NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PRELIMINARY

FLIGHT PLAN
APOLLO 7

AS 205/101

MAY 31, 1968

PREPARED BY
FLIGHT PLANNING BRANCH
FLIGHT CREW SUPPORT DIVISION

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

APOLLO AS-205/101

PRELIMINARY FLIGHT PLAN

MAY 31, 1968

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INTRODUCTION

This document programs the AS-205/101 operations and crew
activities to fulfill the test objectives defined in the
February 14, 1968, Mission Requirements SPD8-R-001 Change
A, and to be compatible with the NASA operational trajec-
tory 68-FM-110, to be published.

This is a control document, subject to review by all
elements of the Apollo Program, and approval by the
Procedures Configuration Control Board.

A final flight plan will be published subsequent to review
and updating of this document.

TABLE OF CONTENTS

ABBREVIATIONS

ARIA	Apollo Range Instrumentation Aircraft	GETI	Ground Elapsed Time of Ignition
ANG	Antigua	Gly	Glycol
AOH	Apollo Operations Handbook	GNCS	Guidance Navigation Control System
AOS	Acquisition of Signal	GST	Goldstone California
ARS	Attitude Reference System	GYM	Guaymas
ACN	Ascension	HAW	Hawaii
Att	Attitude	HBR	High Bit Rate (TM)
BDA	Bermuda	HD	Highly Desirable
CAL	Pt. Arguello, California	HTR	Heater
CAM	Camera	HTV	USNS Huntsville
CDR	Commander	IAW	In Accordance With
CDU	Control Data Unit	IRIG	Inertial Reference Integrating Gyro
Ck	Check	IU	Instrumentation Unit
CMD	Command	IVA	Intervehicular Activities
CMP	Command Module Pilot	KNO	Kano Nigeria
CNB	Canberra	kWh	Kilowatt Hour
CNV	Cape Kennedy, Florida	LBR	Low Bit Rate (TM)
COAS	Crew Optical Alignment Sight	LH	Local Horizontal
CRO	Carnarvon	LHEB	Left-hand Equipment Bay
CSQ	USAF Coastal Sentry	LLM	Lunar Landing Mission
CTN	Canton Island	LLOS	Landmark Line of Sight
CYI	Grand Canary Island	LMP	Lunar Module Pilot
DAP	Digital Autopilot	LOS	Line of Sight
db.	Deadband	LV	Local Vertical
DSE	Data Storage Equipment	LVPD	Launch Vehicle Pressure Display
DTO	Detailed Test Objective	MAD	Madrid Spain
ECO	Engine Cut-off	MER	USNS Mercury
EGL	Eglin AFB	MDC	Main Display Console
EMS	Entry Monitor System	MLA	Merritt Island
F/C	Fuel Cell	MSFN	Manned Space Flight Network
FOV	Field of View	MTVC	Manual Thrust Vector Control
FQ	Flight Qualification	NCC	Nominal Corrective Combination
GBM	Grand Bahama	NM	Nautical Miles
GDC	Gyro Display Coupler	NOM	Nominal
GET	Ground Elapsed Time	NSR	Nominal Slow Rate

P	Pitch	TM	Telemetry
PCM	Pulse Code Modulation	TPF	Terminal Phase Final
PIPA	Pulse Integrating Pendulous Accel.	TPI	Terminal Phase Initiation
Pref	Preferred Orientation	TVC	Thrust Vector Control
PUGS	Propellant Utilization and Gaging System	W.R.T.	With Reference To
Pxx	Programs xx	VAN	USNS Vanguard
R	Roll	VHF	Very High Frequency
Rad	Radiator	Vlv	Valve
RCDR	Recorder	W/O	Without
Rcv	Receiver	WHS	White Sands
RED	Redstone	WSMR	White Sands Missile Range
REFSMMAT	Reference to Stable Member Matrix	WTN	USNS Watertown
Reqd	Required	Y	Yaw
RKV	USAF Rose Knot		
RNDZ	Rendezvous		
RR	Rendezvous Radar		
RT	Real Time		
RTC	Real Time Command		
S/C	Spacecraft		
SA	Shaft Angle		
SCE	Signal Conditioning Equipment		
SCS	Stabilization Control System		
SCT	Scanning Telescope		
SEQ	Sequence		
SLA	Service Module LM Adapter		
SLOS	Star Line-of-Sight		
SR	Sunrise		
SS	Sunset		
Sta	Station		
STBY	Standby		
Sw	Switch		
SXT	Sextant		
TA	Trunnion Angle		
TAN	Tananarive		
TBD	To Be Determined		
TEX	Corpus Christi, Texas		

Note:

Additional abbreviations concerned with maneuver updates are found on pages 1-12 through 1-24.

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SECTION I - GENERAL

FLIGHT PLAN NOTES

A. MISSION

The AS-205/101 mission ascent-to-orbit will include the S-IB boost phase and the S-IVB orbit insertion burn. The spacecraft will remain attached to the S-IVB in a 120 x 150 nautical mile orbit for two revolutions.

The CSM will separate from the S-IVB at GET of 2:55, transpose and perform a simulated docking maneuver using a docking target in the S-IVB SLA. Photographs of the S-IVB and SLA will be taken during the transposition and docking maneuvers.

After completion of the simulated docking, the SM/RCS will be used to perform an initial phasing maneuver for a rendezvous with the S-IVB. The CSM active rendezvous will be a two-impulse transfer ellipse utilizing the SPS for the coelliptic and corrective combination maneuvers. The rendezvous with the S-IVB will be completed at approximately 30 hours into the mission. The nominal sequence of events leading to the rendezvous is shown in Figures 1 and 2.

Following a period of formation flying with the S-IVB, the spacecraft will separate and begin a drifting flight phase for nominally nine days. This period will be devoted to evaluation of crew activities, crew/spacecraft interface, system performance, and mission support activities. The drifting flight phase will be interrupted by SPS burns as presented in Table I.

The deorbit maneuver will be a GNCS controlled SPS burn. Entry will be controlled manually by the crew using the G&N as a reference. Splashdown will occur in the Atlantic recovery area.

B. CREW

1. Crew designation is as follows:

Designation	Couch Position at Lift-off and Entry	Prime	Backup
Commander (CDR)	Left	Schirra	Stafford
Command Module Pilot (CMP)	Center	Eisele	Young
Lunar Module Pilot (LMP)	Right	Cunningham	Cernan

2. The crew will follow a 16-hour work, 8-hour rest cycle. At least one crew member will be awake at all times with the CDR and LMP scheduled for simultaneous sleep periods.

3. The pressure suits will be removed and stowed at crew option following the first six revolutions. Suits will not nominally be donned until prior to deorbit. Partial pressure suit operation will commence at crew option after the GO/NO GO for 2-1 at CRO.

4. Two full night passes are scheduled for IMU orientation, realign and system preparation prior to activities requiring the G&N. If the IMU orientation is known and unacceptable, one full night pass is scheduled for realignment. The crew work-rest has been arranged so that all crewmen are awake at least 30 minutes prior to the IMU orientation procedure for SPS burns.

5. Crew members will eat together when possible. One hour will be allocated per meal. Scheduling of additional activities will be held to a minimum during the meal periods.

6. Spacecraft maneuver rates, unless required to support mission objectives or time critical events, will generally not exceed 0.5°/sec (6 min for a 180° maneuver).

7. The crew couch position for each SPS maneuver is shown in Table I.

8. An effort was made not to schedule G&N operations, i.e. alignments, with one or two crewmen asleep. However, due to the major maneuver schedule and the work-rest requirements, this guideline was not always possible to follow.

9. Food, exercise, crew water consumption, and sleep will be handled on the basis of negative reporting except when TBD minimum requirements are violated.

C. Instrumentation

1. The DSE will be operated continuously in the LBR recording mode except HBR will be recorded during the following periods:

   a. Launch
   b. S-IVB/CSM separation
   c. TPI braking
   d. All SPS maneuvers
   e. CM/SM separation and entry
   f. In support of certain DTO requirements (TBD).

Recorded data will generally be dumped by RTC at least once per rev.

2. The FQ recorder will be used:

   a. ≈45 sec prior to lift-off to GET ≈ 04:00
   b. ≈30 sec prior to G&N/MTVC burn to ≈ 30 sec after shutdown
   c. ≈30 sec prior to deorbit to end of tape

3. The six FQ instrumentation circuit breakers (panel 277) will be configured:

   a. All CLOSED when the FQ recorder is being used.
   b. CB 9 and 10 OPEN during all other periods. (This configuration permits ECS flight qualification instrumentation to be available for real time operational use).

4. Medical requirements for real time bio-med data and use of the TLM BIOMED switch TBD

5. The spacecraft telecommunication system will be configured for optimum ground control via RTC. A typical station pass with a DSE dump via RTC, as planned by the flight control team, would include:

Station AOS:	DSE - rewind
	PCM - HBR
	S-band tape mode (FM - On)
	DSE - playback mode
At end of DSE rewind:	DSE - forward
At end of DSE dump:	DSE - rewind
	S-band tape off (FM - Off)
	DSE - record
Station LOS:	PCM - LBR
	DSE - forward

If there is no DSE dump:

Station AOS:	DSE - Stop
	PCM - HBR
Station LOS:	PCM - LBR
	DSE - forward

D. <u>COMMUNICATION</u>

1. VHF Simplex A (296.8) will be the primary air/ground communication frequency for initial voice contact. However, the USBE voice mode will be powered up throughout the mission and will be used for test purposes and for backup for VHF. All duplex and simplex VHF modes will also be tested. The USB test modes shown in Table II are denoted in the timeline by the ground station when the mode is scheduled for test.

2. The S-Band antenna selection to insure lock on during SPS and RCS ΔV maneuvers is shown in Section II by the maneuver. (TBD)

3. Update data for ΔV maneuvers are presented on pages 1-17 through 1-22. Update data for system tests are presented in Section IV by the applicable test.

4. Landing area block data for PTP's (Preferred Target Point) and ATP's (Alternate Target Point) are voiced up approximately every 4 to 7 revs per Table III.

5. GO/NO GO areas and approximate GETI are present in Table III. The GO/NO GO is passed up to the crew approximately two revs prior to the GETI.

6. Once per day following activities over the US, the flight crew will make a report to the ground containing the following flight plan information:

   a. Particular flight plan item accomplished, including the rev or approximate time of accomplishment.

   b. Quantity and type of photographic film used.

7. General flight plan updates will be voiced up once per day and will contain a schedule of the coming days activities.

8. During communications the spacecraft will be referred to by name (i.e. Apollo 7) and the ground will be referred to as "Houston". The individual crew member callouts will be specified in the final flight plan.

9. Negative reporting will be used by the flight crew in reporting completion of each checklist. The checklist will not be read by the flight crew or the ground station over air/ground during the conduct of the checklist unless specifically requested by the ground (non-nominal conditions only).

10. All onboard gage readings reported to the network will be read directly from the S/C gages and not corrected by the appropriate factors.

E. CSM SYSTEMS

1. The spacecraft liftoff and power down switch positions are no longer in the flight plan but may be found in the AOH, Vol. II.

2. Spacecraft system status checks scheduled prior to the GO/NO GO for 17-1 (GET 7:30), in addition to the normal checklist activities include:

a. Suit integrity check (all 3 suits)
b. Redundant suit compressor check
c. Main and emergency cabin regulators
d. Redundant H_2O accumulator
e. Secondary coolant loop
f. Fuel cell purge
g. Inverter changeover and check
h. VHF check all voice modes
i. USB check all voice modes
j. PIPA bias and EMS bias check
k. CMC update for 6-4
l. IMU alignment to 6-4 REFSMMAT
m. Prethrust activities for 6-4 to gimbal motor check and including the SCT/star attitude check
n. Out-the-window orientation for day and night retro
o. Urine dump

3. Periodic spacecraft system monitoring is a continuing task and does not require real time scheduling; monitoring checks are not shown.

4. Fuel cell purging for both H_2 and O_2 are shown after the expenditure of approximately 30 kWh (See EPS Analysis, Section III).

5. An ECS redundant component check is scheduled each day.

6. One LiOH canister is scheduled for change approximately every 12 hours, starting with the removal of canister No. 1 at 10 hours GET.

7. Cabin humidity surveys (in accordance with DTO P4.4) are shown every six hours when partially suited, starting after GET 9:00, and once a day when in shirt sleeves.

8. The IMU is shown powered up approximately one hour prior to an IMU Orientation.

9. The potable water chlorination procedure is shown approximately every 24 hours starting (after the rendezvous activities) at a GET of 31:00.

F. PROCEDURES

1. Crew procedures for the accomplishment of the system and mission operations called out in the flight plan may be found in the following documents:

a. Apollo Operations Handbook (AOH)
b. Abort Summary Document
c. Rendezvous Procedures Document
d. Reentry Procedures Document

2. Particular procedures for the accomplishment of the specific DTO tests are found in Section IV of this document. A reference to the applicable test procedure is also shown by the test in the timeline, Section II.

Figure 1

"Typical"

MISSION "C" RENDEZVOUS PROFILE

NCC2 (27+30)

NCC1 (26+25)   TPF (29+51)   Trailing Displacement (N.M.)

NSR (28+00)

TPI (29+16)

Vertical Displacement (N.M.)

▲ 10 Minutes ▲

1	22+00	P05	GNCS Startup
2	22+25	P00	Ground Uplink (BDA)
3	22+55	P51	IMU Orientation Determination
4	23+10	P52	IMU Nominal Align
5	24+25	P52	IMU Refsmmat Align
6	24+55	P20	30 Marks (25+00 - 25+29)
7	25+35	P00	Ground Uplink (BDA)
8	25+40	P30	NCC1 External ΔV
9	25+48	P40	Auto Maneuver to Burn Attitude
10	25+55	P52	IMU Refsmmat Align
11	26+08	P40	NCC1 Thrust Program
12	26+25		NCC1 Burn (SPS) - 240.8 FPS
13	26+30	P20	25 Marks (26+35 - 26+59)
14	27+05	P00	Ground Uplink (MLA)
15	27+07	P30	NCC2 External ΔV
16	27+10	P40/P41	NCC2 Thrust Program
17	27+30		NCC2 Burn (SPS/RCS)
18	27+33	P30	NSR External ΔV
19	27+37	P40	Auto Maneuver to Burn Attitude
20	27+40	P52	IMU Refsmmat Align
21	27+47	P40	NSR Thrust Program
22	28+00		NSR Burn (SPS) - 229.0 FPS
23	28+10	P20	10 Marks (28+24 - 28+33)
24	28+15	P34	TPI Prethrust Program
25	28+51		10 Marks (28+51 - 29+00)
26	29+06	P41	TPI Thrust Program
27	29+16		TPI Burn (RCS) - 17.0 FPS
28	29+18	P20	7 Marks (29+20 - 29+27)
29	29+19	P35	MCC1 Prethrust Program
30	29+29	P41	MCC1 Burn Program
31	29+30		MCC1 Burn (RCS)
32	29+31	P35	MCC2 Prethrust Program
33	29+33		2 Marks (29+33 - 29+44)
34	29+36	P41	MCC2 Thrust Program
35	29+37		MCC2 Burn (RCS)
36	29+38	P47	Thrust Monitor (LOS Control)
37	29+51		TPF (RCS) - 17.5 FPS
38	30+00		Station Keeping

Figure 2

"Typical"

ATTITUDE PROFILE

1   22+55   IMU Orientation Determination
2   23+10   IMU Nominal Align
3   24+25   IMU Refsmmat Align
4   24+55   30 Marks (25+00 - 25+25)
5   25+48   Auto Maneuver to Burn Attitude
6   26+25   NCC1 Burn (SPS) - 240.8 FPS
7   26+30   25 Marks (26+35 - 26+50)
8   27+37   Auto Maneuver to Burn Attitude
9   27+40   IMU Refsmmat Align

10   28+00   NSR Burn (SPS) - 225.0 FPS
11   28+10   10 Marks (28+24 - 28+33)
12   28+51   10 Marks (28+51 - 29+00)
13   29+16   TPI Burn (RCS) - 17.0 FPS
14   29+18   7 Marks (29+20 - 29+27)
15   29+30   NCC1 Burn (RCS)
16   29+33   2 Marks (29+33 - 29+44)
17   29+37   MCC2 Burn (RCS)
18   29+38   Thrust Monitor (LOS Control)

Note:

COAS Line of Sight

SXT Line of Sight

Denotes Active Line of Sight
Daylight
Night

Vertical Displacement (N. Mi.)

Trailing Displacement (N. Mi.)
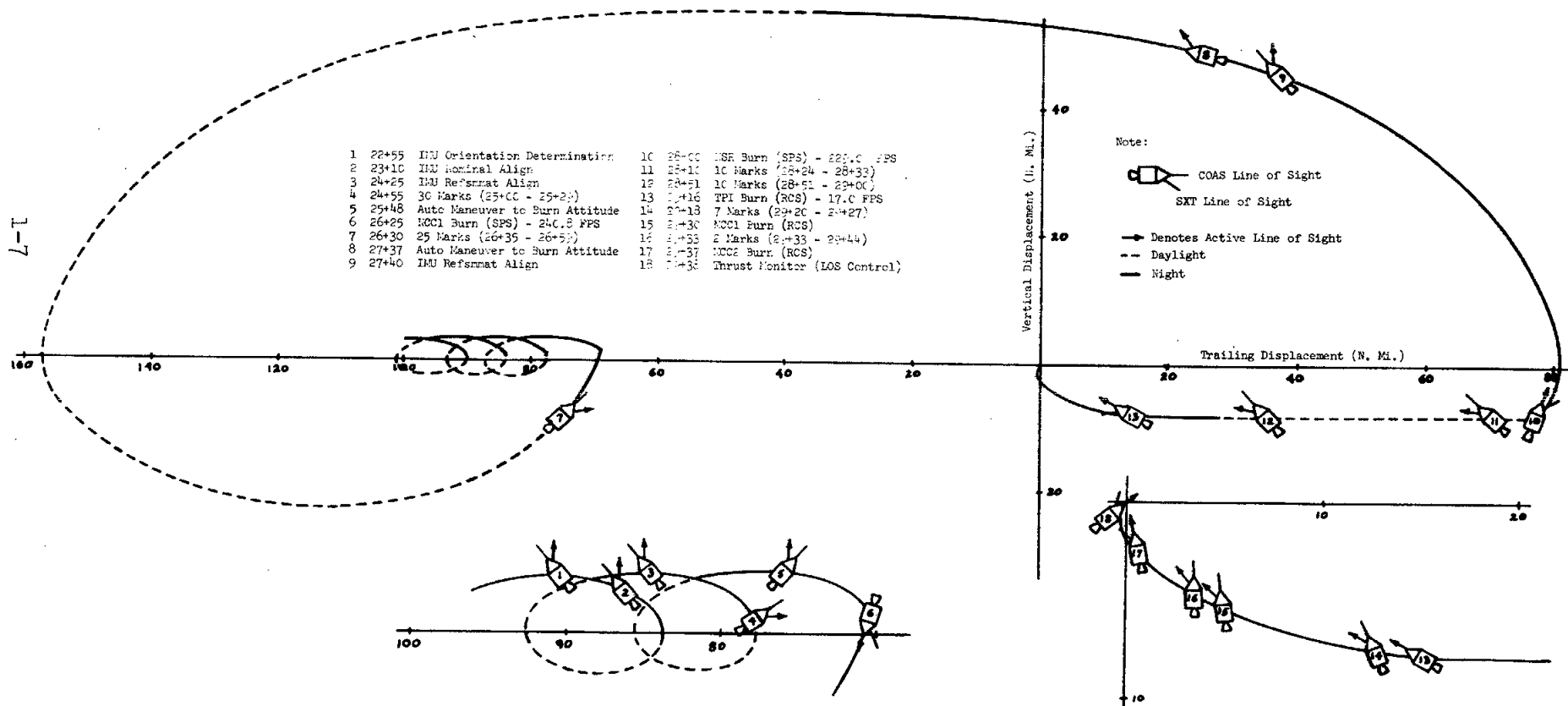
TABLE I
SPS BURN SCHEDULE

BURN NO	GETI BURN TIME DELTA V_c	LH ATTITUDE wrt orb plane	HEADS UP OR DOWN LIGHTING	ΔV (LV) ΔV REQD	ULLAGE ΔV	TVC	SPS ON/OFF	SEAT POSITION L	C	R	REMARKS
1	26:25 BT:10.1 ΔV_c:197.7	R: 0 P: -79.1° Y: +1.6°	UP SR-17 MIN	ΔVX: 54.8 ΔVY: -1.3 ΔVZ: 201.6 ΔV REQD: 208.6	G&N 4 Jet 15 Sec ΔV:5.8	G&N	G&N	CDR	CMP	LMP	NCC1 121/198 WT: 31777
2	28:00 BT:8.8 ΔV_c:174.5	R: 0 P: 60.2° Y: 180°	UP SR-12 MIN	ΔVX: -87.9 ΔVY: 0.36 ΔVZ: -163.8 ΔV REQD: 185.6	G&N 4 Jet 15 Sec ΔV:6.0	G&N	G&N	CDR	CMP	LMP	NSR 117/157 WT: 31195
3	91:43 BT:12.26 ΔV_c:299.4	R: 0° P: 3.7° Y: -103°	UP SS-3 MIN	ΔVX: -58.7 ΔVY: -252.9 ΔVZ: -29.2 ΔV REQD: 260.8	SCS 4 Jet 15 Sec ΔV: 6.1	SCS AUTO	pb ON EMS OFF	CMP	LMP	CDR	96/155 Slosh Damping Test WT: 30285
4	120:52 BT:0.5 ΔV_c:N/A	R: 0° P: -4.4° Y: 0	UP SR+20 MIN	ΔVX: 15 ΔVY: 0 ΔVZ: 0 ΔV REQD: 14.9	G&N 2 Jet 20 Sec ΔV:4.4	G&N	G&N	LMP	CDR	CMP	94/160 Slosh Damping Test WT: 30238
5	165:08 BT:56.2 ΔV_c:1263.9	R: 0° P: 15.9 Y: -84°	UP SR+9 MIN	ΔVX: 110.7 ΔVY: -1204.6 ΔVZ: -418.5 ΔV REQD: 1276.9	G&N 2 Jet 20 Sec ΔV:4.4	G&N MTVC	G&N ON Thrust Sw OFF	CDR	CMP	LMP	91/234 PUGS Test WT: 26635
6	211:42 BT:0.5 ΔV_c:N/A	R: 0 P: -4.4° Y: 0	UP SR+3 MIN	ΔVX: 16.9 ΔVY: 0 ΔVZ: 0 ΔV REQD: 16.9	G&N 2 Jet 20 Sec ΔV:5.0	G&N	G&N	CMP	LMP	CDR	90/240 WT: 26589
7	237:25 BT:19.6 ΔV_c:480	R: 0 P: -48.0° Y: -98.4°	UP SR+10 MIN	ΔVX: -34.4 ΔVY: 345.1 ΔVZ: 353.2 ΔV REQD: 494	G&N 4 Jet 15 Sec ΔV:7.1	SCS AUTO	pb ON EMS OFF	LMP	CDR	CMP	91/216 WT: 25314
8	261:08 BT:9.82 V_c:245.2	R: 0 P: -49.8° Y: -171°	UP SR-6 MIN	ΔVX: -173.2 ΔVY: 0 ΔVZ: 193.9 ΔV REQD: 259.3	G&N 4 Jet 15 Sec ΔV:7.5	G&N	G&N	CDR	CMP	LMP	Deorbit

TABLE II USB COMMUNICATION MODES

MODE	UPLINK	DOWNLINK
6.2	PRN RANGING VOICE UPDATA	PRN RANGING VOICE 51.2 KBPS TM
6.3	PRN RANGING VOICE UP-DATA	PRN RANGING VOICE 1.6 KBPS TM
6.11	PRN RANGING VOICE UP-DATA	PRN RANGING VOICE
7.1	VOICE UP-DATA	VOICE 51.2 KBPS TM
7.6	VOICE UP-DATA	KEY
7.12	VOICE UP-DATA	VOICE
8.4	BACKUP VOICE	VOICE 1.6 KBPS TM
8.8	BACKUP VOICE	BACKUP VOICE 1.6 KBPS TM

CSM TO MSFN FM MODES

MODE	CHANNEL
F1	PLAYBACK VOICE AT 1:1 PLAYBACK 51.2 KBPS TM AT 1:1
F2	PLAYBACK VOICE AT 32:1 PLAYBACK 1.6 KBPS TM AT 32:1
F3	PLAYBACK LEM 1.6 KBPS TM AT 32:1
F4	TV
F5	REAL TIME SCIENTIFIC DATA
F6	REAL TIME 51.2 KBPS TM
F7	REAL TIME 1.6 KBPS TM

Note:

FM mode F5 will not be tested during the AS-205/101 mission.

TABLE III

GO/NO GO AREA

AREA	APPROX GETI hr+min	REV	GO/NO GO STA	REV
2-1	1+25	1	CRO	
6-4	8+56	6	GDS	5
17-1	25+19	16	CRO	14
20-4	31+17	20	TEX	17
32-1	49+12	31	MILA	30
47-1	73+06	46	MILA	45
61-1	95+22	60	MILA	58
76-1	119+12	75	ANT	73
91-1	153+22	90	MILA	88
105-1	165+56	104	ANT	102
120-1	190+00	119	MILA	117
134-1	212+26	133	ANT	131
149-1	236+26	148	ANT	146
164-1	260+25	163	MILA	161

LANDING AREA BLOCK DATA

BLK. NO.	PTP GROUP	ATP GROUP	UPDATE REV	UPDATE STATION
1	2-1 to 8-3	1-B to 8-A	take on	
2	9-3 to 14-2	9-A to 14-C	7	HAW
3	15-1 to 20-4	15-B to 20-A	14	CYI
4	21-4 to 26-A	21-A to 26-C	18	HAW
5	27-A to 32-1	27-C to 32-D	25	VAN
6	33-4 to 38-3	33-A to 38-A	31	CRO
7	39-A to 44-1	39-C to 44-B	36	HAW
8	45-1 to 50-4	45-B to 50-B	44	CYI
9	51-3 to 56-A	51-A to 56-C	48	GWM
10	57-2 to 62-1	57-C to 62-4	55	VAN
11	63-4 to 68-3	63-A to 68-A	61	CRO
12	69-A to 74-1	69-C to 74-B	66	HAW
13	75-1 to 80-3	75-B to 80-A	74	BDA
14	81-3 to 86-A	81-A to 86-C	79	HAW
15	87-2 to 92-4	87-C to 92-A	85	VAN
16	93-4 to 98-A	93-A to 98-A	91	CRO
17	99-A to 104-1	99-C to 104-B	97	VAN
18	105-1 to 110-3	105-B to 110-A	103	CYI
19	111-3 to 116-2	111-A to 116-C	109	HAW
20	117-1 to 122-4	117-B to 122-A	115	CYI
21	123-4 to 128-A	123-B to 128-C	121	MIL
22	129-A to 134-1	129-C to 134-B	127	GWM
23	135-1 to 140-3	135-4 to 140-A	133	CYI
24	141-C to 146-1	141-A to 146-B	139	HAW
25	147-1 to 152-4	147-B to 152-B	145	CYI
26	153-3 to 158-A	153-A to 158-C	151	TEX
27	159-A to 164-1	159-C to 164-B	157	GWM

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
		W_X
X X —	X X —	AREA
X X X .	X X X .	LAT
X X .	X X .	LONG
: :	: :	GETI
		ΔV_C
X X X .	X X X .	W_X
X X —	X X —	AREA
X X X .	X X X .	LAT
X X .	X X .	LONG
: :	: :	GETI
		ΔV_C
X X X .	X X X .	W_X
X X —	X X —	AREA
X X X .	X X X .	LAT
X X .	X X .	LONG
: :	: :	GETI
		ΔV_C
X X X .	X X X .	W_y

BLOCK DATA

REMARKS:

BLOCK DATA

AREA	XXX.XX	RECOVERY AREA (FIRST THREE LANDING REVOLUTIONS - LAST 2 RECOVERY AREA & SUPPORT CAPABILITIES)
LAT	XX.XX	LATITUDE OF TARGET POINT
LONG	XXX.XX	LONGITUDE OF TARGET POINT
GETI	XXX:XX:XX	RETRO-FIRE IGNITION TIME (HR:MIN:SEC)
ΔV_C	XXX.X	PREMANEUVER SETTING IN EMSΔV COUNTER
W_X	XXXXXXX	WEATHER CONDITIONS AT TARGET POINT (GOOD-FAIR-POOR)

P27 UPDATE

PURP			V				V					V		
GET			:		:		:		:			:		:

01	INDEX			INDEX			INDEX	
02								
03								
04								
05								
06								
07								
10								
11								
12								
13								
14								
15								
16								
17								
20								
21								
22								
23								
24								

NAV CHECK

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27 MAY 1968

27 MAY 1968

1-13

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	TIME DATA RECORDED (HR:MIN:SEC)
01	XX	INDEX NO. OF COMMAND WORDS IN LOAD (OCTAL)
02-24	XXXXX	NO. OF CORRECTION COMMAND WORDS
NAV CHECK		TO CONFIRM POINT ABOVE GROUND TRACT FOR A GIVEN TIME
ϕ		LATITUDE
λ		LONGITUDE
H		ALTITUDE
T		TIME

		NAV CHECK		

X	X X		X	X X		HRS	N34
X	X X X		X	X X X		MIN	
X	X	.	X	X	.	SEC	
	0	.		0	.	LAT	N43
		.			.	LONG	
+	0	.	+	0	.	ALT	
X	X X		X	X X		HRS	N34
X	X X X		X	X X X		MIN	
X	X		X	X	.	SEC	
	0	.		0	.	LAT	N43
		.			.	LONG	
+	0	.	+	0	.	ALT	
X	X X		X	X X		HRS	N34
X	X X X		X	X X X		MIN	
X	X		X	X	.	SEC	
	0	.		0	.	LAT	N43
		.			.	LONG	
+	0	.	+	0	.	ALT	
X	X X		X	X X		HRS	N34
X	X X X		X	X X X		MIN	
X	X		X	X	.	SEC	
	0	.		0	.	LAT	N43
		.			.	LONG	
+	0	.	+	0	.	ALT	
X	X X		X	X X		HRS	N34
X	X X X		X	X X X		MIN	
X	X	.	X	X	.	SEC	
	0	.		0	.	LAT	N43
		.			.	LONG	
+	0	.	+	0	.	ALT	

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NAVIGATION CHECK

SPACECRAFT POSITION DEFINED RELATIVE TO THE EARTH FOR A GIVEN TIME.

GET	XXX:XX:XX	TIME THAT LAT,LONG & ALT VALID (HR:MIN:SEC)
LAT	XX.XX	LATITUDE
LONG	XXX.XX	LONGITUDE
ALT	XXXX.X	ALTITUDE

MANEUVER		
		PURPOSE
+ 0 0	+ 0 0	HRS GETI N33
+ 0 0 0	+ 0 0 0	MIN
+ 0 .	+ 0 .	SEC
.	.	△VX N32
.	.	△VY
.	.	△VZ
+ 0 .	+ 0 .	HA N42
0 .	0 .	HP
+ .	+ .	VC≠△VR-T.O.
+	+	WGT N47
0 0 .	0 0 .	PTRM N48
0 0 .	0 0 .	YTRM
X X X :	X X X :	BT(MIN:SEC)
X X X X	X X X X	SXTS
X X .	X X .	SFT
X X .	X X X .	TRN
+ 0 0	+ 0 0	HRS N34
+ 0 0 0	+ 0 0 0	MIN TLAT, LONG
+ 0 .	+ 0 .	SEC
0 .	0 .	LAT N43
.	.	LONG
+ 0 .	+ 0 .	ALT
X X X	X X X	R AS
X X X	X X X	P REQUIRED
X X X	X X X	Y

MANEUVER UPDATE

PURPOSE	XXXXX	TYPE OF MANEUVER TO BE PERFORMED
GETI		TIME OF MANEUVER IGNITION
	XXX	(HR)
	XX	(MIN)
	XX.XX	(SEC)
ΔVX	XXXX.X ⎫	EXTERNAL ΔV COMPONENTS
ΔVY	XXXX.X ⎬	(USED IN P30)
ΔVZ	XXXX.X ⎭	
HA	XXX.X ⎫	PREDICTED APOGEE AND PERIGEE ALTITUDES
HP	XXX.X ⎭	AFTER MANEUVER
V_C	XXXX.X	PREMANEUVER SETTING IN EMS ΔV COUNTER
W_{GT}	XXXXX	TOTAL VEHICLE WEIGHT
PTRM	X.XX ⎫	SPS OFFSETS TO PLACE THRUST
YTRM	X.XX ⎭	VECTOR THRU CENTER OF GRAVITY
BT	X:XX	BURN DURATION OF MANEUVER (MIN:SEC)
SXTS	XX	SEXTANT STAR FOR ORIENTATION CHECK (OCTAL)
SFT	XXX.X	SEXTANT SHAFT SETTING FOR ORIENTATION CHECK
TRN	XX.X	SEXTANT TRUNNION SETTING FOR ORIENTATION CHECK
R	XXX	ROLL IGNITION GIMBAL ANGLE
P	XXX	PITCH IGNITION GIMBAL ANGLE
Y	XXX	YAW IGNITION GIMBAL ANGLE

MANEUVER UPDATE (continued)

```
N34                              TIME OF EVENT
                  XXX            (HR)
                  XX             (MIN)
                  XX.XX          (SEC)

N43 LAT           XX.XX          LATITUDE      (+ NORTH)
    LONG          XXXX.XX        LONGITUDE     (+ EAST)
    ALT           XXX.X          ALTITUDE
```

TERMINAL PHASE INITIATE		
+ 0 0	+ 0 0	HR N37
+ 0 0 0	+ 0 0 0	MIN GETI TPI
+ 0	+ 0	SEC
0 0	0 0	Vgx N86
0 0	0 0	Vgy
0 0	0 0	Vgz
X . /	X . /	ΔV F/A/BT
X . /	X . /	ΔV L/R/BT
X . /	X . /	ΔV U/D/BT
X /	X /	ΔH TPI/ΔΔH
X .	X .	R N53,54
X .	X .	RDOT AT TPI
X .	X .	EL MINUS 5 MIN
X .	X .	AZ
+ 0 0	+ 0 0	HR N37
+ 0 0 0	+ 0 0 0	MIN GETI TPI
+ 0	+ 0	SEC
0 0	0 0	Vgx N86
0 0	0 0	Vgy
0 0	0 0	Vgz
X /	X . /	ΔV F/A/BT
X /	X . /	ΔV L/R/BT
X . /	X . /	ΔV U/D/BT
X / .	X / .	ΔH TPI/ΔΔH
X .	X .	R N53,54
X .	X .	RDOT AT TPI
X .	X .	EL MINUS 5 MIN
X .	X .	AZ

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TERMINAL PHASE INITIATE

GETI		TIME OF IGNITION FOR TPI
	XXX	(HR)
	XX	(MIN)
	XX.XX	(SEC)
E	XX.XX	ELEVATION OF TARGET RELATIVE TO S/C AT IGNITION
ΔTT		TIME FROM GETI TO INTERSECT (Δ TIME OF TRANSFER)
	XX	(MIN)
	XX.XX	(SEC)
VGX	± XX.X	VELOCITY COMPONENTS TO BE
VGY	± XX.X	GAINED BY THE MANEUVER
VGZ	± XX.X	(COMPUTED IN P40)
ΔV F/A	XXX.X	BACKUP LINE OF SIGHT TO TARGET (FORE/AFT)
ΔV L/R	XXX.X	BACKUP LINE OF SIGHT TO TARGET (LEFT/RIGHT)
ΔV U/D	XXX.X	BACKUP LINE OF SIGHT TO TARGET (UP/DOWN)
BT F/A	X:XX	BURN DURATION TO ACQUIRE ΔV (MIN:SEC)
BT L/R	X:XX	BURN DURATION TO ACQUIRE ΔV (MIN:SEC)
BT U/D	X:XX	BURN DURATION TO ACQUIRE ΔV (MIN:SEC)
ΔH MAX	XX.X	MAX ALTITUDE DIFFERENCE PRIOR TO TPI
ΔH MIN	XX.X	MIN ALTITUDE DIFFERENCE PRIOR TO TPI
ΔH TPI	XX.X	ALTITUDE DIFFERENCE AT GETI
R	XXX.XX	RANGE FROM CHASER TO TARGET
RDOT	XXXX.X	RANGE RATE
EL	XXX.XX	TARGET LINE OF SIGHT ELEVATION RELATIVE TO CHASER

TERMINAL PHASE INITIATE (CONTINUED)

AZ	XXX.XX	TARGET LINE OF SIGHT AZIMUTH RELATIVE TO CHASER
GET		TIME RANGE, RANGE RATE, AZIMUTH AND ELEVATION ARE VALID
	XX	(HR)
	XX	(MIN)
	XX	(SEC)

ENTRY UPDATE

PREBURN

X -	X -	AREA
X X - .	X X - .	ΔV TO
X X X	X X X	R400K
X X X	X X X	P400K
X X X	X X X	Y400K
+ .	+ .	RTGO .05G 63
+	+	VIO .05G
X X :	X X :	RET .05G
0 .	0 .	LAT 61
		LONG
X X :	X X :	RET .2G
		DRE 66
R L /	R L /	BANK AN
X X :	X X :	RET RB
X X :	X X :	RETBBO
X X :	X X :	RETEBO
X X :	X X :	RETDROG

POSTBURN

X X X	X X X	R400K
+ .	+ .	RTGO .05G 63
+	+	VIO .05G
X X :	X X :	RET .05G
X X :	X X :	RET .05G
		DRE 66
R L /	R L /	BANK AN
X X :	X X :	RETRB
X X :	X X :	RETBBO
X X :	X X :	RETEBO
X X :	X X :	RETDROG
		CHART UPDATE

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ENTRY UPDATE

AREA	XXX.XX	RECOVERY AREA (FIRST 3-LANDING REVOLUTION LAST 2 - RECOVERY AREA AND SUPPORT CAPABILITIES)
ΔV TO	XX.X	TAIL OFF VELOCITY READ IN EMS ΔV COUNTER
R400K	XXX	ROLL ENTRY GIMBAL ANGLE TO ASSURE CAPTURE
P400K	XXX	PITCH ENTRY GIMBAL ANGLE TO ASSURE CAPTURE
Y400K	XXX	YAW ENTRY GIMBAL ANGLE TO ASSURE CAPTURE
RTGO	+ XXXX.X	RANGE TO GO FROM 0.05G TO TARGET
VIO	+ XXXXX.	INERTIAL VELOCITY AT 0.05G
RET .05G	XX:XX	TIME FROM RETRO FIRE TO 0.05G (MIN:SEC)
LAT	XX:XX	LATITUDE OF TARGET POINT
LONG	XXXX.XX	LONGITUDE OF TARGET POINT
RET .2G	XX:XX	TIME FROM RETRO FIRE TO 0.2G (MIN:SEC)
DRE	XXXXX.X	DOWN RANGE ERROR AT 0.2G
BANK AN	XX/XX	BACKUP BANK ANGLE SCS TYPE ENTRY (ROLL LEFT/ROLL RIGHT)
RETRB	XX:XX	RET TO REVERSE BACKUP BANK ANGLE (MIN:SEC)
RETBBO	XX:XX	RET TO BEGIN BLACK OUT (MIN:SEC)
RETEBO	XX:XX	RET TO END BLACK OUT (MIN:SEC)
RETDROG	XX:XX	RET TO DROG DEPLOY (MIN:SEC)

ENTRY UPDATE (CONTINUED)

POSTBURN

R 400K	XXX	ROLL ENTRY GIMBAL ANGLE TO ASSURE CAPTURE
RTGO .05G	+XXXX.X	RANGE TO GO FROM 0.05G TO TARGET
VIO .05G	+XXXXX.	INERTIAL VELOCITY AT 0.05G
RET .05G	XX:XX	TIME FROM RETROFIRE TO 0.05G (MIN:SEC)
RET .2G	XX:XX	TIME FROM RETROFIRE TO 0.2G (MIN:SEC)
DRE	XXXX.X	DOWN RANGE ERROR AT 0.2G
BANK AN	XX/XX	BACKUP BANK ANGLE SCS TYPE ENTRY (ROLL LEFT/ROLL RIGHT)
RETRB	XX:XX	RET TO REVERSE BACKUP BANK ANGLE (MIN:SEC)
RETBBO	XX:XX	RET TO BEGIN BLACKOUT (MIN:SEC)
RETEBO	XX:XX	RET TO END BLACKOUT (MIN:SEC)
RETDROG	XX:XX	RET TO DROG DEPLOY (MIN:SEC)

SECTION II - DETAILED TIMELINE

FLIGHT PLAN ACTIVITIES SUMMARY

Day 0 (0-24)

1. CSM/S-IVB Orbital Operations
2. S-IVB Safing
3. S-IVB Take-over Demonstration
4. Transposition and Simulated Docking Approach with the S-IVB
5. SLA Photography
6. RCS Phasing
7. CSM System Checkout
8. Cryogenic Stratification Test 1
9. SXT Calibration Test
10. COAS Calibration

Day 1 (24-48)

1. SPS Burns 1 and 2
2. Rendezvous with S-IVB
3. S-IVB Post Rendezvous Tracking at 80 and 160 NM

Day 2 (48-72)

1. S-IVB Tracking at 320 NM
2. SCT Star Count Test 1
3. S005, S006 Photography

Day 3 (72-96)

1. WSMR LM RR Test 1
2. Landmark Tracking
3. SCT Star Count Test 2
4. S005, S006 Photography
5. SPS Burn 3
6. Slosh Damping Test 1
7. ECS Radiator Test

Day 4 (96-120)

1. Midcourse Navigation
2. Cryogenic Stratification Test 2

Day 5 (120-144)

1. SPS Burn 4
2. Slosh Damping Test 2
3. SCT Star Count Test 3
4. SPS Cold Soak
5. Landmark Tracking

Day 6 (144-168)

1. SPS Burn 5
2. Passive Thermal Control Test 1
3. Midcourse Navigation
4. Window Photography

Day 7 (168-192)

1. S005, S006 Photography
2. ECS Secondary Coolant Loop Test

Day 8 (192-216)

1. WSMR LM RR Test 2
2. SCT Star Count Test 1 (HD)
3. SCS Backup Align
4. SPS Burn 6
5. Passive Thermal Control Test 2,3.

Day 9 (216-240)

1. SPS Burn 7
2. SXT Calibration
3. PIPA BIAS and EMS BIAS
4. S005, S006 Photography

Day 10 (240-Deorbit)

1. Window Photography
2. Cryogenic Stratification Test 3
3. Deorbit Burn

FLIGHT PLAN

TIME	EVENT		REMARKS
-00:03	LCC:	REPORT IGNITION	NOMINAL LIFT-OFF 1500 GMT
00:00	LCC; CDR:	REPORT LIFT-OFF	CLOCK STARTS, L/O LIGHT, ENGINE LIGHTS OFF, UMBILICAL DISCONNECT, $tb_1 = 0$
00:10	CDR:	REPORT ROLL COMMENCE	
00:21	CDR:	REPORT PITCH TRACKING	
00:38	CDR:	REPORT ROLL COMPLETE	
00:50	MCC:	REPORT RATE CHANGE	
01:01	MCC:	REPORT MODE IB	PROP DUMP TO RCS CMD
01:17		MAX Q	
01:40	CDR:	REPORT EDS MANUAL OFF	EDS RATE AND ENG AUTO – OFF
01:50	MCC:	REPORT MARK, MODE IC	$h = 100,000$ ft (16.5NM)
02:10	MCC:	REPORT GO/NO GO FOR STAGING	
02:12	CDR:	REPORT GO/NO GO FOR STAGING	
02:23	CDR:	REPORT INBOARD OUT	
02:26	CDR:	REPORT OUTBOARD OUT	
02:27	CDR:	REPORT STAGING	
02:31	CDR:	REPORT ENGINE ON	
02:35	CDR:	REPORT SCALE CHANGE	
02:40	MCC:	REPORT TRAJECTORY GO/NO GO	
02:46	CDR:	REPORT TOWER JETT	TOWER JETTISONED @ J-2 IGNITION +15 sec
02:51	CDR:	REPORT GUIDANCE	
04:00	CMP:	REPORT S/C GO/NO GO	
	MCC:	REPORT GUIDANCE IS GO	
04:30	MCC:	REPORT TRAJECTORY GO/NO GO	

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FLIGHT PLAN

TIME	EVENT	REMARKS
05:00	LMP: REPORT S/C GO/NO GO	
06:00	CDR: REPORT S/C GO/NO GO	CDR: NOTE S-IVB PRESSURE DISPLAY
07:00	CMP: REPORT S/C GO/NO GO	GET ≈ 06:00 (Pg 4-96)
08:00	LMP: REPORT S/C GO/NO GO	
09:00	CDR: REPORT S/C GO/NO GO	
	MCC: REPORT TRAJECTORY AND CMC GO/NO GO	
09:27	MCC: REPORT MARK, MODE IV	
09:53	CDR: REPORT SECO	@ SECO $tb_4 = 0$
	S-IVB MAINTAINS CUTOFF INERTIAL ATT FOR 20 SEC	
	SECO +0.2: LOX VENT VALVE OPEN (closes in 40 SEC)	
	SECO +0.4: LH VENT VALVE OPEN (closes @ GET 30:53)	
SECO +20 SEC	S-IVB MANEUVERS TO LH AND INITIATES ORB RATE (HEADS DOWN)	
SECO +40 SEC	MCC: REPORT ORBITAL GO/NO GO	
	SECO +40.2: LOX VENT VALVE CLOSED	
	NOTE S-IVB LVPD AFTER LOX VENT VALVE CLOSES (Pg 4-96)	
12:40	BDA LOS: INSERTION CHECKLIST	APPROXIMATE TIME TO COMPLETE INSERTION CHECKS (TBD)
	C/W SYS PERIODIC VERIF	
	MOUNT ORDEAL & INITIALIZE	ORDEAL BOX MOVED FROM UNDER LH COUCH TO AREA BEHIND CDR'S HEAD

FLIGHT PLAN

TIME	EVENT	REMARKS
	UNSTOW TEMPORARY STORAGE BAGS (L-3)	
	SCS ATT REF CK (Pg 4-42)	
	SM/RCS MON CK	
	CM/RCS MON CK	
	EPS MON CK	
	ECS MON CK	
	ECS POST INSERTION CONFIG	ECS CONFIG CK COMPLETED AFTER CRO
17:41	CYI AOS MCC: REPORT: ⌈CMC LIFT-OFF TIME UPDATE � GET TIME HACK ⌊ORBITAL PARAMETERS	
23:29	CYI LOS	
30:53	SECO +1260.4: LH VENT VALVE CLOSES	
40:00	SUIT INTEGRITY CHECK	PRIOR TO GOING PARTIAL SUITED
53:41	CRO AOS MCC: REPORT: ⌈GO/NO GO 2-1 ⌊GET S-IVB PASSIVATION INITIATE	
	PARTIAL SUIT OPERATION (AS DESIRED)	
	CENTER COUCH TO 270° POSITION	CMP PREPARES FOR TRANSFER TO LEB
59:12	CRO LOS	

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FLIGHT PLAN

TIME	EVENT	REMARKS
1:01	CNB AOS:	
1:09	CNB LOS:	

CMP: UNSTOW AND SETUP

ITEM	LOCATION
CMP: REMOVE TOOL E FROM PGA AND COMPLETE ECS POST INSERTION CHECK	
70mm FILM MAG (2)	R-13
70mm H-BLAD	B-3
RING SIGHT	B-3
SPOTMETER	B-3
16mm SEQ CAM	B-3
16mm FILM MAG	B-3
18mm LENS	B-3
POWER CABLE	B-3
MIRROR RT. ANGLE	B-3
SEQ CAM BRACKET	A-8
HELMET STORAGE BAGS	A-8
G&N OPTICS	OPTICS CONTAINER
COAS	L/H WINDOW
COAS BULB	U-3
FLIGHT DATA AS REQD	

VHF DUP B (PRIOR TO GYM)

RECORD LVPD PRIOR TO S-IVB PASSIVATION
                    (Pg 4-96)

SELECT P47

REMARKS:

TOOL E REQD TO OPEN COOLANT PANEL 382

CONFIGURE H-BLAD FOR WINDOW AND SLA
PHOTOGRAPHY:
  70mm LENS
  RING SIGHT
  S0368
  F11, 1/250

CONFIGURE SEQ-CAM FOR SLA PHOTOGRAPHY
  18mm LENS
  S0368 FILM
  MOUNT IN RH WINDOW BRACKET

ENABLES MSFN TO MONITOR S/C ACCEL
DURING S-IVB PASSIVATION

1:16

FLIGHT PLAN

TIME	EVENT	REMARKS
01:31	GYM AOS	
	01:31 S-IVB PASSIVATION ENABLE	tb_4 + 4860 SEC
	01:33 START S-IVB LOX DUMP	tb_4 + 4902 SEC (12 MIN DURATION)
	01:33 LOX TANK NPV VALVE OPEN	tb_4 + 4914 SEC
	01:34 START COLD He DUMP	tb_4 + 5034 SEC, TERMINATED AT GET 02:30
	01:45 LOX DUMP COMPLETED	tb_4 + 5621 SEC
	01:45 S-IVB PASSIVATION DISABLE	tb_4 + 5625 SEC
	RECORD LVPD AFTER S-IVB PASSIVATION (Pg 4-96)	
	RETURN TO P00	
01:46	MCC: UPDATE STAR CHART ASCENDING NODE	IF NOT RECEIVED PRE-LAUNCH
01:48	BDA LOS	
	VHF SIM A	
	JETTISON OPTICS COVERS	
02:09	P52 IMU REALIGN (OPTION 3) (REALIGNS TO PAD REFSMMAT)	
02:27	CMP: RETURN TO COUCH FOR S-IVB TAKEOVER AND CSM/S-IVB SEP	
02:28	CRO AOS: APOLLO 7: REPORT GYRO TORQUE ANGLES	
	MCC: REPORT GO/NO GO FOR S-IVB TAKEOVER DEMONSTRATION GIVE 25 min TIME HACK TO S-IVB/CSM SEPARATION REPORT GET S-IVB PITCH DOWN AND INERTIAL MANEUVER UPDATE STATE VECTOR AS REQD	NOTE: S-IVB TAKEOVER DEMONSTRATION DEPENDENT UPON COMPLETION OF P52.

FLIGHT PLAN

TIME	EVENT	REMARKS
02:30	PREPARE FOR S-IVB TAKEOVER INITIATE S-IVB MANUAL ATTITUDE CONTROL DEMONSTRATION PLANNED MANEUVERS (Pg 4-93)	NOTE: VERIFY CONTROL ENABLE EACH AXIS PRIOR TO PLANNED MANEUVERS

MANEUVER	MANEUVER TIME
-P FOR 9°	30 SEC
STOP RATE,HOLD ATT	10 SEC
+P FOR 30°	100 SEC
STOP RATE,HOLD ATT	10 SEC
-R FOR 20°	40 SEC
STOP RATE,HOLD ATT	20 SEC
+R FOR 20°	40 SEC
STOP RATE,HOLD ATT	20 SEC
-Y FOR 15°	50 SEC
STOP RATE,HOLD ATT	10 SEC
+Y FOR 15°	50 SEC
STOP RATE,HOLD ATT	10 SEC
	420 SEC

S-IVB MANEUVER RATES:
  R RATE 0.5°/SEC
  P, Y RATE 0.3°/SEC

TIME	EVENT	REMARKS
02:34	CRO LOS AT COMPLETION OF S-IVB TAKEOVER, UP TLM CMD RESET SW TO RESET THEN NORM.	
02:37	END S-IVB MANUAL CONTROL TEST	S-IVB RETURNS TO I/U TIMELINE
02:38	INITIATE S-IVB SEP PREPARATION CHECKLIST	
02:46	PERFORM WINDOW PHOTOGRAPHY (Pg 4-100)	ARIA COVERAGE 2:34 TO 2:44
02:43	S-IVB PITCHES DOWN 20° AND MAINTAINS ORB RATE	
02:51	S-IVB GOES INERTIAL	

FLIGHT PLAN

TIME	EVENT	REMARKS
02:54	HAW AOS	
	HAW: REPORT GO/NO GO FOR PYRO ARM	
02:55	CSM/S-IVB SEPARATION AND TRANSPOSITION	DSE HBR REQD FOR CSM/S-IVB SEP.
		SEP & TRANSPOSITION SEQUENCE
		+X FOR 3 SEC. ΔV 1.05 FPS
	INITIATE POSTSEP CHECKLIST	COAST 1 MIN 10 SEC. DISTANCE 70 FT.
		−X FOR 1-1/2 SEC. ΔV 0.5 FPS
		PITCH UP 180° @ 5°/SEC
		ROLL LEFT 60° @ 2°/SEC
03:03	US AOS S-IVB SIMULATED DOCKING APPROACH	
	S-IVB FORMATION FLYING AND SLA PHOTOGRAPHY (Pg 4-79)	
03:07		
	MCC: UPDATE INITIAL PHASE MANEUVER	
	REPORT ON VOICE QUALITY DSE DUMP	
03:17	S-IVB MANEUVERS TO RETRO ATT	NOTE: S-IVB RETRO MANEUVER WILL BE IN-HIBITED UNTIL AFTER CSM PHASING MANEUVER.
	TERMINATE FORMATION FLYING	
	P47 THRUST MONITOR	
03:20	INITIAL PHASE (ΔV - 7.5 fps)	RETROGRADE
03:24	VAN LOS	
03:30	ACN AOS CMP TO LEB	
03:38	ACN LOS CHECK THIRD INVERTER	RECORD INVERTER PHASE VOLTAGES
	CMP: UNSTOW FOOD AND PREPARE MEALS, AS REQD	
04:02	CRO AOS	ARIA COVERAGE 4:10 TO 4:18

FLIGHT PLAN

TIME	EVENT	REMARKS
04:08	LMP: REPORT PYRO A, B VOLTS	
	REPORT BAT C VOLTAGE	
	REPORT INVERTER PHASE VOLTAGE	
04:10	CRO LOS	
04:16	ECS REDUNDANT COMPONENT CHECK	MAIN 02 REG VLV CHECK SHOULD BE MADE OVER MSFN. COMPLETE SECONDARY COOLANT LOOP CHECK WITHIN 20 MIN TO AVOID OVERHEATING SCE AND DSE.
04:27	HAW AOS	
04:40		
	PIPA BIAS AND EMS ΔV BIAS TEST (Pg 4-33 and 4-35)	TEST REQUIRES $\approx$ 5 MIN.
04:45	UPDATE STATE VECTOR	
	REFSMMAT (for 6-4)	
	MCC: TGT LOAD (for 6-4)	
	NAV CHECK	
	MANEUVER PAD (for 6-4)	
	DAY RETRO TEST DATA (Pg 4-89)	
	URINE DUMP CHECK	A DUMP SHOULD BE COMPLETED PRIOR TO 6-4
	P30 EXTERNAL ΔV	
04:59	ANG LOS	
05:06	ASC AOS	
	MCC: UPDATE F/C PURGE TIME	
05:09	P52 IMU REALIGN (OPTION 1)	FOR RETRO ORIENTATION CHECKS
05:13	ASC LOS	
05:37	CRO AOS P40 SPS THRUSTING CHECK	TO CHECK OF GIMBAL MOTORS
05:38	H_2 PURGE HTR - ON	

FLIGHT PLAN

TIME	EVENT	REMARKS
05:44	CRO LOS	
05:48	GWM AOS	ARIA COVERAGE 5:43 TO 5:52
05:56	GWM LOS	
06:03	HAW AOS	
06:10	DAY RETRO TEST (Pg 4-89)	
	F/C PURGE	NOTE: VENTING EFFECTS DURING PURGE
	MCC: UPDATA STATE VECTOR	
	NIGHT RETRO TEST DATA (Pg 4-89)	
	NAV CHECK	
06:17		
06:31	ANG LOS	
06:39		
06:53	NIGHT RETRO TEST (Pg 4-89)	
07:15	SXT/STAR CHECK	
07:22	MER AOS	
	MCC: REPORT GO/NO GO 17-1	
07:31	GWM LOS	
07:38	HAW AOS	
07:55	GYM LOS	
08:08	VENT BATTERIES	CMP SLEEP PERIOD
08:45		
08:55	MER AOS ESTIMATED 6-4 GETI	
09:03	MER LOS POWER DOWN FQ INST	
09:13	HAW AOS DOFF SUITS (CDR,LMP)	

FLIGHT PLAN

TIME	EVENT	REMARKS
09:26	HAW LOS	
	NOTE: GNCS, SCS REMAINS POWERED UP UNTIL S-IVB POST RNDZ TRACKING IS COMPLETED.	
	BIOMED SWITCHING TBD	

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FLIGHT PLAN

10:00

COMPLETE UNSTOWAGE

CANISTER CHANGE NO. 1

:30

MER

SELECT DUP A

HAW USB MODE 6.11
FM MODE F6

HAW

11:00

HUMIDITY SURVEY
(Pg 4-59)

RED

8

:30

CRYOGENIC STRATIFICATION
TEST (Pg 4-62)

12:00

CMP
SLEEP
PERIOD

9

12:00

MER

SELECT SIMP B

HAW

:30

P52 IMU REALIGN
(Option 3)
(Pg 4-33)

RED

13:00

ACN

:30

SELECT SIMP A

MER

FLIGHT PLAN STATUS REPORT

GWM

14:00

CMP
SLEEP
PERIOD

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	10:00-14:00	0/7-9	2-12

TABLE IV

TYPICAL

HOUSEKEEPING CONFIGURATION

ITEM	VOLUME	NO. UNSTOWED	INFLIGHT LOCATION
16mm Camera	Vol B3	1	W/Crew or Temp Stow F 1 or 2
16mm Film Mag	Vol B3	3	In Temp Stowage-F 1 or 2 or Bag
18mm Lens	Vol B3	1	In Temp Stow
Power Cable	Vol B3	1	On Panel 227 or PL100
Mirror Rt. Angle	Vol B3	1	On Cam. or Temp Stow
70mm Hasselblad	Vol B3	1	In Temp Stow (Vol F1)
70mm Mag	Vol R13	2	In Temp Stow (Vol F1)
Ring Sight	Vol B3	1	In Temp Stow
Spotmeter	Vol B3	1	In Temp Stow or on Cam
Flt. Data File		As Req'd	In Temp Stow or in Vol R12
Tissue Dispenser		3	In Temp Stow
Helmet Stow Bag W/Helmet			Selectable
Inflt. Coveralls		3	On Crew
Window Shades			On Windows
Temp Stow Bags	U3		1 on RT Hand & LH Girth Ring
Tool Set	A1	1	On A3
CWG Adapter	A8	3	On Crew
CCU Control Head		3	On Crew
O2 Umbilicals		3	Stowed in CM
Seq. Cam. Brt.	A8	1	Mt. on R/H Rend. Wind.
CCU Cable		3	On Crew
Urine Filters	R1	2	Mt. on Panel
COAS & Bulb	Vol U3		LH window
Light wt headset	A8		On Crew

FLIGHT PLAN

14:00

RED

$\overline{10}$

:30

ACN

CDR,
LMP
EAT
PERIOD

CMP
SLEEP
PERIOD

16:00

:30

15:00

MER

GWM

CMP
EAT
PERIOD

CDR,
LMP
SLEEP
PERIOD

:30

RED

$\overline{11}$

16:00

$\overline{12}$

17:00

MER

GWM

HUMIDITY SURVEY
(Pg 4-59)

CDR,
LMP
SLEEP
PERIOD

RED

:30

CYI

18:00

MAD
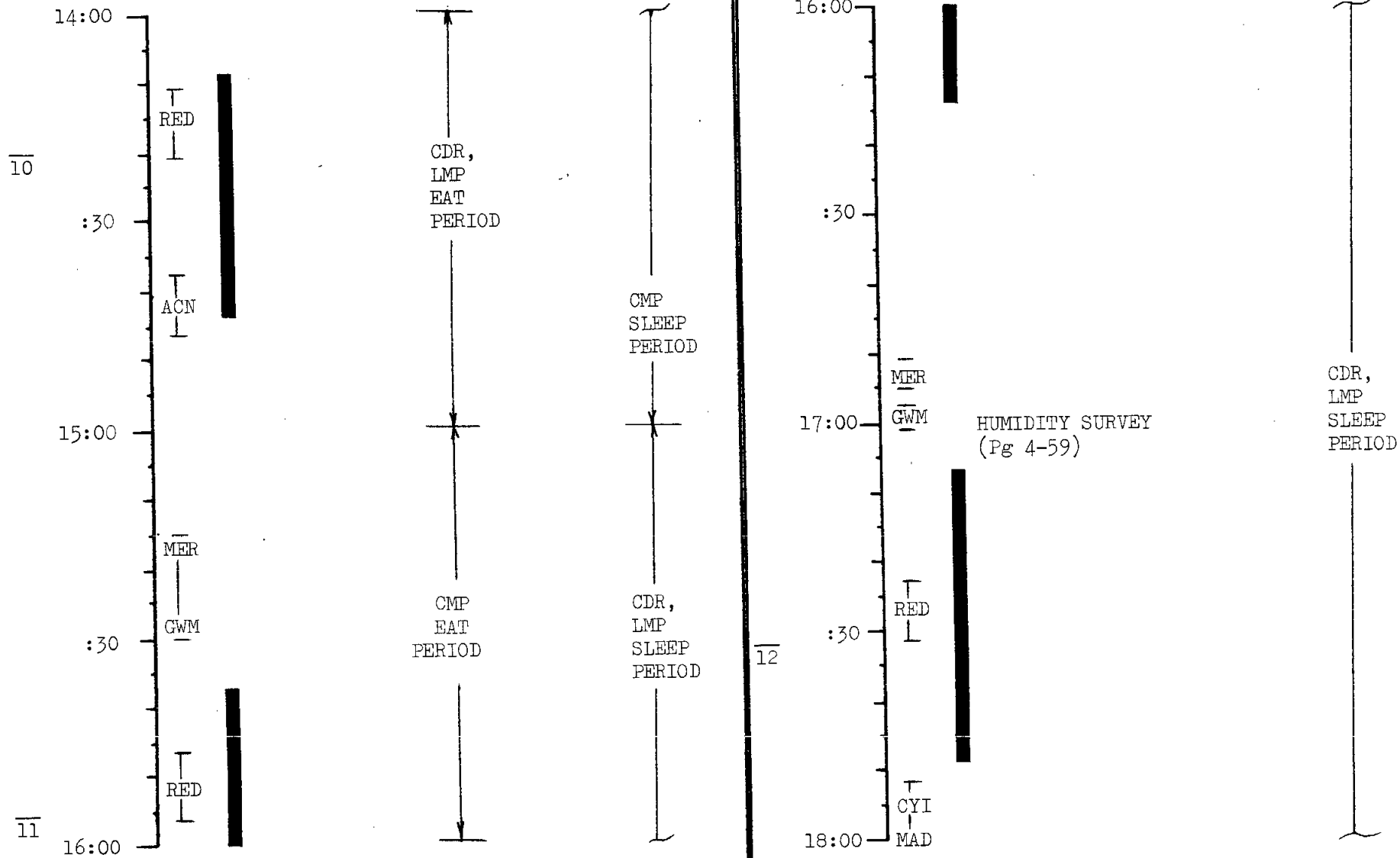
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	14:00-18:00	0/9-12	2-14

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

18:00 — MAD

:10

:20

:30

P52 IMU REALIGN
(Option 3)
(Pg 4-33)

:40   CNB

:50

19:00 — RED

13

CDR,
LMP
SLEEP
PERIOD

19:00 — RED

:10   FLIGHT PLAN UPDATE

ANG
:20

VAN

CYI
:30

MAD

:40

:50

20:00

CDR,
LMP
SLEEP
PERIOD
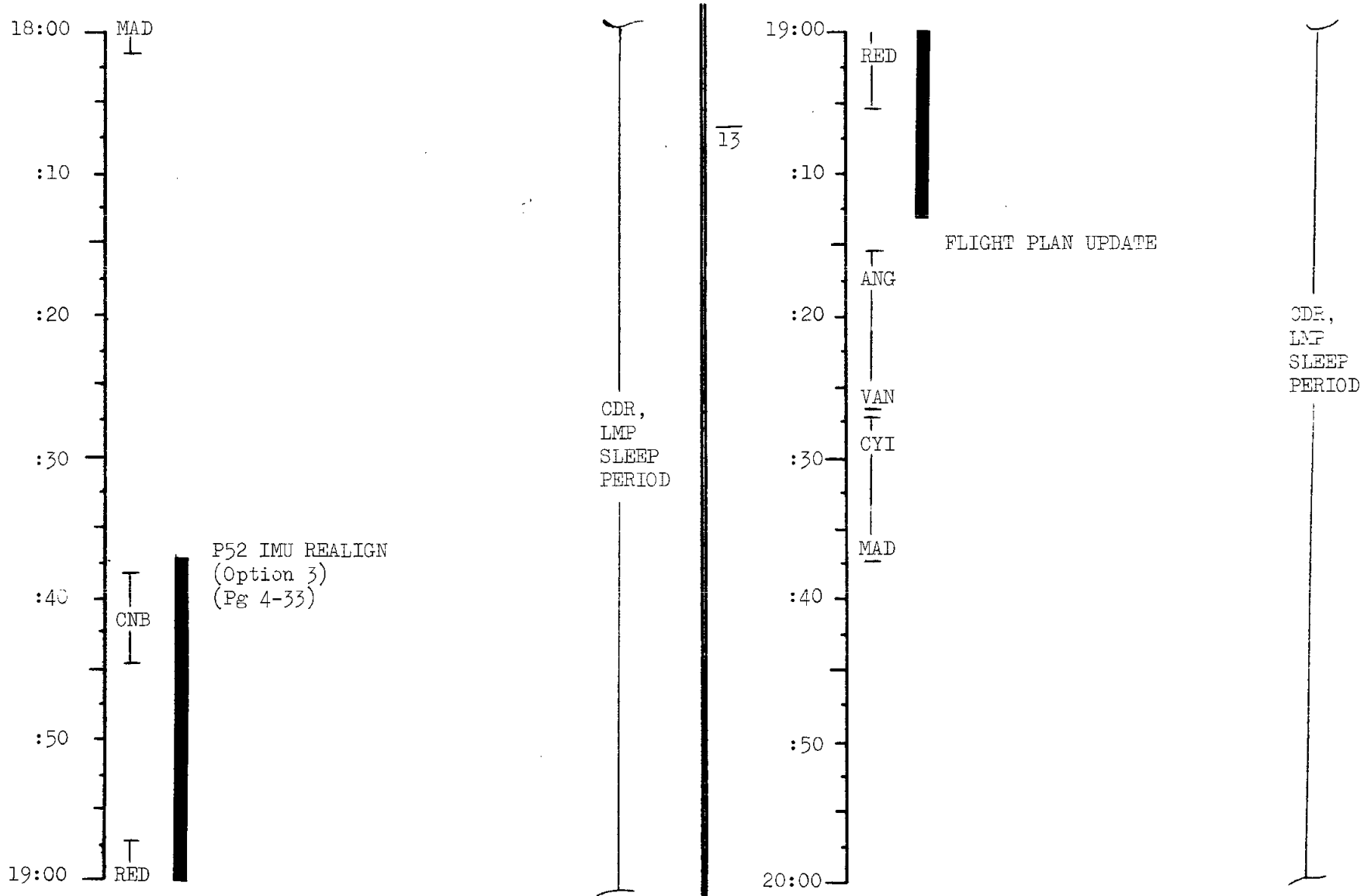
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	18:00-20:00	0/12-13	2-15

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

20:00

CRO

SXT CALIBRATION TEST
(Pg 4-3)

:10

CNB

:20

:30

RED

:40

H₂ PURGE LINE HTR - ON

14

:50

GBM

MCC UPDATE: LANDING AREA
BLOCK DATA NO. 3

21:00

CDR,
LMP
SLEEP
PERIOD

21:00   F/C PURGE

:10   MAD

CANISTER CHANGE NO. 2

:20

:30

COAS CALIBRATION CHECK
(Pg 4-112)

:40

:50   CNB

22:00

CDR,
LMP
SLEEP
PERIOD

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	20:00-22:00	0/13-14	2-16

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

22:00

CMP DOFF SUIT

:10

EAT
PERIOD
ALL

15   :20   TEX

MCC UNDERLINE UPDATE: STATE VECTOR
TGT LOAD
MANEUVER PAD
NAV CHECK
T ALIGN

:30

P30 EXTERNAL ΔV

:40

CYI

DAP DATA LOAD CK

:50

23:00

23:00

P52 IMU REALIGN
(Option 2)

:10   CRO

:20

FINE ALIGN CHECK

CNB

:30

(S-IVB ACQ LIGHTS ON)

:40

SELECT P00

:50   GYM

24:00   SET ORDEAL

16
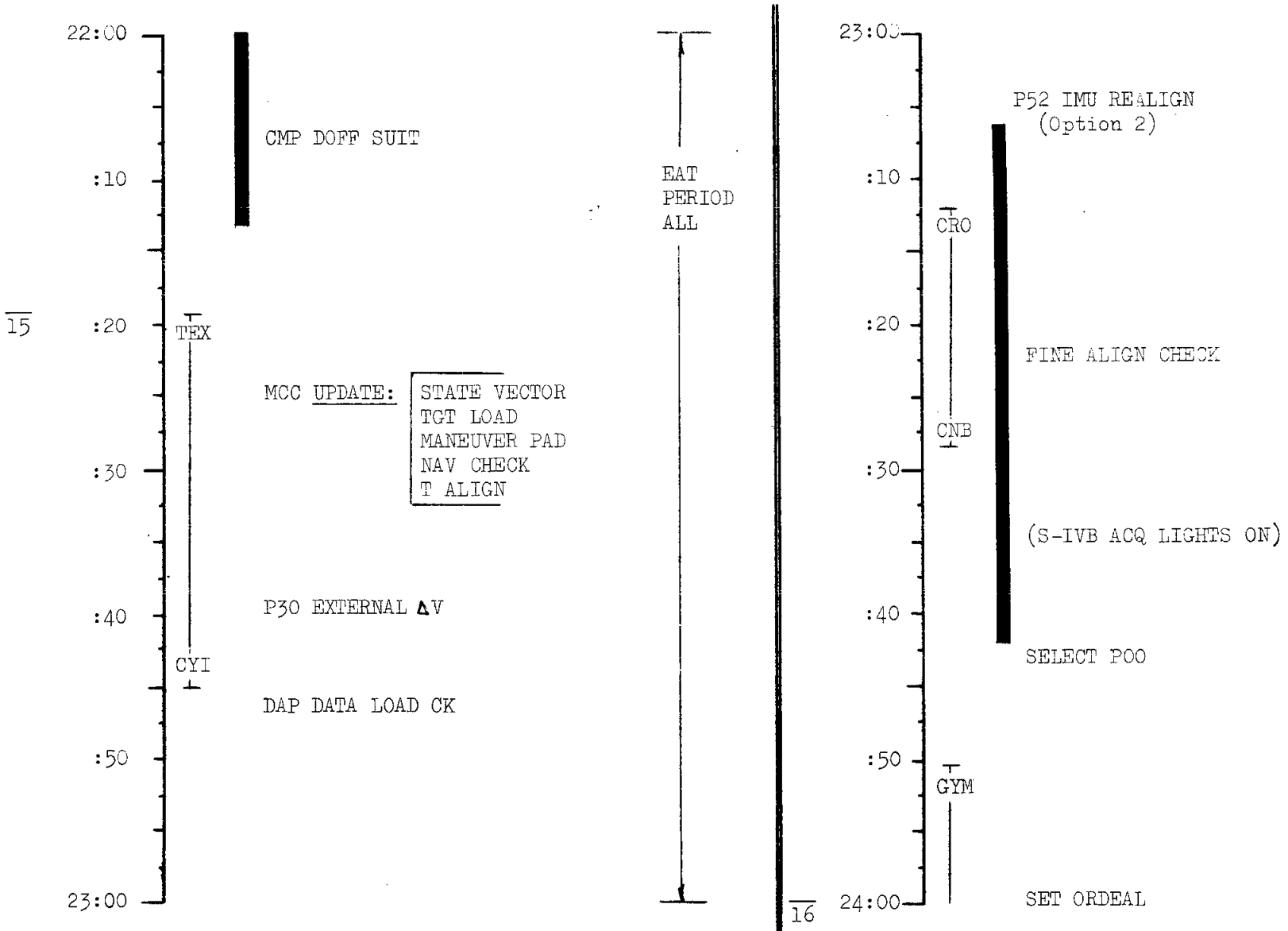
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	22:00-24:00	0/14-16	2-17

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

24:00

:10 PIPA BIAS TEST
     (If IMU has been
     powered down)

CYI
:20

25:00 CNB

:10

HAW
:20

ARIA 2
24:37 to
24:47

17

:30 P52 IMU REALIGN
     (Option 3)

:30 SELECT P00
     MCC UPDATE: STATE VECTOR
                 TGT LOAD
                 MANEUVER PAD

:40 P30 EXTERNAL ΔV
     PERFORM EMS ΔV TEST

:40

FINE ALIGN CHECK

VAN P40 CSM-SPS THRUSTING

CRO SELECT P00
     ALIGN GDC TO IMU
     VERIFY ORDEAL
:50 P20 RNDZ NAVIGATION
     (Track S-IVB, mark
     if desired)

:50 CYI (Auto maneuver to thrust attitude)

ACN SXT/STAR CHECK

     P52 IMU REALIGN
       (Option 3)

25:00

26:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	24:00-26:00	1/16-17	2-18

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

FINE ALIGN CHECK

P40 CSM-SPS THRUSTING

ARIA 2
26:12 to
26:22

SELECT S-BAND ANT _____

ALIGN GDC TO IMU

26:25 SPS BURN 1
G&N

4-JET ULLAGE
BT: 10.1 SEC
ΔV: 208 fps

P20 RNDZ NAVIGATION
(Track S-IVB, mark if desired)

ARIA 3
26:30 to
26:40

HAW FM MODE F1

SET ORDEAL

26:00

:10

:20

:30

:40

:50

27:00

CRO

HAW

27:00

18

MCC UPDATE: NCC2 RCS/SPS DECISION

P30 EXTERNAL ΔV
PERFORM EMS ΔV TEST

P40 CSM-SPS THRUSTING

ANG

ALIGN GDC TO IMU

P47 THRUST MONITOR

ACN

27:30 NCC2
P30 EXTERNAL ΔV
PERFORM EMS ΔV TEST

P52 IMU REALIGN
(Option 3)

P40 CSM-SPS THRUSTING

SXT/STAR CHECK

ALIGN GDC TO IMU

CRO

28:00 SPS BURN 2
G&N

4-JET ULLAGE
BT: 8 SEC
ΔV: 185.6 fps

:10

:20

:30

:40

:50

28:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	26:00-28:00	1/17-18	2-18

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

28:00 — CRO

NULL VG'S WITH RCS

P20 RNDZ NAVIGATION

P34 TPI PRETHRUST

:10 —

GWM

:20 —

S-IVB TRACKING (10 marks)

HAW

:30 —

(DECISION ON TPI TIG
WINDOW — 29+11-29+41)

SET ORDEAL

:40 —

ALIGN GDC TO IMU
S-IVB TRACKING (5 marks)

:50 —

MCC UPDATE: TPI DATA

ANG

S-IVB TRACKING (3 marks)

29:00 —

ARIA 3
28:10 to
28:20

29:00 — ACN

S-IVB TRACKING (7 marks)

:10 —

BORESIGHT ON S-IVB

:20 —

COMPARE TPI SOLUTIONS

29:23 TPI

MANEUVER TO NAV TRACK ATT
(Make one phony mark)

BORESIGHT ON S-IVB WITH SXT

:30 — CRO

P41 RCS THRUST
29:37 MCC1

BORESIGHT ON S-IVB WITH SXT
P41 RCS THRUST

:40 —

29:50 MCC2

GWM

:50 —

P47 THRUST MONITOR

BRAKING GATE
R=1.0 NM/RDOT TO 25 fps
R=0.5 NM/RDOT TO 15 fps
R=0.25 NM/RDOT TO 10 fps
R=1000 FT/RDOT TO 5 fps

30:00 — HAW

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	28:00-30:00	1/18-19	2-20

MSC FORM 1186 (SEP 67)

19

FLIGHT PLAN

30:10 STATION KEEPING

MCC UPDATE: FINAL SEP BURN

30:20 FINAL SEP BURN
RCS ΔV, (ΔV +2fps)
(POSIGRADE)
SLOSH DAMPING TEST
(Pg 4-104)

INITIATE BATTERY CHARGE

WATER CHLORINATION

HAW USB MODE 8.8

TEX

MER
GWM

HAW

GYM

EAT
PERIOD,
ALL

CMP
SLEEP
PERIOD

HUMIDITY SURVEY

ECS REDUNDANT
COMPONENT CHECK

HAW USB MODE 7.1

H_2 PURGE LINE HTR - ON

CANISTER CHANGE NO. 3

MER

HAW

HTV

CMP
SLEEP
PERIOD

30:00

:30

31:00

:30

32:00

32:00

:30

33:00

:30

34:00

20

22

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	30:00-34:00	1/19-22	2-21

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

34:00 — F/C PURGE

FLIGHT PLAN STATUS REPORT :

:30 — MER

HAW USB MODE 8.8

HAW

35:00 — RED

23

ACN

:30 —

36:00 —

CMP
SLEEP
PERIOD

24

36:00 — MER
GWM

:30 — RED

37:00 — ACN

:30 — MER

GWM USB MODE 6.3

GWM

38:00 —

CMP
SLEEP
PERIOD

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	34:00-38:00	1/22-24	2-22

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

38:00

RED

25

ACN

:30

39:00

MER

MCC UPDATE:

GWM

:30

P52 IMU REALIGN
(Option 2)

RED

26

40:00

CDR & LMP
EAT
PERIOD

CMP
SLEEP
PERIOD

CSM & S-IVB
STATE VECTOR
(time tag to SR)
LANDING AREA
BLOCK DATA NO. 5
S-IVB TRACKING TEST
(Pg 4-22)

40:00

CYI

:30

41:00

RED

27

:30

ANG

CYI

MAD

42:00

P20 RNDZ NAVIGATION
(Pg 4-22)
S-IVB TRACKING AT 80 NM

CMP
SLEEP
PERIOD

CMP
EAT
PERIOD

CDR,
LMP
SLEEP
PERIOD
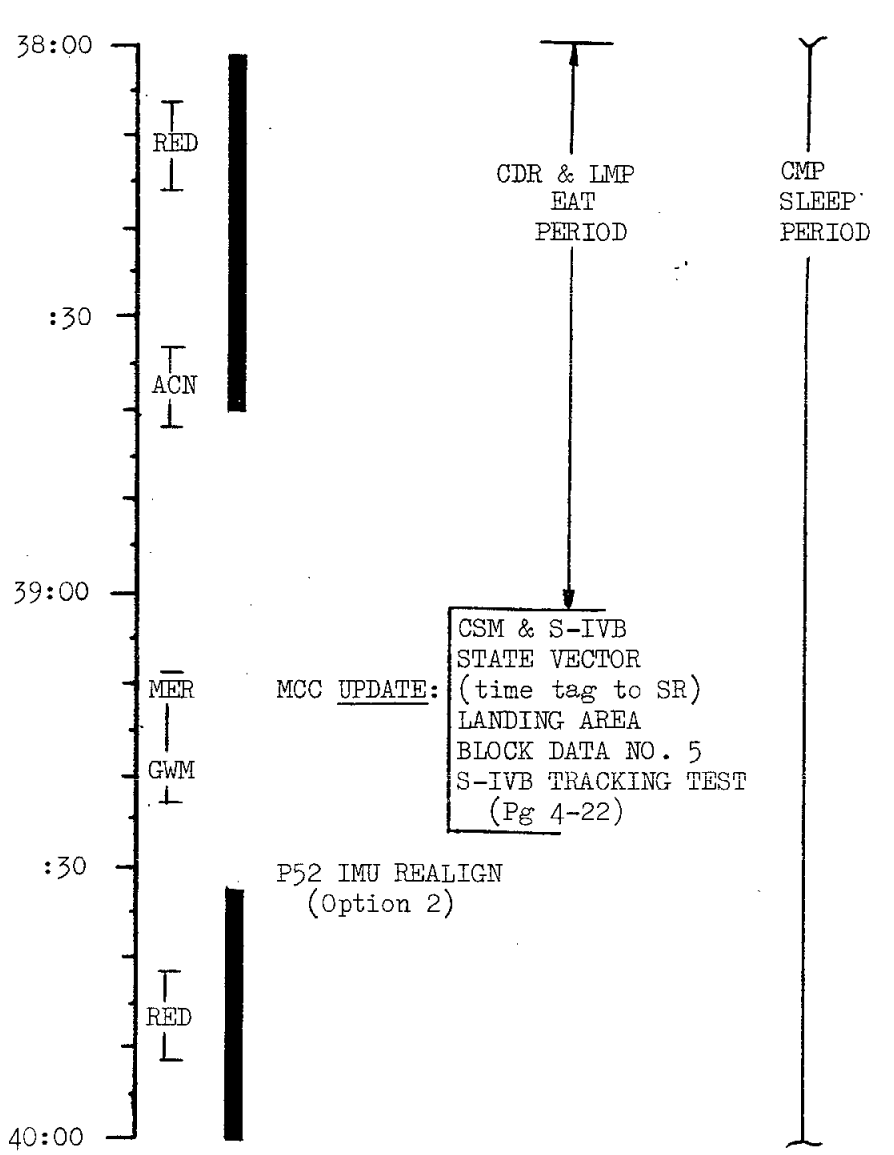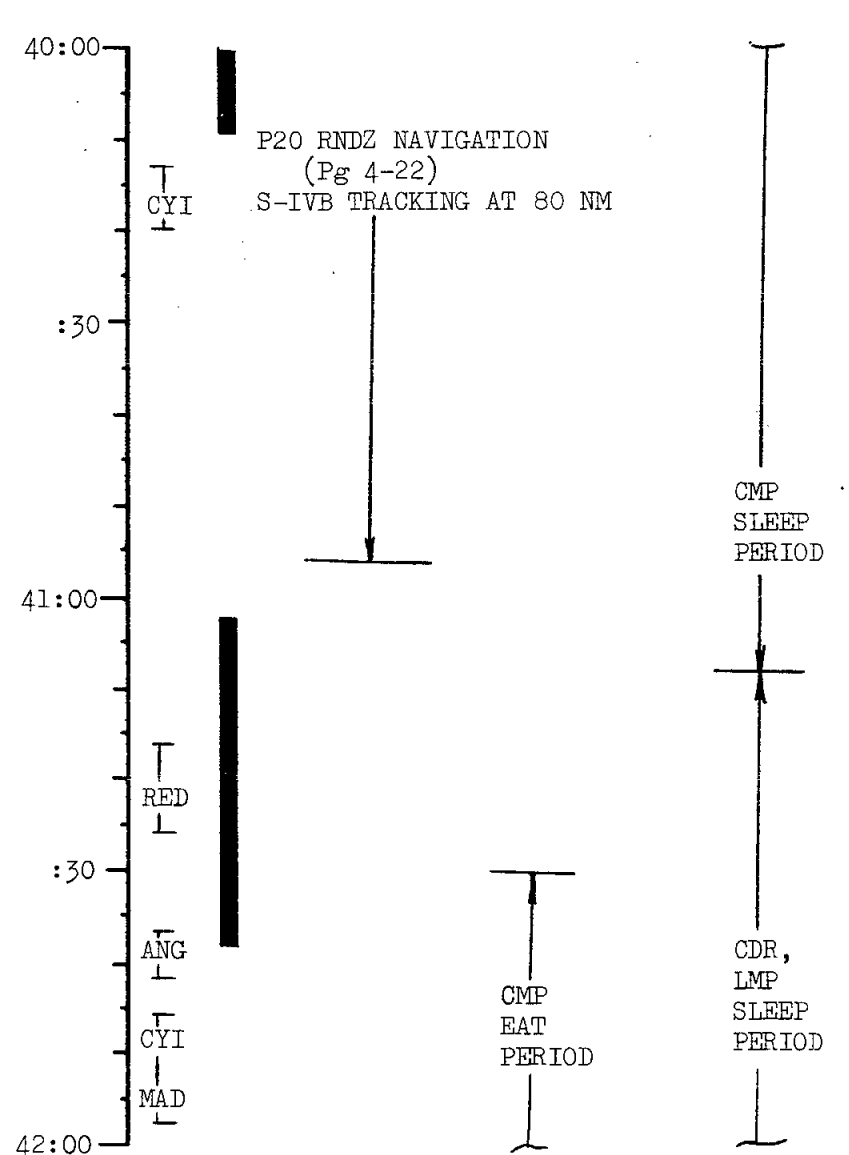
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	38:00-42:00	1/24-27	2-23

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

42:00

:30

CNB

RED

43:00

VAN — FLIGHT PLAN UPDATE

:30

MAD

CRO

44:00

CDR,
LMP
SLEEP
PERIOD

29

44:00

CNB

:30 — RED

MIL · MCC UPDATE: CSM & S-IVB
STATE VECTOR
(Time tag to SR)
S-IVB TRACK DATA
(P4-22)

45:00

MAD

:30 CRO — P52 IMU REALIGN
(Option 2)

CNB

46:00

CDR
LMP
SLEEP
PERIOD
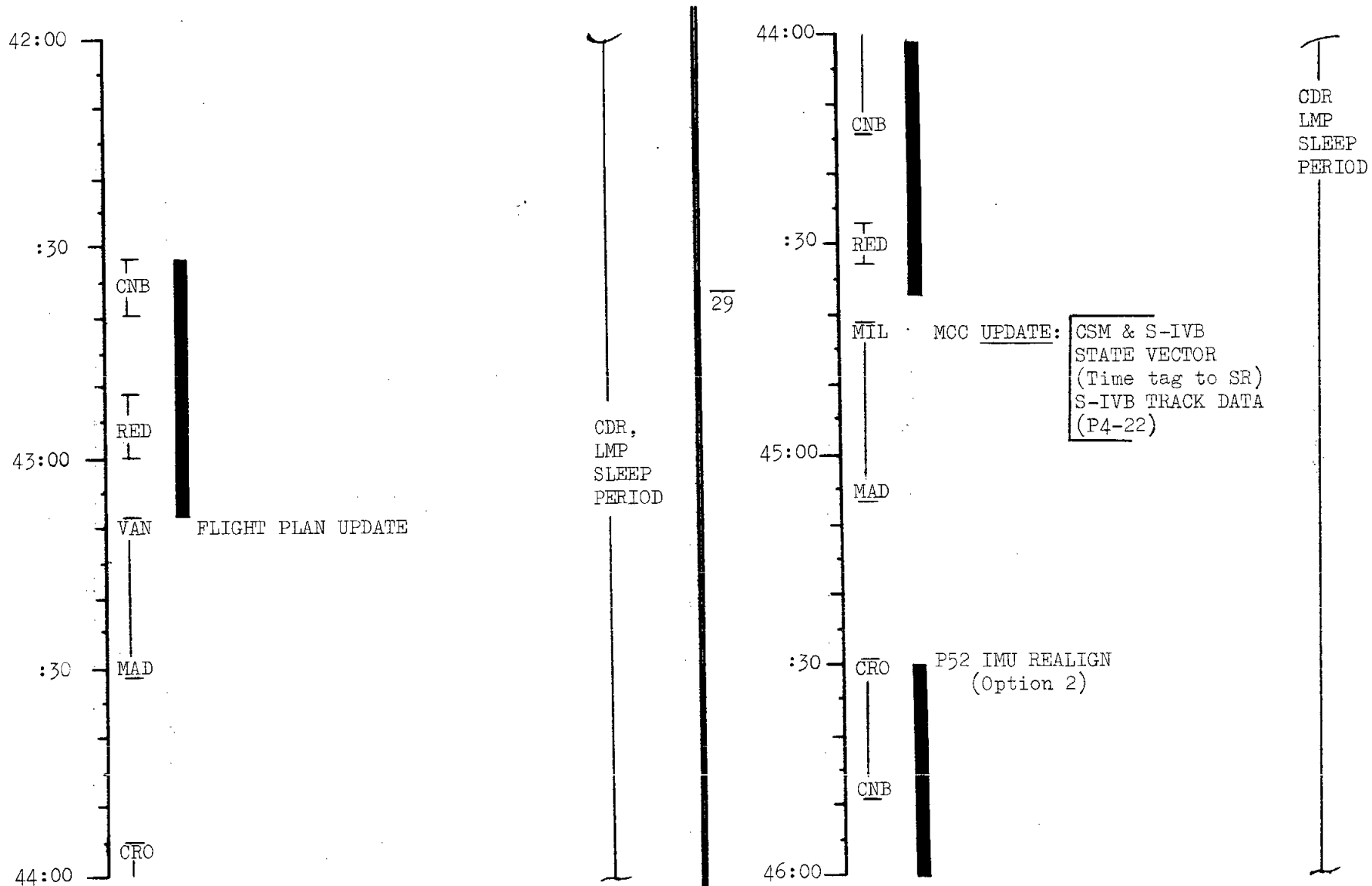
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	42:00-46:00	1/27-29	2-24

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

46:00

30̄

GY̅M

P20 RNDZ NAVIGATION
     (Pg 4-22)
S-IVB TRACKING AT 160 NM
(Check auto maneuver to
tracking att and auto
optics positioning)

:30

CYI

47:00

CR̅O

CANISTER CHANGE NO. 4

CNB

:30

HT̅V
GD̅S

3̄1̄

CDR,
LMP
SLEEP
PERIOD

3̄2̄

48:00

CYI

ARIA 1
48:31 to
48:41

:30

CR̅O

MCC UPDATE: LANDING AREA
               BLOCK DATA NO. 6

CNB

49:00

HA̅W

CDR,
LMP
SLEEP
PERIOD

:30

VA̅N

AC̅N

H$_2$ PURGE LINE HTR – ON

50:00

48:00
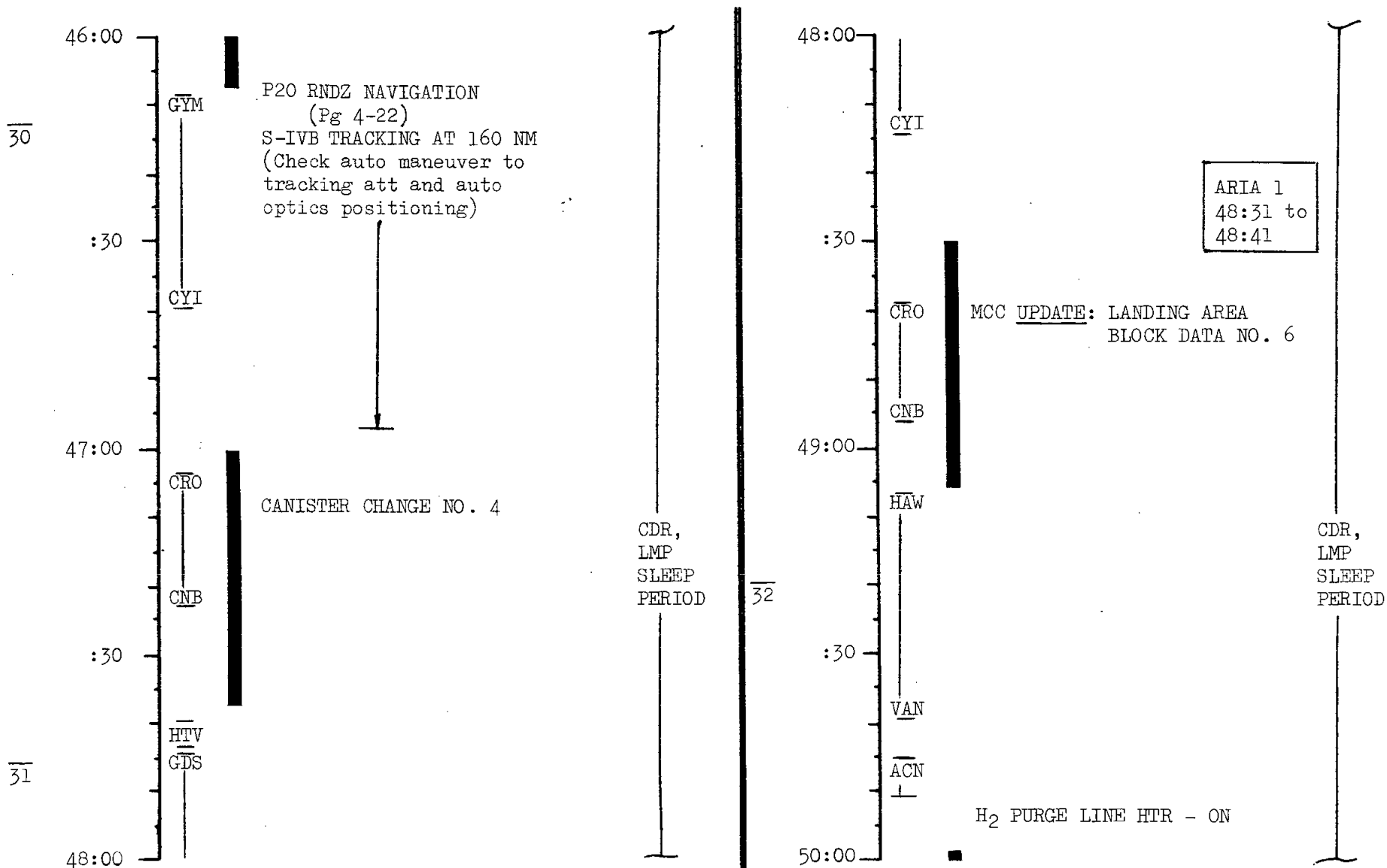
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	46:00-50:00	1-2/29-32	2-25

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

$\overline{33}$

50:00

CRO

F/C PURGE

:30

HAW

MCC UPDATE: CSM AND S-IVB STATE VECTOR (Time tag to SR) S-IVB TRACK DATA (Pg 4-22) SCT STAR COUNT (Pg 4-6)

ANG

51:00

ACN

P52 IMU REALIGN (Option 2)

:30

CRO

52:00

ARIA 1
50:05 to
50:15

CDR,
LMP
SLEEP
PERIOD

EAT
PERIOD
ALL

$\overline{34}$

52:00

GWM

HAW

P20 RNDZ NAVIGATION
(Pg 4-22)
S-IVB TRACKING AT 320 NM

:30

ANG

ACN

53:00

WATER CHLORINATION

SCT STAR COUNT-MODE A
(Pg 4-6)

:30

GWM

HAW
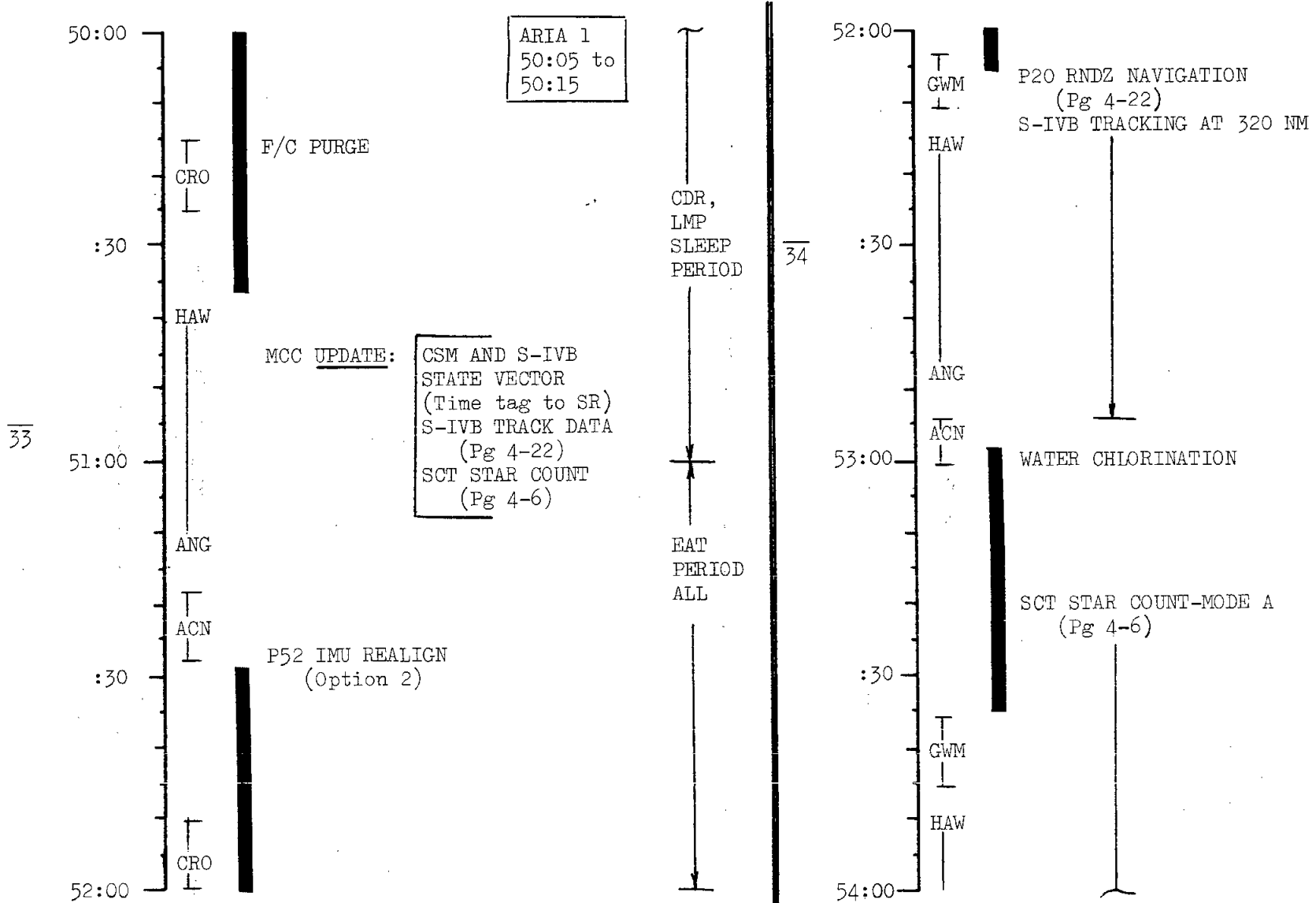
54:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	50:00-54:00	2/32-34	2-26

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

SCT STAR COUNT – MODE A

54:00 — TEX

35̄

:30 —

P06 GNCS POWER DOWN
SCS POWER DOWN

55:00 —

MER
GWM

HAW

:30 —

HTV

CMP
SLEEP
PERIOD

36̄ 56:00 —

37̄

56:00 —

HUMIDITY SURVEY

:30 —

ECS REDUNDANT
COMPONENT CHECK

MER

HAW USB MODE 7.1

57:00 — HAW   MCC UPDATE: LANDING AREA
                        BLOCK UPDATE NO. 7

HTV

CMP
SLEEP
PERIOD

:30 —
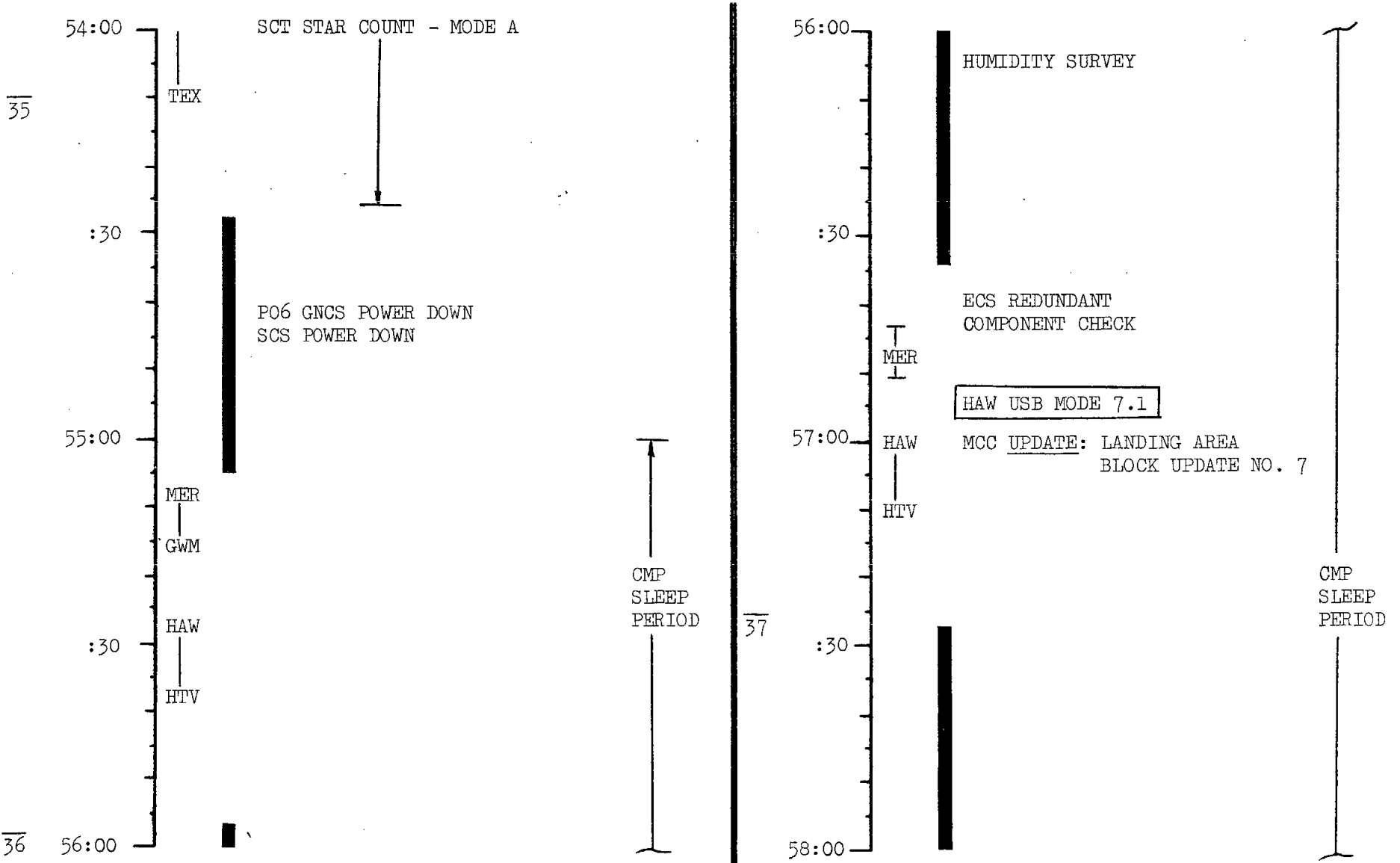
58:00 —

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	54:00-58:00	2/34-37	2-27

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

58:00 —

CANISTER CHENGE NO. 5

FLIGHT PLAN STATUS REPORT

MER

:30 —

HAW USB MODE 6.2

HAW

RED

59:00 —

$\overline{38}$

ACN

:30 —

MER

60:00 —

CMP
SLEEP
PERIOD

$\overline{39}$

60:00 —

GWM

RADAR TRANSPONDER SELF TEST
(GO/NO GO FOR WSMR TEST)

:30 —

RED

ACN

61:00 —

CMP
SLEEP
PERIOD

CDR,
LMP
EAT
PERIOD

MER

:30 —

GWM USB MODE 8.4

GWM
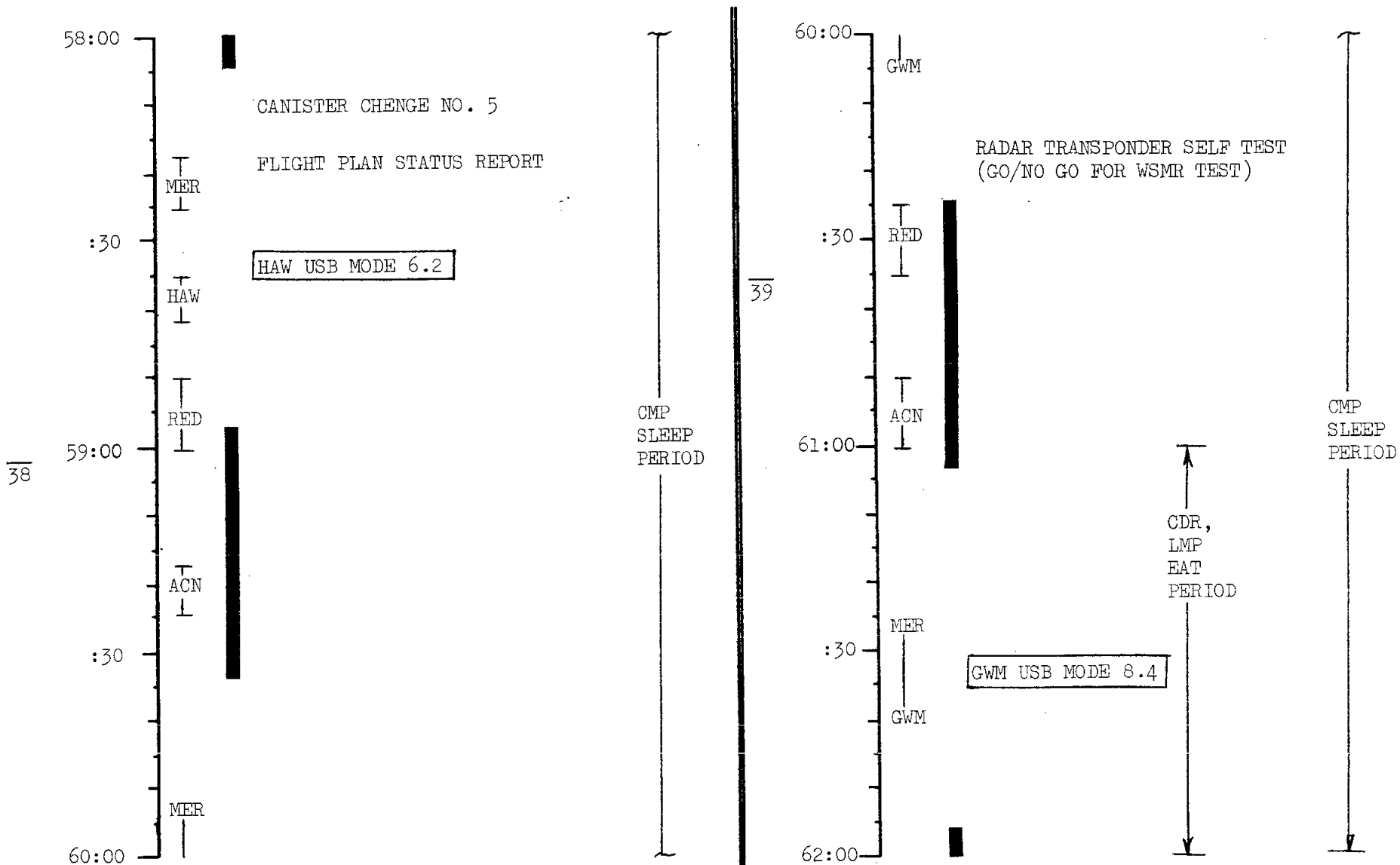
62:00 —

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	58:00-62:00	2/37-39	2-28

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

62:00

40

RED

ACN

:30

CMP
EAT
PERIOD

63:00

MER

GWM

GWM USB MODE 6.2

:30

S005, S006 PHOTOGRAPHY
(REV's 41, 42, Pg 4-108)

RED

41

64:00

CDR,
LMP
SLEEP
PERIOD

42

64:00

CYI

:30

65:00

RED

:30

ANG

CYI

MAD

66:00

FLIGHT PLAN UPDATE

CDR,
LMP
SLEEP
PERIOD
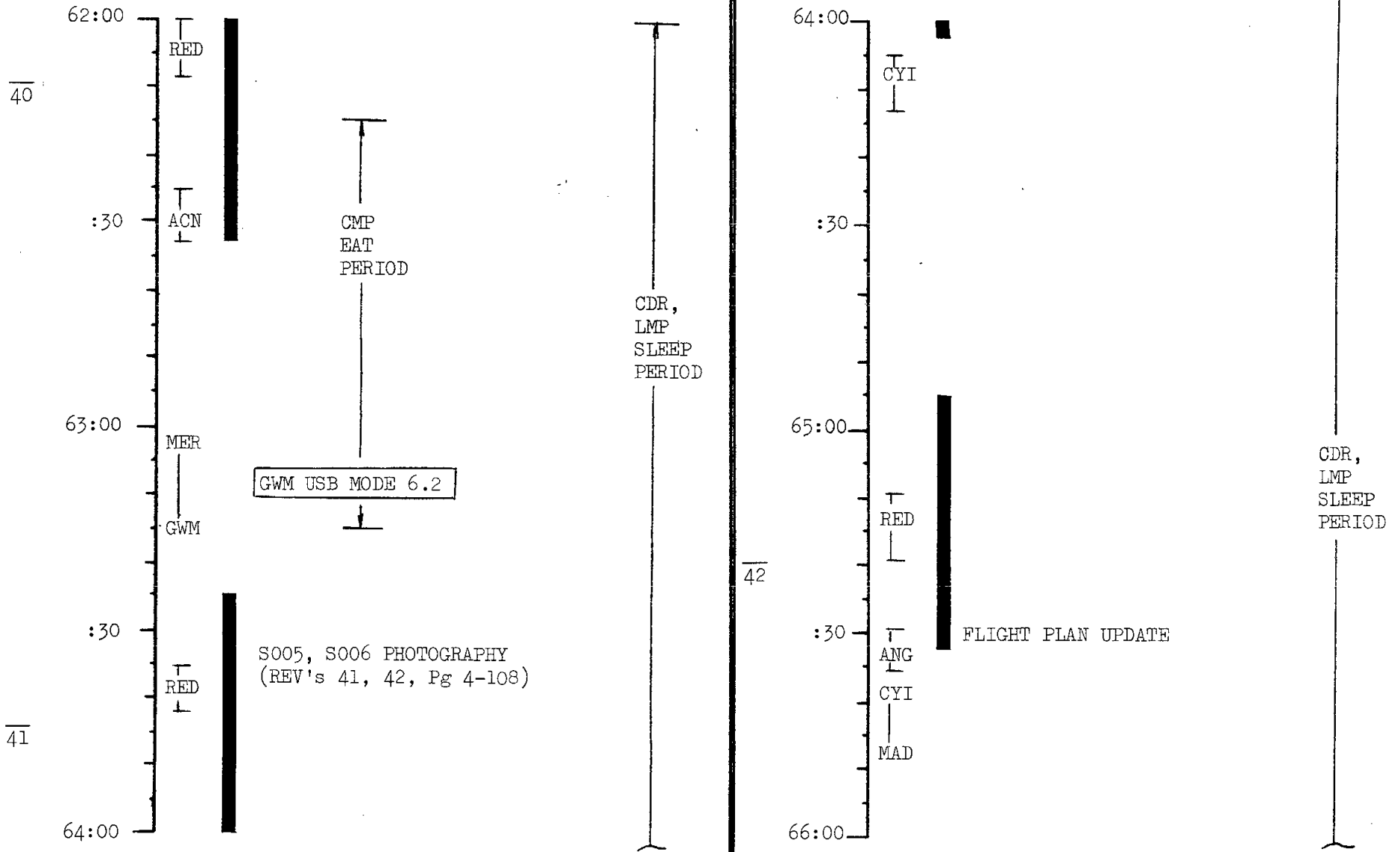
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	62:00-66:00	2/39-42	2-29

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

RADAR TRANSPONDER SELF TEST
(GO/NO GO FOR WSMR TEST)

66:00

CRO

CNB
:30

H_2 PURGE LINE HTR – ON

RED

43

BDA
67:00

F/C PURGE

MAD

:30

P05 CMC ON

CRO

MCC UPDATE: WSMR TEST
(Pg 4-71)
STATE VECTOR
(CMD & VOICE)
(Time Tag to 71:41)

68:00

44

CDR,
LMP
SLEEP
PERIOD

68:00

CNB

P05 IMU POWER UP

:30

TEX

MCC UPDATE: LANDING AREA
BLOCK DATA NO. 8

SCS POWER UP

MAD
69:00

DAP DATA LOAD CK

CRO

P51 IMU ORIENTATION

:30

CNB

P52 IMU REALIGN
(Option 2)

70:00

CDR,
LMP
SLEEP
PERIOD

EAT
PERIOD,
ALL

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	66:00-70:00	2/42-44	2-30

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

70:00 — GYM   P52 IMU REALIGN (Option 3)
               (DAYLIGHT TEST, Pg 4-3)

:30 — CYI

CANISTER CHANGE NO. 6

P52 IMU REALIGN (Option 3)

71:00 — CRO

CNB

:30 — HTV

71:41 WSMR LM RR TEST
      (Pg 4-71)

MCC UPDATE: | LANDMARKS
             | (Pg 4-18)
          : | STATE VECTOR
72:00 — | (Time tag to 73:00)

47

72:00 — CYI

P52 IMU REALIGN
(Option 2)

ARIA 2
72:23 to
72:33

:30 — CRO

CNB

73:00 — HAW   P22 ORBITAL NAVIGATION
               (Pg 4-18)

GDS USB MODE 7.6
    FM MODE F6
TEX USB MODE 6.2
GBM USB MODE 6.3

MCC UPDATE: LANDMARKS
             (Pg 4-18)

:30 — VAN

ACN

P52 IMU REALIGN
(Option 3)

ARIA 2
73:58 to
74:08

74:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	70:00-74:00	2-3/44-47	2-31

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

74:00 —

CRO

WATER CHLORINATION

CRO USB MODE 6.2

:30 —

HAW

P22 ORBITAL NAVIGATION

MCC UPDATE: LANDMARKS
(Pg 4-18)

48

75:00 —

ANG

ACN

P52 IMU REALIGN
(Option 3)

:30 —

CRO

GWM

76:00 —

ARIA 3
75:59 to
76:09

EAT
PERIOD
ALL

49

76:00 — GWM   P22 ORBITAL NAVIGATION

HAW   MCC UPDATE: LANDING AREA
BLOCK DATA NO. 9

:30 —

ANG

ACN

77:00 —

SCT STAR COUNT
MODE B
(Pg 4-6)

:30 —

MER

GWM

HAW

78:00 —

ARIA 3
77:35 to
77:45

CMP
SLEEP
PERIOD
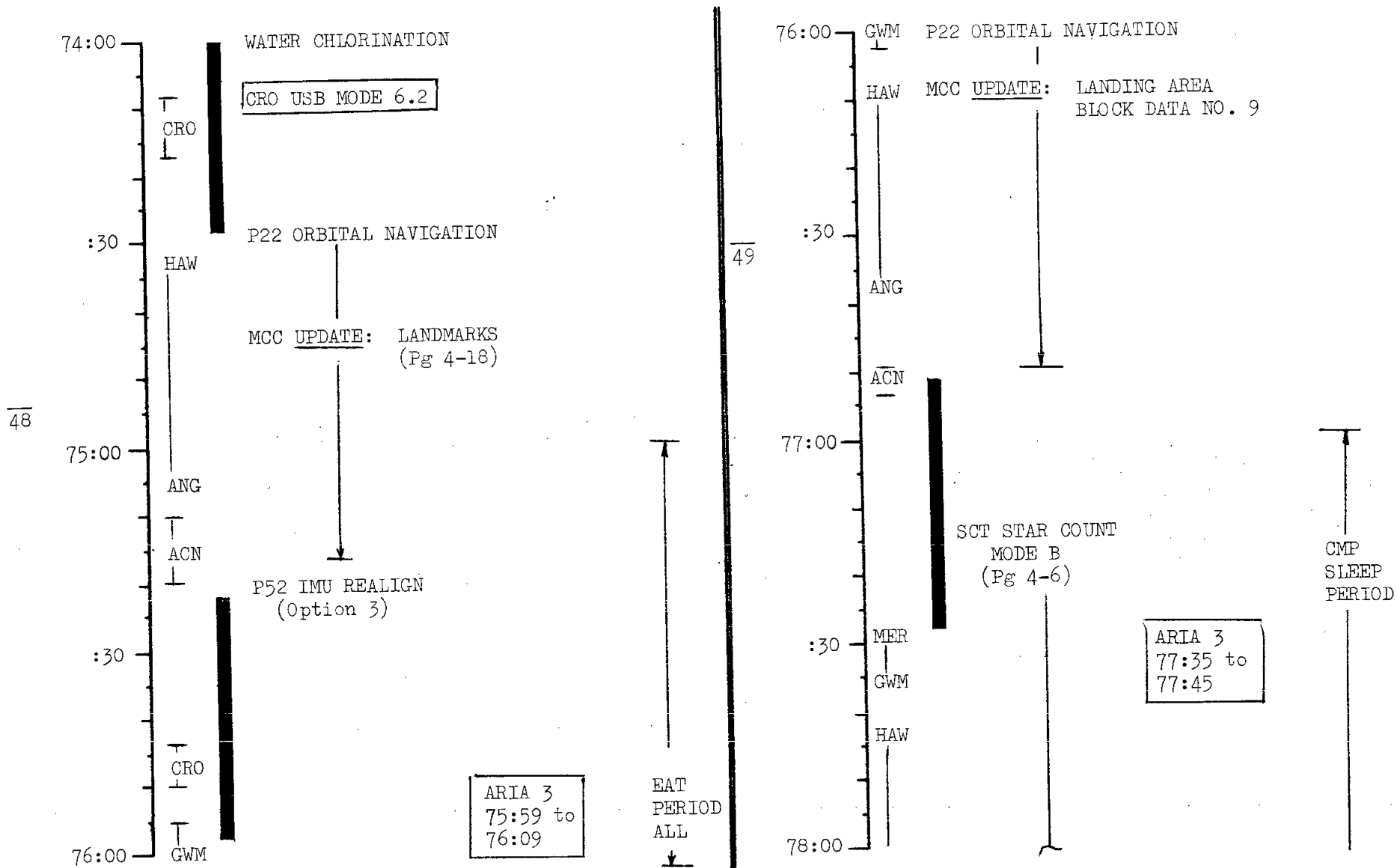
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	74:00-78:00	3/47-49	2-32

FLIGHT PLAN

78:00 — TEX

50

SXT STAR COUNT
MODE B
(pg 4-6)

:30 —

P06 GNCS POWER DOWN
SCS POWER DOWN

S005, S006 PHOTOGRAPHY
79:00 — MER   (Rev 50, Pg 4-108)

GWM

HAW   FLIGHT PLAN STATUS REPORT

:30 — HTV   H$_2$ PURGE LINE HTR – ON

51

F/C PURGE

80:00 —

CMP
SLEEP
PERIOD

52

80:00 —   HUMIDITY SURVEY

:30 —

ECS REDUNDANT
COMPONENT CK.

MER

81:00 — HAW

CMP
SLEEP
PERIOD

:30 —

CMP,
LMP
EAT
PERIOD

82:00 —

CMP
SLEEP
PERIO
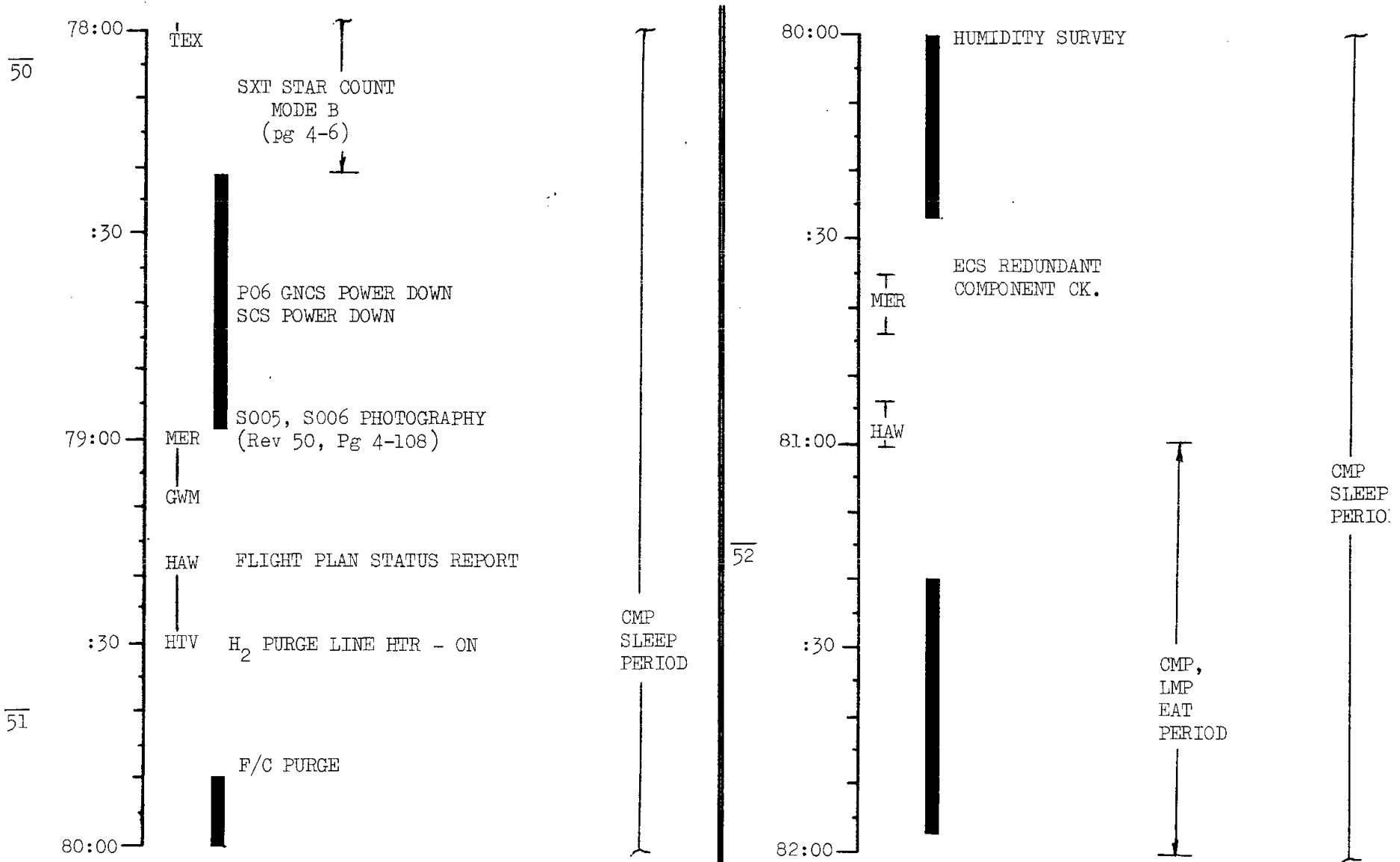
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	78:00-82:00	3/49-52	2-33

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

CANISTER CHANGE NO. 7

82:00 —

MER

:30 — HAW

RED

$\overline{53}$

83:00 —

ACN

:30 —

MER   FLIGHT PLAN UPDATE

84:00 — GWM

CMP
SLEEP
PERIOD

$\overline{54}$

CDR,
LMP
SLEEP
PERIOD

CMP
EAT
PERIOD

84:00 —

RED

:30 —

ACN

85:00 —

MER   MCC UPDATE: LANDING AREA
                              BLOCK DATA NO. 10

:30 — GWM

RED

86:00 —

CDR,
LMP
SLEEP
PERIOD
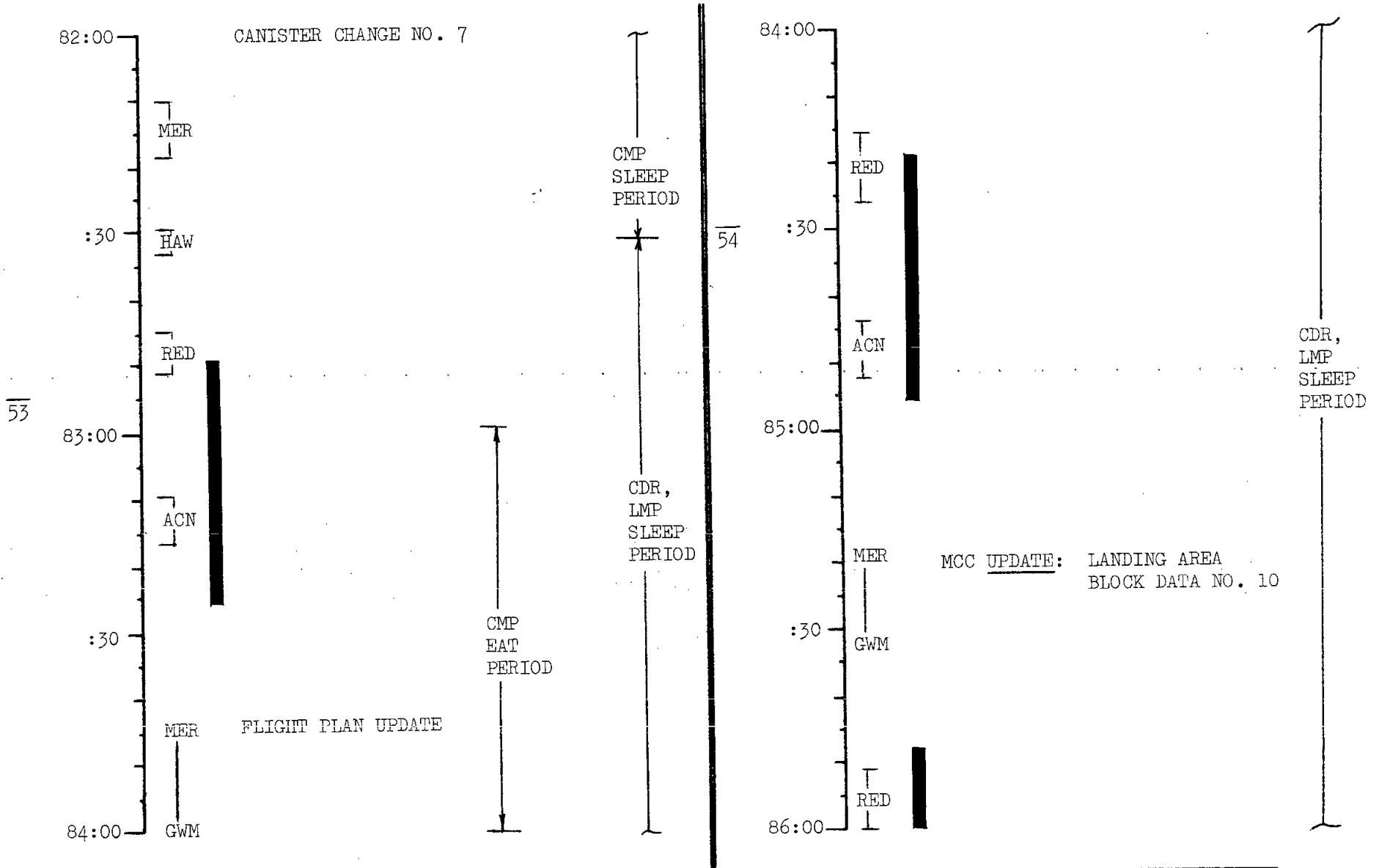
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	82:00-86:00	3/52-54	2-34

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

86:00 — 55

ACN

:30

MER
87:00 — GWM

P05 GNCS POWER UP

MCC UPDATE: STATE VECTOR
TGT LOAD
MANEUVER PAD
NAV CHECK

:30

RED

56

88:00 — CYI   P30 EXTERNAL Δ V

CDR,
LMP
SLEEP
PERIOD

57

88:00 —
MAD   DAP DATA LOAD CK

SCS POWER UP

:30

P51 IMU ORIENTATION

CNB

P40 CSM-SPS THRUSTING
89:00 —
RED   P52 IMU REALIGN
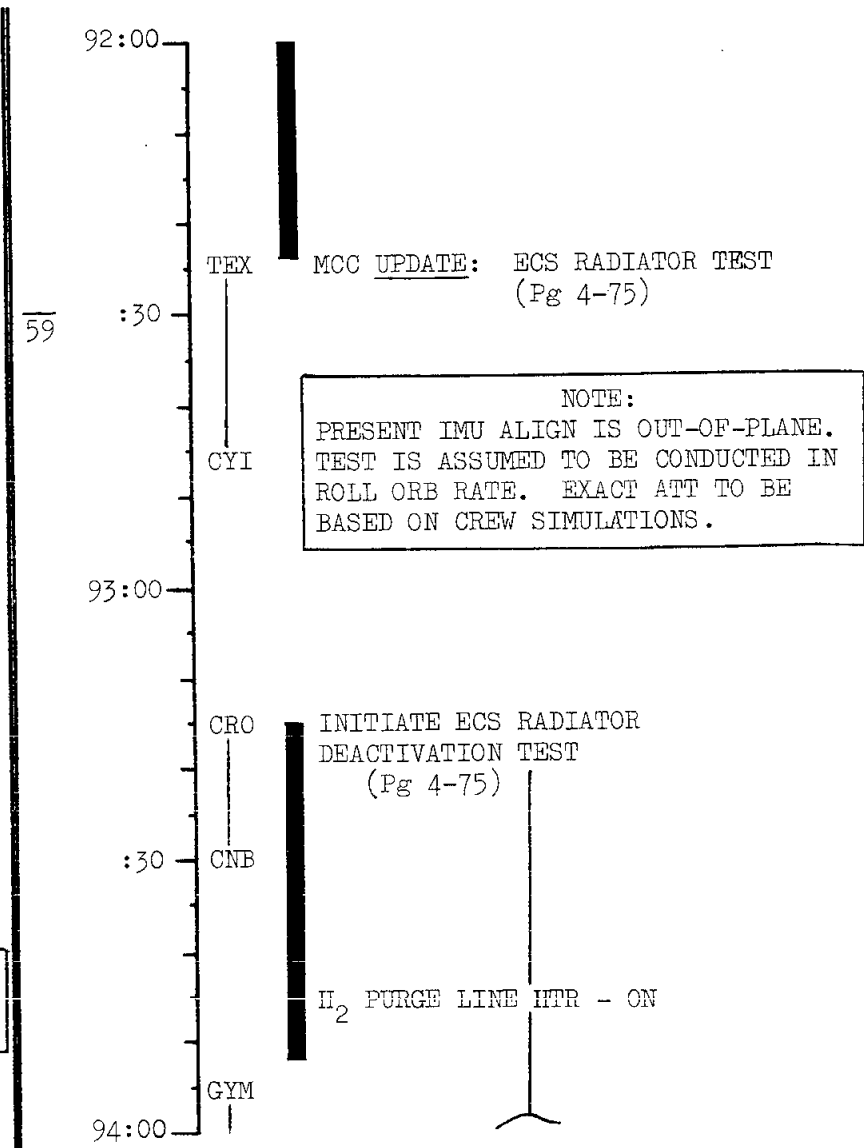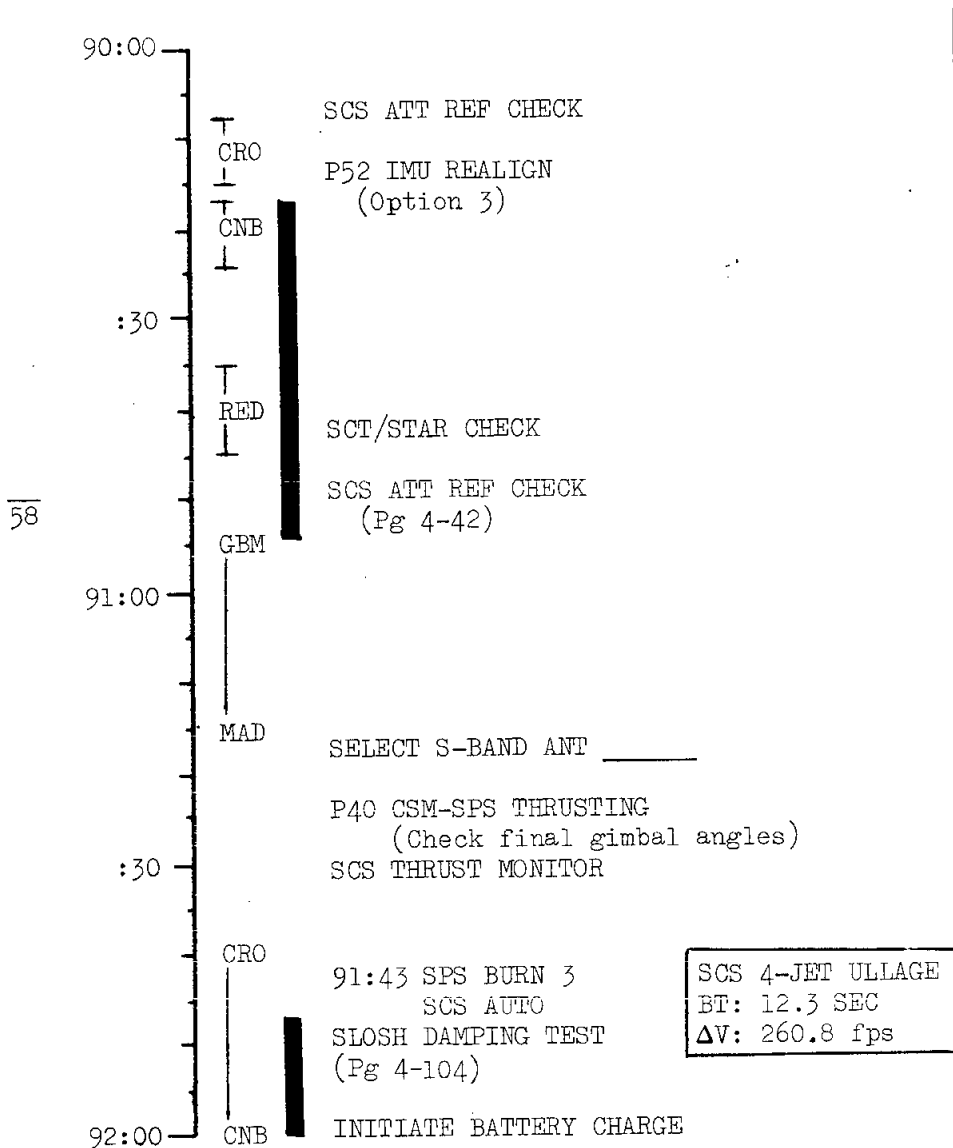(Option 1)

ANG   ALIGN GDC TO IMU

:30

MAD

SCS ATT REF CK
(Pg 4-42)

90:00 —

EAT
PERIOD,
ALL

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	86:00-90:00	3/54-57	2-35

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

90:00

    CRO

    CNB

    SCS ATT REF CHECK

    P52 IMU REALIGN
        (Option 3)

:30

    RED

    SCT/STAR CHECK

    SCS ATT REF CHECK
        (Pg 4-42)

    GBM

91:00

    MAD

    SELECT S-BAND ANT _____

    P40 CSM-SPS THRUSTING
        (Check final gimbal angles)
:30   SCS THRUST MONITOR

    CRO

    91:43 SPS BURN 3
            SCS AUTO
    SLOSH DAMPING TEST
    (Pg 4-104)

    | SCS 4-JET ULLAGE |
    | BT: 12.3 SEC |
    | ΔV: 260.8 fps |

92:00
    CNB   INITIATE BATTERY CHARGE

$\overline{58}$

$\overline{59}$

92:00

    TEX   MCC UPDATE: ECS RADIATOR TEST
                (Pg 4-75)

:30
                    NOTE:
    CYI   PRESENT IMU ALIGN IS OUT-OF-PLANE.
          TEST IS ASSUMED TO BE CONDUCTED IN
          ROLL ORB RATE. EXACT ATT TO BE
          BASED ON CREW SIMULATIONS.

93:00

    CRO   INITIATE ECS RADIATOR
          DEACTIVATION TEST
                (Pg 4-75)

:30   CNB

          H$_2$ PURGE LINE HTR - ON

    GYM
94:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	90:00-94:00	3/57-59	2-36

FLIGHT PLAN

60

94:00 — CYI

F/C PURGE

CANISTER CHANGE NO. 8

:30 —

CRO — ECS RADIATOR
DEACTIVATION
TEST

95:00 — CNB

HTV

:30 —

61

VAN
CYI

96:00 —

62

EAT,
PERIOD,
ALL

96:00 —

CRO

:30 —

HAW

97:00 —

ANG

:30 — ACN

98:00 — CRO

ARIA 1
96:13 to
96:23

MCC UPDATE: LANDING AREA
BLOCK UPDATE NO. 11

ECS RADIATOR
DEACTIVATION
TEST

ARIA 1
97:47 to
97:48

CMP
SLEEP
PERIOD
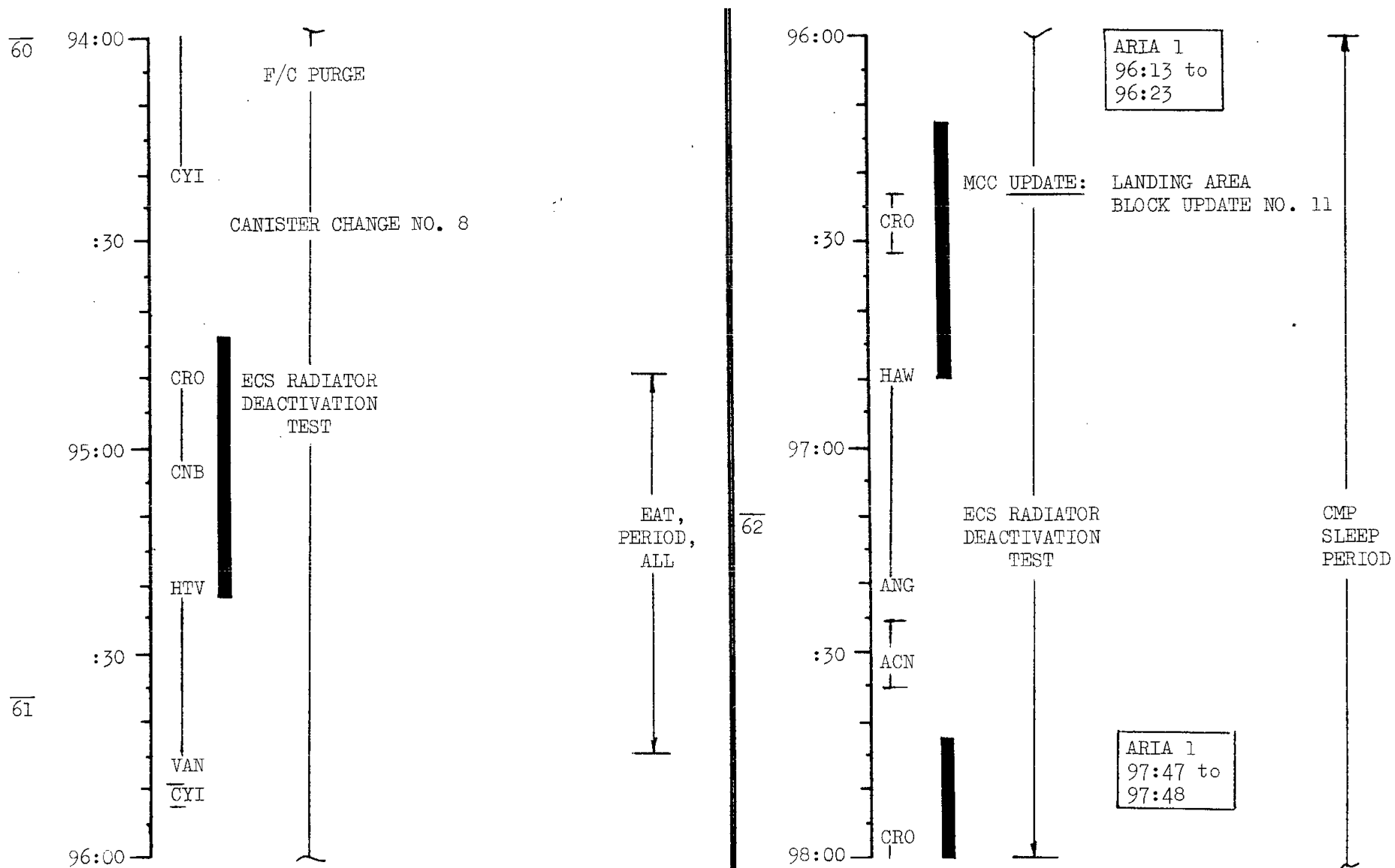
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	94:00-98:00	3-4/59-62	2-37

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

98:00

CRO

GWM

P06 GNCS POWER DOWN
SCS POWER DOWN

HAW

:30

```
GDS USB MODE 7.6
    FM MODE F6

GYM UPLINK VHF VOICE
    & SIM LM DATA

MIL USB MODE 8.4
    FM MODE F3
```

63

ANG

99:00

WATER CHLORINATION

ACN

:30

FLIGHT PLAN STATUS REPORT

CRO

GWM

100:00   HAW

CMP
SLEEP
PERIOD

64

65   102:00

100:00

TEX

:30

101:00

MER

GWM

:30

HAW

GYM

```
GYM UPLINK VHF VOICE
    & SIM LM DATA

MIL USB MODE 6.2
    FM MODE F3
```

```
HAW USB MODE 7.12
    FM MODE F6

GYM USB MODE 6.2
```

CMP
SLEEP
PERIOD
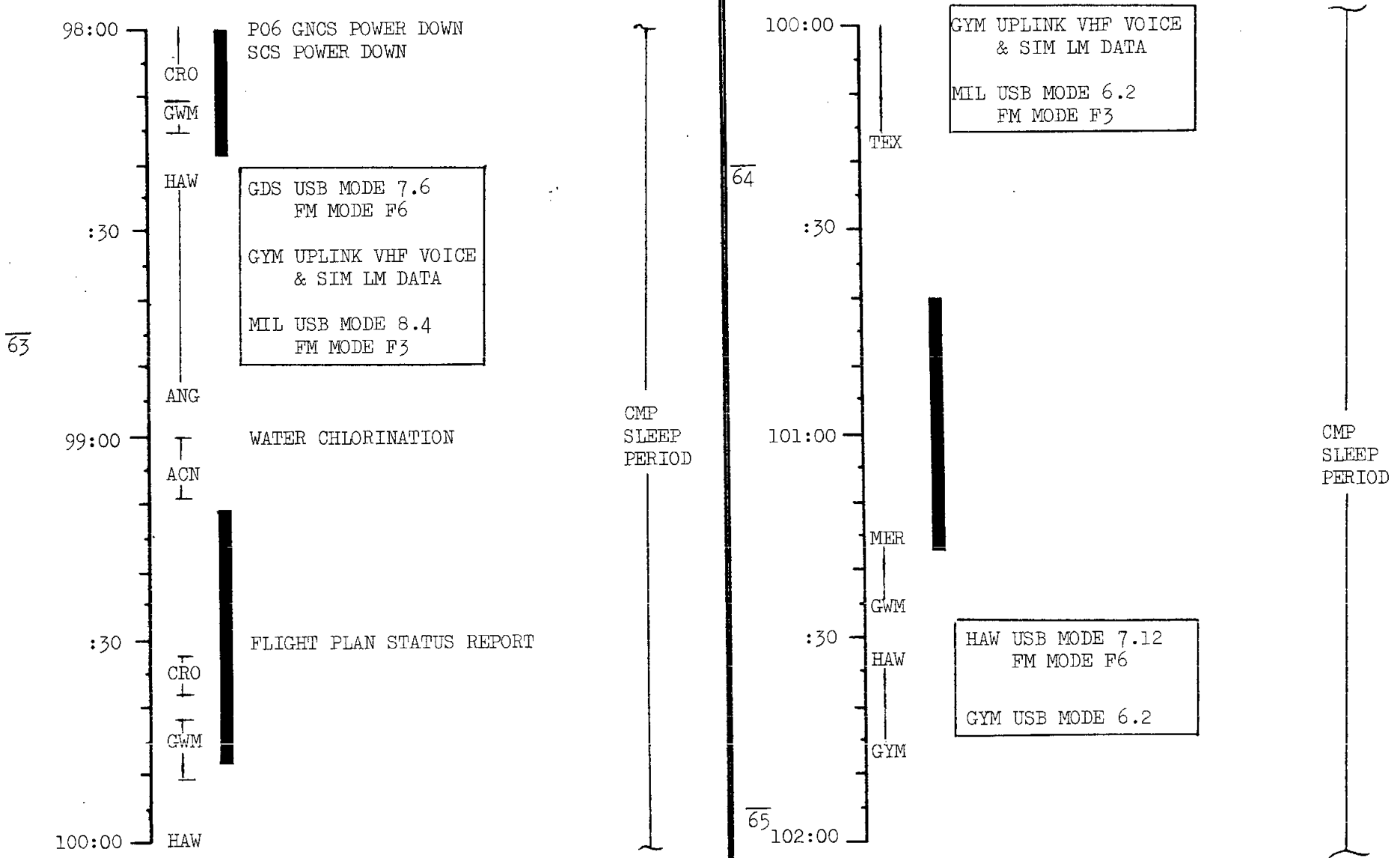
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	98:00-102:00	4/62-65	2-38
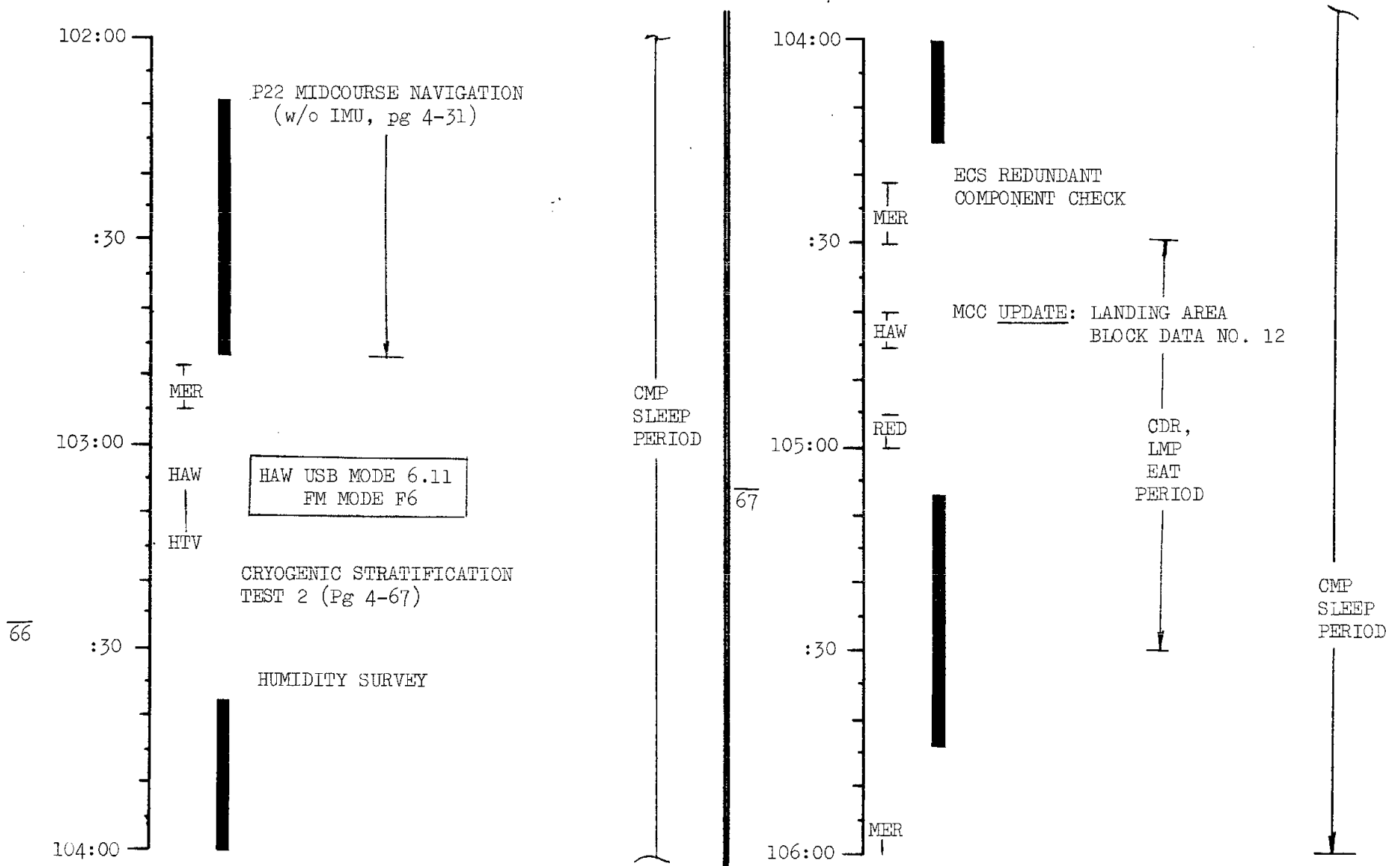
MSC FORM 1186 (SEP 67)

FLIGHT PLAN

P22 MIDCOURSE NAVIGATION
(w/o IMU, pg 4-31)

102:00

:30

MER

HAW

HTV

103:00

HAW USB MODE 6.11
FM MODE F6

CRYOGENIC STRATIFICATION
TEST 2 (Pg 4-67)

:30

HUMIDITY SURVEY

104:00

66

CMP
SLEEP
PERIOD

67

104:00

ECS REDUNDANT
COMPONENT CHECK

MER

:30

MCC UPDATE: LANDING AREA
BLOCK DATA NO. 12

HAW

RED

105:00

CDR,
LMP
EAT
PERIOD

:30

CMP
SLEEP
PERIOD

MER

106:00

FLIGHT PLAN

106:00 — MER

CANISTER CHANGE
NO. 9

:30 — RED

68

ACN

107:00 —

CMP
EAT
PERIOD

CDR,
LMP
SLEEP
PERIOD

:30 — MER

GWM

69

108:00 —

108:00 — RED

:30 — ACN

H$_2$ PURGE LINE HTR – ON

109:00 — MER

F/C PURGE

GWM

CDR
LMP
SLEEP
PERIOD

:30 —

P22 MIDCOURSE NAVIGATION
(w/o IMU, Pg 4-31)

RED

70
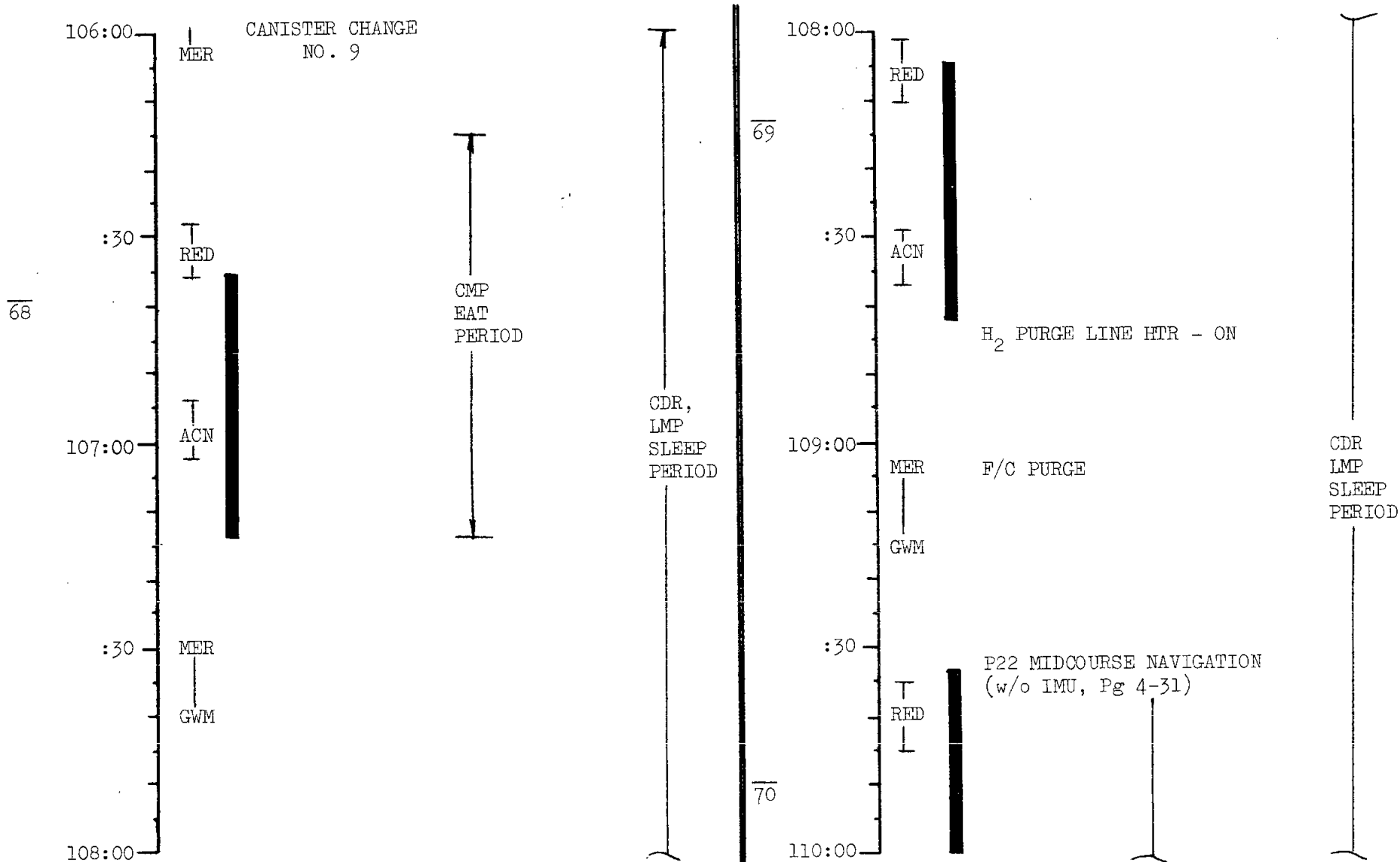
110:00 —

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	106:00-110:00	4/67-70	2-40

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

110:00

:30
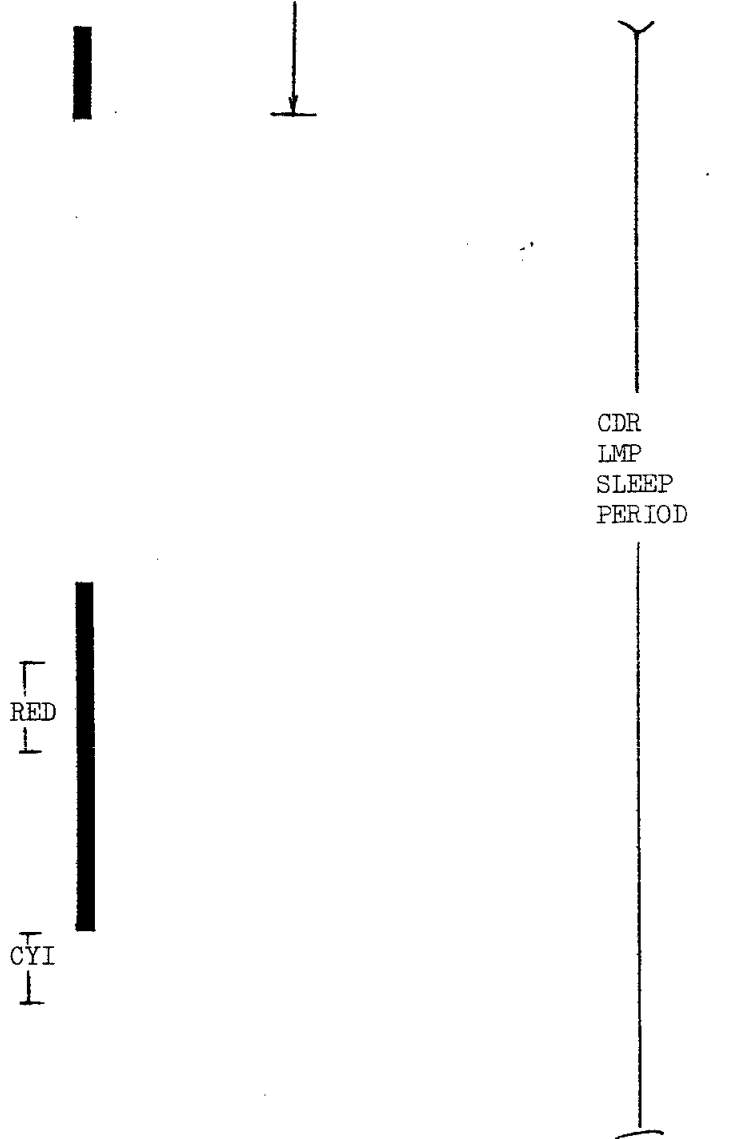
CDR
LMP
SLEEP
PERIOD

$\overline{72}$

RED

111:00

RED

$\overline{71}$

:30

CYI

112:00

112:00

:30

CNB

RED

ANG

VAN

CYI

MAD

FLIGHT PLAN UPDATE

113:00

:30

CRO

CNB

114:00

CDR
LMP
SLEEP
PERIOD
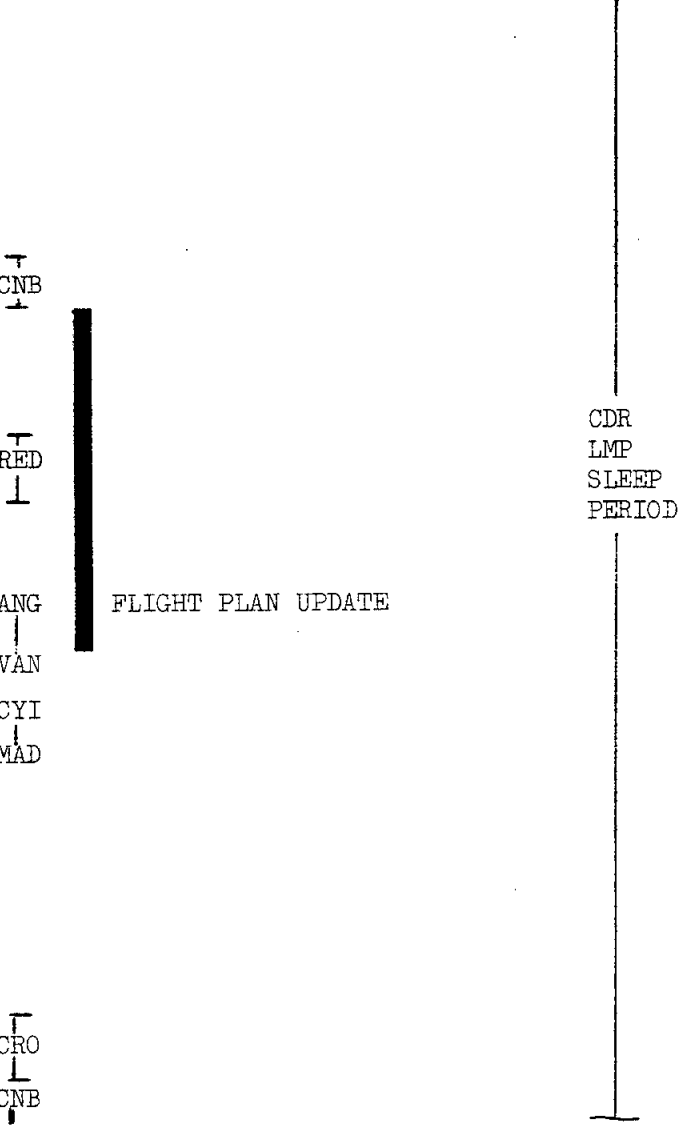
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	110:00-114:00	4/70-72	2-41

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

114:00 — CNB

$\overline{73}$:30 — RED

MIL

MAD

115:00 —

CRO

:30 —

CNB

116:00 —

$\overline{74}$

CDR,
LMP
SLEEP
PERIOD

$\overline{75}$

116:00 — TEX

MCC UPDATE: LANDING AREA
BLOCK DATA NO. 13

:30 — CYI

EAT
PERIOD,
ALL

CRO

117:00 —

CNB

P05 GNCS START UP

:30 — GYM

MCC UPDATE: STATE VECTOR
TGT LOAD
MANEUVER PAD
NAV CHECK

SCS POWER UP
DAP DATA LOAD CHECK
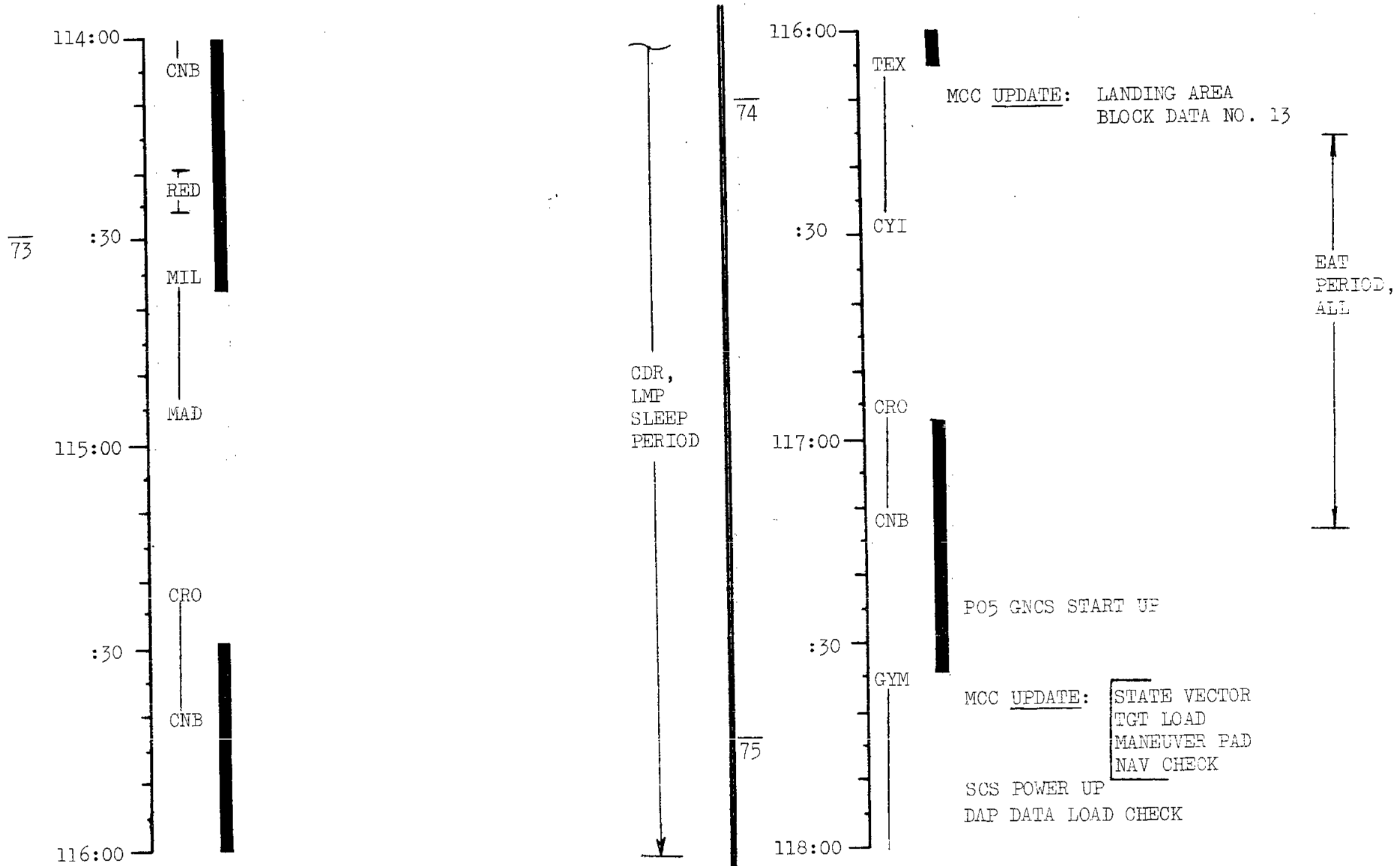
118:00 —

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	114:00-118:00	4/72-75	2-42

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

118:00 — CYI

P30 EXTERNAL ΔV

CANISTER CHANGE NO. 10

P51 IMU ORIENTATION

:30 — CRO

P40 CSM-SPS THRUSTING

CNB   P52 IMU REALIGN
          (Option 1)

119:00 — HAW

76

VAN

:30

P52 IMU REALIGN
    (Option 3)

120:00 —

77

120:00 —

CRO

SELECT S-BAND ANT ____
SXT/STAR CHECK

:30 — HAW

P40 CSM-SPS THRUSTING

120:52 SPS BURN 4
       G&N MIN IMP

121:00 — ANG   SLOSH DAMPING TEST
                  (Pg 4-109)

ACN   MCC UPDATE: SCT STAR COUNT-MODE C
                         (Pg 4-6)

INITIATE BATTERY CHARGE

:30

CRO

SCT STAR COUNT-MODE C
    (Pg 4-6)

GWM

122:00 —

```
┌──────────────┐
│ 2-JET ULLAGE │
│ BT: 05 SEC   │
│ ΔV: 14.9 fps │
└──────────────┘
```

```
┌──────────┐
│ ARIA 2   │
│ 121:28 to│
│ 121:38   │
└──────────┘
```

```
┌──────────┐
│ ARIA 2   │
│ 119:54 to│
│ 120:04   │
└──────────┘
```

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	118:00-122:00	4-5/75-77	2-43

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

122:00 — HAW

78

SCT STAR COUNT—MODE C

MCC UPDATE: SPS PROP
THERMAL
CONTROL TEST
(Pg 4-48)

:30 —

ANG

ACN

123:00 —

P52 IMU REALIGN
(Option 3)

CRO

GWM

:30 —

SPS PROP THERMAL
CONTROL TEST
(Pg 4-48)
SCS ATT CONT TEST 1
(Pg 4-37)

HAW

124:00 — TEX

79

EAT
PERIOD,
ALL

80

ARIA 3
123:42 to
123:52

124:00 —

:30 —

125:00 —
MER

GWM

HAW

GYM

:30 —

126:00 —

SPS PROP
THERMAL CONTROL
TEST

CMP
SLEEP
PERIOD

SCS ATT CONT TEST
(Pg 4-37)

MCC UPDATE: LANDING AREA
BLOCK DATA NO. 14

ARIA 3
125:15 to
125:25
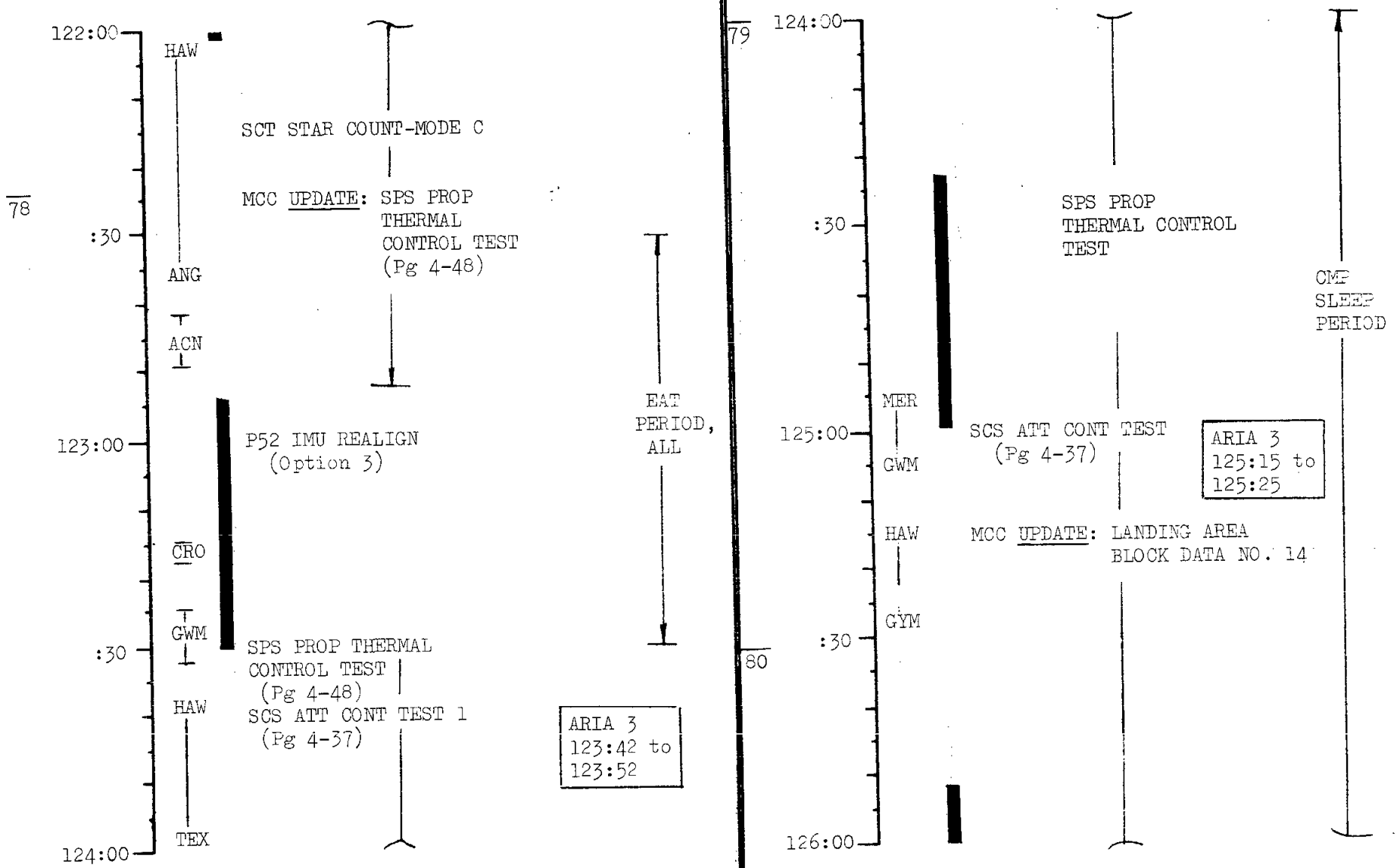
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	122:00-126:00	5/77-80	2-44

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

81

126:00

SPS PROP
THERMAL CONTROL

MER

:30

H_2 PURGE LINE HTR – ON

P06 GNCS POWER DOWN

SCS POWER DOWN

HAW

F/C PURGE

127:00

HTV

WATER CHLORINATION

:30

128:00

82

CMP
SLEEP
PERIOD

128:00

MER

HAW

:30

RED

HUMIDITY SURVEY

129:00

ACN

:30

MER

130:00

ECS REDUNDANT
COMPONENT CHECK

CMP
SLEEP
PERIOD

CANISTER CHANGE NO. 11
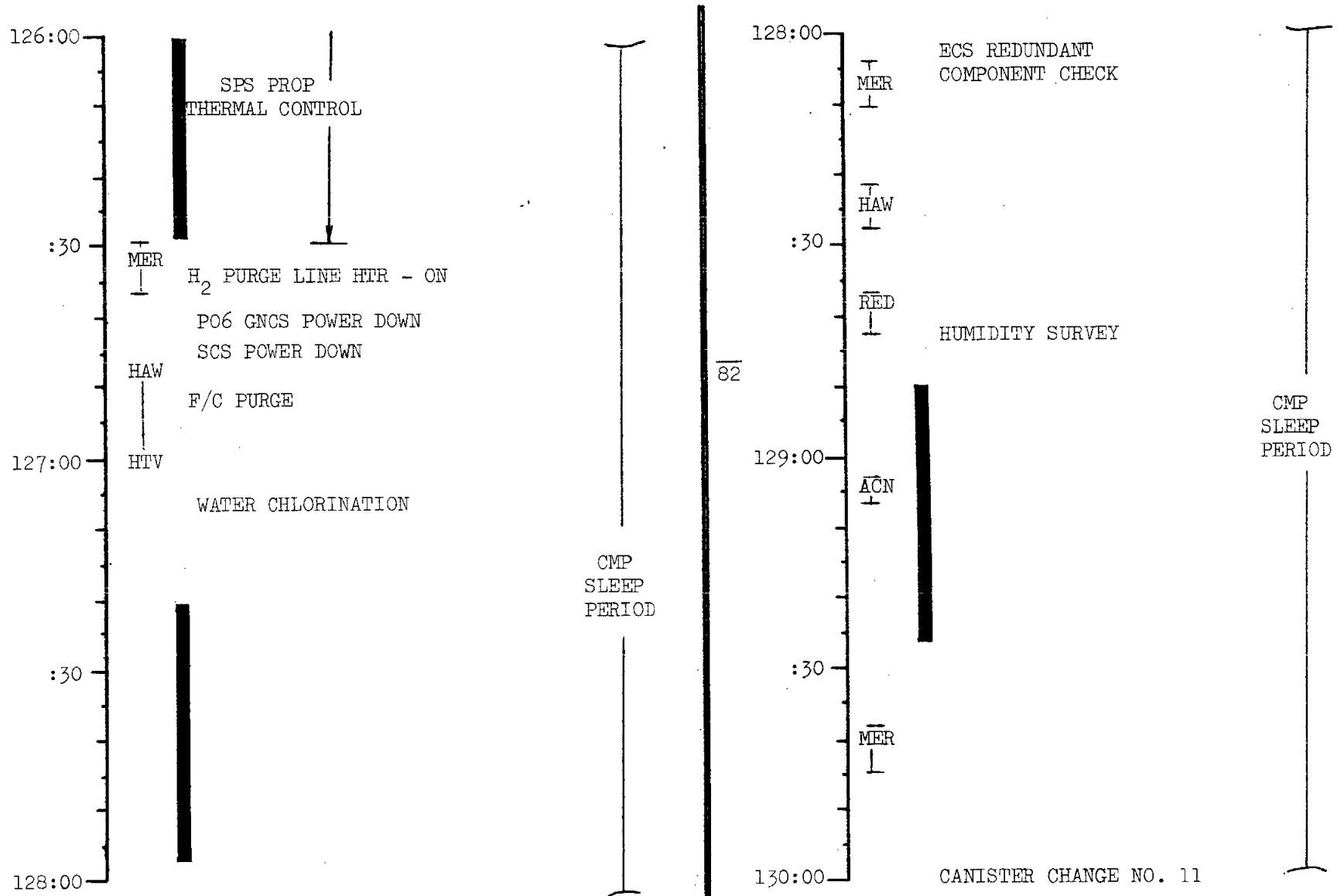
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	126:00-130:00	5/80-82	2-45

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

FLIGHT PLAN STATUS REPORT

$\overline{83}$

RED

ACN

CMP
SLEEP
PERIOD

MER

GWM

RED

$\overline{84}$

CDR,
LMP
EAT
PERIOD

CMP
SLEEP
PERIOD

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	130:00-132:00	5/82-84	2-46

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

132:00

ACN

:30

CMP
EAT
PERIOD

MER

CDR
LMP
SLEEP
PERIOD

GWM

133:00

RED

:30

CYI

134:00

85

134:00

:30

RED

MCC UPDATE: LANDING AREA
              BLOCK DATA NO. 15

135:00

86

CYI

:30   MAD

CDR,
LMP
SLEEP
PERIOD

136:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	132:00-136:00	5/84-86	2-47

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

136:00 — CNB

:30 — RED

87

ANG — FLIGHT PLAN UPDATE

137:00 — MAD

:30 — CRO

CNB

138:00 —

88

CDR,
LMP
SLEEP
PERIOD

89

138:00 — RED

MIL

:30 — MAD

139:00 — CRO

CNB

:30 — P05 GNCS POWER UP

TEX — MCC UPDATE: STATE VECTOR
(CMD & VOICE)
(Time tag to
142:40)
(Pg 4-18)

140:00 —

CDR,
LMP
SLEEP
PERIOD
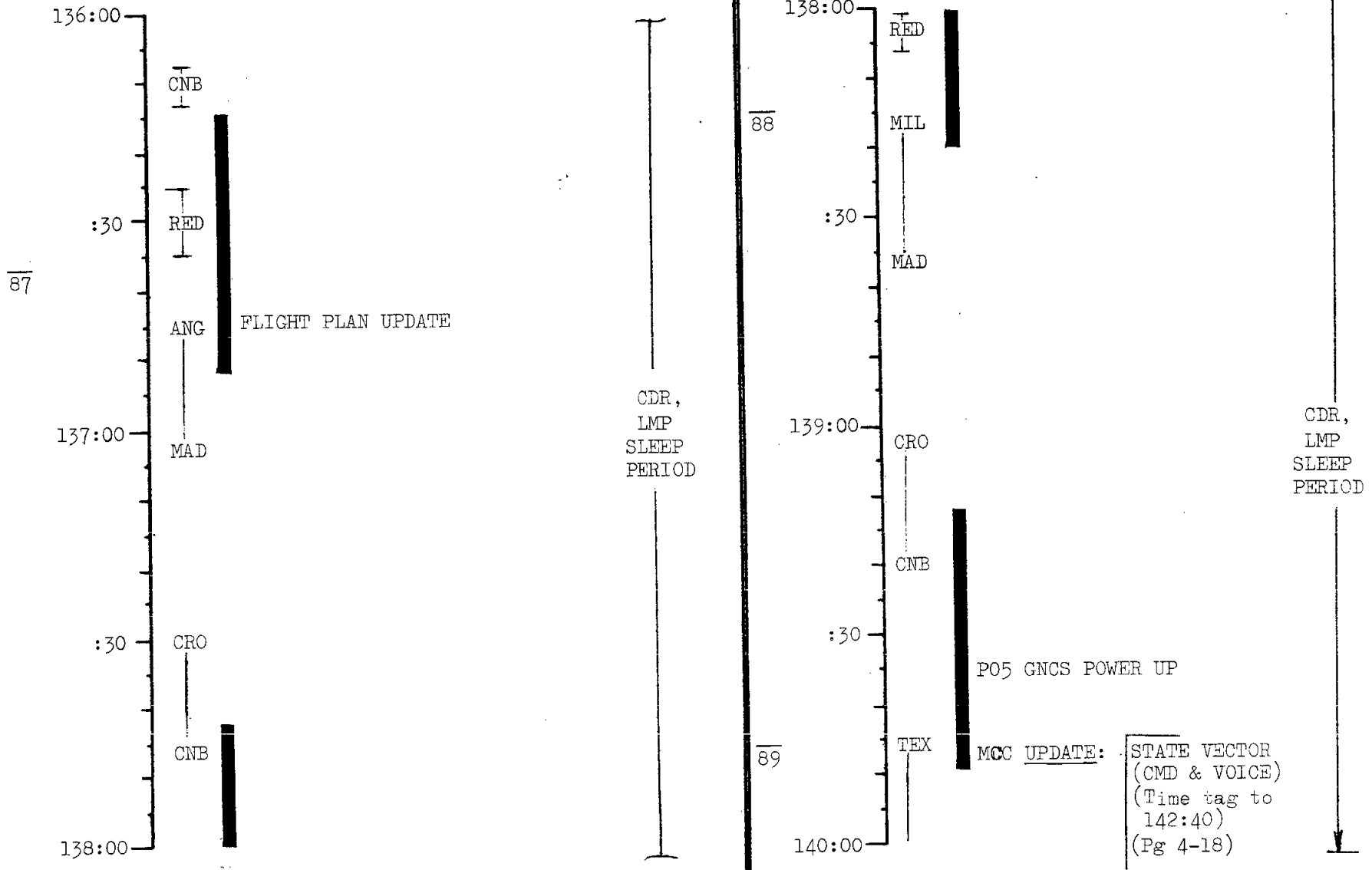
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	136:00-140:00	5/86-89	2-48

FLIGHT PLAN

140:00 — CYI — DAP DATA LOAD CK
W-MATRIX UPDATE
(Pg 4-18)

SCS POWER UP

:30 —

CRO — P51 IMU ORIENTATION

CNB — P52 IMU REALIGN
(Option 2)

141:00 —

HTV — H$_2$ PURGE LINE HTR – ON

MCC UPDATE: LANDMARKS
(Pg 4-18)

90

:30 —

F/C PURGE

CYI —

CANISTER CHANGE NO. 12

142:00 —

EAT
PERIOD
ALL

142:00 —

CRO — P52 IMU REALIGN
(Option 3)

CNB —

:30 —

HAW —

P22 ORBITAL NAVIGATION
(Pg 4-18)

91 143:00 — MCC UPDATE: LANDMARKS

VAN —

ACN —

:30 —

P52 IMU REALIGN
(Option 3)

CRO — MCC UPDATE:

ARIA 1
143:36 to
143:16

LANDING AREA
BLOCK DATA NO. 16
:   STATE VECTOR
(Time tag to 144:15)

144:00 —

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968.	140:00-144:00	5/89-91	2-49

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

144:00

HAW

P22 ORBITAL NAVIGATION

MCC UPDATE: LANDMARKS

:30

$\overline{92}$

ANG

ACN

145:00

P52 IMU REALIGN
(Option 3)

CRO

MCC UPDATE: STATE VECTOR
(Time tag to 145:45)

:30

GWM

HAW P22 ORBITAL NAVIGATION

EAT
PERIOD
ALL

146:00

ARIA 1
145:10 to
145:20

$\overline{93}$

146:00

ANG

ACN

:30

P06 GNCS POWER DOWN
SCS POWER DOWN

147:00

GWM

HAW

:30

TEX

CMP
SLEEP
PERIOD

$\overline{94}$

148:00

WATER CHLORINATION
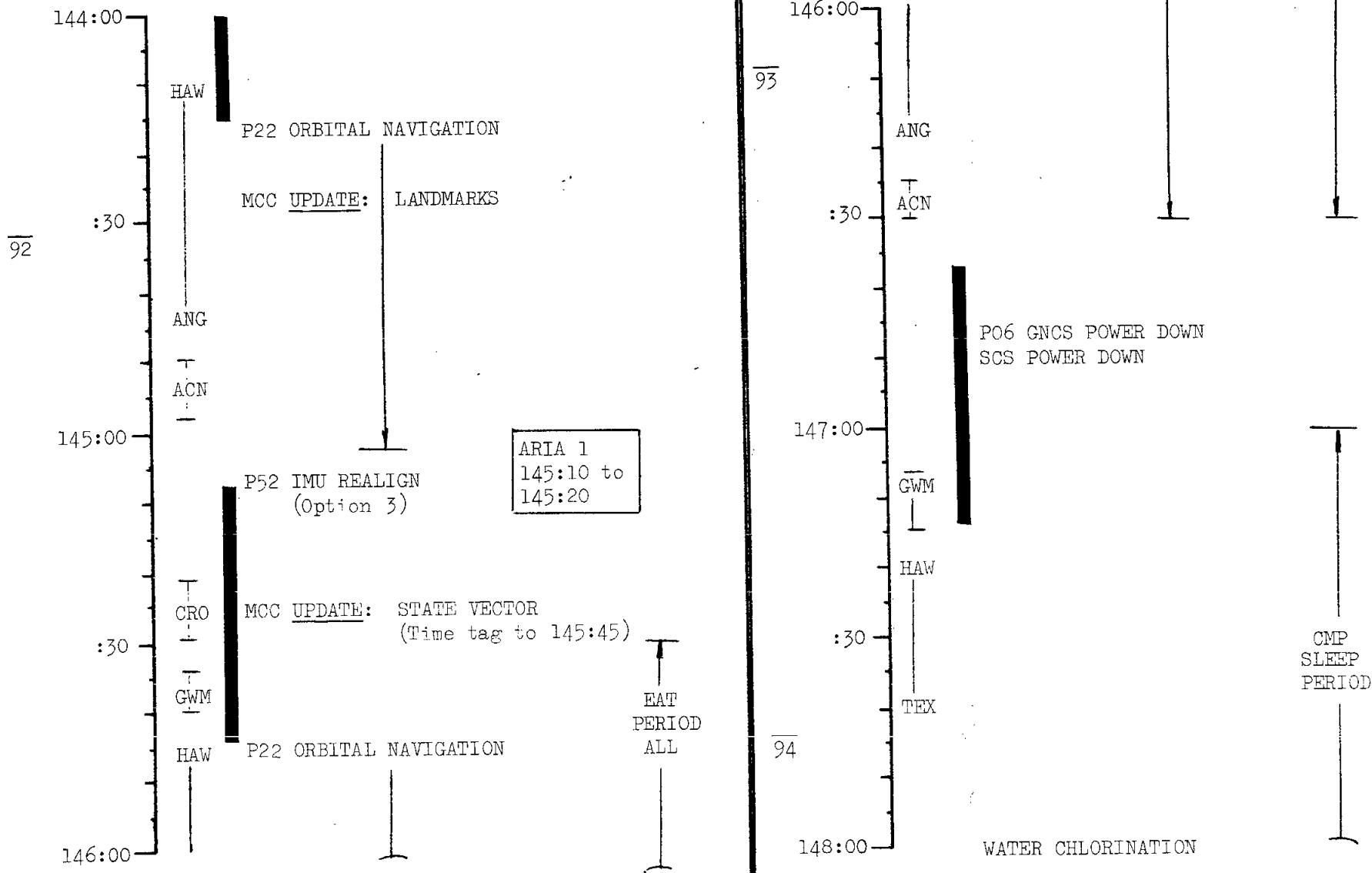
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	144:00-148:00	6/91-94	2-50

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

148:00

:30

MER
|
GWM

FLIGHT PLAN STATUS REPORT

HAW
|
HTV

149:00

95

:30

150:00

150:00

:30

HAW
|
HTV

149:00

151:00

:30

152:00

MER

CMP
SLEEP
PERIOD

96

MER
|
HAW
|
HTV

CMP
SLEEP
PERIOD

MER

MCC UPDATE: LANDING AREA
BLOCK DATA NO. 17
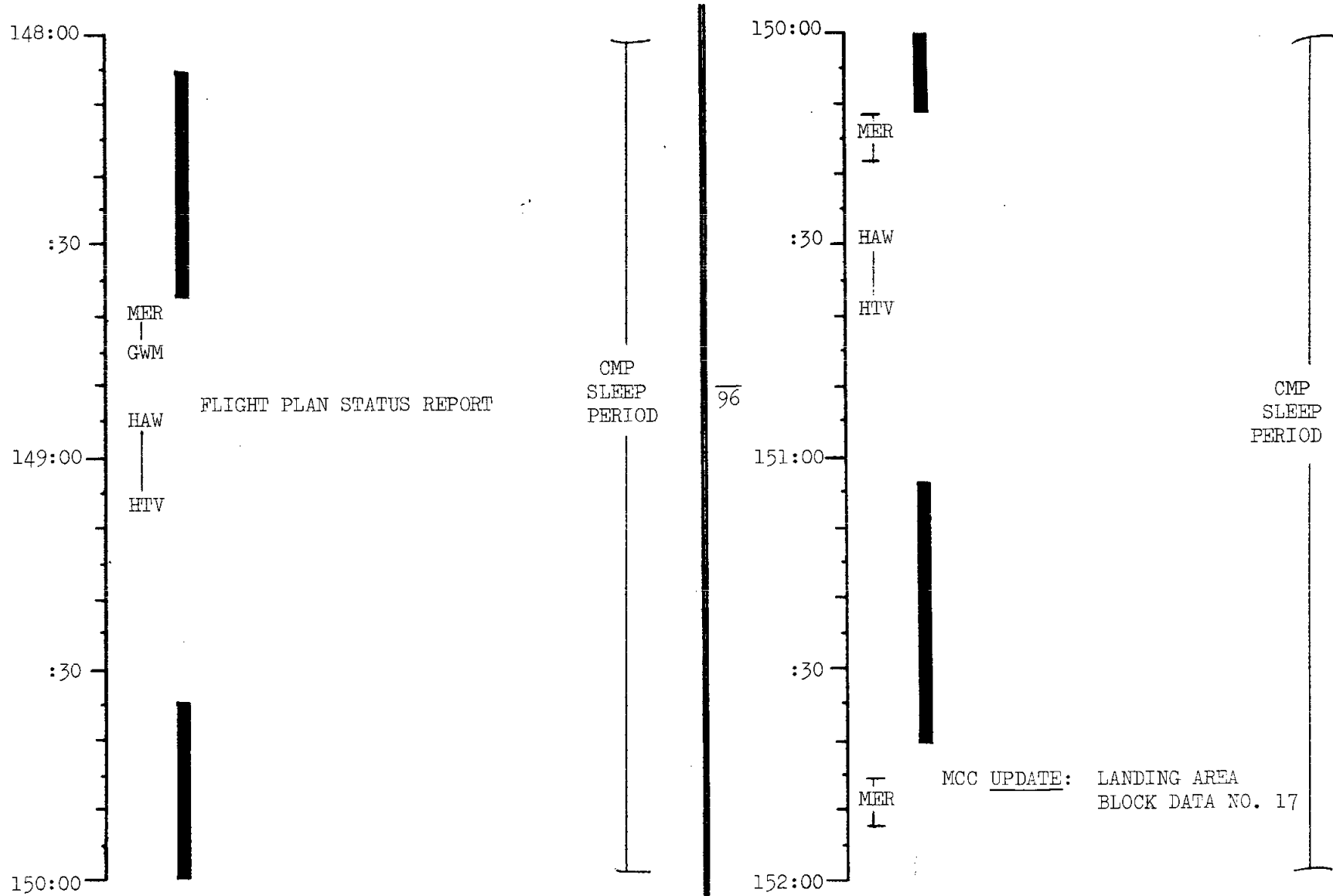
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	148:00-152:00	6/94-96	2-51

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

152:00 —

ECS REDUNDANT
COMPONENT CHECK

HAW

RED

98   :30 —

ACN

153:00 —

HUMIDITY SURVEY

MER

:30 —

CDR
LMP
EAT
PERIOD

RED

154:00 —

CMP
SLEEP
PERIOD

98

99

—— 154:00

ACN

:30

MER

GWM

—— 155:00

RED

:30

ACN

—— 156:00

98

CANISTER CHANGE NO. 13

CMP
EAT
PERIOD

H₂ PURGE LINE HTR — ON

F/C PURGE

CDR
LMP
SLEEP
PERIOD
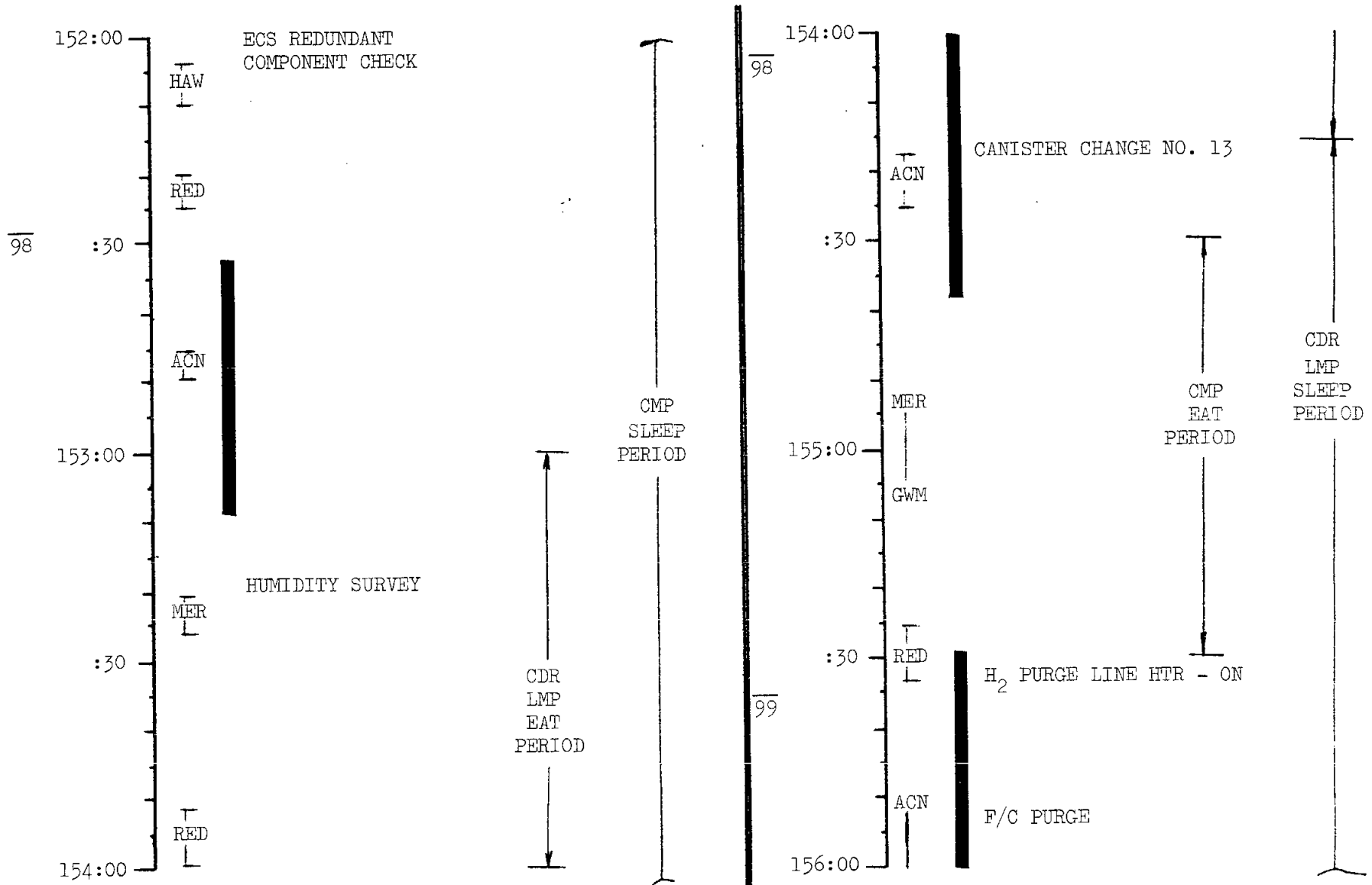
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	152:00-156:00	6/96-99	2-52

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

156:00

:30 — MER
↓
GWM

157:00 — RED
↓

100

:30 — CYI
↓

158:00

101

CDR
LMP
SLEEP
PERIOD

158:00

:30 — RED
↓

FLIGHT PLAN UPDATE

ANG
↓

159:00

CYI
↓
MAD

:30

C̄N̄B
↓

160:00

CDR
LMP
SLEEP
PERIOD

FLIGHT PLAN

160:00

RED

:30 — ANG

MAD

MCC UPDATE: LANDING AREA
BLOCK DATA NO. 18

CDR
LMP
SLEEP
PERIOD

161:00 —

P05 CMC POWER UP

CRO

MCC UPDATE: STATE VECTOR
TGT LOAD
MANEUVER PAD
NAV CHECK
DAP DATA LOAD (Pg 4-34)
TVC DAP DATA (Pg 4-34)

CNB

:30 —

RED

P05 IMU POWER UP

103

162:00 — MIL

P30 PRETHRUST

162:00

MAD

■ DAP DATA LOAD CK

SCS POWER UP
POWER UP FQ INST

:30

CRO

P51 IMU ORIENTATION

163:00 — CNB

P40 CSM-SPS THRUSTING

P52 IMU REALIGN
(Option 1)

GYM

104 :30 —

SELECT SPS AUX GAGING
SYSTEM FOR PUGS TEST

CYI

MCC UPDATE: PASSIVE THERMAL
CONTROL TEST 1
(Pg 4-48)

164:00 —

EMS Δ V BIAS TEST
(Pg 4-35)

EAT
PERIOD
ALL

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	160 - 164	6/101-104	2-54

FLIGHT PLAN

CRO

P52 IMU REALIGN
(Option 3)

:30

CNB

SELECT S-BAND ANT _____

NOTE: FQ RECORDER
          REQD FOR BURN

SXT/STAR CHECK

HTV

P40 CSM-SPS THRUSTING

105
165:00

165:08 SPS BURN 5
          G&N/MTVC

```
┌─────────────────┐
│ 2-JET ULLAGE    │
│ BT: 56.2 SEC    │
│ ΔV: 1263.4 fps  │
└─────────────────┘
```

CYI

POWER DOWN FQ INST
INITIATE BATTERY CHARGE

:30

CRO

P52 IMU REALIGN
(Option 2)

166:00

164:00

166:00

CNB

:30

HTV

CANISTER CHANGE NO. 14

106

PASSIVE THERMAL
CONTROL TEST 1
(Pg 4-48)

CYI

167:00

ACN

(167:15 Nominal Apogee)

EAT
PERIOD
ALL

CRO

:30

MCC: UPDATE WINDOW PHOTOGRAPHY
          (Pg 4-100)

P23 MIDCOURSE NAVIGATION
(WITH IMU, PG 4-31)

HAW

168:00

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	164-168	6/104-106	2-55

FLIGHT PLAN

168:00

107

VAN

:30

ACN

WINDOW PHOTOGRAPHY
(Pg 4-100)

P06 GNCS POWER DOWN
SCS POWER DOWN

169:00

CRO

GWM

:30

HAW

108

FLIGHT PLAN STATUS REPORT

170:00

CMP
SLEEP
PERIOD

109

170:00

ANG

ACN

:30

GWM

171:00

HAW

TEX

:30

ACN

172:00

H_2 PURGE LINE HTR – ON

F/C PURGE

CMP
SLEEP
PERIOD
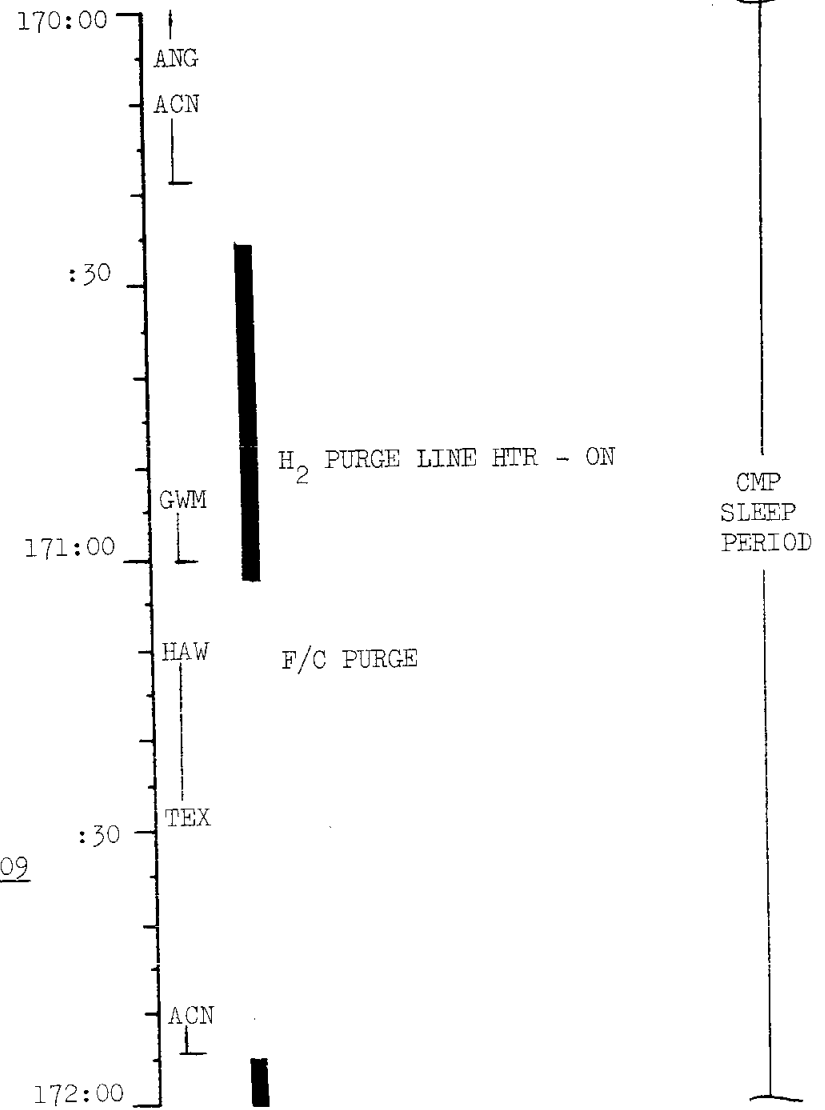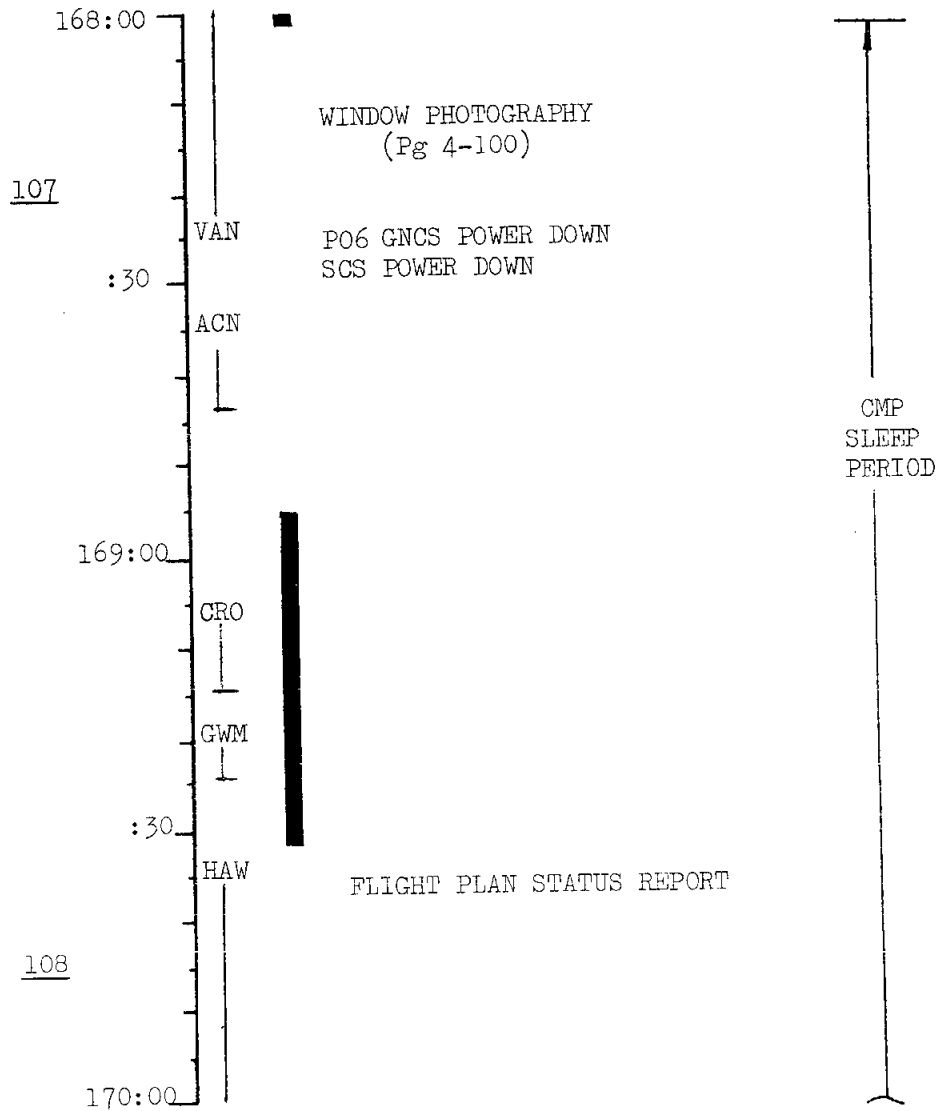
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	168-172	7/106-109	2-56

FLIGHT PLAN

172:00

WATER CHLORINATION

:30 MER
     GWM

HAW

173:00 GYM

_110_

MCC UPDATE: LANDING AREA
            BLOCK DATA NO. 19

HUMIDITY SURVEY

:30

174:00

CMP
SLEEP
PERIOD

174:00 MER

HAW

_111_ :30 HTV

175:00

:30

MER

HAW

176:00

ECS REDUNDANT
COMPONENT CK

CDR
LMP
EAT
PERIOD

CMP
SLEEP
PERIOD

CDR
LMP
SLEEP
PERIOD
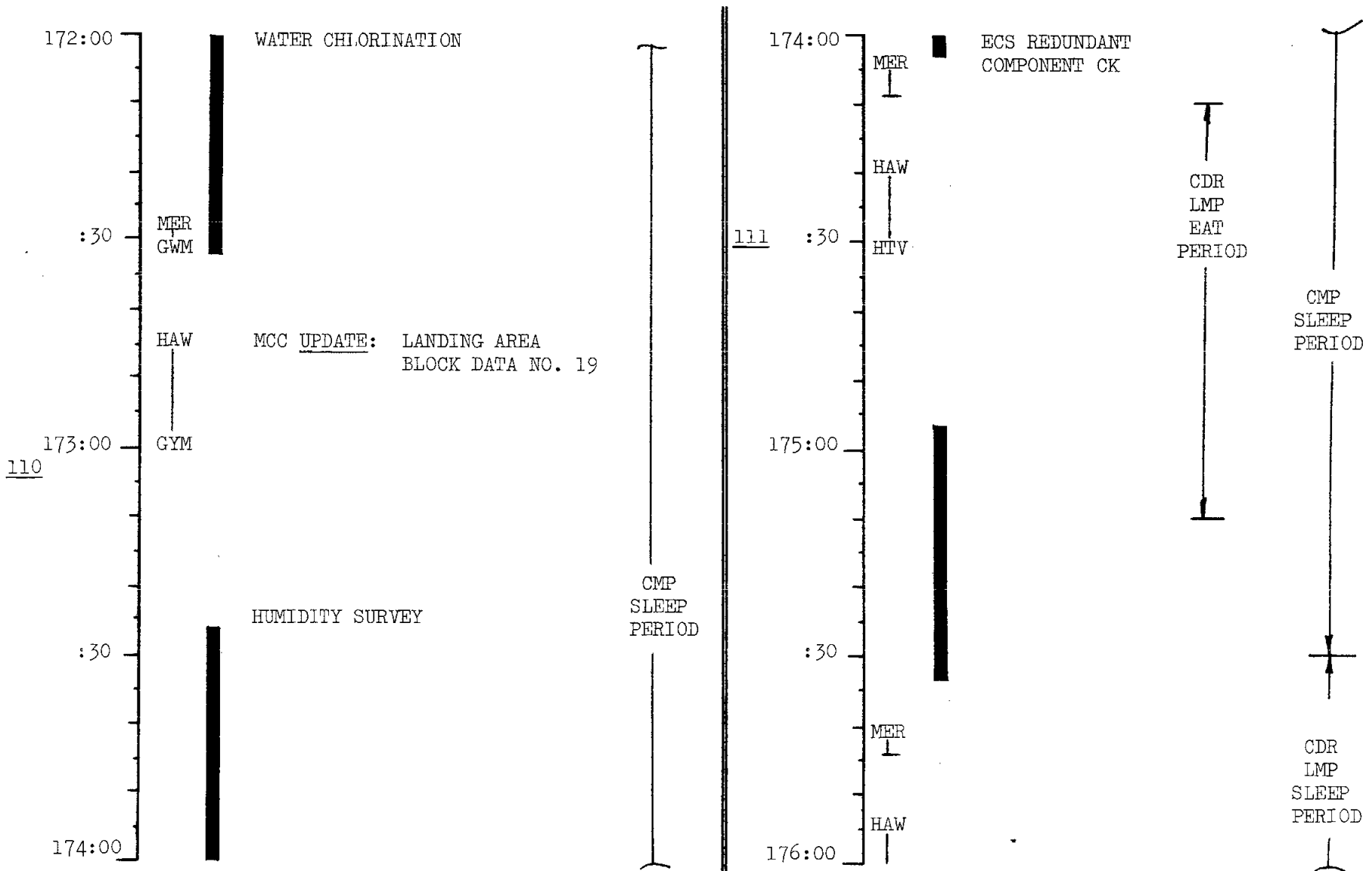
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	172-176	7/109-111	2-57

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

176:00 — HAW

112 — RED

:30

ACN

177:00 — MER

GWM

:30

113 — RED

178:00 —

CMP
EAT
PERIOD

CDR
LMP
SLEEP
PERIOD

114

178:00 —

ACN

:30

MER

179:00 — GWM

RED

:30

ACN

180:00 —

CANISTER CHANGE NO. 15

FLIGHT PLAN UPDATE

CDR
LMP
SLEEP
PERIOD

FLIGHT PLAN

180:00

:30

181:00

115

:30

182:00

MER

GWM

RED

CYI

S005, S006 PHOTOGRAPHY
(REV 115, PG 4-113)

MCC UPDATE: LANDING AREA
              BLOCK DATA NO. 20

CDR
LMP
SLEEP
PERIOD

182:00

:30

116

183:00

:30

184:00

CNB

RED

CYI
MAD

CRO

CNB

RADAR TRANSPONDER SELF TEST
(GO/NO GO FOR WSMR TEST)

CDR
LMP
SLEEP
PERIOD

ECS SECONDARY COOLANT
LOOP TEST - MODE A
(Pg 4-57)

EAT
PERIOD
ALL

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	180-184	4/114-116	2-59

FLIGHT PLAN

184:00

117

RED

ANG

:30

MAD

ECS SECONDARY COOLANT
LOOP TEST - MODE A
(Pg 4-57)

185:00

CRO

:30   CNB   HUMIDITY SURVEY
(Pg 4-59)

118
186:00

186:00   MIL

MAD

POWER UP FOR   H$_2$ PURGE LINE
MODE B TEST   HTR – ON
(Pg 4-57)

:30

F/C PURGE

CRO

187:00

CNB

119   :30   GYM   ECS SECONDARY COOLANT
LOOP TEST – MODE B
(Pg 4-57)

188:00   CYI

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	184-188	7/116-119	2-60

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

188:00 — CRO

:30 — CRO

CNB

189:00 — HTV

ECS SECONDARY COOLANT
LOOP TEST - MODE B

120

:30 — CYI

CANISTER CHANGE NO. 16

190:00 —

EAT
PERIOD
ALL

121

190:00 — CRO

CNB

:30 — HAW

RADAR TRANSPONDER
SELF CHECK
(GO/NO GO FOR WSMR TEST)

P05 GNCS POWER UP

191:00 — VAN
ACN

MCC UPDATE: STATE VECTOR
(Time tag to 193:52)
WSMR TEST DATA
(PG 4-71)

SCS POWER UP

DAP DATA LOAD CHECK

:30 — CRO

P51 IMU ORIENTATION

P52 IMU REALIGN
(Option 2)

192:00 —

CMP
SLEEP
PERIOD
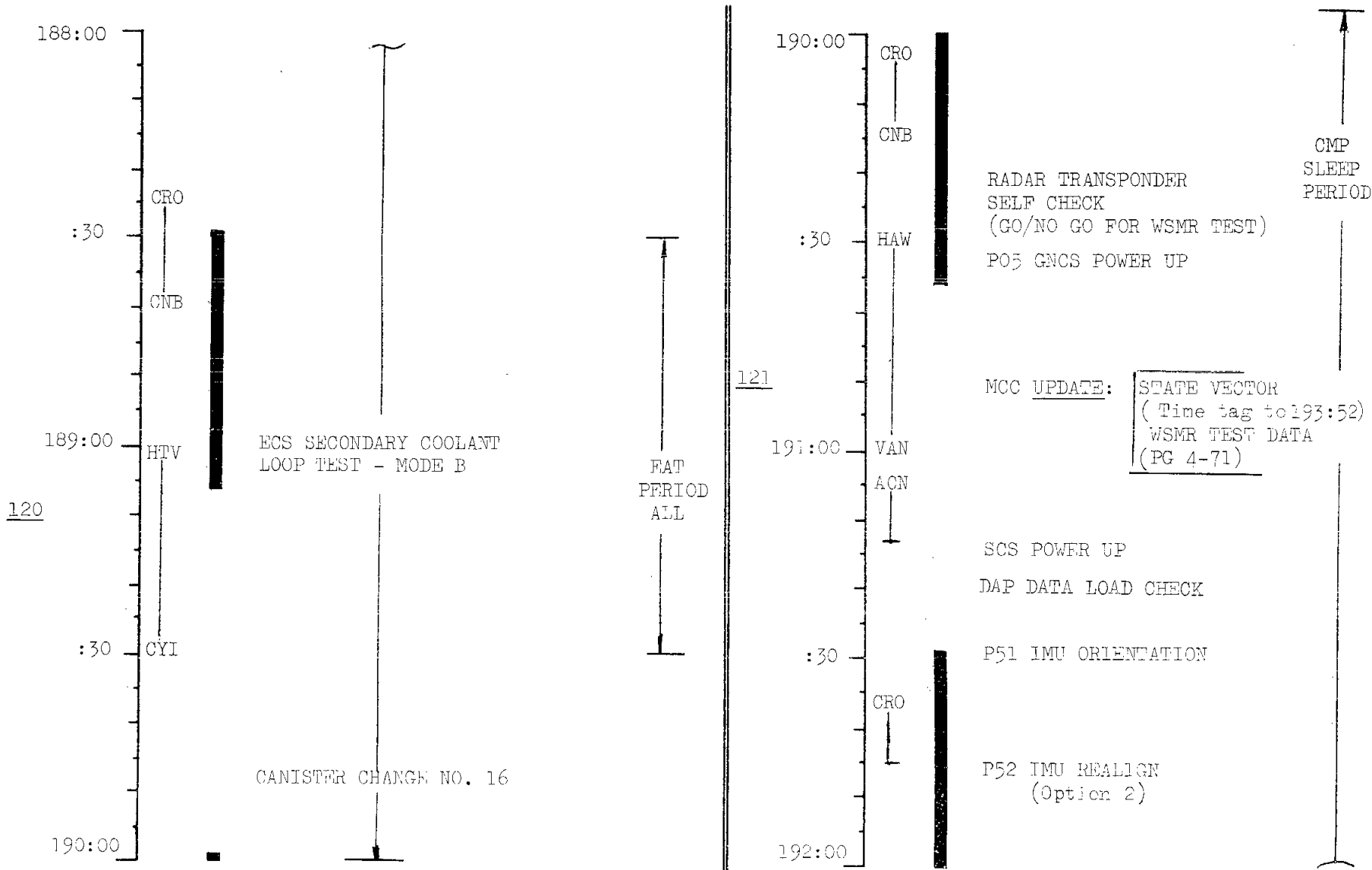
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	188-192	7/119-121	2-61

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

192:00 — HAW ▮

122

MCC UPDATE: LANDING AREA
BLOCK DATA NO. 21

:30 —

ANG
ACN

P52 IMU REALIGN
(Option 3)

193:00 —

CRO

GWM

:30 —

HAW

193:52 WSMR RR TEST
(Pg 4-71)

123

194:00 —

CMP
SLEEP
PERIOD

124

194:00 —

ANG

ACN

:30 —

195:00 —

GWM

HAW

:30 — TEX

196:00 —

MCC UPDATE: SCT STAR COUNT -
MODE A (Pg 4-6)

SCT STAR COUNT - MODE A
(Pg 4-6)

CMP
SLEEP
PERIOD
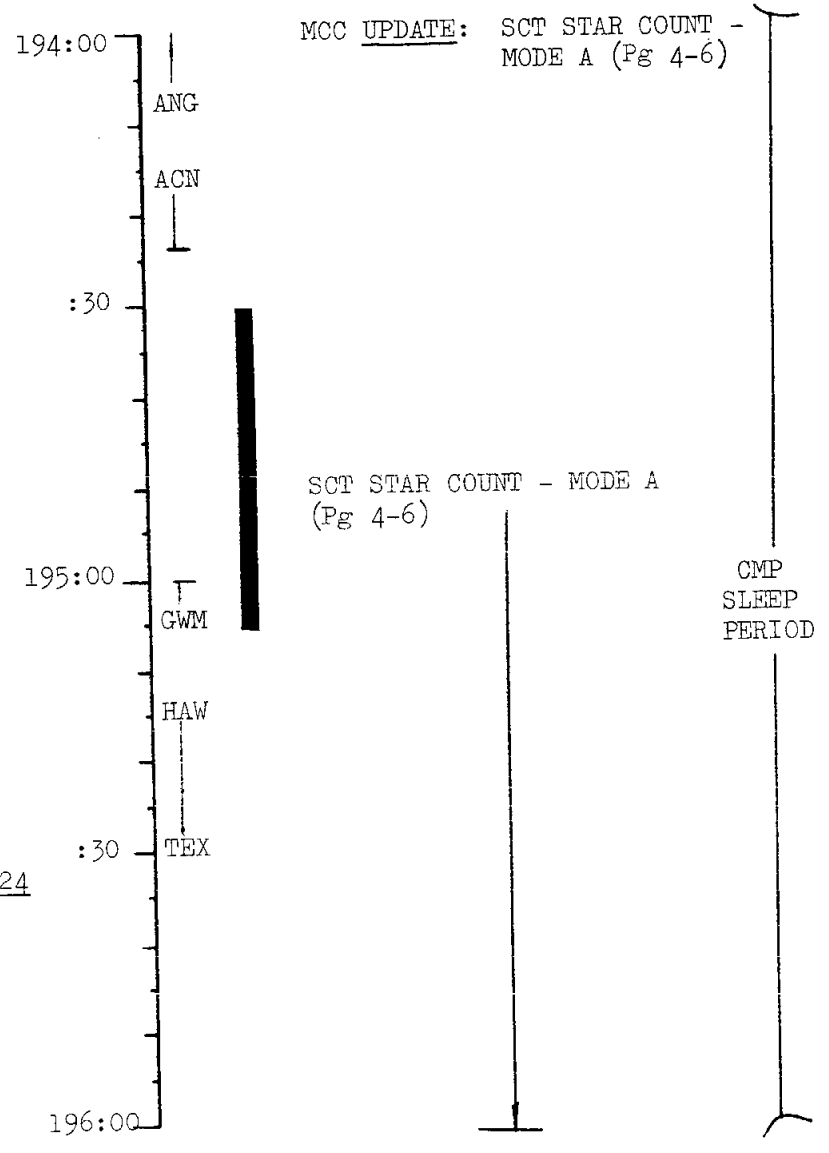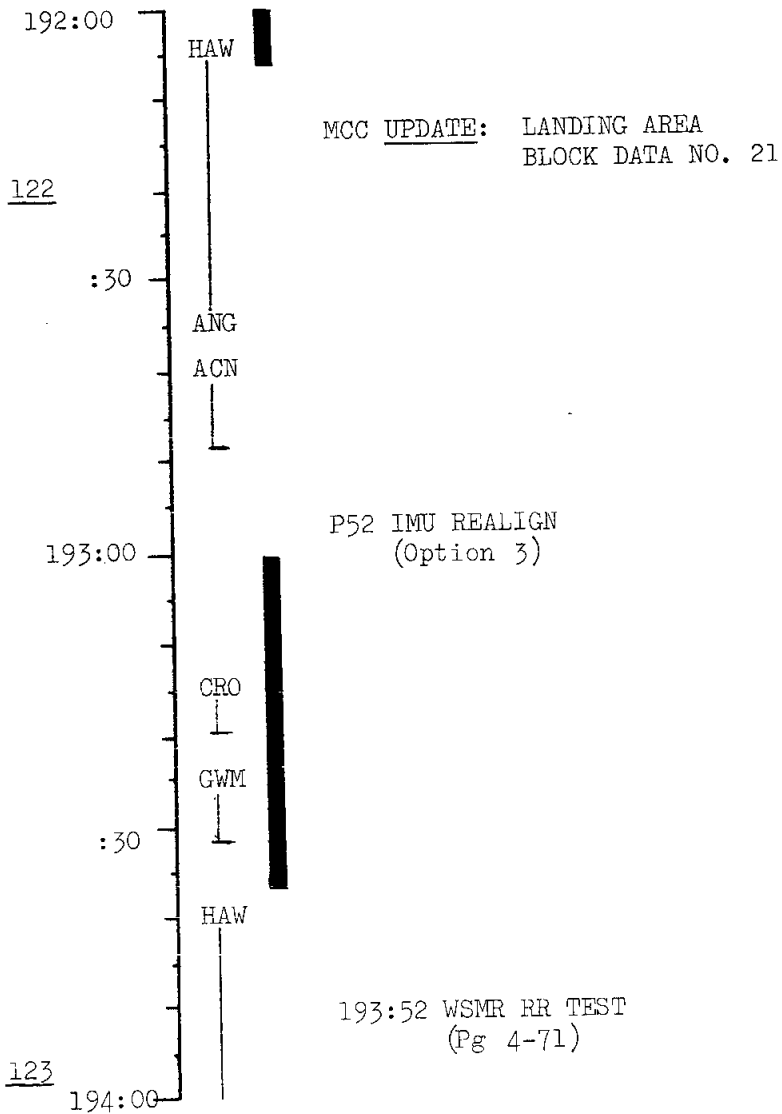
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	192-196	8/121-124	2-62

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

196:00

P06 GNCS POWER DOWN

H₂ PURGE LINE HTR – ON
SCS POWER DOWN

:30

F/C PURGE

MER

WATER CHLORINATION

HAW

ECS REDUNDANT
COMPONENT CK

FLIGHT PLAN STATUS REPORT

197:00

HTV

125

:30

HUMIDITY SURVEY

CDR
LMP
EAT
PERIOD

198:00

CMP
SLEEP
PERIOD

126

198:00

MER

:30

HAW

HTV

RED

199:00

:30

MER

200:00 HAW

CMP
SLEEP
PERIOD

CDR
LMP
SLEEP
PERIOD

CMP
EAT
PERIOD
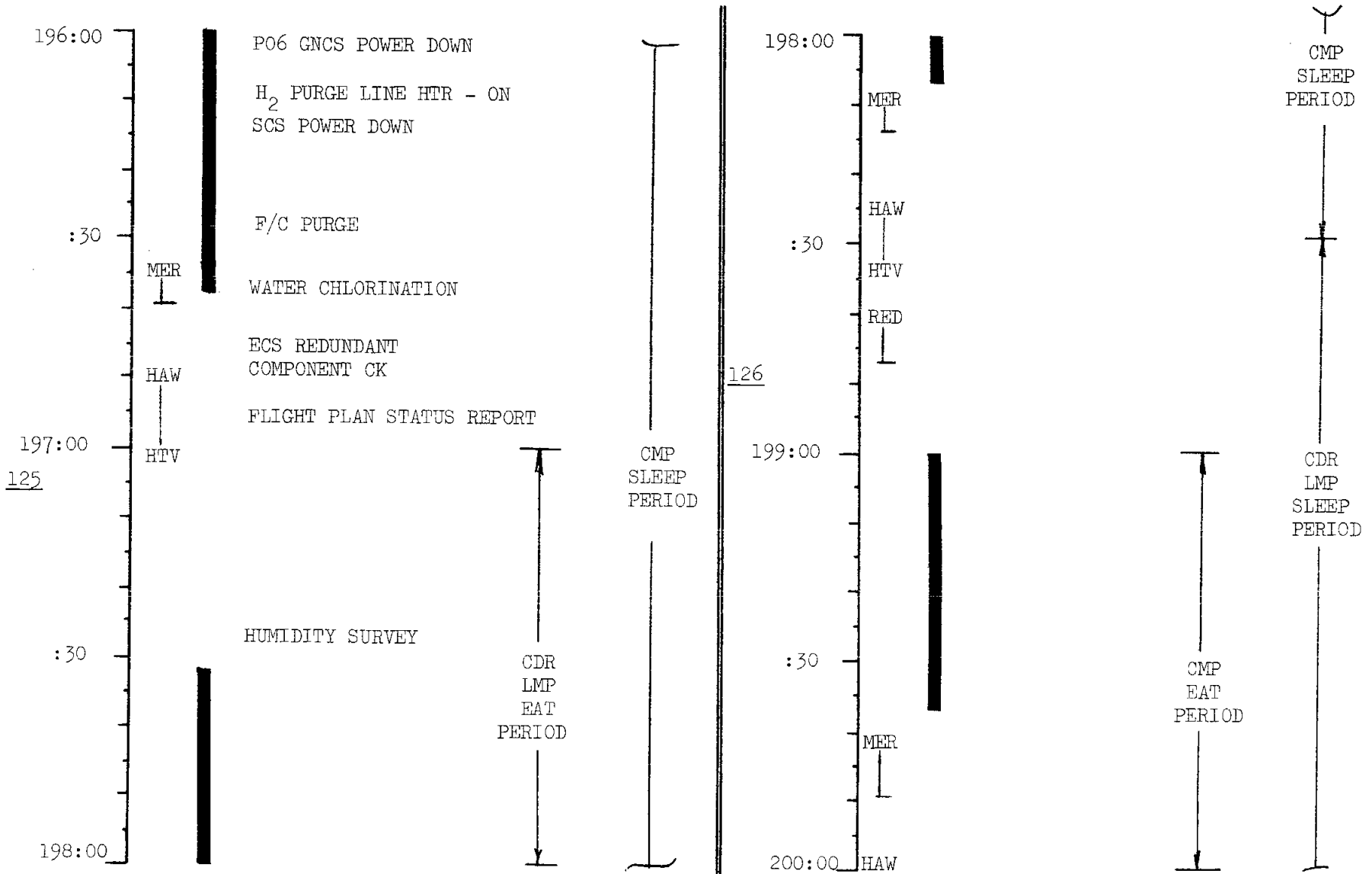
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	196 – 200	8/124–126	2-63

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

200:00 —

127

HAW

RED

:30 —

ACN

201:00 —

MER

:30 — GWM

128

RED

202:00 —

MCC UPDATE: LANDING AREA
                      BLOCK DATA NO. 22

CDR
LMP
SLEEP
PERIOD

202:00 —

ACN

:30 —

MER

203:00 —

GWM

129   :30 —

RED

204:00 —

CANISTER CHANGE NO. 17

CDR
LMP
SLEEP
PERIOD
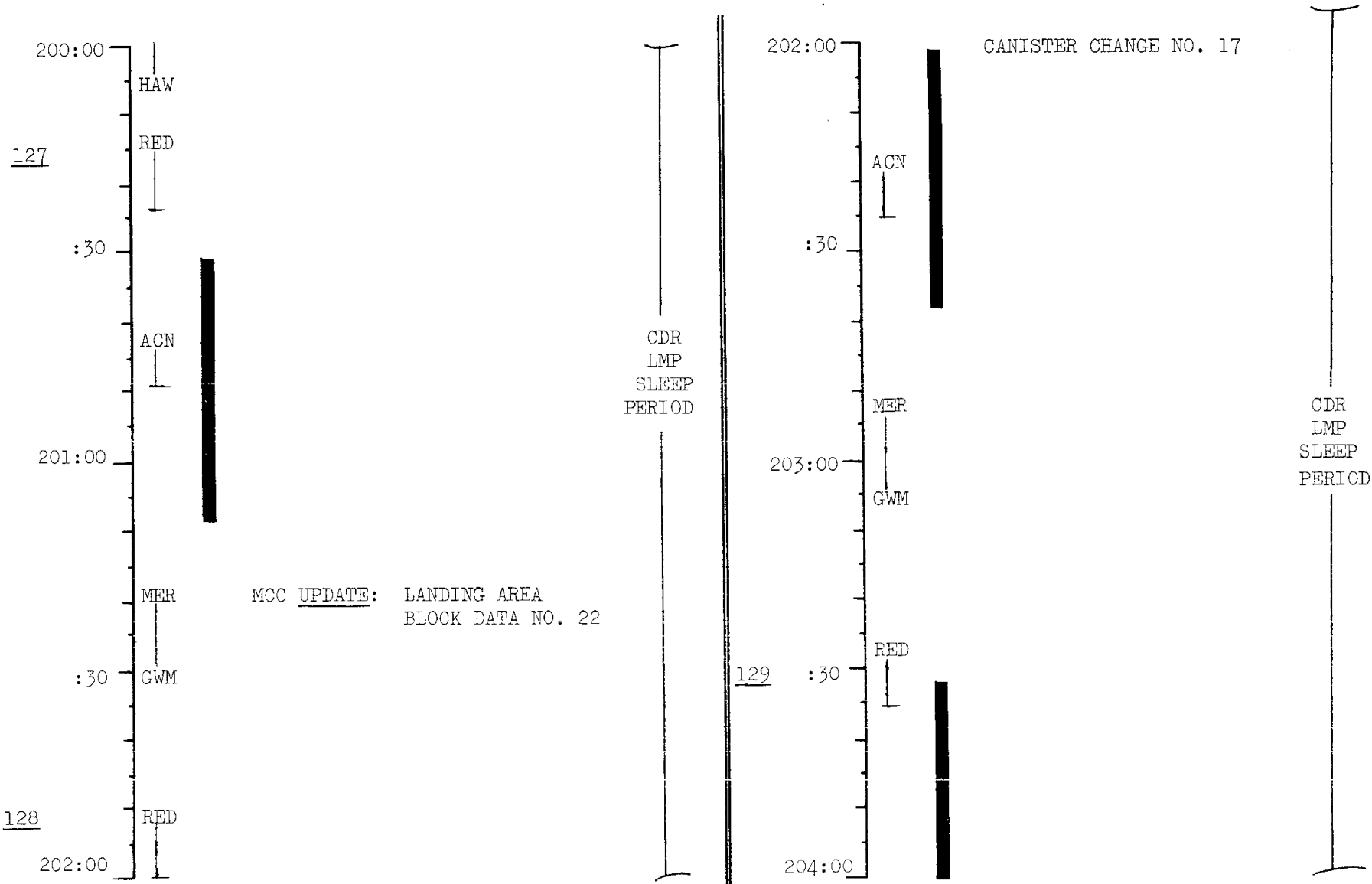
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	200-204	8/126-129	2-64

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

204:00

:30 — MER   FLIGHT PLAN STATUS REPORT

GWM

205:00 — RED

130

:30

CYI

206:00

CDR,
LMP
SLEEP
PERIOD

131

206:00

CNB

:30 — RED

207:00 — ANG   P05 GNCS POWER UP

CYI

MAD   MCC UPDATE: STATE VECTOR
                         TGT LOAD
                         MANEUVER PAD
                         NAV CHECK
                         SCS BACKUP ALIGN DATE
                         DATA (Pg 4-44)

:30

CRO   SCS POWER UP

P30 EXTERNAL ΔV

208:00   DAP DATA LOAD CK

CDR
LMP
SLEEP
PERIOD

EAT
PERIOD
ALL
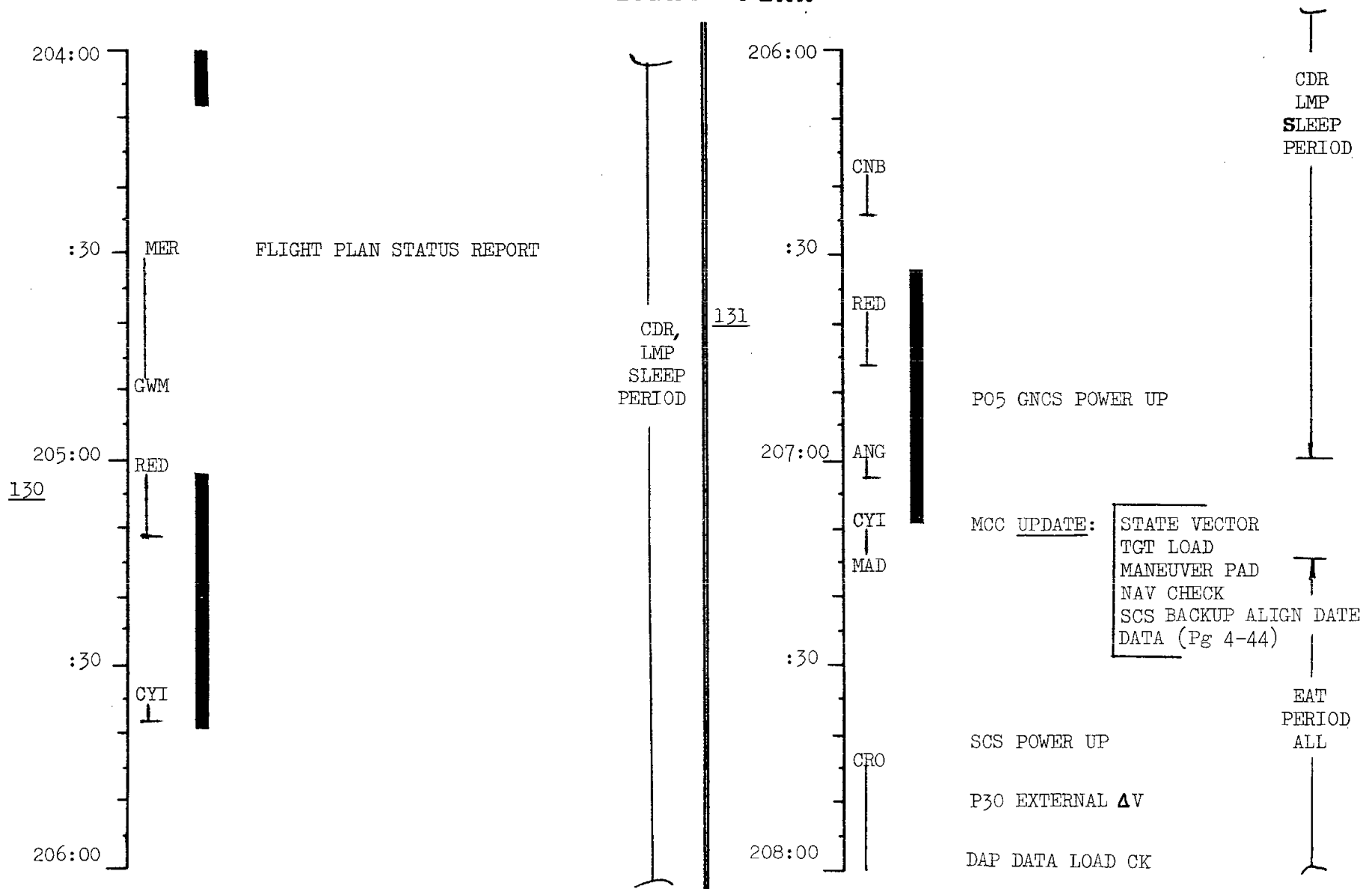
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	204 - 208	8/129-131	2-65

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

208:00 — CNB   P51 IMU ORIENTATION

132   RED

                 P40 CSM - SPS THRUSTING

                 H_2 PURGE LINE HTR - ON

                 P52 IMU REALIGN
                   (Option 1)

:30   GBM

                 F/C PURGE

     MAD

209:00

     CRO

:30

     CNB   SCS BACK-UP ALIGN
                 (Pg 4-44)

210:00

210:00 133

     TEX

     MAD

:30

     CRO

211:00

     CNB   P52 IMU REALIGN
                 (Option 3)

                 SELECT S-BAND ANT _____

                 SXT/STAR CHECK

:30 134   P40 CSM - SPS THRUSTING

     GYM

                 211:42 SPS BURN 6
                      G&N MIN IMP
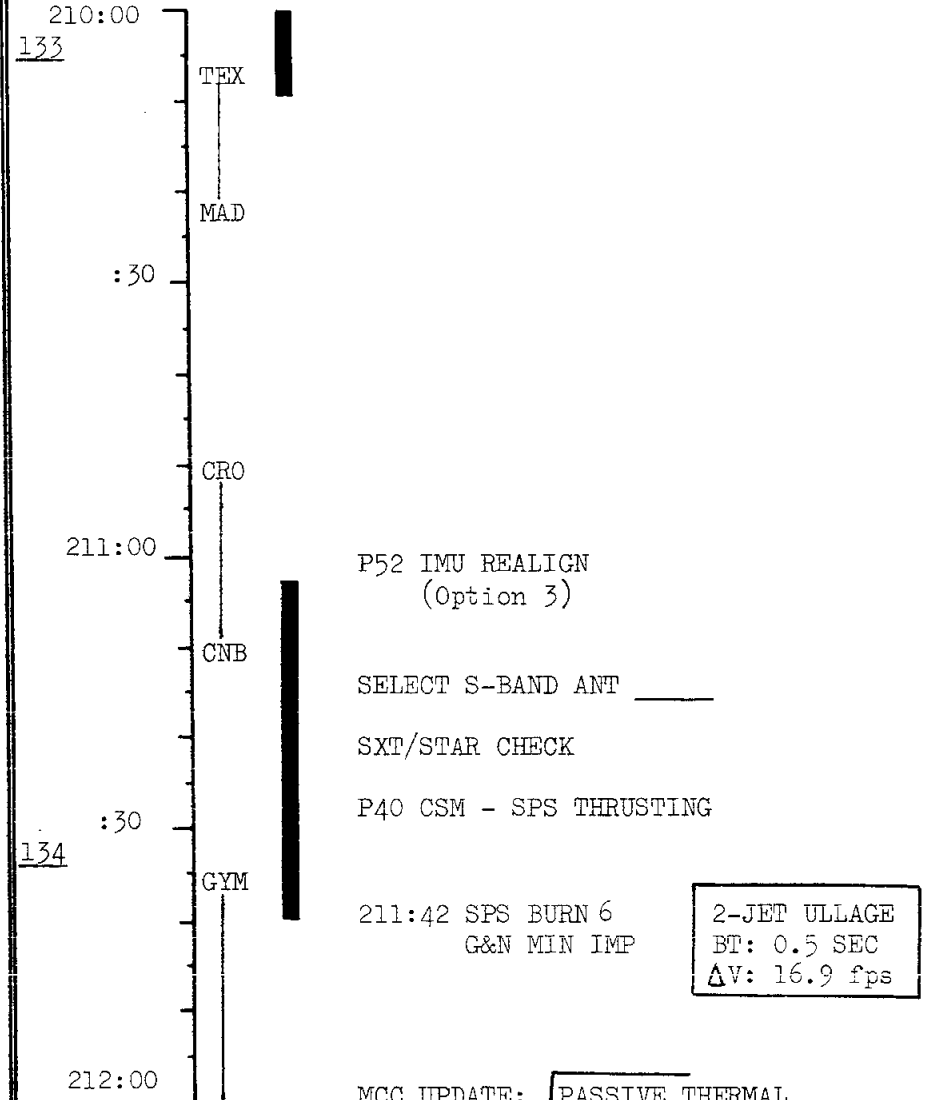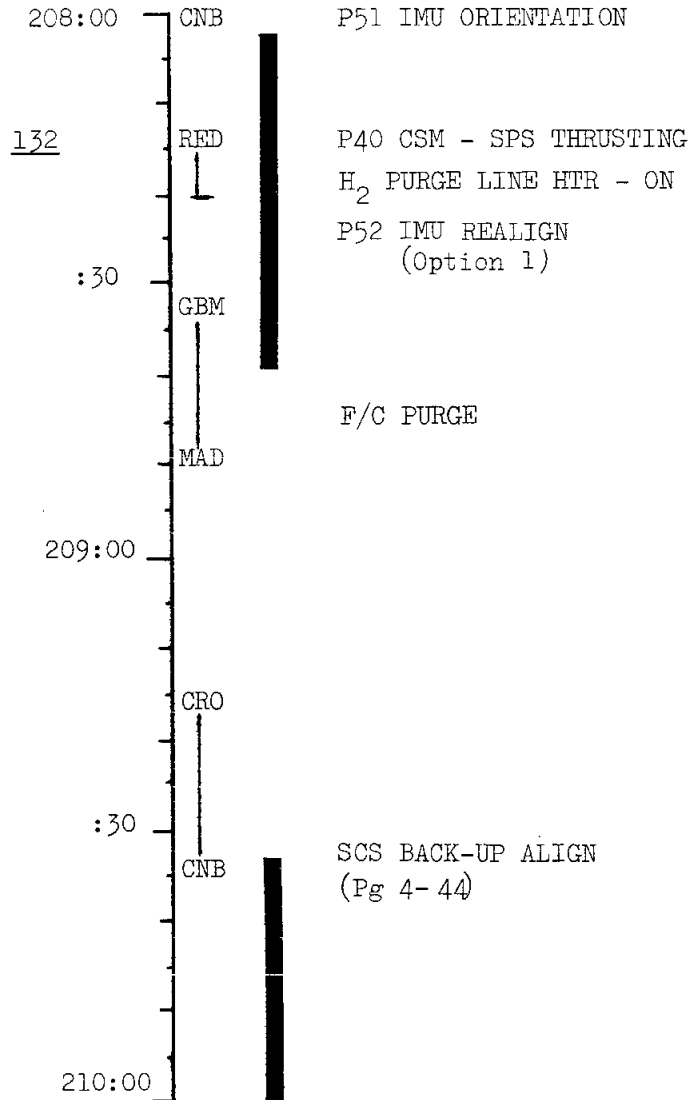
2-JET ULLAGE
BT: 0.5 SEC
ΔV: 16.9 fps

212:00

                 MCC UPDATE: PASSIVE THERMAL
                              CONTROL TEST 2
                              (Pg 4-85)

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	208-212	8/131-134	2-66
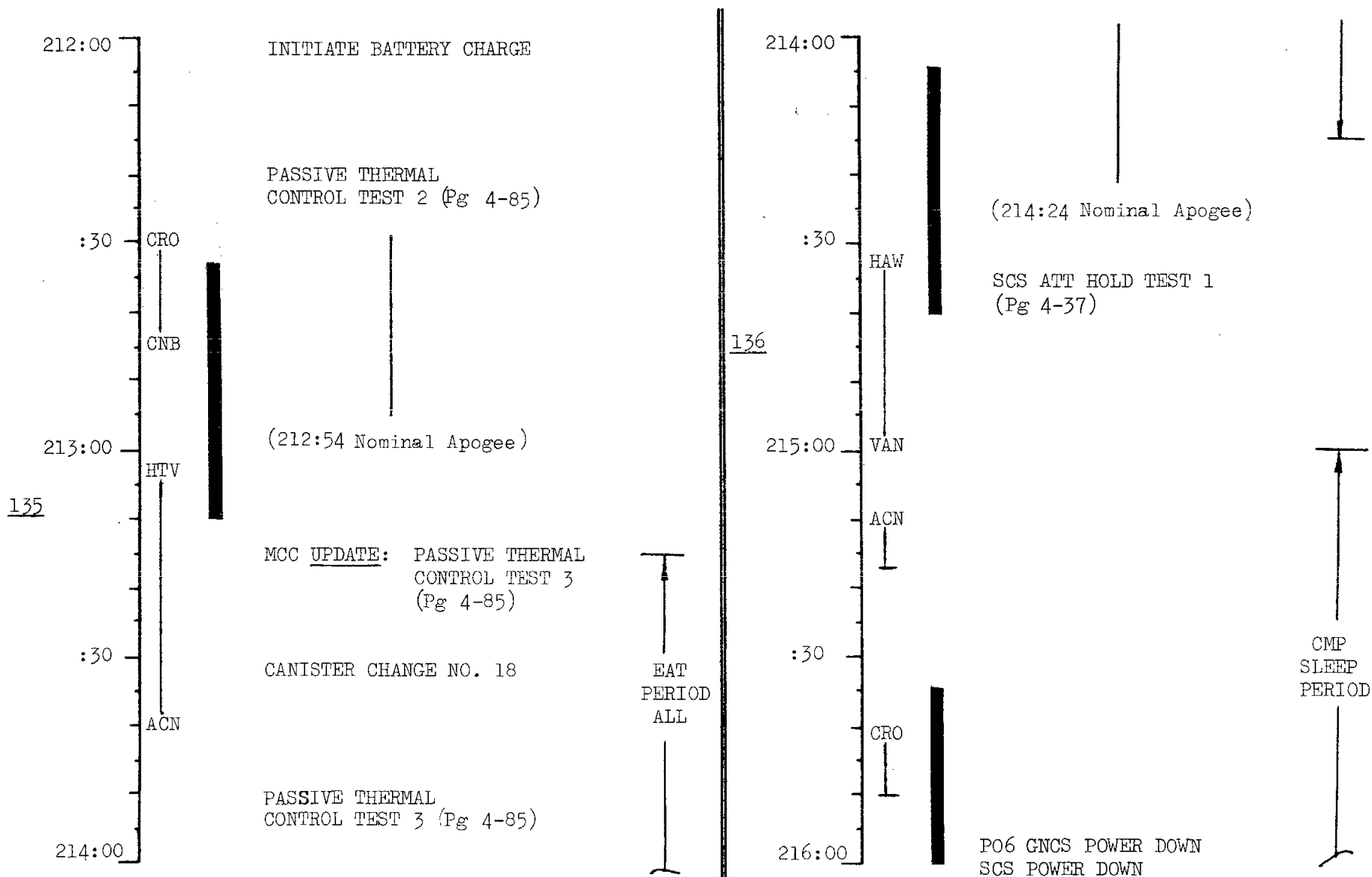
MSC FORM 1186 (SEP 67)

FLIGHT PLAN

INITIATE BATTERY CHARGE

PASSIVE THERMAL
CONTROL TEST 2 (Pg 4-85)

212:00

:30 — CRO

CNB

(212:54 Nominal Apogee)

213:00

135

HTV

MCC UPDATE: PASSIVE THERMAL
               CONTROL TEST 3
               (Pg 4-85)

:30

CANISTER CHANGE NO. 18

ACN

PASSIVE THERMAL
CONTROL TEST 3 (Pg 4-85)

214:00

EAT
PERIOD
ALL

136

214:00

(214:24 Nominal Apogee)

SCS ATT HOLD TEST 1
(Pg 4-37)

:30 — HAW

215:00 — VAN

ACN

:30

CRO

216:00

P06 GNCS POWER DOWN
SCS POWER DOWN

CMP
SLEEP
PERIOD

FLIGHT PLAN

216:00 — <u>137</u> HAW

:30 — ANG

ACN

217:00 —

CRO

:30 — GWM

HAW

FLIGHT PLAN STATUS REPORT

218:00 —

CMP
SLEEP
PERIOD

218:00 — <u>138</u> GBM
ANG

ACN

:30 —

219:00 —

MER
GWM

HAW

:30 — <u>139</u> GYM

220:00 —

CMP
SLEEP
PERIOD
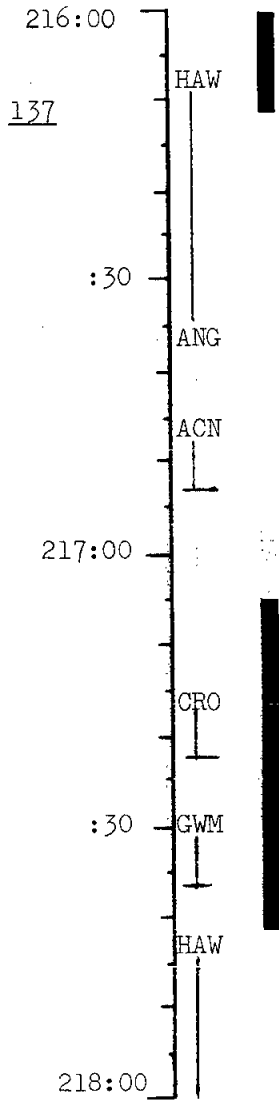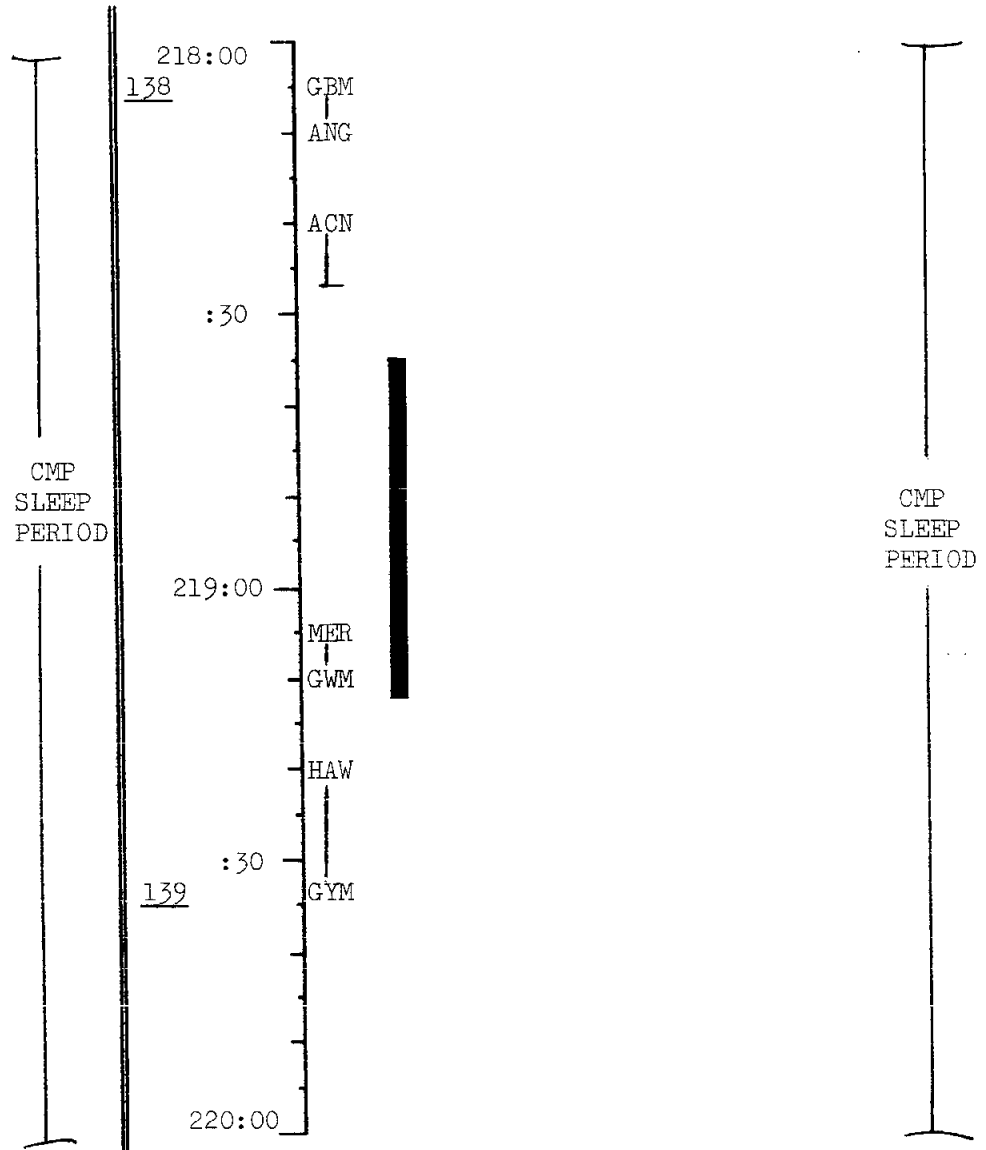
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	216-220	9/136-139	2-68

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

220:00 —
WATER CHLORINATION

:30 —

ECS REDUNDNAT
COMPONENT CHECK

MER

HAW

221:00 —   MCC UPDATE: LANDING AREA
                               BLOCK DATA NO. 24

140

HTV

HUMIDITY SURVEY

:30 —

222:00 —

141

CMP
SLEEP
PERIOD

222:00 —

MER

:30 —

HAW

RED

223:00 —

ACN

:30 —

MER

224:00 —

CMP
SLEEP
PERIOD

CDR
LMP
EAT
PERIOD

CMP
SLEEP
PERIOD

CDR
LMP
SLEEP
PERIOD
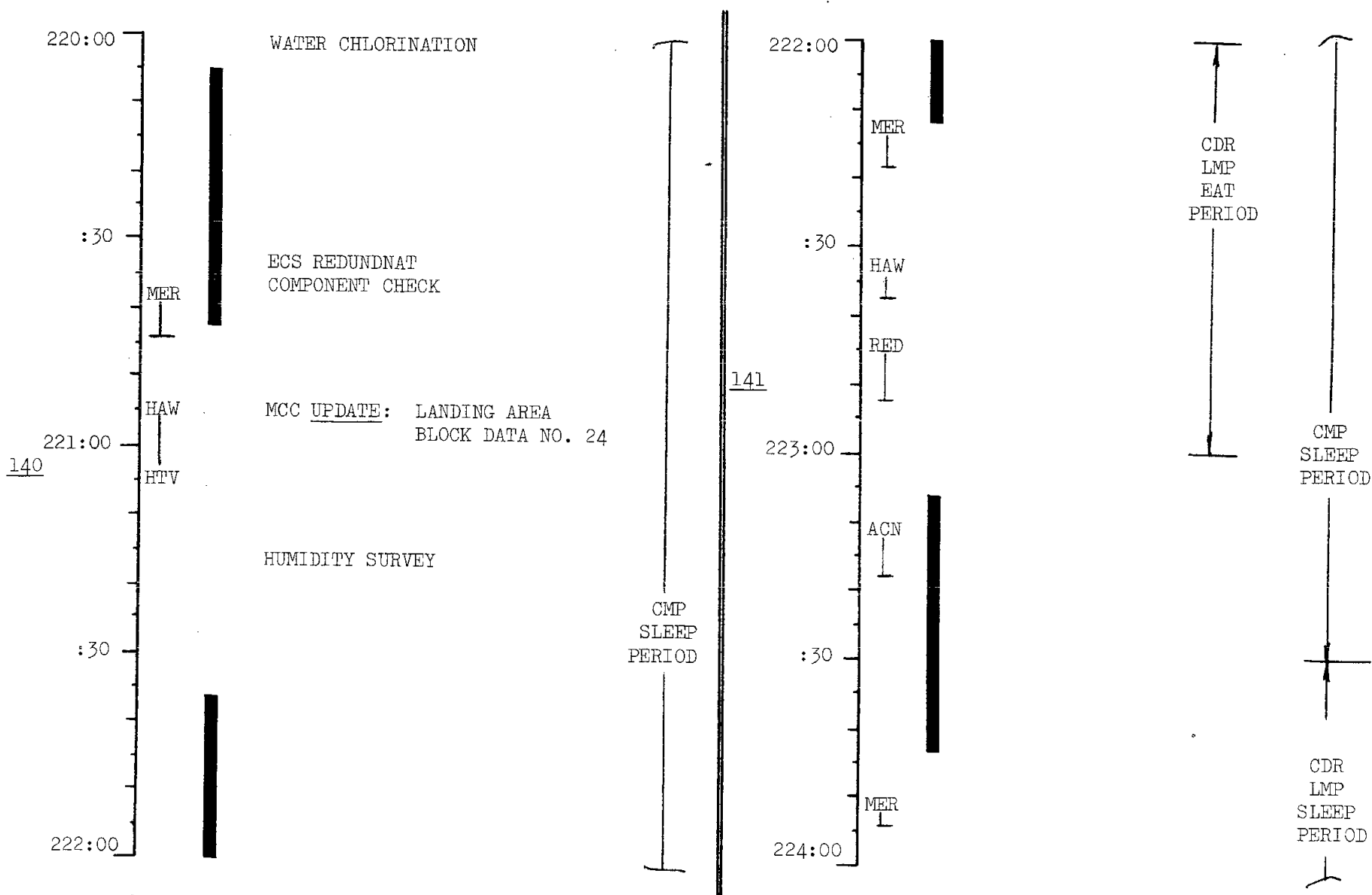
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	220-224	9/139-141	2-69

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

CANISTER CHANGE NO. 19

224:00

142 — RED

:30

ACN

225:00

MER

:30

GWM

143 226:00 — RED

CMP
EAT
PERIOD

CDR
LMP
SLEEP
PERIOD

144

226:00

ACN

:30

227:00 — MER

GWM

:30

RED

228:00

CDR
LMP
SLEEP
PERIOD
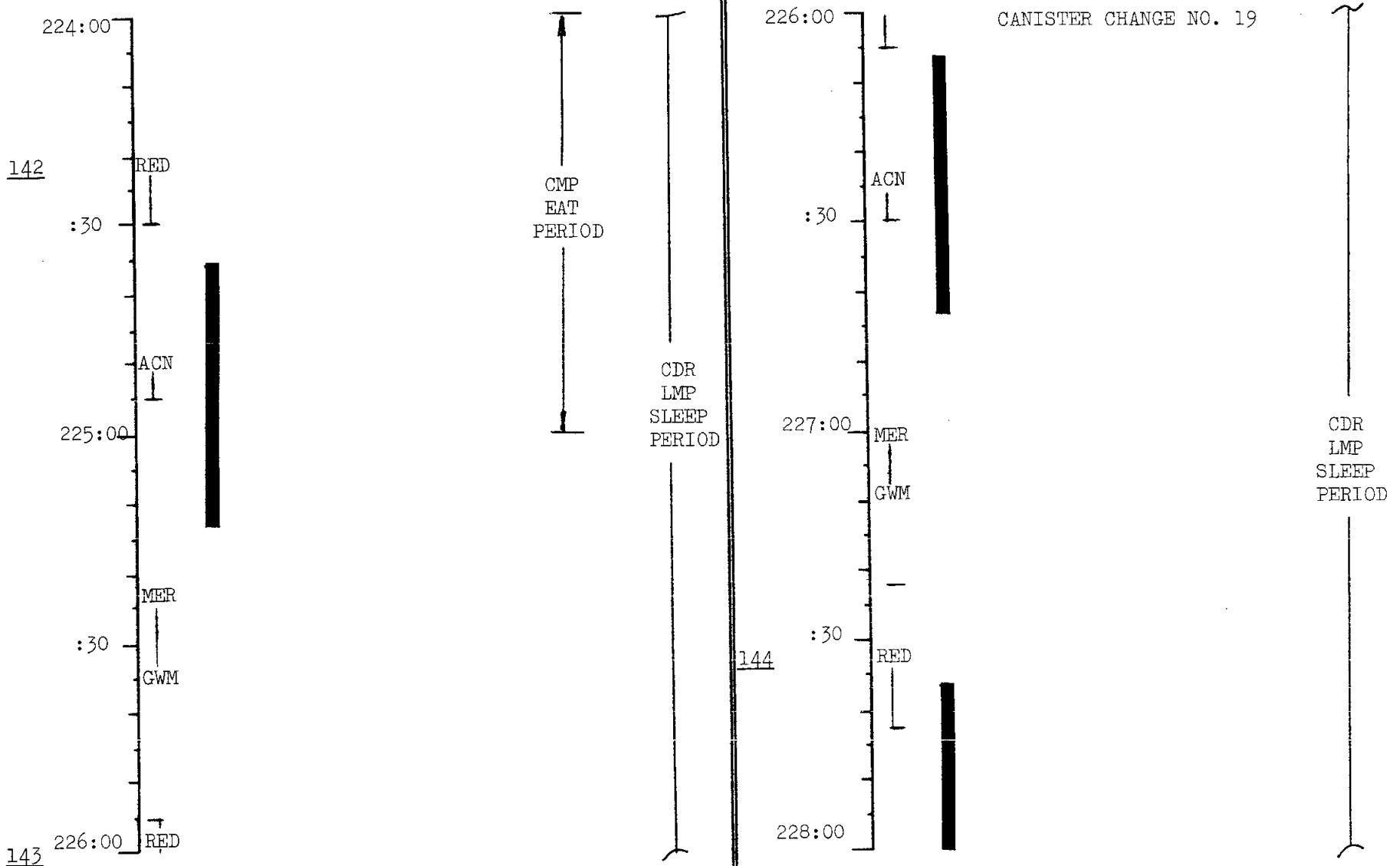
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	224-228	9/141-144	2-70

FLIGHT PLAN

228:00 — CYI

:30 —

229:00 —

RED

145

:30 —

CYI
MAD

230:00 —

230:00 —

CRO

:30 — CNB

RED

231:00 — ANG

MAD

:30 —

CRO

232:00 —

146

CDR
LMP
SLEEP
PERIOD

MCC UPDATE: LANDING AREA
              BLOCK DATA NO. 25

H$_2$ PURGE LINE HTR – ON

F/C PURGE

FLIGHT PLAN UPDATE

CDR
LMP
SLEEP
PERIOD
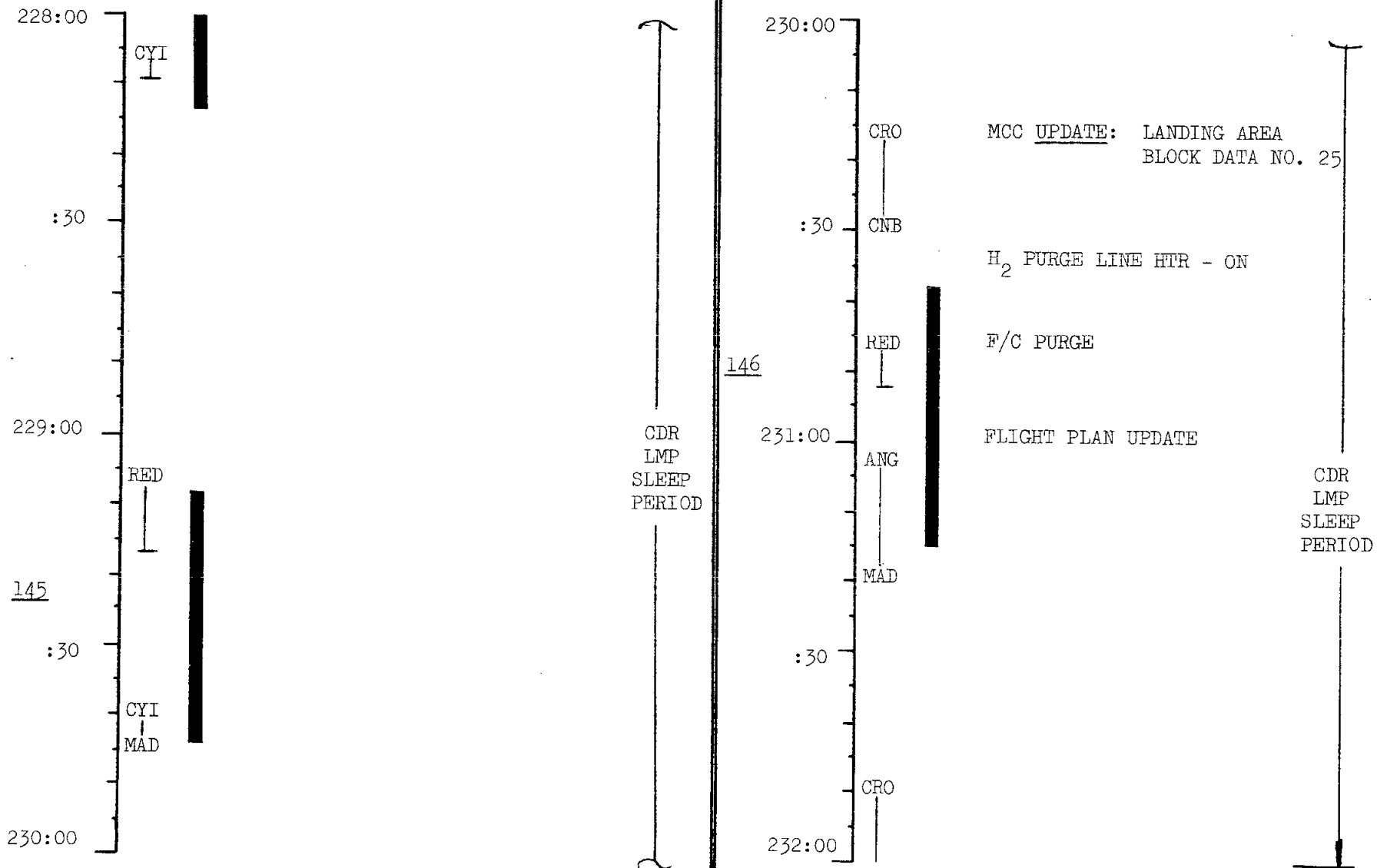
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	228-232	9/144-146	2-71

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

232:00 — CNB

147

:30 — RED

MIL

MAD

233:00 —

P05 CMC POWER UP

CRO

MCC UPDATE:
- STATE VECTOR
- TGT LOAD
- MANEUVER PAD
- NAV CHECK

:30 —

CNB

POS IMU POWER UP
DAP DATA LOAD CK

234:00 —

EAT
PERIOD
ALL

148

234:00 — GYM

P30 EXTERNAL ΔV

S005, S006 PHOTOGRAPHY
(REV 148, PG 4-108)

SCS POWER UP

:30 — CYI

235:00 — CRO

P52 IMU ORIENTATION

CNB

P40 CSM – SPS THRUSTING

P52 IMU REALIGN
(Option 1)

:30 —

HTV

149

236:00 —

FLIGHT PLAN

236:00 — CYI

:30 —

CRO — P52 IMU REALIGN
(Option 3)

CNB —

237:00 — SELECT S-BAND ANT _____

HAW — SXT/STAR CHECK

P40 CSM – SPS THRUSTING
(Check final gimbal angles)
SCS THRUST MONITOR
237:25   SPS BURN 7
SCS AUTO

150

4-JET ULLAGE
BT: 19.6 SEC
ΔV: 494 fps

:30 —

VAN —

ACN — INITIATE BATTERY CHARGE

238:00 —

238:00 —

CRO —

:30 —

HAW — PIPA BIAS, EMS BIAS TEST
(Pg 4-33, 4-35)

151 — MCC UPDATE: LANDING AREA
BLOCK DATA NO. 26

239:00 — FLIGHT PLAN STATUS REPORT

ANG —

ACN —

:30 —

CRO — SXT CALIBRATION
TEST (Pg 4-3)

240:00 — GWM

CANISTER CHANGE NO. 20

EAT
PERIOD
ALL

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	236-240	9/149-151	2-73

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

NOTE: ATTITUDE CONTROL TESTS
(Pg 4-26 and 4-37) NOT
COMPLETED WILL BE
SCHEDULED PRIOR TO GNCS
AND SCS POWER DOWN, RCS FUEL
PERMITTING.

240:00

HAW

152

:30

ANG

P06 GNCS POWER DOWN
SCS POWER DOWN

F/C PURGE

ACN

241:00

:30

GWM

HAW

242:00

CMP
SLEEP
PERIOD

153

242:00

TEX

COMPLETE WINDOW
PHOTOGRAPHY TEST
(Pg 4-100)

:30

243:00

GWM

HAW

:30

154

HTV

244:00

WATER CHLORINATION

INITIATE DEORBIT STOWAGE

CMP
SLEEP
PERIOD
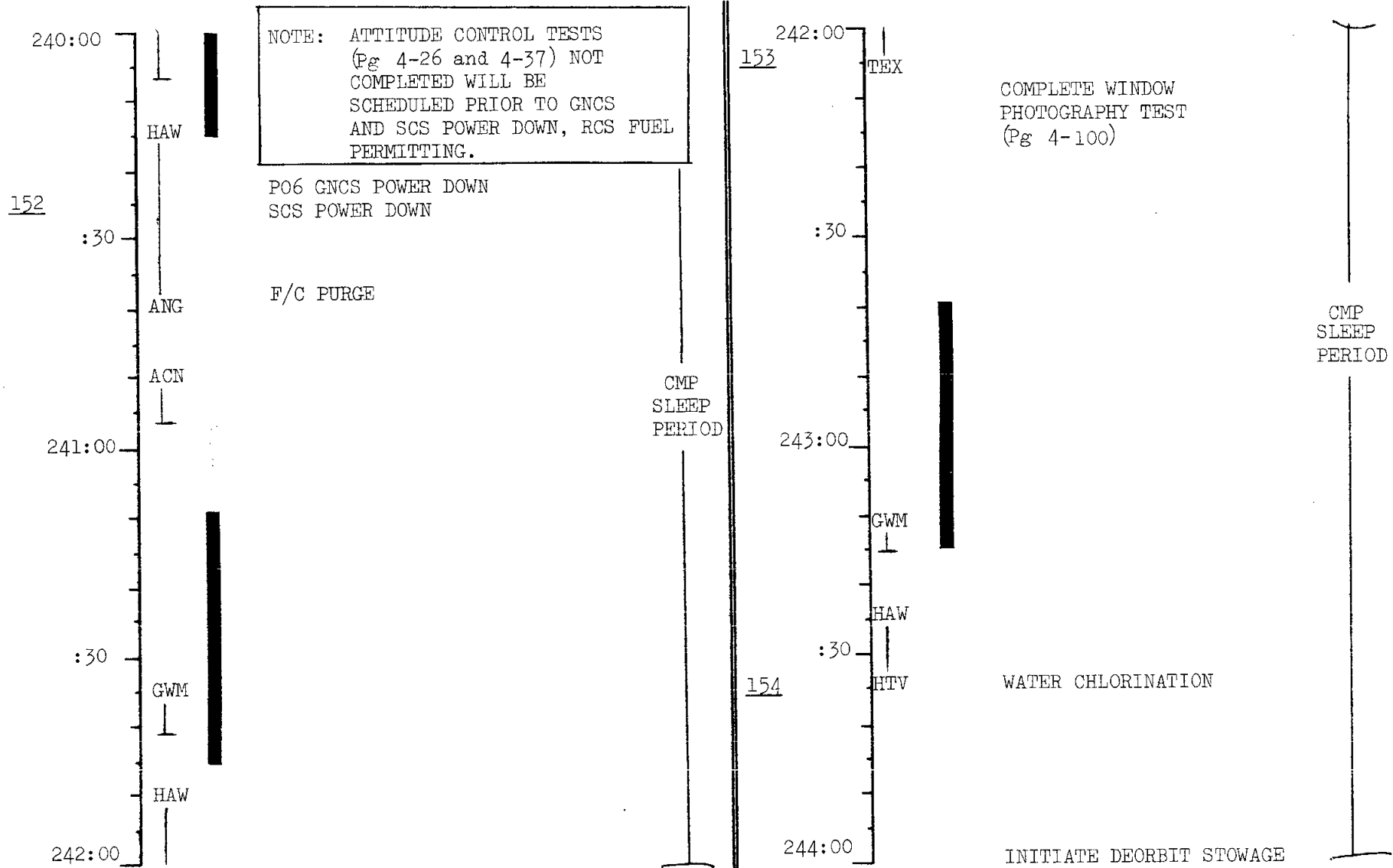
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	240-244	10/151-154	2-74

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

244:00

:30

ECS REDUNDANT
COMPONENT CK

MER

CRYOGENIC STRATIFICATION
TEST 3 (Pg 4-67)

245:00

155

HTV

HUMIDITY SURVEY

:30

246:00

CMP
SLEEP
PERIOD

156

246:00

MER

:30

HAW

RED

247:00

ACN

:30

MER

248:00

CMP
SLEEP
PERIOD

CDR
LMP
EAT
PERIOD

CMP
SLEEP
PERIOD
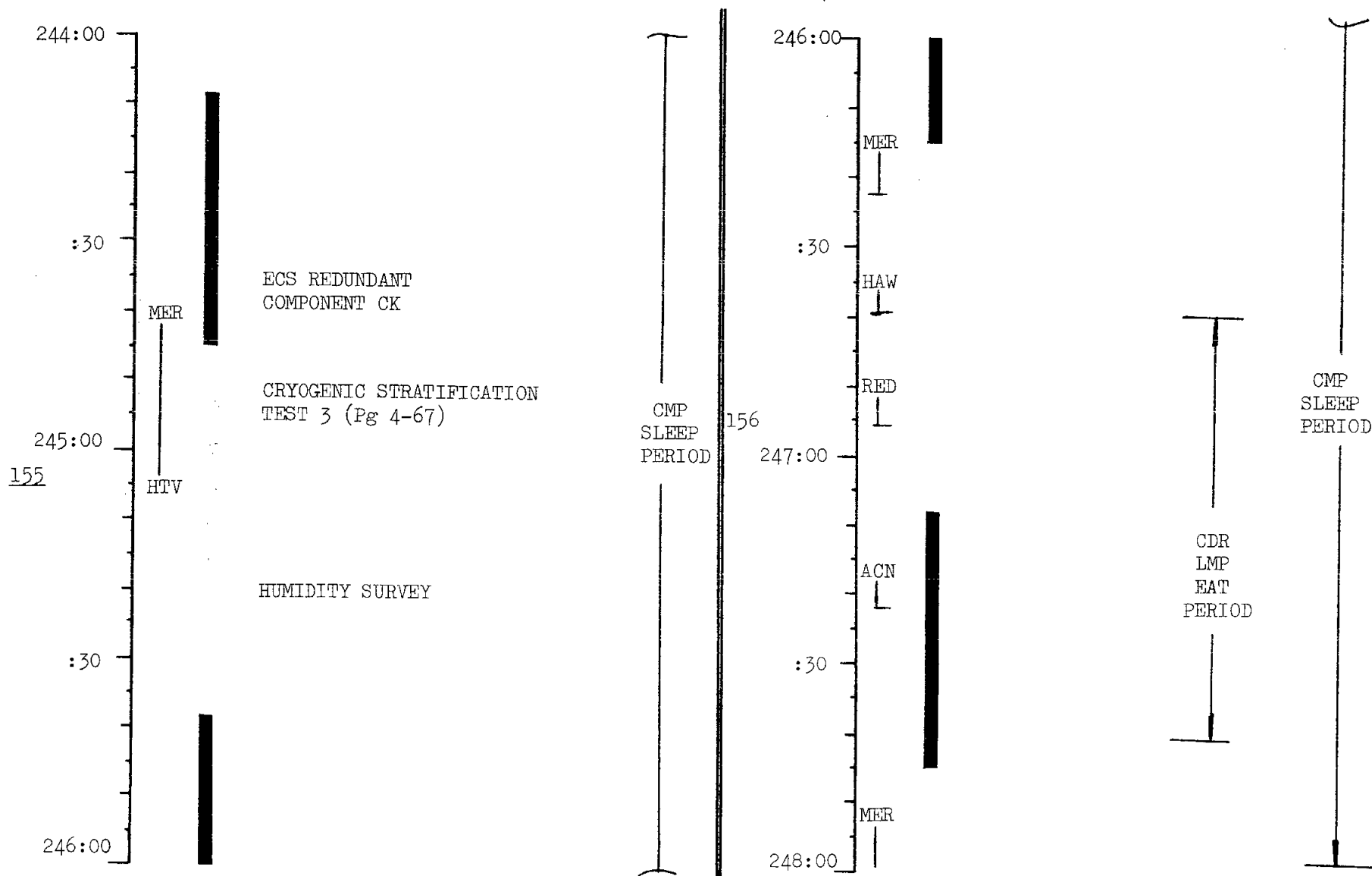
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	244-248	10/154-156	2-75

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

248:00

157

:30

RED

ACN

249:00

MER

:30

GWM

250:00 RED

CMP
EAT
PERIOD

CDR
LMP
SLEEP
PERIOD

MCC UPDATE: LANDING AREA
            BLOCK DATA NO. 27

INITIATE CABIN COLD SOAK

250:00

158

:30

ACN

251:00

MER
GWM

:30

RED

159

252:00

CANISTER CHANGE NO. 21

CDR
LMP
SLEEP
PERIOD

S005, S006 PHOTOGRAPHY
(REV 159, PG 4-108)
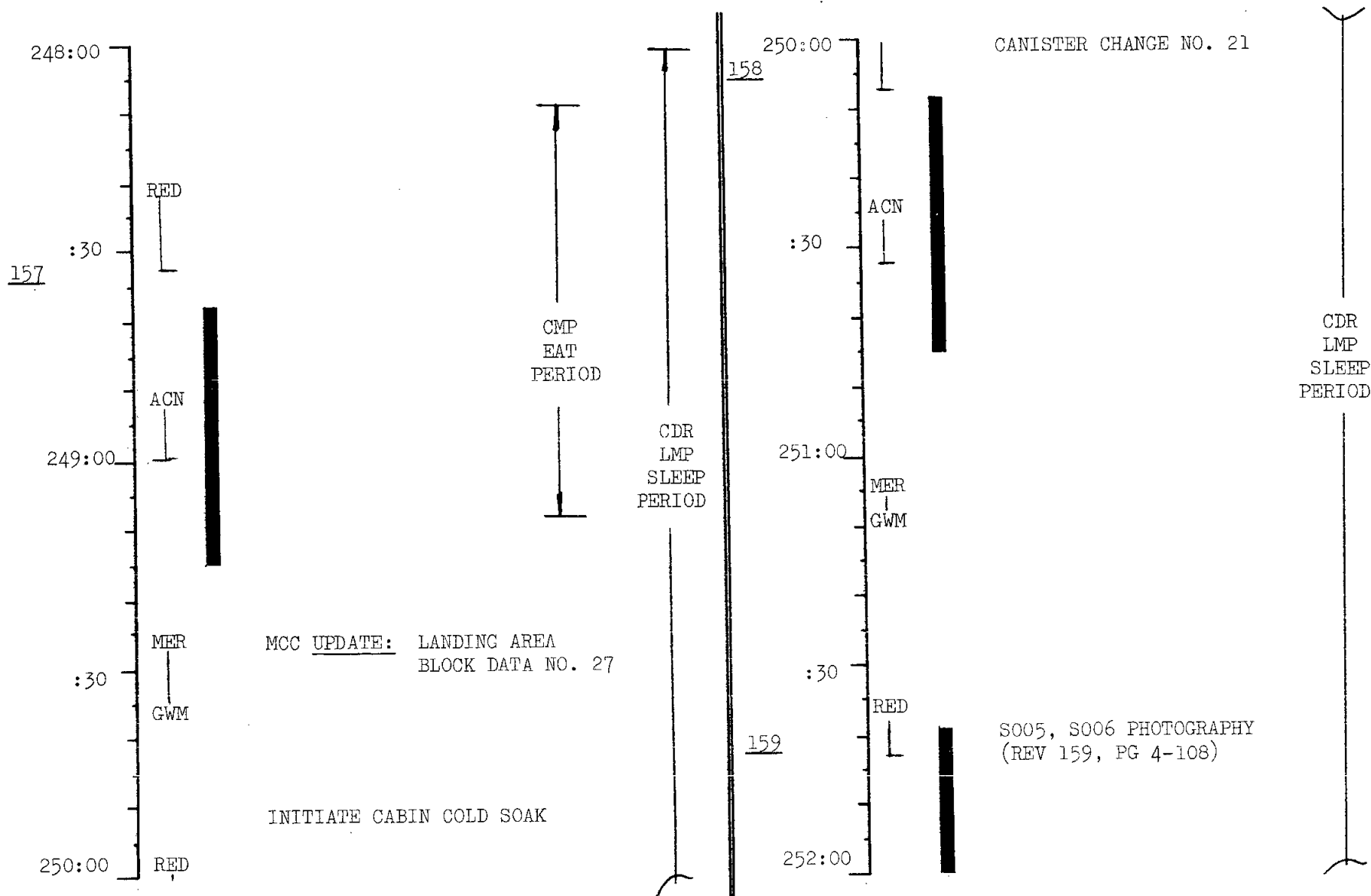
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	248-252	10/156-159	2-76

FLIGHT PLAN

252:00 — CYI

:30

253:00 — RED

160 —

:30 — ANG

CYI

MAD

254:00 —

FLIGHT PLAN UPDATE

CDR
LMP
SLEEP
PERIOD

161

254:00 — CRO

CNB

:30 —

RED

255:00 — GBM

MAD

:30 —

CRO

256:00 —

CDR
LMP
SLEEP
PERIOD
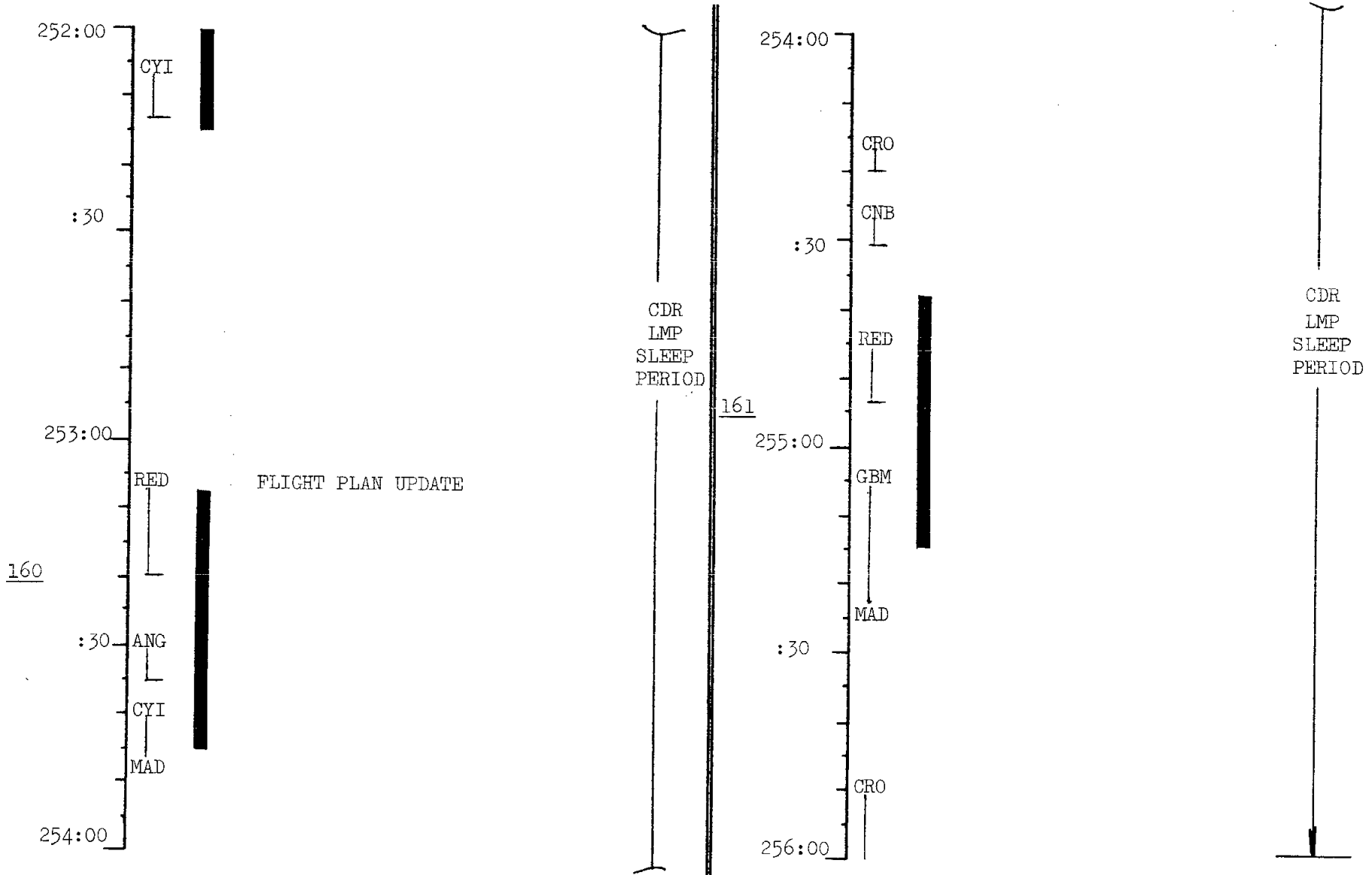
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	252-256	10/159-161	2-77

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

256:00

:10

:20

:30

162

:40

:50

257:00

CNB

RED

TEX

MAD

P05 CMC POWER UP

MCC UPDATE:

REFSMMAT
STATE VECTOR
TGT LOAD
MANEUVER PAD
NAV CHECK
ENTRY UPDATE

P05 IMU POWER UP

P30 EXTERNAL ΔV

DAP DATA LOAD CK

EAT
PERIOD
ALL

257:00

:10

:20

:30

:40

:50

258:00

DONN SUITS - ALL

SCS POWER UP

CRO

CNB

P51 IMU ORIENTATION

P52 IMU REALIGN
(Option 1)
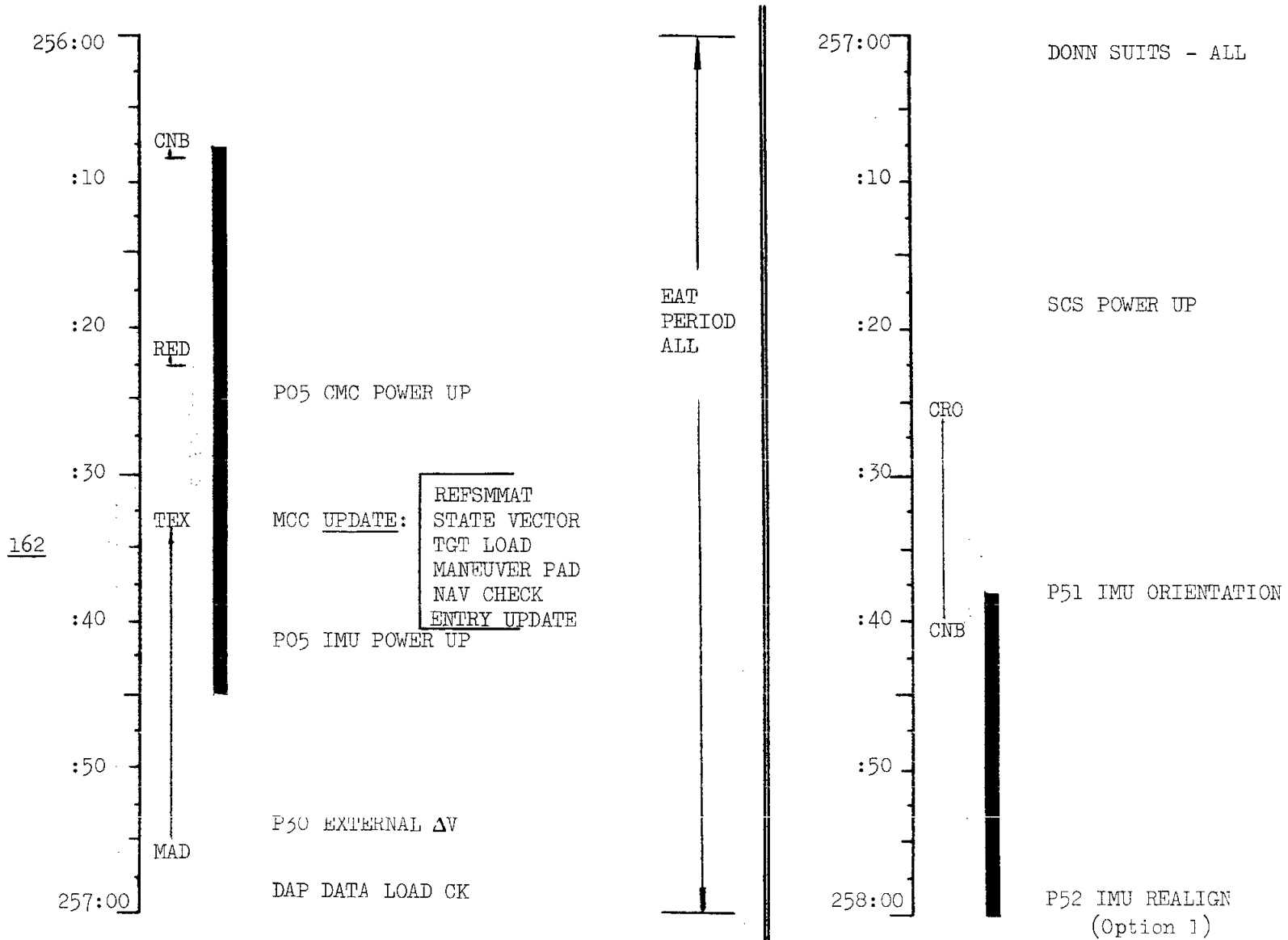
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	256-258	10/161-162	2-78

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

258:00 — GYM

:10

163

:20 — COMPLETE DEORBIT STOWAGE

:30 — CYI — CANISTER CHANGE NO. 22, AS DESIRED

:40

:50

259:00 — CRO

259:00 —

:10 — CNB — P52 IMU REALIGN (Option 3)

:20

:30 — HTV — EMS DEORBIT TEST

164

:40

:50 — P30 PRETHRUST

SUIT INTEGRITY CHECK

260:00 — VAN — POWER UP FQ INST

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	258-260	10/162-164	2-79

MSC FORM 1186 (SEP 67)

FLIGHT PLAN

260:00 — CYI

CM RCS PREHEAT (20 MIN)

:10 —

STOW ORDEAL

:20 —

:30 —

CRO

MCC: REPORT GO/NO GO PYRO ARM

CM RCS THRUSTER CHECK

:40 —

CNB

P40 CSM - SPS THRUSTING

:50 —

SELECT S-BAND ANT _____

FQ RECORDER REQ FOR DEORBIT

261:00 —

261:00 — HAW

-5:30 GIMBAL DRIVE CHECK

261:08 DEORBIT
         G&N Δ V

4-JET ULLAGE	
BT: 9.9 SEC	ΔV: 259 fps

:10 —

+5.24 CM/SM SEP

+10:33 400K

:20 —

+13:09 .05G - P64
+13:45 .02G - P67
+18:09 MAX G
+20:55 DROGUES (23K)
+21:41 MAINS (10K)
+22:16 SPLASHDOWN

:30 —

:40 —

:50 —

262:00 —

MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	260-262	10/164	2-80

MSC FORM 1186 (SEP 67)

SECTION III – CONSUMABLE ANALYSIS

NOTE

Acknowledgement is made to the Consumable Analysis Section (CAS) of the Mission Planning and Analysis Division (MPAD) for their work in the preparation of the RCS and cryogenic consumable analysis presented herein.

The results of the SM-RCS budget analysis are summarized in the following tables and figures:

Table V   RCS USAGE SUMMARY
Table VI   AS-205/101 PARAMETRIC DATA
Table VII   SM-RCS DEORBIT REDLINE SCS MODE/HYBRID ALLOWANCE
Figure 3   NOMINAL MISSION SM-RCS PROFILE
Table VIII   NOMINAL MISSION SM-RCS BUDGET

Ground Rules and Assumptions

The following ground rules and assumptions are listed below to give the user some insight into the construction of SM-RCS profiles. A more detailed analysis of propellant prediction is being prepared by the CAS of MPAD.

1. Data Source: Data for SM/RCS engine performance and propellant requirements was obtained from Part 4 of the CSM/LM Spacecraft Operational Data Book, May 1968.

2. Attitude Hold: Attitude hold propellant usage prediction for CSM-101 are based on simulator results. GNCS mode was simulated at 6.0 lb/hr for a 0.5° deadband and 20.0 lb/hr for a SCS 0.2° deadband with one roll channel disabled. Maximum deadband cost was assumed to be 1.4 lb/hr for both guidance modes.

3. Maneuvers: Since it is nearly impossible to predict in all cases what maneuver rates or angles will be required, it was assumed that all maneuvers were 3 axis orientations at rates of 0.2°/sec, unless otherwise specified. It was also assumed that all IMU alignments required 3 axis orients, which may seem conservative, but would allow for propellant usage at higher rates and angles. A 3 axis orientation at 0.2°/sec was predicted to cost 0.7 lb with 0.3 allotted for corrections and minimum impulse control.

4. <u>Flow Rate</u>: A propellant flow rate of 0.361 lb/sec/engine was assumed for calculating applicable translation and SM spin-up maneuvers (MMDB, Table 4-1).

5. <u>Steady State Isp</u>: A value of 276 seconds was assumed (MMDB, Table 4-1).

6. <u>Propellant Quantity</u>:

	Lb
Maximum loaded	1362
Unusable	58
Minimum Del.	1304
Gaging accuracy	82
Total available for mission	1222

7. <u>Deorbit Philosophy</u>: The deorbit philosophy presented here gives only the current general thinking and does not represent a final plan.

Since the SCS mode for translation costs approximately 10% more than the GNCS, it has been advised that the SM-RCS redline include the additional SCS cost. An additional allowance of 15 lb is included for damping rates caused by a possible SPS engine hardover or for SCS attitude reference alignment.

An allowance of 80 fps from the SM-RCS propellant was made for the hybrid assistance.

TABLE V

RCS SUMMARY

DAY (GET)	PER DAY	RCS PROPELLANT CUMULATIVE	REMAINING
0(0-24)	105.5	105.5	1256.5
1(24-48)	409.8	515.3	746.7
2(48-72)	19.6	534.9	827.1
3(72-96)	62.5	597.4	766.6
4(96-120)	26.8	624.2	737.8
5(120-144)	19.8	644.0	718.0
6(144-168)	44.8	688.8	673.2
7(168-192)	10.4	699.2	662.2
8(192-216)	57.4	756.6	605.4
9(216-240)	77.5	834.1	529.7
10(240-CM/SM SEP)	46.3	880.4	473.4

TABLE VI

PARAMETRIC DATA FOR MISSION AS-205/101

PARAMETRIC DATA	PRIOR TO BURN							
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8
CSM Weight, lb	32,480	31,810	31,225	30,453	30,409	26,790	26,746	25,467
CM Weight, lb	12,659	12,659	12,659	12,659	12,659	12,659	12,659	12,659
SM RCS Propellant Requirement for X-axis Translation lb/ft/sec								
PGNCS Mode	3.7	3.6	3.6	3.5	3.5	3.1	3.1	2.9
SCS Mode	4.0	3.9	3.9	3.8	3.8	3.4	3.4	3.2
Orbital Parameters, Perigee/Apogee n.m. (orbital decay and other dispersions are neglected)	126/170	126/162	126/160	95/160	95/163	90/220	90/223	90/221
Total RCS Δ V Required for Deorbit, fps	153	153	153	98	98	89	89	89
Total SM RCS Propellant Requirement for SM RCS Deorbit, lb								
SCS Mode	667	652	652	431	431	358	358	338

TABLE VII

SM-RCS DEORBIT REDLINE SCS MODE/HYBRID ALLOWANCE

	PROPELLANT REQUIRED PRIOR TO SPS BURN							
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8
S/C Wt Lbs	(32 480)	(31 810)	(31 225)	(30 453)	(30 409)	(26 790)	(26 746)	(25 467)
Engine Hardover Recovery	15	15	15	15	15	15	15	15
Orient To Deorbit Att. (4°/sec) & Att Hold 0.2°db 15 min.	13	13	13	13	13	13	13	13
SM-RCS Longitudinal Deorbit Translation (3% Accel. Error) (40 m.mi. Perigee)	619	604	604	384	384	312	312	293
Orient For Jettison (4°/sec)	5	5	5	5	5	5	5	5
Jettison (Spin 5.5 sec VEL ≈ 3 fps)	15	15	15	14	14	13	13	12
Total SM-RCS Prop. Req'd For Deorbit (SCS Mode)	(667)	(652)	(652)	(431)	(431)	(358)	(358)	(338)
Hybrid Allowance (80 fps)	320	312	312	304	304	272	272	256
Total SM-RCS Prop Req'd For Deorbit (SCS Hybrid Mode)	(347)	(340)	(340)	(127)	(127)	(86)	(86)	(82)

FIGURE 3

SM-RCS PROFILE
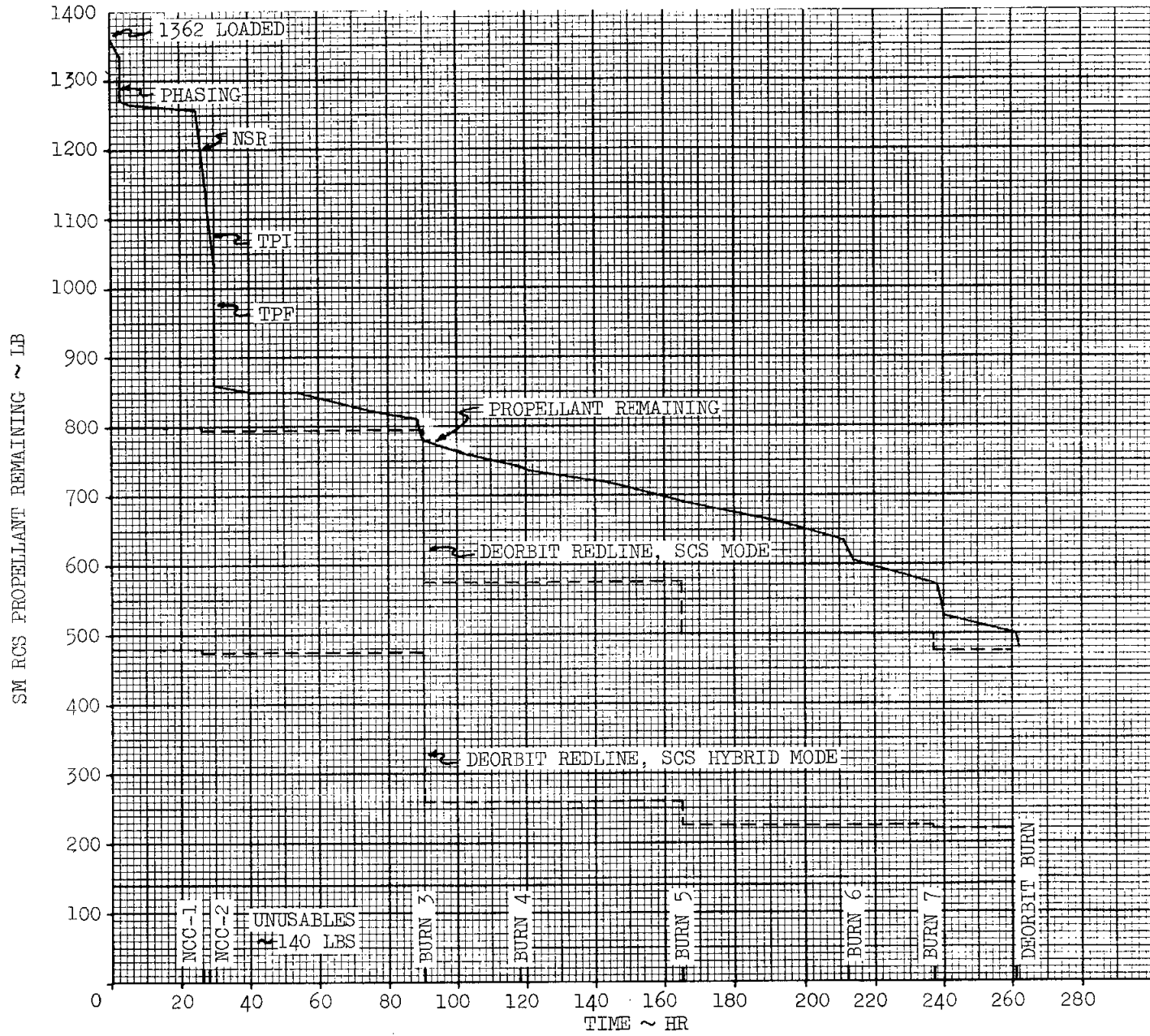
TABLE VIII

NOMINAL MISSION SM/RCS BUDGET

ITEM	TIME	EVENT	MANEUVER	PROPELLANT LBS PER MANEUVER	TOTAL PROP. USED, LBS.
1	Prelaunch	SCS Prelaunch SM-RCS checkout	Fire each jet for 1 sec		
			SUBTOTAL	5.8	5.8
2	2:55	CSM/S-IVB SEP and transposition	SCS S/C WT $\approx$ 32300		
			+X, 5 sec, Sep $\Delta V \approx$ 1 fps	4.2	
			-X, 1.5 sec, Null Vel. & -X jets check	2.1	
			Pitch Up 180° @ 5°/sec	12.8	
			Roll 60° @ 2°/sec	3.0	
			SUBTOTAL	22.1	27.9
3	3:03	SCS Simulated Docking Formation flying, & SLA photography	+X, 1.5 sec, null sep. vel.	2.1	
			indexing allowance fly around	10.0	
			$\pm$Y, ΔVel $\approx$ 0.5 fps	4.5	
			$\pm$X, ΔVel $\approx$ 0.5 fps	4.1	
			Yaw 90° @ 2°/sec & Att Hold, 0.2° lb.	3.0	
			$\pm$Z, ΔVel $\approx$ 0.5 fps	4.5	
			$^+_-$X, ΔVel $\approx$ 0.5 fps	4.1	
			Pitch 90° 22°/sec & att hold, 5.0 lb. (front, side & top view)	3.0	
			SUBTOTAL	35.3	63.2

TABLE VIII (CONT.)

ITEM	TIME	EVENT	MANEUVER	PROPELLANT LBS. PER MANEUVER	TOTAL PROP. USED, LBS.
4	3:20	RCS Phasing	GNCS/P-47 – 3 axis orient		
			Orient/att hold, 0.5 db	1.2	
			+X, 7.5 fps	27.1	
			GNCS/Free – Orient to		
			Monitor S-IVB	0.8	
			SUBTOTAL	29.1	92.3
5	5:09	IMU Realign	GNCS/P-52 – 3 axis orient/MI	1.0	
	5:00	PIPA & EMS Bias Test	SCS Null Rates, 0.2°db, Att hold 6 min	2.0	
	5:37	SPS Thrusting Check & Manual Retro	GNCS/P40 – 2-3 axis orient/ att hold, 0.5°db, 15 min.	2.2	
			SUBTOTAL	5.2	97.5
6	12:40	IMU Realign	GNCS/P-52 – 3 axis orient/MI	1.0	
	18:37	IMU Realign	GNCS/P-52 – Orient/MI	1.0	
	20:07	SXT Calibration Check	GNCS/P-23 – 2-3 Axis Orient/MI	2.0	
			SUBTOTAL	4.0	101.5
7	21:37	COAS Calibration	GNCS/Auto – 3 Axis Orient/MI	1.0	
	23:05	IMU Realign	GNCS/P-52 – 3 Axis Orient/MI	1.0	
	24:55	Rendezvous Navigation	GNCS/P-20 – 2 -3 Axis Orient/MI	2.0	
			SUBTOTAL	4.0	105.5
8	26:25	IMU Realign NCC-1 (SPS)	Orient/MI	1.0	
			GNCS/P-40 – Orient for SPS/att hold & MI	2.7	
			GNCS/P-40 – Ullage, 4 jets, 15 sec.,	21.1	

TABLE VIII (CONT.)

ITEM	TIME	EVENT	MANEUVER	PROPELLANT LBS. PER MANEUVER	TOTAL PROP. USED, LBS.
8 (cont'd)	26:30	Rendezvous Navigation	GNCS/P-20 - 2-3 axis Orient/MI	2.0	
	27:28	NCC-2 (SPS)	GNCS/P-40 - 3 axis orient for SPS/Att Hold	2.7	
			Ullage, 4 jets, 15 sec	21.1	
			Null VG's	25.5	
	27:35	IMU Realign	GNCS/P52 - Orient/MI	1.0	
	27:57	NSR	GNCS/P-40 - 3 axis orient/ MI & Att Hold	2.7	
			Ullage, 4 jets, 15 sec	21.1	
			Null VG's	24.8	
	28:00	Rendezvous Navigation	GNCS/P-20 - 2-3 axis orient/MI	2.0	
			Orient to Tracking Att	1.6	
			Backup Data Collection	7.4	
	29:11	SM-RCS Burn	GNCS/P-41 - TPI/TRIM	83.4	
			Maneuver to Track Att.	1.2	
			Navigation Tracking	0.2	
			Backup Data Collection	3.6	
	29:38		Midcourse Burns	36.1	
			Braking & LOS Control	131.9	
			Station Keeping	2.0	
			SUBTOTAL	395.1	500.6
9	30:20	Final S-IVB Sep (RCS)	Orient/MI	1.2	
			GNCS/P-47 +X, Vel = 2 fps	7.4	
		Slosh Damping Test (RCS)	GNCS - Att Hold Wide db, 10 min	0.1	
			SUBTOTAL	8.7	509.3

TABLE VIII (CONT.)

ITEM	TIME	EVENT	MANEUVER	PROPELLANT LBS. PER MANEUVER	TOTAL PROP. USED, LBS.
10	39:30	IMU Realign	3-axis oreint/MI	1.0	
	40:10	Post Rendezvous S-IVB Tracking @ 80 n.mi.	GNCS/P-20 - 2-3 axis orient/MI	2.0	
			SUBTOTAL	3.0	512.3
11	45:30	IMU Realign	3-axis Orient/MI	1.0	
	46:10	Post Rendezvous S-IVB Tracking @ 160 n. mi.	GNCS/P-20 - 2-3 Axis Orient/MI	2.0	
			SUBTOTAL	3.0	515.3
12	51:30	IMU Realign	GNCS/P-52 - 3 axis Orient/MI	1.0	
	52:05	Post Rendezvous S-IVB Tracking @ 320 n. mi.	GNCS/P-20 - 2-3 axis Orient/MI	2.0	
			SUBTOTAL	3.0	518.3
13	53:20	SCT Star Count (Mode A) IMU Orient. Determination	GNCS/Auto - 3 axis orient for GET_{SR} Attitude	0.7	
			GNCS/Auto - 35 min. att hold 5.0° db	0.7	
			GNCS/Auto - 3 axis orient for GET_{SS} Attitude	0.7	
			GNCS/Auto - 35 min. att hold 5.0°db	0.7	
			SUBTOTAL	2.8	521.1

TABLE VIII (CONT.)

ITEM	TIME	EVENT	MANEUVER	PROPELLANT LBS. PER MANEUVER	TOTAL PROP. USED, LBS.
14	54:35	Power Down	SCS - Allot 2-3 axis/orient 10 min att Hold to damp drift rates when req'd. & photography orientations (S-005&6)		
			SUBTOTAL	2.4	523.5
15	69:20	IMU Align	GNCS/P-51, 52 - 2-3 axis Orient/MI	2.0	
	70:00	Daylight Test, IMU Align	GNCS/ P-52, 3 axis orient/MI	1.0	
			SUBTOTAL	3.0	526.5
16	70:50	IMU Realign	GNCS/P-52 - 3 axis Orient/MI	1.0	
	71:41	WSMR LM RR Test	SCS, Manual - Orient to Tracking Att Att Hold 0.5° db, 20 min	1.4 6.0	
			SUBTOTAL	8.4	534.9
17	73:00	Orbital Navigation	GNCS/P-52 - Realign IMU GNCS/P-22 - 3 axis orient/MI Est. Orbital Rate, MI P, Y&R Att Hold 0.2° db	1.0 1.0 1.0	
			SUBTOTAL	3 0	537.9

TABLE VIII (CONT.)

ITEM	TIME	EVENT	MANEUVER		PROPELLANT LBS. PER MANEUVER	TOTAL PROP. USED, LBS.
18	74:30	Orbital Navigation	GNCS/P-52 - Realign IMU		1.0	
			GNCS/P-22 - 3 axis orient/MI		1.0	
			Est. Orbital Rate, MI P, Y&R			
			Att Hold 0.2° db		1.0	
				SUBTOTAL	3.0	540.9
19	76:00	Orbital Navigation	GNCS/P-52 - Realign IMU		1.0	
			GNCS/P-22 - 3 axis orient/MI		1.0	
			Est. Orbital Rate, MI P, Y&R			
			Att Hold 0.2° db		1.0	
				SUBTOTAL	3.0	543.9
20	77:15	SCT Star Count (Mode B)	GNCS/Auto - 3 axis orient for GET_{SR} Attitude		0.7	
			GNCS/Auto - 35 min. att hold 5.0° db		0.7	
			GNCS/Auto - 3 axis orient for GET_{SS} Attitude		0.7	
			GNCS/Auto - 35 min. att hold 5.0° db		0.7	
				SUBTOTAL	2.8	546.7

TABLE VIII (CONT.)

ITEM	TIME	EVENT	MANEUVER	PROPELLANT LBS. PER MANEUVER	TOTAL PROP. USED, LBS.
21	78:30	Power Down	SCS - Allot 2-3 axis/orient 10 min att Hold to damp drift rates when req'd. & photography orientations (S-005&6)		
			SUBTOTAL	2.4	549.1
22	88:50	IMU Align	GNCS/P51,52 - 2-3 axis Orient/MI	2.0	
		SCS Att. Ref. Ck.	Null FDAI Att Error, 0.5° db 10 Min.	0.5	
			SUBTOTAL	2.5	551.6
23	90:10	IMU Realign SCS Att. Ref. Ck.	GNCS/P-52 - 3 axis Orient/MI Null FDAI Att Error, 0.5° db 10 Min	1.0 0.5	
		SPS Burn 3	SCS - 3 axis orient/MI & Att Hold 15 min SCS - Ullage, 4 jet, 15 sec	6.0 22.8	
			SUBTOTAL	30.3	581.9
24	91:40	Slosh Damping Test	SCS - Att Hold 4.2° db, 10 min.	1.0	582.9

TABLE VIII (CONT.)

ITEM	TIME	EVENT	MANEUVER		PROPELLANT LBS. PER MANEUVER	TOTAL PROP. USED, LBS.
25	93:15	ECS Radiator Test	3axis orient		1.0	
			SCS/ Est. Roll Orb Rate/ 2 axis att. hold 4.2° db, 4½ hr.		13.5	
				SUBTOTAL	14.5	597.4
26	98:00	Power Down	SCS – Allot 2-3 axis/orient 10 min att Hold to damp drift rates when req'd. & photography orientations (S-005&6)			
				SUBTOTAL	2.4	599.8
27	102:10	Midcourse Navigation	3-Axis Orient/9 mark MI			
				SUBTOTAL	1.8	601.6
28	118:30	IMU Align	GNCS/P51-52 - 2-3 axis Orient/MI		2.0	
		SPS Burn 4	GNCS P-40 - 3 axis orient/MI & Att hold		2.7	
			GNCS/P40 - Ullage 2 jet, 20 sec		16.1	
				SUBTOTAL	20.8	622.4
29		Slosh Damping Test	GNCS, Free - Inhibit Att Hold, 3 min		N. A.	

TABLE VIII (CONT.)

ITEM	TIME	EVENT	MANEUVER	PROPELLANT LBS. PER MANEUVER	TOTAL PROP. USED, LBS.
30	109:30	Midcourse Navigation	3-Axis Orient/9 mark MI		
			SUBTOTAL	1.8	624.2
31	121:42	SCT Star Count Mode C	GNCS/Auto – 3 axis orient for GET_{SR} Attitude	0.7	
			GNCS/Auto – 35 min att hold 5.0° db	0.7	
			GNCS/Auto – 3 axis orient for GET_{SS} Attitude	0.7	
			GNCS/Auto – 35 min. att hold 5.0° db	0.7	
			SUBTOTAL	2.8	627.0
32	123:00	IMU Realign	GNCS/P-52 – 3 axis orient/MI	1.0	
	123:30	SPS Prop. Thermal Control Test	SCS Manual – 3 axis orient, +X axis toward sun	1.0	
	123:40	SCS Att Control Test	SCS Att. Hold 5° db 1.5 hrs., low rate	2.1	
	125:00	SCS Att. Control Test	Att.hold 0.5°db, High rate 1.5 hrs	2.5	
			SUBTOTAL	6.6	633.6

TABLE VIII (CONT.)

ITEM	TIME	EVENT	MANEUVER	PROPELLANT LBS. PER MANEUVER	TOTAL PROP. USED, LBS.
33	126:40	Power Down	SCS – Allot 2-3 axis/orient 10 min att Hold to damp drift rates when req'd. & photography orientations (S-005&6)		
			SUBTOTAL	2.4	636.0
34	140:40	IMU Align	GNCS/P51,52 – 2-3 axis orient		
			SUBTOTAL	2.0	638.0
35	142:10	IMU Realign	GNCS/P-52 – 3 axis orient	1.0	
	142:45	Orbital Navigation	GNCS/P22 – Realign IMU	1.0	
			GNCS/P-22 – 3 axis orient/MI Est. Orbital Rate, MI P, Y&R	1.0	
			Att Hold 0.2° db	1.0	
			SUBTOTAL	3.0	641.0
36	143:30	IMU Realign	GNCS/P-52	1.0	
	144:15	Orbital Navigation	P-22 – Realign IMU	1.0	
			P-22 – 3 axis orient/MI Est. Orbital Rate, MI P, Y&R	1.0	
			Att Hold 0.2° db	1.0	
			SUBTOTAL	3.0	644.0

TABLE VIII (CONT.)

ITEM	TIME	EVENT	MANEUVER	PROPELLANT LBS. PER MANEUVER	TOTAL PROP. USED, LBS.
37	145:05	IMU Realign Orbital Navigation	P-22 - Realign IMU P-22 - 3 axis orient/MI Est. Orbital Rate, MI P, Y&R Att. Hold 0.2° db	1.0 1.0 1.0 1.0	
			SUBTOTAL	3.0	647.0
38	146:45	Power Down	SCS - Allot 2-3 axis orient/ 10 min att Hold to damp drift rates when req'd. & photography orientations (S-005&6)		
			SUBTOTAL	2.4	649.4
39	162:50	IMU Align	GNCS/P51-52 - 2-3 axis orient/MI	2.0	
	164:20	IMU Realign	GNCS/P52 - 3 axis orient/MI	1.0	
	165:08	SPS Burn 5	GNCS/P40 - 3 axis orient/MI & Att. Hold 15 min. Ullage, 2 Jet, 20 sec	2.7 14.2	
			SUBTOTAL	19.9	669.3
40	165:50	IMU Realign	GNCS/P52 - 3 axis orient/MI	1.0	
	166:45	Passive Thermal Control	SCS - 3 axis orient & att hold 0.2° db 30 min Est. roll rate 0.3°/sec & att hold 0.2° db P&Y, 26 min	11.0 1.5	
			SUBTOTAL	13.5	682.8

TABLE VIII (CONT.)

ITEM	TIME	EVENT	MANEUVER	PROPELLANT LBS. PER MANEUVER	TOTAL PROP. USED, LBS.
41	167:40	Mid Course Nav.	GNCS/P-22 - Realign IMU	1.0	
			GNCS/P-22 - 3 axis orient/MI	1.0	
			Est. Orbital Rate, MI P,		
			Y&R att hold 0.2° db	<u>1.0</u>	
			SUBTOTAL	3.0	686.4
42	168:00	Power Down	SCS - Allot 2-3 axis orient/		
			10 min att		
			Hold to damp drift rates		
			when req'd & photography		
			orientations (S-005&6)		
			SUBTOTAL	2.4	688.8
43	191:30	IMU Align	GNCS/P51-52 - 2-3 axis orient	2.0	
	193:00	IMU Realign	GNCS/P52 - 3 axis orient	1.0	
	193:52	WSMR, RR Test	SCS/Manual - Orient to tracking att	1.4	
			Att Hold 0.5° db, 20 min	<u>6.0</u>	
			SUBTOTAL	10.4	699.2
44	194:50	SCT Star Count (Mode A)	GNCS/Auto - 3 axis orient for GET_{SR} Attitude	0.7	
			GNCS/Auto - 35 min att hold 5.0° db	0.7	
			GNCS/Auto - 3 axis orient for GET_{SS} Attitude	0.7	
			GNCS/Auto - 35 min att hold 5.0° db	<u>0.7</u>	
			SUBTOTAL	2.8	702.0

TABLE VIII (CONT.)

ITEM	TIME	EVENT	MANEUVER	PROPELLANT LBS. PER MANEUVER	TOTAL PROP. USED, LBS.
45	196:00	Power Down	SCS – Allot 2-3 axis orient/ 10 min att Hold to damp drift rates when req'd & photography orientations (S-005&6)		
			SUBTOTAL	2.4	704.4
46	208:00	IMU Align	GNCS/P-51,52 – 2-3 Orient	1.0	
	209:00	SCS Backup Align	SCS – 3 axis orient to south stars	0.7	
			SCS – Roll to nav. star/MI	0.3	
			SCS – Pitch MI, R&Y 0.2° db, 15 min	0.8	
			3 axis orient to burn att/MI	1.0	
			SUBTOTAL	3.8	708.2
47	211:00	IMU Realign	GNCS/P-52 – 3 axis orient	1.0	
	211:45	SPS Burn 6	GNCS/P-40 – 3 axis orient/ 15 min att hold	2.7	
			Ullage 2 Jet, 20 sec	15.9	
			SUBTOTAL	19.6	727.8
48	211:46	Att Hold Test	SCS – Max db (±4.2°) High Rate, 1 hr.		
			SUBTOTAL	1.4	729.2

TABLE VIII (CONT.)

ITEM	TIME	EVENT	MANEUVER	PROPELLANT LBS. PER MANEUVER	TOTAL PROP. USED, LBS.
49	212:20	Passive Thermal Control Test	SCS - 3 axis orient & att hold 0.2° db 30 min	11.0	
			Est. roll rate 0.3°/sec & att hold 0.2° db P&Y, 26 min	<u>1.5</u>	
			SUBTOTAL	12.5	741.7
50	213:40	Passive Thermal Control Test	SCS - 3 axis orient & att hold 0.2° db 30 min	11.0	
			Est. roll rate 0.3°/sec & att hold 0.2° db P&Y, 26 min	<u>1.5</u>	
			SUBTOTAL	12.5	754.2
51	214:45	Power Down	SCS - Allot 2-3 axis orient/ 10 min att		
			Hold to damp drift rates when req'd & photography orientations (S-005&6)		
			SUBTOTAL	2.4	756.6
52	235:00	IMU Align	GNCS/P51,52 - 2-3 axis orient	2.0	
	236:35	IMU Realign	GNCS/P51 - 3 axis orient	1.0	
	237:25	SPS Burn 7	SCS - 3 axis orient/15 min att hold	6.0	
			Ullage 4 Jet, 15 sec	<u>23.1</u>	
			SUBTOTAL	32.1	788.7

TABLE VIII (CONT.)

ITEM	TIME	EVENT	MANEUVER		PROPELLANT LBS. PER MANEUVER	TOTAL PROP. USED, LBS.
53	238:00	Window Visibility Test	S20.16-2 - 3 axis orient P&Y @ 0.5°/sec		0.7 <u>1.8</u>	
				SUBTOTAL	2.5	791.2
54	238:15	PIPA & EMS Bias Test	SCS - Null rates, 0.2° db, att hold 6 min			
				SUBTOTAL	2.0	793.2
55	239:40	SXT Cal Test	GNCS/P-23 - 2-3 axis orient/MI			
				SUBTOTAL	2.0	795.2
56	240:00	RCS Control Test	SCS - Att hold 0.2° db, 1 hr.		20.0	
		Align IMU	GNCS/ACC - 1-3 axis orient		0.9	
			GNCS/Auto - 1-3 axis @ 0.5°/sec		1.4	
			GNCS/Auto - 1-3 axis @ 4°/sec		8.0	
			GNCS/FREE - 1-3 axis @ 0.5°/sec		1.2	
			GNCS, FREE - 1-3 axis @ 4°/sec		<u>7.4</u>	
				SUBTOTAL	38.9	834.1

TABLE VIII (CONT.)

ITEM	TIME	EVENT	MANEUVER	PROPELLANT LBS. PER MANEUVER	TOTAL PROP. USED, LBS.
57	242:00	Power Down	SCS - Allot 2-3 axis orient/ 10 min att Hold to damp drift rates when req'd & photography orientations (S-005&6)		
			SUBTOTAL	2.4	836.5
58	257:35	IMU Align	2-3 axis orient.	2.0	
	259:05	IMU Realign	3 axis orient	1.0	
	261:08	SPS Deorbit	Orient for SPS, 15 min 0.5° att hold Ullage 4 Jets, 15 sec	2.7 20.2	
			SUBTOTAL	25.9	862.4
59		S/C Separation	CM/SM Sep 4 Jet -X Translation of 3 FPS & SM Spin Up		
			SUBTOTAL	18.0	880.4

CRYOGENIC CONSUMPTION ANALYSIS

	SUMMARY	
	H_2 (lbs)	O_2 (lbs)
Available	626.9	55.4
Mission requirements	523.6	47.8
Margin	103.3	7.6

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

Figure 4 Nominal Mission O_2 Profile

Figure 5 Nominal Mission H_2 Profile

The following ground rules and assumptions were used for the construction of the mission H_2 and O_2 profiles. A more detailed breakdown of the cryogenic consumption analysis is being prepared by the CAS of MPAD.

1. Fuel cell purge after the expenditure of approximately 30 kWh.

2. Cabin O_2 leak rate of 0.2 lb/hr

3. Metabolic O_2 rate of 0.23 lb/hr

4. Waste management O_2 rate of 0.05 lb/hr

5. Water tank O_2 purge rate of 0.056 lb/hr

6. 2 inverter operation

7. Batteries were on for lift-off and for the first 12 minutes of flight

8. Batteries shared the loads for all 8 burns

    Batteries were put on the line 5 minutes before each burn and taken off immediately after the burn.

9. Batteries were charged after the second, third, fourth, fifth, sixth, and seventh burns

10. The hydrogen consumption rate is

    .00257 lb/amp/hr.

11. The oxygen consumption rate is

    7.936 times the hydrogen consumption rate

12. Prelaunch:

    T – 17 hours to T – 15 minutes assumes 43 amp load on fuel cells

    T – 15 minutes to lift-off assumes lift-off loads.

13. The average load summary for each checklist procedure was used

    as shown in Table IX.

FIGURE 4: NOMINAL MISSION O_2 PROFILE

MISSION TIME (HRS)
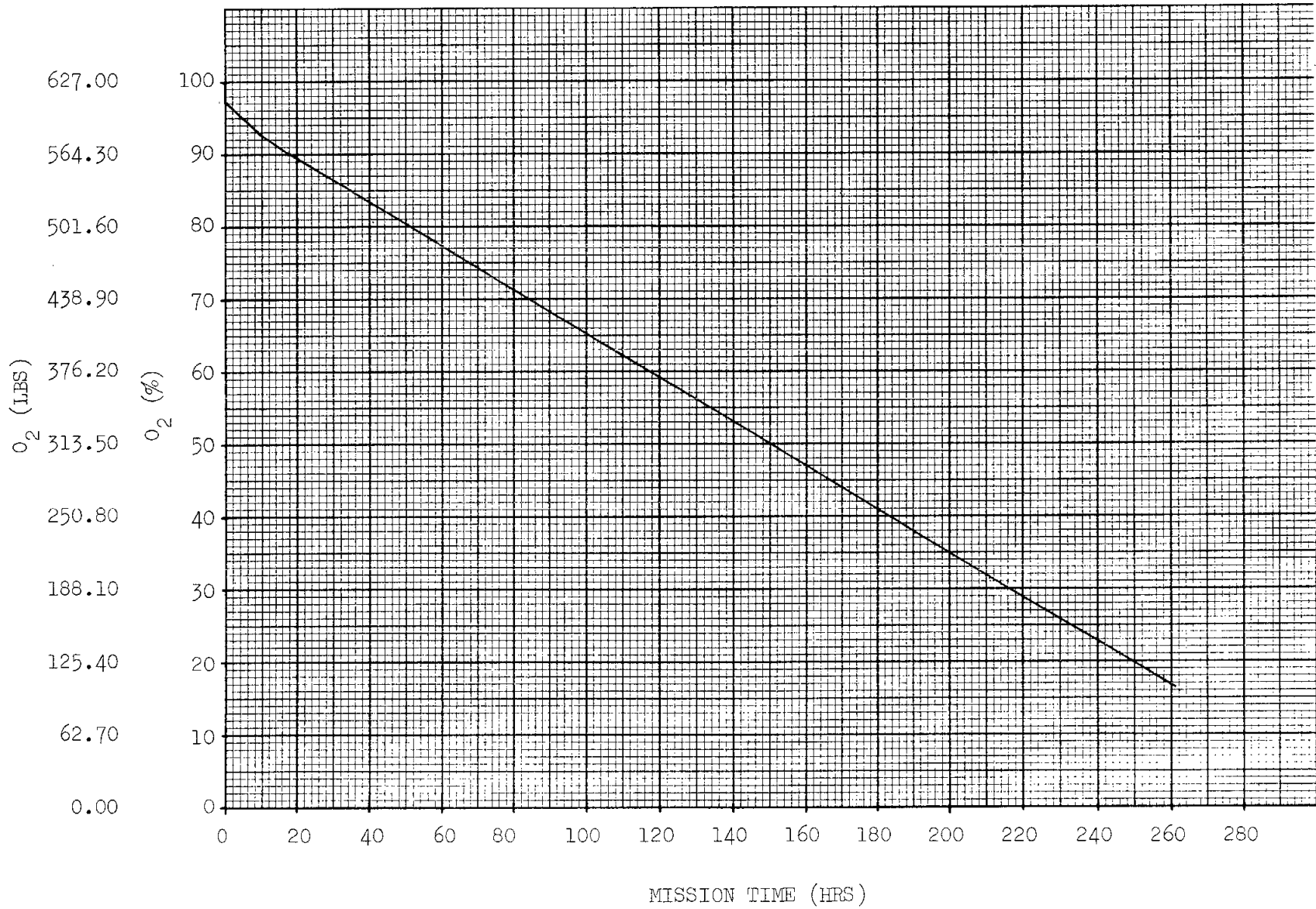
FIGURE 5: NOMINAL MISSION H$_2$ PROFILE

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

CREW CHECKLIST PROCEDURE	AVERAGE POWER		BUS VOLTAGE	BATTERY CURRENT	BATTERY POWER	FUEL CELL CURRENT	BUS POWER	CRYO CONSUMPTION		H_2O PRODUCTION
	AC	DC						H_2	O_2	
	WATTS	WATTS	VOLTS	AMPS	WATTS	AMPS	WATTS	LB/HR	LB/HR	LB/HR
Drift Flight	652.4	769.6	29.5	---	---	62.0	1829	0.163	1.29	1.46
Lift-Off	785.7	1127.4	29.4	17.0	500	63.6	1870	0.164	1.30	1.49
Boost Insertion Thru Post Separation										
a) T = 2:42	786.1	1576.1	29.0	23.7	687	73.8	2140	0.193	1.53	1.73
b) Postorbital Insertion	705.3	1275.1	28.7	---	---	83.0	2380	0.220	1.70	1.95
c) Separation: 1. Initial	718.7	1281.3	28.6	---	---	84.0	2400	0.220	1.75	1.97
2. Separation Thru 0:04	718.7	1713.3	28.0	---	---	98.0	2740	0.263	2.08	2.31
3. T = 1:13 Thru 1:15	718.7	1713.3	28.0	---	---	98.0	2740	0.263	2.08	2.31
Post Separation	718.7	1281.3	28.4	---	---	87.0	2470.8	0.250	1.99	2.04
Rendezvous Nav. (P20) Orbital Nav. (P22):										
a) Optics On	741.1	1224.1	28.7	---	---	83.0	2350	0.216	1.69	1.93
b) Optics Off	741.1	1128.1	28.85	---	---	78.0	2250	0.207	1.62	1.83
Cislunar Midcourse Navigation (P23):										
a) Optics On	652.4	1093.5	29.0	---	---	75.0	2180	0.196	1.53	1.76
b) Optics Off	652.4	997.5	29.3	---	---	71.0	2080	0.185	1.43	1.67

TABLE IX (cont'd)

CREW CHECKLIST PROCEDURE	AVERAGE POWER		BUS VOLTAGE	BATTERY CURRENT	BATTERY POWER	FUEL CELL CURRENT	BUS POWER	CRYO CONSUMPTION		H$_2$O PRODUCTION
	AC	DC						H$_2$	O$_2$	
	WATTS	WATTS	VOLTS	AMPS	WATTS	AMPS	WATTS	LB/HR	LB/HR	LB/HR
IMU Orientation Determination (P51)/ IMU Realign (P52):										
a) Optics On	737.1	1220.1	28.7	----	----	82.0	2350	0.217	1.69	1.93
b) Optics Off	737.1	1124.1	28.85	----	----	78.0	2250	0.208	1.62	1.83
Orbit Change G&N/SPS Thrust (P40):										
a) Initial	764.0	1253.9	28.6	----	----	84.0	2400	0.220	1.72	1.97
b) TTI = 5:00	777.4	1660.1	28.95	24.0	695	74.4	2160	0.194	1.55	1.75
c) TTI = 2:00	777.4	1706.1	29.9	25.0	748	76.3	2280	0.198	1.58	1.79
d) TTI = 0:30	791.8	1736.9	28.9	25.8	745	77.5	2240	0.204	1.60	1.82
e) TTI = 0:15	792.8	2200.5	28.5	32.5	925	85.6	2440	0.230	1.82	2.01
f) Ignition	842.3	2664.9	28.1	40.8	1150	96.3	2710	0.258	2.05	2.26
g) Ignition + 0:01	841.3	2201.3	28.4	34.0	965.0	87.8	2495	0.235	1.85	2.00
G&N Startup (P05)										
a) CMC and IMU	685.1	986.2	29.1	----	----	72.0	2100	0.190	1.45	1.69
b) CMC Only	652.4	824.6	29.4	----	----	65.0	1910	0.168	1.35	1.53
G&N RCS Thrust (P40):										
a) Initial	756.1	1226.0	28.7	----	----	82.8	2376	0.217	1.72	1.95
b) TTI = 5:00	764.0	1254.0	28.65	----	----	83.0	2380	0.219	1.73	1.95
c) TTI = 0:30	778.4	1284.8	28.5	----	----	86.0	2450	0.228	1.78	2.02
d) Ignition	779.4	1748.4	27.9	----	----	101.0	2820	0.270	2.15	2.37
SCS Power Up	737.1	896.3	29.2	----	----	71.0	2070	0.186	1.45	1.67
SCS Orbit Change:										
a) Initial	737.1	1022.4	29.0	----	----	75.0	2175	0.198	1.53	1.76

TABLE IX (cont'd)

CREW CHECKLIST PROCEDURE	AVERAGE POWER AC	POWER DC	BUS VOLTAGE	BATTERY CURRENT	BATTERY POWER	FUEL CELL CURRENT	BUS POWER	CRYO CONSUMPTION H$_2$	O$_2$	H$_2$O PRODUCTION
	WATTS	WATTS	VOLTS	AMPS	WATTS	AMPS	WATTS	LB/HR	LB/HR	LB/HR
b) TTI = 12:00	745.0	1050.4	28.9	---	---	77.0	2220	0.202	1.58	1.81
c) TTI = 5:00	758.4	1456.6	29.15	21.7	633	70.0	2040	0.184	1.48	1.65
d) TTI = 2:00	758.4	1502.6	29.1	22.0	640	71.0	2065	0.187	1.50	1.67
e) TTI = 0:30	772.8	1533.4	29.05	22.5	653	72.5	2105	0.192	1.52	1.71
f) TTI = 0:15	773.8	1997.0	28.65	29.5	845	82.5	2360	0.217	1.73	1.94
g) Ignition	823.3	2461.4	28.25	37.8	1070	92.5	2620	0.247	1.97	2.17
h) Ignition + 0:01	822.3	1997.8	28.6	31.7	906	83.3	2380	0.223	1.75	1.96
G&N Entry Thru Touchdown:										
a) Initial Thru P61	764.0	1244.8	28.6	---	---	84.0	2400	0.221	1.73	1.98
b) P62 Thru Separation	778.4	1275.6	29.3	18.7	548	66.3	1940	0.177	1.41	1.56
c) Separation Thru Main Chute Deployment	562.3	851.1	27.1	60.0	1630	---	---	---	---	---
d) Main Chute Deployment Thru Touchdown	562.3	867.1	27.0	61.3	1660	---	---	---	---	---
SCS Entry Thru Touchdown:										
a) Before Separation	759.4	1072.1	29.45	16.7	492	62.5	1840	0.167	1.33	1.46
b) Post Separation	543.3	647.7	27.35	56.6	1550	---	---	---	---	---
c) Landing Phase	543.3	663.7	27.5	57.0	1570	---	---	---	---	---
Postlanding	---	37.9	30.0	1.26	37.9	---	---	---	---	---
CMC DAP Maneuver	685.1	986.2	29.25	---	---	71.0	2080	0.188	1.47	1.67

TABLE IX (cont'd)

CREW CHECKLIST PROCEDURE	AVERAGE POWER		BUS VOLTAGE	BATTERY CURRENT	BATTERY POWER	FUEL CELL CURRENT	BUS POWER	CRYO CONSUMPTION		H_2O PRODUCTION
	AC	DC						H_2	O_2	
	WATTS	WATTS	VOLTS	AMPS	WATTS	AMPS	WATTS	LB/HR	LB/HR	LB/HR
Battery Charge	748.4	818.6	29.28	---	---	68.5	2010	0.171	1.40	1.61
Secondary Coolant Loop	620.4	752.1	29.6	---	---	60.0	1775	0.158	1.25	1.41
Fuel Cell Purge	652.4	778.8	29.5	---	---	62.5	1845	0.163	1.33	1.47

SECTION IV - DETAILED TEST OBJECTIVES

SECTION IV - DETAILED TEST OBJECTIVES

This section contains DTO data sheets indicating for each detailed test (as of 4-26-68):

    a. A summary of the test requirements to satisfy each objective

    b. The crew test procedures to accomplish the objective (when required). The crew procedures presented are for those tests for which standard AOH or other controlled crew procedural documents do not suffice.

    c. The crew log of data to be noted during the performance of the objective.

The general criteria used in preparing the test procedures were to state what operations are required to satisfy the test, how the ground will up-date and support the real-time accomplishment of the test and any special notes pertaining to the test. System configuration switching and detailed procedures are performed by normal checklist operation.

The following is a list of DTO's, their priority ranking, and an indication if a test procedure is included with the DTO data sheet. See Section V for further information on DTO priorities.

DTO Number	Priority	Identification Title	Test Procedure Included
P1.6	5	IMU Inflight Alignment	X
P1.7	4	IMU Orientation Determination	X
P1.8	23	Orbital Nav/Landmark Tracking	X
P1.10	13	Sextant Tracking	X
S1.11	47	Boost Phase Monitoring	
P1.12	8	GNCS Attitude Control	X
P1.13	7	GNCS ΔV Control	
P1.14	11	GNCS Entry Monitoring	
P1.15	24	Midcourse Navigation	X
P1.16	25	IMU Performance	X
S1.17	39	TVC DAP Controller Evaluation	
P2.3	26	EMS Performance	X
P2.4	10	SCS Attitude Control	X
P2.5	9	SCS ΔV control	
P2.6	22	G&N/MTVC ΔV Takeover	
P2.7	27	SCS Drift Checks	X
P2.10	36	SCS Backup Alignment Procedure	
P3.14	20	SPS Minimum Impulse Burn	
P3.15	6	SPS Performance	
P3.16	21	Prim/Aux Prop Gauging System	
S3.17	38	SM/RCS Performance	
P3.20	19	SPS Propellant Thermal Control	X

DTO Number	Priority	Identification Title	Test Procedure Included
P4.4	3	CM ECS Life Support Functions	TBD
P4.6	34	CSM Waste Management	
P4.8	33	CSM Secondary Coolant Loop	X
P4.9	12	CSM Water Management	X
P4.10	37	CM Postlanding Ventilation	
P5.8	29	Zero-G Effects on Cryogenics	X
P5.9	28	Cryogenic Pressure Control	
P5.10	18	Water Separation and Potability	
P6.7	31	S-Band Updata Link	
P6.8	32	Overpass Simulation with LM RR	X
M7.19	1	Rad Heat Rejection & Degradation	X
P7.20	2	Flat Apex Thermal Protection	
P7.21	16	SLA Deployment System	X*
S7.24	43	Passive Thermal Control Procedure	X
S7.28	50	CSM Structural Performance	
S20.8	15	Sep/Transportation/Sim Docking	X*
S20.9	46	Manual Retro Att Orientation	X
P20.10	30	CSM/MSFN S-Band Comm Performance	
P20.11	17	Consumables Usage	
S20.12	48	Manual S-IVB Attitude Control	X
S20.13	14	CSM Active Rendezvous	X*
S20.14	41	L/V Propellant Pressure Display	X
P20.15	35	Crew Activities Evaluation	X*
S20.16	45	Environ Induced Window Deposits	X
S20.17	42	Propellant Slosh Damping	X
S20.18	49	CSM A/RIA Communications	
S20.19	40	CSM/MSFN VHF Voice Comm	
S20.20	44	COAS Evaluation	TBD
EXP.S005	51	Synoptic Terrain Photography	X
EXP.S006	52	Synoptic Weather Photography	X

* Photo reqts only

IMU INFLIGHT ALIGNMENT (P1.6)

Purpose:

To establish the uncertainties in the alignment process and to evaluate the overall alignment accuracy.

Requirements:

1. Perform alignments using Preferred, Nominal, and REFSMMAT options. Use auto and manual optics positioning.

2. Attempt one alignment in daylight.

3. Perform P52 prior to CSM/S-IVB separation.

4. Following each alignment, it is HD (highly desirable) to perform at least one alignment check (two extra sightings) using procedures listed below.

5. Perform a SXT calibration check early and late in mission using procedure listed below.

Procedures:

NOTE

For all optical sightings allow at least 10 seconds between marks when recording LBR.

SXT CALIBRATION CHECK

1. Perform P23 through step 3

2. Modify step 4 as follows:

    Acquire known star in SXT LLOS

    Acquire known star in SXT SLOS

    Superimpose the two stars and mark

Record:

Star 1 ID (LLOS)_____SA_____

Star 2 ID (SLOS)_____TA_____

T MARK _____

Without changing the LLOS star, acquire a third known star in the SLOS approximately perpendicular to original stars.

Superimpose the two stars and mark

Record:

Star 3 ID (SLOS)_____SA_____

TA_____

T MARK _____

ALIGNMENT CHECK

The alignment check required by this DTO consists of re-running the alignment procedure (steps 6-13 in the P52 checklist) with the following deviations:

1. Key into the DSKY two other nav stars (step 6) and perform sightings on these stars.

2. After the gyro torquing angles are displayed (step 13), return to step 6 or exit the program.

Crew Log:

• Complete for each P52 including alignment checks.

• Also state whether auto optics positioning was used and if it acquired the loaded star in the SCT-FOV.

• Indicate crewman performing the alignment.

GET START	HR	X X	X X
	MIN	X X X	X X X
P52 OPTION		X X 1 2 3	X X 1 2 3
CONT MODE			
STAR CODE	1	X X X	X X X
	2	X X X	X X X
STAR DIFF		X X .	X X .
GYRO TORQUE	X	.	.
	Y	.	.
	Z	.	.
GET STOP	HR	X X	X X
	MIN	X X X	X X X

GET START	HR	X X	X X
	MIN	X X X	X X X
P52 OPTION		X X 1 2 3	X X 1 2 3
CONT MODE			
STAR CODE	1	X X X	X X X
	2	X X X	X X X
STAR DIFF		X X .	X X .
GYRO TORQUE	X	.	.
	Y	.	.
	Z	.	.
GET STOP	HR	X X	X X
	MIN	X X X	X X X

IMU ORIENTATION DETERMINATION (P1.7)

Purpose:

To validate accuracy of IMU orientation determination. To determine if star patterns are visible in daylight through the SCT and to obtain data for prediction of star visibility on the LLM.

Requirements:

1. Count the number of stars visible during daylight through the SCT for the following conditions:
   MODE A: SCT SUN LOS 120°
   MODE B: SCT SUN LOS 70°
   MODE C: SCT SUN LOS 120° (w/o window shades)

2. Perform a P51 IMU orientation per checklist.

Procedures:

A summary of the operational sequences and logic flow diagram for conducting the star visibility test requirement 1, are below. This is followed by the crew procedures for the SXT star count, the SCT star count, and the spotmeter check required by the DTO.

SUMMARY OF OPERATIONAL SEQUENCES

SEQ 1: All three S/C configurations and lighting geometries (Modes A,B, and C) allow sufficient stars to be seen through the SCT. Astronaut also performs SXT auto-optics check (P1.6).

SEQ 2: The first two S/C configurations and lighting geometries (Modes A and B) allow sufficient stars to be seen through the SCT. Insufficient stars are seen in Mode C. Astronaut performs photometer measurement and SXT auto-optics check on subsequent rev.

SEQ 3: The first S/C configuration and lighting geometry (Mode A) allows sufficient stars to be seen through the SCT. Insufficient stars are seen in Modes B and C. Astronaut receives update to perform SXT star counts on subsequent rev. Sufficient stars are seen with the SXT.

SEQ 4: Same as SEQ 3 except that insufficient stars seen on first SXT rev. Astronaut performs photometer check on subsequent rev.

SEQ 5: Insufficient stars seen through SCT in first S/C configuration (Mode A). Astronaut receives update to perform SXT star counts on 2 following revs. Sufficient stars seen on both revs (different S/C configurations).

SEQ 6: Same as SEQ 5 except that sufficient stars are seen on the first SXT rev. and not on the second rev. Astronaut performs photometer check on subsequent rev.

SEQ 7: Same as SEQ 5 except that sufficient stars are not seen on the first SXT rev.

P1.7 TIMELINE AND LOGIC DIAGRAM

P1.7 EXPANDED TIMELINES
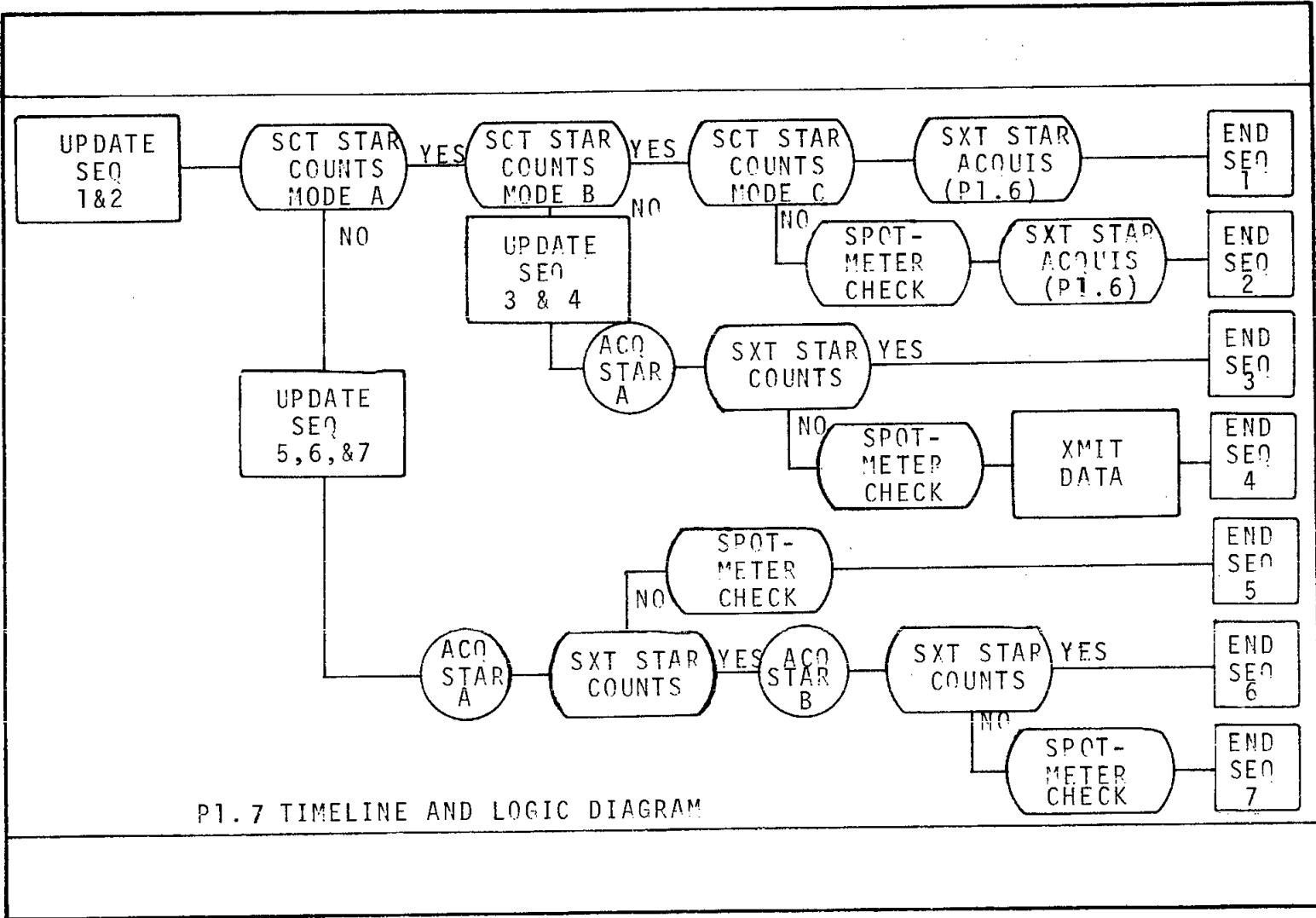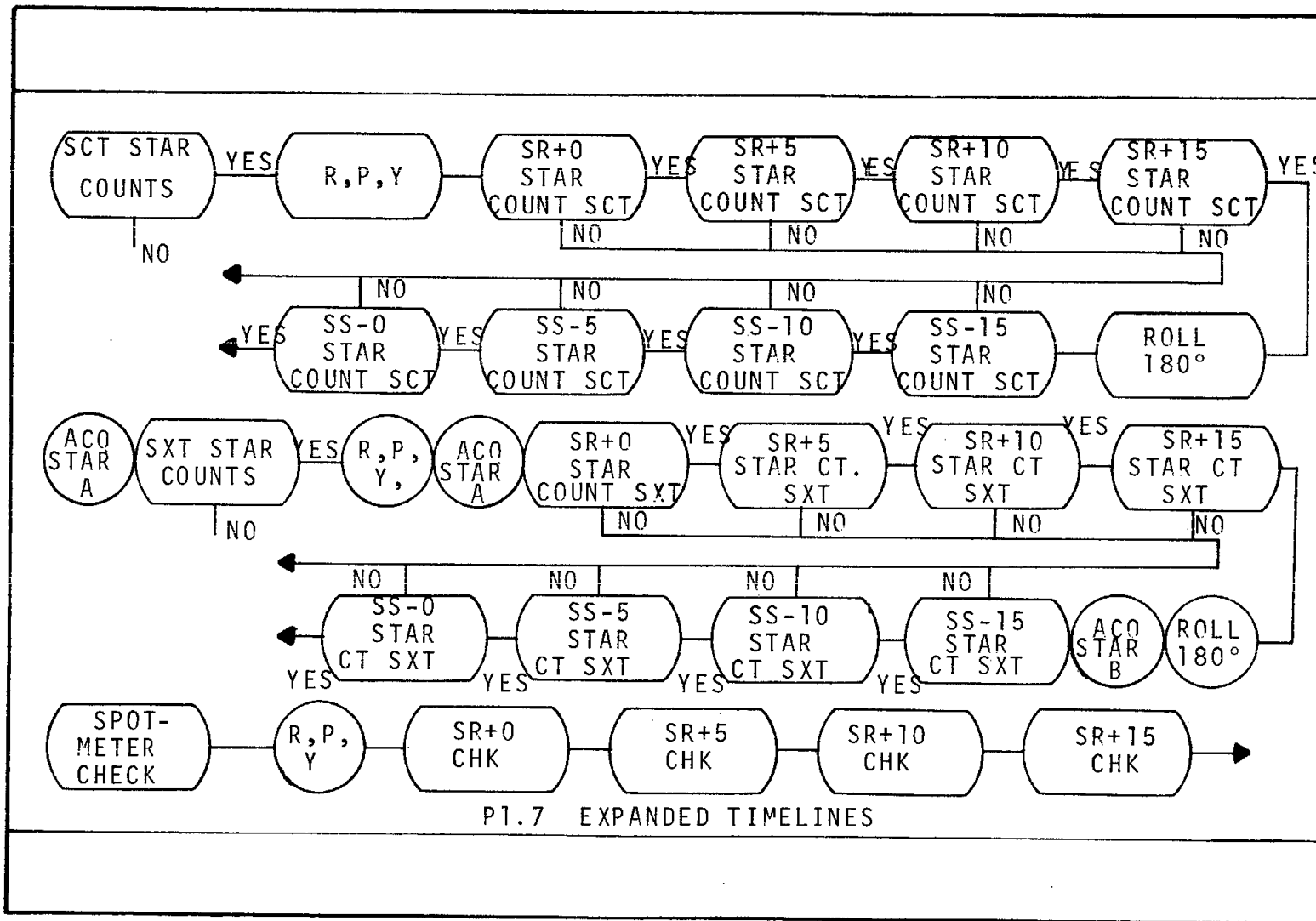
SCT STAR COUNT

MODE A: SCT SUN LOS 120° (HD to repeat late in mission)
MODE B: SCT SUN LOS 70° (HD)
MODE C: SCT SUN LOS 120° (HD)
         w/o window shades

Receive the following updates:

. State vector (if test is conducted with IMU ini-
   tially powered down)

. GET align _____. The time of align will be
   the spacecraft sunrise time of the night pass
   that the test is initiated.

. GET_{SR}_____. Spacecraft sunrise

. R_____P_____Y_____CDU fly-to angles at sunrise
   for a SCT-SUN LOS of 120° (or 70°) with a SCT zero
   shaft and trunnion angle.

. GET _____spacecraft sunset minus 15 min.
      SS
   R_____P_____Y_____CDU fly-to angles at GET_{SS}
   for heads down, SCT-SUN LOS of 120° (or 70°)
   and a SCT zero shaft and trunnion angle.

The following are required:

     CMC – ON
     IMU – ON
     SCT – SA 0°, TA 0°
     SCS – powered up
     Window shades installed (except Mode C)
     Cabin lights subdued

   1. Maneuver to updated attitude for GET_{SR}.
       Maintain att hold, max deadband.

   2. Initiate SCT observation at SR-15 for dark-
       ness adaptation.

   3. At SR, count stars visible in SCT and at
       5-min intervals, until SR + 15 min.

4. Maneuver to updated attitude for GET$_{SS}$.
   Maintain att hold, max. deadband.

5. Att SS-15 min., count stars visible in SCT and
   at 5-min intervals until SS.

   End of Test Mode

NOTE:

Keep ground appraised of star visibility conditions
during test. The use of the SCT will be discontinued
in any sighting where no stars are visible in the
SCT-FOV. Star counting is not required in any in-
terval in which the number of stars noted is above 50.

ALTERNATE PROCEDURE

If stars cannot be seen through the SCT, proceëd with
following alternate procedures.

LUMINANCE CHECK

The following are required:

    CMC - ON
    IMU - at known orientation
    SCS - powered up
    Spotmeter - unstowed

Ground Update:

. GET$_{SR}$_____spacecraft sunrise.

. R____P____Y____. CDU fly-to angles at sunrise
  for a S/C +X axis SUN LOS of 120° (or 70°), heads
  down.

. GET$_{SS}$_____spacecraft sunset minus 15 minutes.

. R____P____Y____ CDU fly-to angles at sunset for
  a S/C +X axis SUN LOS of 120° (or 70°), heads down.

1. Obtain and record spotmeter readings through LH
   rndz window at updated attitude and at times noted
   in primary procedure.

End of test

SXT STAR COUNT

The following are required:

    CMC - ON
    IMU - at known orientation
    SCS - powered up
    window shades installed
    cabin lighting subdued.

Ground Update:

GET_____Start of test.
R_____P_____Y_____CDU fly-to angles.
Nav star A_____B_____.

1. Maneuver to updated attitude prior to sunrise.

2. During daylight, use auto-optics to acquire Star
   A. With Star A centered on the reticle, count
   stars visible in the SXT-FOV.

   Repeat procedure for Star B

End of Test

Crew Log:

    . Complete log for each STAR VISIBILITY test mode.

    . For LUMINANCE test (if performed) comment on the
      condition of the window as to cleanliness and
      sky color.

    . For SXT STAR COUNT, record name of nav stars,
      number of stars and GET.

UPDATE	MODE A, B, C			
	GET ALIGN	HRS	X X	X X
		MIN	X X X	X X X
		SEC	X .	X .
	GET SR	HRS	X X	X X
		MIN	X X X	X X X
		SEC	X .	X .
	CDU	R	.	.
		P	.	.
		Y	.	.
	GET SS	HRS	X X	X X
		MIN	X X X	X X X
		SEC	X .	X .
	CDU	R	.	.
		P	.	.
		Y	.	.
	MODE			
	GET ALIGN	HRS	X X	X X
		MIN	X X X	X X X
		SEC	X .	X .
	GET SR	HRS	X X	X X
		MIN	X X X	X X X
		SEC	X .	X .
	CDU	R	.	.
		P	.	.
		Y	.	.
	GET SS	HRS	X X	X X
		MIN	X X X	X X X
		SEC	X .	X .
	CDU	R	.	.
		P	.	.
		Y	.	.

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CREW LOG - SCT STAR COUNT

CREW LOG					
	GET SUNRISE HR	X	X	X	
	MIN	X X	X X	X X	
	SEC	.	.	.	
	STAR COUNT SR				
	+5				
	+10				
	+15				
	GET SUNSET-15 HR	X	X	X	
	MIN	X X	X X	X X	
	SEC	.	.	.	
	STAR COUNT -15				
	-10				
	-5				
	SS				
	GET SUNRISE HR	X	X	X	
	MIN	X X	X X	X X	
	SEC	.	.	.	
	STAR COUNT SR				
	+5				
	+10				
	+15				
	GET SUNSET-15 HR	X	X	X	
	MIN	X X	X X	X X	
	SEC	.	.	.	
	STAR COUNT -15				
	-10				
	-5				
	SS				

LUMINANCE CHECK		
GET SR HRS	X X	X X
MIN	X X X	X X X
SEC	X .	X .
CDU R	.	.
P	.	.
Y	.	.
GET SS HRS	X X	X X
MIN	X X X	X X X
SEC	X .	X .
CDU R	.	.
P	.	.
Y	.	.
GET SR HRS	X X	X X
MIN	X X X	X X X
SEC	X .	X .
CDU R	.	.
P	.	.
Y	.	.
GET SS HRS	X X	X X
MIN	X X X	X X X
SEC	X .	X .
CDU R	.	.
P	.	.
Y	.	.

UPDATE

4-15

CREW LOG - LUMINANCE CHECK

CREW LOG					
GET SR	HRS	X X		X X	
	MIN	X X X		X X X	
	SEC	X .		X .	
SPOT METER	SR				
	+5				
	+10				
	+15				
GET SS-15	HRS	X X		X X	
	MIN	X X X		X X X	
	SEC	X .		X .	
SPOT METER	-15				
	-10				
	- 5				
	SS				
GET SR	HRS	X X		X X	
	MIN	X X X		X X X	
	SEC	X .		X .	
SPOT METER	SR				
	+5				
	+10				
	+10				
GET SS-15	HRS	X X		X X	
	MIN	X X X		X X X	
	SEC	X .		X .	
SPOT METER	-15				
	-10				
	- 5				
	SS				

SXT STAR COUNT		
GROUND UPDATE		
GET HRS	X X	X X
MIN	X X X	X X X
SEC	X .	X .
CDU R	.	.
P	.	.
Y	.	.
NAV STAR A	X X X	X X X
B	X X X	X X X
CREW LOG		
GET HRS	X X	X X
MIN	X X X	X X X
SEC	X .	X .
NAV STAR A NO. STARS VISUAL	X X X	X X X
NAV STAR B NO. STARS VISUAL	X X X	X X X

ORBITAL NAV/LANDMARK TRACKING (P1.8)

Purpose:

> To establish error uncertainties in the navigation
> sightings.
> To evaluate the procedural aspects of landmark tracking.

Requirements:

1. Perform orbital navigation per P22 in the checklist
   using known and unknown landmarks. Use P21 and auto
   optics positioning to aid in landmark selection and
   acquisition.

NOTES

. Landmark tracking is planned for day 3 and 6.

. Prior to the second series of landmark tracking (day 6)
  update the covariance matrix to simulate the procedure
  for landing site determination.

. TBD revs of MSFN tracking are required prior to each
  tracking exercise (for postflight evaluation). Three
  revs of continuous landmark tracking are required for
  each exercise.

. It is desirable that a practice session (acquire and
  track one landmark) be held prior to the specified
  tracking schedule.

Procedures:

LANDMARK TRACKING

Receive the following update:

. CSM state vector (voice and cmd)

. GET align _____ for a nominal alignment. The time
  of align will be the spacecraft sunrise time of the
  night pass in which the P52 is performed.

. Landmark ID _____ . Landmarks selected are within
  35° elevation to spacecraft, weather 0.3 cloud cover
  or less and local time between 0900 and 1500.

Available on request:

. GET_{LMK} _____ . Time when spacecraft within the
  landmark 35° elevation angle.

<u>Procedures</u>: (cont'd)

- R_____ P_____ Y_____. CDU fly-to angles to assist
  in acquisition at above time for a SCT. SA _TBD_
  and TA _TBD_.

- Orbital Map Node

  Perform P22-CSM ORBITAL NAV per checklist

- Perform IMU realign each night pass, if possible,
  during exercise.

- Update state vector for each landmark sighting
  (step 12 in checklist)

- Obtain a minimum of three marks per known landmark;
  four per unknown landmarks.

- If recording LBR, allow ΔV, ΔR (checklist step 13)
  to remain displayed at least 10 seconds.

- For the day 6 sightings, the state vector will be
  updated by MSFN during each night pass between
  sightings.

- Requirement for crew initiation of DSE HBR TBD

- Prior to the day 6 sightings, update the covariance
  matrix as follows:

Key	. . . . .	V25N01E
	. . . . .	2004E
	. . . . .	E
	. . . . .	E
	. . . . .	01414E

  To Verify:

Key	. . . . .	V06N01E
	. . . . .	2004E
	. . . . .	.R1:00000
	. . . . .	.R2:00000
	. . . . .	.R3:01414

<u>Crew Log</u>:

- Complete log for each landmark

- Comment on ease of locating and identifying landmarks
  and usefulness of maps.

- Comment on crew techniques in maintaining S/C control
  during sightings.

UPDATE - LANDMARK TRACKING

LANDMARK TRACKING			
GET ALIGN HRS	X X		X X	
MIN	X X X		X X X	
SEC	X .		X .	
LANDMARK ID	X X		X X	
GET LMK HRS	X X		X X	
MIN	X X X		X X X	
SEC	X .		X .	
CDU R	.		.	
P	.		.	
Y	.		.	
SA	.		.	
TA	.		.	

GET ALIGN HRS	X X		X X	
MIN	X X X		X X X	
SEC	X .		X .	
LANDMARK ID	X X		X X	
GET LMK HRS	X X		X X	
MIN	X X X		X X X	
SEC	X .		X .	
CDU R	.		.	
P	.		.	
Y	.		.	
SA	.		.	
TA	.		.	

UPDATE

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CREW LOG - LANDMARK TRACKING

CREW LOG	LANDMARK TRACKING			
	GET START HRS	X X		X X
	MIN	X X X		X X X
	LMK I.D.	X X X		X X X
	LMK DATA			
	AUTO OPTS			
	ΔR	.		.
	ΔV	.		.
	NO. MARKS	X X X		X X X
	LAT	.		.
	LONG/2	.		.
	ALT	.		.
	GET START HRS	X X		X X
	MIN	X X X		X X X
	LMK I.D.	X X X		X X X
	LMK DATA			
	AUTO OPTS			
	ΔR	.		.
	ΔV	.		.
	NO. MARKS	X X X		X X X
	LAT	.		.
	LONG/2	.		.
	ALT	.		.

SXT TRACKING (P1.10)

Purpose:

To obtain data for determination of SXT accuracy while tracking a target vehicle.
To obtain data on the acquisition of the target under varying lighting conditions and ranges.

Requirements:

See below

Procedures:

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SXT TRACKING

Use P20 checklist procedure and track the S-IVB:

- CSM behind and below; CSM ahead and above (per rendz plan)

- Post rendz at 80, 160, and 320 nm at sunrise (SR), SR + 11, 27 and 43 minutes

NOTES

- Allow at least 10 seconds between marks if recording LBR

- Check auto maneuver to tracking attitude and auto optics positioning.

- For post rendz tracking, it is HD that a false S-IVB state vector (position error TBD) be updated to determine how well the CMC can correct target position.

- Updates for post rendz tracking:

  CSM state vector
  S-IVB state vector
  GET align _____. The align time will be the time at the midpoint of the night pass in which P52 is performed.
  GET_{SR} _____ target sunrise.
  R _____ P _____ Y _____. CDU fly-to angles to assist in target acquisition at target sunrise for at SXT SA _TBD_ TA _TBD_. Data also available for SR + 11, 27 and 43 minutes.

</div>

UPDATE - SXT TRACKING

	SXT TRACKING			
UPDATE	GET ALIGN	HRS	X X	X X
		MIN	X X X	X X X
		SEC	X .	X .
	S-IVB RANGE		.	.
	GET SR	HRS	X X	X X
		MIN	X X X	X X X
		SEC	X .	X .
	CDU SR	R	.	.
		P	.	.
		Y	.	.
	SR	SA	.	.
		TA	.	.
	CDU SR+11	R	.	.
		P	.	.
		Y	.	.
	CDU SR+27	R	.	.
		P	.	.
		Y	.	.
	CDU SR+43	R	.	.
		P	.	.
		Y	.	.

CREW LOG - SXT TRACKING

SXT TRACKING		
HRS	X X	X X
MIN	X X X	X X X
RANGE	.	.
LIGHTING CONDITIONS		
AUTO OPTICS		
R1		
R2		
R3		
CONTROL MODE		
HRS	X X	X X
MIN	X X X	X X X
RANGE	.	.
LIGHTING CONDITIONS		
AUTO OPTICS		
R1		
R2		
R3		
CONTROL MODE		
HRS	X X	X X
MIN	X X X	X X X
RANGE	.	.
LIGHTING CONDITIONS		
AUTO OPTICS		
R1		
R2		
R3		
CONTROL MODE		

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BOOST PHASE MONITORING (P1.11)

Purpose:

To determine GNCS performance under the launch environment.

Requirements:

Perform normal boost phase monitoring per checklist.

Procedures:

No special crew procedures are required.

Crew Log:

Comment on:

- DSKY display of VI, H DOT and H PAD

- FDAI display of attitude, attitude error and attitude rate

- P11 displays used, if any.

- Satisfaction with displayed data, i.e., scaling, lighting resolution, readability and display location.

GNCS ATTITUDE CONTROL (P1.12)

Purpose:

To verify the ability of the GNCS to perform automatic and manual attitude control functions.

Requirements:

Perform G&N control functions as noted below.

Procedures:

GNCS ATT CONTROL

TEST NO.	FUNCTION
1	Max db (5°) att hold 20 to 30 min.
2	Min db (0.5°) att hold 10 to 20 min.
3	Automatic maneuver @ 0.2°/sec.
4	Manual maneuver @ 0.2°/sec $\pm$ all axes.
5	Minimum impulse
6	Translation $\pm$X, $\pm$Y, $\pm$Z.
7	Acceleration cmd @ 0.3°/sec $\pm$ all axes.
8	Automatic maneuver @ 0.05, 0.5 and 5°/sec.
9	Manual maneuver @ 0.05, 0.5 and 4°/sec $\pm$ all axes.

NOTES

. Jet select 2-2-2 (all rotational tests)

. Desired vehicle rate $\approx$ 1°/sec prior to initiation of att hold (Test 1,2).

. Attempt to initiate att hold tests at AOS +30 sec (or TM lock-on). HBR required for att hold tests.

. Although not required in DTO, demonstrate att hold and maneuver with jet select 1-1-1.

. Desired att hold or free drift prior to initiation of manual maneuver tests (Test 4,5,7,9).

. 4° and 5°/sec maneuvers will be scheduled real time late in mission if propellant available.

Crew Log:

Complete for each test.

GET	HR	X	X			X	X			
TESTS 1 & 2	MIN	X	X	X		X	X	X		
	SEC	X			.	X			.	
BODY RATES	R			.						
(PRIOR TO ATT	P			.						
HOLD INITIATION)	Y			.						
VERIFY VEH HOLD ATT		X	X	X	X	X	X	X	X	
GET START	HR	X	X			X	X			
TESTS 4,5,7,9	MIN	X	X	X		X	X	X		
	SEC	X			.	X			.	
BEGIN	R			.				.		
	P			.				.		
	Y			.				.		
MANEUVER RATE		X	X	.		X	X	.		
CONCLUSION	R			.				.		
	P							.		
	Y									
GET STOP	HR	X	X			X	X			
	MIN	X	X	X		X	X	X		
	SEC	X			.	X			.	
MANEUVER RATE			X	X	.	X	X		.	

COMMENTS RELEVANT TO CROSS COUPLING

CREW LOG - GNCS ATT CONTROL

RATE REVERSALS			
GET START (HR:MIN:SEC) : : .			
TEST 1&2	R	P	Y
GET (MIN:SEC) OF RATE REVERSAL	:	:	:
GET STOP (HR:MIN:SEC) : :			

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GNCS ΔV CAPABILITY (P1.13)

Purpose:

To evaluate the accuracy of GNCS TVC using the SPS.
To evaluate the accuracy of RCS ΔV maneuvers.
To verify ability of the TVC DAP to control attitude
rates and attitude deadband.

Requirements:

Perform following types of G&N controlled burns:
1. SPS 10-30 sec duration
2. SPS 0.5-8 sec duration
3. RCS 2-12 sec duration

Procedures:

No special test procedures are required. Refer to SPS
burn schedule.

Crew Log:

Log per standard SPS burn log.

GNCS ENTRY MONITORING (P1.14)

Purpose:

To evaluate adequacy of GNCS driven displays (DSKY and
FDAI) in the entry environment.
To evaluate GNCS accuracy in the entry environment.

Requirements:

SCS manual entry with GNCS displays available for steering
errors.

Procedures:

Crew checklist

Crew Log:

Crew Debriefing and Onboard Update Logs.

SPS BURN #			X X X	X X X
GET		HR	X X	X X
		MIN	X X X	X X X
		SEC	X .	X .
	RCS (PRIOR TO G&N POWER UP FOR P51)	A	X X X	X X X
		B	X X X	X X X
		C	X X X	X X X
		D	X X X	X X X
	SPS	FUEL	X X .	X X .
		OX	X X .	X X .
P30 VO6N33		HR	X X	X X
		MIN	X X X	X X X
		SEC	X .	X .
	VO6N42	HA	X .	X .
		HP	X .	X .
		ΔV	.	.
		ΔV_C	X .	X .
P40 VO6N86LCVERT		VGX	.	.
		VGY		
		VGZ	.	.
	VO6N22	R	.	.
		P	.	.
		Y	.	.
		ΔV_C	X .	X .
	VO6N85	VGX (CONT)	.	.
		VGY (CONT)	.	.
		VGZ (CONT)	.	.
	VO6N44	HA	.	.
		HP	.	.
GET		HR	X X	X X
		MIN	X X X	X X X
		SEC	X .	X .
	RCS (AT COMPLETION OF BURN)	A	X X X	X X X
		B	X X X	X X X
		C	X X X	X X X
		D	X X X	X X X
	SPS·	FUEL	X X .	X X .
		OX	X X .	X X .

MIDCOURSE NAVIGATION (P1.15)

Purpose:

        To verify the onboard (SXT) midcourse navigation
capability and procedures.

Requirements:

        Perform P23 CSM-CISLUNAR MIDCOURSE NAV MEASUREMENT
PROGRAM for a lunar landmark/star and the lunar
horizon/star technique.

Procedures:

MIDCOURSE NAVIGATION

Perform P23 per checklist

NOTES:

- Each crewman should perform the lunar landmark/star
procedure making at least nine marks.

- One crewman should perform the lunar horizon/star
procedure making at least nine marks.

- The IMU should be powered up for at least one demon-
stration with HBR TM. (HD)

- Use FDAI 5:1 scale for proper scaling of TM data.

- Allow at least 10 seconds between marks if recording
LBR.

Crew Log:

- Complete log for each sighting

- Comment on controls, displays and procedures.

- Comment on ability to sight each lunar landmark as
influenced by landmark shape, location, illumination,
and usefulness of landmark maps.

MIDCOURSE NAVIGATION				
GET START	HRS	X X	X X	
	MIN	X X X	X X X	
LMK DATA				
STAR DATA				
TRUNNION BIAS ANGLE		.	.	
OPTICS ANGLE	SHAFT	.	.	
	TRUNNION	.	.	
GET MARK	HR	X X	X X	
	MIN	X X X	X X X	
	SEC	X .	X .	

GET START	HRS	X X	X X	
	MIN	X X X	X X X	
LMK DATA				
STAR DATA				
TRUNNION BIAS ANGLE		.	.	
OPTICS ANGLE	SHAFT	.	.	
	TRUNNION	.	.	
GET MARK	HR	X X	X X	
	MIN	X X X	X X X	
	SEC	X .	X .	

IMU PERFORMANCE (P1.16)

Purpose:

To determine the value and stability of inertial component parameters after exposure to the flight environment.

Requirements:

1. Obtain gyro drift data by performing IMU alignment checks one hour apart.

2. Conduct a PIPA bias test prior to first power down and prior to deorbit.

Procedures:

IMU PERFORMANCE

Perform MEASUREMENT AND LOADING OF PIPA BIAS per checklist.

Notes

. HBR required

Crew Log:

. Record data as indicated in the checklist

TVC DAP CONTROLLER EVALUATION (S1.17)

Purpose:

To demonstrate the capability to select alternate DAP controller compensation to capitalize on the flexibility aspect of a digital autopilot.

Requirements:

1. Change the TVC DAP filter coefficients via uplink command prior to the MTVC takeover burn.

2. Change the DAP parameters as follows:

   All burns:

   > P trim
   > Y trim
   > WT

   Prior to and after the longest burn:

   > P trim
   > Y trim
   > WT
   > IX
   > IAV
   > TLX

Procedures:

Standard update and DAP activation procedures.

Crew Log:

Record data in SPS burn log.

EMS PERFORMANCE (P2.3)

Purpose:

To obtain data on the accuracy of the EMS in a flight environment and to determine the adequacy of the displays as a visual reference for manual control during entry.

Requirements:

1. Perform an EMS accelerometer bias prior to the first SPS burn, the long SPS burn, and the deorbit burn.

2. Setup ΔV counter for each SPS ΔV.

3. Setup EMS for entry as specified in the crew checklist.

Procedures:

```
┌─────────────────────────────────────────────────────────────┐
│              EMS ACCELEROMETER BIAS                          │
│                                                             │
│  1.  S/C in drifting flight with no RCS firing.             │
│                                                             │
│  2.  EMS FUNCTION - ΔV                                       │
│      EMS MODE - AUTO                                         │
│                                                             │
│  3.  Record output of ΔV counter over a period of 100 seconds│
│      minimum.  Inform MSFN of results so that a bias cor-   │
│      rection can be established, as required.               │
└─────────────────────────────────────────────────────────────┘
```

Crew Log:

. Record ΔV counter readings in SPS burn log. (with P1.13)

. Comment on adequacy of displays during entry.

. Record log data on EMS.

CREW LOG - EMS PERFORMANCE

AT 0.05G	
RANGE TO TARGET (DSKY)	
EMS RANGE COUNTER	
EMS 0.05 G LIGHT ON	
EMS SCROLL SLEWING TO LEFT	
INERTIAL VELOCITY (DSKY)	
EMS G-V PLOTTER	
G-V PLOT WITHIN LIMITS	

AT 0.2G	
EMS 0.2G LIGHT ON	
EMS ROLL ATTITUDE IND.	
FDAI DISPLAY ATT.	

AFTER 0.2G		
GET	HR	X X
	MIN	X X X
	SEC	X

COMMENTS:

EMS ACCELEROMETER BIAS		
GET	HRS	X X
	MIN	X X X
	SEC	X
ΔV COUNTER		

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SCS ATTITUDE CONTROL (P2.4)

Purpose:

To verify the ability of the SCS to perform attitude control functions and to obtain RCS propellant usage data.

Requirements:

Perform SCS control functions as noted below.

Procedures:

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SCS ATT CONTROL

TEST NO.	FUNCTION
1	Max deadband ($\pm 5°$) low rate for 1.5 to 2 hrs.
2	Min deadband (± 0.2) low rate for 1 to 1.5 hrs.
3	Rate command @ 0.3°/sec
4	Minimum impulse
5	Acceleration command @ 0.5°/sec
6	Translation $\pm$X, $\pm$Y, $\pm$Z
7	Manual direct @ 0.5°/sec $\pm$ all axes.
8	Rate command @ 1.5°/sec
9	Max deadband ($\pm 8°$) high rate for 1.5 to 2.5 hrs.
10	Min deadband ($\pm 4°$) high rate for 1 to 1.5 hrs.

NOTES

• Desired vehicle rates > 1°/sec prior to initiation of att hold tests (Tests 1,2,9,10).

• Jet select 2-2-2 for all rotation tests.

• Attempt to initiate att hold tests at AOS + 30 sec (or TM lock-on). 20 min of HBR reqd for test 1 and 9; 10 min for test 2 and 10.

• Although not required in DTO, demonstrate att hold and maneuver with jet select 1-1-1.

</div>

Crew Log:

Complete for indicated tests.

GET HRS	X X		X X	
TESTS 1,2,9&10 MIN	X X X		X X X	
SEC	X .		X .	
BODY RATES (PRIOR TO ATT HOLD INITIATION)	. . . .		. . . .	
VERIFY VEH HOLD ATT	X X X X		X X X X	
GET START HRS	X X		X X	
TESTS 3,4,5,7,8 MIN	X X X		X X X	
SEC	X .		X .	
BEGIN R	.		.	
P	.		.	
Y	.		.	
MANEUVER RATE	X X .		X X .	
CONCLUSION R	.		.	
P	.		.	
Y	.		.	
GET STOP HRS	X X		X X	
MIN	X X X		X X X	
SEC	X .		X .	
MANEUVER RATE	X X .		X X .	
COMMENTS RELEVANT TO CROSS COUPLING				

RATE REVERSALS

GET START (HR:MIN:SEC)	:	'	,

TESTS 1,2,7&10	R	P	Y
GET (MIN:SEC) OF RATE REVERSAL			

GET STOP (HR:MIN:SEC)	:	:	.

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SCS ΔV CONTROL (P2.5)

Purpose:

To demonstrate the ability to perform SCS Auto TVC.

Requirements:

Perform SCS auto SPS maneuver of 15 sec in duration.
(5 to 12 sec minimum)

Procedures:

Per checklist. Use P47 to display cross axis error
at cutoff.

Crew Log:

. Record data on SPS burn log. (included with P1.13)

. Comment on handling characteristics and any unusual
attitude/rate transients.

G&N/MTVC TAKEOVER (P2.6)

Purpose:

> To demonstrate the capability to perform manual thrust vector control takeover from the GNCS ΔV control mode.

Requirements:

> This demonstration is to take place in conjunction with any GNCS/DAP controlled burn which allows at least 10 sec of manual control after takeover.

Procedures:

> Standard crew checklist procedure for MTVC takeover.

Crew Log:

> - Record data on SPS burn log. (included with P1.13)
>
> - Comment on handling characteristics and any unusual attitude/rate transients.

SCS ATTITUDE REFERENCE CHECKS (P2.7)

Purpose:

To determine SCS attitude reference system drift during flight environment.

Requirements:

Perform an SCS attitude reference check at:

1. Insertion
2. 30 minute intervals during a long duration coast prior to an SPS burn. An IMU realignment is desired at the completion of the coast period.

Procedures:

SCS ATT REF CHECKS

ARS Boost Phase Drift:

- Perform SCS att ref check prior to CSM/S-IVB separation by recording FDAI 1 and 2 total attitude.

ARS Drift during coast

- Following the P52 IMU alignment completed during the second night pass prior to an SPS burn align the GDC to the IMU.

- At 30 minute intervals prior to burn, perform SCS ATT REF COMPARISON per checklist.

- Perform IMU alignment (HD) at completion of coast phase.

Crew Log:

- Complete for each SCS Att Ref check.

BOOST PHASE DRIFT		FDAI #1	FDAI #2
GET	R	.	.
HRS MIN	P	.	.
:	Y	.	.

DRIFT DURING COAST		STEP #3	STEP #4
GET	HR	X X	X X
	MIN	X X X	X X X
	SEC	X .	X .
ICDU	R	.	.
	P	.	.
	Y	.	.
ATT SET	R	.	.
	P	.	.
	Y	.	.
GET	HR	X X	X X
	MIN	X X X	X X X
	SEC	X .	X .
ICDU	R	.	.
	P	.	.
	Y	.	.
ATT SET	R	.	.
	P	.	.
	Y	.	.
GET	HR	X X	X X
	MIN	X X X	X X X
	SEC	X .	X .
ICDU	R	.	.
	P	.	.
	Y	.	.
ATT SET	R	.	.
	P	.	.
	Y	.	.

SCS ATTITUDE REFERENCE ALIGNMENT (P2.10)

Purpose:

> To evaluate the procedural aspects of GDC/FDAI
> alignment using the SCT and to determine the
> resultant pointing error.

Requirements:

> Perform a Backup GDC Alignment per the checklist.
> Prior to the test, the IMU shall be aligned to a
> known orientation to provide an attitude reference
> standard.

Procedures:

> No special test procedures are required. The
> ground update data will be referenced to the
> current REFSMMAT and will be per the crew checklist
> procedure.

Crew Log:

> ● Complete log each time procedure is performed
>
> ● Comment on evaluation of controls, displays, and
> procedures.

ATT. REF ALIGN				
GET START	HRS	X X		X X
	MIN	X X X		X X X
CDU STEP 6	R		.	.
	P		.	.
	Y		.	.
ATT ERROR STEP 8	R		.	.
	P		.	.
	Y			
CDU STEP 8	R		.	.
	P		.	.
	Y		.	.
GET STOP	HR	X X		X X
	MIN	X X X		X X X
GET START	HRS	X X		X X
	MIN	X X X		X X X
CDU STEP 6	R		.	.
	P			.
	Y			.
ATT ERROR STEP 8	R		.	.
	P		.	.
	Y		.	.
CDU STEP 8	R		.	.
	P		.	.
	Y			.
GET STOP	HR	X X		X X
	MIN	X X X		X X X

4-45

SPS MINIMUM IMPULSE BURN (P3.14)

Purpose:

To assure that the repeatibility of the SPS minimum impulse satisfactorily complies with lunar mission midcourse connection criteria.
To determine the crossover for utilization of the SPS or RCS for LM rescue maneuvers and limited trajectory adjustments.

Requirements:

Refer to SPS burn schedule. A minimum of two burns are required. (<0.5 sec >1.0 sec G&N)

Procedures:

Standard crew checklist procedure. The same ullage requirements will be used for both burns.

Crew Log:

No crew recording required.

SPS PERFORMANCE EVALUATION (P3.15)

Purpose:

To assure that the SPS performance is sufficient to satisfy the velocity gain requirements imposed by the LLM.

Requirements:

Refer to SPS burn schedule. Perform long duration burn that uncovers 2 point sensors.

Crew Log:

No crew recording required.

PRIM/AUX PROPELLANT GAUGING SYSTEM (P3.16)

Purpose:

>   To determine the accuracy of the SPS propellant utilization and gauging subsystem in terms of the relative accuracy of the primary and auxiliary system.

Requirements:

>   One SPS burn of sufficient duration to uncover at least two point sensors in one fuel and one oxidizer tank.

Procedures:

>   Refer to SPS burn schedule.

Crew Log:

>   No crew log required.

SM/RCS PERFORMANCE (S3.17)

Purpose:

>   To obtain data on SM/RCS pulse and steady state performance.

Requirements:

>   No specific maneuvers are required by the test objective

Procedures:

>   None

Crew Log:

>   None

SPS PROPELLANT THERMAL CONTROL (P3.20)

Purpose:

To substantiate the validity of the SPS propellant feed thermal control system and analytical design model.

Requirements:

Determine that the SPS heaters can contain the propellant lines within the temperature operating limits during:

. Drifting flight

. With the SPS in a cold soak attitude (+X towards sun)

Procedures:

<div style="border:1px solid">

SPS COLD SOAK

Receive the following update:

. CSM state vector (if GNCS powered down)

. GET align _____. The time of align will be the spacecraft sunrise time of the day pass the test will commence.

. R_____ P_____ Y_____ CDU fly-to angles places S/C + X towards sun.

. GET_____ Time to initiate test.

The following is required:

CMC – ON
IMU – at known orientation
SCS – powered up

1. Maneuver to updated attitude. Maintain att hold, max deadband.

NOTE:

S/C attitude must be known for the two revs preceding the cold soak for determination of structural and skin temperatures.

</div>

2. Monitor SPS PRPLNT TK TEMP. Determine if SPS line heaters can maintain propellant feed line temperatures 45°F or better.

3. Test duration 3 hours

NOTES

. MSFN will monitor temperature trend data from Temp 1 Ox Distr Line (SP0054T) and Temp 1 Fuel Distr Line (SP0057) for minimums of 35°F and 25°F. Data available only on HBR.

. Cold soak should not be scheduled less than two hrs following an SPS burn.

. Monitor CM/RCS ENG INJECTOR TEMP (6) during cold soak to note effects of solar heating on the CM/RCS.

. Crew initiation of DSE HBR TBD.

. It is not necessary for the two revolutions per hour vehicle roll rate requirement to be enforced if the quad soak does not exceed three hours duration.

Crew Log:

. Complete for SPS heater use.

. Complete CM/RCS temp log during cold soak.

UPDATE - SPS COLD SOAK

UPDATE	GET ALIGN	HRS	X	X		X	X		
		MIN	X	X	X	X	X	X	
		SEC	X		.	X		.	
	CDU	R			.			.	
		P			.			.	
		Y			.			.	
	GET	HRS	X	X		X	X		
		MIN	X	X	X	X	X	X	
	GET ALIGN	HRS	X	X		X	X		
		MIN	X	X	X	X	X	X	
		SEC	X		.	X		.	
	CDU	R			.			.	
		P			.			.	
		Y			.			.	
	GET	HRS	X	X		X	X		
		MIN	X	X	X	X	X	X	

SPS COLD SOAK					
GET	HRS	X X		X X	
	MIN	X X X		X X X	
HTR POS					
OX		X X X		X X X	
FUEL		X X X		X X X	
GET	HRS	X X		X X	
	MIN	X X X.		X X X	
HTR POS					
OX		X X X		X X X	
FUEL		X X X		X X X	
GET	HRS	X X		X X	
	MIN	X X X		X X X	
HTR POS					
OX		X X X		X X X	
FUEL		X X X		X X X	
GET	HRS	X X		X X	
	MIN	X X X		X X X	
HTR POS					
OX		X X X		X X X	
FUEL		X X X		X X X	

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CREW LOG - CM/RCS THRUSTER TEMP

GET		HRS	X X		X X	
		MIN	X X X		X X X	
VOLTS/TEMP	5C	(24)	X X .		X X .	
	5D	(25)	X X .		X X .	
	6A	(12)	X X ,		X X .	
	6B	(14)	X X .		X X .	
	6C	(16)	X X .		X X .	
	6D	(21)	X X .		X X .	

GET		HRS	X X		X X	
		MIN	X X X		X X X	
VOLTS/TEMP	5C	(24)	X X .		X X .	
	5D	(25)	X X .		X X .	
	6A	(12)	X X .		X X .	
	6B	(14)	X X .		X X .	
	6C	(16)	X X .		X X .	
	6D	(21)	X X		X X	

GET		HRS	X X		X X	
		MIN	X X X		X X X	
VOLTS/TEMP	5C	(24)	X X .		X X .	
	5D	(25)	X X .		X X .	
	6A	(12)	X X .		X X .	
	6B	(14)	X X .		X X .	
	6C	(16)	X X .		X X .	
	6D	(21)	X X .		X X .	

CREW LOG

4-52

CSM LIFE SUPPORT FUNCTIONS P4.4

Purpose:

To establish the flight performance of the ECS in the following areas:

Pressure control - cabin, suit, water, and glycol tank

Thermal control - primary coolant loop, water boiler and radiator

Habitability - comfort, CO_2 removal, temperature and humidity control, toxic gas and odor removal

Requirements:

TBD

Procedures:

TBD

Crew Log:

TBD

CREW LOG - CANISTER CHANGES

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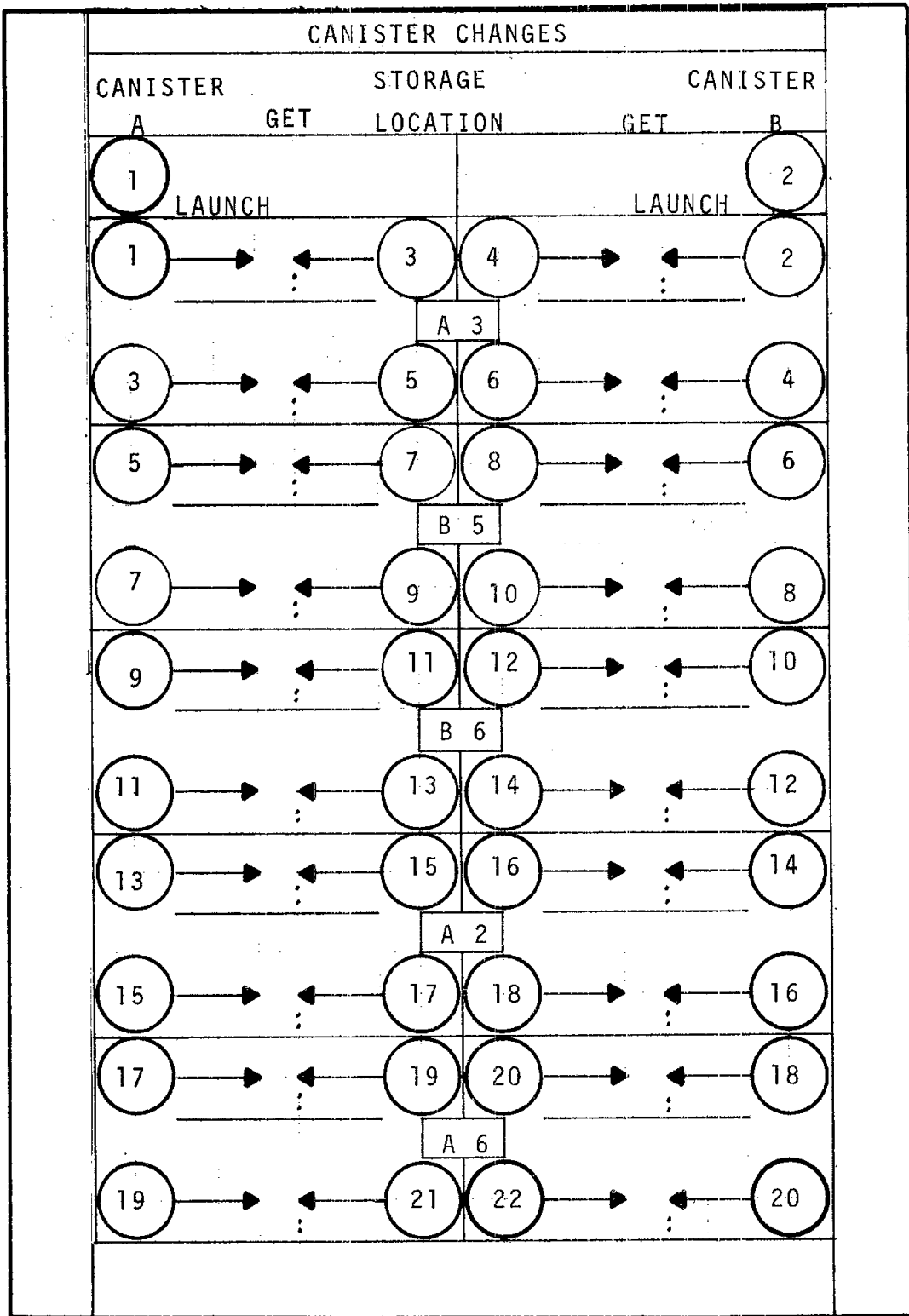
CSM WASTE MANAGEMENT (P4.6)

Purpose:

To demonstrate the operation of the waste management system in a flight environment.

Requirements:

1. Demonstrate urine dump operation

2. Demonstrate adequacy of fecal canister

3. Demonstrate adequacy of the waste storage compartment ventilation

Procedures:

Per the AOH.

Crew Log:

. Comment on use of urine and fecal subsystem and vacuum cleaner.

. Comment on changes in O_2 flow during times that the overboard drain switch is in the DUMP position.

. Comment on noxious odors.

CSM SECONDARY COOLANT LOOP (P4.8)

Purpose:

To evaluate the secondary coolant loop operation,
the radiator and the evaporator during high and
and low ECS thermal loads.

Requirements:

Test procedures are below.

Procedures:

SECONDARY COOLANT LOOP

Mode A - S/C electrical load   TBD watts
Mode B - S/C electrical load   TBD watts

The following are required for each mode:

    CMC - STBY
    IMU - STBY
    DSE - OFF
    SCE - 20 min ON 40 min OFF duty cycle
    WATER QTY - at least 30 pounds in potable and
    waste tank

MODE A

1. Verify electrical load   TBD watts
    Maintain drifting flight

2. Activate and operate secondary coolant
    loop per checklist.

3. Test duration approximately 2 orbits

MODE B

1. At completion of MODE A, increase electrical
    load to TBD watts by powering up SCS. Allow
    1 orbit for thermal load stabilization.
    Maintain drifting flight.

2. Test duration 2 orbits

NOTES:

- Perform a humidity survey at least once during secondary coolant loop operation.

- If desired, the primary loop pumps can be turned on for about 5 min. each orbit and a check made of the radiator outlet temperature change.

- The following MDC displays are inoperative with the SCE OFF:

     F/C 1,2,3 COND EXH
     F/C 1,2,3 SKIN TEMP
     SPS FLANGE TEMP HI
     INV 1,2,3 TEMP HI

Crew Log:

     None required.

WATER MANAGEMENT (P4.9)

Purpose:

To verify the water management capability from prelaunch to recovery.

Requirements:

- Perform water chlorination per AOH procedure.

- Perform cabin dew point measurements as noted below.

Procedures:

> AOH procedure for water chlorination
>
> ### HUMIDITY SURVEY
>
> - Configure and operate the hygrometer per the checklist.
>
> - Perform dew point readings every 6 hours when partially suited and once a day when in shirt sleeves, in the following locations:
>
>   Any suit circuit outlet
>   Cabin heat exchanger outlet
>   LEB
>   LHEB near cabin air return
>   Free cabin air
>
> - Be on the lookout for condensation on the heater glycol lines, inside the cabin heat exchanger, and particularly be watchful for areas of stagnation or gas flow channeling.

Crew Log:

- Estimate of water used on as per crew basis.

- Comments on adequacy of procedures and equipment used for potable water chlorination.

- Record results of humidity surveys.

GET	HR	X	X		X	X		
	MIN	X	X	X	X	X	X	
DEW POINT								
SUIT CIRCUIT	WET	X	X	X	X	X	X	
	DRY	X	X	X	X	X	X	
HEAT EXCHANGER	WET	X	X	X	X	X	X	
	DRY	X	X	X	X	X	X	
LEB	WET	X	X	X	X	X	X	
	DRY	X	X	X	X	X	X	
LHEB	WET	X	X	X	X	X	X	
	DRY	X	X	X	X	X	X	
FREE AIR	WET	X	X	X	X	X	X	
	DRY	X	X	X	X	X	X	
CONDENSATION OBSERVED								
GET	HR	X	X		X	X		
	MIN	X	X	X	X	X	X	
	LOG							

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POSTLANDING VENTILATION (P4.10)

Purpose:

To demonstrate the capability of the postlanding
ventilation circuit to provide a habitable environ-
ment for the crew members during the postlanding
period.

Requirements:

1. Demonstrate postlanding ventilation per checklist
   procedure.

2. Determine if the intake and exhaust ventilation
   valves prevent sea water from entering the CM
   in case the CM tilts greater than 60° from vertical.

Procedures:

Crew checklist.

Crew Log:

Astronaut debriefing comments to include following:

. Adequacy of ventilation during fan operation.

. Adequacy of intake and exhaust ventilation valves
  to prevent the entry of sea water if the CM
  tilted   60°.

. Approximate time in hours that fans operated at
  HIGH flow and at LOW flow.

. Time that fans were operated and reason for final
  cessation of fan operation.

ZERO-G EFFECTS ON CRYOGENICS (P5.8)

Purpose:

To determine if excessive thermal stratification will occur without the fans. To verify the fans will effectively reduce stratification if it should occur.

Requirements:

Perform test per procedures at following H_2 and O_2 quantities (onboard gage readings)

    Test 1 - 90 $\pm 5\%$
    Test 2 - 60 $\pm 5\%$
    Test 3 - 15 $\pm 5\%$ (or last day)

Procedures:

H_2 TEST

The following are required:

    Steady state power
    Quantity balance per AOH
    Tank pressures per AOH
    Total H_2 flow to the F/C's exceeds min flow req'd
       to prevent overpressurization (see curve)

1. H_2 HEATERS (both) - OFF
   H_2 FANS (both) - OFF

2. When either H_2 TANK PRESS reaches 230 psia
   H_2 HEATERS (both) - ON

3. Monitor H_2 TANK PRESS (both) for 260-265 psia limit.
   Note rate of pressure rise.

4. Approximately one minute prior to 260-265 psia
   record log data.

5. At approximately 260-265 psia (either tank)
   H_2 HEATERS (both) - OFF
   H_2 FANS (both) - ON

6. Record log data at one minute intervals for four
   minutes or until pressures have stabilized.

---

7. H_2 HEATERS (both) - AUTO
   H_2 FANS (both) - AUTO

O_2 TEST

The following are required:

   Steady state power
   Quantity balance per AOH
   Tank pressures per AOH
   Total O_2 flow to the F/C's exceeds min flow req'd
   to prevent overpressurization (see curve)

1. O_2 HEATERS (both) - OFF
   O_2 FANS (both) - OFF

2. When either O_2 TANK PRESS reaches 820 psia
   O_2 HEATERS (both) - ON

3. Monitor O_2 TANK PRESS (both) for 910 psia. Note
   rate of pressure rise.

4. Approximately one minute prior to 910 psia
   record log data.

5. At approximately 910 psia (either tank)
   O_2 HEATERS - OFF
   O_2 FANS - ON

6. Record log data at one minute intervals for four
   minutes or until pressures have stabilized.

7. O_2 HEATERS (both) - AUTO
   O_2 FANS (both) - AUTO

Crew Log:

   . Complete for each test.

CRYOGENICS							
			H2			O2	
GET STEP #1	HRS	X X			X X		
	MIN:SEC	X		:	X		:
GET STEP #2	HRS	X X			X X		
	MIN:SEC	X		:	X		:
PRESS	1	X X			X X		
	2	X X			X X		
QUANTITY	1	X X X			X X X		
230 PSIA	2	X X X			X X X		
GET STEP #3	HRS	X X			X X		
	MIN:SEC	X		:	X		:
PRESS	1	X X			X X		
	2	X X			X X		
QUANTITY	1	X X X			X X X		
260-265 PSIA	2	X X X			X X X		
+1 MIN	PRESS	1	X X		X X		
		2	X X		X X		
	QUANTITY	1	X X X		X X X		
		2	X X X		X X X		
+2 MIN	PRESS	1	X X		X X		
		2	X X		X X		
	QUANTITY	1	X X X		X X X		
		2	X X X		X X X		
+3 MIN	PRESS	1	X X		X X		
		2	X X		X X		
	QUANTITY	1	X X X		X X X		
		2	X X X		X X X		
+4 MIN	PRESS	1	X X		X X		
		2	X X		X X		
	QUANTITY	1	X X X		X X X		
		2	X X X		X X X		

CRYOGENIC H_2 HEATER AND FAN DUTY CYCLES

NOTES: 1. Q_{LEAK}=7.24 BTU/HR PER TANK
2. P = 250 PSIA
3. FULL = 100 PERCENT BY GAUGE
4. EQUAL SHARING BETWEEN TANKS

H_2 FLOW
RATE=0.4 LB/HR

RATE=0.3 LB/HR

RATE=0.2 LB/HR

RATE=0.1 LB/HR

OVERPRESSURIZATION AREA

CRYOGENIC H_2 HEATER AND FAN DUTY CYCLES, PERCENT

H_2 REMAINING BY WEIGHT, PERCENT

CRYOGENIC O₂ HEATER AND FAN DUTY CYCLES

CRYOGENIC O₂ HEATER AND FAN DUTY CYCLES, PERCENT (vertical axis)

O₂ REMAINING BY WEIGHT, PERCENT (horizontal axis)

NOTES: 1. Q_{LEAK}=26 BTU/HR PER TANK
2. P = 900 PSIA
3. FULL = 100 PERCENT BY GAUGE
4. EQUAL SHARING BETWEEN TANKS

O₂ FLOW
RATE=3.0 LB/HR

RATE=2.5 LB/HR

RATE=2.0 LB/HR

RATE=1.5 LB/HR

RATE=1.0 LB/HR

OVERPRESSURIZATION AREA
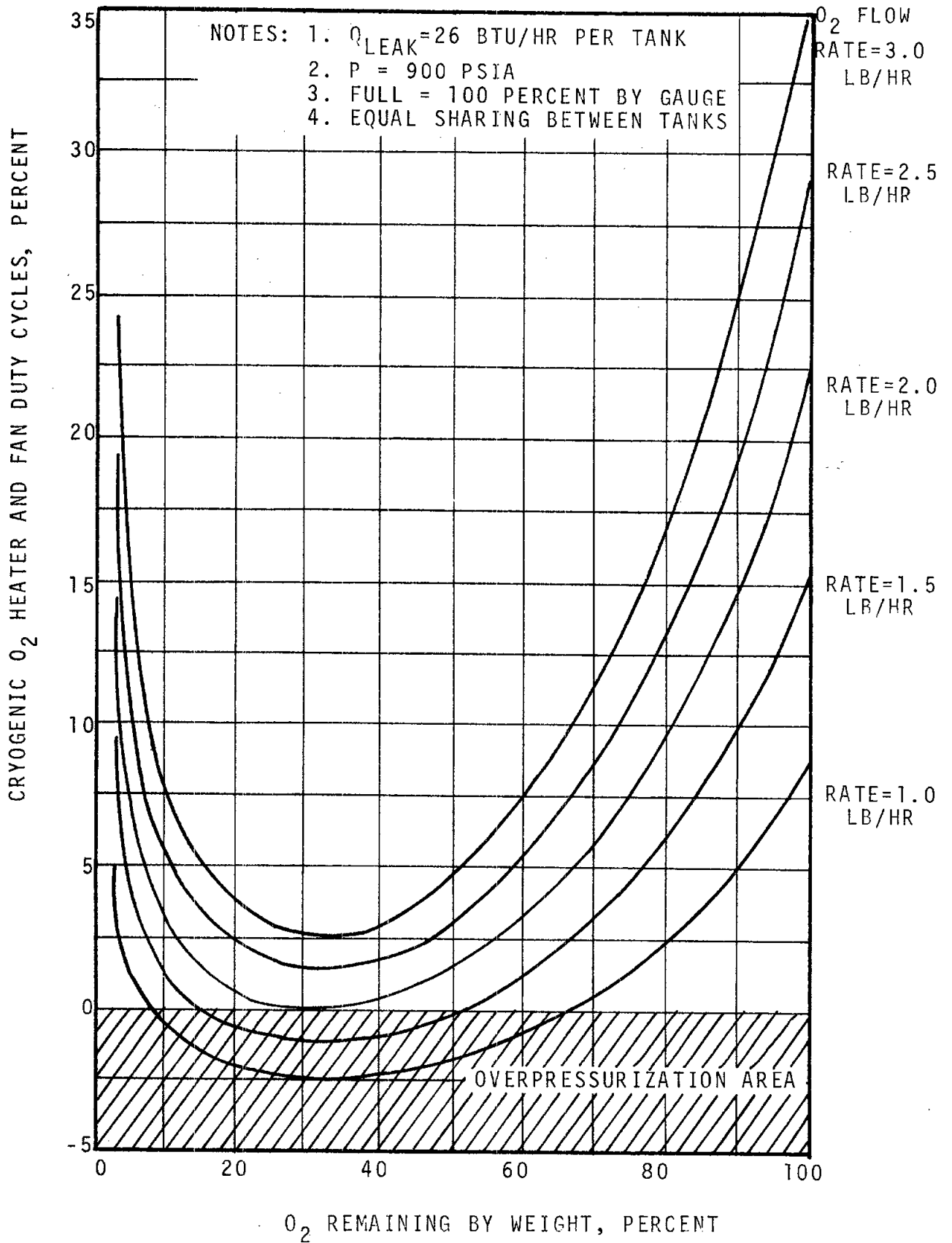
CRYOGENIC PRESSURE CONTROL (P5.9)

Purpose:

To obtain data on the automatic pressure control.
To verify the manual balance procedure is effective
should tank unbalance exceed AOH values.

Requirements:

Normal system operation and monitoring per the check-
list. Perform manual balance procedure per checklist
if tanks become unbalanced.

Procedures:

No special crew procedures are required.

Crew Log:

Complete log if manual balancing required.

CREW CRYOGENIC PRESSURE CONTROL

			O_2			H_2		
GET	HR		X	X		X	X	
	MIN		X	X	X	X	X	X
	SEC		X			X		
PRESS	1		X	X		X	X	
	2		X	X		X	X	
QUANTITY	1		X	X	X	X	X	X
	2		X	X		X	X	X
HTRS								
FANS								
GET	HR		X	X		X	X	
	MIN		X	X	X	X	X	X
	SEC		X			X		
PRESS	1		X	X		X	X	
	2		X	X		X	X	
QUANTITY	1		X	X	X	X	X	X
	2		X	X	X	X	X	X
HTRS								
FANS								
GET	HR		X	X		X	X	
	MIN		X	X	X	X	X	X
	SEC		X			X		
PRESS	1		X	X		X	X	
	2		X	X		X	X	
QUANTITY	1		X	X	X	X	X	X
	2		X	X	X	X	X	X
HTRS								
FANS								

WATER SEPARATION AND POTABILITY (P5.10)

Purpose:

To verify that fuel cell produced water is potable and
usable for crew sustenance.
To verify that fuel cell produced water is removed from
fuel cells by H_2 pump separator to maintain normal fuel
cell performance.

Requirements:

Normal monitoring of fuel cell water generation and transfer.

Procedures:

Crew evaluation of water potability TBD.

Crew Log:

Record water usage in crew status report log.

S-BAND UPDATA LINK (P6.7)

Purpose:

    To verify the S-band updata link.

Requirements:

1. At least one automatic CMC update

2. Normal MSFN RTC of following CSM communication functions:

    S-band PRN to OFF to ON
    S-band PCM to OFF to ON
    S-band PCM data rate to LBR to HBR
    S-band P/A to HIGH PWR to LOW
    DSE playback to PCM/ANLG to LM/PCM
    DSE record to RECORD to OFF to PLAYBACK
    DSE transport to FWD to POWER OFF to REWIND
    S-band AUX to TAPE to OFF to DN VOICE BU

3. A CTE update if the CTE time is more than 5 seconds different from the MSFN GET

Procedures:

    Normal crew communication procedures per checklist and mission communication plan.

Crew Log:

    No crew log required.

OVERPASS SIMULATION WITH LM RR (P6.8)

Purpose:

To determine that the RR/transponder transmission and reception link will operate consistent with the requirements of a mode II operation during a lunar stay phase.

Requirements:

Perform two simulated CSM overpasses with the LM RR located at WSMR.

Procedures:

WSMR RR TEST

Receive following update:

- CSM state vector (if test conducted with IMU initially powered down)

- GET align _____ for a nominal alignment (if required). The align time will be the spacecraft sunrise time of the night pass in which the P52 is performed.

- GET$_{WSMR}$ _____. WSMR AOS

- GET$_{RR}$ _____. Lock-on by RR

- R ____ P ____ Y ____. CDU fly-to angles to enable WSMR acquisition (32° 26', 106° 22') at AOS time for an assumed SCT shaft angle of 115° and trunnion angle of 59°.

The following is required:

    CMC – ON
    IMU – aligned to known orientation
    SCS – powered up

    RR transponder self-test compt (system GO for test)

    1. Maneuver to updated attitude.
       Maintain att hold, min deadband (initiate att hold at minimum of 10 min prior to WSMR AOS).

---

2. Repeat transponder self-test check just prior to WSMR AOS.
Leave SYSTEM TEST (2) at XPNDR and D

3. Inform MSFN when lock-on noted.

NOTE:

Spacecraft maneuver requirements during lock-on TBD.

Crew Log:

. Complete for each self-test

NOTE:

There are 4 revs in the OT that the ground based LM RR could track Apollo 7 and not excede the LM RR capabilities of:

Max range: 400NM
LOS velocity: -5500 ft/sec to +15000 ft/sec
LOS acceleration: 300 ft/sec^2
Slew rate: 2.6°/sec

These revs and their status:

REV	STATUS
45	No conflict
48	Landmark tracking
119	ECS secondary coolant loop test
122	No conflict

The test is therefore scheduled on rev's 45 and 122.

UPDATE	GET ALIGN	HRS	X	X			X	X		
		MIN	X	X	X		X	X	X	
		SEC	X				X			
	GET WSMR	HRS	X	X			X	X		
		MIN	X	X	X		X	X		
		SEC	X				X			
	GET RR	HRS	X	X			X	X		
		MIN	X	X	X		X	X	X	
		SEC	X				X			
	CDU	R								
		P								
		Y								

CREW LOG - WSMR TEST

CREW LOG							
GET	HR				
	MIN	X	X	X	X
SYS TEST	A	X .	X .	X .	X .
	B	X .	X .	X .	X .
	C	X .	X .	X .	X .
	D	X .	X .	X .	X .
GET	HR				
	MIN	X	X	X	X
SYS TEST	A	X .	X .	X .	X .
	B	X .	X .	X .	X .
	C	X .	X .	X .	X .
	D	X .	X .	X .	X .
GET	HR				
	MIN	X	X	X	X
SYS TEST	A	X .	X .	X .	X .
	B	X .	X .	X .	X .
	C	X .	X .	X .	X .
	D	X .	X .	X .	X .
GET	HR				
	MIN	X	X	X	X
SYS TEST	A	X .	X .	X .	X .
	B	X .	X .	X .	X .
	C	X .	X .	X .	X .
	D	X .	X .	X .	X .

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RADIATOR HEAT REJECTION AND DEGRADATION (M7.19)

Purpose:

To determine the heat rejection capability of the primary and secondary ECS radiators.
To assess the degree of thermal coating degradation of both radiators.

Requirements:

1. Operation and management of the ECS system per the checklist satisfies the heat rejection requirement.

2. Perform a radiator coating degradation test by constraining the spacecraft orientation for 3 revolutions with one radiator panel held towards the earth and deactivated (procedures below).

Procedures:

RADIATOR DEACTIVATION

Receive the following update:

. CSM state vector (if GNCS initially powered down)

. REFSMMAT (if required). Desired orientation TBD

. GET _____. Time to initiate orbital rate

. R_____ P_____ Y_____. CDU fly-to angles for start of orb rate. Spacecraft attitude TBD.

The following are required:

    CMC – ON
    IMU – at known orientation
    S/C electrical load   2100 watts
    ECS mon and redundant component check compt

1. Maneuver to updated attitude. At test start time set up orb_____rate, _____and _____att hold, max deadband.

2. Radiator deactivation:

    GLYCOL EVAP TEMP IN – MAN

```
GLYCOL EVAP TEMP IN - COOL (CCW)
FLOW CONT PWR - MAN SEL MODE
MAN SEL - RAD 1 (OR 2) TBD

3.  Test duration 4.5 hours after radiator deactivation

                        NOTE:

Terminate test if ECS RADIATOR TEMP outlet goes
below 38°F.
```

Crew Log:

No crew log required.

UPDATE - RADIATOR DEACTIVATION

UPDATE						
	GET START	HRS	X X		X X	
		MIN	X X X		X X X	
		SEC	X		X	
	CDU	R				
		P				
		Y				
	GET STOP	HRS	X X		X X	
		MIN	X X X		X X	
	GET START	HRS	X X		X X	
		MIN	X X X		X X X	
		SEC	X		X	
	CDU	R				
		P				
		Y				
	GET STOP	HRS	X X		X X	
		MIN	X X X		X X X	
	GET START	HRS	X X		X X	
		MIN	X X X		X X X	
		SEC	X		X	
	CDU	R				
		P				
		Y				
	GET STOP	HRS	X X		X X	
		MIN	X X X		X X X	

FLAT APEX THERMAL PROTECTION (M7.20)

Purpose:

To evaluate the flat areas of the apex and to obtain
data to allow thermal model updating.

Requirements:

DTO satisfied during entry.

Procedures:

Crew entry checklist

Crew Log:

No crew log required

SEPARATION/TRANSPOSITION/SIMULATED DOCKING (P20.8)

Purpose:

    Demonstrate the capability of CSM to perform a separation, transposition, and simulated docking.

Requirements: Photo Requirements

    A sequence camera on the right side window will record data during the transposition and simulated docking.

SLA DEPLOYMENT SYSTEM (P7.21)

Purpose:

    To determine that the panels deployed to a position that would have allowed docking and LM extraction. To determine that the debris catchers contained the debris from the explosive severing of the panels.
    To determine the effects of soot on the interior of the SLA panels.

Requirements: Photo Requirements

1.   The still camera and sequence camera will be ready for use prior to S-IVB/CSM separation.

2.   Photographs of the deployed panels must be obtained immediately following separation and transposition. The view is desired along the X axis and should approximate the scene in Figure 6. If a "fly-round" is accomplished, the two sideviews 90° apart showing SLA deployment angles should approximate the scene in Figure 7. Spring reel retention cables, attenuator and pulley mechanisms and the hinge points are areas of interest shown in Figure 8 which should be given special attention if the deployment is not nominal.

Procedures:

```
┌─────────────────────────────────────────────────┐
│          SLA/DEPLOYMENT/SIM DOCKING             │
│                                                 │
│   Mode A - SEQ - CAM                            │
│                                                 │
│                                                 │
│                                                 │
│                                                 │
└─────────────────────────────────────────────────┘
```

The following are required:

Seq Cam: 18mm lens
           S0368 film
           f11, 1/250, 6 fps
           adjust focus as necessary
           Seq cam mounted in right hand rndz.
             window bracket

. When SLA comes into view, Seq Cam - ON

. Load film magazines as necessary

. When simulated docking operation is completed,
  Seq Cam - OFF

. If a "fly-round" of the SLA by the CSM is
  accomplished then continuous sequence camera
  coverage is highly desirable.

Mode B - H-blad

The following are required:

  H-blad: 80mm lens
            Ring sight
            S3068 film
            f11, 1/250
            Adjust focus as necessary

. Photographs shall be taken of end-on view
  (fig. 6) and at least two side views 90° apart
  (fig. 7).

. Photographs of panels shall have emphasis on:

  1. Evidence of materials which have penetrated
      the debris catchers.

  2. Any "stringers" of material attached to the
      SLA.

  3. The smoothness of all four edges of all the
      SLA panels.

  4. Pattern & distribution of soot deposits on
      the SLA.

5. Lower circumferential corners of SLA panels

6. Hinge point and visual reference panel.

7. Forward circumferential edges

8. Spring reel retention cables

9. Panel angles

10. Any evidence of smoke cloud caused by ignition
    of SLA pyros.

11. Attenuator and pulley mechanisms

Crew Log: Photo Log

. Estimate of angle of each panel with respect to
  S-IVB X axis.

. Record of any anomalies such as bent or missing
  panels and stringers.

. Comments on evidence of the debris catchers being
  out of place or materials having penetrated them.

. Comments on visibility of all SLA panel seam lines
  as affected by soot.

. Comments on pattern of soot deposited and conclusions
  to the probability of effect on LM, had there been
  one present.

. Comments on the condition of each restraining cable
  (i.e., loose or taut).

Figure 6.- Desired view for head-on photography,
still camera 80mm lens range 75 feet.
(END VIEW - Nominal SLA Deployment)

ATTENUATOR
& PULLEY
MECHANISM

49 Ft

49 Ft
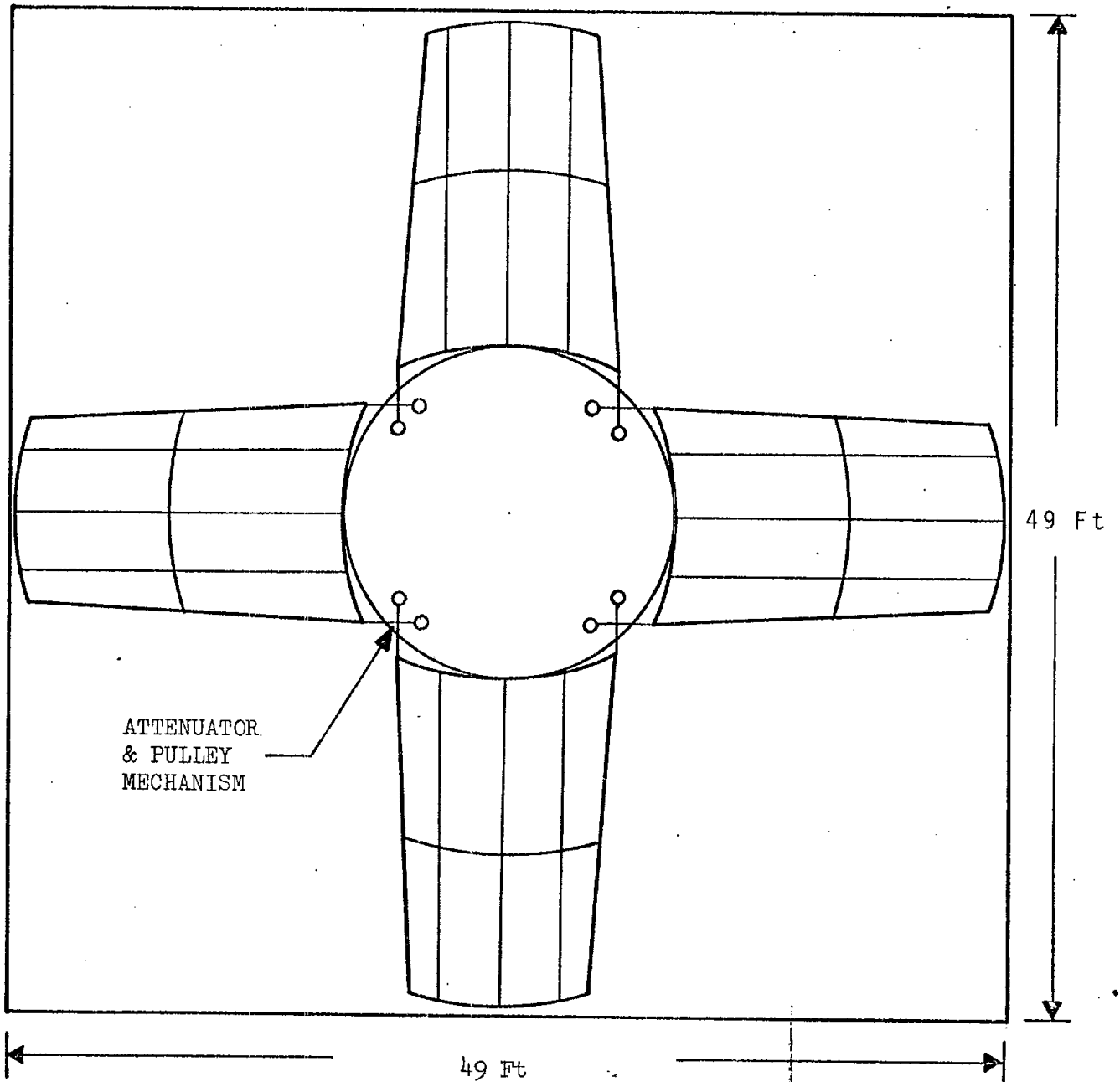
Figure 7.- Desired view for side photography,
still camera 80mm lens, range 75 feet.
(SIDE VIEW - Nominal SLA Deployment)

49 Ft

49 Ft

Note: One SLA panel has been removed to
give a better view.
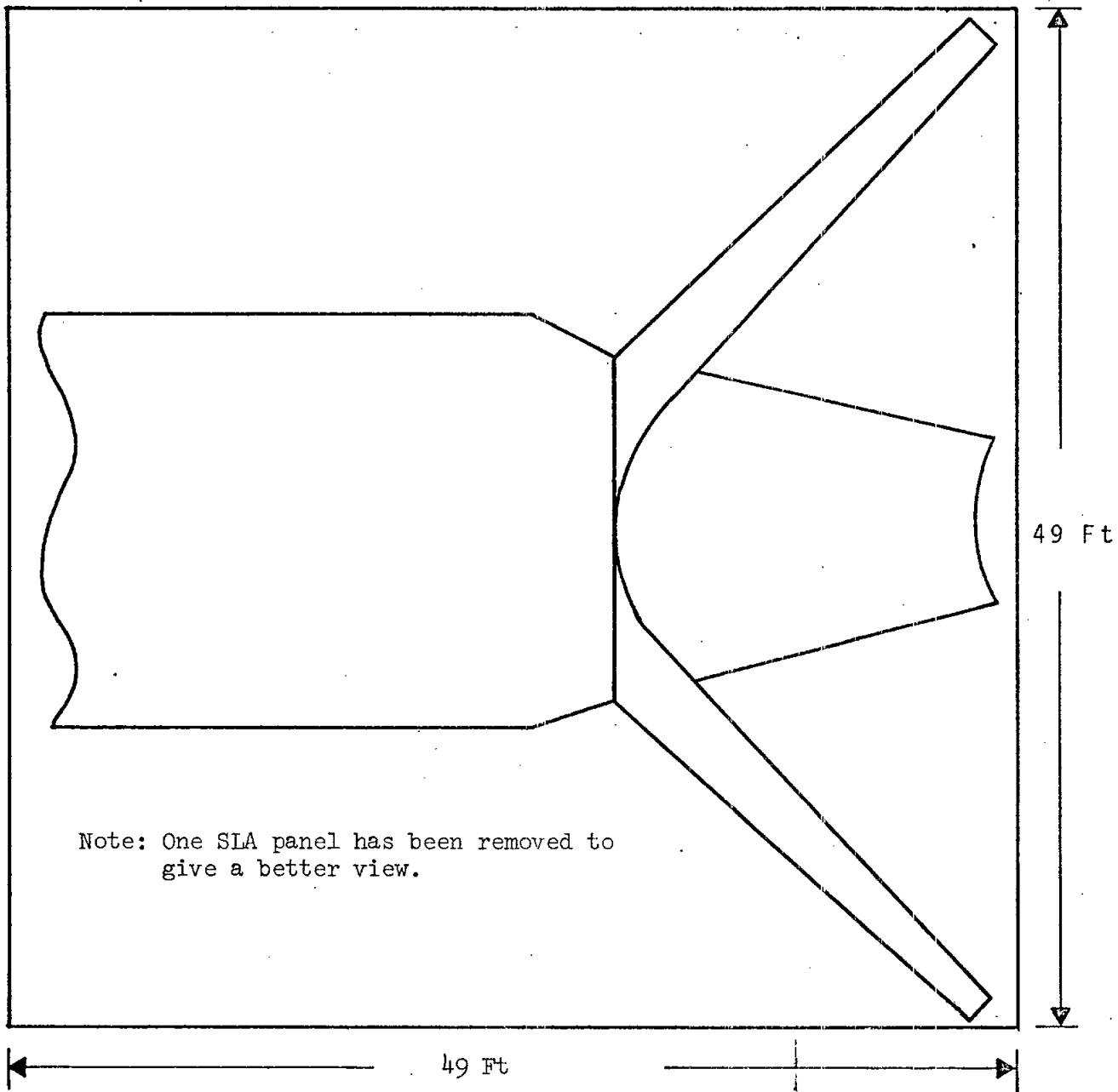
(A similar view from top or bottom is desired to get both
angles of SLA deployment)

SLA PANEL DEPLOYMENT

Figure 8.- Items of special Interest

SPRING REEL RETENTION CABLE

THRUSTERS

SPRING REEL RETENTION CABLE

ATTENUATORS
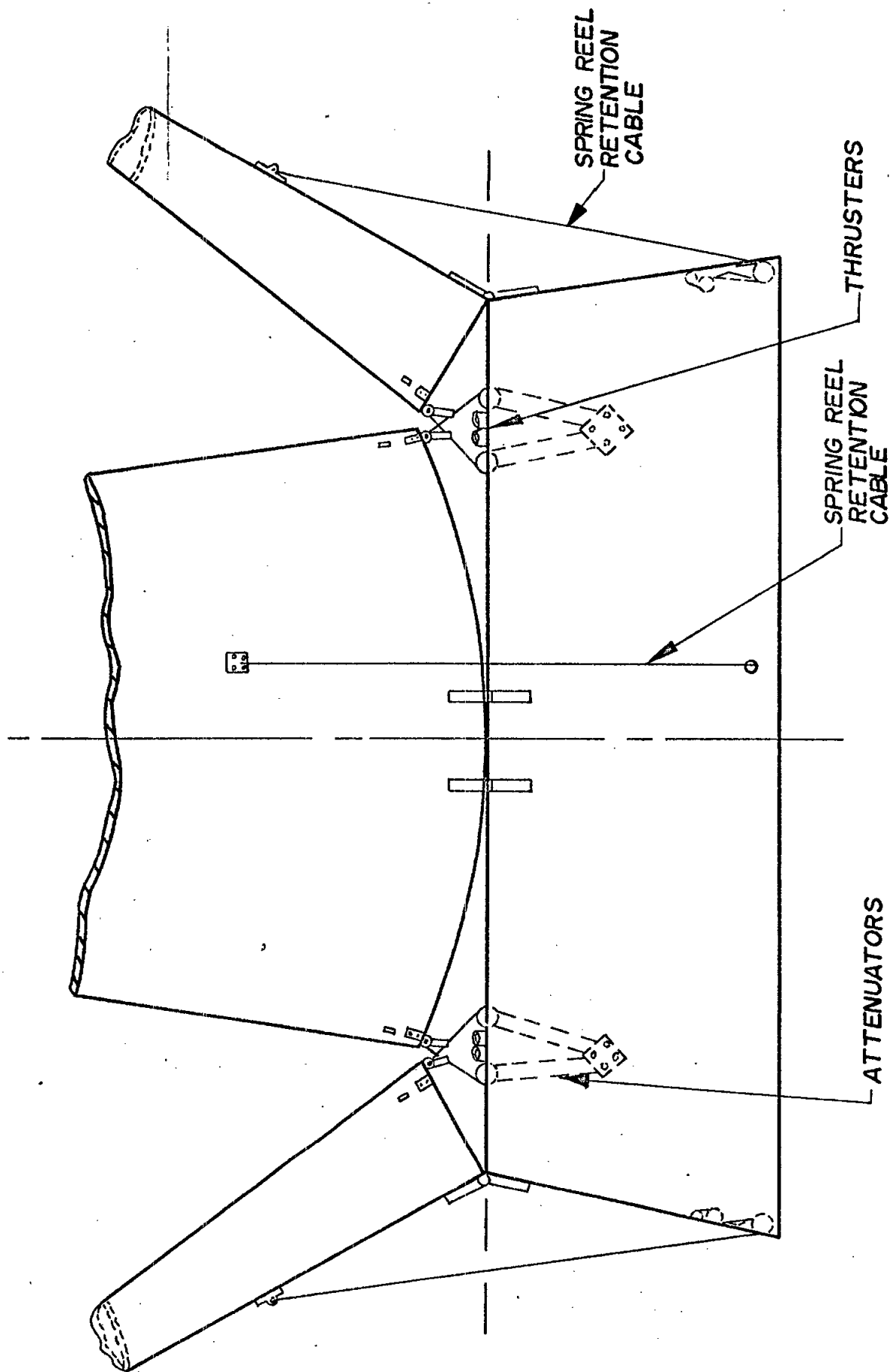
PASSIVE THERMAL CONTROL PROCEDURE (S7.24)

Purpose:

To determine the initial coning angles when the space-
craft is placed in the passive thermal mode of opera-
tion as planned to be used during transearth. To
establish spin up procedures that will minimize the
initial wobble angles.

Requirements:

Perform passive thermal control procedure listed below
at an altitude above 200 n.m. (HD to conduct test
three times)

Procedures:

```
┌─────────────────────────────────────────────────────────┐
│                PASSIVE THERMAL CONTROL                   │
│                                                          │
│    Receive following update:                             │
│                                                          │
│  . CSM state vector                                      │
│                                                          │
│  . GET align_____.  For a nominal alignment.  The       │
│    align time will be the time of apogee and also the    │
│    time the test is to commence (step 4 in procedures)   │
│                                                          │
│  . GET₁_____.  Time to start pretest preparation        │
│    (step 2 in procedures)                                │
│                                                          │
│  . GET₂_____.  Time to initiate test.                   │
│                                                          │
│  . R_____ P_____ Y_____  CDU fly-to angles for          │
│    spacecraft orientation.                               │
│                                                          │
│  The following is required:                              │
│                                                          │
│    CMC - ON                                              │
│    IMU - at known orientation                            │
│    SCS - powered up and aligned to IMU                   │
│                                                          │
│  1.  Maneuver to and maintain updated attitude.          │
│                                                          │
│ T-26  2.  At GET₁ select SCS att hold, minimum deadband. │
│                                                          │
└─────────────────────────────────────────────────────────┘
```

The boxed procedure list:

Receive following update:

. CSM state vector

. GET align_____. For a nominal alignment. The
  align time will be the time of apogee and also the
  time the test is to commence (step 4 in procedures)

. GET_1_____. Time to start pretest preparation
  (step 2 in procedures)

. GET_2_____. Time to initiate test.

. R_____ P_____ Y_____ CDU fly-to angles for
  spacecraft orientation.

The following is required:

CMC - ON
IMU - at known orientation
SCS - powered up and aligned to IMU

1. Maneuver to and maintain updated attitude.

T-26 2. At GET_1 select SCS att hold, minimum deadband.

T-21　3.　At the completion of 5 minutes of att hold, set up a roll rate of approximately 0.3°/sec. Maintain pitch and yaw att hold.

T=0　4.　At GET_2 (plus 0 minus 1 min) disable pitch and yaw channels. Minimize S/C disturbances and crew motions during the next 20 minutes.

T+20　　End of Test

NOTE:

Crew recording of DSE HBR TBD

Crew Log:

Record sequence of events as accomplished.

UPDATE	PASSIVE THERMAL CONTROL								
	GET ALIGN	HRS	X	X			X	X	
		MIN	X	X	X		X	X	X
		SEC	X				X		
	GET₁	HRS	X	X			X	X	
		MIN	X	X	X		X	X	X
		SEC	X				X		
	GET₂	HRS	X	X			X	X	
		MIN	X	X	X		X	X	X
		SEC	X				X		
	CDU	R							
		P							
		Y							
	GET ALIGN	HRS	X	X			X	X	
		MIN	X	X	X		X	X	X
		SEC	X				X		
	GET₂	HRS	X	X			X	X	
		MIN	X	X	X		X	X	X
		SEC	X				X		
	GET₂	HRS	X	X			X	X	
		MIN	X	X	X		X	X	X
		SEC	X				X		
	CDU	R							
		P							
		Y							

MSC Form 1190 (Apr 65)

CSM STRUCTURAL PERFORMANCE (S7.28)

Purpose:

To obtain structural vibration data during launch, powered flight and deorbit.

Requirements:

Operate the FQ recorder:

a. Minus 45 sec through lift-off plus ≈ GET 03:00

b. Minus 30 sec through thrust termination plus ≈ 30 sec for SPS Burn 5

c. Minus 30 sec prior to deorbit burn and continuing through tape runout.

Procedures:

Crew checklist

Crew Log:

None required

MANUAL RETRO ATTITUDE ORIENTATION (S20.9)

Purpose:

To demonstrate that in event of total attitude reference loss, the capability exists to manually orient the CSM to retro attitude using the window marks and horizons as a reference.

Requirements:

Perform an out-the-window orientation maneuver to the SPS retro attitude during both day and night side passes.

Procedures:

```
RETRO ORIENTATION


MODE A - Night
MODE B - Day

The following are required:
   CMC - ON
   IMU - at known orientation
   SCS - powered up
   Ground update:
      GET ___
      Retro Att  R___ P___ Y___     (SPS deorbit)
      Window angle _____
      ICDU's R___ P___ Y___

1.  Couches in boost position
    Maneuver in ACCEL CMD or DIRECT to retro attitude

2.  At retro time record
      GET _____
      FDAI 2 total att R___ P___ Y___
      ICDU's           R___ P___ Y___

3.  Comment on maneuver complexity and window horizon
    visibility.
```

Crew Log:

Log form included in procedure

UPDATE AND CREW LOG - RETRO ORIENTATION

RETRO ORIENTATION			
UPDATE		MODE A	MODE B
	HRS	X X	X X
	MIN	X X X	X X X
	SEC	X	X
RETRO ATT	R		
	P		
	Y		
WINDOW ANGLE		X X X	X X X
ICDU	R		
	P		
	Y		
LCG		MODE A	MODE B
	HRS	X X	X X
	MIN	X X X	X X X
	SEC	X	X
FDAI #2	R		
	P		
	Y		
ICDU	R		
	P		
	Y		

CSM/MSFN S-BAND COMM PERFORMANCE (P20.10)

Purpose:

To verify the performance of the CSM S-Band in operational and backup modes.

Requirements:

Demonstrate following modes:

Voice, RT-HBR, Ranging (6.2)
Voice, RT-LBR, Ranging (6.3)
Voice, RT-LBR (and HBR)(7.1)(8.4)
Voice and Ranging (6.11)
Voice (7.12)
Backup Voice (7.10)
Backup - Down Voice
Backup - Down Voice and RT-LBR (8.8)
Key (7.6)
Down Data Backup
Dump PCM/Analog, LBR and HBR (F1,F2)
Dump LM (simulated) PCM
Voice Relay

Note: Numbers in
parenthesis refer
to modes, Table II.

Procedures:

No special crew procedures are required

Crew Log:

No crew log required

CONSUMMABLES USAGE (P20.11)

Purpose:

To obtain data to update existing EPS, ECS and RCS estimates.

Requirements:

No specific tasks are required to conduct this test.

Procedures:

Crew checklist and flight procedures

Crew Log:

No crew logs are required

MANUAL S-IVB ATTITUDE CONTROL (S20.12)

Purpose:

To verify the crew capability to control S-IVB attitude.

Requirements:

Perform S-IVB take-over and attitude maneuvers listed below.

Procedures:

MANUAL S-IVB ATT CONTROL

Assume control of S-IVB per checklist

Perform following maneuver:

NOTE

Prior to starting the planned set of maneuvers, verify control enabled in each axis by commanding a small attitude change in each axis.

MANEUVER	APPROXIMATE MANEUVER TIME
-P for 9°	30 sec
Stop rate, att hold	10 sec
+P for 30°	100 sec
Stop rate, att hold	10 sec
-R for 20°	40 sec
Stop rate, att hold	20 sec
+R for 20°	40 sec
Stop rate, att hold	20 sec
-Y for 15°	50 sec
Stop rate, att hold	10 sec
+Y for 15°	50 sec
Stop rate, att hold	10 sec
	420 sec (7 min)

Return control to I. U. per checklist

NOTE:

When control of the S-IVB is returned to the I. U. the normal attitude timeline will be picked up in real time as if it had never been interrupted.

Crew Log:

Comment on handling ability.

CSM ACTIVE RENDEZVOUS (P20.13)

Purpose:

> To demonstrate the CSM capability to rescue the LM.

Requirements: Photo Requirements

1. To photograph the CSM relative motion (with
    respect to the S-IVB) at range rate and find
    position.

2. If a "fly-round" is not accomplished during simu-
    lated docking, this will be the only opportunity
    to get a sideview of SLA panel deployment.

Procedures:

CSM ACTIVE RENDEZVOUS

Mode A - SEQ - CAM

The following are required:

Seq-Cam: 18mm lens
         SO368 film
         f11, 1/250, 6 fps
         adjust focus as necessary
         Seq Cam mounted in right hand rndz.
            window bracket

. When S-IVB comes into view, Seq Cam - ON

. Load film magazines as necessary

.. When rndz. maneuver is completed
    Seq Cam - OFF

Mode B - H-blad

The following are required:

H-blad: 80mm lens
         ring sight   .
         S3068 film
         f11, 1/250
         adjust focus as necessary

. Photographs shall be taken of the SLA in accordance with the procedures given in the simulated docking.

. If a "fly-round" is not accomplished during the simulated docking maneuver this will be the only opportunity to get photographic data on the angles of SLA deployment. Two side views 90° apart are desired.

Crew Log: Photo Log

Mode A

. GET

. Magazine number

. Feet of film used

. Exposure setting

. Lens

. Activity

Mode B

. GET

. Magazine

. Frame Number

. Exposure settings

.. Lens

L/V PROPELLANT PRESSURE DISPLAYS (S20.14)

Purpose:

> To evaluate the L/V propellant pressure displays are
> adequate to monitor a possible overpressurization of
> the H_2 tank or loss of O_2 tank pressure causing a
> common bulkhead reversal.

Requirements:

> Monitor LVPD prior to and after at least two periods
> of SIVB programmed venting.

Procedures:

<div style="border:1px solid">

LVPD

Verify following:
SII/S-IVB-GPI - SII/S-IVB
TVC SERVO PWR 1 - AC1/MNA
TVC SERVO PWR 2 - AC2/MNB

Record LVPD immediately prior to and immediately after
the following periods. Report results to MSFN.

GET

GET	
00:06:00	– To establish baseline at flight pressure
00:10:38	– LOX vent valve closes. Reading desired ASAP to get near low range rate of LOX pressure
01:30	– Reading prior to passivation enabled
01:44	– Reading after passivation disabled

At completion of each reading, return TVC SERVO PWR
(both) - Off

</div>

Crew Log:

> . Complete log for each monitoring period.
>
> . Note gage response and lowest value observed on each of
> the four displays.

GET	HR	X	X		X X
	MIN	X	X X		X X X
	SEC	X			X
OXID.PRESS BEFORE	L	X	X		X X
	C	X	X		X X
AFTER	L	X	X		X X
	C	X	X		X X
FULL PRESS BEFORE	C	X	X		X X
	R	X	X		X X
AFTER	C	X	X		X X
	R	X	X		X X
TYPE OF PRESS CHANGE					
LOWEST VALUE OXID		X	X		X X
FUEL		X	X		X X

GET	HR	X X			X X
	MIN	X X	X		X X X
	SEC	X			X
OXID.PRESS BEFORE	L	X X			X X
	C	X X			X X
AFTER	L	X X			X X
	C	X X			X X
FUEL PRESS BEFORE	C	X X			X X
	R	X X			X X
AFTER	C	X X			X X
	R	X X			X X
TYPE OF PRESS CHANGE					
LOWEST VALUE OXID		X X			X X
FUEL		X X			X X

CREW ACTIVITIES EVALUATION (S20.15)

Purpose:

To investigate all areas of crew activity within the S/C in order to identify potential problems, improve on crew procedures, and avoid interface incompatibilities with the S/C equipment.

Requirements: Photo Requirements

1. Photographs taken of crew activity as available (crew preference). No specific areas are required so procedures only reflect suggested areas.

Procedures:

PHOTOGRAPHIC COVERAGE OF CREW ACTIVITIES

Mode A (Nominal) - Seq Cam 6 Frames/Second

The following are required:

Seq-Cam: Wide angle lens
EF film
f2.8, 1/50, 6 fps
adjust focus as necessary

Photo objective at crew option as needed for coverage of internal operations. Camera is handheld.

. Doffing and donning of PGA

. The preparation for stowing and unstowing of the PGA's

. A crewman entering the couch assembly and attaching the crew restraints when he is in the PGA and again when not in the PGA.

. A crewman leaving the couch assembly and going to the lower equipment bay.

. Unstowing, erecting, and stowing sleep stations.

. Entering and exiting from sleep stations

- Leaving couch assembly and going to stowage area on aft bulkhead.

- Unstowing and stowing of the LiOH elements

- Installing and removing the LiOH elements

- Unstowing and use of optical scanning equipment

- Using the DSKY

- Moving about in the forward equipment bay

- Using flight plan and other documents

- Routing used by crewmen for ECS umbilicals in couch assembly

- Unstowing, preparing and eating food

- Unstowing and stowing of photographic equipment.

- G&N station operations

- Simulated foldable couch docking position

Mode B   - Sequence Camera (only used if crewman has difficulty in performing his objectives - 16 frames/second)

The following are required:

Seq Cam: Wide angle lens
            EF film
            f2.8, 1/50, 16 fps
            adjust focus as necessary

Crew Log: Photo Log

- GET

- Magazine number

- Feet of film used

- Exposure setting

- Lens

- Activity

ENVIRONMENTAL INDUCED WINDOW DEPOSITS (S20.16)

Purpose:

> To determine vision degradation of the CM rendezvous
> windows to allow development of lighting constraints.
> To determine the sources of window deposits causing
> degradation.

Requirements: Photo Requirements

1. Between separation and deorbit burn, maneuver the
    spacecraft so as to obtain a sequence camera record
    of light scattering on the left-hand rendezvous CM
    window by traversing at approximately .5°/second
    the sun's rays across the window plane in ortho-
    gonal axes.

2. At a convenient time during the mission, the crew
    shall take still camera photographs of left-hand
    CM window.

NOTE

> If there is a significant difference in observed
> right-hand and left-hand window deposits, photo-
> graphs shall be taken of both windows.

Procedures:

ENVIRONMENTAL INDUCED WINDOW DEPOSITS

Mode A - SEQ CAM

The following are required

    CMC - ON
    IMU - at known orientation
    SCS - powered up
    Seq Cam: 18mm lens
               S0368 film
               f11, 1/250, 1 fps
               focus on window

Receive following update:

. ICDU R_____ P_____ Y_____

- Maneuver to place sun along -Z axis

- Handhold seq Cam 2 feet from and normal to LH rndz. window.

- Seq Cam - ON

- Pitch + 180° @ 0.5/sec
    Maintain R and Y att hold, max deadband

- Seq Cam - OFF at maneuver completion

- Roll 90° (either way)

- Yaw 180° through sun at 0.5/sec
    Maintain R and P att hold, max. deadband

- Seq Cam - OFF at maneuver completion

    End of Test

Mode B - H-blad

The following are required:

    H-blad: 80mm lens
              ring sight
              SO368 film
              f11, 1/250
              focus on window

- Photograph LH rndz. window to obtain best possible view of any window deposits
    1. Prior to CSM/S-IVB sep (3 frames)
    2. After CSM/S-IVB sep (3 frames)
    3. After CSM/S-IVB sep with camera focused at infinity showing earth (3 frames)
    4. Prior to deorbit equipment stowage (3 frames)

Crew Log: Photo Log

Mode A

- Maneuver being performed

- GET at start of maneuver

- Rate of Maneuver

- GET when camera is turned on each time the sun traverses across the window

- Location of the sun (crew estimate) with respect to window at start of maneuver.

- Film magazine number

- Crew comments on observed deposits

  1. Visibility at time photographs are taken
  2. Structural pattern of window deposits, if any

Mode B

- Film magazine number

- Frame number

- GET of picture

- Window designation

CREW LOG – WINDOW PHOTOGRAPHY

CONDITION #1			
MANEUVER			
GET START HR	X X		X X
MIN	X X X		X X X
SEC	X .		X .
MANEUVER RATE	X X 0.		X X 0.
GET CAMERA ON HR	X X		X X
MIN	X X X		X X X
SEC	X .		X .
SUN LOCATION			
FILM MAGAZINE NO.	X X X		X X X
COMMENTS:			

CONDITION #2			
FILM MAGAZINE NO.	X X X X		X X X X
FRAME NO.	X X		X X
GET OF PICTURE HR	X X		X X
MIN	X X X		X X X
SEC	X .		X .
WINDOW DESIGNATION			
COMMENTS:			

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PROPELLANT SLOSH DAMPING (S20.17)

Purpose:

To determine SM-RCS propellant requirements to
maintain spacecraft stability during long term
propellant slosh following SPS operations
and RCS burns.

Requirements: See below

Procedures:

PROPELLANT SLOSH DAMPING

1. Approximately 10 sec following shutdown of the
    3rd SPS burn, select G&N or SCS maximum deadband att
    hold, low rate, and maintain the _attitude_ at the time
    of tail-off for 10 minutes. HBR required.

2. Approximately 10 sec following shutdown of the
    4th SPS burn, inhibit att hold. for 3 minutes.
    Terminate at the end of 3 minutes or if the
    attitude error in any axis is greater than
    50 deg or if the rate is greater than 2°/sec.
    HBR required.

3. Approximately 10 seconds following an RCS transla-
    tion select G&N or SCS maximum deadband att hold,
    low rate, and maintain attitude for 10 minutes.
    Repeat test except select minimum deadband att hold,
    low rate. HBR required for both tests.

    If fuel available, repeat min deadband test.

    Repeat for plus or minus Z translation.

Crew Log:

No crew recording required.

CSM ARIA COMMUNICATIONS (S20.18)

Purpose:

To verify TM, voice and relay compatibility of the CSM-ARIA links.

Requirements:

Perform following comm functions between CSM and ARIA:

a) ARIA to CSM S-band voice

b) CSM to ARIA S-band voice and HBR

c) CSM to ARIA 296.8 voice

d) ARIA to CSM 296.8 voice

Procedures:

Normal checklist procedures.

Crew Log:

No astronaut recording required

Note:

Planned ARIA coverage times (GET)

2:34 - 2:44	96:13 - 96:23
4:10 - 4:18	97:47 - 97:57
5:43 - 5:51	119:54 - 120:04
24:37 - 24:47	121:28 - 121:38
26:12 - 26:22	123:42 - 123:52
26:30 - 26:40	125:15 - 125:25
28:10 - 28:20	143:36 - 143:46
48:31 - 48:41	145:10 - 145:20
50:05 - 50:15	
72:23 - 72:33	
73:58 - 74:08	
75:59 - 76:09	
77:35 - 77:45	

CSM/MSFN VHF VOICE COMM (S20.19)

Purpose:

To obtain data for use in assessing the CSM/LM VHF comm link by demonstrating CSM/MSFN simplex and duplex links.

Requirements:

Perform VHF modes:
Duplex A
Simplex A
Simplex B
Duplex B

Procedures:

Crew checklist procedures.

Crew Log:

No astronaut recording required

COAS EVALUATION S20.20

Purpose:

To evaluate the COAS as a sighting aid for the crew during the various operational modes.

Requirements:

1. Evaluate the utilization of the COAS in conjunction with the LM target during the simulated docking with the S-IVB.

2. Perform a COAS evaluation per checklist and evaluate alignment inaccuracies.

3. Evaluate the utilization of the COAS to control the relative motion of the CM and a S-IVB target during the terminal phases of a rendezvous.

4. Evaluate the utilization of the COAS to verify proper thruster attitude prior to a maneuver.

5. Evaluate the usefulness of the COAS to verify proper deorbit attitude by sighting the earth horizon.

6. Perform P53 IMU Orientation

7. Perform P54 IMU Realign

8. Perform IMU/GDC Alignment

9. Align the camera with the COAS.

Procedures:

Crew checklist procedures.

Crew Log:

TBD

This DTO is not finalized and all required test conditions are not scheduled in the timeline.

S005

SYNOPTIC TERRAIN PHOTOGRAPHY

A. Purpose

   To obtain high-quality photographs with color and panatomic -X film of selected land and ocean areas for geologic, geographic and oceanographic study, and for evaluation of relative effectiveness of color and black and white film.

B. Spacecraft Configuration

   1. Window shades on windows as necessary

   2. Unstow as required:

Volume B3

   a. 70mm Hasselblad camera with 80mm standard lens.

   b. Ring sight

   c. 70mm film magazine (S0121)

   d. Haze filter (used with color film)

   e. Spotmeter

   f. 70mm film magazine (Panatomic-X)

   g. Red filter (used withPanatomic -X film)

Volume R13

   h. 70mm film magazine (S0121)

C. Procedures

    1. Prepare camera and accessories for photo-
        graphy as time permits or as per ground up-
        date.

    2. Interior lights - OFF

    3. Record in log:

        a. GET of exposure

        b. Exposure number

        c. Film magazine number

        d. Filter used

        e. Area and description

        f. Unusual camera settings

        g. Unusual colors

        h. Window obscuration

    4. Control spacecraft attitude as required to
        photograph area of interest if propellant is
        available.

NOTE:

    1. Window should be parallel to earth's surface.

    2. NADIR photos are desired for best
        data.

    3. Control roll as required to keep spacecraft
        window in shade if propellant is available.

    4. Photography should be done between 9 a.m. and
        3 p.m. local time, unless otherwise updated.

    5. Strip photos - a long sequence of overlapping
        photographs taken every 5 seconds to cover
        large land areas.

    6. Stereo photos - two or more photographs taken
        5 seconds apart, to cover small land areas.

D. Mode

    A - strip photos, SO121 (color)
    B - strip photos, Pan-X (black and white)
    C - stereo photos, SO121 (color)

E. Item

Strip Photography

1. Southwest United States with emphasis on San Diego Imperial Valley - Yuma area, Tucson, El Paso, and New Orleans. Separate runs are required with color (Mode A) and black and white (Mode B). Mode A and Mode B runs should be carried out under identical conditions.

    All other strip photos - Mode A

2. Southern Mexico

3. Northern Chile and adjacent areas

4. Southeast coast of South America

5. Lake Chad and adjacent areas

6. Southwest coast of Africa

7. Eastern and Southern Africa

8. Southwest Asia - Iran, Oman, and West Pakistan

9. Southern India

10. Thailand, Malaysia, and adjacent areas

11. Indonesia

12. Northwest Australia

13. Solomon Islands
    a. Ruguria Is.
    b. Kilinalau Is.
    c. Ontong Java, Is.

4-110

Stereo photography all Mode C, not in order of
priority

14. Colorado River mouth

15. Mississippi River mouth

16. Any other river mouths in Southeast United
States

17. Florida Straits

18. Tongue of the Ocean

19. Echo Bank (shoal; no island visible)

20. Argus Island (Texas tower)

21. Dry lake in Mexico (Bolson de Mapina)

22. Dry lake in Mexico (Laguma de Mayran)

23. Dry lake in Mexico (Guadalupe)

24. Dry lake in Mexico (San Luis Potosi)

25. Yucatan coastal waters

26. Oyster Bay, Jamaica

27. St. Andrews and Old Providence Islands

28. Northeast coast of South America

29. Amazon River mouth

30. Northwest coast of South America

31. Liberia

32. Congo River mouth

33. Diego Garcia Islands (Chagos Islands)

34. Pointe de CaMay, South Vietnam

35. Dangerous ground, South China Sea

4-111

36. Wake Island

37. Johnson Island

38. Islands in large area North and Northeast of Phoenix Island

39. Christmas Island

40. Danger and Nassau Islands

41. Hawaii

MSC Form 1190 (Apr 65)

S006

SYNOPTIC WEATHER PHOTOGRAPHY

A. Purpose

To improve the techniques of weather interpretation from photographs taken at orbital altitudes.

B. Spacecraft Configuration

1. Window shades on necessary windows

2. Unstow as required:

Volume B3

a. 70mm Hasselblad camera with 80mm standard lens

b. Ring sight

c. 70mm film magazine (S0121)

d. Spotmeter

Volume R13

e. 70mm film magazine (S0121)

C. Procedures

1. Prepare camera and accessories for photography as time permits or as per ground update.

2. Interior light - OFF

3. Record in log:

a. GET of exposure
b. Exposure number
c. Film magazine number
d. Area and description
e. Unusual camera settings

f. Unusual colors

g. Window obscuration

4. Control spacecraft attitude as required to photograph area of interest if propellant is available.

Note:

1. Control roll as required to keep spacecraft window in shade if propellant is available.

2. Photography should be done between 9 a.m. and 3 p.m. local time, unless otherwise updated.

D. Item:

W01 - Tropical storms

W01A - Precursor easterly waves over North Equatorial Africa

W01B - Incipient disturbed areas north of the Atlantic intertropical convergence zone

W02 - Extra-tropical storms

W03 - Frontal cloud patterns

W04 - Thunderstorms

W04A - Indonesia

W04B - Southern U. S. A.

W04C - Guinea coast countries

W05 - Coastal cloudiness - sea breeze effects

W05A - India

W05B - East coast of Florida, South Carolina, Georgia

W05C - Texas coast

W05D - South Peru and Chile

W05E - Venezuela

W05F - Eastern Brazil

W05G - Capetown, South Africa area

W06 - Island - Induced cloud patterns

W06A - Galapagos Islands

W06B - Northwest of Sumatra

W06C - Southwest of Sumatra

W06D - Hawaiian Islands

W06E - Mozambique Channel

W07 - Eddies induced by islands or coastal
        prominences

W07A - Guadalupe Islands

W07B - Cape Verde Islands

W07C - Canary Islands

W07D - Madeira Islands

W08 - Mountain - Induced clouds

W08A - Wave clouds in lee of Andes

W08B - Wave clouds in lee of Sierra Nevada

W09 - Cloud streets

W10 - Cellular cloud patterns

W11 - Complex convective cloud patterns

W12 - Cirrus clouds

W12A - Jet stream cirrus

W12B - Cirrus movement

4-115

W12C - Cirrus from thunderstorm tops

W12D - Cirrus from 1 CZ

W13 - Fog and stratus patterns on land

W14 - Ship contrails

W15 - Wet and dry ground

W16 - Indicators of climatic zones and changes

W17 - Flooding

W18 - Snow cover

W18A - Mountains of the southwest U. S. and
        Mexico

W18B - Andes Mountains

W18C - Atlas Mountains

W18D - Kenya and Tanganyika

W18E - Himalayas

W19 - Air pollution

W19A - Smoke from industrial sources

W19B - Smoke from forrest fires.

W19C - Los Angeles Basin

W20 - Dust storms

W20A - Sahara

W20B - Arabian Peninsula

W20C - Asia

W21 - Atmospheric layers observed at twilight

W22 - Sand dunes

W22A - Southwest Africa

W22B - Western Sahara

W22C - Arabian Peninsula

W23 - Sun glitton on ocean

W24 - Water color

W24A - Gulf stream

W24B - Lombok Straits

W24C - West of Gilbralter

W25 - Shorelines showing surf

W26 - Ocean bottom configuration

W26A - Bahama area

W26B - Eastern Puerto Rico - Virgin Islands area

W27 - Special studies

W27A - Barbados experiment

W27B - Florida convective activity

W27C - Bahama area convective activity

W27D - Project stormfury

W27E - Panama Canal area

W27F - Special weather

W27G - Satellite studies

MAP LEGEND
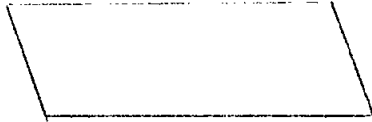
S005 TERRAIN STRIP PHOTOGRAPHY
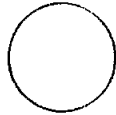
S005 TERRAIN STEREO PHOTOGRAPHY

S006 WEATHER PHOTOGRAPHY

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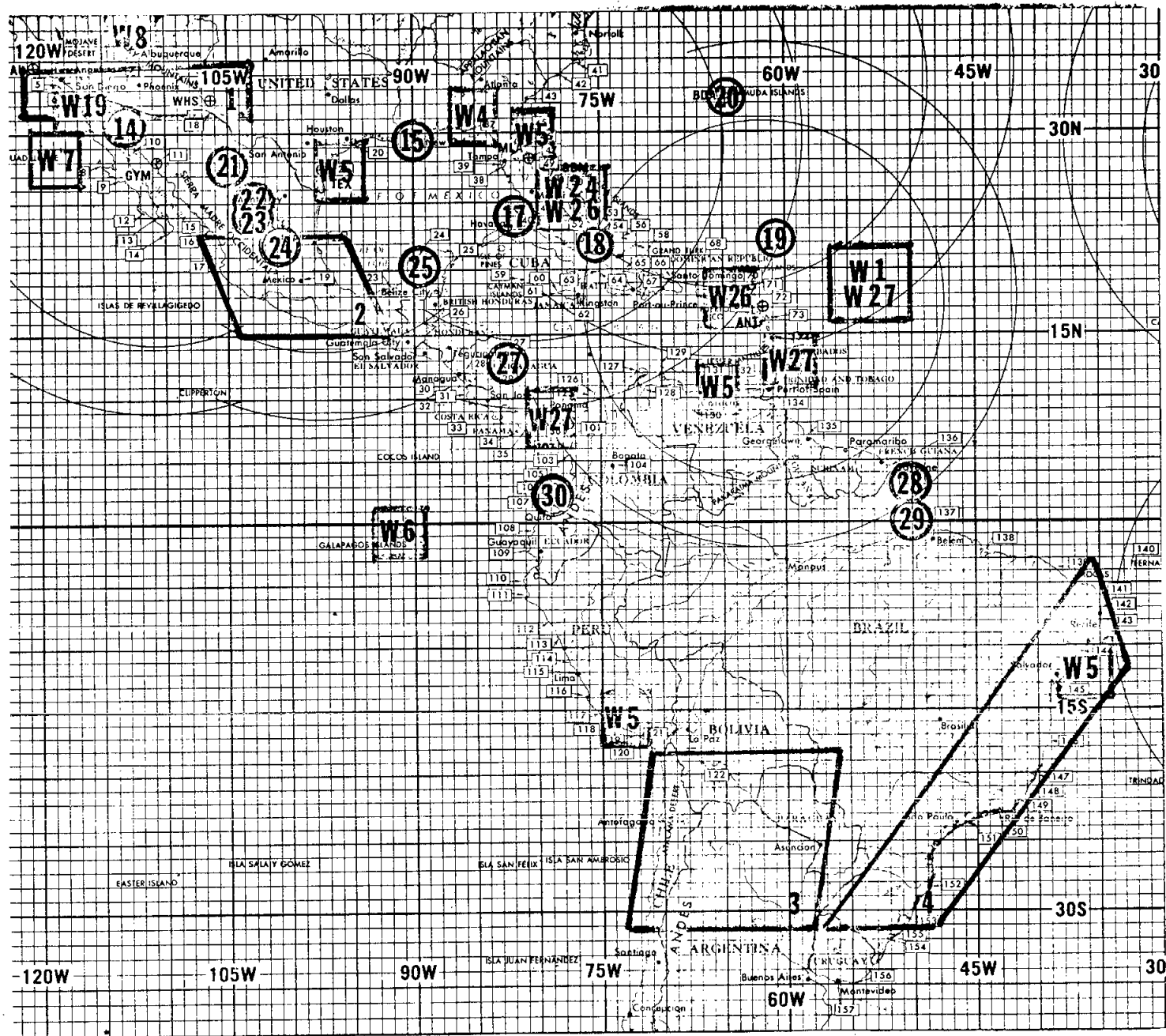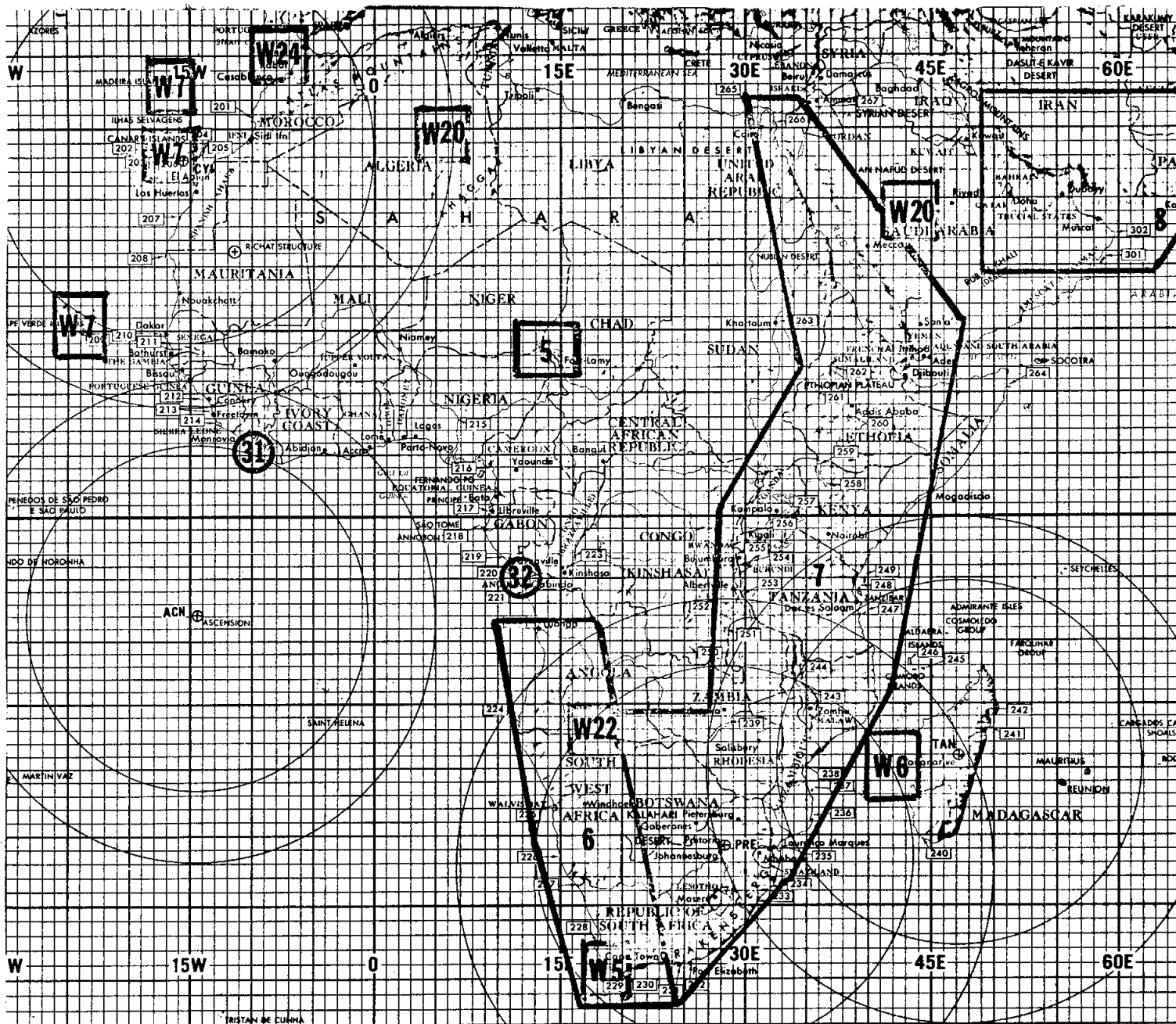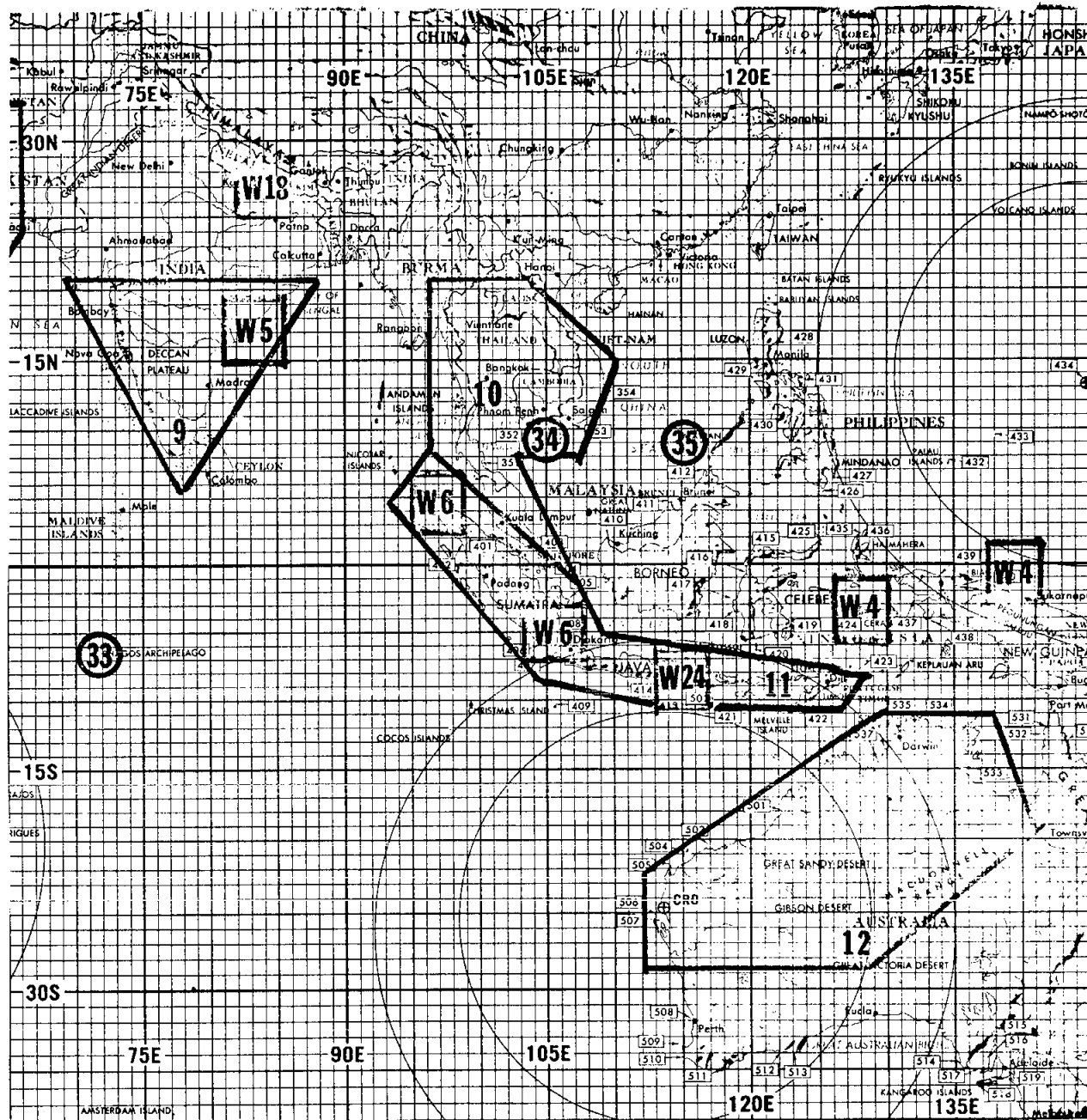
SECTION V - ALTERNATE MISSION PLANNING DATA

SECTION V

MISSION ALTERNATE PLANNING DATA

General

Data presented in this section is intended to aid in the preparation of
alternate mission plans during the mission if such plans become necessary.
This data will be used by mission control flight planning personnel
in conjunction with other real time monitoring and planning aids under
development. These aids include those for tracking consumables usage
(electrical power, hydrogen, oxygen, water, and RCS propellants) based
on telemetry readouts from spacecraft equipment, and a DTO/FTO mission
activities correlation matrix which shows the DTO's/FTO's which will or
can be accomplished during specific mission activities such as rendezvous,
SPS Delta V burn, deorbit and entry, etc.

Description of Tabular Data

Mission alternate planning data contained in this section is listed in
Table XI. Entries for each column heading are described in the following
paragraphs.

1. **DTO/FTO Title, Number, Priority (P), and Weight (%):**

   a. **Title and Number.** Identifies each DTO/FTO by assigned title
      and number.

   b. **Priority (P).** Indicates the numerical priority assigned to
      each DTO (1 through 52 in order of descending priority).

   c. **Weight (%).** Indicates the weight (percentage value) assigned
      to each DTO and FTO. The sum of the percentage values assigned
      to all DTO's is 100%; the sum of the percentage values assigned
      to all FTO's of each DTO equals 100%.

2. **DTO/FTO Accomplishment Record (Mission Days)**

Indicates the nominal time(s) scheduled for accomplishment of each FTO
in terms of Mission Day (0 thru 10) and ground elapsed time (Hours:
Minutes). DTO/FTO completion status will be maintained by entries
inserted in the applicable column/row intersection.

3. **Min. Crew Rqmt**

Indicates the minimum crew members required to perform an FTO.

4. **Per Unit Time Rqmt**

Shows the time required for each FTO portion. For DTO P1.7/FTO-1, the
indicated time of 1 hour/10 minutes is required for each of the three
star counts.

5. Consumables Rqmt

   a. Electrical Power (kilowatts). Power level for a specific FTO.
      Two values (minimum and maximum) may be shown for an FTO where
      the power level changes such as during an SPS Delta V burn.

   b. RCS (Reaction Control System) Propellant. RCS propellant
      consumption in pounds or, if so indicated, propellant consumption
      rate in pounds per hour.

   c. Hydrogen (H_2). H_2 consumption rate in pounds per hour (for
      electrical power generation only).

   d. Oxygen (O_2). O_2 consumption rate in pounds per hour (for
      electrical power generation only).

6. Inertial Platform Rqmt.

Indicates whether an aligned IMU is required for an FTO. (Consumables
requirements for the FTO do not include those required for the IMU
alignment; thus, consumables requirements for the IMU alignment must
be added to those listed for the FTO).

7. Section IV Procedure Reference

Identifies the number of the page in Section IV which contains procedures
for accomplishing the DTO/FTO.

8. Remarks.

Amplifies other tabular data.

Approach to Mission Alternate Planning

The following general approach in preparation of an alternate mission
plan will be used, based on use of the following table and the real time
monitoring and planning aids under development.

1. Determine which DTO's/FTO's have been accomplished (from status
   maintained by entries inserted in the DTO/FTO Accomplishment Record).

2. Determine mission time available in terms of consumables remaining
   and equipment operational status (from crew status reports, spacecraft
   equipment telemetry readouts, and consumables usage monitoring aids).

3. Using the DTO/FTO - Mission Activities Correlation Matrix, prepare an
   optimized mission alternate plan, taking into consideration factors
   such as:

a. Mission activities which must be performed (IMU Orientation Determination, IMU Realign extending over two dark periods, ullage, SPS Thrusting, Entry, Splashdown, etc.).

b. DTO/FTO priorities and the maximum number of DTO's/FTO's which can be accomplished in terms of time and consumables remaining.

TABLE XI

MISSION ALTERNATE PLANNING DATA

TITLE	NUMBER	P	%	0 (0-24)	1 (24-48)	2 (48-72)	3 (72-96)	4 (96-120)	5 (120-144)	6 (144-168)	7 (168-192)	8 (192-216)	9 (216-240)	10 (240-END)	MIN CREW RQMT	PER UNIT TIME RQMT (HR:MIN)	ELEC PWR (kw)	RCS (LB)	H_2 (LB/HR)	O_2 (LB/HR)	INERTIAL PLATFORM RQMT(*)	SECT. IV PROC. REF.	REMARKS
1. RADIATOR HEAT REJECTION & DEGRADATION	M7.19	1	5	-	-	-	-	-	-	-	-				-	-	-	-	-	-	-	4-75	
Primary Radiator Performance	-1		55	S	S	-	-	-	-	-					2	26:36	2140-2740	N/A	0.263	2.08	-	-	Part of P4.8-1; Insertion -09:00, 20:00-30:00
Rad Isol for Therm Coat'g Degrad	-2		40					96:30							2	04:30	2100	14.5	0.190	1.45	*	-	3 Rev.
Secondary Radiator Performance	-3		5							183:00					2	07:30	TBD	N/A	TBD	TBD	-	-	Part of P4.8-1
2. FLAT APEX THERMAL PROTECTION	P7.20	2	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	
Record/Recover Flat Apex Data & S/C	-1		100											261:00	N/A	N/A	N/A	N/A	N/A	N/A	-	*	During Earth orbital entry
3. CSM LIFE SUPPORT FUNCTIONS	P4.4	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	TBD (DTO not complete)
Pressure Control	-1		33	-	-	-	-	-	-	-	-				-	-	-	-	-	-	-	-	
Cabin	a			See Remarks											3	N/A	N/A	N/A	N/A	N/A	-	-	Continuous thru Msn
Suit	b			" "											3	"	"	"	"	"	-	-	" "
Water	c			" "											3	"	"	"	"	"	-	-	"
Water Glycol Tanks	d			" "											3	"	"	"	"	"	-	-	"
Thermal Control	-2		34	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	
Primary Coolant Loop	a			See Remarks											3	N/A	N/A	N/A	N/A	N/A	-	-	Continuous thru Msn
Water Boiler	b			" "											3	"	"	"	"		-	-	"
Radiator	c			" "											3	"	"	"	"		-	-	"
Habitability	-3		33	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	
Comfort	a			See Remarks											3	N/A	N/A	N/A	N/A	N/A	-	-	Continuous thru Msn
CO_2 Removal	b			" "											3	"	"	"	"	"	-	-	"
Temp & Humidity Control	c			" "											3	"	"	"	"	"	-	-	"
Toxic Gas & Odor Removal	d			" "											3	"	"	"	"	"	-	-	"
4. IMU ORIENTATION DETERMINATION	P1.7	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-6	
3 Star Counts (Modes A, B, C)	-1		50			53:30	77:30		122:00						2	01:10	2350	2.8	0.217	1.69	*	-	Time rqmt each star count
1 Star Count (Mode A)	-2		25								195:00				2	01:10	2350	2.8	0.217	1.69	*	-	FTO highly desirable
1 IMU Orient. Determ (P51)	-3		25	See Remarks											1	Nite Pass	2350	1.0	0.217	1.69	-	-	Accomplish for each G&N power-up
5. IMU INFLIGHT ALIGNMENT	P1.6	5	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-3	
3 Almnts/w Almnt Ck	-1		50	-	-	-	-	-	-	-	-				-	-	-	-	-	-	-	-	
1 Preferred (Option 1)	a		(17)				89:00	118:30		163:00		208:00	235:00		1	Nite Pass	2350	1.0	0.217	1.69	-	-	Assumes completion of IMU orient.
1 Refsmmat (Option 3)	b		(17)											258:00	1	Nite Pass	2350	1.0	0.217	1.69	-	-	" Rqd for SPS burns 3 thru 7
1 Local Horizontal/Nominal (Option 2)	c		(16)	23:00 / 39:30 45:30		69:30			141:00	166:00		192:00			1	Nite Pass	2350	1.0	0.217	1.69	-	-	" Reqd for each Almnt ck
Daylite Almnt/w Almnt Ck	-2		20			70:00									1	Day Pass	2350	1.0	0.217	1.69	*	-	"
S-IVB Realignment (1, Any Astro)	-3		10	02:00											1	Nite Pass	2350	1.0	0.217	1.69	-	-	
Any Almnt/w Almnt Ck (2, Other Astro)	-4		10	See Remarks											1	Nite Pass	2350	1.0	0.217	1.69	-	-	Two alignments required. Accomplish for each realignment.
SXT Calibration Ck (1 Early, 1 Late in Msn)	-5		10	20:00									239:30		1	Nite Pass	2180	2.0	0.196	1.53	-	-	Accomplished by P23
6. SPS PERFORMANCE	P3.15	6	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	
1 Long Burn (56 sec)	-1a		50						165:08						3	02:30	2160-2710	16.9	0.258	2.05	*	-	Burn 5 (G&N/MTVC/2-Jet Ullage)
1 Burn (> 20 sec)	-1b		50	See Remarks											3	02:30	2160-2710	16.9	0.258	2.05	*	-	Time TBD
7. GNCS ΔV CONTROL	P1.13	7	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	
1 SPS Mnvr (10-30 sec)	-1		50		26:25										3	02:30	2160-2710	23.8	0.258	2.05	*	-	Burn 1 (G&N/SPS/4-Jet Ullage)
1 SPS Mnvr (0.5-8 sec)/G&N	-2		30						120:52			211:42			3	02:30	2160-2710	18.6	0.258	2.05	*	-	Burn 4 and 6 (minimum impulse)
1 SM/RCS Mnvr (2-12 sec)	-3		20	3:20											3	02:30	2376-2820	29.1	0.258	2.05	*	-	RCS phasing mnvr (P47); time shown is for burn if scheduled independently
8. GNCS ATTITUDE CONTROL	P1.12	8	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-26	Jet select 2-2-2 all rotational tests
Att Hold, Max db (±5d, 20-30 Min)	-1		20	See Remarks											1	00:30	2250	0.7	0.207	1.62	*	-	High bit rate required; accomplished during P1.7-1
Att Hold, Min db (±0.5d, 10-20 Min)	-2		20	" "											1	00:20	2250	2.2	0.207	1.62	*	-	High bit rate required
Auto Mnvr at 0.2 d/s	-3		10	" "											1	-	2250	0.7	0.207	1.62	*	-	Simultaneous 3-axis
Manual Mnvr at 0.2 d/s, ± all axes	-4		10	" "											1	-	2250	3.4	0.207	1.62	*	-	±P, ±Y, ±R
Minimum Impulse	-5		10	" "											1	-	2180	0.1	0.196	1.53	*	-	Accomplished during any optical sightings

TABLE XI (cont'd)

| DTO/FTO TITLE, NUMBER, PRIORITY (P), AND WEIGHT (%) | | | | DTO/FTO ACCOMPLISHMENT RECORD (MISSION DAYS) | | | | | | | | | | | MIN CREW RQMT | PER UNIT TIME RQMT (HR:MIN) | CONSUMABLES RQMT (**) | | | | INERTIAL PLATFORM RQMT(*) | SECT. IV PROC. REF. | REMARKS |
TITLE	NUMBER	P	%	(0-24)	(24-48)	(48-72)	(72-96)	(96-120)	(120-144)	(144-168)	(168-192)	(192-216)	(216-240)	(240-END)			ELEC PWR (kw)	RCS (LB)	H2 (LB/HR)	O2 (LB/HR)			
Translation (±X, ±Y, ±Z)	-6		10	03:00	30:00										1	—	2250	13.1	0.207	1.62	*	—	Concurrent with P1.13; during Sim. Docking and Formation Flying
Accel Cmd at 0.3 d/s, ± All Axes	-7		10												1	—	2250	0.7	0.207	1.62	*	—	
Auto. Mnvrs (0.05, 0.5, 5 d/s)	-8		5	See Remarks											1	—	2250	-	0.207	1.62	*	—	0.1/1.4/6.4 lb RCS, respectively
Man. Mnvrs (0.05, 0.5, 4 d/s, ± All Axes)	-9		5	" "											1	—	2250	-	0.207	1.62	*	—	0.1/1.2/12 lb RCS, respectively
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
9. SCS ΔV CONTROL	P2.5	9	4	-	-	-	-	-	-	-	-	-	-	-	—	-'	-	-	-	-	-	N/A	
1 SPS Mnvr/SPS Auto. (5-12 sec)	-1		100				91:43						237:25		3	02:30	2160-2710	29.1/29.1	0.258	2.05	*	—	Burn 3 and 7; concurrent with P1.13
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
10. SCS ATTITUDE CONTROL	P2.4	10	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-37	
Max db (±5d), Lo Rate, 1.5 - 2.0 hr	-1		20						123:30						1	01:30	2070	2.1	0.186	1.45	*	—	Stateside pass
Min db (±0.2d), Lo Rate, 1.0 - 1.5 hr	-2		20												1	01:30	2070	20.0	0.186	1.45	*	—	Stateside pass
Rate Cmd at 0.3 d/s	-3		10												1	N/A	2070	0.7	0.186	1.45	*	—	
Minimum Impulse	-4		10												1	"	2250	0.1	0.208	1.62	*	—	Accomplish during any optical sightings
Acceleration Cmd at 0.5 d/s	-5		10												1	"	2070	0.9	0.186	1.45	*	—	
Translation (±X, ±Y, ±Z)	-6		10												1	"	2250	13.1	0.207	1.62	*	—	Accomplish during Simulated Docking and Formation Flying
Manual Direct at 0.5 d/s, ± All Axes	-7		5												1	"	2070	1.2	0.186	1.45	*	—	
Rate Cmd at 1.5 d/s	-8		5												1	"	2070	0.7	0.186	1.45	*	—	
Max db (±8d), Hi Rate, 1.5 - 2.5 hr	-9		5												1	02:00	2070	1.3	0.186	1.45	*	—	Stateside pass
Min db (±4d), Hi Rate, 1.0 - 1.5 hr	-10		5						125:00						1	01:30	2070	2.6	0.186	1.45	*	—	Stateside pass
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
11. GNCS ENTRY MONITORING	P1.14	11	4	-	-	-	-	-	-	-	-	-	-	-	—	-	-	-	-	-	-	N/A	
SCS Entry/w G&N Displays	-1		100											261:08	3	N/A	N/A	N/A	N/A	N/A	*	—	During entry
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
12. CSM WATER MANAGEMENT	P4.9	12	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-59	
Storage/Expulsion Potable & Waste Water	-1		50	See Remarks											3	N/A	N/A	N/A	N/A	N/A	—	—	Continuous
Adequate Potable Water Chlorination	-2		50	See Remarks											3	N/A	N/A	N/A	N/A	N/A	—	—	Accomplish each 24 hours
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
13. SEXTANT TRACKING	P1.10	13	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-22	
CSM Behind & Below	-1		25		28:10										1	00:09	2350	2.0	0.217	1.69	*	—	
CSM Ahead & Above	-2		25		26:30										1	00:29	2350	2.0	0.217	1.69	*	—	.
CSM/S-IVB Separation:	-3		20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	—	
80 n.m.					40:10										1	00:43	2350	2.0	0.217	1.69	*	—	
160 n.m.					46:10										1	00:43	2350	2.0	0.217	1.69	*	—	
320 n.m.						52:10									1	00:43	2350	2.0	0.217	1.69	*	—	
Auto. Mnvr to Trkg Att, & Auto. Optics Positioning	-4		15		46:10										1	N/A	2350	2.0	0.217	1.69	*	—	
Update Tgt False State Vector; Rdz Navigation	-5		15	See Remarks											1	N/A	2250	TBD	0.207	1.62	*	—	Schedule TBD
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
14. CSM ACTIVE RENDEZVOUS	P20.13	14	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-94	
Terminal Phase Initiate (TPI)	-1		60		28:15										1	01:06	2820	88.4	0.270	2.15	*	—	Max elec pwr shown
Terminal Phase Final (TPF)	-2		40		29:38										1	00:13	2820	170.0	0.270	2.15	*	—	Max elec pwr shown
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
15. SEPARATION/TRANSPOSITION/SIMULATED DOCKING	P20.8	15	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	
Simulated Docking	-1		70	03:05											3	00:02:10	2250	35.3	0.207	1.62	*	—	Immediately after CSM sep
Transposition Mnvr	-2		15	02:55											2	00:01:15	2250	22.1	0.207	1.62	*	—	" " " "
SM/RCS Consumables Analysis	-3		10	N/A											1	N/A	N/A	N/A	N/A	N/A	—	—	
S-IVB Stability	-4		5	N/A											2	N/A	N/A	N/A	N/A	N/A	—	—	

TABLE XI (cont'd)

TITLE	NUMBER	P	%	0 (0-24)	1 (24-48)	2 (48-72)	3 (72-96)	4 (96-120)	5 (120-144)	6 (144-168)	7 (168-192)	8 (192-216)	9 (216-240)	10 (240-END)	MIN CREW RQMT	PER UNIT TIME RQMT (HR:MIN)	ELEC PWR (kw)	RCS (LB)	H2 (LB/HR)	O2 (LB/HR)	INERTIAL PLATFORM RQMT(*)	SECT. IV PROC. REF.	REMARKS
16. SLA DEPLOYMENT SYSTEM	P7.21	16	3	-	-	-	-	-	-	-	-	-	-	-	~	-	-	-	-	-	-	4-79	
Verification of Deployment	-1		80	-	-	-	-	-	-	-	-	-	-	-	~	-	-	-	-	-	-	-	
Crew Evaluation	a		(50)	03:00											3	00:02	N/A	N/A	N/A	N/A	-	-	Concurrent with P20.8
Head-on Photo	b		(20)	03:00											3	00:01	"	"	"	"	-	-	Concurrent with P20.8
Side Photo	c		(10)		29:51										3	00:01	"	"	"	"	-	-	During Rdz (P20.13)
Deployment & Separation Debris	-2		10	03:00											3	00:02	"	"	"	"	-	-	Concurrent with P20.8
Sooting Pattern on Panels	-3		10	03:00											3	00:02	"	"	"	"	-	-	Concurrent with P20.8
17. CONSUMABLES USAGE	P20.11	17	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	
SM RCS Prplnt (Att/Xln Control)	-1			See Remarks												N/A	N/A	N/A	N/A	N/A	-	-	Continuous thru Msn
SPS Prplnt (ΔV Rqmt)	-2			" "												"	"	"	"	"	-	-	"
Elec Power Char & Loads	-3			" "												"	"	"	"	"	-	-	"
ECS Water Usage	-4			" "												"	"	"	"	"	-	-	"
ECS Oxygn Usage	-5			" "												"	"	"	"	"	-	-	"
LiOH Usage	-6			" "												"	"	"	"	"	-	-	"
Crew Food/Water Rqmt	-7			" "												"	"	"	"	"	-	-	"
CM/RCS Entry Usage	-8			" "												"	"	"	"	"	-	-	"
18. WATER SEPARATION & POTABILITY	P5.10	18	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	
Fuel Cell Generation & Transfer	-1		50	See Remarks											1		N/A	N/A	N/A	N/A	-	-	Continuous thru Msn
Fuel Cell Water Potability	-2		50	" "											3		"	"	"	"	-	-	"
19. SPS PROPELLANT THERMAL CONTROL	P3.20	19	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	~	4-48	
Normal Opr (F/L Htr On/45dF)	-1		50	See Remarks											1	00:01	N/A	N/A	N/A	N/A	*	-	Continuous thru Msn
Cold Soak (F/L Temp 45 - 65dF)	-2		50						123:30						1	03:00	2350	5.6	0.217	1.69	*	-	
20. SPS MINIMUM IMPULSE BURN	P3.14	20	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	
1 SPS Burn (<1.0 sec)	-1		75						120:52						3	02:30	2160-2710	18.8	0.258	2.05	*	-	Burn 4 (G&N, 2-Jet Ullage)
Repeat Above Burn	-2		25									211.42			3	02:30	2160-2710	18.8	0.258	2.05	*	-	Burn 6 (G&N, 2-Jet Ullage)
21. PRIM/AUX PRPLNT GAUGING SYSTEM	P3.16	21	2	-	-	-	-	-	-	-	-	-	-	-	~	-	-	-	-	-	-	N/A	
1 Long Burn (2 Pt Sensors Uncovered)	-1		100							165:08					1	02:30	2160-2710	16.9	0.258	2.05	*	-	Burn 5 (G&N, SPS, 2-Jet Ullage)
22. G&N/MTVC ΔV TAKEOVER	P2.6	22	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	
1 MTVC Takeover (>10 sec)	-1		100							165:08					1	02:30	2160-2710	16.9	0.258	2.05	*	-	Burn 5 (G&N, SPS, 2-Jet Ullage)
23. ORBITAL NAV/LMK TRACKING	P1.8	23	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-18	
3 Continuous Passes Over CONUS	-1		90				73:00	143:00							2	00:45	2350	3.0	0.217	1.69	*	-	Time required for each pass; align IMU between passes
Targets of Opportunity (Known/Unknown)	-2		5	See Remarks											2	00:45	2350	TBD	0.217	1.69	*	-	To be scheduled real time
LMK Recognition (Known/Unknown)	-3		5	" "											2	00:45	2350	TBD	0.217	1.69	*	-	Not scheduled pending FTO deletion
24. MIDCOURSE NAVIGATION	P1.15	24	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-31	Inertial platform required for one procedure below
1 Star/Lunar Landmark	-1		40							167:30					2	00:10	2350	3.0	0.217	1.69	*	-	IMU powered up
1 Star/Lunar Horizon	-2		40					109:30							2	00:10	2180	1.8	0.196	1.53	-	-	9 marks min
2 Star/Lunar Landmark	-3		20					109:30							2	00:10	2180	1.8	0.196	1.53	-	-	Consumables shown for each sighting

TABLE XI (cont'd)

TITLE	NUMBER	P	%	0 (0-24)	1 (24-48)	2 (48-72)	3 (72-96)	4 (96-120)	5 (120-144)	6 (144-168)	7 (168-192)	8 (192-216)	9 (216-240)	10 (240-END)	MIN CREW RQMT	PER UNIT TIME RQMT (HR:MIN)	ELEC PWR (kw)	RCS (LB)	H₂ (LB/HR)	O₂ (LB/HR)	INERTIAL PLATFORM RQMT(*)	SECT. IV PROC. REF.	REMARKS
25. IMU PERFORMANCE	P1.16	25	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-33	Consumables shown per each test
1 Gyro Drift Test/w B/B Alnmt Ck	-1		50	12:30 18:40											1	01:30	2350	1.0	0.217	1.69	*	-	Concurrent with P1.6-1; 1 hr between cks
Launch Performance Evaluation	-2		30	See Remarks											3	N/A	N/A	N/A	N/A	N/A	*	-	During Ascent
2 PIPA Bias Ck	-3		20	04:40									238:30		1	00:05	2250	2.0	0.168	1.35	*	-	
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
26. EMS PERFORMANCE	P2.3	26	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-35	
Crew Time Correlation G-V Plot	-1													261:21	3	N/A	N/A	N/A	N/A	N/A	*	-	Entry, after 0.2G
Crew Comments on Entry Displays	-2													261:21	3	N/A	"	"	"	"	*	-	During entry
Eval of ΔV Counter for Mnvrs	-3			See Remarks											3	00:01	"	"	"	"	*	-	After Delta V burns
ΔV Accelerometer Bias Ck	-4			04:40						164:00			238:30		1	00:02	1829	"	0.163	1.29	*	-	Drifting flight; before burns 1 and 5
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
27. SCS ATTITUDE DRIFT CHECKS	P2.7	27	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-42	After earth orbit and before CSM/S-IVB sep
Boost Performance Eval (S-IVB)	-1		50	00:15											1	N/A	N/A	N/A	N/A	N/A	*	-	Post insertion (before sep)
Zero-G Performance (GDC Alnmt/Drift Ck)	-2		50				89:30								1	00:05	2350	0.5	0.217	1.69	*	-	Drift ck at 1/2-hr intervals and during Rdz; before & part of SPS burn 3
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
28. CRYOGENIC PRESSURE CONTROL	P5.9	28	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	
Adequacy of Cryo Press. Control	-1		100	See Remarks											1	N/A	N/A	N/A	N/A	N/A	-	-	Continuous thru Msn
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
29. ZERO-G EFFECTS ON CRYOGENICS	P5.8	29	1	-	-	-	-	-	-	-	-	-	-	-	-	Varies (>00:15)	-	-	-	-	-	4-62	During earth orbit (drifting flight)
Htr & Fan Test (90% Qty)	-1														1	(>00:15)	1829	N/A	0.163	1.29	-	-	
Htr & Fan Test (60% Qty)	-2														1	"	1829	"	0.163	1.29	-	-	
Htr & Fan Test (15% Qty)	-3														1	"	1829	"	0.163	1.29	-	-	
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
30. CSM/MSFN S-BAND COMM PERFORM	P20.10	30	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	
2-Way A/G S-Band Comm	-1		90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Uplink (Voice, Updata, Ranging)	a			See Remarks											1	N/A	1829	N/A	0.163	1.29	-	-	Continuous thru Msn
Dnlink PM (Voice, TM, Ranging)	b			" "											1	"	1829	N/A	0.163	1.29	-	-	"
Downlink FM	-2		10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Playback TM	a			See Remarks											1	N/A	1829	N/A	0.163	1.29	-	-	Continuous thru Msn
Voice	b			" "											1	"	1829	"	0.163	1.29	-	-	"
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
31. S-BAND UPDATA LINK	P6.7	31	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	
Uplink Any Cmd & Verify	-1		100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
CMC	a			See Remarks											1	N/A	1910	N/A	0.168	1.35	-	-	Continuous thru Msn
RTC	b			See Remarks											N/A	"	1829	N/A	0.163	1.29	-	-	"
CTE	c			See Remarks											N/A	"	1829	N/A	0.163	1.29	-	-	"
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
32. OVERPASS SIM WITH LM RR	P6.8	32	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-71	
1 Successful Pass over WHS	-1		75			71:41									1	00:15	2350	7.4	0.217	1.69	*	-	
2nd Successful Pass	-2		25									193:52			1	00:15	2350	7.4	0.217	1.69	*	-	

TABLE XI   (cont'd)

TITLE	NUMBER	P	%	0 (0-24)	1 (24-48)	2 (48-72)	3 (72-96)	4 (96-120)	5 (120-144)	6 (144-168)	7 (168-192)	8 (192-216)	9 (216-240)	10 (240-END)	MIN CREW RQMT	PER UNIT TIME RQMT (HR:MIN)	ELEC PWR (kw)	RCS (LB)	H$_2$ (LB/HR)	O$_2$ (LB/HR)	INERTIAL PLATFORM RQMT(*)	SECT. IV PROC. REF.	REMARKS
33. CSM SECONDARY COOLANT LOOP	P4.8	33	1	-	-	-	-	-	-	-	-	-	-	-	-	..	-	-	-	-	-	4-57	
Eval Sec Cool. Loop (Lo/Hi Loads)	-1		40								183:00				1	7:30	1350/1850	N/A	0.163	1.33	-	-	5 Rev required
Eval Rad Opr (Lo/Hi Loads)	-2		40								183:00				1	7:30	1350/1850	"	0.163	1.33	-	-	5 Rev required
Eval Evap Perform (Lo/Hi Loads)	-3		20								183:00				1	7:30	1350/1850	"	0.163	1.33	-	-	5 Rev required
				-	-	-	-	-	-	-	-			-	-	..	-	-	-	-	-		
34. CSM WASTE MANAGEMENT	P4.6	34	1	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	N/A	
Urine Dump Operation	-1		40	See Remarks											1	N/A	N/A	N/A	N/A		-	-	Continuous thru Msn
Fecal Canister Adequacy	-2		25	" "											1	"	"	"	"		-	-	"
Waste Cpmt Ventilation	-3		20	" "											1	"	"	"	"		-	-	"
Vacuum Cleaner Opr	-4		15	" "											1	"	"	"	"		-	-	Vacuum cleaner to be deleted
				-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-		
35. CREW ACTIVITIES EVAL	P20.15	35	1	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	4-98	
Control Display Interface	-1		35	See Remarks												N/A	N/A	N/A	N/A	N/A	-	-	Continuous thru Msn
DSKY Operations	a			" "											3	"	"	"	"	"	-	-	"
Adequacy of Launch/Entry Displays	b			" "											3	"	"	"	"	"	-	-	"
Routine Systems Monitoring	c			" "											3	"	"	"	"	"	-	-	"
Readability	d			" "											3	"	"	"	"	"	-	-	"
Access. of Suit Interference	e			" "											3	"	"	"	"	"	-	-	"
Mobility	-2		20	See Remarks												N/A	N/A	N/A	N/A	N/A	-	-	Continuous thru Msn
In LEB	a			" "											3	"	"	"	"	"	-	-	"
In Couches	b			" "											3	"	"	"	"	"	-	-	"
In Sleep Configuration	c			" "											3	"	"	"	"	"	-	-	"
With/Without Restraints	d			" "											3	"	"	"	"	"	-	-	"
During Eating	e			" "											3	"	"	"	"	"	-	-	"
During Waste Mgmt	f			" "											3	"	"	"	"	"	-	-	"
In All Suit Modes	g			" "											3	"	"	"	"	"	-	-	"
Sleeping	-3		20	See Remarks												N/A	N/A	N/A	N/A	N/A	-	-	Continuous thru Msn
Comfort	a			" "											3	"	"	"	"	"	-	-	"
Noise	b			" "											3	"	"	"	"	"	-	-	"
Restraint	c			" "											3	"	"	"	"	"	-	-	"
Interference/w Crew Activities	d			" "											3	"	"	"	"	"	-	-	"
In Suit Modes	e			" "											3	"	"	"	"	"	-	-	"
Stowage	-4		15	See Remarks												N/A	N/A	N/A	N/A	N/A	-	-	Continuous thru Msn
LiOH Cartridges	a			" "											3	"	"	"	"	"	-	-	"
Optic Equipment	b			" "											3	"	"	"	"	"	-	-	"
Cameras	c			" "											3	"	"	"	"	"	-	-	"
Documentation	d			" "											3	"	"	"	"	"	-	-	"
Foods	e			" "											3	N/A	"	"	"	"	-	-	"
Waste Mgmt Supplies	f			" "											3	"	"	"	"	"	-	-	"
Suits	g			" "											3	"	"	"	"	"	-	-	"
Eating	-5		5	See Remarks												N/A	N/A	N/A	N/A	N/A	-	-	Continuous thru Msn
Preparation	a			" "											3	"	"	"	"	"	-	-	"
Stowage	b			" "											3	"	"	"	"	"	-	-	"
Desirability	c			" "											3	N/A	"	"	"	"	-	-	"
Timing, wrt other Activities	d			" "											3	"	"	"	"	"	-	-	"
Acoustics	-6		5	See Remarks												"	N/A	N/A	N/A	N/A	-	-	Continuous thru Msn
Sounds & Vibrations	a			" "											3	"	"	"	"	"	-	-	"
Air/Ground Noises	b			" "											3	"	"	"	"	"	-	-	"

TABLE XI (cont'd)

TITLE	NUMBER	P	%	0 (0-24)	1 (24-48)	2 (48-72)	3 (72-96)	4 (96-120)	5 (120-144)	6 (144-168)	7 (168-192)	8 (192-216)	9 (216-240)	10 (240-END)	MIN CREW RQMT	PER UNIT TIME RQMT (HR:MIN)	ELEC PWR (kw)	RCS (LB)	H_2 (LB/HR)	O_2 (LB/HR)	INERTIAL PLATFORM RQMT(*)	SECT. IV PROC. REF.	REMARKS
36. SCS B/U ALIGNMENT PROC	P2.10	36	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	Accomp as part of burn prep
SCS Att Alnmt to Thrusting	-1		100									209:30			1	Nite Pass	2350	2.8	0.217	1.69	*	-	GDC/FDAI alnmt
Att Using South Set Stars				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
37. POST LANDING VENTILATION	P4.10	37	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	
Ventilation	-1		75	See Remarks											1	N/A	Batt.	N/A	N/A	N/A	-	-	Postlanding
Measure of Water in CSM	-2		25	" "											1	"	Batt.	N/A	N/A	N/A	-	-	"
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
38. SM/RCS PERFORMANCE	S3.17	38	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	
Pitch, Yaw, & Roll Att Mnvr	-1		75	See Remarks											1	N/A	N/A	N/A	N/A	N/A	-	-	Part of other DTO's
Fwd/Aft Lateral Translations	-2		25	" "											1	"	"	"	"	"	-	-	Part of other DTO's
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
39. TVC DAP CONTROLLER EVAL	S1.17	39	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	
Change Gain in Filter	-1		100							161:30					1		1829	N/A	0.163	1.29	-	-	Drifting flight between burns 4 and 5
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
40. CSM/MSFN VHF VOICE COMM	S20.19	40	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N/A	
2-Way A/G Voice, CSM to MSFN (296.8), & MSFN to CSM (259.7) (Duplex A)	-1		70	See Remarks											1	N/A	1829	N/A	0.163	1.29	-	-	Schedule TBD
2-Way A/G Voice (296.8) (Simplex A)	-2		10	See Remarks											1	N/A	1829	N/A	0.163	1.29	-	-	Primary Air/Gnd comm: continuous
2-Way A/G Voice (259.7) (Simplex B)	-3		10	" "											1	N/A	1829	N/A	0.163	1.29	-	-	Schedule TBD
2-Way A/G Voice, CSM to MSFN (259.7), & MSFN to CSM (296.8) (Duplex B)	-4		10	" "											1	N/A	1829	N/A	0.163	1.29	-	-	
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
41. L/V PRPLNT PRESS. DISPLAYS	S20.14	41	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-96	
Fuel/Oxid Display Readings Before & After Vent Period	-1		100	See Remarks											1	N/A	N/A	N/A	N/A	N/A	-	-	Both before and after two programmed S-IVB ventings; during boost, at insertion, and before and after S-IVB Safing
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
42. PROPELLANT SLOSH DAMPING	S20.17	42	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-104	Stateside pass; High hit rate required
SCS/SPS ΔV Mnvr	-1		40				91:43								3	00:10	2250	1.0	0.207	1.62	*	-	Following burn 3
G&N ΔV Mnvr	-2		50						120:52						3	00:03	2250	N/A	0.207	1.62	*	-	Following burn 4
RCS Xln Mnvr	-3		10		30:20										3	00:30	2250	0.1			*	-	During Rendezvous final maneuver (separation)
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
43. PASSIVE THERMAL CONTROL PROC	S7.24	43	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-85	
PTC:	-1		100	-	-	-	-	-	-	-	-	-	-	-									
Spin Stabilize			(80)							166:30					1	00:46	2250	12.5	0.208	1.62	*	-	
Repeat			(10)									212:12			1	00:46	2250	12.5	0.208	1.62	*	-	
Repeat			(10)									213:30			1	00:46	2250	12.5	0.208	1.62	*	-	
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
44. COAS EVALUATION	S20.20	44	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Superimpose Tgt on Reticle	-1		40	See Remarks																	-	-	Schedule TBD (DTO not completed)
Boresight Star Check	-2		20	" "																	-	-	"
Horizon Check in Deorbit Att	-3		20	" "																	-	-	"
LOS to Tgt During Rdz	-4		20	" "																	-	-	"

TABLE XI (cont'd)

TITLE	NUMBER	P	%	0 (0-24)	1 (24-48)	2 (48-72)	3 (72-96)	4 (96-120)	5 (120-144)	6 (144-168)	7 (168-192)	8 (192-216)	9 (216-240)	10 (240-END)	MIN CREW RQMT	PER UNIT TIME RQMT (HR:MIN)	ELEC PWR (kw)	RCS (LB)	H₂ (LB/HR)	O₂ (LB/HR)	INERTIAL PLATFORM RQMT(*)	SECT. IV PROC. REF.	REMARKS
45. ENVIRONMENTAL INDUCED WINDOW DEPOSITS	S20.16	45	0.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4-105	
Handheld Still Photos	-1		80	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
1 Before S-IVB Sep (FOW)	a			02:45											2	00:10	2250	N/A	0.207	1.62	—	—	Camera setup included in time required
1 Post Sim Docking (FOW)	b			03:10											2	00:10	2250	"	0.207	1.62	—	—	"
1 Late in Mission (FOW)	c													242:00	2	00:10	2250	"	0.207	1.62	—	—	"
1 Any Time -- Focus at Infinity	d			See Remarks											2	00:10	2250	"	0.207	1.62	—	—	To be scheduled real time
Sequence Camera Photos of LH Window	-2		20							168:00					2	00:30	2250	2.5	0.207	1.62	*	—	
46. MANUAL RETRO ATT ORIENT.	S20.9	46	0.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4-89	
Day Maneuver	-1		55	06:10											1	00:05	2250	2.2	0.207	1.62	*	—	
Night Maneuver	-2		45	06:53											1	00:05	2250	2.2	0.207	1.62	*	—	
47. BOOST PHASE MONITORING	S1.11	47	0.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N/A	
State Vector Comparison	-1		50	See Remarks											3	00:10	N/A	N/A	N/A	N/A	*	—	During launch/boost
Program 11 Evaluation	-2		25	" "											3	00:10	"	"	"	"	*	—	"
Adequacy of Displays	-3		25	" "											3	00:10	"	"	"	"	*	—	"
48. MANUAL S-IVB ATTITUDE CONTROL	S20.12	48	0.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4-93	
Enable S/C Control, & Perform Any 3-Axis Mnvr	-1		100	02:30											3	00:07	N/A	N/A	N/A	N/A	—	—	
49. CSM A/RIA COMMUNICATIONS	S20.18	49	0.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N/A	
Satisfactorily Record S/C TM	-1		50	See Remarks											1	1829		N/A	0.163	1.29	—	—	To be scheduled real time (TBD)
2-Way A/G Voice Relay Either Link	-2		40	—	—	—																	
VHF	a			See Remarks											1	1829		N/A	0.163	1.29	—	—	To be scheduled real time (TBD)
S-band	b			" "											1	1829		"	0.163	1.29	—	—	"
Telemetry Dump (S-band)	-3		10	" "											1	1829		"	0.163	1.29	—	—	"
50. CSM STRUCTURAL PERFORMANCE	S7.28	50		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N/A	
Obtain Vibration Data (Launch)	-1			See Remarks											3	N/A	N/A	N/A	N/A	N/A	*	—	Concurrent with S1.11
Obtain Vibration Data (SPS Mnvrs)	-2			" "											3	"	"	"	"	"	*	—	Concurrent with SPS burns
51. SYNOPTIC TERRAIN PHOTO	S005	51	0.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4-113	
Strip Photos (Color)						S	S			S			S		2	2070	As Avail	0.186	1.45		—	—	
Strip Photos (B&W)						S	S			S			S		2	2070	As Avail	0.186	1.45		—	—	
Stereo Photos (Color)						S	S			S			S		2	2070	As Avail	0.186	1.45		—	—	
52. SYNOPTIC WEATHER PHOTO	S006	52	0.5	—	—	S	S	—	—	S	—	—	S	—	—	2	2070	As Avail	0.186	1.45		—	4-118	

NOTES:

1. (*) Add time and consumables requirements for IMU Orientation Determination/P51 (P1.7-3) & IMU Realign/P52 (P1.6-1)
2. Where power levels vary over an activity (such as a ΔV Burn), the range of power levels is shown; cryogenic consumption rates shown are for the higher power level.
3. S indicates FTO is scheduled on a Mission Day -- no specific time.
4. (**) Unless otherwise indicated, consumables requirements are per/unit quantities.