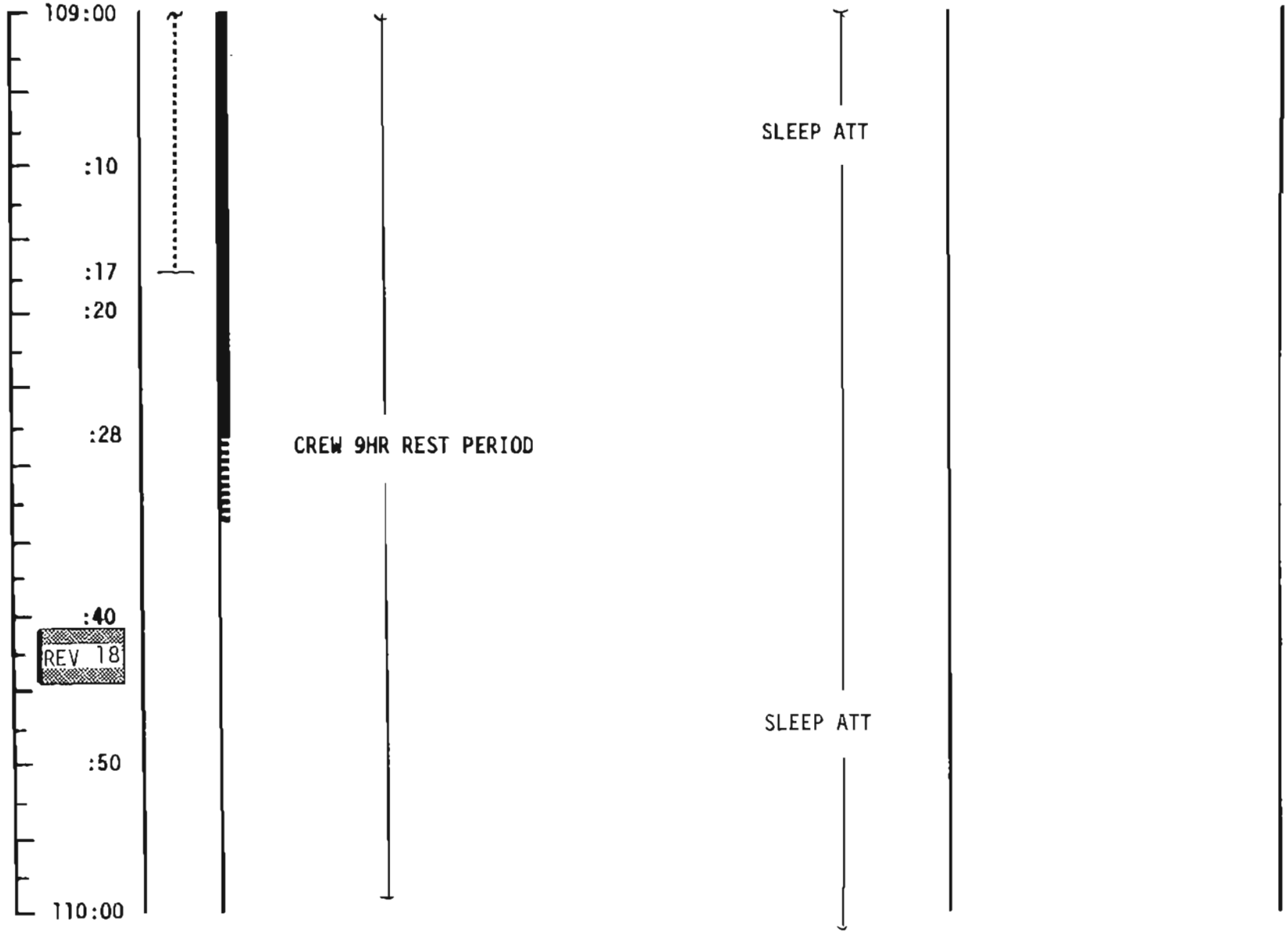
0200 EDT

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	108:00 - 109:00	5/17	3-66

REV A FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN



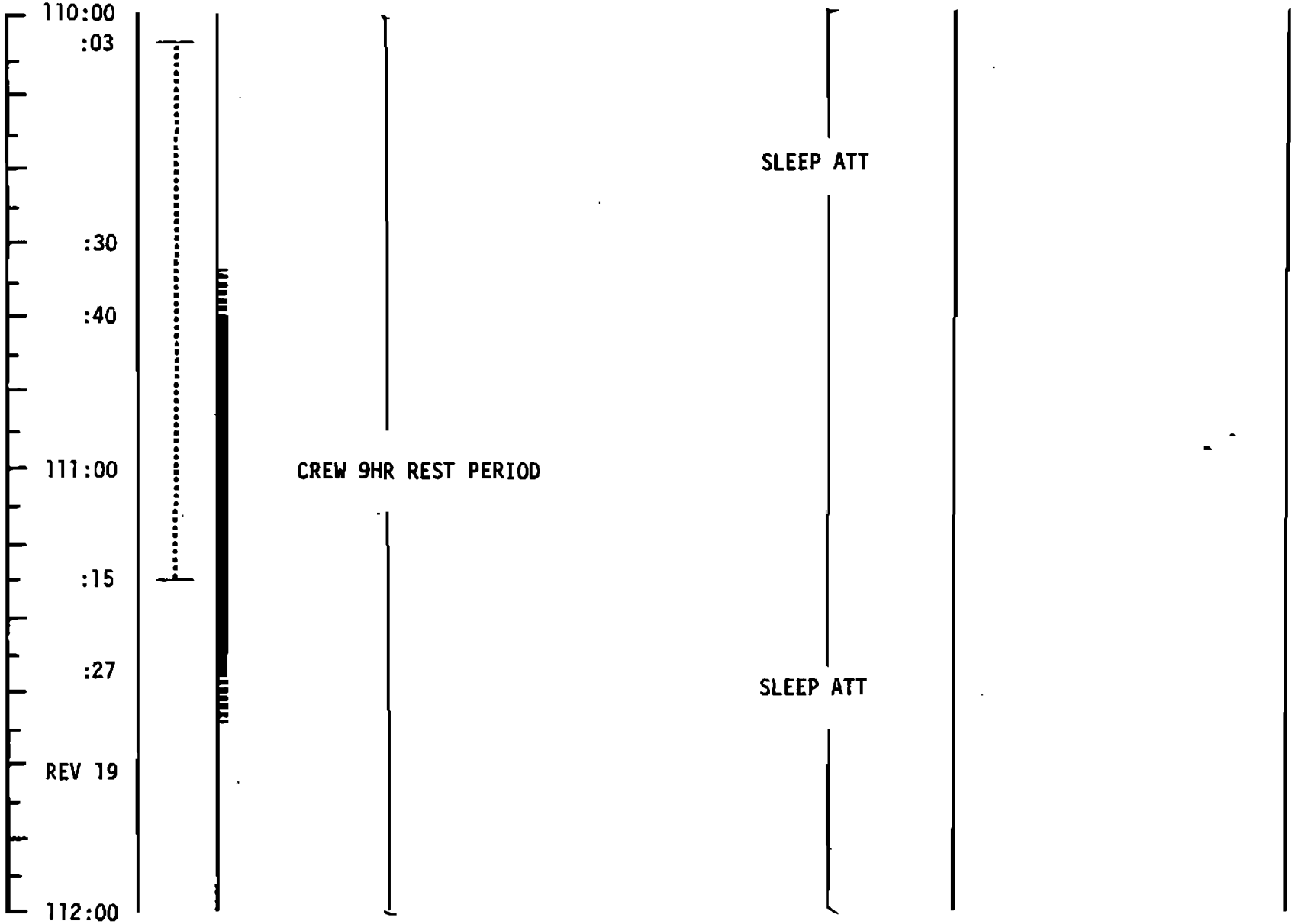
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	109:00 - 110:00	5/18	3-67

FLIGHT PLANNING BRANCH

MCC-F

NOTES

FLIGHT PLAN

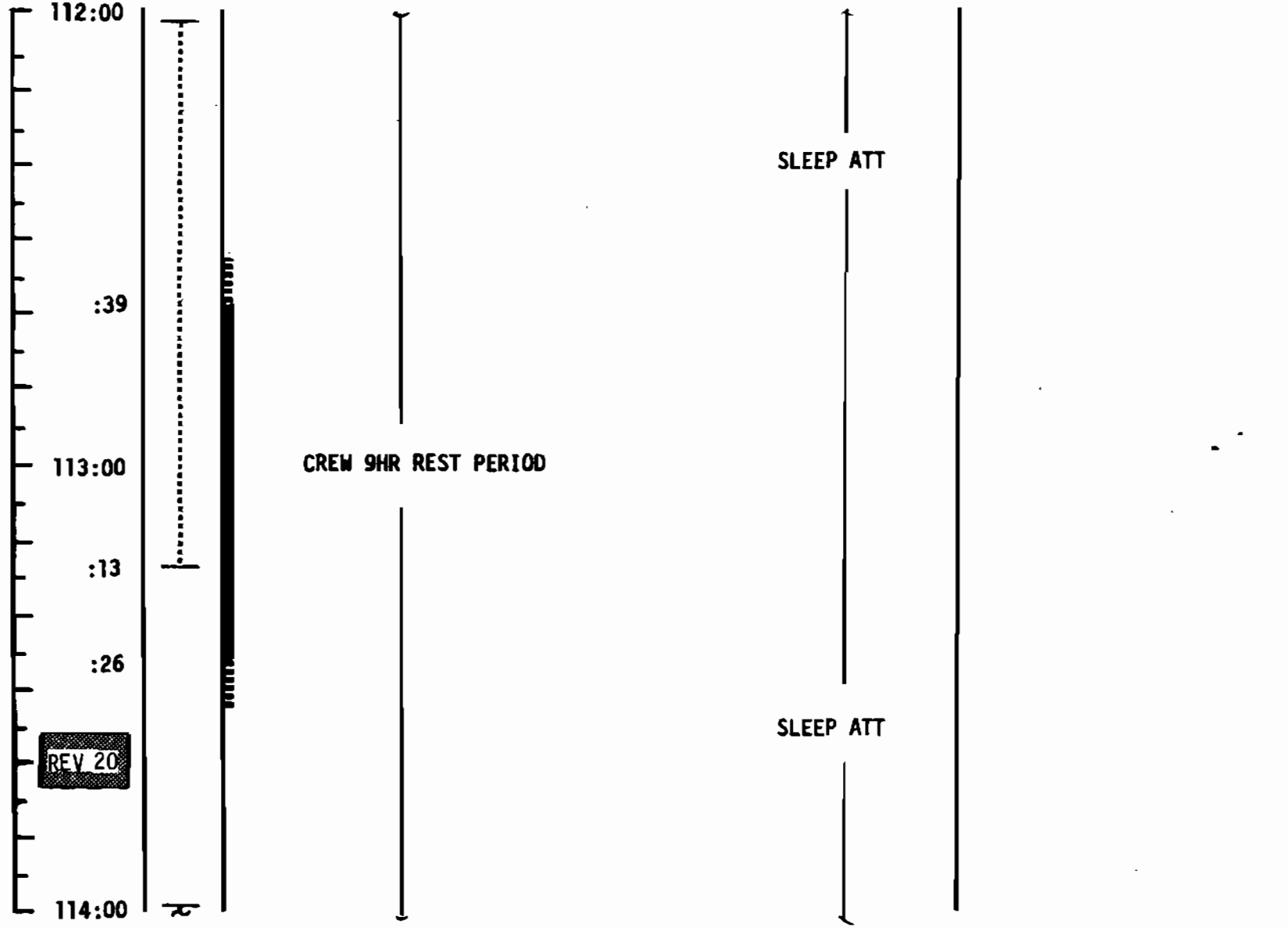


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	110:00 - 112:00	5/19	3-68

FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN



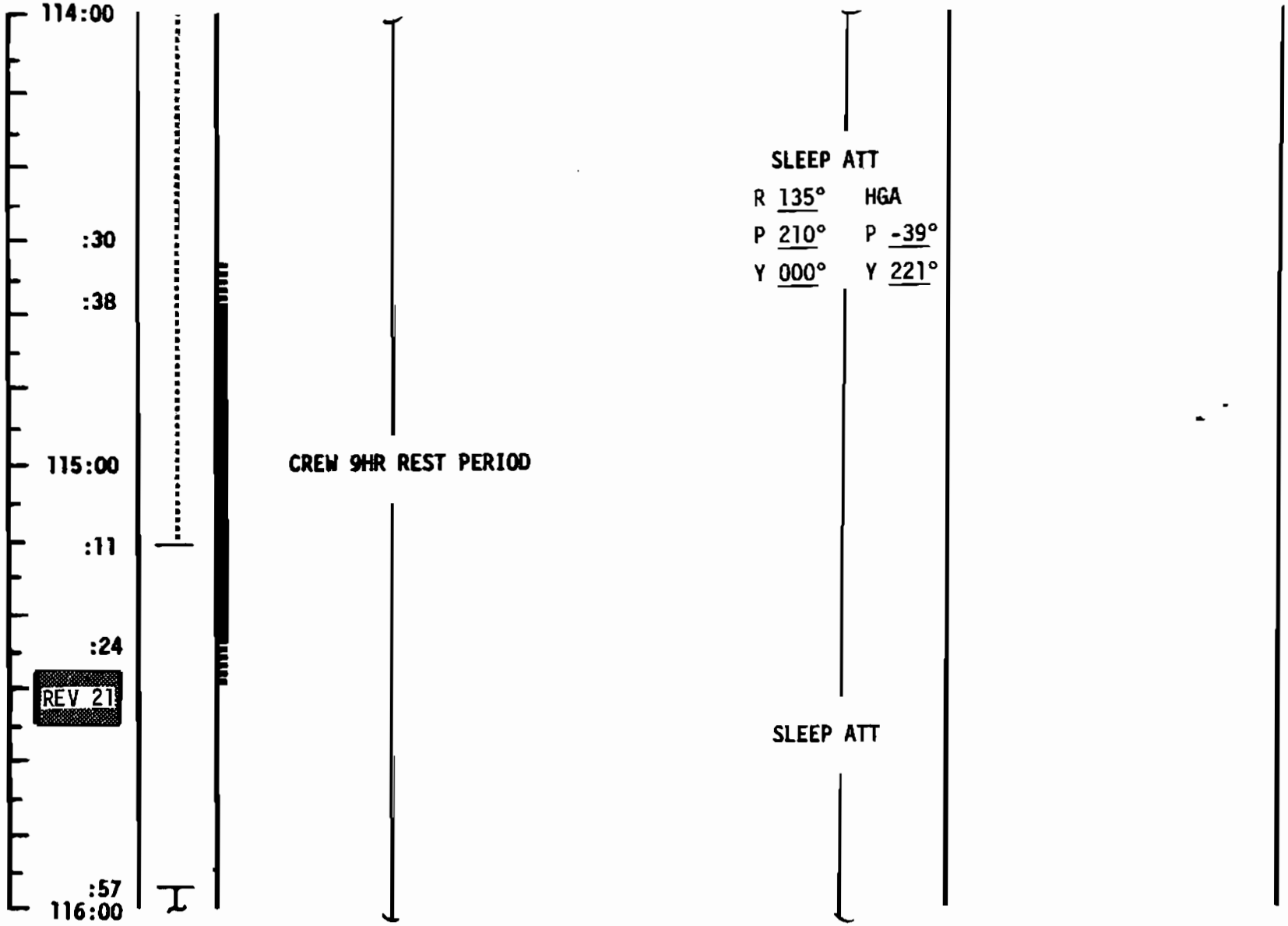
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
C	FINAL	APRIL 17 1969	112:00 - 114:00	5/20	3-69

FLIGHT PLA BRANCH

MCL

NOTES

FLIGHT PLAN

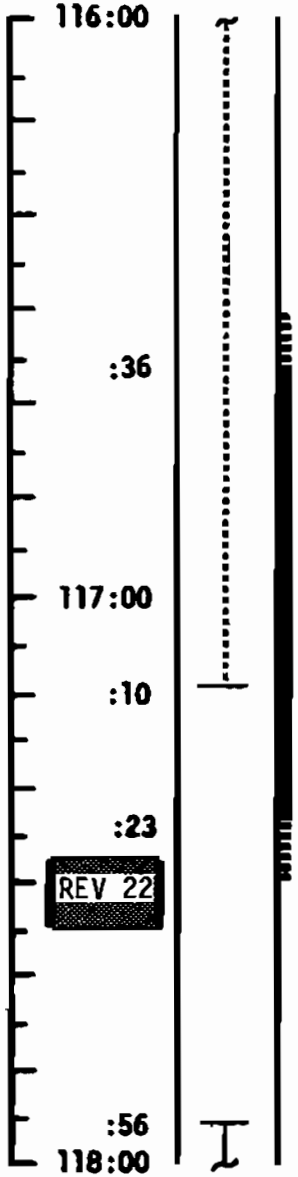


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	114:00 - 116:00	5/21	3-70

FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN



CREW 9 HR REST PERIOD

WAKE UP

BREAKFAST

V64 ACQ MSFN

SLEEP ATT

OBLIQUE STRIP LLS 2

R ___ ___ ___:___

P ___ ___ ___:___

Y ___ ___ ___:___

To ___ ___ ___:___ ___:___ ___ (camera start)

T_1 ___ ___ ___:___ ___:___ ___ (start 0.5° sec pitch rate

T_2 ___ ___ ___:___ ___:___ ___ (stop pitch)

SLEEP ATT

R 135° HGA

P 210° P -36°

Y 000° Y 217°

MAP UPDATE REV 22

LOS :___ ___:___ ___:___ ___

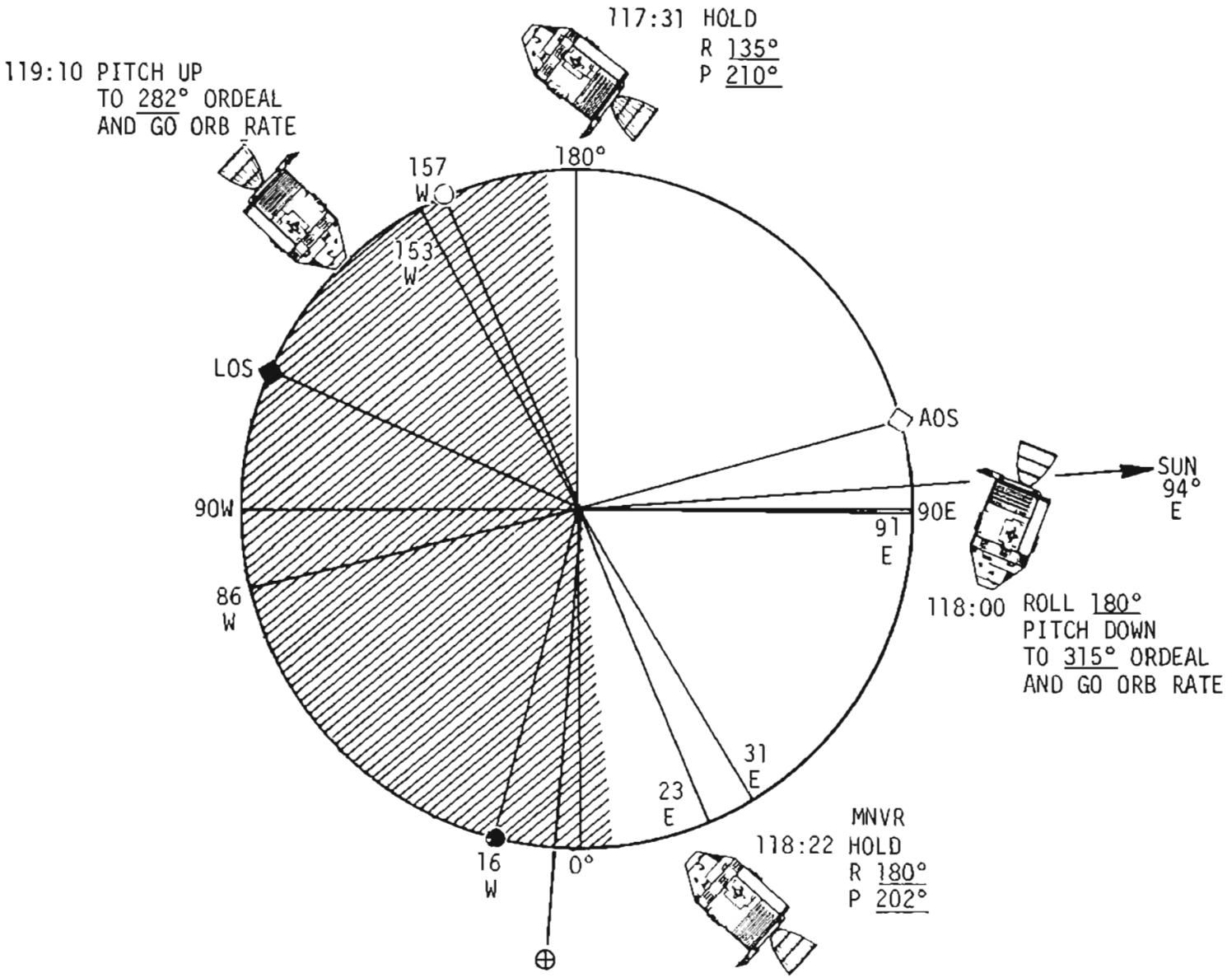
150°W:___ ___:___ ___:___ ___

AOS :___ ___:___ ___:___ ___

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	116:00 - 118:00	5/22	3-71

FLIGHT PLAN BRANCH

RE 22



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	118:00-119:00	5/22	3-71A

REV A

NOTES

FLIGHT PLAN

118:00

:10

:20

UPDATE
CONSUMABLES
FLIGHT PLAN
DEBRIEF LLS 2
P22 TRACKING
REV 23 MAP
UPDATE
TEI$_{23}$ PAD
STATE VECTOR

:35

:40

:50

UPDATE
STRIP PHOTO
UPDATE

119:00

ROLL 180°, PITCH DOWN TO 315° ORDEAL FOR LLS 2 OBLIQUE PHOTO AND GO ORB RATE (HEADS UP)

F/C O_2 PURGE

INITIATE BATT B SECOND CHARGE

T_1 118:19 INITIATE 0.5°/SEC PITCH

T_2 118:22 TERMINATE PITCH, MNVR

POSTSLEEP CHECKLIST

CREW STATUS REPORT
CONSUMABLES UPDATE from MSFN
FLIGHT PLAN UPDATE
CYCLE H2, O2 FANS
COMM BASIC
CREW MANAGES ANT OPS

P27 UPDATE

CONFIGURE CAMERA FOR STRIP PHOTO: on NEXT PASS
70/80/BW-BRKT,IVL (f4.0,250,∞) 200

ECS REDUNDANT COMPONENT CHECK

SUN ⫽ 19°
OVER SITE 2

HOLD
R 180° HGA
P 202° P -41°
Y 000° Y 174°

FRIDAY, MAY 23, 1100 EDT
19h 20m to TEI
ACTIVITY SUMMARY to TEI:
1 REV STRIP PHOTO
4 REVS LDMK TRACK
2 REVS REST
1 REV PHOTO OPPORTUNITY
1 REV LDMK TRACK
1 REV STRIP PHOTO

CONSUMABLES UPDATE

GET: _____
RCS TOT _____
A _____
B _____
C _____
D _____
H_2 TOT _____
O_2 TOT _____

MAP UPDATE REV 23

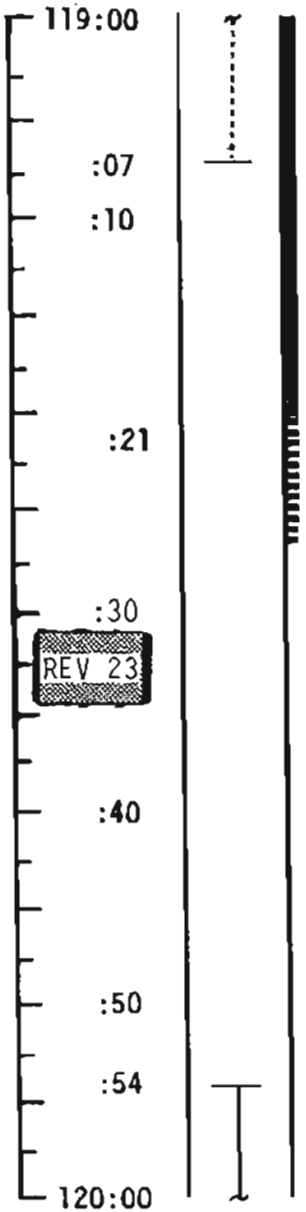
LOS : _ _ _ : _ _ : _ _
150°W: _ _ _ : _ _ : _ _
AOS : _ _ _ : _ _ : _ _

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	118:00 - 119:00	5/22	3-72

REV A FLIGHT PLAN[illegible]G BRANCH

NOTES

FLIGHT PLAN



P52 IMU REALIGN
(OPTION 3 - REFSMMAT)

NOTE: IF NO DSE MOTION
@ LOS GO CMD RESET THEN NORM

119:10 PITCH UP TO 282° ORDEAL FOR STRIP PHOTOGRAPHY
AND GO ORB RATE (HEADS DOWN)

VERTICAL STERO

To	__ __ __ : __ __ : __ __	Camera start
T1	__ __ __ : __ __ : __ __	(Sub-solar Pt)
T2	__ __ __ : __ __ : __ __	(65°E)
T3	__ __ __ : __ __ : __ __	(34°E)

OMNI ____

T_1 119:55 (SUB-SOLAR PT) ROLL 180° to TURN WINDOW
AWAY FROM SUN, PITCH DN 24°, CONT ORB RATE, 258° ORDEAL, HEADS DOWN

P52 OPT ____

N71: ____, ____

N05: ____ ____

N93:

X ____ ____

Y ____ ____

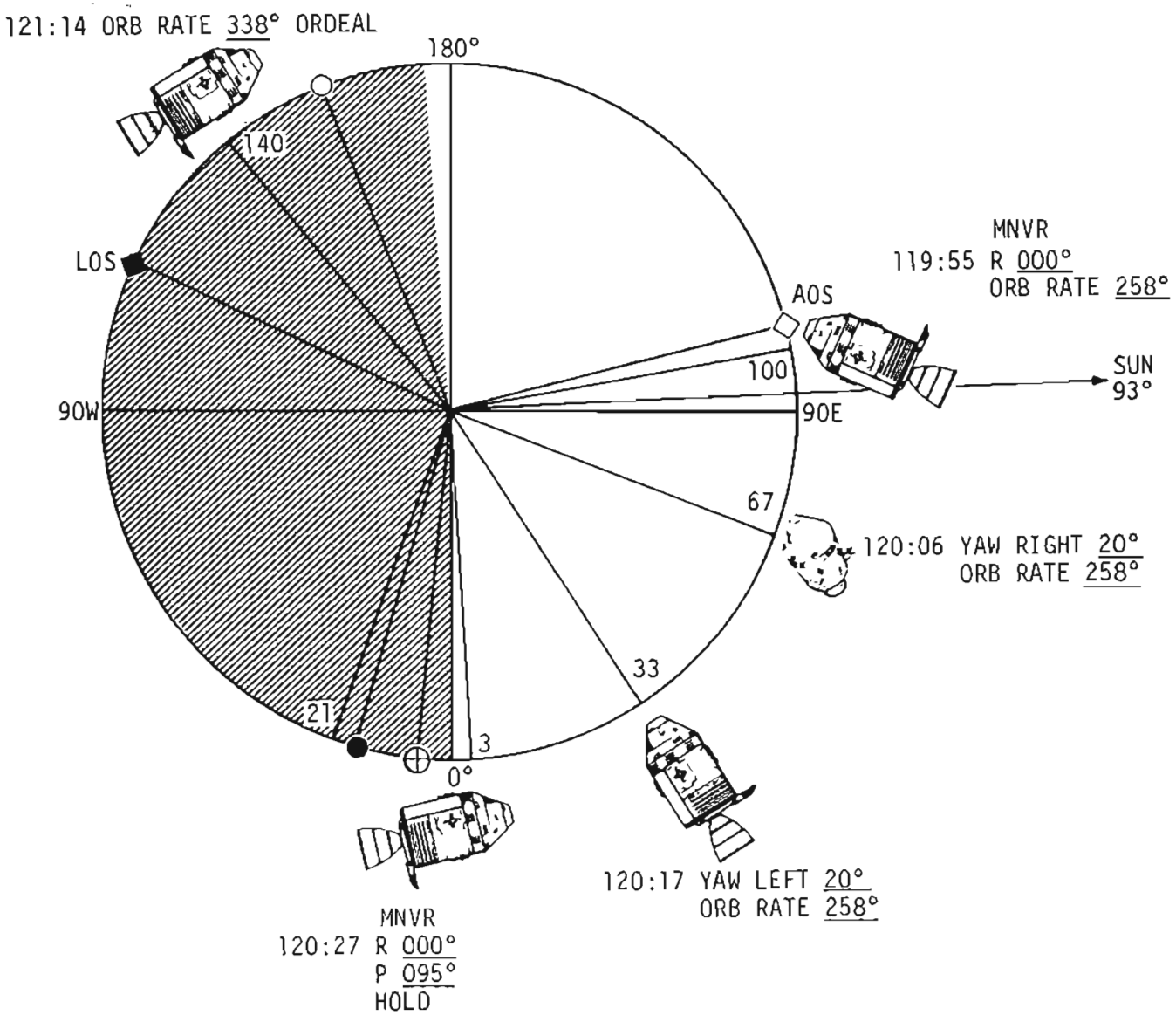
Z ____ ____

TERMINATOR TO TERMINATOR STRIP PHOTOGRAPHY. THE SPACECRAFT WILL BE YAWED OFF THE VERTICLE AT 65° E IN ORDER TO CENTER LANDING SITE 1 (34°E) AND ITS APPROACH PATH IN THE STRIP. THE SPACECRAFT WILL THEN BE MANEUVERED BACK TO THE VERTICLE AT 34°E TO CENTER LANDING SITE 2 (23°E) IN THE STRIP. THE STRIP IS THEN CONTINUED TO THE TERMINATOR.

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	119:00 - 120:00	5/23	3-73

REV A FLIGHT PLANNING BRANCH

REV 23



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	119:00-120:00	5/23	3-73A
	REV A				

NOTE:

FLIGHT PLAN

120:00

CONT ORB RATE (258° ORDEAL)

T_2 120:06 YAW RIGHT 20° to
PHOTO LLS 1, ORB RATE

:10

T_3 120:17 TCA LLS 1-SUN ≯ 31°
YAW LEFT 20°,
CONT ORB RATE (258° ORDEAL)

:20

120:20 TCA LLS 2-SUN ≯ 20°

120:27 TERMINATE STRIP PHOTO, MNVR R 000° HGA
P 095° P -55°
Y 000° Y 187°

:30

V64 ACQ MSFN

:33

P52 IMU REALIGN
(Option 3 - REFSMMAT)

UPDATE
STATE VECTOR
LDMK TRACKING
PAD-REV 24
TEI_{24} PAD

REV 24 MAP
UPDATE

:39

P27 UPDATE

:50

CANISTER B CHANGE
(12 to B, 10 to A3)

121:00

P52 OPT ___
N71: ___, ___
N05: ___ ___ ___ • ___ ___
N93:
X ___ • ___
Y ___ • ___
Z ___ ___ • ___ ___

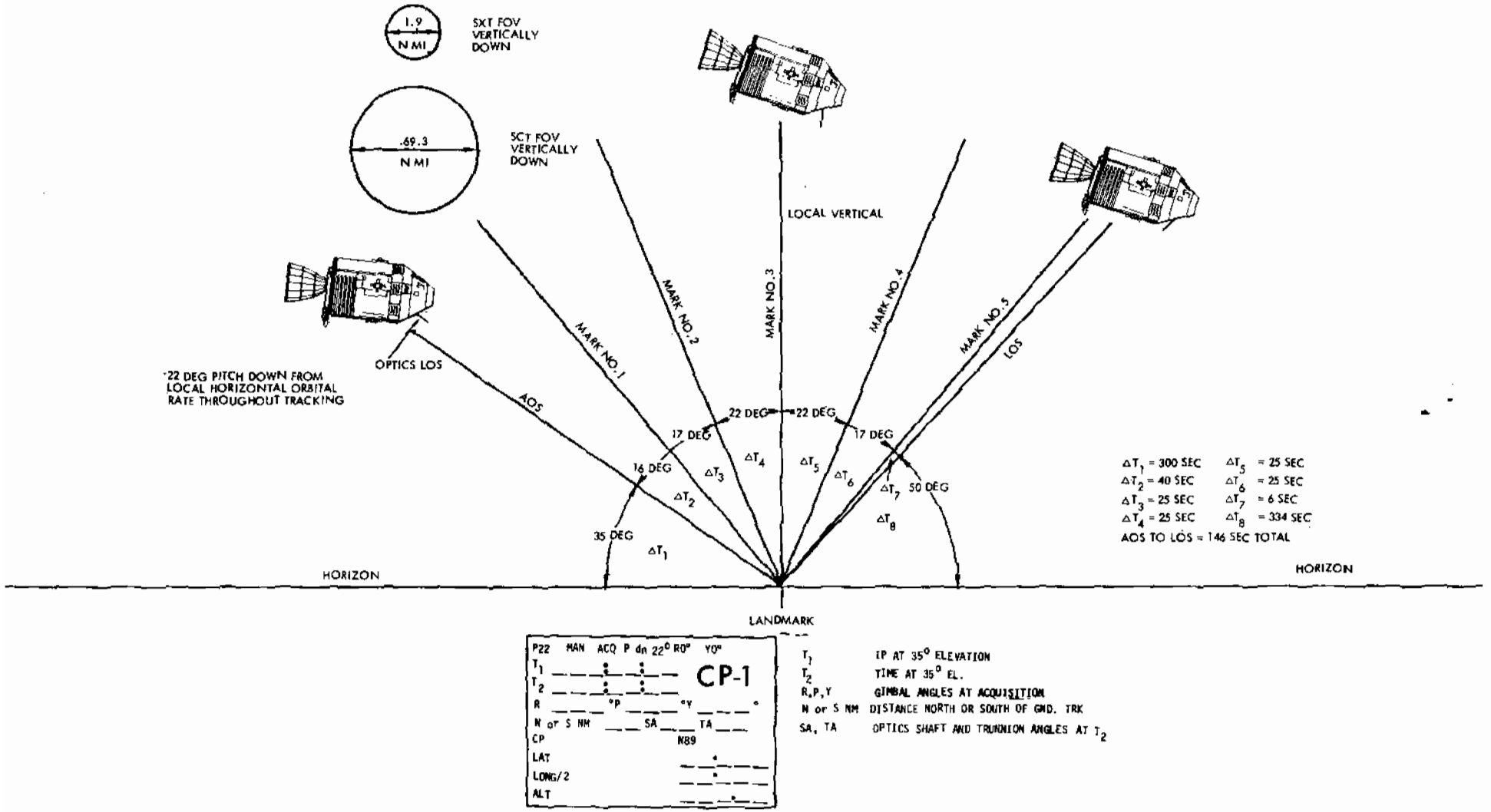
MAP UPDATE REV 24
LOS : ___ ___ : ___ ___ : ___ ___
150°W: ___ ___ : ___ ___ : ___ ___
AOS : ___ ___ : ___ ___ : ___ ___

P22 MAN ACQ P dn 22° R0° Y0°
T_1 ___ ___ ___ • ___ • ___ ___ ___
T_2 ___ ___ ___ • ___ • ___ ___ ___
R ___ ___ °P ___ ___ °Y ___ ___ ___ °
N or S NM ___ ___ SA ___ ___ TA ___ ___

CP-1

	CP-1	N89
LAT	+00.875	___ ___ ___ • ___ ___ ___
LONG/2	+85.073	___ ___ ___ • ___ ___ ___
ALT	+000.00	___ ___ ___ • ___ ___

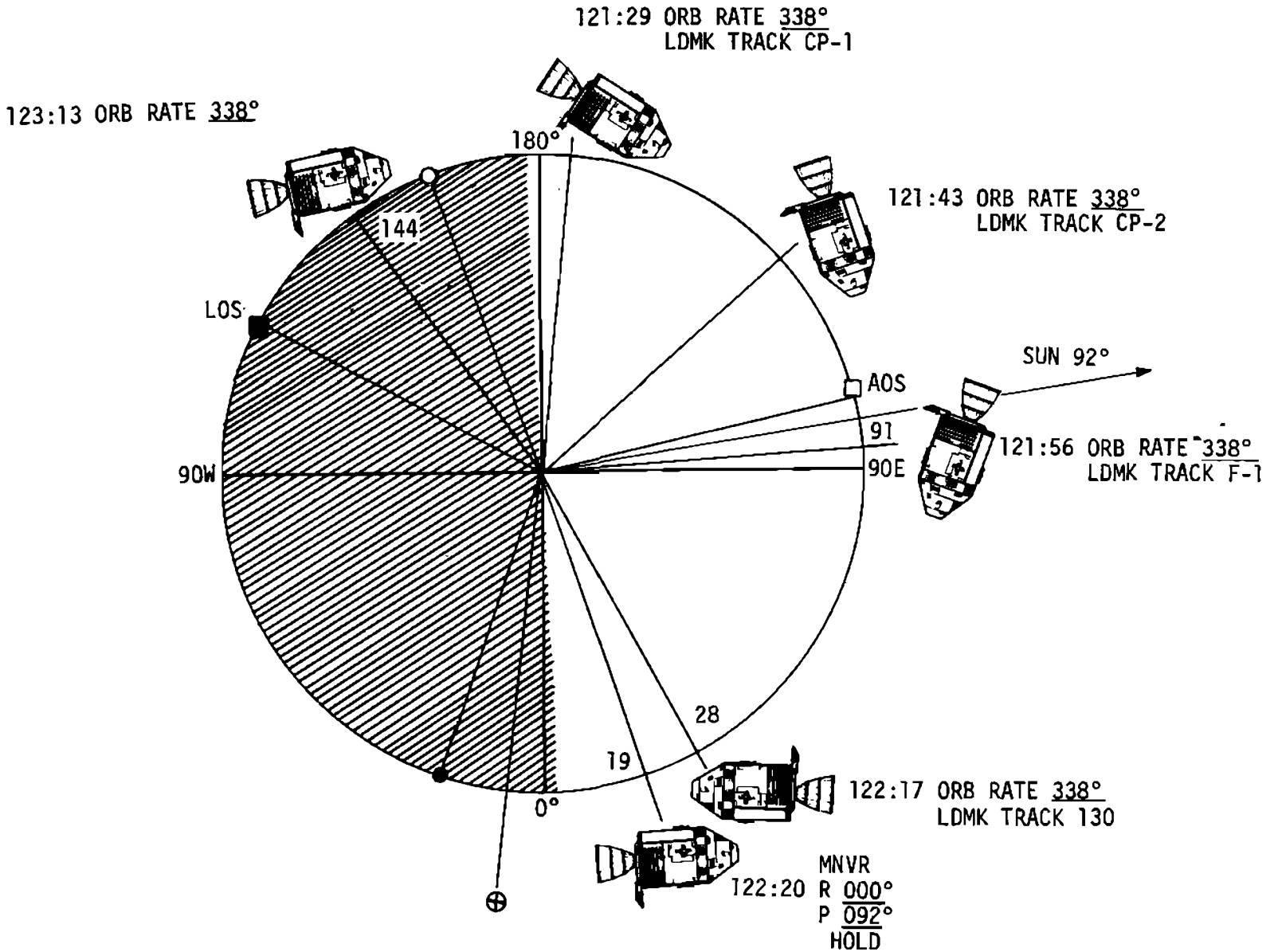
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	120:00 - 121:00	5/24	3-74



CSM TYPICAL LANDMARK TRACKING PROFILE

3-74A

REV 24



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	121:00-122:00	5/24	3-74B

NOTES

FLIGHT PLAN

121:00

CONT INERTIAL HOLD

NOTE: IF NO DSE MOTION @ LOS
GO CMD RESET THEN NORM/

OMNI C

121:14 INITIATE ORB RATE (338° ORDEAL)

NOTES
DURING P22 DO NOT
PRO ON FINAL N89 DESPLAY

25 sec BETWEEN MARKS

:10

:19

REV 24

:30

P22 ORBITAL NAVIGATION - REV 24 (pg 4-22)

T_1 121:26 IP-1 AOS
T_2 121:28 CP-1 AOS SUN ∢ 12°

:40

T_1 121:41 IP-2 AOS
T_2 121:43 CP-2 AOS SUN ∢ 55°

:50

:52

T_1 121:54 IP-F1 AOS
T_2 121:56 F-1 AOS SUN ∢ 84.5°

122:00

1st REV
LDMK TRACKING

P22 MAN ACQ P dn 22° R0° Y0°
T_1
T_2
CP-2
R °P °Y °
N or S NM SA TA
CP-2 N89
LAT +01.000
LONG/2 +63.700
ALT +000.00

P22 MAN ACQ P dn 22° R0° Y0°
T_1
T_2
F-1
R °P °Y °
N or S NM SA TA
F-1 N89
LAT +01.600
LONG/2 +43.440
ALT +000.00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	121:00 - 122:00	5/24	3-75

FLIGHT PLANNING BRANCH

MCC-H

NOTES

FLIGHT PLAN

NOTE:

MSFN WILL OBTAIN MAX PRN RANGING DURING LDMK TRACKING

122:00

:10

:20

:31

:40

:50

123:00

CONT ORB RATE (338° ORDEAL)

T_1 122:15 IP-130 AOS

T_2 122:17 LDMK 130 AOS (LLS 2) SUN ∢ 21°

MNVR R 000° HGA

P 092° P -70°

Y 000° Y 192°

V64 ACQ MSFN

P27 UPDATE

P52 IMU REALIGN
(Option 3 - REFSMMAT)

UPDATE
STATE VECTOR
TEI_{25} PAD
LDMK TRACKING
PAD-REV 25
REV 25 MAP
UPDATE

MAP UPDATE REV 25

LOS :___:___:___

150°W:___:___:___

AOS :___:___:___

1st REV
LDMK TRACKING

P22 MAN ACQ P dn 22° R0° Y0°

T_1 ___:___:___

T_2 ___:___:___

130

R ___ °P ___ °Y ___ °

N or S NM ___ SA ___ TA ___

130 N89

LAT +01.266

LONG/2 +11.839

ALT -001.73

P22 MAN ACQ P dn 22° R0° Y0°

T_1 ___:___:___

T_2 ___:___:___

CP-1

R ___ °P ___ °Y ___ °

N or S NM ___ SA ___ TA ___

CP-1 N89

LAT +00.875

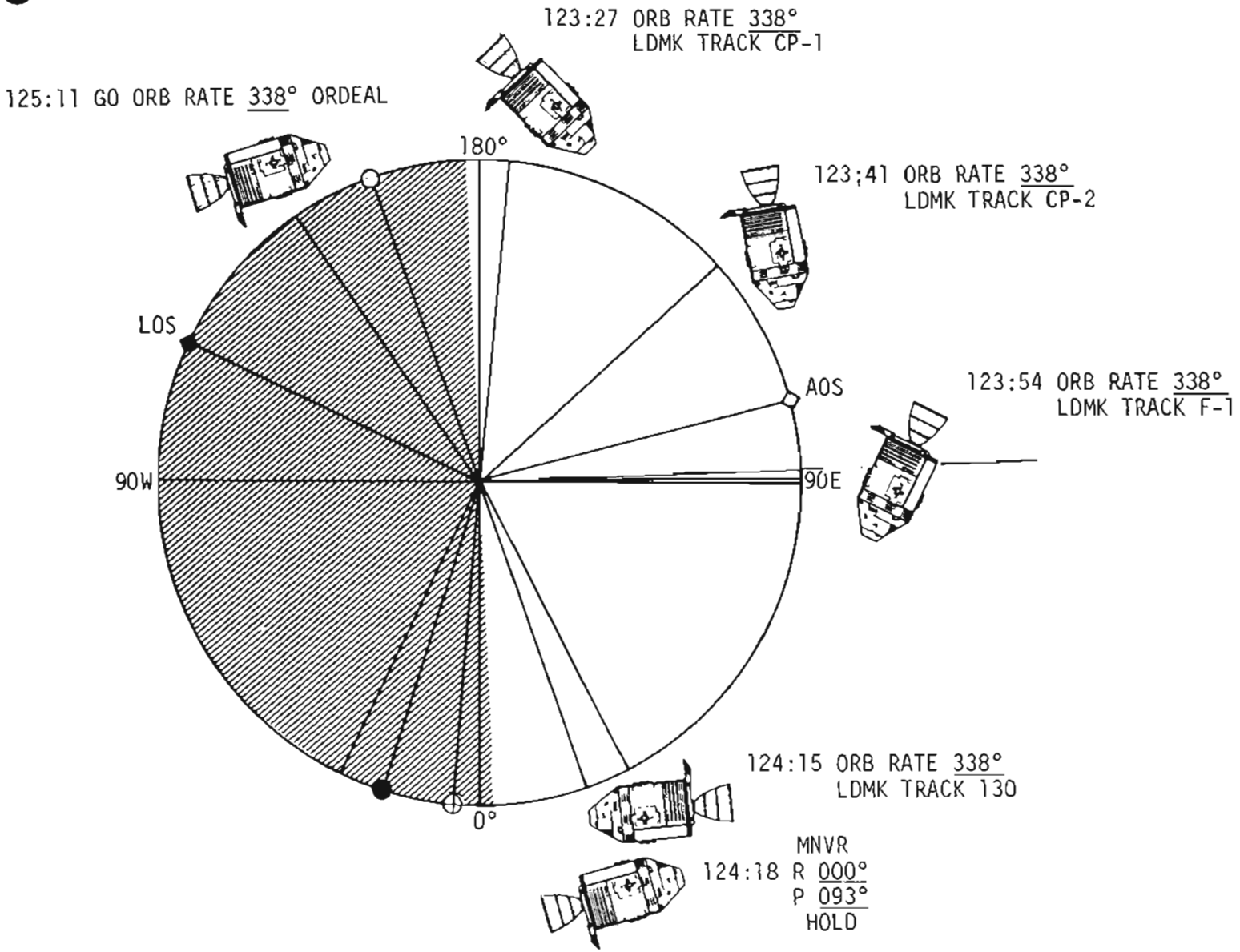
LONG/2 +85.073

ALT +000.00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	122:00 - 123:00	5/25	3-76

FLIGHT PLANNING BRANCH

REV 25



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	123:00-124:00	5/25	3-76A

REV A

MCC-H

NOTES

FLIGHT PLAN

123:00
:04
:10
:12
:18
REV 25
:30
:40
:50
124:00

NOTE: IF NO DSE MOTION @ LOS
GO CMC RESET THEN NORM

OMNI C

CONT INERTIAL
HOLD

2nd REV
LDMK TRACKING

123:13 INITIATE ORB RATE (338° ORDEAL)

NOTE: USE UPDATED N89 VALUES FOR LDMK TRACKING (REV 25, 26, AND 27)

P22 ORBITAL NAVIGATION - REV 25

T_1	123:24	IP-1	AOS	
T_2	123:27	CP-1	AOS	SUN ∢ 11°
T_1	123:39	IP-2	AOS	
T_2	123:41	CP-2	AOS	SUN ∢ 54°
T_1	123:52	IP-F-1	AOS	
T_2	123:54	F-1	AOS	SUN ∢ 85.5°

P22 MAN ACQ P dn 22° R0° Y0°
T_1 ____
T_2 ____
CP-2
R ____ °P ____ °Y ____ °
N or S NM ____ SA ____ TA ____
CP-2 N89
LAT +01.000
LONG/2 +63.700
ALT +000.00

P22 MAN ACQ P dn 22° R0° Y0°
T_1 ____
T_2 ____
F-1
R ____ °P ____ °Y ____ °
N or S NM ____ SA ____ TA ____
F-1 N89
LAT +01.600
LONG/2 +43.440
ALT +000.00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	123:00 - 124:00	5/25	3-77

FLIGHT PLANNING BRANCH

MCC-H

FLIGHT PLAN

NOTES

124:00

EVENING MEAL

CONT ORB RATE (338° ORDEAL)

T_1 124:13 IP-130 AOS

T_2 124:15 LDMK 130 AOS (LLS-2) SUN ∢ 22°

124:18 MNVR R 000° HGA
P 093° P -70°
Y 000° Y 191°

V64 ACQ MSFN

P27 UPDATE

P52 IMU REALIGN
(Option 3 - REFSMMAT)

:10

:20

:30

UPDATE
STATE VECTOR
TEI_{26} PAD
LDMK TRACKING
PAD-REV 26
REV 26 MAP
UPDATE
DEBRIEF LDMK
TRACKING

:40

:50

125:00

END
2nd REV LDMK TRACKING
1700 EDT

P22 MAN ACQ P dn 22° RO° YO°
T_1 _____
T_2 _____
130
R _____ °P _____ °Y _____ °
N or S NM _____ SA _____ TA _____
130 N89
LAT +01.266
LONG/2 +11.839
ALT -001.73

MAP UPDATE REV 26

LOS :___:___:___

150°W:___:___:___

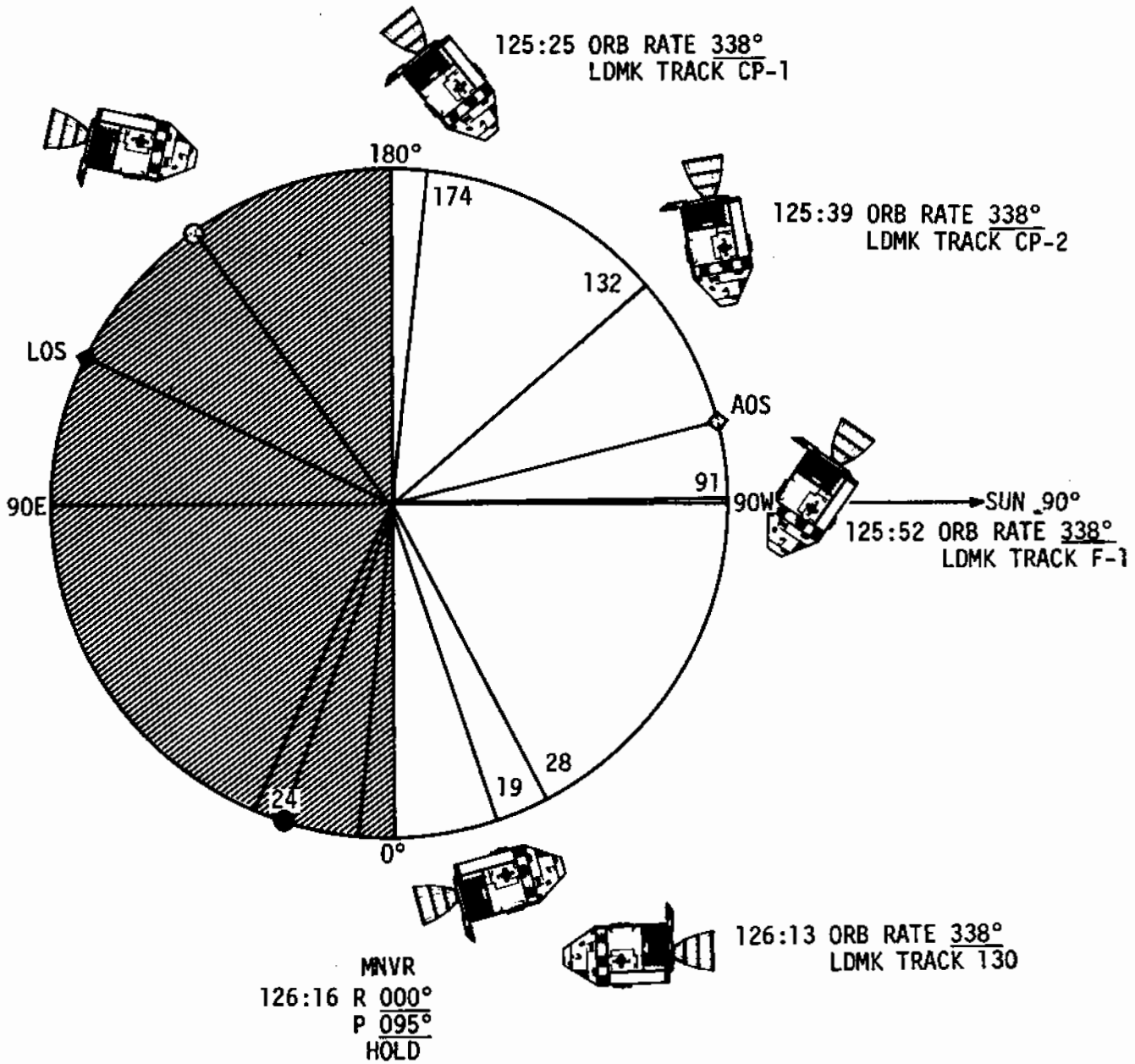
AOS :___:___:___

P22 MAN ACQ P dn 22° RO° YO°
T_1 _____
T_2 _____
CP-1
R _____ °P _____ °Y _____ °
N or S NM _____ SA _____ TA _____
CP-1 N89
LAT +00.875
LONG/2 +85.073
ALT +000.00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	124:00 - 125:00	5/25	3-78

FLIGHT PLANNING BRANCH

REV 26



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	125:00-126:00	5/26	3-78A

NOTES

FLIGHT PLAN

125:00
:04
:10
:17
:20
REV 26
:30
:40
:48
:50
126:00

NOTE: IF NO DSE MOTION @ LOS
GO CMD RESET THEN NORM

CONT INERTIAL
HOLD

3rd REV LDMK
TRACKING

OMNI C

125:11 INITIATE ORB RATE (338° ORDEAL)

P22 ORBITAL NAVIGATION - REV 26

T_1	125:22	IP-1	AOS	
T_2	125:25	CP-1	AOS	SUN ∢ 10°
T_1	125:37	IP-2	AOS	
T_2	125:39	CP-2	AOS	SUN ∢ 53°
T_1	125:50	IP-F-1	AOS	
T_2	125:52	F-1	AOS	SUN ∢ 86.5°

P22 MAN ACQ P dn 22° R0° Y0°

T_1 _ _ _ : _ _ : _ _ _

T_2 _ _ _ : _ _ : _ _ _

CP-2

R _ _ _ °P _ _ _ °Y _ _ _ °

N or S NM _ _ SA _ _ TA _ _

CP-2 N89

LAT +01.000 _ _ _ . _ _ _

LONG/2 +63.700 _ _ _ . _ _ _

ALT +000.00 _ _ _ _ . _ _

P22 MAN ACQ P dn 22° R0° Y0°

T_1 _ _ _ : _ _ : _ _ _

T_2 _ _ _ : _ _ : _ _ _

F-1

R _ _ _ °P _ _ _ °Y _ _ _ °

N or S NM _ _ SA _ _ TA _ _

F-1 N89

LAT +01.600 _ _ _ . _ _ _

LONG/2 +43.440 _ _ _ . _ _ _

ALT +000.00 _ _ _ _ . _ _

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
				5/26	3-79

MCC-h

NOTES

FLIGHT PLAN

126:00

CONT ORB RATE (338° ORDEAL)

END 3rd REV LDMK TRACKING

P22 MAN ACQ P dn 22° R0° Y0°

T_1 _ _ _ : : _ _ _

T_2 _ _ _ : : _ _ _ 130

R _ _ _ °P _ _ _ °Y _ _ _ °

N or S NM _ _ SA _ _ TA _ _

130 N89

LAT +01.266

LONG/2 +11.839

ALT -001.73

:10

T_1 126:11 IP-130 AOS

T_2 126:13 LDMK 130 AOS SUN ∢ 23°

:20

MNVR R 000° HGA

P 095° P -70°

Y 000° Y 191°

TV (GDS) 126:20 - 127:00

HGA to NARROW

:28

V64 ACQ MSFN

UPDATE
STATE VECTOR
TEI_{27} PAD

P27 UPDATE

LDMK TRACKING
PAD-REV 27
REV 27 MAP UPDATE
DEBRIEF LDMK TRACKING

P52 IMU REALIGN
(Option 3 - REFSMMAT)

:40

MAP UPDATE REV _ 27 _

LOS :_ _ _:_ _:_ _

150°W:_ _ _:_ _:_ _

AOS :_ _ _:_ _:_ _

:50

NOTE: IF NO DSE MOTION @ LOS
GO CMD RESET THEN NORM

P22 MAN ACQ P dn 22° R0° Y0°

T_1 _ _ _ : : _ _ _

T_2 _ _ _ : : _ _ _ CP-1

R _ _ _ °P _ _ _ °Y _ _ _ °

N or S NM _ _ SA _ _ TA _ _

CP-1 N89

LAT +00.875

LONG/2 +85.073

ALT +000.00

127:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	126:00 - 127:00	5/26	3-80

FLIGHT PLANNING BRANCH

FLIGHT PLAN

NOTES

127:00

CONT INERTIAL HOLD

OMNI C

4th REV
LDMK TRACKING

:10

127:09 INITIATE ORB RATE (338° ORDEAL)

:15

P22 ORBITAL NAVIGATION - REV 27

:20

REV 27

T_1 127:20 IP-1 AOS

T_2 127:23 CP-1 AOS SUN ∢ 9°

P22	MAN	ACQ	P dn 22°	R0°	Y0°
T_1					
T_2					
R		°P		°Y	°
N or S NM		SA		TA	
	CP-2		N89		
LAT	+01.000				
LONG/2	+63.700				
ALT	+000.00				

CP-2

:30

T_1 127:35 IP-2 AOS

T_2 127:37 CP-2 AOS SUN ∢ 52°

P22	MAN	ACQ	P dn 22°	R0°	Y0°
T_1					
T_2					
R		°P		°Y	°
N or S NM		SA		TA	
	F-1		N89		
LAT	+01.600				
LONG/2	+43.440				
ALT	+000.00				

F-1

:40

:46

T_1 127:48 IP-F-1 AOS

:50

T_2 127:50 F-1 AOS SUN ∢ 87.5

CONFIGURE CAMERA FOR NEXT PHOTO SEQ LLS 3
70/80/BW-BRKT,IVL (f4.0,125,∞) 30
16/18/CEX-BRKT (LH WIN) (f8/f2,250,∞) 1 fps
1 MAG

128:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	127:00 - 128:00	5/27	3-81

REV A FLIGHT PLANNING BRANCH

MCC-H

NOTES

FLIGHT PLAN

128:00

CONT ORB RATE (338° ORDEAL)

CHLORINATE POTABLE WATER PRIOR TO REST PERIOD

END 4th REV
LDMK TRACKING

UPDATE
$\overline{TEI_{29}}$ PAD
REV 29 MAP
UPDATE
LLS 3 PHOTO

:10

T_1 128:09 IP-130 AOS
T_2 128:11 LDMK 130 AOS SUN ∢ 24°

:20

128:14 MNVR R 180° HGA- REST ATT
P 226° P -60°
Y 000° Y 172°

V64 ACQ MSFN

UPDATE
STATE VECTOR

:27

P27 UPDATE

:30

COMM BASIC EXCEPT
S-BD SQUELCH - ENABLE
HI GAIN ANT TRACK - REACQ
HI GAIN ANT BEAM - NARROW
HGA P -60° Y 172°

:40

F/C O_2 PURGE

CREW 3 1/2 HR REST PERIOD

:50

G&N ATT HOLD
±10° DB. TWO
ADJACENT QUAD
CONTROL

:58

129:00

P22 MAN ACQ P dn 22° R0° Y0°

T_1 ___:___:___
T_2 ___:___:___

130

R ___ °P ___ °Y ___ °

N or S NM ___ SA ___ TA ___

130 N89

LAT +01.266

LONG/2 +11.839

ALT -001.73

MAP UPDATE REV 29

LOS :___:___:___

150°W:___:___:___

AOS :___:___:___

2200 EDT, 8h 20m to TEI

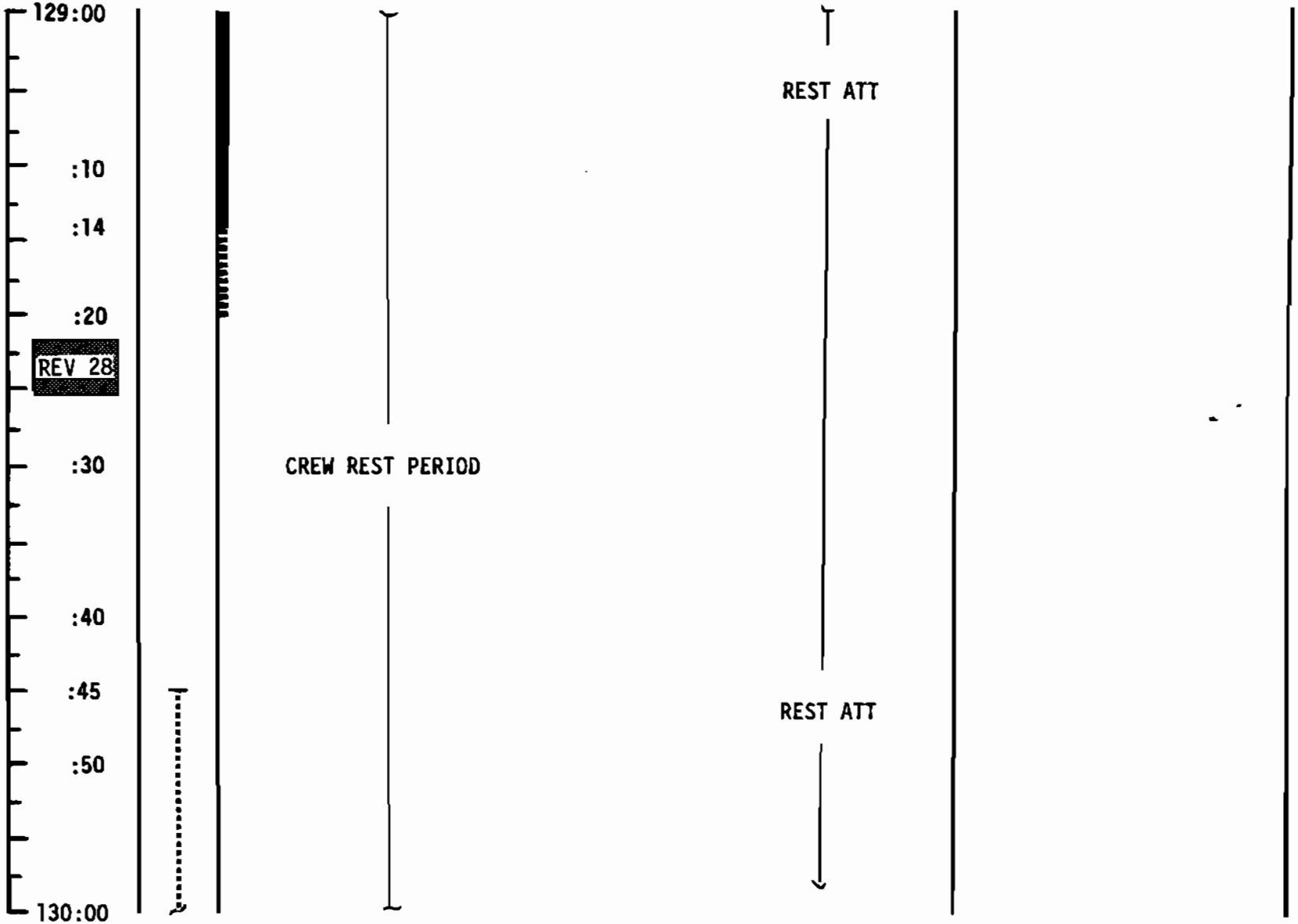
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	128:00 - 129:00	5/27	3-82

REV A FLIGHT PLANNING BRANCH

MCC –

NOTES

FLIGHT PLAN

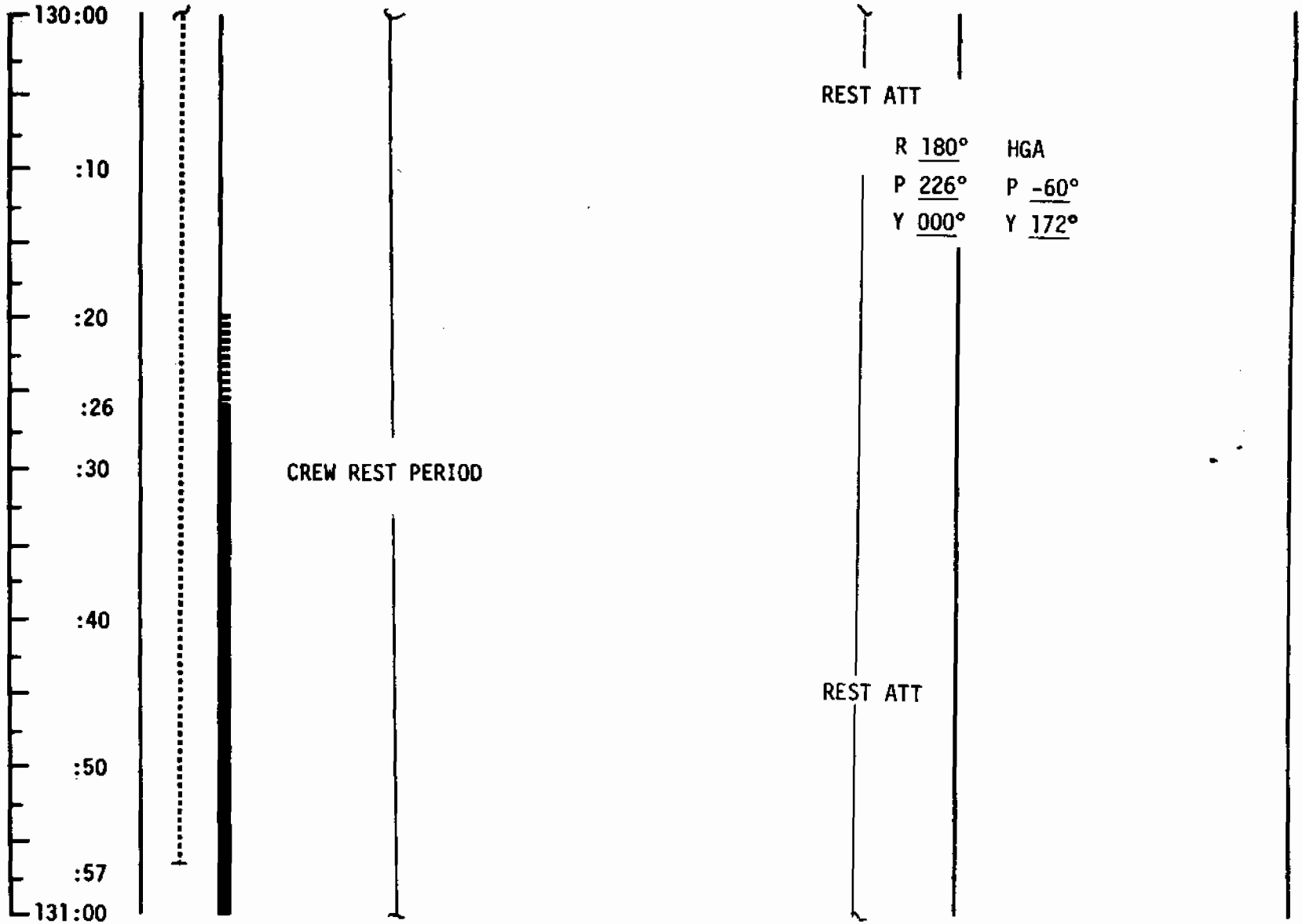


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	129:00 - 130:00	5/28	3-83

FLIGHT PLANNING BRANCH

NOTES

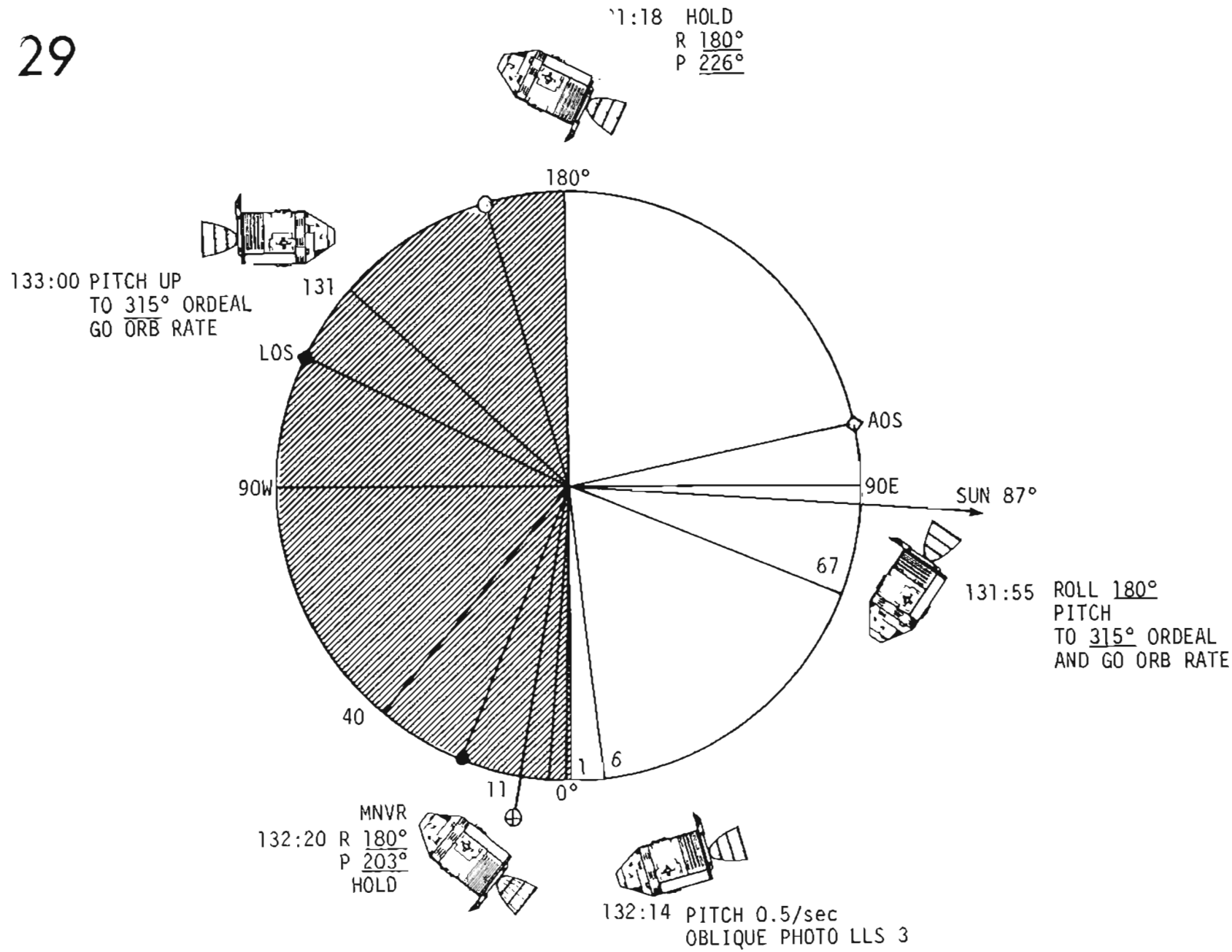
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	130:00 - 131:00	5/28	3-84

FLIGHT PLANN[illegible] BRANCH

REV 29

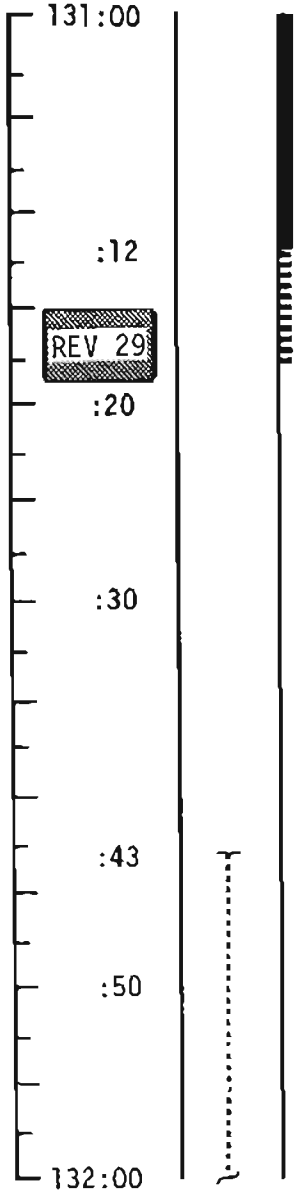


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	131:00-132:00	5/29	3-84A

REV A

NOTES

FLIGHT PLAN



CREW REST PERIOD

REST ATT
R180° HGA
P226° P-60°
Y000° Y172°

OBLIQUE STRIP LLS 3
R ___ ___ ___:___
P ___ ___ ___:___
Y ___ ___ ___:___
To ___ ___ ___:___ ___:___ ___ (camera start)
T_1 ___ ___ ___:___ ___:___ ___ (start 0.5° sec pitch rate)
T_2 ___ ___ ___:___ ___:___ ___ (stop pitch)

END REST PERIOD
RETURN TO COMM BASIC

131:55 ROLL 180°, PITCH TO 315° ORDEAL AND GO ORB RATE FOR LLS 3 PHOTO (HEADS UP)

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	131:00 - 132:00	5/29	3-85

REV A FLIGHT PLANNING BRANCH

MCC-

NOTES

FLIGHT PLAN

132:00

:10

:20

:24

UPDATE
STATE VECTOR
TEI_{30} PAD

:30

LDMK TRACK PAD
DEBRIEF LDMK
TRACKING REV 27
REV 30 MAP
UPDATE

:40

:50

:55

133:00

MEAL SNACK

CONT OR8 RATE (315° ORDEAL)

T_1 132:14 START 0.5°/SEC PITCH RATE

T_2 132:18 TCA LLS 3 SUN } 1.6°, TERMINATE PITCH

132:20 MNVR R 180° HGA
P 203° P -35°
V64 ACQ MSFN Y 000° Y 176°
P27 UPDATE

P52 IMU REALIGN
(Option 3 - REFSMMAT)

CONFIGURE CAMERAS FOR TARGETS OF OPPORTUNITY
70/80/BW-(f.0,250,∞) 140
70/250/BW-(f5.6,250,∞) 200
70/80/SCF-(f-TBD,250,∞) 30

SATURDAY, MAY 24,
0100 EDT, 5h 20m to TEI

P52 OPT ___
N71: ___, ___
N05: ___ ___.___
N93:
X ___.___ ___
Y ___.___ ___
Z ___.___ ___

MAP UPDATE REV 30

LOS :___:___:___

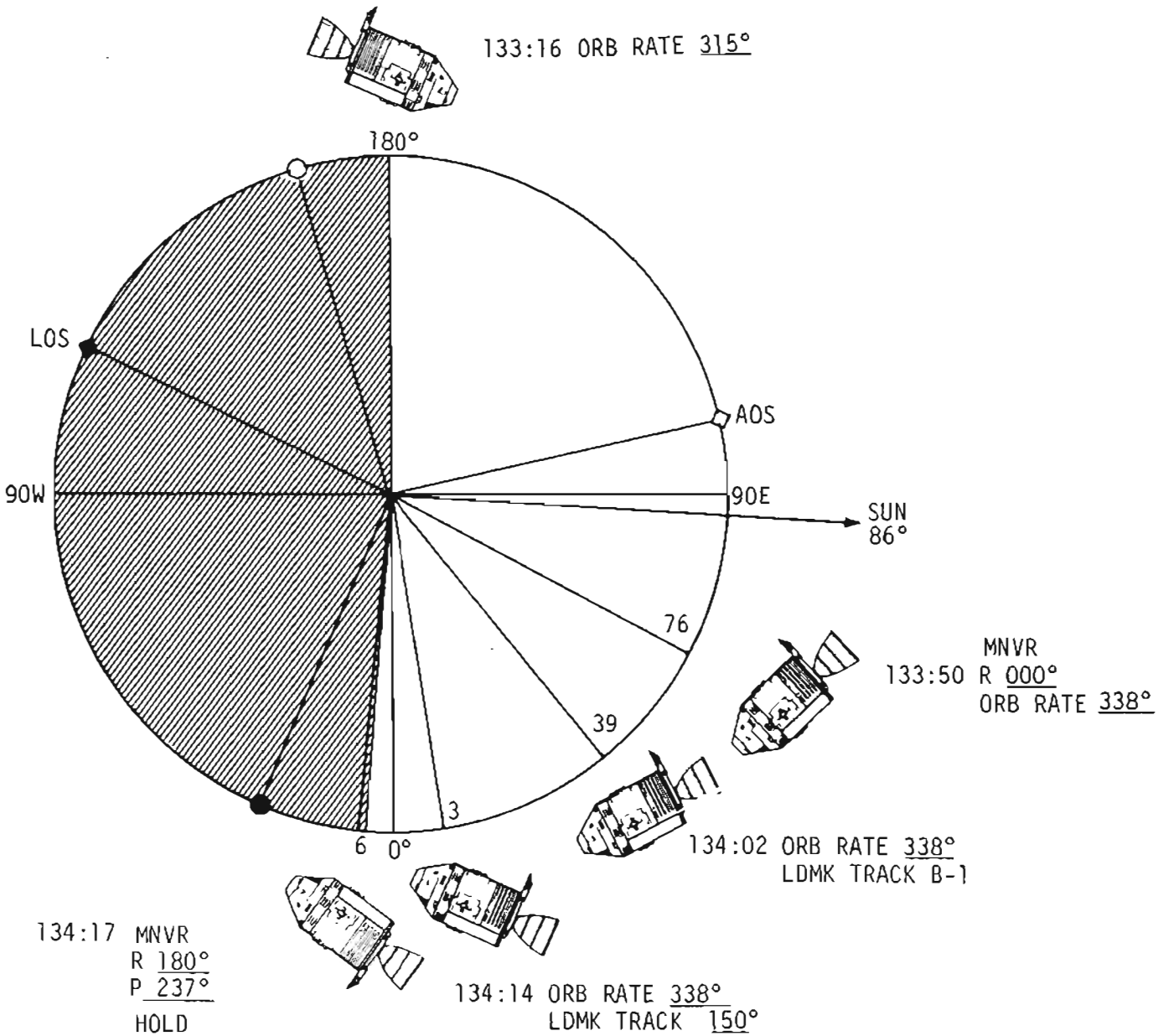
150°W:___:___:___

AOS :___:___:___

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	132:00 - 133:00	5/29	3-86

FLIGHT PLANNING BRANCH

REV 30



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	132:00-133:00	5/30	3-86A

REV A

NOTES

FLIGHT PLAN

133:00

133:00 PITCH UP 315° ORDEAL AND GO ORB RATE FOR PHOTOS OF OPPORTUNITY (HEADS DOWN)

:11

CANISTER A CHANGE
(13 to A, 11 to A3)

REV 30

:20

PHOTOS OF OPPORTUNITY

PHOTOGRAPHS WILL BE OBTAINED, AT CREW OPTION, OF SELECTED AREAS ON THE LUNAR SURFACE. AREAS OF INTEREST ARE SPECIFIED ON THE TARGET OF OPPORTUNITY CHART:

:30

:41

:50

133:50 MNVR TO LDMK TRACK ATT R 000° AND GO ORB RATE 338° ORDEAL (HEADS UP)

OMNI C

134:00

P22 ORBITAL NAVIGATION

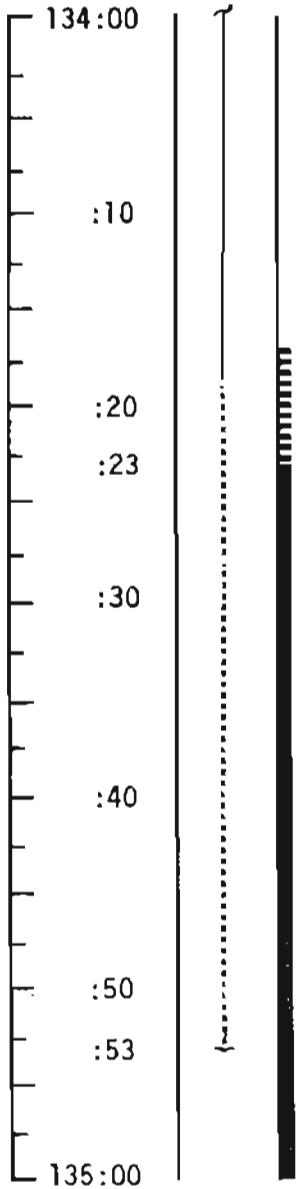
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	133:00 - 134:00	5/30	3-87

REV A FLIGHT PLANNING BRANCH

MCC-H

NOTES

FLIGHT PLAN



T_1 134:00 IP-B-1 AOS

T_2 134:02 B-1 AOS SUN ⨽ 38°

T_1 134:12 IP-150 AOS

T_2 134:14 LDMK 150 AOS SUN ⨽ 2.6°

134:17 MNVR R 180° HGA
P 237° P -68°
Y 000° Y 171°

V64 ACQ MSFN

P27 UPDATE

UPDATE
PRELIM TEI_{31} PAD
REV 31 MAP
UPDATE
STRIP PHOTO
STATE VECTOR

CONFIGURE CAMERA FOR DESCENT
STRIP PHOTOGRAPHY:
70/80/BW-BRKT,IVL (f4.0,250,∞) 55
70/80/BW-BRKT,IVL (f4.0,125,∞) 40

P22 MAN ACQ P dn 22° R0° Y0°

T_1

T_2

B-1

R °P °Y °

N or S NM SA TA

B-1 N89

LAT +02.522

LONG/2 +17.518

ALT -001.54

P22 MAN ACQ P dn 22° R0° Y0°

T_1

T_2

150

R °P °Y °

N or S NM SA TA

150 N89

LAT +00.283

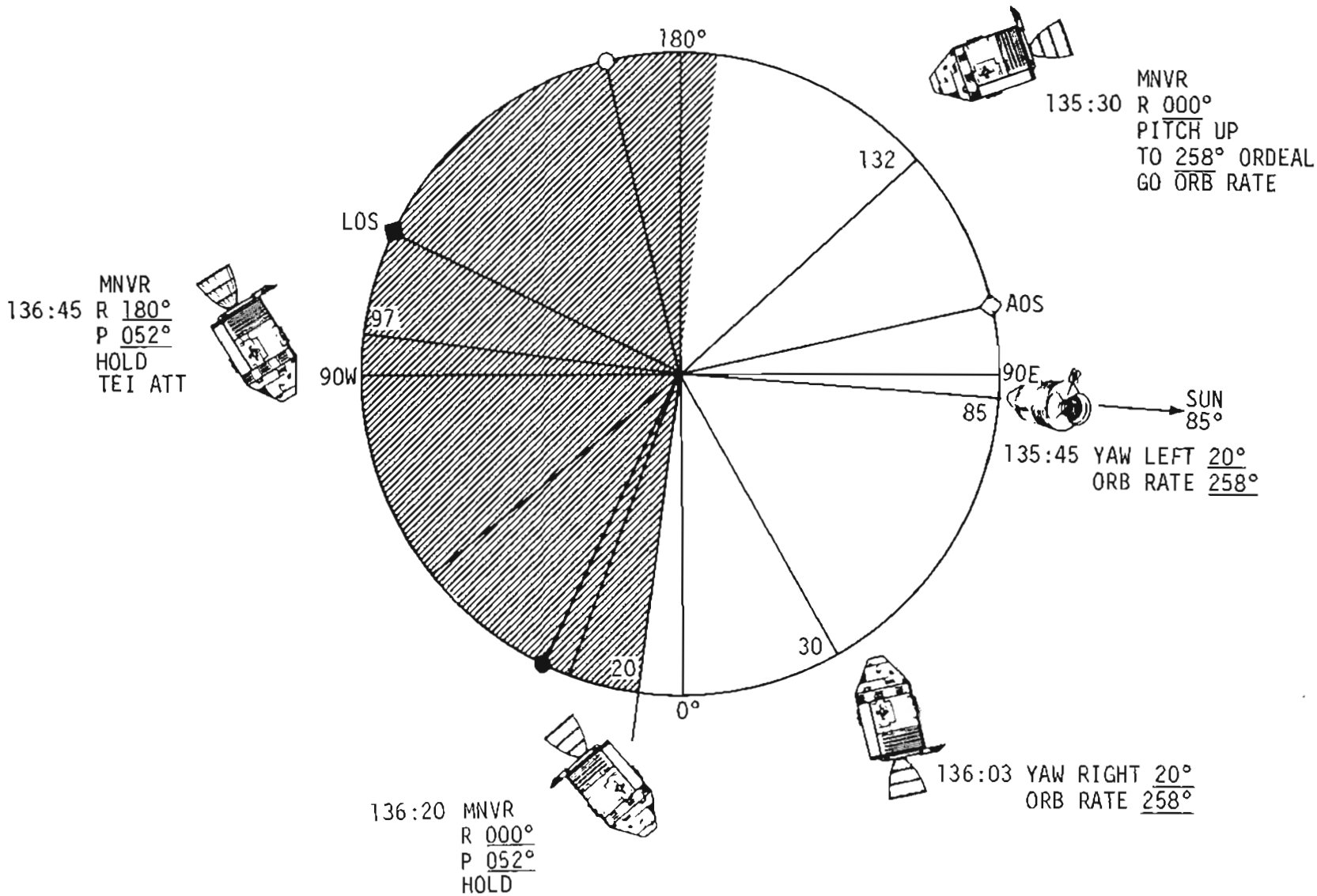
LONG/2 -00.714

ALT -001.05

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	134:00 - 135:00	5/30	3-88

REV A FLIGHT PLANNING BRANCH

REV 31



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	136:00-137	6/31	3-88A

REV A

NOTES

FLIGHT PLAN

135:00

CONT INERTIAL HOLD

MAP UPDATE REV 31

LOS :__ __ __:__ __:__ __

150°W:__ __ __:__ __:__ __

AOS :__ __ __:__ __:__ __

:09

REV 31

PHOTO TARGETS OF OPPORTUNITY

:20

OMNI _____

DESCENT STRIP AND LLS3

To __ __ __ : __ __ : __ __

T1 __ __ __ : __ __ : __ __ (85°E)

T2 __ __ __ : __ __ : __ __ (30°E)

:30

135:30 ROLL 180° AND PITCH UP TO 258° ORDEAL
AND GO ORB RATE (HEADS DOWN)

:37

:40

135:45 YAW LEFT 20° TO PHOTO
HIGHLAND SITE, ORB RATE (258° ORDEAL)

P27 UPDATE (VIA OMNI's)

P30 EXTERNAL ΔV AND DAP DATA CHECK

STRIP PHOTOGRAPHY BEGINNING AT 90°E AND CONTINUING TO THE TERMINATOR. THE SPACECRAFT IS YAWED 20° OFF THE VERTICLE AT 85°E TO CENTER CENSORINUS (32°E) AND ITS APPROACH PATH IN THE STRIP AND MANEUVERED BACK TO VERTICLE AT 30°E TO CENTER LANDING SITE 3 (1.4°W) AND ITS APPROACH PATH IN THE STRIP.

UPDATE
STATE VECTOR
TEI TGT LOAD(FINAL) :50
TEI MNVR PAD
TEI_{32} PAD
TEI MAP UPDATE

136:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	135:00 - 136:00	5/31	3-89

REV A FLIGHT PLAN[illegible] BRANCH

NOTES

FLIGHT PLAN

136:00

136:03 YAW RIGHT 20° AND CONT ORB RATE AND STRIP PHOTO (258° ORDEAL) TO INCLUDE LLS 3

:10

136:15 DISCONTINUE STRIP PHOTO AT TERMINATOR

:21

136:20 MNVR R 000° HGA
P 052° P -63°
Y 000° Y 353°

TEI ATT EXCEPT ROLLED 180°

UPDATE
TV ATT

P52 IMU REALIGN
(OPTION 3 - REFSMMAT)

:30

P52 OPT ___
N71: ____, ____
N05: ____.____
N93:
X ____.____
Y ____.____
Z ____.____

:40

UPDATE
GO/NO GO TEI

P30/P40 SPS THRUST

MNVR R 180° TEI ATT
P 052°
Y 000°

OMNI _____

:51

MAP UPDATE TEI
LOS : ___ : ___ : ___
AOS(W/TEI) : ___ : ___ : ___
AOS(NO TEI): ___ : ___ : ___

137:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	136:00 - 137:00	5/31	3-90

FLIGHT PLANNING BRANCH

MCC-H

NOTES

FLIGHT PLAN

137:00

SXT STAR CHECK

:07

REV 32

TEI OVERBURN CRITERIA: 2 SEC AND ΔV_c >40 fps

TRIM X to 0.2 fps Y, Z as is

:20

137:20 TEI

ULLAGE: 2 jet 14 sec
BT: 2m 50 sec
ΔV: 3622.5 fps

V66 TRANSFER CSM
SV TO LM SLOT

MNVR R 180° FOR COMM

:29

V64 ACQ MSFN

P 320°

APOLLO 10: POST BURN REPORT Y 000°

:40

HGA to NARROW

TV (HSK): 137:45 - 138:00

TV UPDATE

R _____ HGA

P _____ P _____

Y _____ Y _____

:50

BREAKFAST

UPDATE
PTC REFSMMAT

P27 UPDATE

138:00

FRIDAY, MAY 24, 0600 EDT
54h 50m to EI

BURN STATUS REPORT

X X ΔTIG

X X BT

V_{gx}

TRIM

X X X R

X X X P

X X X Y

V_{gx}

V_{gy}

V_{gz}

ΔV_c

X X X FUEL

X X X OX

X X X UNBAL

REMARKS:

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	137:00 - 138:00	5/31	3-91

REV A FLIGHT PLANNING BRANCH

FLIGHT PLAN

NOTES

138:00

DEACTIVATE PRIMARY EVAPORATOR
- GLY EVAP H2O FLOW - OFF
- GLY EVAP STM PRESS AUTO - MAN
- GLY EVAP STM PRESS INCR - INCR for 58 sec

P52 IMU REALIGN (Option 1 - preferred) ——— Pulse torque to PTC REFSMMAT

:30

ESTABLISH PTC
±20°DB P&Y

P23 NO COMM (1)
TEI + 1:30
- 5 SETS LH
- Arcturus(31)F
- Regulus(22)N
- Regulus(22)N
- Alphard(21)N
- Alpharad(21)N

W-MATRIX DATA Pg 3-93

M S F N

139:00

CREW STATUS REPORT
ONBOARD READOUTS to MSFN
CYCLE H2, O2 FANS

H_2 PURGE LINE HTR-ON

VERIFY
- WASTE MNGT OVBD DRAIN vlv - OFF
- WASTE STOW VENT vlv - CLOSED
- EMER CABIN PRESS vlv - BOTH
- SURGE TK O2 vlv - ON
- PLSS O2 vlv - OFF
- LM TUNNEL VENT vlv - OFF

PRESLEEP CHECKLIST

COMM BASIC EXCEPT
- S-BD SQUELCH - ENABLE
- S-BD NORM MODE VOICE - OFF
- S-BD AUX TAPE - OFF

HI GAIN OPS
- Y 270 P40 (roll right)
- Y 90 P-40 (roll left)
- HI GAIN ANT BEAM - NARROW
- HI GAIN ANT TRACK - REACQ
- S-BD ANT OMNI - HI GAIN

ONBOARD READOUT

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

DC IND sel - MNA or B

:30

F/C H_2, O_2 PURGE

140:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	138:00 - 140:00	6/TEC	3-92

MCC-..

FLIGHT PLAN

NOTES

UPDATE
STATE VECTOR

140:00

ECS REDUNDANT COMPONENT CHECK

P27 UPDATE

PTC +20°
P & Y

203,000 NM from EARTH
12h 20m to MCC_5

26h 50m to MCC_6

:30

CREW 5 1/2 HR REST PERIOD

0930 EDT
11h 50m to MCC_5

M
S
F
N

141:00

:30

142:00

W-MATRIX

In the event of a loss of COMM the W-MATRIX will be initialized to the values listed before the next scheduled batch of sightings.

NOTE

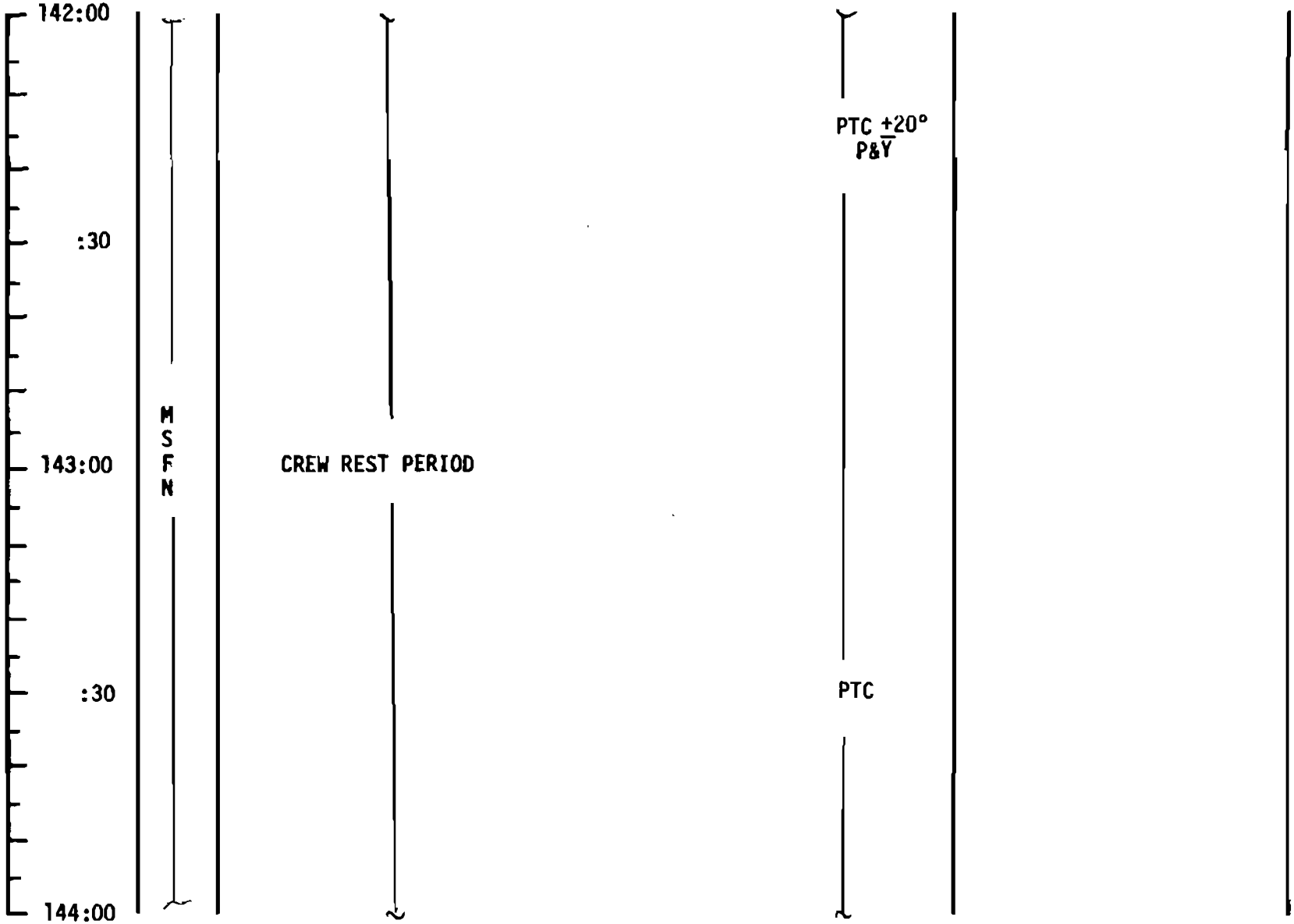
The W-MATRIX is initialized only once on the Transearth leg.

Batch 2 has two sets of values listed; if the MSFN State Vector update at GET 147:00 has not been received, the first set should be used; if received before loss of COMM occurr, the second set should be used. If loss of COMM occurs after EI-30 hrs (GET 161:50), and provided the EI-30 hrs entry pad update has been recieved, the current CMC state vector will provide reentry capability, and no navigation marks will be made.

BATCH NR	VALUES TO BE LOADED VIA V67 INTO THE DSKY R1	R2
1	+00094	+00057
2	+02928	+00039
	+00998	+00008
3	+00998	+00008
4	+00998	+00008
5	+00998	+00008
6	+00998	+00008

NOTES

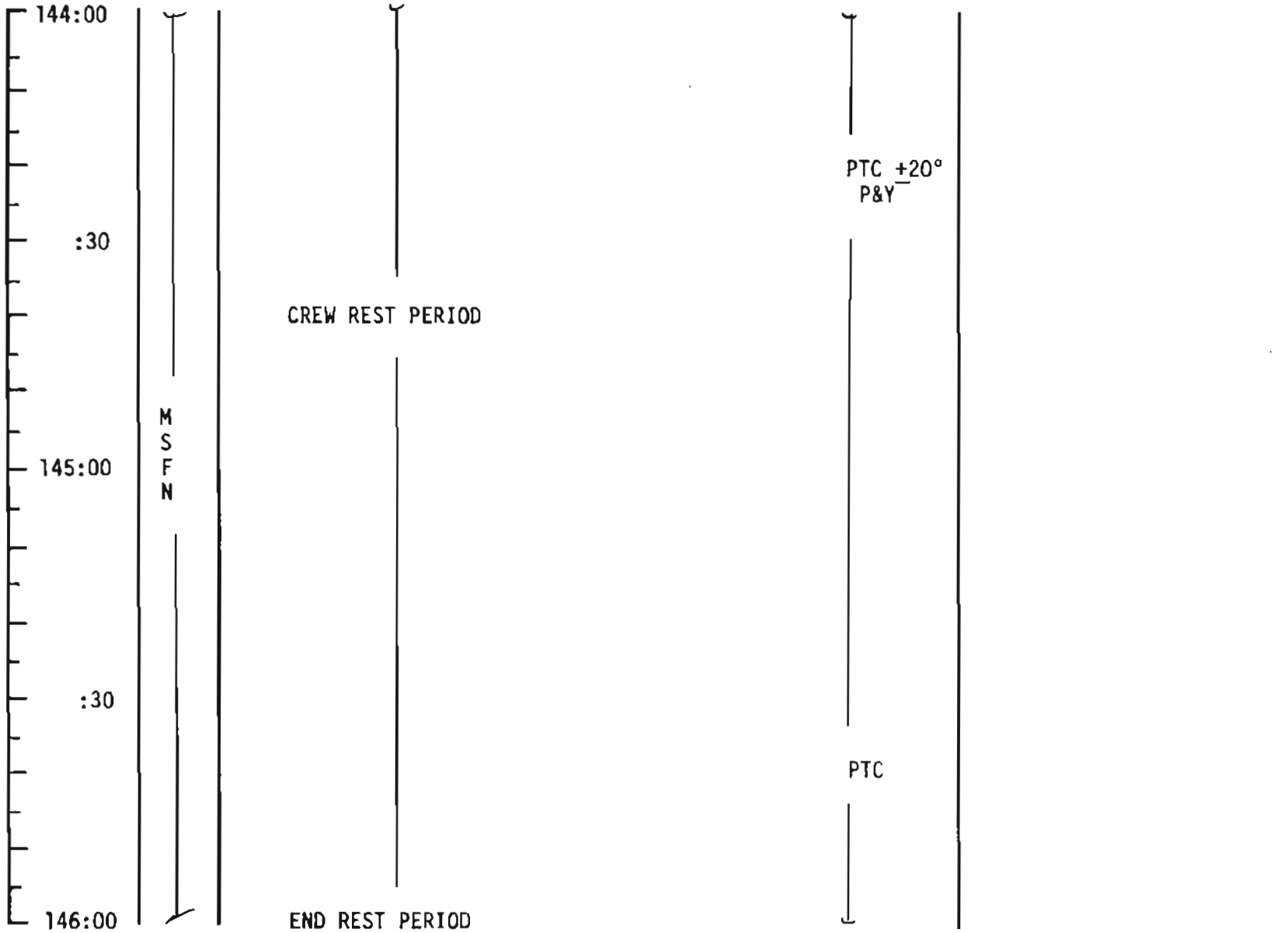
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	142:00 - 144:00	6/TEC	3-94

FLIGHT PLA[illegible]NG BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	144:00 - 146:00	7/TEC	3-95

FLIGHT PLANNING BRANCH

FLIGHT PLAN

NOTES

186,000 NM from EARTH

SATURDAY, MAY 24, 1500 EDT

6 h to MCC_5

MSFN will advise at the completion of the PTC test at ± 30° DB the operation PTC mode to use. (DB and roll rate)

146:00

CANISTER B CHANGE
(14 to B, 12 to A3)

PTC +20°DB P&Y

:30

BREAKFAST

BATT A THIRD CHARGE

RE-ESTABLISH PTC
@ 0.3°/SEC ROLL RATE.
DISABLE ROLL JETS.
10m LATER GO TO
± 30° DB. MAINTAIN A MINIMUM OF 4 HRS.
(Pg 4-14)

MSFN

147:00

UPDATE CONSUMABLES FLIGHT PLAN

POSTSLEEP CHECKLIST

CREW STATUS REPORT
CONSUMABLES UPDATE from MSFN
FLIGHT PLAN UPDATE
CYCLE H2, O2 FANS
COMM BASIC EXCEPT
  S-BD AUX TAPE - OFF
  TAPE RCDR FWD - OFF
MSFN MANAGES ANT OPS

CONSUMABLES UPDATE

GET: _____
RCS TOT _____
A _____
B _____
C _____
D _____
H_2 TOT _____
O_2 TOT _____

:30

UPDATE STATE VECTOR

P27 UPDATE

PTC

CONFIGURE CAMERA FOR LONG DISTANCE EARTH AND MOON PHOTOS
70/250/CEX-(f11,250,∞) - EARTH
70/250/CEX-(f5.6,250,∞) - MOON

148:00

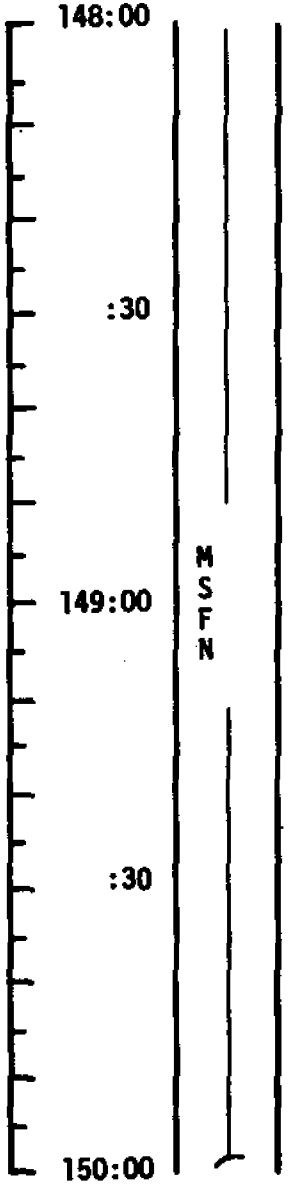
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	146:00 - 148:00	7/TEC	3-96

REV A FLIGHT PLA[illegible]S BRANCH

MCC

NOTES

FLIGHT PLAN



PTC ±30° DB
P&Y

PTC

NOTE
INITIALIZE THE W-MATRIX
PRIOR TO THE FIRST STAR/LUNAR
LDMK SIGHTING TO R_1 00094
R_2 00057

THE W-MATRIX WILL NOT BE
RE-INITIALIZED PRIOR TO THE
REMAINING P23 SIGHTINGS SCHEDULED

P23 NO COMM (2)
TEI + 12:30
5 SETS LH
Regulus(22)N
Regulus(22)N
Gienah(24)F
Spica(26)F
Spica(26)F
W-MATRIX DATA Pg 3-93

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	148:00 - 150:00	7/TEC	3-97

FLIGHT PLANNING BRANCH

MCC-H

NOTES

FLIGHT PLAN

150:00

:30

151:00

:30

152:00

MSFN

APOLLO 10: READ TO MSFN
CM/RCS THRUSTER TEMPS

PTC ±30 DB
P&Y

P52 IMU REALIGN
(Option 3 - REFSMMAT)

P23 OPTICS CALIBRATION

P23 MIDCOURSE NAVIGATION STAR/
LUNAR LDMK (3 marks
each SET)

SET 1: Spica (26)-420
SET 2: Denebola (23)-420
SET 3: Arcturus (31)-420
SET 4: Gienah (24)-423
SET 5: Spica (26)-423
SET 6: Arcturus (31)-423
SET 7: Spica (26)-422
SET 8: Denebola (23)-422
SET 9: Arcturus (31)-422

P27 UPDATE

P30 EXTERNAL ΔV

UPDATE
STATE VECTOR
MCC_5 TGT LOAD
MCC_5 MNVR PAD

P23 NO COMM (3)
TEI + 13:30
3 SETS EH
Alpheratz(1)N
Alpheratz(1)N
Diphada(2)N
W-MATRIX DATA Pg 3-93

INCORP P23 MARK DATA
AND UPDATE ONBOARD
STATE VECTOR

NOTE: If Gienah (24) too dim use following stars for sets 4, 5, 6:
SET 4: Spica (26)-423
SET 5: Denebola (23)-423
SET 6: Arcturus (31)-423

LDMK 421 is larger than 420, 423, and 422 and may be substituded for any or all of these three

174,000 NM from EARTH

P52 OPT ___
N71: ____, ____
N05: ____ ____
N93:
X ____ ____
Y ____ ____
Z ____ ____

LDMK 420 (TARUNTIUS P)
LAT +00.866
LONG/2 +25.851
ALT -000.34

LDMK 423 (SECCHI K)
LAT -00.050
LONG/2 +22.741
ALT -000.34

LDMK 422 (MESSIER B)
LAT -00.950
LONG/2 +23.968
ALT -000.34

LDMK 421 (TARUNTIUS H)
LAT +00.350
LONG/2 +24.949
ALT -000.86

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	150:00 - 152:00	7/TEC	3-98

FLIGHT . NING BRANCH

MCC-H

FLIGHT PLAN

152:00

TEI +15h

:30

153:00

:30

154:00

MSFN

P40/P41 SPS/RCS THRUST

SXT/STAR CHECK

152:20 MCC$_5$ — TRIM To 0.2 fps all axes

V66 TRANSFER CSM SV TO LM SLOT

APOLLO 10: POST BURN REPORT

TV(GDS): 152:35 - 152:45 HGA to NARROW

ESTABLISH PTC

PRESLEEP CHECKLIST

CREW STATUS REPORT
ONBOARD READOUTS to MSFN
CYCLE H2 O2 FANS
CHLORINATE POTABLE WATER
VERIFY
- WASTE MNGT OVBD DRAIN vlv - OFF
- WASTE STOW VENT vlv - CLOSED
- EMER CABIN PRESS vlv - BOTH
- SURGE TK O2 vlv - ON
- PLSS O2 vlv - OFF
- LM TUNNEL VENT vlv - OFF

COMM BASIC EXCEPT
- S-BD SQUELCH - ENABLE
- S-BD NORM MODE VOICE - OFF
- S-BD AUX TAPE - OFF

HI GAIN OPS (or OMNI OPS per MSFN)
- Y 270 P40 (roll right)
- Y 90 P-40 (roll left)
- HI GAIN ANT BEAM - NARROW
- HI GAIN ANT TRACK - REACQ
- S-BD ANT OMNI - HI GAIN

EMS CHECK

F/C O_2 PURGE

CANISTER A CHANGE (15 to A, 13 to A4)

P23 NO COMM (4)
TEI + 16:00
- 5 SETS EH
- Altair(40)F
- Diphda(2)N
- Diphda(2)N
- Alpheratz(1)N
- Alpheratz(1)N

W-MATRIX DATA Pg 3-93

NOTES

BURN STATUS REPORT

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

REMARKS:

ONBOARD READOUT

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

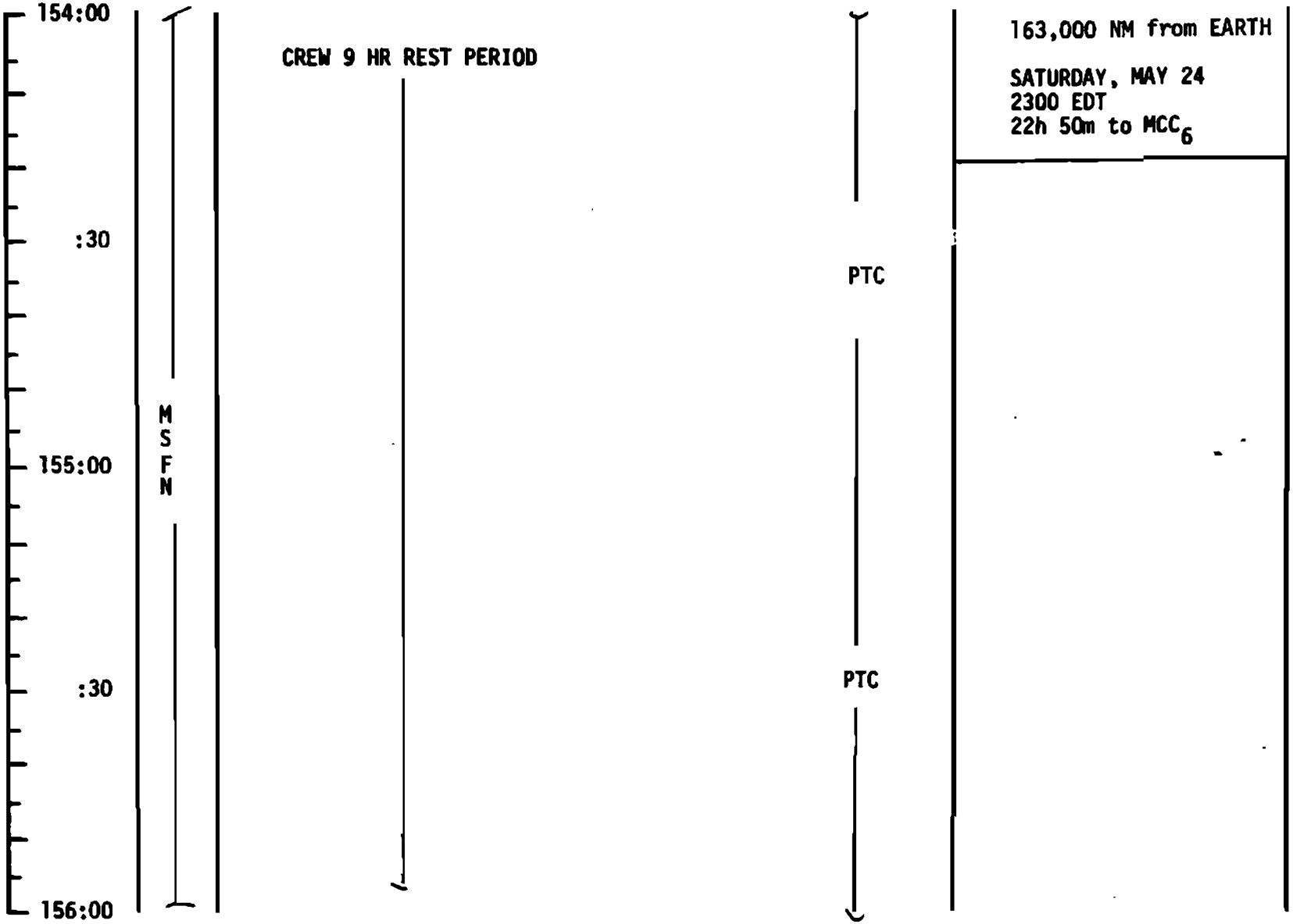
DC IND sel - MNA or B

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	152:00 - 154:00	7/TEC	3-99

FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN

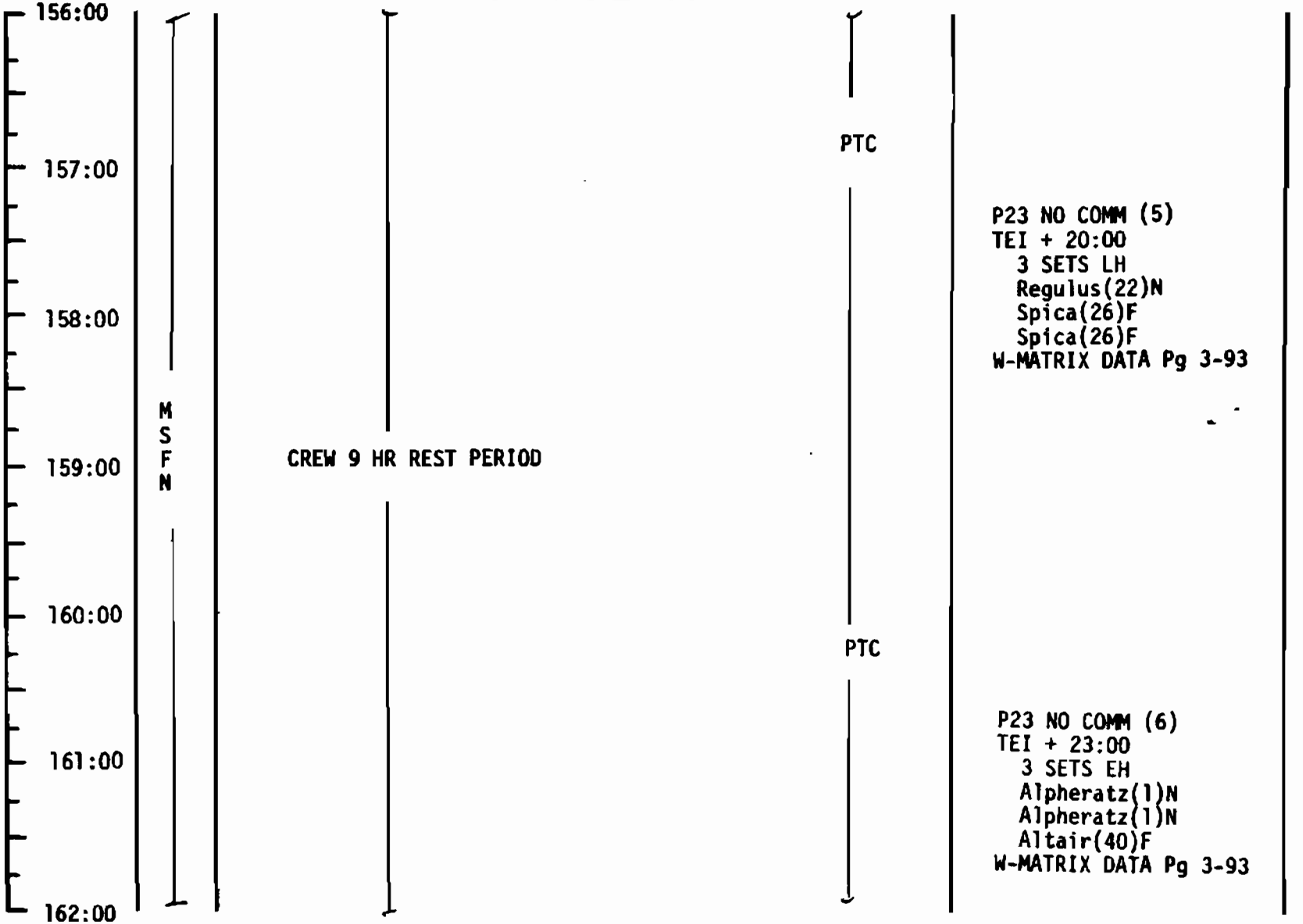


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	154:00 - 156:00	7/TEC	3-100

FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN

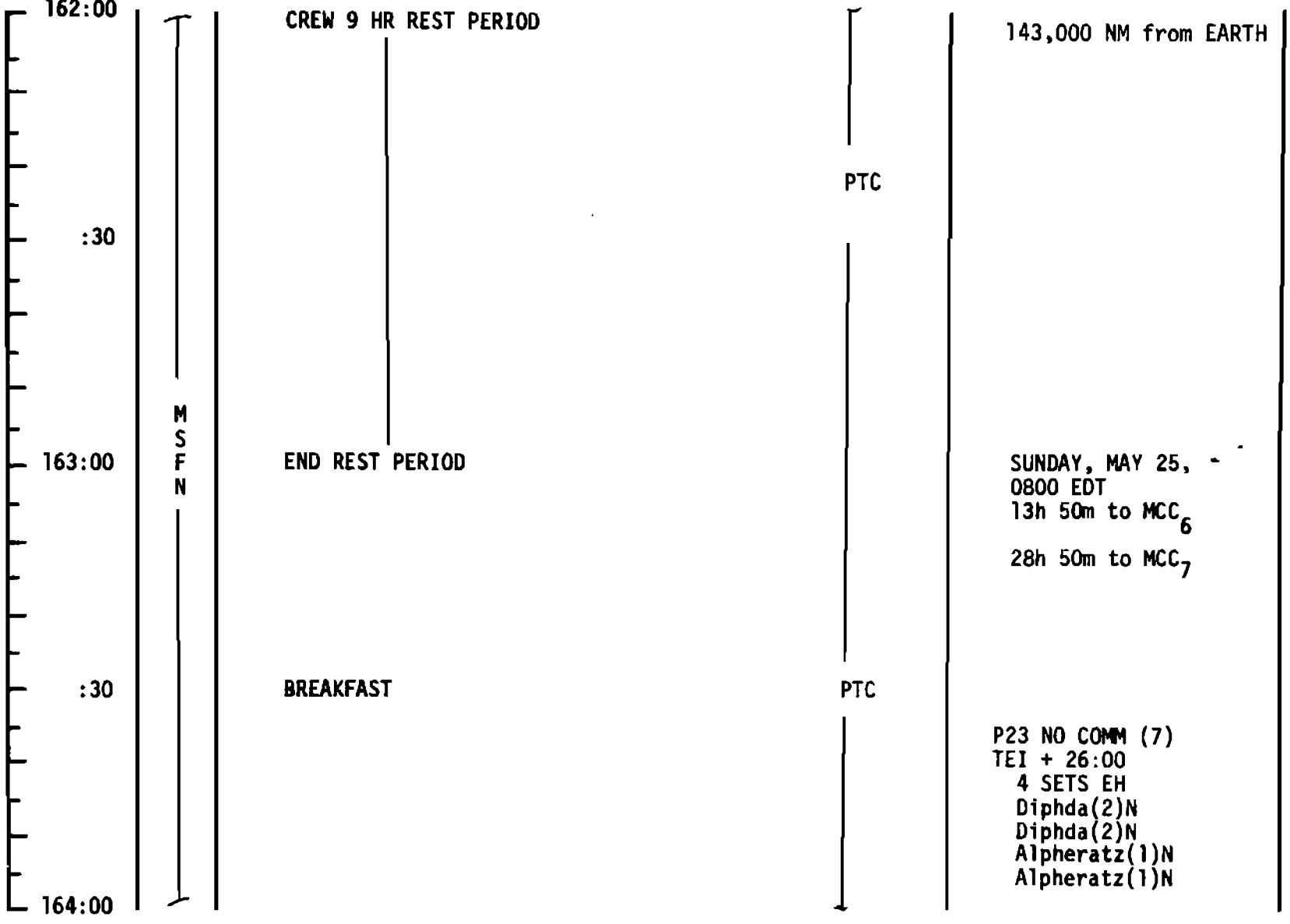


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	156:00 - 162:00	7/TEC	3-101

FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	162:00 - 164:00	7/TEC	3-102

FLIGHT PLAN[illegible]G BRANCH

FLIGHT PLAN

NOTES

164:00

UPDATE
CONSUMABLES
FLIGHT PLAN

:30

UPDATE
STATE VECTOR
MCC_6 MNVR PAD
ENTRY PAD
(ASSUMES NO
MCC_6 BUT MCC_7)

165:00

:30

166:00

MSFN

POSTSLEEP CHECKLIST

CREW STATUS REPORT
CONSUMABLES UPDATE from MSFN
FLIGHT PLAN UPDATE
CYCLE H2, O2 FANS
COMM BASIC EXCEPT
  S-BD AUX TAPE - OFF
  TAPE RCDR FWD - OFF
MSFN MANAGES ANT OPS
ECS REDUNDANT COMPONENT CHECK

INITIATE BATT B THIRD CHARGE

P27 UPDATE

PTC

P52 IMU REALIGN
  (Option 3 - REFSMMAT)

P23 OPTICS CALIBRATION

P23 MIDCOURSE NAVIGATION-STAR/EARTH HORIZON
  (3 marks each SET)

  SET 1: Diphda(2)N
  SET 2: Enif(44)F
  SET 3: Fomalhaut(45)F

PTC

F/C O_2 PURGE

CANISTER B CHANGE
(16 to B, 14 to A4)

CONSUMABLES UPDATE

GET: _____
RCS TOT _____
A _____
B _____
C _____
D _____
H_2 TOT _____
H_2 TOT _____

MINIMUM SUN ELEVATION
CONTRAINT TEST

INCORP P23 MARK DATA
AND UPDATE ONBOARD
STATE VECTOR

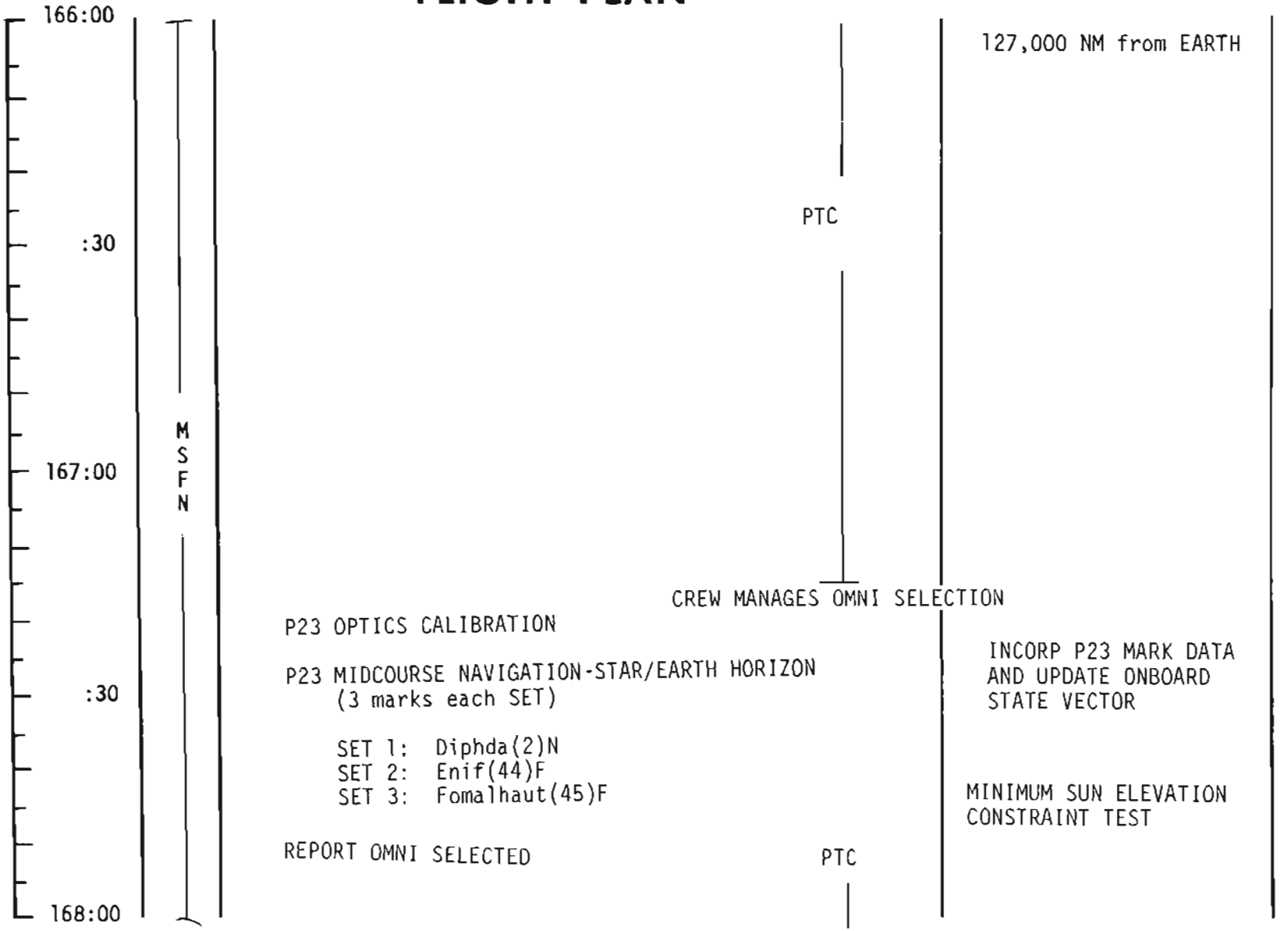
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	164:00 - 166:00	7/TEC	3-103

REV A FLIGHT PLANNING BRANCH

MCC-H

NOTES

FLIGHT PLAN

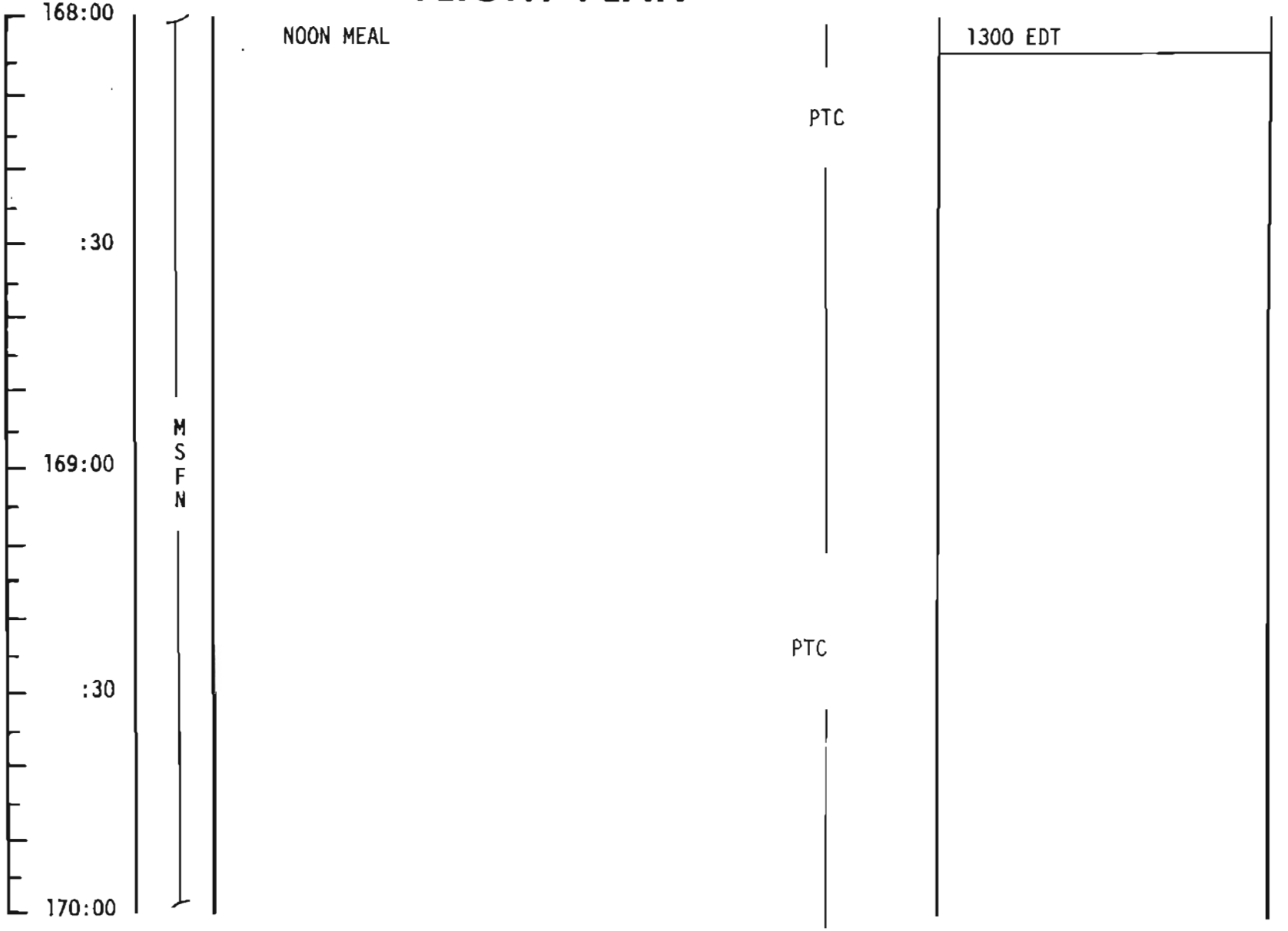


MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	166:00 - 168:00	7/TEC	3-104

REV A FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN



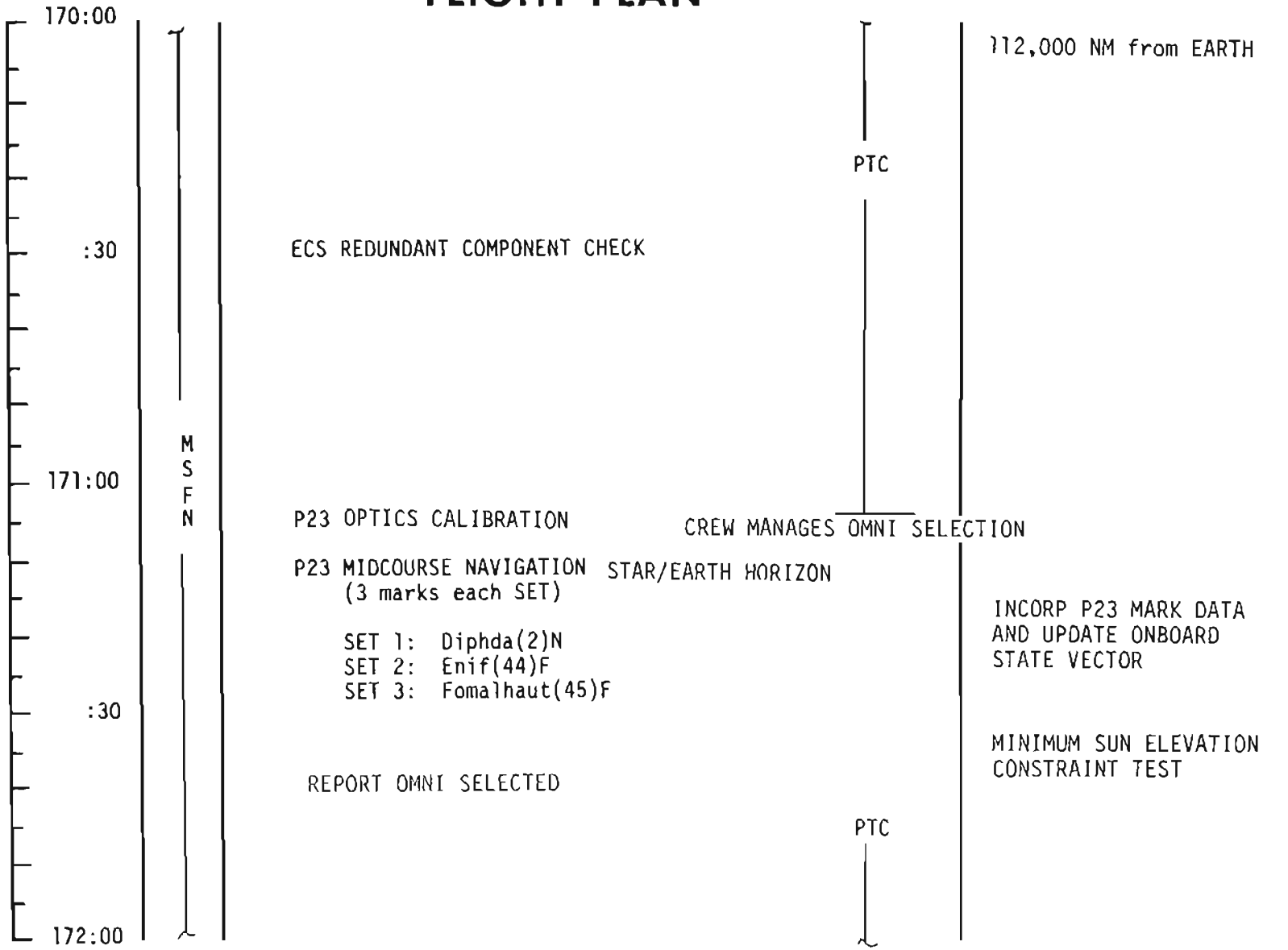
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	168:00 - 170:00	8/TEC	3-105

REV A

FLIGHT PLANNING BRANCH

NOTES

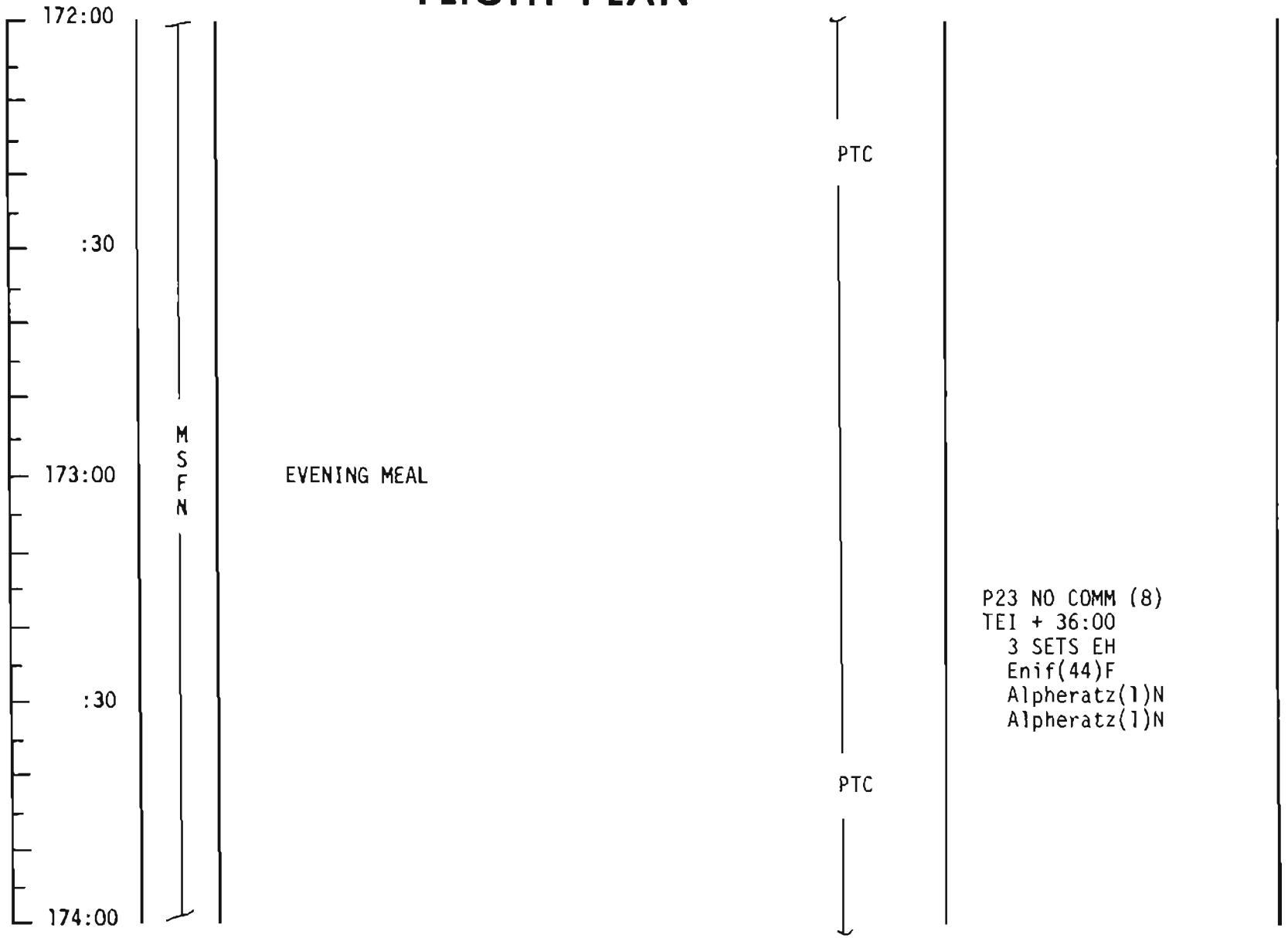
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	170:00 - 172:00	8/TEC	3-106

REV A FLIGHT PLANNI BRANCH

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	172:00 - 174:00	8/TEC	3-107

FLIGHT PLANNING BRANCH

MCC-H

FLIGHT PLAN

NOTES

174:00

:30

175:00

:30

176:00

MSFN

UPDATE
STATE VECTOR
MCC_6 TGT LOAD
MCC_6 MNVR PAD
ENTRY PAD
(ASSUMES MCC_6)

P23 OPTICS CALIBRATION

P23 MIDCOURSE NAVIGATION-STAR/EARTH HORIZON
(3 marks each SET)

SET 1: Diphda(2)N
SET 2: Enif(44)F
SET 3: Fomalhaut(45)F

P27 UPDATE:

P30 EXTERNAL ΔV AND DAP CHECK

P52 IMU REALIGN
(Option 3 - REFSMMAT)

PTC
CREW
MANAGES
OMNI
SELECTION

95,000 NM from EARTH

MINIMUM SUN ELEVATION
CONSTRAINT TEST

INCORP P23 MARK DATA
AND UPDATE ONBOARD
STATE VECTOR

P23 NO COMM (9)
TEI + 37:00
3 SETS LH
Regulus(22)N
Spica(26)F
Spica(26)F

P23 NO COMM (10)
TEI + 38:30
5 SETS EH
Enif(44)F
Diphda(2)N
Diphda(2)N
Alpheratz(1)N
Alpheratz(1)N

P52 OPT ___
N71: ___ ___, ___ ___
N05: ___ ___ ___ . ___ ___
N93:
X ___ ___ . ___ ___
Y ___ ___ . ___ ___
Z ___ ___ . ___ ___

MISSION	EDITION	DATE	TIME		
F	FINAL	APRIL 17, 1969	174:00 - 176:00	8/TEC	3-108

REV A FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN

176:00

:30

EI
-15

177:00

:30

178:00

MSFN

P40/P41 SPS/RCS THRUST

176:50 MCC_6 ——— TRIM to 0.2 fps all axes

V66 TRANSFER CSM SV TO LM SLOT

APOLLO 10: POST BURN REPORT

MNVR R _____
P 090°
Y 000°

PTC

REPORT OMNI SELECTED

PRESLEEP CHECKLIST (NEXT PAGE)

F/C O_2 PURGE

READ TO MSFN CM/RCS THRUSTER TEMPS
5C ____
5D ____
6A ____
6B ____
6C ____
6D ____

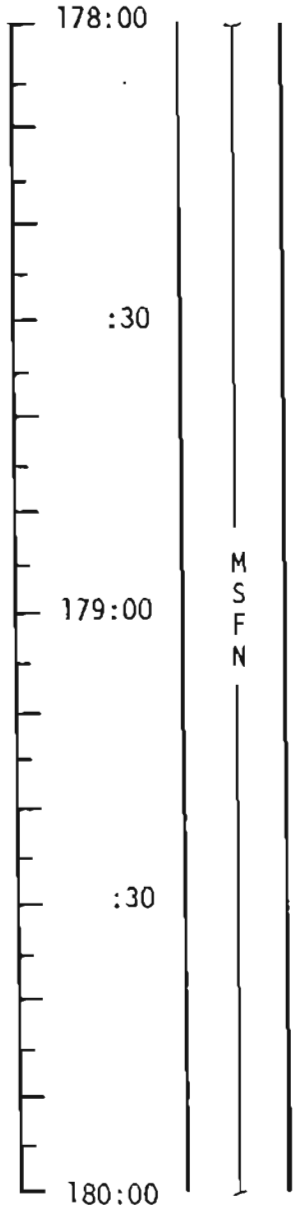
CANISTER A CHANGE
(17 to A, 15 to A4)

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	176:00 - 178:00	8/TEC	3-109

REV A FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN



PRESLEEP CHECKLIST
(FOR 177:30)

CREW STATUS REPORT
ONBOARD READOUTS to MSFN
CYCLE H2, O2 FANS
CHLORINATE POTABLE WATER
VERIFY
- WASTE MNGT OVBD DRAIN vlv - OFF
- WASTE STOW VENT vlv - CLOSED
- EMER CABIN PRESS vlv - BOTH
- SURGE TK O2 vlv - ON
- PLSS O2 vlv - OFF
- LM TUNNEL VENT vlv - OFF

COMM BASIC EXCEPT
- S-BD SQUELCH - OFF
- S BD NORM MODE - OFF
- S-BD AUX TAPE - OFF

OMNI OPS
- S-BD ANT OMNI - OMNI
- S-BD ANT A - B
- TAPE RCDR FWD - OFF

CREW 8 HR REST
PERIOD

PTC

80,000 NM from EARTH

SUNDAY, MAY 25,
2300 EDT
11h 50m to MCC-7

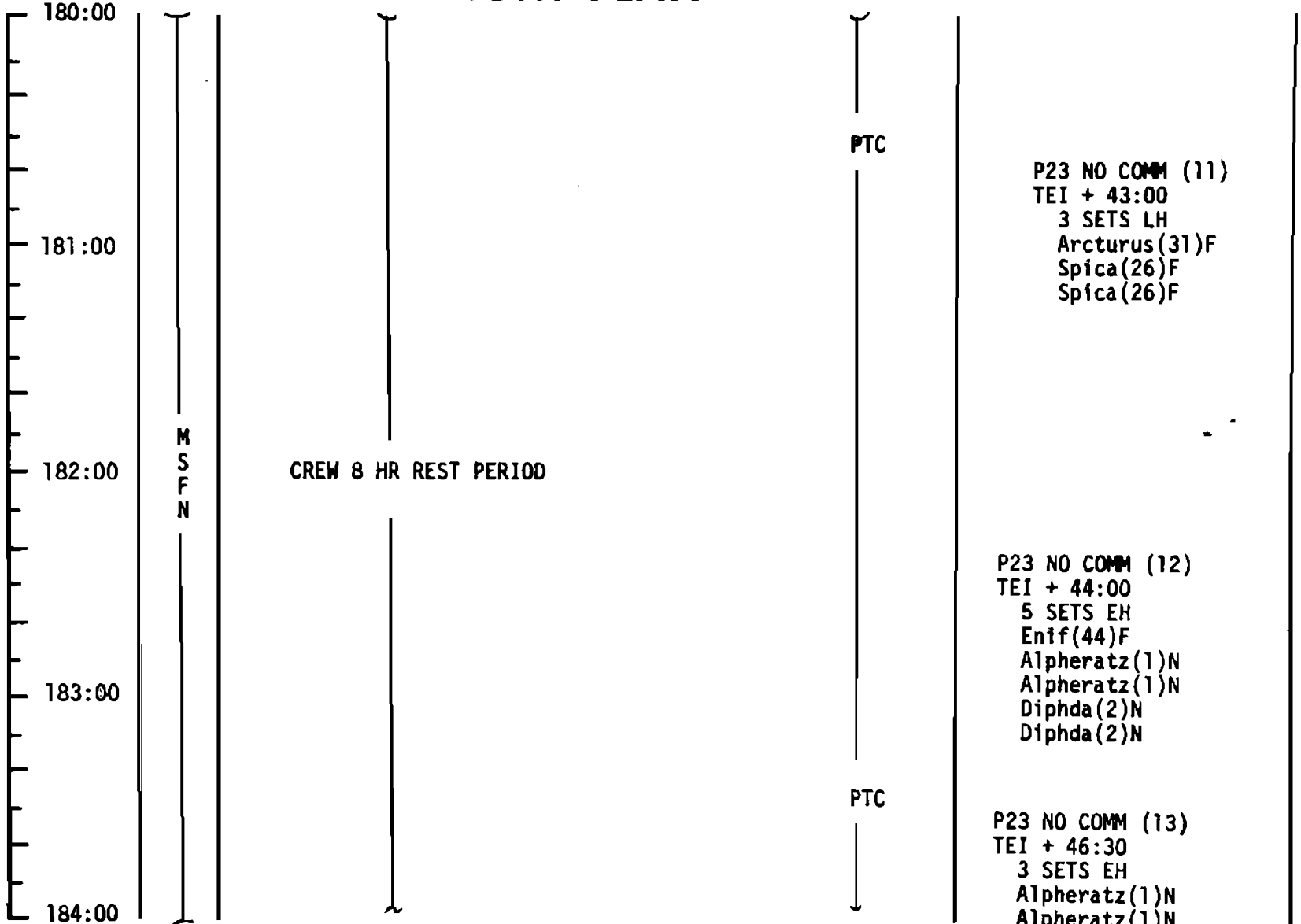
ONBOARD READOUT

BAT C _____
PYRO BAT A _____
PYRO BAT B _____
RCS A _____
B _____
C _____
D _____
DC IND sel - MNA or B

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	178:00 - 180:00	P/TEC	3-110

FLIGHT PLANY BRANCH

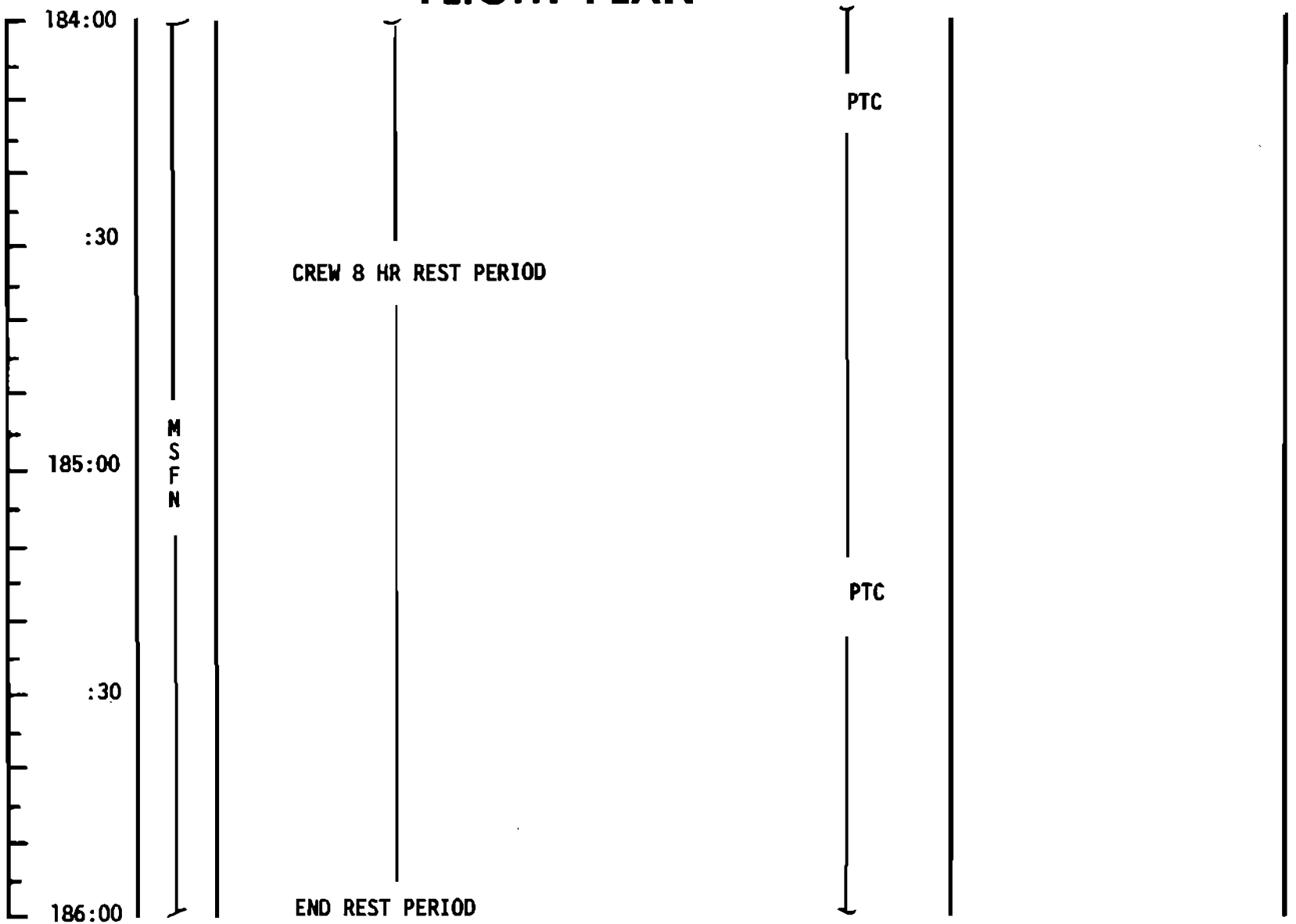
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	180:00 - 184:00	8/TEC	3-111

NOTES

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	184:00 - 186:00	8/TEC	3-112

FLIGHT PLANNING BRANCH

MCC-

NOTES

FLIGHT PLAN

UPDATE
MCC$_7$ DECISION
FLIGHT PLAN

186:00

BREAKFAST

44,000 NM from EARTH

MONDAY, MAY 26,
0648 EDT
EI - 6h

POSTSLEEP CHECKLIST

CREW STATUS REPORT
FLIGHT PLAN UPDATE
CYCLE H2, O2 FANS
COMM BASIC EXCEPT
  S-BD AUX TAPE - OFF
  TAPE RCDR FWD - OFF
MSFN MANAGES ANT OPS

PTC

:30

P23 NO COMM (14)
TEI + 49:30
2 SETS EH
Alpheratz(1)N
Fomalhaut(45)F

VHF AM A - SIMPLEX AND VOICE CHECK

TV (HSK): 186:50 - 187:05 HGA to MEDIUM

CREW MANAGES
ANT OPS

M
S
F
N

187:00

UPDATE
STATE VECTOR
ENTRY REFSMMAT
MCC$_7$ TGT LOAD
MCC$_7$ MNVR PAD
ENTRY PAD

P27 UPDATE (EI - 4h 30m)

:30

P52 IMU REALIGN
(Option 1 - Preferred)

ALIGNS IMU
TO ENTRY
REFSMMAT

P52 OPT ___
N71: ___, ___
N05: ___ ___.___
N93:
X ___.___ ___
Y ___.___ ___
Z ___.___ ___

CANISTER B CHANGE
(18 to B, 16 to A4)

188:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	186:00 - 188:00	8/TEC	3-113

REV A FLIGHT PLANNING BRANCH

MCC-H

NOTES

FLIGHT PLAN

188:00

P30 EXTERNAL ΔV AND DAP LOAD CHECK

:30

P40/41 SPS/RCS THRUST

SXT STAR CHECK

EI
- 3h

188:50 MCC$_7$ ——— TRIM to 0.2 fps all axes

MSFN

189:00

V66 TRANSFER CSM SV TO LM SLOT

APOLLO 10: POST BURN REPORT

:30

UPDATE
GO/NO GO
PYRO ARM

ELS LOGIC AND SEQ CHECK (EI-2h)

MNVR TO ENTRY ATTITUDE

BORESIGHT AND SXT STAR CHECK

190:00

BURN STATUS REPORT

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

REMARKS:

P23 NO COMM (15)
TEI + 52:00
3 SETS EH
Enif(44)F
Fomalhaut(45)F
Fomalhaut(45)F

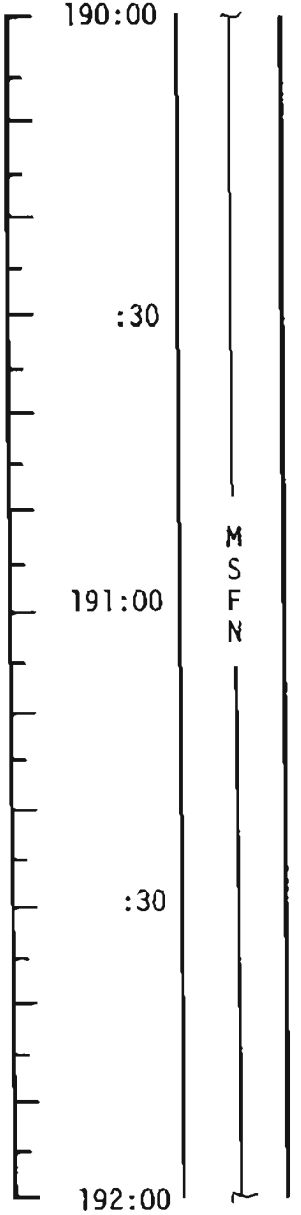
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	188:00 - 190:00	8/TEC	3-114

REV A FLIGHT PLANNING BRANCH

MCC-H

NOTES

FLIGHT PLAN



P52 IMU REALIGN (EI - 1h 35m)
(Option 3 - REFSMMAT)

GDC ALIGN

FINAL STOWAGE

:30

EMS CHECK (EI - 1h 15m)
ACTIVATE PRIMARY EVAPORATOR
CM RCS PREHEAT (20 min) (EI - 1h 10m) (if reqd)
ACTIVATE SECONDARY EVAPORATOR
PYRO BAT CHECK
SECS, PYRO ARM, CM RCS ACTIVATION

191:00

UPDATE
STATE VECTOR
ENTRY PAD

P27 UPDATE (EI - 1h)

CM RCS CHECK

:30

191:35 CM/SM SEP

191:50 ENTRY INTERFACE

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	190:00 - 192:00	8/TEC	3-115

REV A FLIGHT PLANNING BRANCH

NOTES

FLIGHT PLAN

192:00

192:04 TOUCHDOWN

MONDAY, MAY 26
1252 EDT

:30

TYPICAL DATA - EI to TOUCHDOWN

EVENT	TIME FROM EI - min:sec
400,000 FT	00:00
ENTER S-BAND BLACKOUT	00:26
0.05 G	00:30
KA - INITIATE CONSTANT DRAG	00:52
RDOT=-700 FPS	01:20
PEAK G	01:24
P64 TO P67	02:10
EXIT S-BAND BLACKOUT	03:26
GUIDANCE TERMINATION	07:30
DROGUE DEPLOYMENT	08:33.2
MAIN DEPLOYMENT	09:22.0
TOUCHDOWN	14:15.2

L/D = 0.286
V = 36,221 R=1350
γ = -6.48

193:00

:30

194:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
F	FINAL	APRIL 17, 1969	192:00 - 194:00	8/TEC	3-116

SECTION 4 - DETAILED TEST OBJECTIVES

SECTION 4

DETAILED TEST OBJECTIVE ACTIVITIES

This section contains the activity summaries which reflect the test objectives for Mission F as described in "Mission Requirements F Type Mission", SPD9-R-037, dated February 11, 1969. 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 and require minimal support for accomplishment are grouped at the end of this section as "Passive Tests." 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 (and mission phase if necessary) are presented in addition to brief statements of the requirements for performing the activity;

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

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

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

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

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

B. CSM data storage equipment (DSE) HBR recording is needed only when MSFN coverage is not available and when mandatory data are required.

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

TABLE 4-1 MISSION ACTIVITY/TEST OBJECTIVE CROSS REFERENCE

ACTIVITY	FTO
Trans/Docking/Ejection	20.46-1, 2
PTC	7.26-1; 20.79-1, 2, 3, 4
Midcourse Navigation	1.39-1, 2, 3, 4
MCC	20.95-1
LOI	20.117-1, 2
LM Sensor Biases	11.17-1; 12.6-1
LM IMU Alignment	11.17-2
Lunar Landmark Tracking	20.91-1, 2, 3, 4, 5; 20.121-1, 2, 3
LM Inspection by CSM	20.86-1, 3
DOI	11.15-2; 13.14-1; 16.14-2; 20.82-1, 2; 20.86-2, 3
Near Lunar Surface Activity	16.14-1; 20.86-4; 16.10-3
Phasing	11.17-3; 13.14-1; 11.15-1; 12.6-1; 16.14-2; 20.82-1, 2
Insertion and Rendezvous	12.10-1, 2; 16.15-1, 2, 3, 4, 5; 20.77-1; 20.78-1, 2; 20.82-1, 2; 20.86-2, 3
Station Keeping	12.8-1, 2, 5, 6, 7, 8; 20.78-2
APS Burn to Depletion	11.17-3; 12.9-1, 3; 13.13-1, 2
Telecommunications	6.9-1; 16.10-1, 2,3; 16.12-1; 16.17-1, 2, 3, 4, 5
LM Consumables	20.83-1, 2, 3, 4, 5
Passive Tests	7.26-1, 2; 20.66-1, 2; 20.80-1

TABLE 4-2
TEST OBJECTIVE/MISSION ACTIVITY
CROSS REFERENCE

DTO/FTO NUMBER	TEST OBJECTIVE	MISSION ACTIVITY	SECTION PAGE NO.
S1.39	Midcourse Navigation/Star-Lunar Landmark		
S1.39-1	Star/Lunar Landmark Navigation Accuracy	Midcourse Navigation	4-16
S1.39-2	OSS Adequacy for Star/Lunar Landmark Navigation	Midcourse Navigation	4-16
S1.39-3	Coordinate Optics and Maneuvers/Identify LMK	Midcourse Navigation	4-16
S1.39-4	Propellant Usage/Time for Navigation	Midcourse Navigation	4-16
S3.22	PUGS Evaluation		
S3.22-1	DELETED	Lunar Orbit Insertion	4-18
		Transearth Injection	4-56
S6.9	CSM High Gain Antenna Reflectivity		
S6.9-1	CSM HGA Reflectivity Region - Docked	Telecommunications	4-42
S7.26	Space Environment Thermal Control		
S7.26-1	TC System - Translunar and Transearth	Passive Thermal Control	4-14
		Passive Test	4-54
P7.26-2	TC System - Lunar Orbit	Passive Test	4-54
P11.15	PGNCS Undocked DPS Performance		
P11.15-1	PGNCS/DPS High Thrust Burn	Phasing	4-32
P11.15-2	PGNCS/DPS Descent Orbit Insertion	Descent Orbit Insertion	4-26
S11.17	LM IMU Performance		
S11.17-1	LM PIPA Bias	LM Sensor Biases	4-20
S11.17-2	LM IMU Drift Rate	LM IMU Alignment	4-21
S11.17-3	LM PGNCS Errors	Phasing	4-32
		APS Burn to Depletion	4-41

TABLE 4-2
TEST OBJECTIVE/MISSION ACTIVITY
CROSS REFERENCE

DTO/FTO NUMBER	TEST OBJECTIVE	MISSION ACTIVITY	SECTION PAGE NO.
S12.6	AGS Performance		
S12.6-1	AGS/PGNCS Gyro and Accelerometer Data	LM Sensor Biases	4-20
		Phasing	4-32
S12.8	AGS/CES Attitude/Translation Control		
S12.8-1	AGS/CES Auto Hold-Minimum Deadband	Station Keeping	4-38
S12.8-2	AGS/CES Auto Hold - Maximum Deadband	Station Keeping	4-38
S12.8-3	Deleted	Station Keeping	4-38
S12.8-4	Deleted	Station Keeping	4-38
S12.8-5	AGS/CES Man Attitude - Pulse Mode	Station Keeping	4-38
S12.8-6	AGS/CES Man Attitude - Proportional Rate	Station Keeping	4-38
S12.8-7	AGS/CES Man Translation - THC	Station Keeping	4-38
S12.8-8	Propellant Usage	Station Keeping	4-38
S12.9	Unmanned AGS Controlled APS Burn		
S12.9-1	AGS/APS Burn - Range of Inertias	APS Burn to Depletion	4-41
S12.9-2	Deleted	APS Burn to Depletion	4-41
S12.9-3	RCS Propellant Usage	APS Burn to Depletion	4-41
S12.10	LM/AGS Rendezvous Evaluation		
S12.10-1	AGS Controlled CFP Rendezvous	Insertion and Rendezvous	4-34
S12.10-2	AGS/CES - RCS ΔV Maneuver	Insertion and Rendezvous	4-34
S13.13	Long Duration Unmanned APS Burn		
S13.13-1	APS Performance	APS Burn to Depletion	4-41
S13.13-2	APS Propellant Depletion	APS Burn to Depletion	4-41
S13.14	LM Supercritical Helium		
S13.14-1	Supercritical Helium Pressure Profile	Descent Orbit Insertion	4-26
		Phasing	4-32
		Passive Tests	4-54

TABLE 4-2
TEST OBJECTIVE/MISSION ACTIVITY
CROSS REFERENCE

DTO/FTO NUMBER	TEST OBJECTIVE	MISSION ACTIVITY	SECTION PAGE NO.
P16.10	LM Steerable Antenna Performance		
P16.10-1	LM S-Band Steerable Antenna - Lunar Distance	Telecommunications	4-42
P16.10-2	Steerable Antenna Pattern	Telecommunications	4-42
P16.10-3	Steerable Antenna Procedures	Telecommunications	4-42
		Near Lunar Surface	4-28
S16.12	LM Omni-Antennas Lunar Distance		
S16.12-1	LM Omni-Antennas Lunar Distance	Telecommunications	4-42
P16.14	Landing Radar Test		
P16.14-1	Landing Radar Lock-on	Near-Lunar Surface	4-28
P16.14-2	Spurious Signal Lock-on	Descent Orbit Insertion	4-26
		Phasing	4-32
S16.15	Rendezvous Radar Performance		
S16.15-1	Maintain Lock at Maximum Range	Insertion and Rendezvous	4-34
S16.15-2	Range Data Accuracy	Insertion and Rendezvous	4-34
S16.15-3	Range Rate Data Accuracy	Insertion and Rendezvous	4-34
S16.15-4	Tracking Angle Data	Insertion and Rendezvous	4-34
S16.15-5	LM -X RCS Plume Effect on RR	Insertion and Rendezvous	4-34
S16.17	Relay Modes Voice/TM		
S16.17-1	LM/MSFN via S-Band, LM/CSM via VHF, CSM/MSFN via S-Band	Telecommunications	4-42
S16.17-2	LM/MSFN/CSM S-Band Conference, MSFN Relay	Telecommunications	4-42
S16.17-3	LM/CSM via VHF, CSM/MSFN via S-Band, CSM Relay	Telecommunications	4-42
S16.17-4	LM Voice and LBR to CSM - CSM Dump	Telecommunications	4-42
S16.17-5	LM/CSM via VHF, CSM/MSFN via S-Band, LM Relay	Telecommunications	4-42
S20.46	Transposition/Docking/LM Ejection		
S20.46-1	Trans/Dock/Ejection Demonstration	Trans/Dock/Ejection	4-11
S20.46-2	Trans/Dock/Ejection Procedures and Time	Trans/Dock/Ejection	4-11
P20.66	Crew Activities Lunar Distance		
P20.66-1	Pre-LOI Through DOI Timeline	Passive Tests	4-54
P20.66-2	Lunar Orbit Mission Procedures	Passive Tests	4-54

TABLE 4-2
TEST OBJECTIVE/MISSION ACTIVITY
CROSS REFERENCE

DTO/FTO NUMBER	TEST OBJECTIVE	MISSION ACTIVITY	SECTION PAGE NO.
S 20.77	VHF Ranging		
S20.77-1	Accuracy of VHF Ranging During Rendezvous	Insertion and Rendezvous	4-34
P20.78	CSM/LM Rendezvous Capability		
P20.78-1	LM Rendezvous Demonstration	Insertion and Rendezvous	4-34
P20.78-2	LM Rendezvous Procedures	Insertion and Rendezvous	4-34
		Station Keeping	4-38
S 20.79	Passive Thermal Control Modes		
S 20.79-1	PTC-Docked-Roll 0.1 Deg/Sec	Passive Thermal Control	4-14
S 20.79-2	PTC-Docked-Roll 0.3 Deg/Sec	Passive Thermal Control	4-14
S 20.79-3	PTC-CSM-Roll 0.1 Deg/Sec	Passive Thermal Control	4-14
S 20.79-4	PTC-CSM-Roll 0.3 Deg/Sec	Passive Thermal Control	4-14
S 20.80	Ground Support Lunar Distance		
S 20.80-1	Ground Support Lunar Distance	Passive Tests	4-54
S 20.82	PGNCS/AGS Monitoring		
S 20.82-1	Ground Monitor of PGNCS/AGS	Descent Orbit Insertion	4-26
		Phasing	4-32
		Insertion and Rendezvous	4-34
S 20.82-2	Crew Monitor of PGNCS/AGS	Descent Orbit Insertion	4-26
		Phasing	4-32
		Insertion and Rendezvous	4-34
S20.83	LM Consumables Lunar Orbit		
S20.83-1	Electrical Loads	Lm Consumables	4-53
S20.83-2	Water and Oxygen Requirements	LM Consumables	4-53
S20.83-3	LiOH Requirements	LM Consumables	4-53
S20.83-4	Propellant Requirements	LM Consumables	4-53
S20.83-5	Food Requirements	LM Consumables	4-53

TABLE 4-2
TEST OBJECTIVE/MISSION ACTIVITY
CROSS REFERENCE

DTO/FTO NUMBER	TEST OBJECTIVE	MISSION ACTIVITY	SECTION PAGE NO.
S20.86	Lunar Orbit Visibility		
S20.86-1	Illumination/Time for LM Inspection	LM Inspection	4-24
S20.86-2	Optical Tracking of LM	Descent Orbit Insertion	4-26
		Insertion and Rendezvous	4-34
S20.86-3	Visual Phenomena When Viewing LM	LM Inspection	4-24
		Descent Orbit Insertion	4-26
		Insertion and Rendezvous	4-34
S20.86-4	Lunar Surface Optical Washout	Near Lunar Surface	4-28
P20.91	Lunar Landing Site Determination		
P20.91-1	Landmark Tracking Error Uncertainties	Lunar Landmark Tracking	4-22
P20.91-2	Coordinate Sightings and Maneuvers	Lunar Landmark Tracking	4-22
P20.91-3	Propellant and Time for Landmark Tracking	Lunar Landmark Tracking	4-22
P20.91-4	Equipment for Landmark Tracking	Lunar Landmark Tracking	4-22
P20.91-5	Low Sun Angle Landmark Tracking	Lunar Landmark Tracking	4-22
S20.95	Midcourse Correction Capability		
S20.95-1	GNCS and SPS/RCS Performance for MCC	Midcourse Corrections	4-17
S20.117	LOI Maneuver		
S20.117-1	Preparation and Execution of LOI	Lunar Orbit Insertion	4-18
S20.117-2	Procedures and Timeline for LOI	Lunar Orbit Insertion	4-18
P20.121	Lunar Orbit Determination		
P20.121-1	Improve Lunar Gravity Model	Lunar Landmark Tracking	4-22
P20.121-2	Equipment for Landmark Tracking	Lunar Landmark Tracking	4-22
P20.121-3	Propellant and Time for Landmark Tracking	Lunar Landmark Tracking	4-22

TABLE 4-3
CORRELATION OF TEST OBJECTIVES WITH MISSION PHASES AND ACTIVITIES FOR MISSION F

MISSION PHASE	MISSION ACTIVITY	GET
	NOT SCHEDULED	
TRANS LUNAR COAST	TRANSPOSITION/DOCKING	03:00
	MIDCOURSE CORRECTION #1	11:33
	PASSIVE THERMAL CONTROL	12:00
	MIDCOURSE CORRECTION #2	26:30
	TELECOMMUNICATIONS	26:45
	PASSIVE THERMAL CONTROL	45:10
	MIDCOURSE CORRECTION #3	53:45
	MIDCOURSE CORRECTION #4	70:45
LUNAR ORBIT INJECTION	LOI #1 PREPARATION	74:40
	PASSIVE THERMAL CONTROL	76:00
	LOI #2 PREPARATION	79:00
LUNAR ORBIT	MCCH UPDATE	81:00
	LUNAR LANDMARK TRACKING	82:25
	TELECOMMUNICATIONS	83:05
	MCCH UPDATE (TIMELINE)	94/107
	TELECOMMUNICATIONS	96:20
	LUNAR LANDMARK TRACKING	96:35
	LM SENSOR BIASES	96:55
	LM INSPECTION BY CSM	98:10
	DESCENT ORBIT INSERTION	99:30
	TELECOMMUNICATIONS	100:10
LUNAR ORBIT	NEAR LUNAR SURFACE	100:20
	PHASING MNVR	100:45

NO.	FUNCTIONAL TEST OBJECTIVE
51.39-1	STAR/LUNAR LANDMARK NAVIGATION ACCURACY
51.39-2	OSS ADEQUACY FOR STAR/LUNAR LANDMARK NAVIGATION
51.39-3	COORDINATE OPTICS AND MANEUVERS/IDENTIFY LMK
51.39-4	PROPELLANT USAGE/TIME FOR NAVIGATION
53.22-1	DELETED
56.9-1	CSM HGA REFLECTIVITY REGION - DOCKED
57.26-1	TC SYSTEM - TRANSLUNAR AND TRANSEARTH
57.26-2	TC SYSTEM - LUNAR ORBIT
P11.15-1	PGNCS/DPS HIGH THRUST BURN
P11.15-2	PGNCS/DPS DESCENT ORBIT INSERTION
511.17-1	LM PIPA BIAS
511.17-2	LM MAU DRIFT RATE
511.17-3	LM PGNCS ERRORS
512.6-1	AGS/PGNCS GYRO AND ACCELEROMETER DATA
512.8-1	AGS/CES AUTO HOLD-MINIMUM DEADBAND
512.8-2	AGS/CES AUTO HOLD - MAXIMUM DEADBAND
512.8-3	DELETED
512.8-4	DELETED
512.8-5	ACS/CES MAN ATTITUDE - PULSE MODE
512.8-6	ACS/CES MAN ATTITUDE - PROPORTIONAL RATE
512.8-7	AGS/CES MAN TRANSLATION - THC
512.8-8	PROPELLANT USAGE
512.9-1	AGS/APS BURN - RANGE OF INERTIAS
512.9-2	DELETED
512.9-3	RCS PROPELLANT USAGE
512.10-1	AGS CONTROLLED CSI RENDEZVOUS
512.10-2	AGS/CES - RCS ΔV MANEUVER
513.13-1	APS PERFORMANCE
513.13-2	APS PROPELLANT DEPLETION
513.14-1	SUPERCRITICAL HELIUM PRESSURE PROFILE
P16.10-1	LM S-BAND STEERABLE ANTENNA - LUNAR DISTANCE
P16.10-2	STEERABLE ANTENNA PATTERN
P16.10-3	STEERABLE ANTENNA PROCEDURES
516.12-1	LM OMNI-ANTENNAS LUNAR DISTANCE
P16.14-1	LANDING RADAR LOCK-ON
P16.14-2	SPURIOUS SIGNAL LOCK-ON
516.15-1	MAINTAIN LOCK AT MAXIMUM RANGE
516.15-2	RANGE DATA ACCURACY
516.15-3	RANGE RATE DATA ACCURACY
516.15-4	TRACKING ANGLE DATA
516.15-5	LM -X RCS PLUME EFFECT ON IR
516.17-1	LM/MSFN VIA S-BAND, LM/CSM VIA VHF, CSM/MSFN VIA S-BAND
516.17-2	LM/MSFN/CSM S-BAND CONFERENCE, MSFN RELAY
516.17-3	LM/CSM VIA VHF, CSM/MSFN VIA S-BAND, CSM RELAY
516.17-4	LM VOICE AND LBR TO CSM - CSM DUMP
516.17-5	LM/CSM VIA VHF, LM/MSFN VIA S-BAND, LM RELAY
520.46-1	TRANS/DOCK/EJECTION DEMONSTRATION
520.46-2	TRANS/DOCK/EJECTION PROCEDURES AND TIME
P20.46-1	PRE-LOI THROUGH DOI TIMELINE
P20.46-2	LUNAR ORBIT MISSION PROCEDURES
520.77-1	ACCURACY OF VHF RANGING DURING RENDEZVOUS
P20.78-1	LM RENDEZVOUS DEMONSTRATION
P20.78-2	LM RENDEZVOUS PROCEDURES
520.79-1	PTC-DOCKED- ROLL AT 0.1 DEG/SEC
520.79-2	PTC-DOCKED-ROLL AT 0.3 DEG/SEC
520.79-3	PTC-CSM-ROLL AT 0.1 DEG/SEC
520.79-4	PTC-CSM-ROLL AT 0.3 DEG/SEC
520.80-1	GROUND SUPPORT LUNAR DISTANCE
520.82-1	GROUND MONITOR OF PGNCS/AGS
520.82-2	CREW MONITOR OF PGNCS/AGS
520.83-1	ELECTRICAL LOADS
520.83-2	WATER AND OXYGEN REQUIREMENTS
520.83-3	LION REQUIREMENTS
520.83-4	PROPELLANT REQUIREMENTS
520.83-5	FOOD REQUIREMENTS
520.86-1	ILLUMINATION/TIME FOR LM INSPECTION
520.86-2	OPTICAL TRACKING OF LM
520.86-3	VISUAL PHENOMENA WHEN VIEWING LM
520.86-4	LUNAR SURFACE OPTICAL WASHOUT
P20.91-1	LANDMARK TRACKING ERROR UNCERTAINTIES
P20.91-2	COORDINATE SIGHTINGS AND MANEUVERS
P20.91-3	PROPELLANT AND TIME FOR LANDMARK TRACKING
P20.91-4	EQUIPMENT FOR LANDMARK TRACKING
P20.91-5	LOW SUN ANGLE LANDMARK TRACKING
520.95-1	GNCS AND SPS/RCS PERFORMANCE FOR MCC
520.117-1	PREPARATION AND EXECUTION OF LOI
520.117-2	PROCEDURES AND TIMELINE FOR LOI
P20.121-1	IMPROVE LUNAR GRAVITY MODEL
P20.121-2	EQUIPMENT FOR LANDMARK TRACKING
P20.121-3	PROPELLANT AND TIME FOR LANDMARK TRACKING

TABLE 4-3
CORRELATION OF TEST OBJECTIVES
WITH
MISSION PHASES AND ACTIVITIES
FOR
MISSION F

MISSION PHASE	MISSION ACTIVITY	GET	S1.39-1 STAR/LUNAR LANDMARK NAVIGATION ACCURACY	S1.39-2 OSS ADEQUACY FOR STAR/LUNAR LANDMARK NAVIGATION	S1.39-3 COORDINATE OPTICS AND MANEUVERS/IDENTIFY LMK	S1.39-4 PROPELLANT USAGE/TIME FOR NAVIGATION	S3.22-1 DELETED	S4.9-1 CSM HGA REFLECTIVITY REGION - DOCKED	S7.26-1 TC SYSTEM - TRANSLUNAR AND TRANSEARTH	S7.26-2 TC SYSTEM - LUNAR ORBIT	P11.15-1 PGNCS/DPS HIGH THRUST BURN	P11.15-2 PGNCS/DPS DESCENT ORBIT INSERTION	S11.17-1 LM PIPA BIAS	S11.17-2 LM IMU DRIFT RATE	S11.17-3 LM PGNCS ERRORS	S12.6-1 AGS/PGNCS GYRO AND ACCELEROMETER DATA	S12.8-1 AGS/CES AUTO HOLD—MINIMUM DEADBAND	S12.8-2 AGS/CES AUTO HOLD - MAXIMUM DEADBAND	S12.8-3 DELETED	S12.8-4 DELETED	S12.8-5 AGS/CES MAN ATTITUDE - PULSE MODE	S12.8-6 AGS/CES MAN ATTITUDE - PROPORTIONAL RATE
	RENDEZVOUS RADAR TESTS	102:05																				
	INSERTION & RENDEZVOUS	102/106															X	X			X	X
	LM SENSOR BIASES & COMM	106:30											X			X						
	TELECOMMUNICATIONS	106:55																				
	APS BURN TO DEPLETION	108:39													X							
	LUNAR LANDMARK TRACKING	121:15																				
	LUNAR LANDMARK TRACKING	123:18																				
	LUNAR LANDMARK TRACKING	125:15																				
	LUNAR LANDMARK TRACKING	127:15																				
TRANS EARTH COAST	PASSIVE THERMAL CONTROL	138:40							X													
	MIDCOURSE NAVIGATION	151:00	X	X	X	X																
	MIDCOURSE CORRECTION #5	152:20																				
	PASSIVE THERMAL CONTROL	165:30							X													
	MIDCOURSE CORRECTION #6	176:50																				
	MIDCOURSE CORRECTION #7	188:50																				

MISSION PHASE	MISSION ACTIVITY	GET	S12.8-7 AGS/CES MAN TRANSLATION - THC	S12.8-8 PROPELLANT USAGE	S12.9-1 AGS/APS BURN - RANGE OF INERTIAS	S12.9-2 DELETED	S12.9-3 RCS PROPELLANT USAGE	S12.10-1 AGS CONTROLLED CFP RENDEZVOUS	S12.10-2 AGS/CES - RCS ΔV MANEUVER	S13.13-1 APS PERFORMANCE	S13.13-2 APS PROPELLANT DEPLETION	S13.14-1 SUPERCRITICAL HELIUM PRESSURE PROFILE	P16.10-1 LM S-BAND STEERABLE ANTENNA - LUNAR DISTANCE	P16.10-2 STEERABLE ANTENNA PATTERN	P16.10-3 STEERABLE ANTENNA PROCEDURES	S16.12-1 LM OMNI-ANTENNAS LUNAR DISTANCE	P16.14-1 LANDING RADAR LOCK-ON	P16.14-2 SPURIOUS SIGNAL LOCK-ON	S16.15-1 MAINTAIN LOCK AT MAXIMUM RANGE	S16.15-2 RANGE DATA ACCURACY	S16.15-3 RANGE RATE DATA ACCURACY	S16.15-4 TRACKING ANGLE DATA
	RENDEZVOUS RADAR TESTS	102:05																	X	X	X	X
	INSERTION & RENDEZVOUS	102/106	X	X				X	X													
	LM SENSOR BIASES & COMM	106:30											X									
	TELECOMMUNICATIONS	106:55																				
	APS BURN TO DEPLETION	108:39			X		X			X	X											
	LUNAR LANDMARK TRACKING	121:15																				
	LUNAR LANDMARK TRACKING	123:18																				
	LUNAR LANDMARK TRACKING	125:15																				
	LUNAR LANDMARK TRACKING	127:15																				
TRANS EARTH COAST	PASSIVE THERMAL CONTROL	138:40																				
	MIDCOURSE NAVIGATION	151:00																				
	MIDCOURSE CORRECTION #5	152:20																				
	PASSIVE THERMAL CONTROL	165:30																				
	MIDCOURSE CORRECTION #6	176:50																				
	MIDCOURSE CORRECTION #7	188:50																				

MISSION PHASE	MISSION ACTIVITY	GET	S16.15-5 LM -X RCS PLUME EFFECT ON RR	S16.17-1 LM/MSFN VIA S-BAND, LM/CSM VIA VHF, CSM/MSFN VIA S-BAND	S16.17-2 LM/MSFN/CSM S-BAND CONFERENCE, MSFN RELAY	S16.17-3 LM/CSM VIA VHF, CSM/MSFN VIA S-BAND, CSM RELAY	S16.17-4 LM VOICE AND LBR TO CSM - CSM DUMP	S16.17-5 LM/CSM VIA VHF, LM/MSFN VIA S-BAND, LM RELAY	S20.46-1 TRANS/DOCK/EJECTION DEMONSTRATION	S20.46-2 TRANS/DOCK/EJECTION PROCEDURES AND TIME	P20.66-1 PRE-LOI THROUGH DOI TIMELINE	P20.66-2 LUNAR ORBIT MISSION PROCEDURES	S20.77-1 ACCURACY OF VHF RANGING DURING RENDEZVOUS	P20.78-1 LM RENDEZVOUS DEMONSTRATION	P20.78-2 LM RENDEZVOUS PROCEDURES	S20.79-1 PTC-DOCKED-ROLL AT 0.1 DEG/SEC	S20.79-2 PTC-DOCKED-ROLL AT 0.3 DEG/SEC	S20.79-3 PTC-CSM-ROLL AT 0.1 DEG/SEC	S20.79-4 PTC-CSM-ROLL AT 0.3 DEG/SEC	S20.80-1 GROUND SUPPORT LUNAR DISTANCE	S20.82-1 GROUND MONITOR OF PGNCS/AGS	S20.82-2 CREW MONITOR OF PGNCS/AGS
	RENDEZVOUS RADAR TESTS	102:05	X																			
	INSERTION & RENDEZVOUS	102/106											X	X	X						X	X
	LM SENSOR BIASES & COMM	106:30																				
	TELECOMMUNICATIONS	106:55				X																
	APS BURN TO DEPLETION	108:39																				
	LUNAR LANDMARK TRACKING	121:15																				
	LUNAR LANDMARK TRACKING	123:18																				
	LUNAR LANDMARK TRACKING	125:15																				
	LUNAR LANDMARK TRACKING	127:15																				
TRANS EARTH COAST	PASSIVE THERMAL CONTROL	138:40																				
	MIDCOURSE NAVIGATION	151:00																				
	MIDCOURSE CORRECTION #5	152:20																				
	PASSIVE THERMAL CONTROL	165:30																	X			
	MIDCOURSE CORRECTION #6	176:50																				
	MIDCOURSE CORRECTION #7	188:50																				

MISSION PHASE	MISSION ACTIVITY	GET	S20.83-1 ELECTRICAL LOADS	S20.83-2 WATER AND OXYGEN REQUIREMENTS	S20.83-3 LIOH REQUIREMENTS	S20.83-4 PROPELLANT REQUIREMENTS	S20.83-5 FOOD REQUIREMENTS	S20.86-1 ILLUMINATION/TIME FOR LM INSPECTION	S20.86-2 OPTICAL TRACKING OF LM	S20.86-3 VISUAL PHENOMENA WHEN VIEWING LM	S20.86-4 LUNAR SURFACE OPTICAL WASHOUT	P20.91-1 LANDMARK TRACKING ERROR UNCERTAINTIES	P20.91-2 COORDINATE SIGHTINGS AND MANEUVERS	P20.91-3 PROPELLANT AND TIME FOR LANDMARK TRACKING	P20.91-4 EQUIPMENT FOR LANDMARK TRACKING	P20.91-5 LOW SUN ANGLE LANDMARK TRACKING	S20.95-1 GNCS AND SPS/RCS PERFORMANCE FOR MCC	S20.117-1 PREPARATION AND EXECUTION OF LOI	S20.117-2 PROCEDURES AND TIMELINE FOR LOI	P20.121-1 IMPROVE LUNAR GRAVITY MODEL	P20.121-2 EQUIPMENT FOR LANDMARK TRACKING	P20.121-3 PROPELLANT AND TIME FOR LANDMARK TRACKING
	RENDEZVOUS RADAR TESTS	102:05																				
	INSERTION & RENDEZVOUS	102/106							X	X												
	LM SENSOR BIASES & COMM	106:30																				
	TELECOMMUNICATIONS	106:55																				
	APS BURN TO DEPLETION	108:39																				
	LUNAR LANDMARK TRACKING	121:15																		X	X	X
	LUNAR LANDMARK TRACKING	123:18																		X	X	X
	LUNAR LANDMARK TRACKING	125:15																		X	X	X
	LUNAR LANDMARK TRACKING	127:15																		X	X	X
TRANS EARTH COAST	PASSIVE THERMAL CONTROL	138:40																				
	MIDCOURSE NAVIGATION	151:00																				
	MIDCOURSE CORRECTION #5	152:20															X					
	PASSIVE THERMAL CONTROL	165:30																				
	MIDCOURSE CORRECTION #6	176:50															X					
	MIDCOURSE CORRECTION #7	188:50															X					

REMARKS:

1) LM IMU back-to-back alignments will not be conducted per FTO S11.17-2 requirement. The station keeping time after rendezvous would have to be extended to implement the subject DTO requirement.

2) Some of the AGS controlled RCS maneuvers required by DTO S12.8 will be accomplished during the normal rendezvous activities and may be conducted without the benefit of HBR TM as required.

3) LR temp data per DTO P16.14 will not be recorded after the Phasing Burn. The Phasing Burn is done within MSFN line-of-sight and TM should be available.

4) Required data will be voiced to the ground rather than recorded by the crew during the communications tests per DTO's 16.10, 16.12 and 16.17

5) DTO 16.10 and 16.12 will be partially implemented.

TRANSPOSITION/DOCKING/EJECTION

A. TEST OBJECTIVES

S20.46-1 Transposition/Docking/Ejection Demonstration
S20.46-2 Transposition/Docking/Ejection Procedures and Timeline

B. TEST REQUIREMENTS

1. Accomplish transposition, docking and LM ejection. [20.46]

2. Following S-IVB TLI burn and in sunlight. [20.46]

3. S-IVB attitude and maximum limit cycle rates during docking and ejection will be in accordance with the Apollo Inter-Center ICD 80M90505, "Flight Mechanics Panel Interface Control Document for the Apollo-Saturn 505". Paragraph TBD. [20.46]

4. S-IVB in inertial hold. [20.46]

5. Lighting constraints as specified in MSC/MSFC Trajectory Document No. TBD, "Joint Operational Mission Constraints" for Mission F will be met. [20.46]

6. Photograph view through right hand rendezvous window from end of transposition until initial probe and drogue capture latching using 16 mm sequence camera with 18 mm lens and color film at 6 frames per second. [20.46]

7. MSFN coverage required for entire test. [20.46]

C. TEST PROCEDURES/CHECKLISTS

1. CSM-AOH "LM Interface"

2. FCAC "Separation Through Withdrawal", L9-1 through 3

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs

   a. Comment on CSM handling characteristics during transposition and docking. [20.46] (M)

   b. Comment on adequacy of docking alignment target on the LM. [20.46] (M)

   c. Comment on vehicle dynamics of CSM/LM during ejection from the S-IVB. [20.46] (M)

   d. Comment on adequacy of attitude control and stability characteristics of S-IVB prior to, during and immediately after the separation and ejection of the LM from the S-IVB/SLA. [20.46] (M)

e. Comment on any adverse effects of the SM RCS plumes on astronaut visibility or on S-IVB stability.[20.46] (HD)

f. Comment on adequacy of sunlight and CSM docking lights. [20.46] (HD)

g. Comment on adequacy of contact with ground operational facilities. [20.46] (M)

h. Log

(1) GET when transposition initiated.[20.46] (M)

(2) Radial, angular and rotational alignment at time of initial probe and drogue contact.[20.46] (M)

(3) Axial, radial and angular relative velocities at time of initial probe and drogue contact. [20.46] (M)

(4) After docking, the included angle between the CM and LM Z-X planes, measured about the CM X axis.[20.46] (M)

(5) GET when CSM/LM ejection was completed. [20.46] (M)

(6) Separation rate during ejection. [20.46] (HD)

2. Photographs

a. Photos through right hand rendezvous window from end of CSM transposition until initial probe and drogue capture latching. [20.46] (HD)

b. Log film mag, footage in Photographic Log. [20.46] (HD)

3. Ground Support

a. CSM TM HBR.[20.46] (HD)

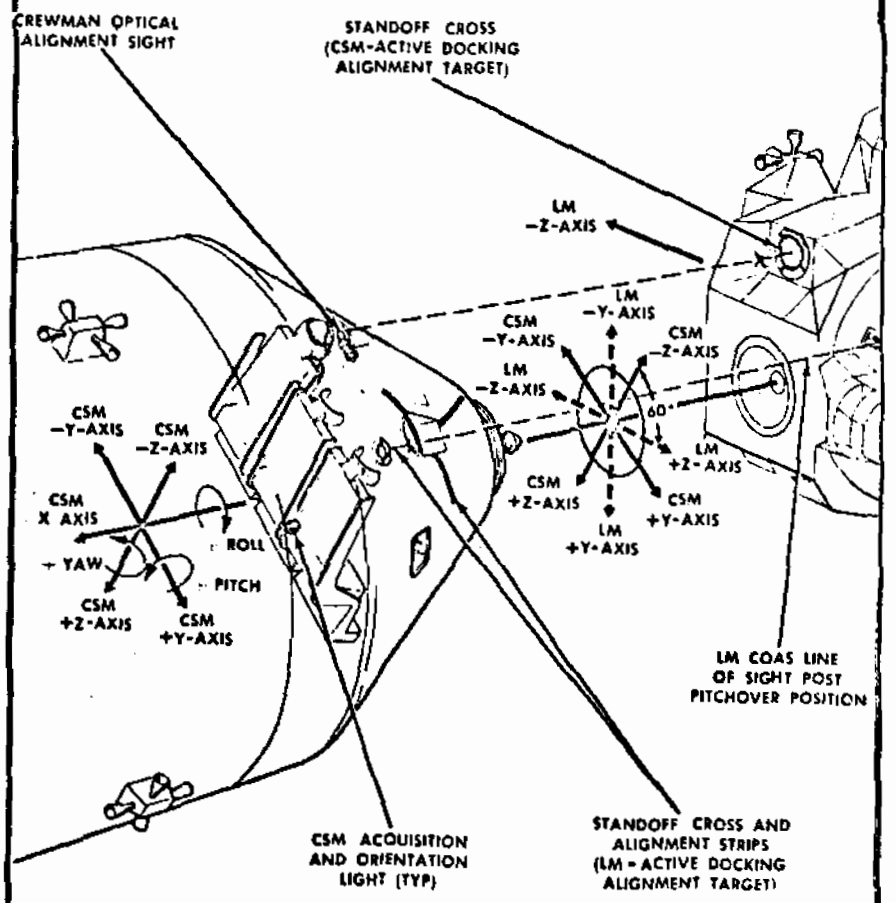
b. CSM TM LBR.[20.46] (M)

c. LVDC TM Data.[20.46] (M)

d. Flight Director will assess ground operational support and determine its adequacy. [20.46] (M)

DOCKING VELOCITY AND ALIGNMENT

S20.46 Transposition/Docking/LM Ejection



RECORD:

GET Transposition Initiated			
Initial Probe/Drogue Contact			

Alignment		Relative Velocity	
(Ins.) Radial		(FPS) Axial	
(Deg.) Angular		(FPS) Radial	
(Deg.) Rotational		°/Sec.Angular	

Final ∠ Between CSM -Z and LM +Z Axis			Deg.
GET CSM/LM Ejection Completed			

FIGURE 4-1 DOCKING VELOCITY AND ALIGNMENT

PASSIVE THERMAL CONTROL MODES

A. TEST OBJECTIVES

S7.26-1 TC System for Translunar and Transearth Flight
S20.79-1 PTC-Docked-Roll 0.1 DEG/SEC
S20.79-2 PTC-Docked-Roll 0.3 DEG/SEC
S20.79-3 PTC-CSM-Roll 0.1 DEG/SEC
S20.79-4 PTC-CSM-Roll 0.3 DEG/SEC

B. TEST REQUIREMENTS

1. At least four uninterrupted hours for each PTC Mode. [20.79-1,2,3,4]

2. MSFN Coverage. [7.26, 20.79-1,2,3,4]

3. Roll Modes - Orient the S/C to place the X axis perpendicular to the LOS to the sun within ±5 degrees attitude deadband. Roll about the X axis at the rate and within the attitude deadband specified below:

   a. 0.1 DEG/SEC roll, pitch & yaw D/B $\pm 20^{o}$

      (1) Translunar - Docked CSM/LM [20.79-1]

      (2) Transearth - CSM only [20.79-3]

   b. 0.3 DEG/SEC roll, pitch & yaw D/B $\pm 30^{o}$

      (1) Translunar - Docked CSM/LM [20.79-2]

      (2) Transearth - CSM only [20.79-3]

4. Roll jets should be disabled when the required roll rate is established & the computer procedure for PTC should be terminated before re-enabling the roll jets. [20.79-1,2,3,4]

C. TEST PROCEDURES/CHECKLISTS

1. CSM AOH 4.10.2.9 Passive Thermal Control

2. FCAC, "Passive Thermal Control", G2-95

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs

   a. Voice record of sequence of events. [20.79-1,2,3,4] (M)

   b. Comment on ease of operation and adequacy of procedures to accomplish required communications. [20.79] (M)

c. Comment on preferred technique for initiating and maintaining PTC. [20.79-1, 2, 3, 4] (M)

2. Ground Support

a. CSM TM HBR.[7.26, 20.79-1, 2, 3, 4] (M)

b. CSM TM LBR. [7.26, 20.79-1, 2, 3, 4] (M)

c. BET. [20.79-1, 2, 3, 4] (M)

MIDCOURSE NAVIGATION

A. TEST OBJECTIVES

S1.39-1 Star/Lunar Landmark Navigation Accuracy
S1.39-2 OSS Adequacy for Star/Lunar Landmark Navigation
S1.39-3 Crew Ability to Coordinate Optics and Vehicle Maneuvers and Identify Lunar Landmarks
S1.39-4 RCS Propellant and Time Required - Star/Lunar Landmark Navigation

B. TEST REQUIREMENTS

1. The trunnion calibation routine of P23 to be used if more than about 30 minutes has elapsed since the previous P23 trunnion calibration. [1.39]

2. The onboard state vector to be updated, utilizing the navigation sighting data, after each set of sightings. [1.39]

3. MSFN coverage. [1.39]

4. Transearth, less than 30,000 NM from moon center, five Star/Lunar Landmark sightings. [1.39]

5. RCS consumption data required during one tracking set. [1.39]

NOTE: The above sightings are defined as at least three marks on a common Star/LDMK combination.

C. TEST PROCEDURES/CHECKLISTS

1. CSM-AOH "Cislunar Navigation (P23)"

2. FCAC "P23 - Cislunar Midcourse Navigation Measurement", G2-26 thru 31

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs

   a. Comments on ease of handling optics and spacecraft. [1.39] (M)

   b. Comments on ability to identify lunar landmarks. [1.39] (M)

   c. Log star, LMK/horizon and GET. [1.39] (M)

2. Ground Support

   a. CSM TM HBR. [1.39] (M)

   b. CSM TM LBR. [1.39] (M)

   c. BET. [1.39] (M)

MIDCOURSE CORRECTIONS

A. TEST OBJECTIVES

S20.95-1 GNCS, SPS & RCS Performance on Midcourse Corrections

B. TEST REQUIREMENTS

1. Perform translunar MCC with SPS or RCS while docked. [20.95]

2. MSFN coverage. [20.95]

C. TEST PROCEDURES/CHECKLISTS

1. CSM - AOH "CSM/CMC Update P27"

2. CSM - AOH "G&N/SPS Orbit Change Thrusting (P40)" or

3. CSM - AOH "G&N SM RCS Orbit Change Thrusting (P41)"

4. FCAC "P27 CMC Update", G2-32 and 33

5. FCAC "P40 SPS Thrust", G2-44 thru 50

6. FCAC "P41 RCS Thrust", G2-51 thru 54

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs

   a. Comments on adequacy of procedures to prepare for and accomplish Midcourse Corrections. [20.95] (M)

2. Ground Support

   a. CSM TM HBR. [20.95] (M)

   b. CSM TM LBR. [20.95] (M)

   c. BET. [20.95] (M)

LUNAR ORBIT INSERTION

A. TEST OBJECTIVES

S20.117-1 Crew/Spacecraft/MSFN Preparation and Execution of LOI Maneuver
S20.117-2 Procedures and Timeline Adequacy for LOI Maneuver

B. TEST REQUIREMENTS

1. SPS operation to insert the docked CSM/LM into lunar orbit in two stages as follows; [20.117]

   a. The first burn of approximately 352 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. DSE recording 40 seconds before, during and 2 minutes after both burns. [20.117]

3. IMU realignment performed as soon prior to LOI-1 as practicable. [20.117]

4. MSFN tracking prior to LOS before LOI. [20.117]

5. MSFN record dumped DSE data at AOS after LOI. [20.117]

C. TEST PROCEDURES/CHECKLISTS

1. CSM - AOH "G&N SPS Orbit Change Thrusting (P40)"

2. FCAC "SPS Thrusting (P40)", G2-44 thru 50

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs

   a. Procedural and/or timeline difficulties or inadequacies. [20.117] (M)

   b. Feasibility of monitoring abort parameters on FDAI's. [20.117] (M)

   c. Adequacy of contact with ground operational support facilities. [20.117] (HD)

2. Ground Support

   a. CSM TM LBR from DSE after AOS. [20.117] (M)

b. CSM TM HBR from DSE after AOS. [20.117] (HD)

c. BET before LOS and after AOS. [20.117] (M)

d. Flight Director's reports of procedural and/or timeline difficulties or inadequacies. [20.117] (M)

LM SENSOR BIASES

A. TEST OBJECTIVES

S11.17-1 LM PGNCS PIPA Bias During Coasting Flight
S12.6-1 AGS Gyro Bias and Accelerometer Data and PGNCS Gyro Data During Drifting Flight

B. TEST REQUIREMENTS

1. MSFN collection of LM PGNCS PIPA bias data at least three times during the mission using uninterrupted TM for at least five minute intervals as follows: [11.17]

   a. During LM systems activation and checkout.

   b. During LM activation prior to rendezvous.

   c. After LM rendezvous.

2. IMU and LGC on [11.17, RCS off. [11.17, 12.6]

3. MSFN collection of AGS gyro bias and accelerometer data and PGNCS gyro data during drifting flight using uninterrupted TM for at least five minutes. [12.6]

4. MSFN coverage. [11.17, 12.6]

C. DATA REQUIREMENTS

1. LM TM HBR. [11.17, 12.6] (M)

LM IMU ALIGNMENT

A. TEST OBJECTIVES

S11.17-2 PGNCS IRIG Drift Rates During Coasting Flight

B. TEST REQUIREMENTS

1. One set of back-to-back LM IMU alignments during coasting flight. [11.17] N.I.

2. At least one hour between IMU alignments with no intervening thrust maneuvers. [11.17] N.I.

3. PGNCS powered up between alignments in a set. [11.17]

4. MSFN coverage. [11.17]

C. TEST PROCEDURES/CHECKLISTS

1. LM-AOH "IMU Orientation Determination Program (P51)" or

2. LM AOH "IMU Realign (P52)"

3. FCAC "P51 - IMU Orientation" or

4. FCAC "P52 - IMU Realign"

D. DATA REQUIREMENTS

LM TM HBR following the second alignment of each set of alignments. [11.17] (M) N.I.

LUNAR LANDMARK TRACKING

A. TEST OBJECTIVES

P20.91-1 Error Uncertainties - LDMK Tracking
P20.91-2 Crew Coordination of Sighting and Maneuvers
P20.91-3 RCS Propellant and Time Required Docked
P20.91-4 Adequacy of Equipment for LDMK Tracking Docked
P20.91-5 Low Sun Angle LDMK Tracking Evaluation
P20.121-1 Improve Lunar Gravity Model
P20.121-2 Adequacy of Equipment for LDMK Tracking Undocked
P20.121-3 RCS Propellant and Time Required Undocked

B. TEST REQUIREMENTS

1. IMU must be realigned on the dark side preceding each tracking pass. [20.91, 20.121]

2. MSFN coverage is reacquired on each earth side pass. [20.91, 20.121]

3. Time between marks should be a minimum of 25 seconds [20.91, 20.121]

4. First mark with S/C 45 to 55^{o} above local horizontal. [20.91, 20.121]

5. MSFN will support the tracking schedule with updates if necessary. If HBR TM data cannot be recorded in real time by MSFN, the data will be recorded on the DSE and dumped at the first opportunity during the same revolution. [20.91, 20.121]

6. With CSM/LM docked, track each of the following one time:

   a. One preselected landmark on the orbit preceding undocking. [20.91]

   b. Surveyor spacecraft. [20.91]

   c. A landmark at a sun elevation approximately 3 degrees. [20.91]

7. With the CSM/LM undocked one day after rendezvous, track each of the following three landmarks on each of four orbits:

   a. One landmark 27 degrees after the morning terminator. [20.121]

   b. The second landmark 57 degrees after the morning terminator. [20.121]

   c. The third landmark 8 degrees before the evening terminator. [20.121]

Photograph the above landmark through the S/C window using the highest resolution camera/lens combination. [20.121]

C. TEST PROCEDURES/CHECKLISTS

1. CSM-AOH "Orbital Navigation (P22)"

2. FCAC "P22 Orbital Navigation," G2-18 thru 24

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs

a. Comments on ease of handling optics and spacecraft.[20.91, 20.121] (M)

b. Comments on minimum sun elevation angle for lunar LDMK tracking. [20.91] (M)

c. Comments on the lunar landmark recognition on each successive revolution. [20.91, 20.121] (M)

d. "Landmark Tracking Log" (Flight Plan) [20.91, 20.121] (M)

e. Photographs of Landmarks. [20.121] (HD)

2. Ground Support

a. BET. [20.91] (M)

b. CSM TM HBR from DSE after AOS. [20.91] (M) [20.121] (HD)

c. CSM TM LBR from DSE after AOS. [20.91, 20.121] (M)

LM INSPECTION BY CSM

A. TEST OBJECTIVES

S20.86-1 Illumination and Time Required for CSM Inspection of LM in Lunar Orbit
S20.86-3 Visual Phenomena Observed from CSM During LM Inspection and LM Descent and Ascent

B. TEST REQUIREMENTS

1. Undocked. [20.86]

2. CSM pilot visually inspects LM in lunar orbit prior to DOI. [20.86]

C. DATA REQUIREMENTS

1. CSM pilot comment on illumination of LM and any unexpected visual phenomena during LM inspection. [20.86] (M)

2. CSM pilot comment on adequacy of time allotted for LM inspection. [20.86] (HD)

S20.86 LM INSPECTION PROCEDURE

REQUIRED

LANDING SITE REFSMMAT

DOCKED ATTITUDE:

CSM R 180.0°, P 14.3°, Y 0.0°

LM R 120.0°, P 204.0°, Y 0.0°

PROCEDURE

CMP Maintain inertial attitude hold in low rate, wide deadband.

CDR When clear of CSM by 40 to 50 feet, null separation velocity and maintain station keeping distance, inertial hold.

Yaw right 120° and pitch + 90°.

For inspection, yaw 360° at 2 deg/sec clockwise.

LMP Inspect the CM probe extension when in view.

CMP Inspect the following LM components through the CDR's window:

Landing Gear
Drogue
Descent Engine Nozzle
S-Band Antenna
Thermal Shields & Surfaces

DESCENT ORBIT INSERTION

A. TEST OBJECTIVES

P11.15-2	Capability of PGNCS to Execute the DOI Maneuvers
S13.14-1	Supercritical Helium Pressure Profile
S16.14-2	No Velocity/Altimeter Frequency Tracker Lock On to Spurious Doppler Signals
S20.82-1	Ground Monitoring of LM PGNCS/AGS
S20.82-2	Crew Monitoring of LM PGNCS/AGS
S20.86-2	Optical Tracking of LM by CSM Pilot During LM Descent to 50,000 Feet
S20.86-3	Unusual Visual Phenomena Observed by the CSM Pilot During LM Descent to 50,000 Feet

B. TEST REQUIREMENTS

1. DOI, including orientation, to be performed under PGNCS control with DPS. [11.15]

2. Burn profile to be the same as that planned for the LLM. (HD) [11.15]

3. CSM pilot to track LM with the SXT. [20.86]

4. DSE on HBR while taking marks and processing data. [20.86]

5. VHF ranging required during tracking. [20.82, 20.86]

6. LR to be operated during DOI/DPS burn with antenna in position 1. [16.14]

7. LM crew displays, procedures and computational aids shall be used in monitoring LM PGNCS/AGS performance to determine if guidance should be transferred at any point during the burn. [20.82]

C. TEST PROCEDURES/CHECKLISTS

1. LM AOH paragraph 4.10.1, "DPS Thrust Program (P40) with AGS Follow-Up/ In Control"

2. CSM AOH paragraph 4.6.2, "CSM Rendezvous Navigation", steps 1 through 7

3. FCAC, "P20 Rendezvous Navigation", G2-15

4. LM AOH paragraph 4.6.3.2, "Landing Radar Power Up"

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs

   a. Confirm that false LR lock did not occur. [16.14] (HD)

b. Comments on adequacy of procedures necessary to accomplish the DOI. [11.15] (M)

c. Comments on PGNCS performance during DOI. [11.15] (HD)

d. CSM pilot comments on LM tracking with SXT during LM descent including GET of loss of view. [20.86] (HD)

e. Comments on any significant unexpected visual phenomena. [20.86] (M)

f. Record LR antenna temperature at end of DPS burn and two minutes later. [16.14] (HD)

g. Comments on adequacy of LM displays, onboard procedures and onboard charts used to perform guidance monitor functions during lunar orbit operations. [20.82] (M)

h. Comments on adequacy and clarity of MSFN data concerning PGNCS/AGS residuals during lunar orbit operations as furnished by voice link to the LM. [20.82] (M)

i. Comments on adequacy and clarity of GNCS and VHF derived range rate data as furnished by voice link from the CM to the LM. [20.82] (M)

2. Ground Support

a. LM TM LBR [11.15, 13.4-1, 16.14] (M), recorded on DSE

b. BET LM [11.15, 20.86] (M); BET CSM/LM [20.82] (HD); [20.86] (M)

c. Flight Director's reports of timeline and/or procedural difficulties. (M)

d. Real time S-band ranging data from LM. [20.82, 20.86] (M)

e. Real time S-band ranging data from CSM. [20.82, 20.86] (HD)

f. MSFN doppler data during powered phases. [20.82, 20.86] (M)

g. CSM TM HBR. [20.86] (M)

NEAR LUNAR SURFACE ACTIVITY

A. TEST OBJECTIVES

P16.10-3 Evaluate Steerable Antenna During Simulated "G" Descent Maneuvers
P16.14-1 Lock on for Landing Radar Beams and Generation of Velocity/Altitude Data
S20.86-4 Extent/Severity of Washout When Viewing the Lunar Surface from the LM

B. TEST REQUIREMENTS

1. Landing radar to be operated during the 200 sec. period prior to and during the 200 sec. period after pericynthion.

   a. LR antenna in position 2. [16.14]

   b. Constant pitch rotation rate of .052 deg/sec. (Lunar Orb. Rate). [16.14]

   c. LM +X axis vertical, +Z axis forward, 0 degrees yaw. [16.14]

   d. Roll angle 0 ($\pm$1) degree. [16.14]

   e. Altitude above lunar surface not to exceed 10 NM. [16.14]

   f. Steerable antenna operational procedures to be exercised during 180° roll face up and 90° pitch up to local vertical. [16.10]

2. Commander to observe lunar surface near point of closest approach. [20.86]

C. TEST PROCEDURES/CHECKLISTS

1. LM AOH paragraph 4.6.3.2, "Landing Radar Power-Up"

2. LM AOH paragraph 4.6.3.4, "Landing Radar Checkout"

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs

   a. Commander comments on extent and severity of observed surface washout. [20.86] (M)

   b. LPD coordinates defining the area of loss of useful detail and time of observation. [20.86] (M)

   c. Data TBD for the steerable antenna test. [16.10] (M)

2. Ground Support

   a. BET [16.14] (M)

   b. LM TM HBR [16.14] (M)

   c. LM TM LBR [16.14] (M)

   d. MSFN records of received S-band signal strength. [16.10] (M)

NEAR LUNAR SURFACE ACTIVITY

P16.10 LM/MSFN Comm Lunar Distance
P16.14 Landing Radar
S20.86 Lunar Surface Washout

REQUIRED

LR Powered Up
Ordeal - Orb Rate
Steerable Antenna - MSFN Acquisition
To - Pericynthion
Antenna Position - 2

PROCEDURE

To -900 Sec. Acquire MSFN (Steerable Antenna)
Yaw Right 180° (Face Down to Face Up)
Pitch Up to Within 10° of Local Vertical
Start Orbit Rate ≈ .052 Deg/Sec Pitch Down
To -400 Sec, Checkout LR
To -200 Sec, Pitch Down 10° To Local Vertical
Observe Lunar Surface Through Front Window
Use LPD Markings to Designate Washout Area
Record Washout Area Coordinates and Time Observed

			TO				DEG.				HRS.
			TO				AHEAD	X			MIN.
							BEHIND	X			SEC.

To +200 Sec, Pitch Down 90° (Face Down)
Observe Landing Site (Photographs HD)
Terminate LR Test
Terminate Orbit Rate
To +600 Sec, Mnvr to Phasing Burn Attitude

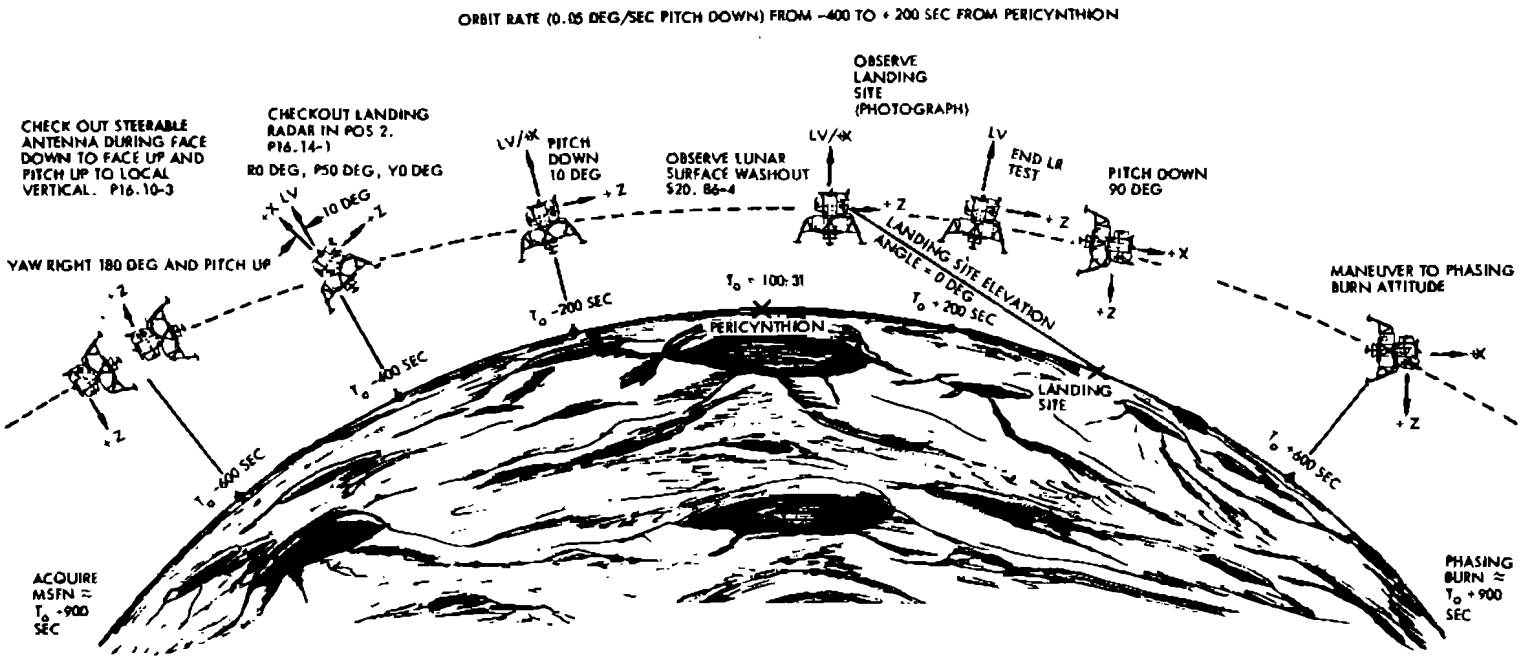


FIGURE 4-2 NEAR LUNAR SURFACE ACTIVITY

PHASING

A. TEST OBJECTIVES

P11.15-1 Capability of the PGNCS to Execute a DPS High Thrust Level Undocked Maneuver
S11.17-3 Overall PGNCS Errors During Thrusting Maneuvers

S12.6-1 AGS Overall Inertial Sensor Performance During an Undocked DPS Burn at Fixed Throttle
S13.14-1 Supercritical Helium Pressure Profile
S16.14-2 No Velocity/Altimeter Frequency Tracker Lock On to Spurious Doppler Signals
S20.82-1 Ground Monitoring of LM PGNCS/AGS
S20.82-2 Crew Monitoring of LM PGNCS/AGS

B. TEST REQUIREMENTS

1. At least 15 seconds of phasing DPS burn to be performed at a thrust level of 40 percent or higher, [11.15] with fixed throttle. [12.6].

2. AGS to be aligned to PGNCS prior to DPS burn. [12.6]

3. AGS sensor performance data and LM IMU performance data to be acquired during the DPS burn at fixed throttle point. [11.17, 12.6]

4. LR to be operated in position 2 during the DPS burn. [16.14]

5. MCC data, displays, procedures and computations shall be utilized in support monitoring of LM PGNCS/AGS performance to permit recommending guidance transfer if necessary in real time. [20.82]

6. LM crew displays, procedures and computational aids shall be used in monitoring LM PGNCS/AGS performance to determine if guidance should be transferred at any point during the burn. [20.82]

7. MSFN coverage. [11.17, 11.15]

C. TEST PROCEDURES/CHECKLISTS

1. LM AOH paragraph 4.10.1, "DPS Thrust Program (P40) With AGS Follow-Up/ In Control"

2. LM AOH paragraph 4.9.2.1, "PGNCS/AGS Align"

3. LM AOH paragraph 4.6.3.2, "Landing Radar Power Up"

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs

   a. Comments on adequacy of procedures necessary to accomplish the high thrust maneuver. [11.15] (M)

   b. Comments on PGNCS performance during the high thrust maneuver and on control response during start and throttle up periods. [11.15] (HD)

   c. Confirm that false LR lock did not occur. [16.14] (HD)

   d. Record LR antenna temperature at end of DPS burn and two minutes later. [16.14] (HD)

   e. Comments on adequacy of LM displays, onboard procedures and onboard charts used to perform guidance monitor functions during lunar orbit operations. [20.82] (M)

   f. Comments on adequacy and clarity of MSFN data concerning PGNCS/AGS residuals during lunar orbit operations as furnished by voice link to the LM. [20.82] (M)

   g. Comments on adequacy and clarity of GNCS and VHF derived range rate data as furnished by voice link from the CM to the LM. [20.82] (M)

2. Ground Support

   a. MSFN tracking 60 seconds prior to, during and 60 seconds after the high thrust maneuver. [11.15] (M)

   b. BET LM [11.15] (M); BET CSM/LM [20.82] (HD)

   c. LM TM HBR [11.17, 11.15, 12.6, 16.14, 20.82] (M)

   d. LM TM LBR [13.14-1, 16.14, 20.82] (M)

   e. Flight Director reports of timeline/procedural difficulties. (M)

   f. Real time S-band ranging data from LM. [20.82] (M)

   g. Real time S-band ranging data from CSM. [20.82] (HD)

   h. MSFN doppler data during powered phases. [20.82] (M)

   i. AGS/PGNCS downlink data on uninterrupted TM for at least 5 minutes during drifting flight prior to phasing with astronaut motions minimal. [12.6] (M)

INSERTION AND RENDEZVOUS

A. TEST OBJECTIVES

S12.10-1	Capability of AGS to Perform Guidance Functions Required to Accomplish a CFP Rendezvous
S12.10-2	AGS/CES Performance During an RCS ΔV Maneuver
S16.15-1	RR Capability of Monitoring Lock Near Maximum Range
S16.15-2	Accuracy of RR Range Data Obtained Near Maximum Range
S16.15-3	Accuracy of RR Range Rate Data Obtained Near Maximum Range
S16.15-4	RR Tracking Angle Data Near Maximum Range
S16.15-5	LM -X RCS Plume Effects On RR at Maximum Range
S20.77-1	Accuracy of VHF Ranging
S20.78-1	Demonstrate Nominal LM Rendezvous in Lunar Orbit
S20.78-2	Update Simulations Data for Nominal LLM Rendezvous
S20.82-1	Ground Monitoring of LM PGNCS/AGS
S20.82-2	Crew Monitoring of LM PGNCS/AGS
S20.86-2	Optical Tracking of LM by CSM Pilot During LM Ascent From 50,000 Feet
S20.86-3	Unusual Visual Phenomena Observed by CSM Pilot During LM Ascent From 50,000 Feet

B. TEST REQUIREMENTS

1. AGS to be aligned to PGNCS per "PGNCS/AGS Align" prior to insertion. [12.10]

2. AGS to be updated per "AGS Initialization Routine (R47)" prior to APS insertion burn. [12.10]

3. RR to be operated as much as feasible with SC separation distance between 350 and 450 NM. [16.15]

4. LM/CSM orientation at a separation of at least 300 NM to be such that the LM RR beam will illuminate the CSM transponder beam. [16.15]

5. LM -X RCS engines 1U and 4U to be fired at least once while the RR is tracking the CSM transponder at a range of 300 to 400 NM. [16.15]

6. Solutions for all rendezvous maneuvers through TPF to be computed by PGNCS, MSFN, GNCS and AGS. [12.10]

7. All PGNCS, AGS, GNCS solutions for the CFP maneuvers will be compared to MSFN solutions prior to ΔV. [20.78] (CSI not implemented)

8. PGNCS solutions to be used for targeting all burns. [12.10, 20.78]

9. All burns except CDH under PGNCS control. [20.78]

10. CDH burn to be under AGS/CES control. [12.10]

11. AGS state vector to be updated every 3 minutes from CDH +10 minutes to TPI. [12.10]

12. Prior to TPI, AGS to be updated for the last time. [12.10]

13. AGS will not be used as a reference post TPI. [12.10]

14. MCC data, displays, procedures and computations shall be utilized in support monitoring of LM PGNCS/AGS performance to permit recommending guidance transfer if necessary in real time. [20.82]

15. LM crew displays, procedures and computational aids shall be used in monitoring LM PGNCS/AGS performance to determine if guidance should be transferred at any point during the burn. [20.82]

16. CSM pilot to track LM with SXT from insertion through Rendezvous. [20.86]

17. DSE on HBR for all burns conducted during MSFN LOS. [20.77]

18. VHF ranging required during tracking except during DPS/APS burns conducted outside the MSFN line-of-sight. [20.77, 20.82, 20.86]

C. TEST PROCEDURES/CHECKLISTS

1. LM AOH paragraph 4.9.2.1, "PGNCS/AGS Align"

2. LM AOH paragraph 4.6.1.18, "AGS Initialization Routine (R47)"

3. LM AOH paragragh 4.8.2.2, "AGS Manual Rendezvous Radar LM State Vector Update"

4. CSM AOH paragràph 4.6, "Rendezvous"

5. LM AOH paragraph 4.6.3.1, "Rendezvous Radar Power Up"

6. CSM AOH paragraph 4.7.6.9, "Rendezvous Transponder Activation and Self Test"

7. MSC Document, "LM Rendezvous Procedures F Mission"

8. FCAC, "P17 TPI Search or P77 LM TPI Search", G2-14

9. FCAC, "P20 Rendezvous Navigation", G2-15

10. FCAC,"P34 TPI Prethrust (P74 LM)", G2-38

11. FCAC, "P35 TPM Prethrust (P75 LM)", G2-39

12. FCAC, "P38 SOR Targeting (P78 LM)", G2-42

13. FCAC, "P39 Stable Orbit Mid (P79 LM)", G2-43

14. FCAC, "V83 Rndz Parameter Display #1", G2-73

15. FCAC, "V85 Rndz Parameter Display #2", G2-74

16. FCAC, "V90 Out of Plane Display", G2-75

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs

a. Comments on adequacy of AGS/CES procedures and performance during the CDH burn. [12.10] (HD)

b. Comments on ability to maintain RR lock at a range greater than 350 NM. [16.15] (HD)

c. GET ± 1 minute at any deliberate break of RR lock. [16.15] (M)

d. Min/Max transponder AGC voltage readings during LM -X RCS firings. [16.15] (HD)

e. Comments on planned and actual crew procedures used. [20.78] (M)

f. Comments on AGS & RR performance. [20.78] (M)

g. Comments on PGNCS & RR performance. [20.78] (M)

h. Comments on single crewmember LM rendezvous capability. [20.78] (M)

i. Comments on usefulness of CSM rendezvous beacon light. [20.78] (M)

j. CSM crewman comments on adequacy of rendezvous procedures using VHF ranging and optics. [20.77] (M)

k. Rendezvous targeting solution data as recorded by the CSM and LM crewman. [20.77] (M)

l. Comments on adequacy of LM displays, onboard procedures and onboard charts used to perform guidance monitor functions during lunar orbit operations. [20.82] (M)

m. Comments on adequacy and clarity of MSFN data concerning PGNCS/AGS residuals during lunar orbit operations as furnished by voice link to the LM. [20.82] (M)

n. Comments on adequacy and clarity of GNCS and VHF derived range rate data as furnished by voice link from the CM to the LM. [20.82] (M)

o. Comments on LM tracking with SXT. [20.86] (HD)

p. Comments on significant unexpected visual phenomena. [20.86] (M)

2. Ground Support

a. BET of CSM and LM [16.15, 20.77, 20.78, 20.86] (M); [12.10, 20.82] (HD)

b. MSFN tracking data prior to, during and after CDH burn. [12.10] (M)

c. Flight Director's Post Mission Report. [20.78] (M)

d. LM TM HBR [12.10, 16.15, 20.78, 20.82] (M)

e. LM TM LBR [12.10, 20.82] (M); [16.15, 20.78] (HD)

f. Real time S-band ranging data from LM. [20.82, 20.86] (M)

g. Real time S-band ranging data from CSM. [20.82, 20.86] (HD)

h. MSFN doppler data during powered phases. [20.82, 20.86] (M)

i. CSM TM LBR [12.10, 16.15, 20.78] (M); [20.82] (HD)

j. CSM TM HBR [20.86] (M)

k. MSFN-RTCC trajectory profile. [20.77] (M)

STATION KEEPING

A. TEST OBJECTIVES

S12.8-1 AGS Automatic Attitude Hold - Min. Deadband
S12.8-2 AGS Automatic Attitude Hold - Max. Deadband
S12.8-3 Deleted
S12.8-4 Deleted
S12.8-5 AGS Manual Attitude Control - Pulsed Mode
S12.8-6 AGS Manual Attitude Control - Proportional Rate
S12.8-7 AGS Manual Translation Control
S12.8-8 RCS Propellant Usage During AGS Control
P20.78-2 Update Simulations Data for Nominal LLM Rendezvous

B. TEST REQUIREMENTS

1. AGS/CES attitude hold/control and translation to be demonstrated with a staged LM. [12.8]

2. MSFN coverage required for all modes. [12.8]

3. The following modes are to be demonstrated during normal operation or as special tests.

   a. Automatic hold in minimum deadband. MSFN coverage required with HBR for 0.5 minute. It is HD that the vehicle rates exceed 1 deg/sec in all axes prior to enabling attitude hold. [12.8]

   b. Automatic hold in maximum deadband. MSFN coverage required with HBR for 5 minutes. It is HD that the vehicle rates exceed 1 deg/sec in all axes prior to enabling attitude hold. [12.8]

   c. Manual attitude control using minimum pulse mode. [12.8]

      (1) Two jets operation, pitch and roll.

      (2) Four jets operation, yaw.

   d. Manual attitude control using proportional rate command in all axes (+ and -). [12.8]

   e. Manual translation control in + and - axes using THC. [12.8]

C. TEST PROCEDURES/CHECKLISTS

1. LM AOH paragraph 4.10.5, "AGS RCS Axis-by-Axis Thrust"

2. LM AOH Paragraph 4.5.1.6 "AGS Attitude Hold/Rate Command

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs

   a. Initial body rates prior to auto attitude control. [12.8] (M)

   b. Time auto attitude hold demonstration/periods begin. [12.8] (M)

   c. Time interval of attitude error zero crossings in each axis for the min/max deadband attitude hold demonstrations. [12.8] (M)

   d. Comments on the success of controlling the S/C in each of the mannual attitude control modes. [12.8] (M)

   e. Comments on the success of manually controlling the S/C during the translation maneuver. [12.8] (M)

   f. Comments regarding any unusual torques or venting detected. [12.8] (HD)

2. Ground Support

   a. LM TM HBR [12.8] (M)

   b. LM TM LBR [12.8] (M)

   c. BET CSM/LM [20.78] (M)

AGS CONTROL AND MANEUVER CAPABILITY

S12.8 AGS/CES Attitude/Translation Control

Required:

LM Staged
TM - HBR
AGS Control

Demonstrate the Following:

a) Automatic attitude hold - Min Dbnd
Max Dbnd

b) Manual attitude control - Prop Rate
Pulse Mode

c) Manual translation control

Procedure

Guidance Control - AGS
Mode Control - Attitude Hold
Attitude Control R, P, Y - Mode Cont
Deadband - Max
ACA - Mnvr S/C to any New Attitude. Exceed 1.0 Deg/Sec. in All Axis During Maneuver
Start Attitude Hold
GET ___ ___ ___ : ___ ___
Allow 5 Min. Attitude Hold With Continuous TM Coverage
Deadband - Min
ACA - Maneuver S/C To Any New Attitude. Exceed 1°/Sec. In All Axis During Maneuver
Start Attitude Hold
GET ___ ___ ___ : ___ ___
Allow 0.5 Min. Attitude Hold With Continuous TM Coverage
Attitude Control R, P, Y - Pulse
ACA - Maneuver S/C About 3 Axis (Free Drift)
Attitude Control, R, P, Y - Mode Control
TTCA Lever - Down
TTCA - Translate S/C Along All 3 Axis In The + and - Directions

APS BURN TO DEPLETION

A. TEST OBJECTIVES

S11.17-3 Overall PGNCS Errors During Thrusting Maneuvers
S12.9-1 AGS Controlled APS Burn Over An Extended Range Of Inertias
S12.9-2 Deleted
S12.9-3 RCS Fuel Consumption
S13.13-1 APS Performance Characteristics
S13.13-2 APS Propellant Depletion Shutdown Hazard Determination

B. TEST REQUIREMENTS

1. LM IMU performance data to be obtained by TM. [11.17]

2. Crew to preset LM switching prior to leaving LM for subsequent MCC control. [12.9]

   a. Set mode control switch to AUTO.

   b. Close the ABORT switch.

   c. Set AGS DEDA address 616 to 0.

3. PGNCS to be programmed as if it were controlling the burn. External ΔV prethrust program P30 will be called and targeting parameter input VIA the uplink. P42 will be called prior to initiation of the burn. [12.9]

4. Continuous tracking and telemetry data are required for a delta velocity of at least 1000 feet per second. [12.9]

5. The APS burn will be AGS controlled to depletion with the ascent engine operating continuously for a minimum duration of 100 seconds. [13.13]

C. TEST PROCEDURES/CHECKLISTS

1. LM AOH paragraph 4.10.6, "APS Burn to Depletion"

D. DATA REQUIREMENTS

1. LM TM HBR [11.17, 13.13] (M)

2. LM TM LBR [12.9, 13.13] (M)

3. BET [12.9, 13.13] (M)

4. Preflight data on isolation valve inlet pressures and tank temps from servicing to launch. [13.13] (M)

TELECOMMUNICATIONS

A. TEST OBJECTIVES

S6.9-1 CSM High Gain Antenna Reflectivity with CSM/LM Docked
P16.10-1 LM Steerable Antenna Comm Modes at Lunar Distance, Docked/Undocked
P16.10-2 Verify LM Steerable Antenna on Target Gain
P16.10-3 Evaluate Steerable Antenna Procedures During Maneuvers That Simulate Descent to Lunar Surface
S16.12-1 LM Omni Antenna Comm Modes at Lunar Distance, Docked/Undocked
S16.17-1 CSM/LM/MSFN Simultaneous Voice Communications Using S-Band & VHF
S16.17-2 LM/MSFN/CSM Voice Conference via S-Band using MSFN as Voice Relay
S16.17-3 LM/CSM/MSFN Voice Conference via S-Band and VHF using CSM as Voice Relay
S16.17-4 Simultaneous LM Voice/LBR Transmission to CSM with CSM Recording/Dumping to MSFN
S16.17-5 LM/CSM via VHF, LM/MSFN via S-Band, LM Relay.

B. TEST REQUIREMENTS

1. Lunar distance or equivalent is defined as: [6.9]

   a. 200K NM with 85' ground antenna.

   b. 110K NM with 30' ground antenna cooled.

   c. 70K NM with 30' ground antenna uncooled.

2. Manual acquisition will be demonstrated using wide beam width. [6.9]

3. Automatic tracking will be demonstrated with the CSM high gain antenna using wide, medium and narrow beamwidths. [6.9]

4.

Tests	Signal Combination (M)
a. Reflectivity Lunar Distance or Equivalent [6.9] (3 designated attitudes)	7.8
b. LM Steerable Antenna Lunar Distance [16.10]	6.2, 8.4 and 6.7
c. LM Omni Lunar Distance [16.12]	6.4, 6.1, 6.15 and 6.2

5. LM steerable antenna data will be obtained to verify on target gain at lunar distance. [16.10]

6. LM steerable antenna operational procedures will be performed to simulate maneuvers during LM descent to the lunar surface. [16.10]

7. At least one signal combination while docked and at least one signal combination while undocked. [16.10]

TELECOMMUNICATIONS

A. TEST OBJECTIVES

S6.9-1 CSM High Gain Antenna Reflectivity with CSM/LM Docked
P16.10-1 LM Steerable Antenna Comm Modes at Lunar Distance, Docked/Undocked
P16.10-2 Verify LM Steerable Antenna on Target Gain
P16.10-3 Evaluate Steerable Antenna Procedures During Maneuvers That Simulate Descent to Lunar Surface
S16.12-1 LM Omni Antenna Comm Modes at Lunar Distance, Docked/Undocked
S16.17-1 CSM/LM/MSFN Simultaneous Voice Communications Using S-Band & VHF
S16.17-2 LM/MSFN/CSM Voice Conference via S-Band using MSFN as Voice Relay
S16.17-3 LM/CSM/MSFN Voice Conference via S-Band and VHF using CSM as Voice Relay
S16.17-4 Simultaneous LM Voice/LBR Transmission to CSM with CSM Recording/Dumping to MSFN
S16.17-5 LM/CSM via VHF, LM/MSFN via S-Band, LM Relay.

B. TEST REQUIREMENTS

1. Lunar distance or equivalent is defined as: [6.9]

   a. 200K NM with 85' ground antenna.

   b. 110K NM with 30' ground antenna cooled.

   c. 70K NM with 30' ground antenna uncooled.

2. Manual acquisition will be demonstrated using wide beam width. [6.9]

3. Automatic tracking will be demonstrated with the CSM high gain antenna using wide, medium and narrow beamwidths. [6.9]

4.

Tests	Signal Combination (M)
a. Reflectivity Lunar Distance or Equivalent [6.9] (3 designated attitudes)	7.8
b. LM Steerable Antenna Lunar Distance [16.10]	6.2, 8.4 and 6.7
c. LM Omni Lunar Distance [16.12]	6.4, 6.1, 6.15 and 6.2

5. LM steerable antenna data will be obtained to verify on target gain at lunar distance. [16.10]

6. LM steerable antenna operational procedures will be performed to simulate maneuvers during LM descent to the lunar surface. [16.10]

7. At least one signal combination while docked and at least one signal combination while undocked. [16.10]

8. Simultaneous voice communications between the CSM and MSFN by S-band and between the LM and MSFN via S-band and between the LM and CSM via VHF will be demonstrated in the undocked configuration, using the S-band steerable antenna, CSM HI gain antenna and VHF inflight antennas. [16.17]

9. Voice conference capability among the LM, MSFN and the CSM will be demonstrated in the docked configuration using the LM S-band steerable and CSM High Gain antennas with MSFN acting as voice relay. [16.17]

10. Voice conference communications among the LM, CSM and MSFN will be demonstrated in the docked configuration using VHF voice communications between the LM and the CSM with CSM providing voice relay to MSFN via S-band. Use VHF inflight and CSM HI Gain antenna. [16.17]

11. LM voice will be transmitted via VHF-A simultaneous with LBR TM via VHF-B. The LM voice and LBR will be recorded by the CSM DSE. The LM TM data will be dumped by the CSM to MSFN via S-band FM mode 3. The LM voice data will be dumped by the CSM to MSFN via S-band FM mode 2. Use VHF inflight and CSM HI Gain antenna. [16.17]

12. Voice conference communications among the CSM, LM and MSFN will be demonstrated in the docked configuration using VHF voice between the CSM and LM and S-band voice between the LM and MSFN with LM relay. Use VHF inflight antennas and the LM steerable antenna. [16.17]

C. TEST PROCEDURES/CHECKLISTS

1. CSM AOH paragraph 4.7.6, "Telecommunications"

2. FCAC, "Telecomm Procedures", S2-19
3. LM AOH paragraph 4.13.2, "Communications"

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs

a. Comments on adequacy of communications quality and procedures. [6.9, 16.10, 16.17] (M) [16.12] (HD)

b. Time/Pitch/Yaw/S-Band antenna information to be recorded during the S/C reflectivity tests. [6.9] (M)

c. Data TBD for the steerable antenna pattern coverage test. [16.10] (M)

d. Data acquired during simulated LM descent to lunar surface maneuvers concerning S-Band antenna procedures. [16.10] (M)

e. LM tape recording of MSFN voice. [16.10] (M)

f. LM recording of CSM, MSFN and MSFN relayed to CSM voice. [16.17] (M)

2. Ground Support

   a. BET CSM [6.9] (M)

   b. Post Launch Instrumentation Message containing information on adequacy of CSM/MSFN communication procedures and quality. [6.9, 16.10, 16.12] (HD)

   c. Unified S-band telemetry bit stream. [16.10, 16.12] (M)

   d. Unified S-band tracking data processor output. [6.9, 16.10] (M) [16.12] (HD)

   e. BET LM [16.10] (M) [16.12] (HD)

   f. Flight Director's Post-Mission Report [6.9] (M) [16.10, 16.12] (M)

   g. MSFN tape recording of LM voice. [16.10, 16.12, 16.17] (M)

   h. MSFN records of received S-band signal strength. [16.10, 16.12] (M)

   i. LM TM HBR [16.10, 16.12] (M)

   j. LM TM LBR [16.10, 16.12] (M)

   k. MSFN tape recording of LM emergency key mode. [16.12] (HD)

   l. MSFN recording of CSM voice. [16.17] (M)

   m. MSFN recording of CSM playback of LM LBR TM. [16.17] (M)

   n. MSFN recording of CSM playback of LM voice. [16.17] (M)

   o. MSFN recording of the LM voice relayed from the CSM. [16.17] (M)

   p. LM recording of MSFN voice. [16.17] (M)

   q. LM recording of CSM voice. [16.17] (M)

   r. LM recording of MSFN voice for CSM. [16.17] (M)

CSM COMMUNICATIONS TEST

S6.9 CSM High Gain Antenna Reflectivity

PROCEDURE

MNVR R 71.5 P 323.8 Y 318.5 (PTC REFSMMAT)

R _____ P _____ Y _____

COMMUNICATIONS MODE 7.8

SWITCH CONFIGURATION - BASIC, EXCEPT

S-BAND RANGING - OFF

SET UP HGA OPERATION

(HGA pitch -10^{o}, yaw 340^{o})

ATTITUDE HOLD - MAX D/B, LOW RATE

STEPS 1 THROUGH 7, COLUMN 1

1. VERIFY HGA TWO WAY LOCK

	COLUMN	1	2	3
2. MNVR S/C TO -	PITCH (HGA METER)	-10^{o}	-20^{o}	-30^{o}
	YAW (HGA METER)	340^{o}	350^{o}	360^{o}
3. SET HGA CNTL POSITION -	PITCH	-10^{o}	-20^{o}	-30^{o}
	YAW	320^{o}	330^{o}	340^{o}

4. BEAM WIDTH - WIDE, TRACK SW - MANUAL
   (when HGA indicators compare to cntl settings)
5. TRACK SW - AUTO, BEAM WIDTH - NARROW
6. RECORD:

COLUMN	1	2	3
M16 DEGREES PITCH	X _ _	X _ _	X _ _
M18 DEGREES YAW	_ _ _	_ _ _	_ _ _
M17 PERCENT SIGNAL	X _ _	X _ _	X _ _

7. EVALUATE VOICE COMMUNICATIONS
   REPEAT STEPS 1. THROUGH 7. COLUMN 2
   REPEAT STEPS 1. THROUGH 7. COLUMN 3
   RETURN TO COAST AWAKE COMMUNICATIONS MODE

LM S-BAND COMMUNICATIONS TESTS

P16.10 LM STEERABLE ANTENNA LUNAR DISTANCE

REQUIRED:

LM - S Band/Steerable Antenna
MSFN - Line of Sight
SW Configuration - LM Basic Per Crew Checklist

PROCEDURE

SIGNAL COMB	PANEL	SWITCH POSITION
6.2		BASIC
8.4		BASIC, Except
	12	Updata Link - VOICE BU
	12	Voice - DN VOICE BU
	12	S-Bd Range - OFF
	12	Audio Cont - BU
	12	TLM PCM - LOW
	12	S-Bd Pwr Ampl - OFF
	12	TLM BIOMED - OFF
	12	ICS Volume - AS REQD
	8	S-Bd - OFF
	8	VHF A - OFF
6.7		BASIC, Except
	12	S-Bd Range - OFF
	12	TLM PCM - LOW
	12	S-Bd Pwr Ampl - OFF

LM S-BAND COMMUNICATIONS TESTS

S16.12 LM OMNI ANTENNA LUNAR DISTANCE

REQUIRED

LM - OMNI Fwd or Aft
MSFN - Line of Sight
SW Configuration - LM Basic Per Crew Checklist

PROCEDURE

SIGNAL COMB	PANEL	SWITCH POSITION
6.4		BASIC, Except
	12	*S-Bd Antenna - FWD OR AFT
	12	TLM PCM - LOW
	12	Voice - DN VOICE BU
	12	TLM BIOMED - OFF
	12	S-Bd Range - OFF
6.1		BASIC, Except
	12	*S-Bd Antenna - FWD OR AFT
	12	S-Bd Range - OFF

PROCEDURE CONTD.

SIGNAL COMB	PANEL	SWITCH POSITION
6.15		BASIC, Except
	12	*S-Bd Antenna - FWD OR AFT
	12	Voice - OFF
	12	BIOMED - OFF
6.2		BASIC, Except
	12	*S-Bd Antenna - FWD OR AFT

* Maneuver LM to Permit Optimum Communications With Either the Forward or Rear Omniantenna.

COMMUNICATIONS RELAY MODES

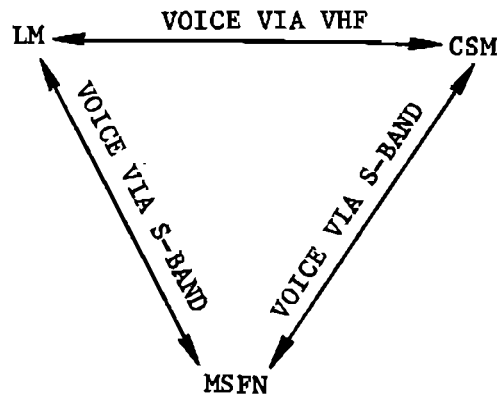
S16.17 LM/CSM/MSFN Voice/TM

REQUIRED

CSM - S-Band/VHF
LM - S-Band/VHF
MSFN - Line-of-Sight
SW. Configuration - CSM Basic Per Crew Checklist
LM Basic Per Crew Checklist

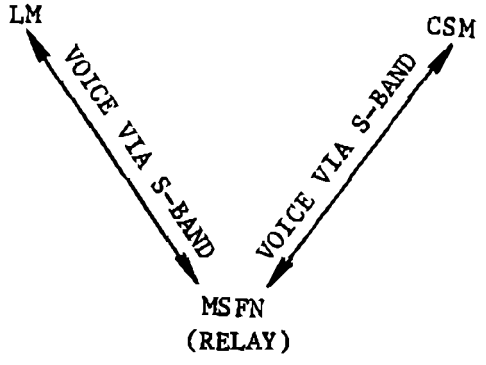
PROCEDURE

1.



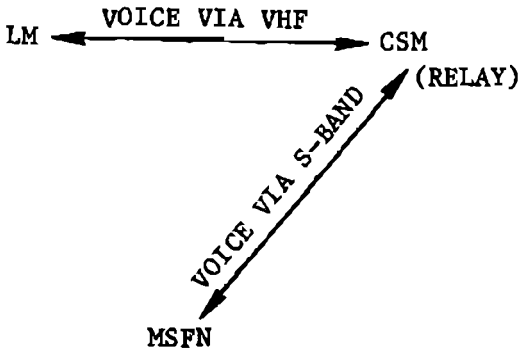
S/C	PANEL	SWITCH CONFIGURATION
CSM		BASIC
LM		BASIC

2.



S/C	PANEL	SWITCH CONFIGURATION
		BASIC, Except
CSM	10 or 9	VHF AM - OFF
LM	12	VHF A T/R - OFF
	8	VHF A T/R - OFF

3.

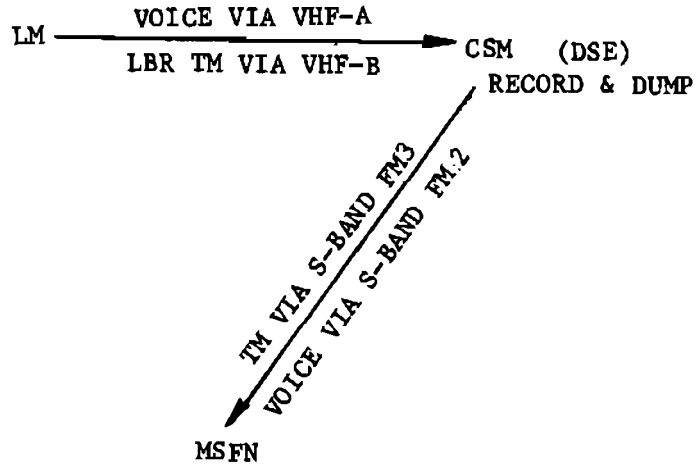


S/C	PANEL	SWITCH CONFIGURATION
		BASIC, Except
CSM	3	S-Bd Mode Voice - RELAY
	9	Mode - VOX
	10	Mode - VOX
	10	Control - BU
	10	S-Bd T/R - OFF
	10	VHF AM - T/R
	10	VOX Sense - 6

3. Continued

S/C	PANEL	SWITCH CONFIGURATION
CSM	10	VHF AMA - SIMPLEX
	10	Intercomm - OFF
LM	12	S-Bd T/R - OFF
	8	S-Bd T/R - OFF

4.



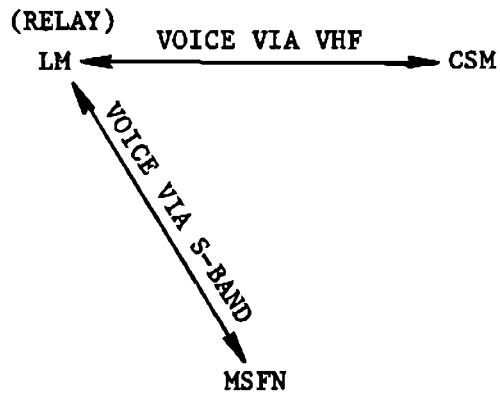
S/C	PANEL	SWITCH CONFIGURATION
		BASIC, Except
CSM	3	REWIND TAPE
	3	PCM BIT RATE - HIGH
	3	VHF AM RCV Only - B DATA (Wait 5 Min)
	3	PCM BIT Rate - LOW (Wait 5 Min)
	3	Tape Recorder - PLAY
	3	Tape Recorder - REWIND
	3	Tape Recorder - FWD (Wait 10 Min)
	3	Tape Recorder - REWIND (Rewind Complete)

(Continued)

4. Continued

S/C	PANEL	SWITCH CONFIGURATION
CSM	3	Tape Recorder - LM PCM
	3	Tape Recorder - FWD (Wait 10 Min)
LM	12	TLM PCM - LOW
	12	S-Bd T/R - OFF
	8	S-Bd T/R - OFF

5.



S/C	PANEL	SWITCH CONFIGURATION
		BASIC, Except
CSM	10 or 9	S-Bd T/R - OFF
	3	VHF B- DUPLEX
	3	VHF A - OFF
LM	8	VHF B - RCV
	8	Mode - VOX
	8	ICS T/R - OFF
	12	RELAY - ON
	12	Mode - VOX
	12	ICS T/R - OFF
	12	Audio Cont - BU
	12	VHF B RCVR - ON

LM CONSUMABLES

A. TEST OBJECTIVES

S20.83-1 Electrical Loads and Crew Procedures Affecting Demands on Batteries, Battery Capacity and Load Distribution
S20.83-2 Water/Oxygen Requirements Data
S20.83-3 LiOH Cartridge Requirements Data
S20.83-4 APS/DPS/RCS Propellant Requirements Data
S20.83-5 Crew Food Requirements Data

B. TEST REQUIREMENTS

1. Perform management and use of the EPS per the flight plan. [20.83]
2. Obtain data on water/oxygen consumption. [20.83]
3. Manage the replacement of LiOH cartridges per the flight plan. [20.83]
4. Manage the consumption of APS/DPS/RCS propellant as required. [20.83]
5. Utilize the food supply per the flight plan. [20.83]

C. TEST PROCEDURES/CHECKLISTS

1. LM AOH paragraph 4.13, "Subsystems Management"
2. FCAC: LM Subsystems Management

D. DATA REQUIREMENTS

1. Flight Crew Reports/Logs
   a. Deviations from the EP configuration (HD)
   b. LiOH log (M)
   c. Comments regarding crew comfort level (HD)
   d. Water Log (M)
   e. Food Log (HD)
2. Ground Support
   a. BET before and after APS/DPS burns (M)
   b. LM TM HBR (M)

PASSIVE TESTS

A. TEST OBJECTIVES

S7.26-1 TC System - Translunar and Transearth
S7.26-2 TC System - Lunar Orbit
S13.14-1 LM Supercritical Helium Pressure Profile
P20.66-1 Pre-LOI Through DOI Timeline
P20.66-2 Lunar Orbit Mission Timeline
S20.80-1 Ground Support for Lunar Mission

B. TEST REQUIREMENTS

1. All CM and LM crew procedures will be accomplished in the same manner, where feasible, as for the lunar landing mission. [20.66]

2. All CM and LM procedures will be accomplished within the same timeline as for the lunar landing mission from the pre-LOI preparation through DOI. [20.66]

3. MSFN will provide state vector update and targeting information for maneuvers. [20.80]

4. Translunar and transearth flight will be accomplished using the PTC modes identified under Passive Thermal Control. [7.26]

5. Lunar orbit flight will be accomplished in the CSM/LM docked and undocked configurations. [7.26]

6. LM supercritical helium pressure data will be acquired from LM activiation to LM staging. [13.14]

C. DATA REQUIREMENTS

1. Flight Crew Reports/Logs

   a. Recommended changes in procedures and/or equipment. [20.66] (M)

   b. Procedures requiring repeating or not accomplished. [20.66] (M)

2. Ground Support

   a. The Flight Director will assess the ground operational support and determine its adequacy for the entire mission. [20.80] (M)

   b. CSM TM HBR periodically to generate time history of temperatures during TL and TE phases. [7.26] (M)

   c. MSFN voice recordings of CSM/MSFN and LM/MSFN communications. [20.66] (HD)

d. LM TM HBR when LM is manned and activated while in lunar orbit of the front side of the moon. [7.26] (M)

e. LM TM LBR [13.14] (M)

TRANSEARTH INJECTION

A. TEST OBJECTIVES

S3.22-1 Deleted

SECTION 5 - CONSUMABLES ANALYSIS

CONSUMABLES DATA TO BE SUPPLIED