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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

Submitted by: W. M. Anderson

W. M. Anderson
Flight Planning Branch

Approved by: W. J. North

W. J. North
Chief, Flight Crew Support Division

D. K. Slayton

Donald K. Slayton
Director of Flight Crew Operations

Any comments or questions on this document should be forwarded to W. M. Anderson, Flight Planning Branch, Extension 4271, Mail Code CF34.

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

P	Pitch
PCM	Pulse Code Modulation
PIPA	Pulse Integrating Pendulous Accel.
Pref	Preferred Orientation
PUGS	Propellant Utilization and Gaging System
Pxx	Programs xx
R	Roll
Rad	Radiator
RCDR	Recorder
Rcv	Receiver
RED	Redstone
REFSMMAT	Reference to Stable Member Matrix
Reqd	Required
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
TM	Telemetry
TPF	Terminal Phase Final
TPI	Terminal Phase Initiation
TVC	Thrust Vector Control
W.R.T.	With Reference To
VAN	USNS Vanguard
VHF	Very High Frequency
Vlv	Valve
W/O	Without
WHS	White Sands
WSMR	White Sands Missile Range
WTN	USNS Watertown
Y	Yaw

Note:

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

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. COMMUNICATION

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^2 (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

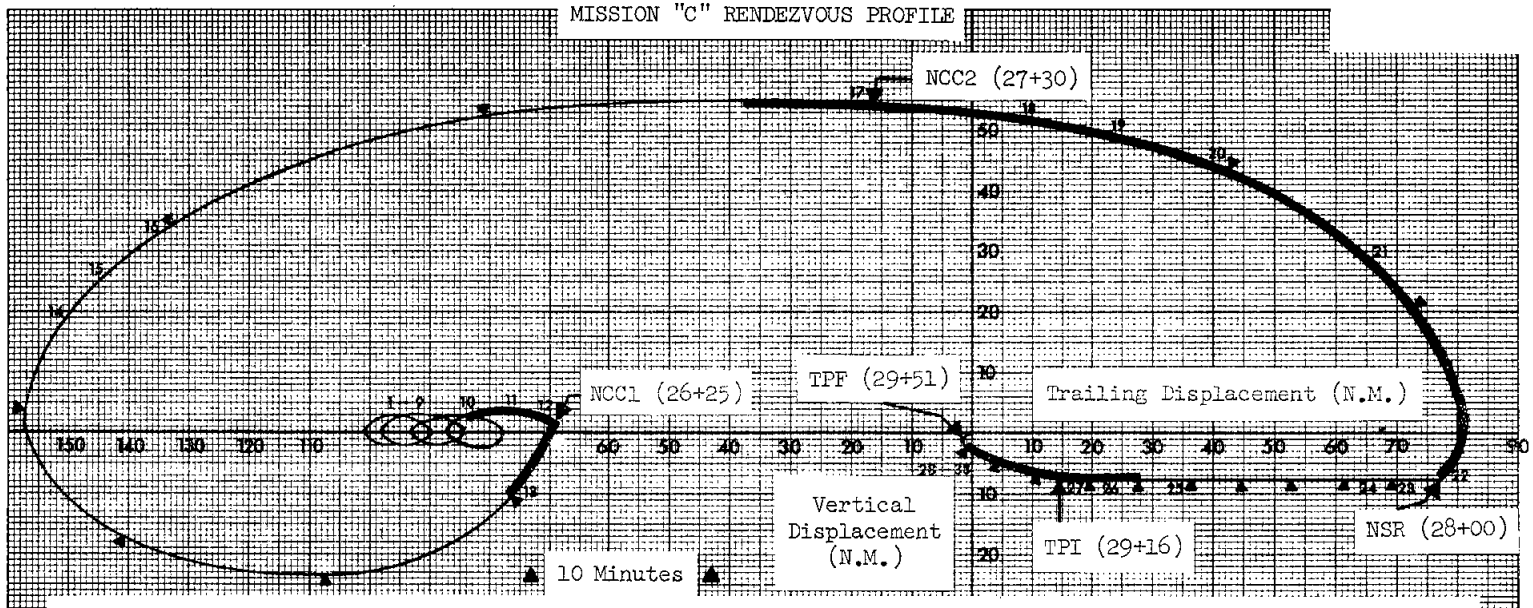
1. Crew procedures for the accomplishment of the system and mission operations called out in the flight plan may be found in the following documents:

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"



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

Figure 2

"Typical"

ATTITUDE PROFILE

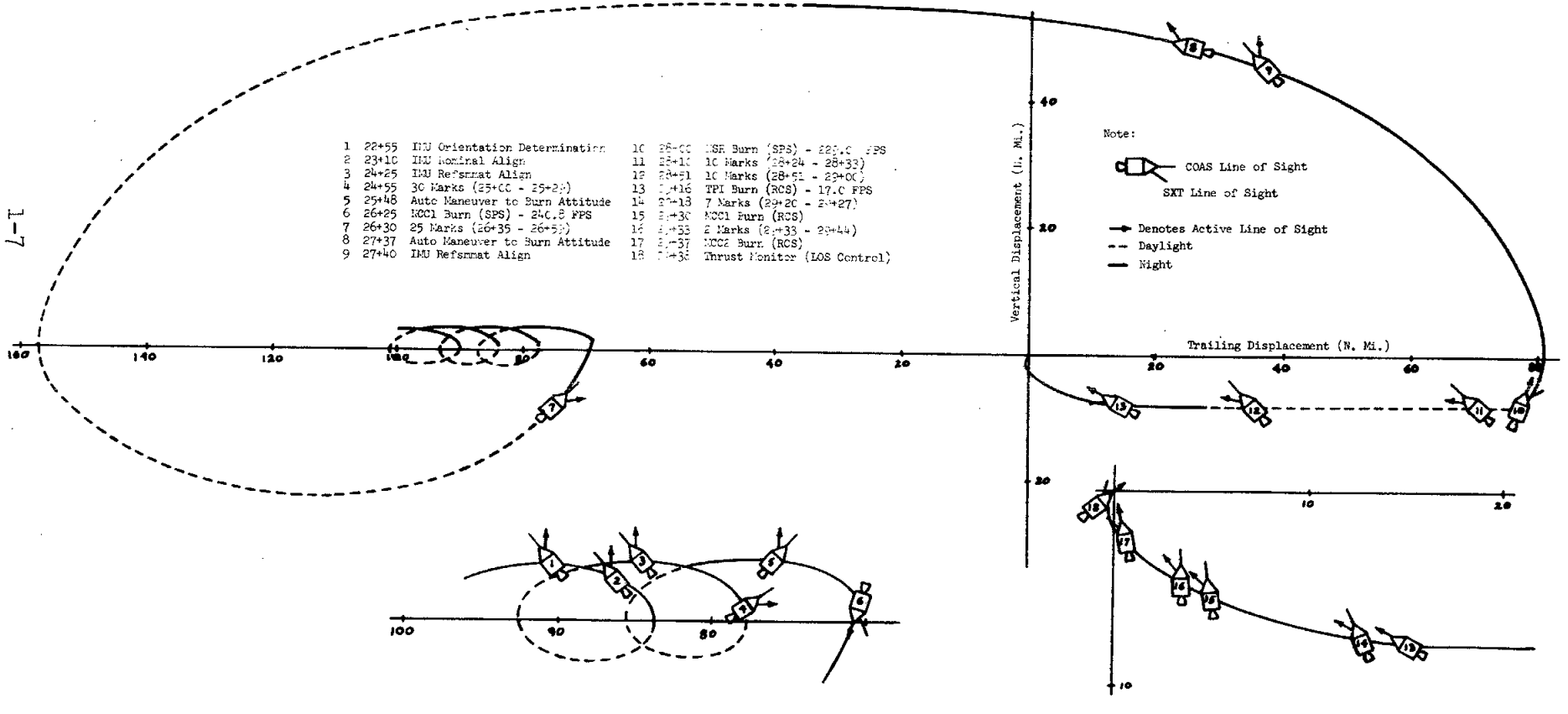


TABLE I
SPS BURN SCHEDULE

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			REMARKS
								L	C	R	
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

BLOCK DATA

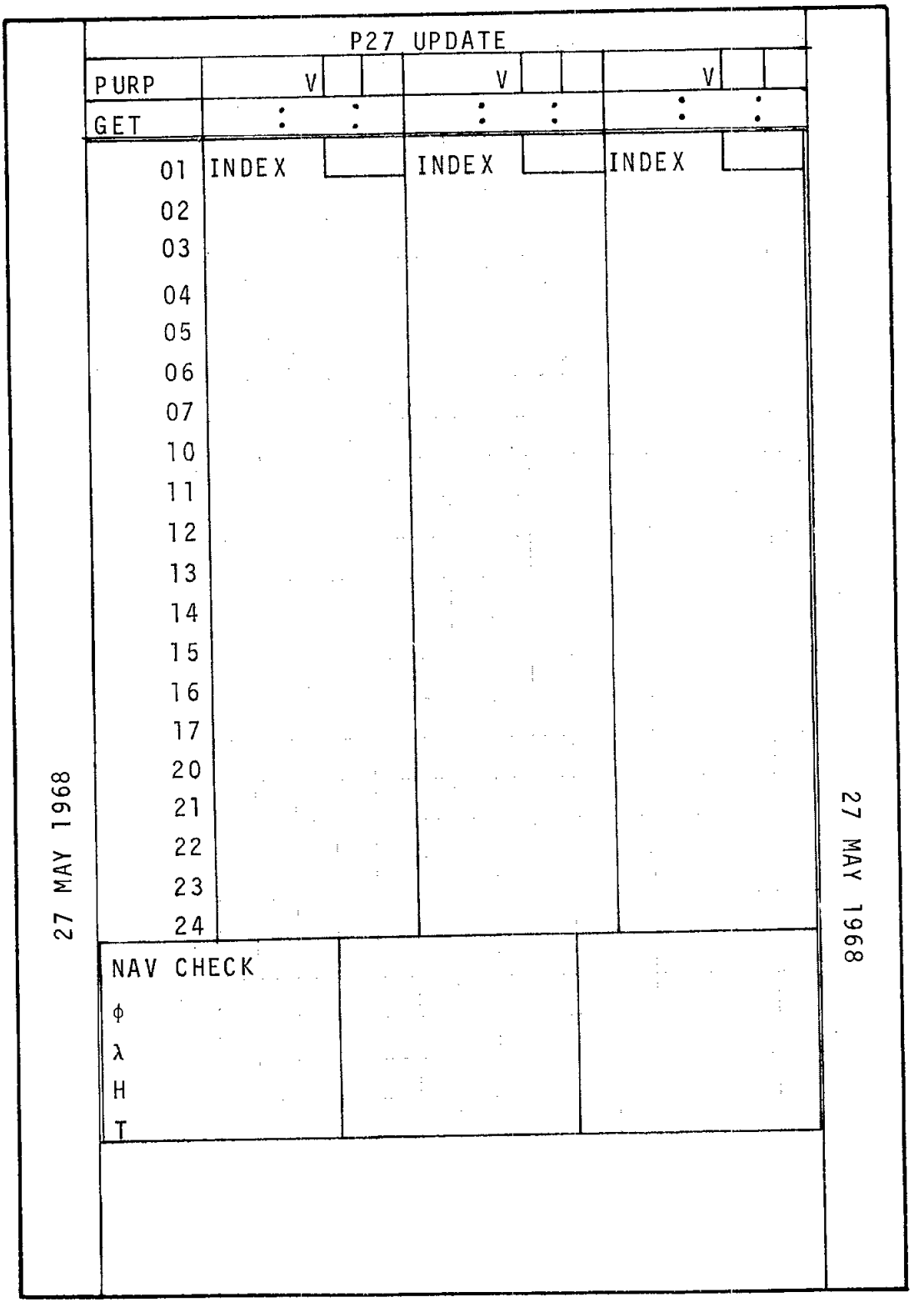
X X –	X X –	AREA
X X X .	X X X .	LAT
X X .	X X .	LONG
: :	: :	GETI
X X X .	X X X .	ΔV_C
		W_X
X X –	X X –	AREA
X X X .	X X X .	LAT
X X .	X X .	LONG
: :	: :	GETI
X X X .	X X X .	ΔV_C
		W_X
X X –	X X –	AREA
X X X .	X X X .	LAT
X X .	X X .	LONG
: :	: :	GETI
X X X .	X X X .	ΔV_C
		W_X
X X –	X X –	AREA
X X X .	X X X .	LAT
X X .	X X .	LONG
: :	: :	GETI
X X X .	X X X .	ΔV_C
		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)



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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

27 MAY 1968

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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MSC Form 1190 (Apr 65)

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

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MANEUVER		
		PURPOSE
+ 0 0	+ 0 0	HRS GETI N33
+ 0 0 0	+ 0 0 0	MIN
+ 0 .	+ 0 .	SEC
.	.	ΔVX N32
.	.	ΔVY
.	.	ΔVZ
+ 0 .	+ 0 .	HA N42
0 .	0 .	HP
+ .	+ .	VC∓ΔVR-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 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

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MANEUVER UPDATE

PURPOSE	XXXXXX	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)

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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	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 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	

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 GET ≈ 06:00 (Pg 4-96)
07:00	CMP: REPORT S/C GO/NO GO	
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	

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	TOOL E REQD TO OPEN COOLANT PANEL 382
	70mm FILM MAG (2) — R-13	
	70mm H-BLAD — B-3	CONFIGURE H-BLAD FOR WINDOW AND SLA PHOTOGRAPHY:
	RING SIGHT — B-3	70mm LENS
	SPOTMETER — B-3	RING SIGHT
	16mm SEQ CAM — B-3	S0368
	16mm FILM MAG — B-3	F11, 1/250
	18mm LENS — B-3	
	POWER CABLE — B-3	CONFIGURE SEQ-CAM FOR SLA PHOTOGRAPHY
	MIRROR RT. ANGLE — B-3	18mm LENS
	SEQ CAM BRACKET — A-8	S0368 FILM
	HELMET STORAGE BAGS — A-8	MOUNT IN RH WINDOW BRACKET
	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	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 POO	
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.

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FLIGHT PLAN

TIME	EVENT	REMARKS
	PREPARE FOR S-IVB TAKEOVER	
02:30	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
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 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
	INITIATE POSTSEP CHECKLIST	
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 INHIBITED 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 O2 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 ≈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)	

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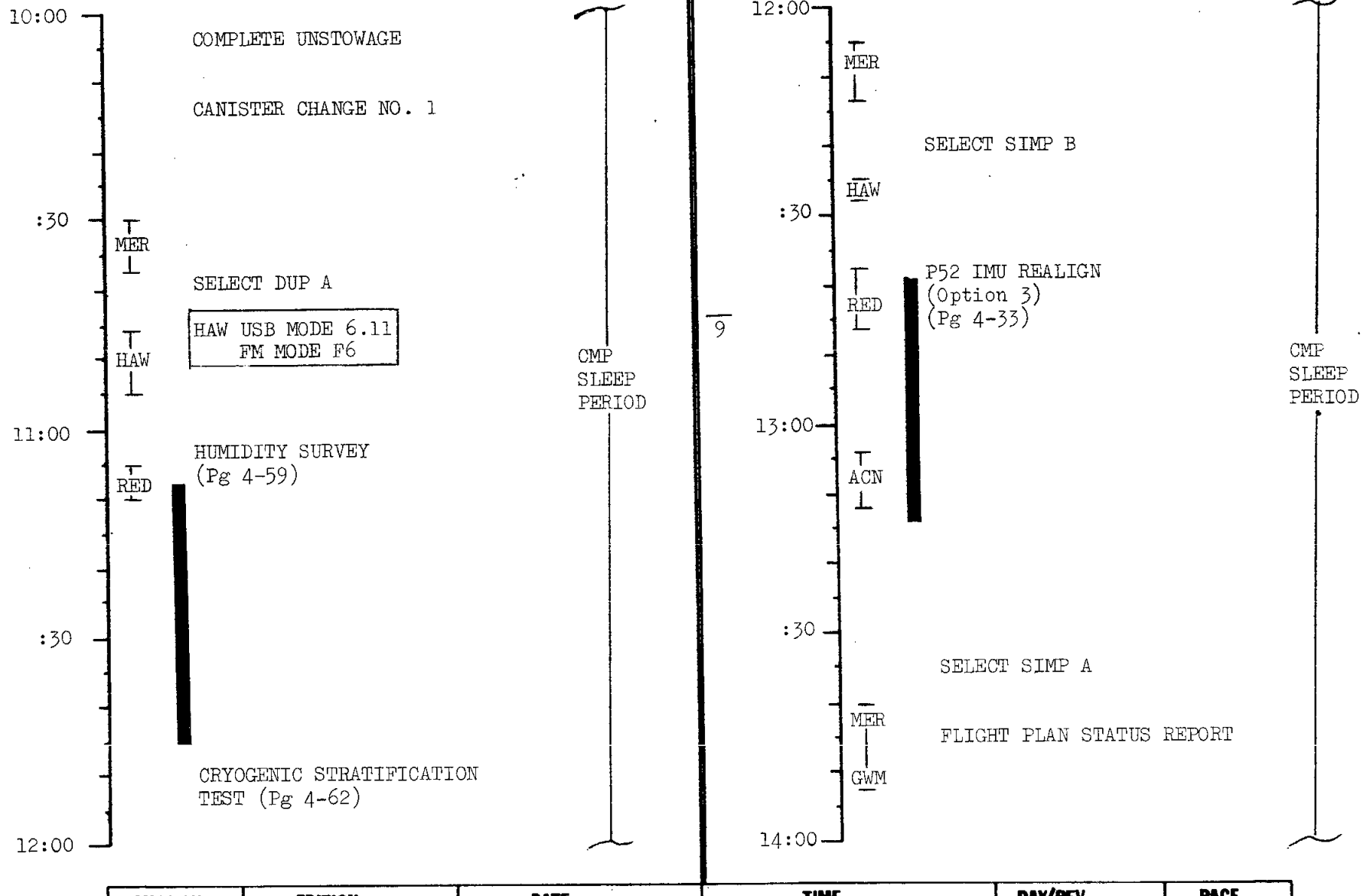
FLIGHT PLAN

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

FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
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MSC FORM 1186 (SEP 67)

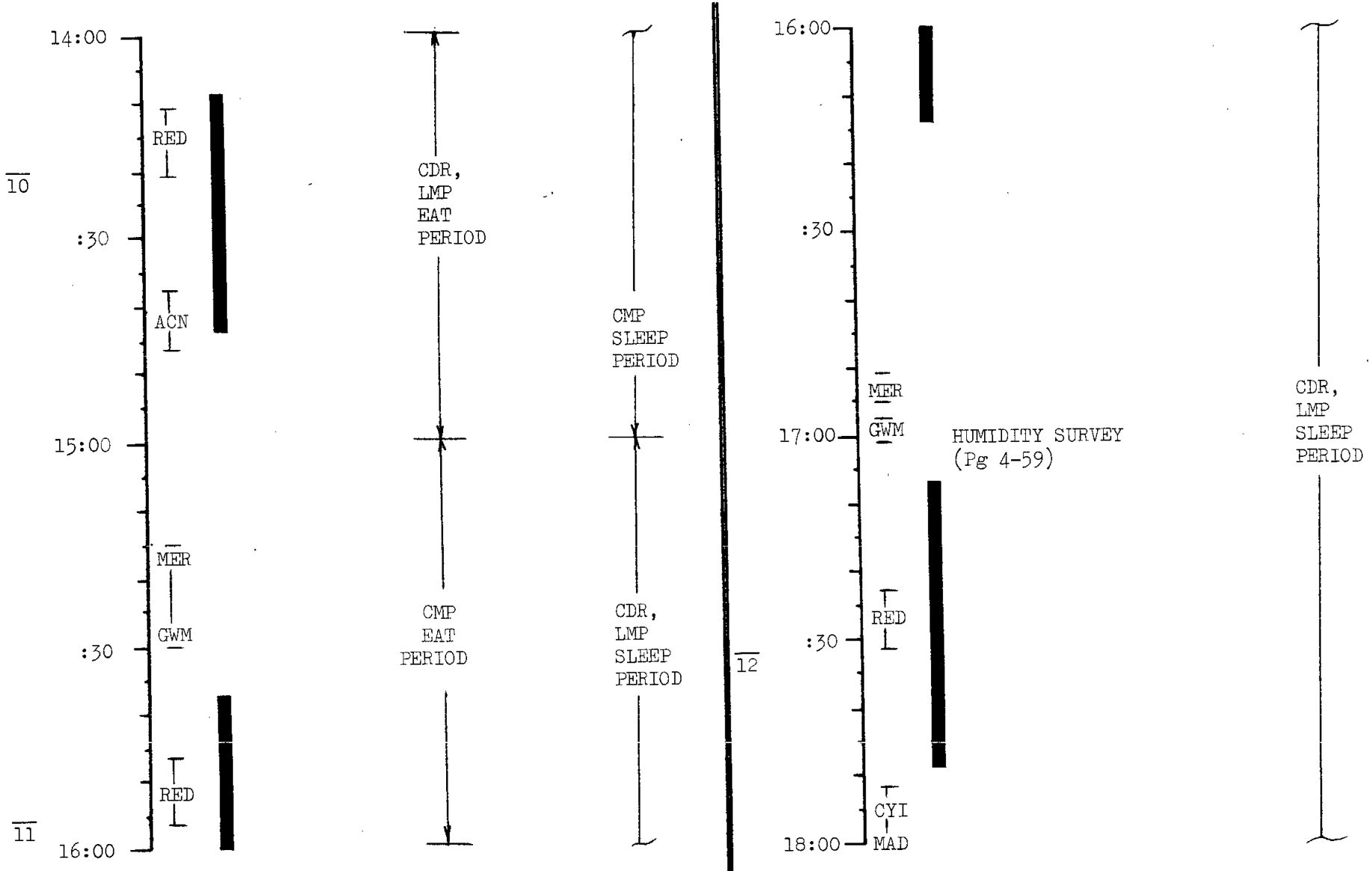
TABLE IV

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
O_2 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

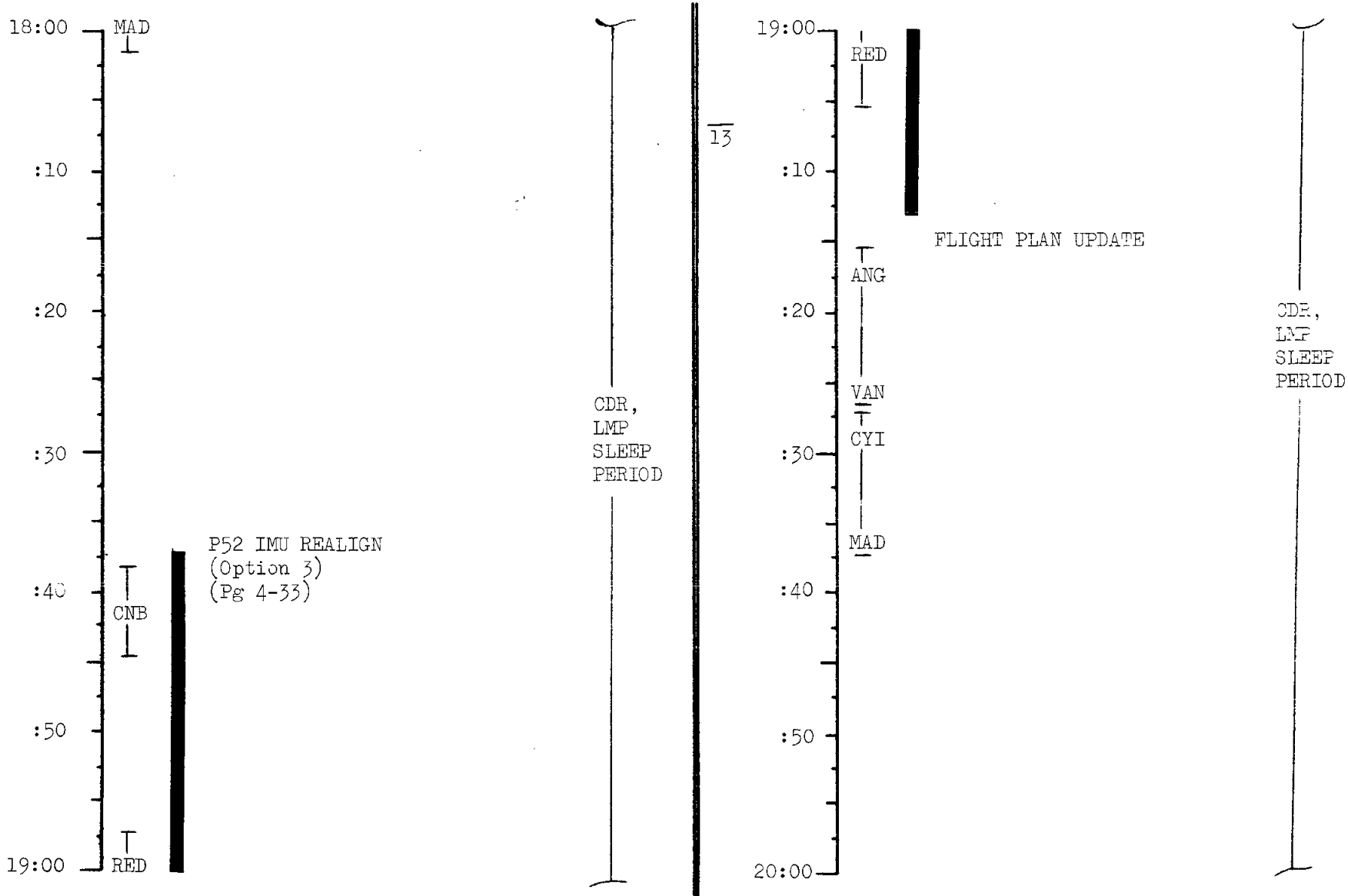
FLIGHT PLAN



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)

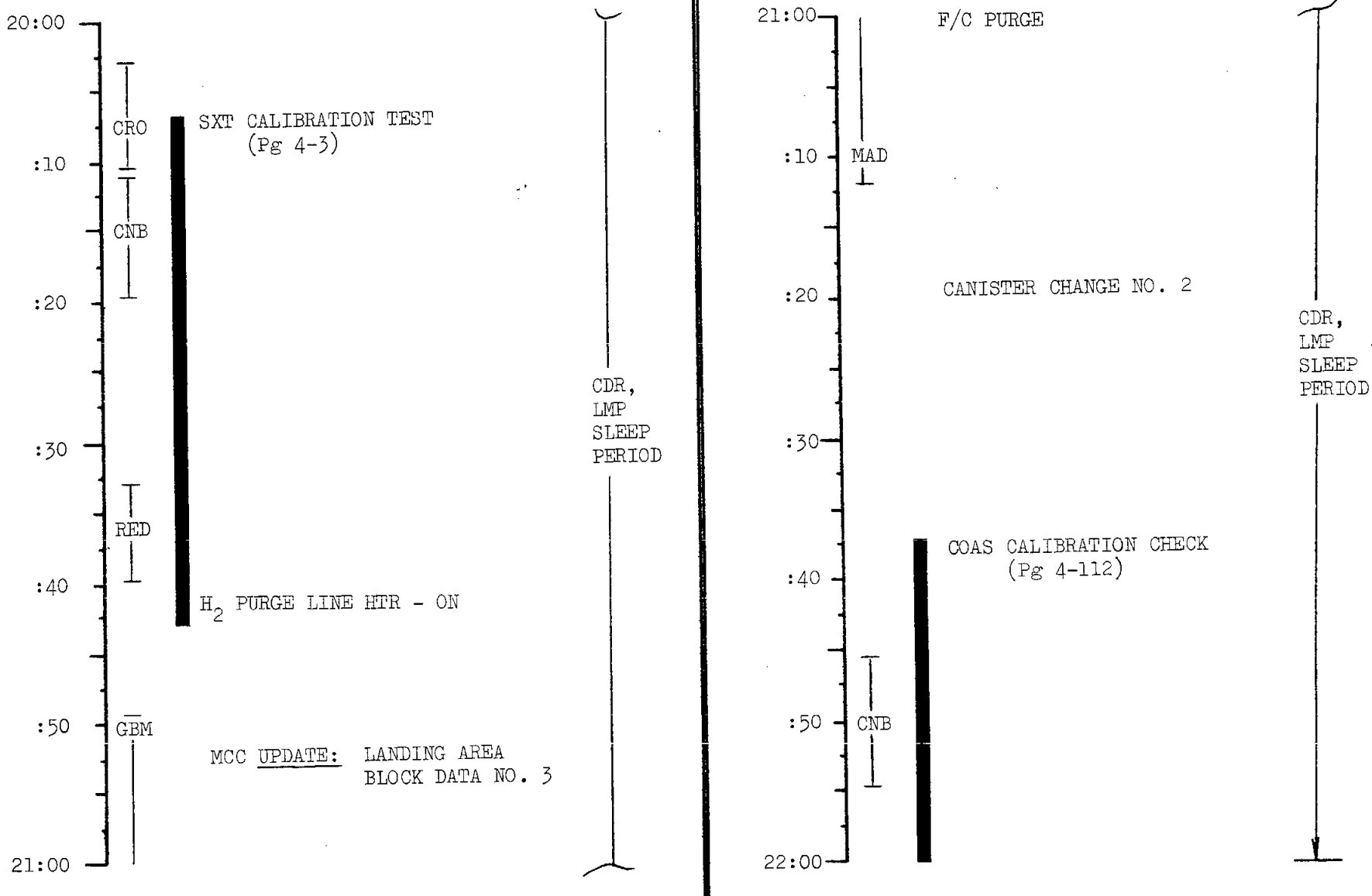
FLIGHT PLAN



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



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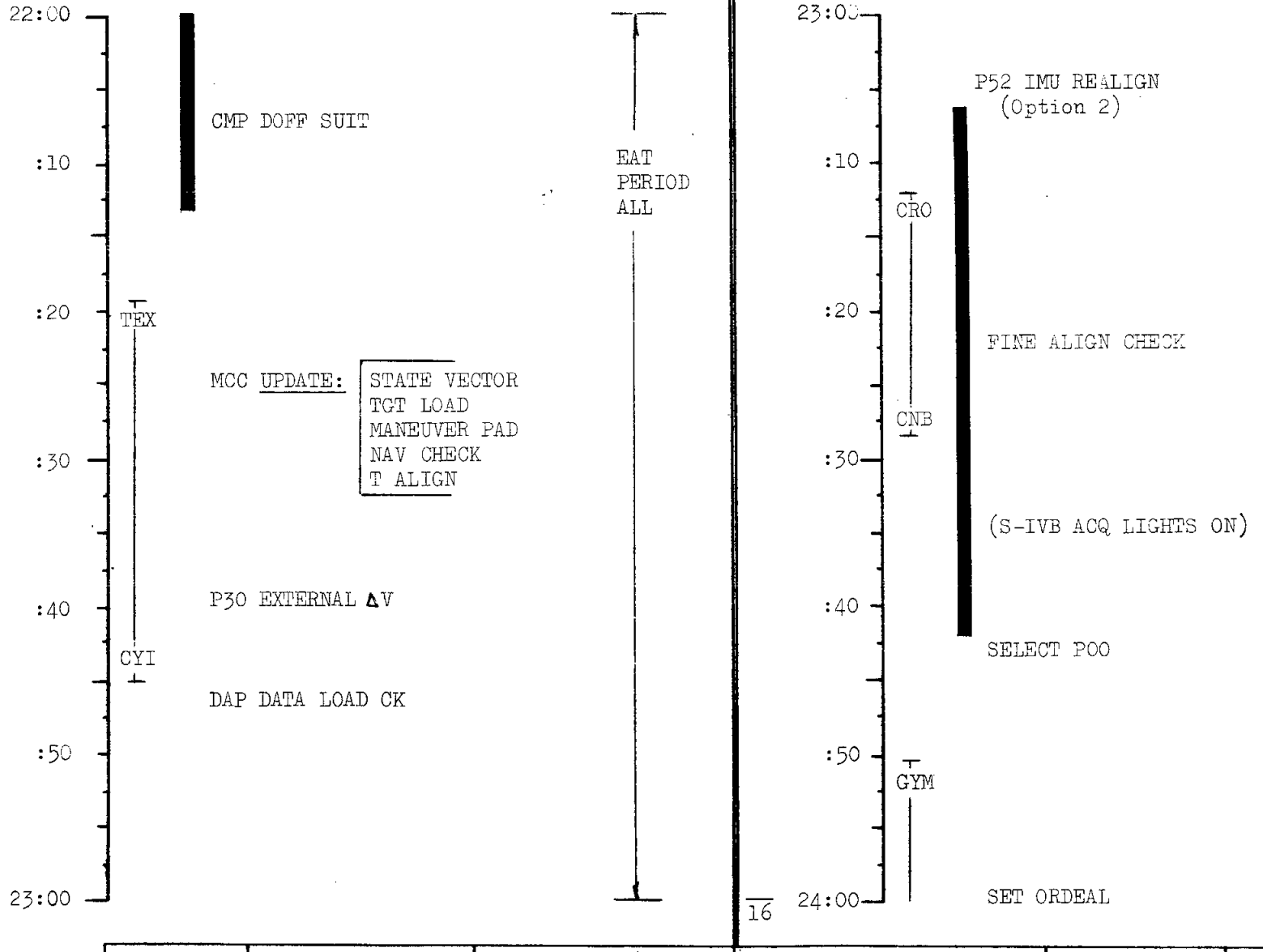
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	20:00-22:00	0/13-14	2-16

MSC FORM 1186 (SEP 67)

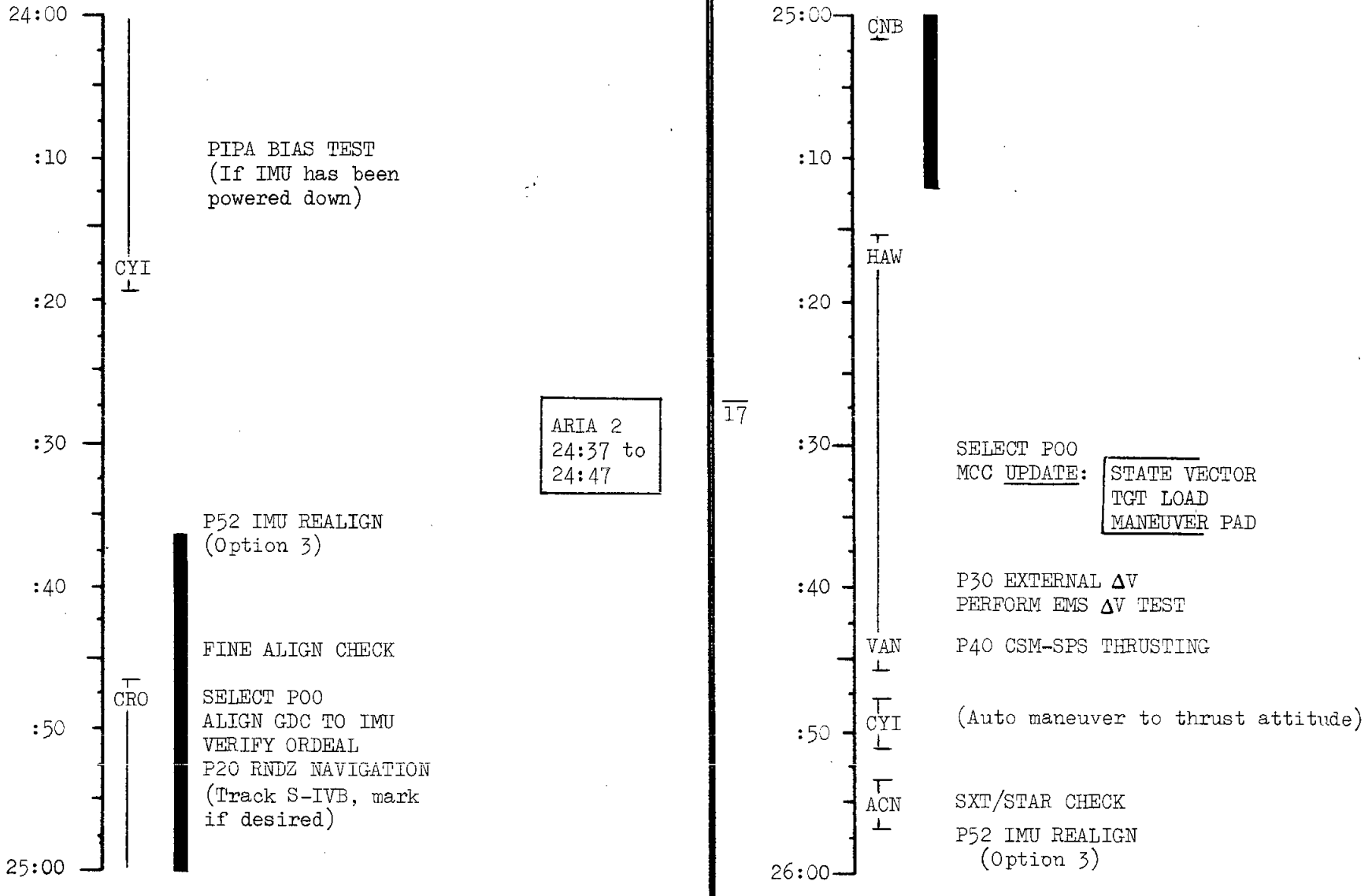
FLIGHT PLAN



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)

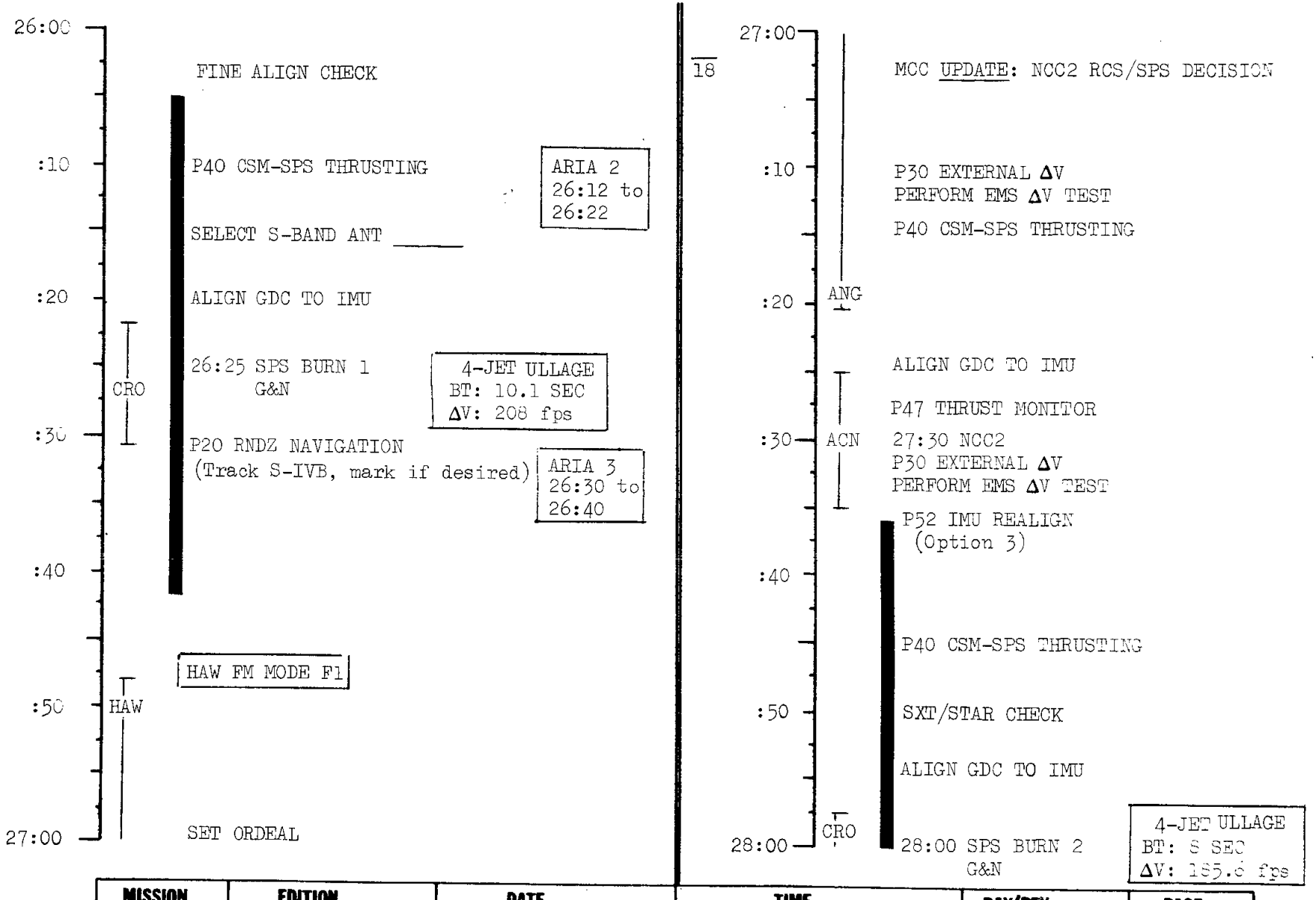
FLIGHT PLAN



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)

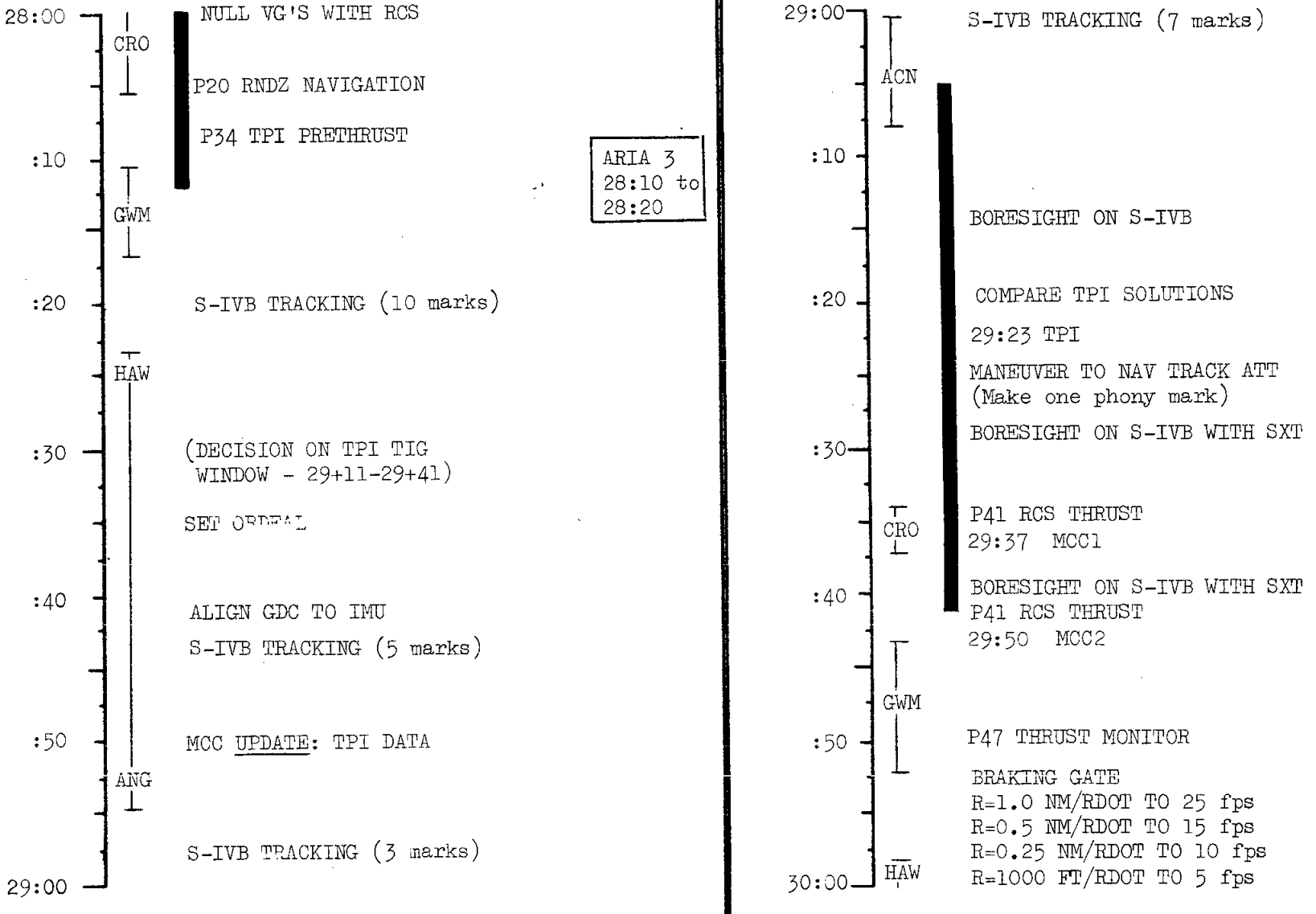
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	26:00-28:00	1/17-18	2-19

MSC FORM 1186 (SEP 67)

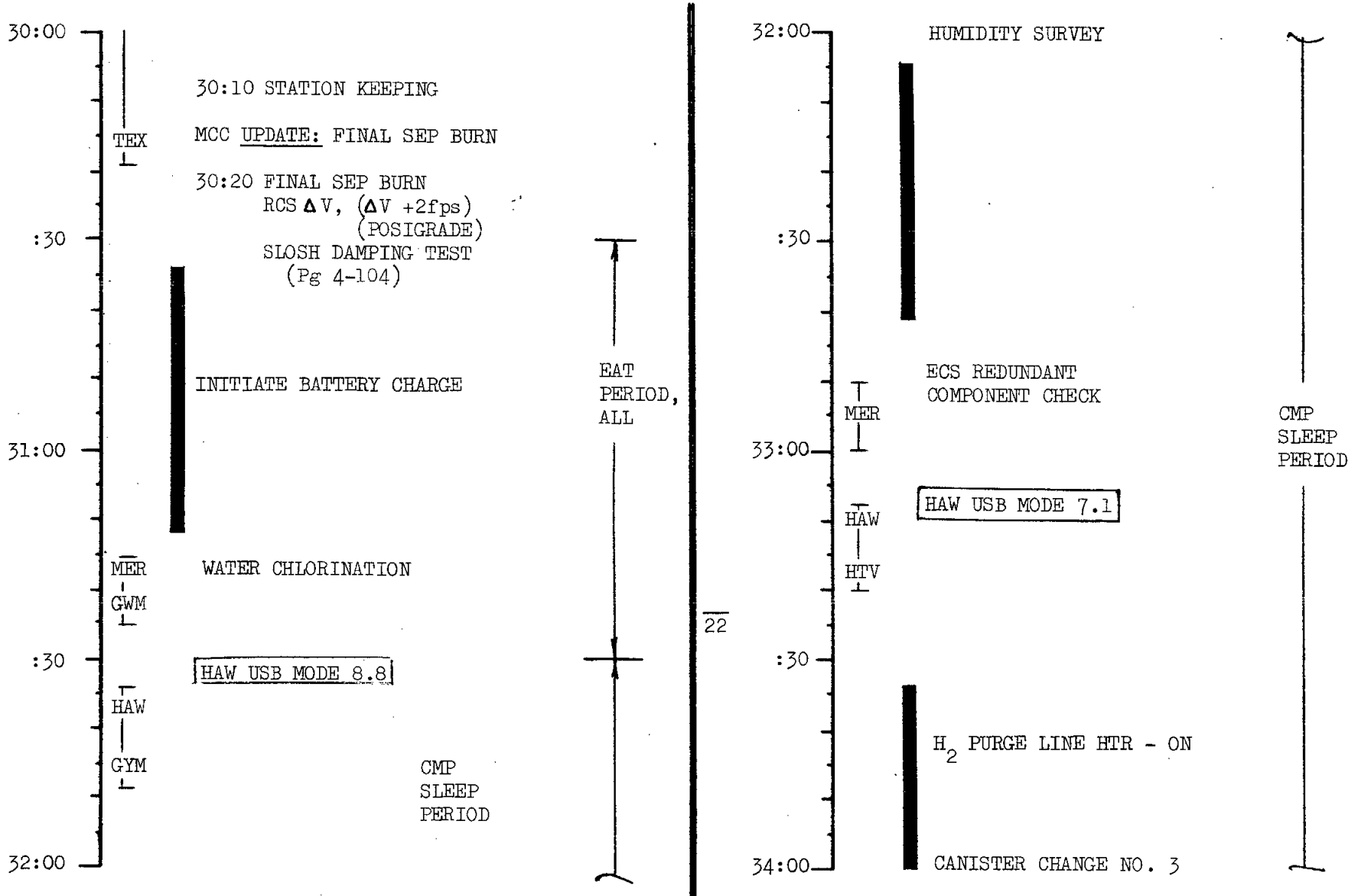
FLIGHT PLAN



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)

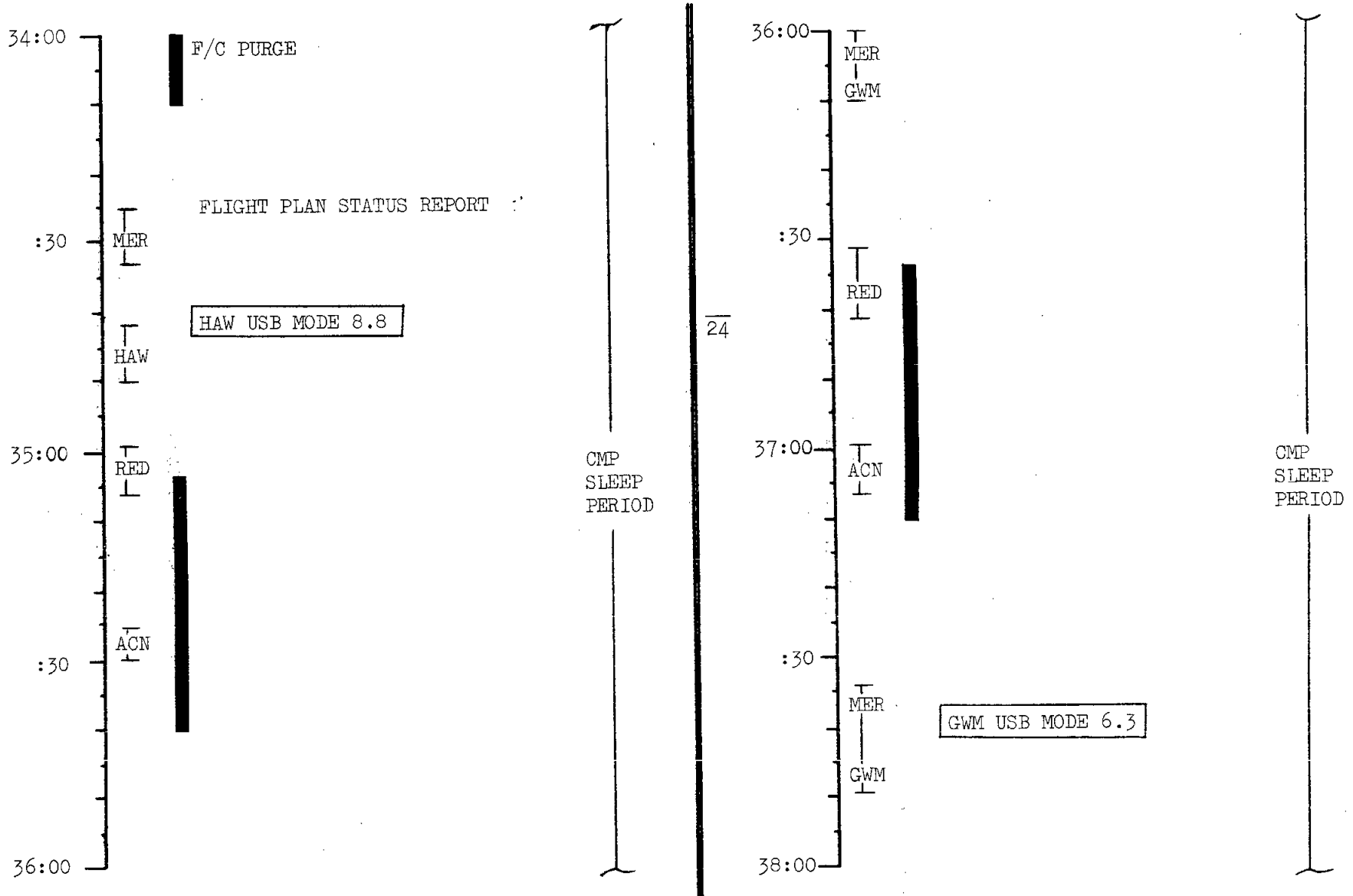
FLIGHT PLAN



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)

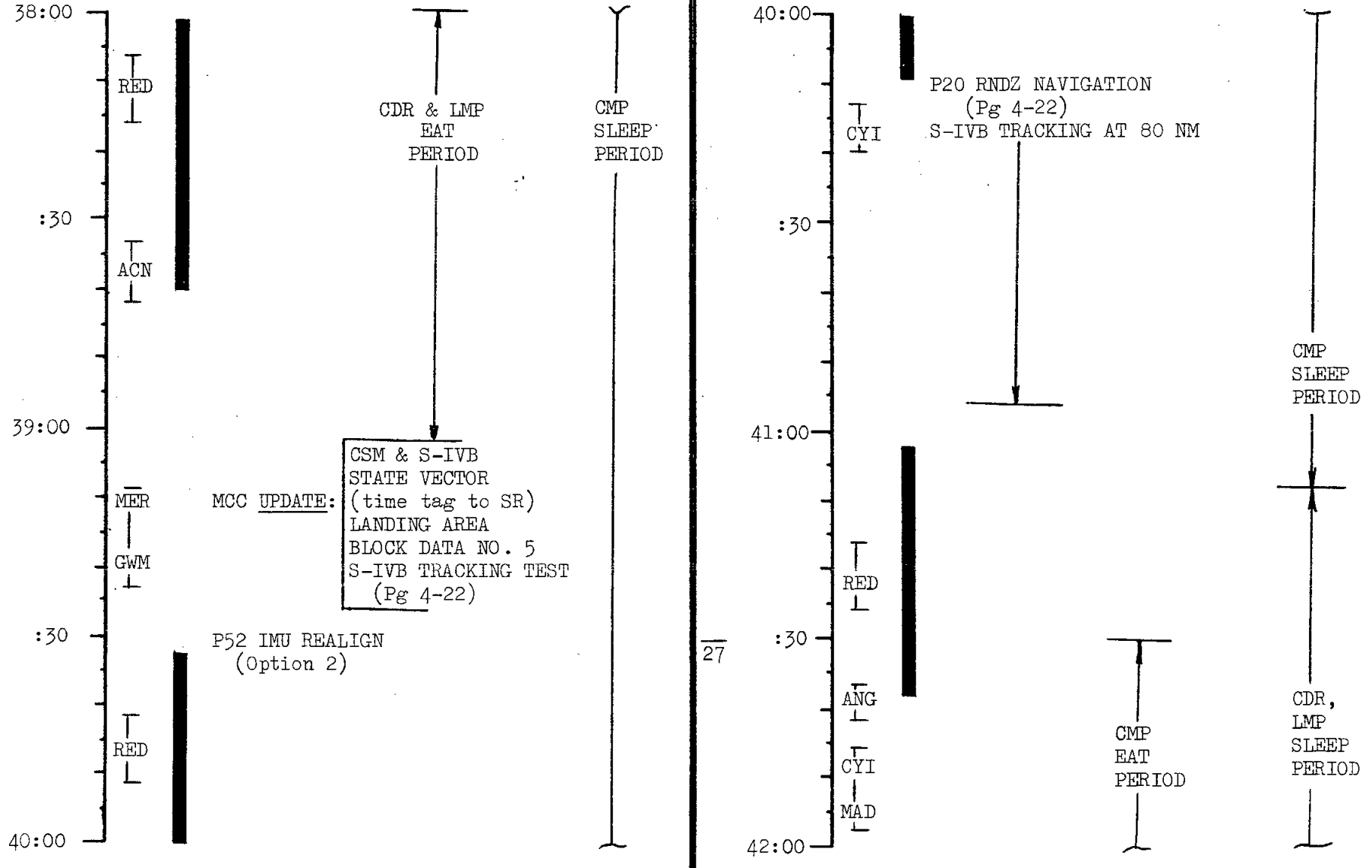
FLIGHT PLAN



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



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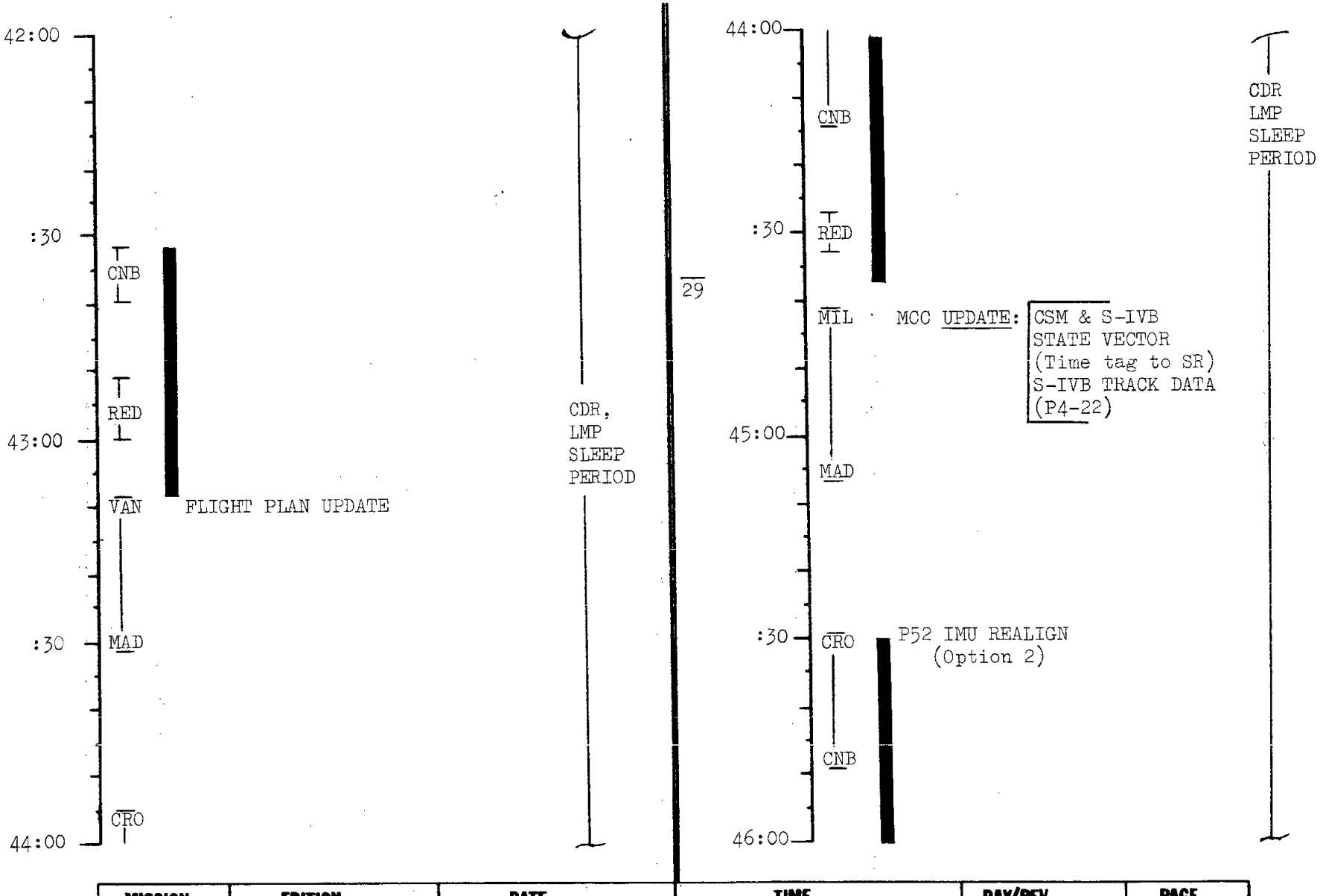
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	38:00-42:00	1/24-27	2-23

MSC FORM 1186 (SEP 67)

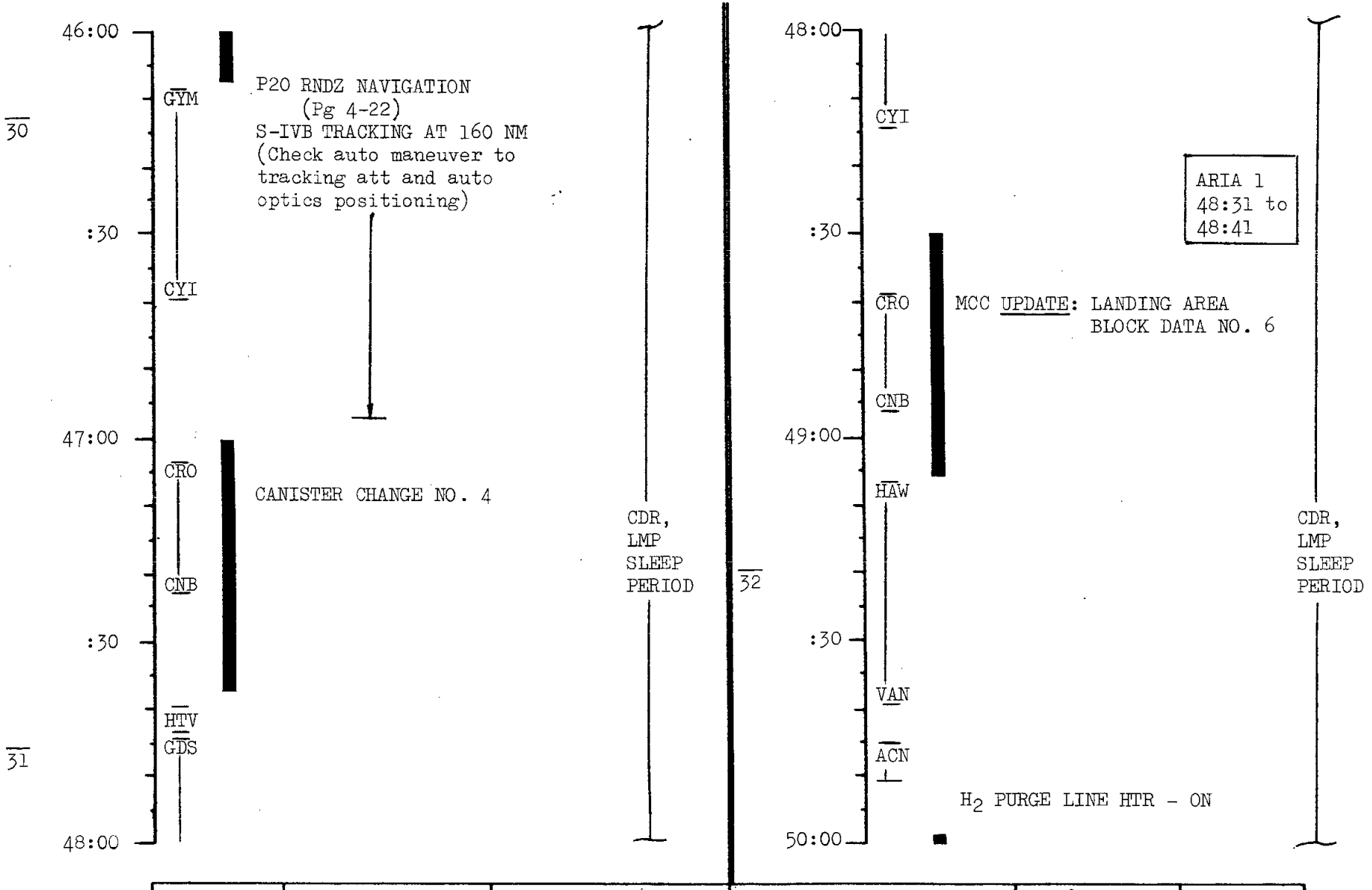
FLIGHT PLAN



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)

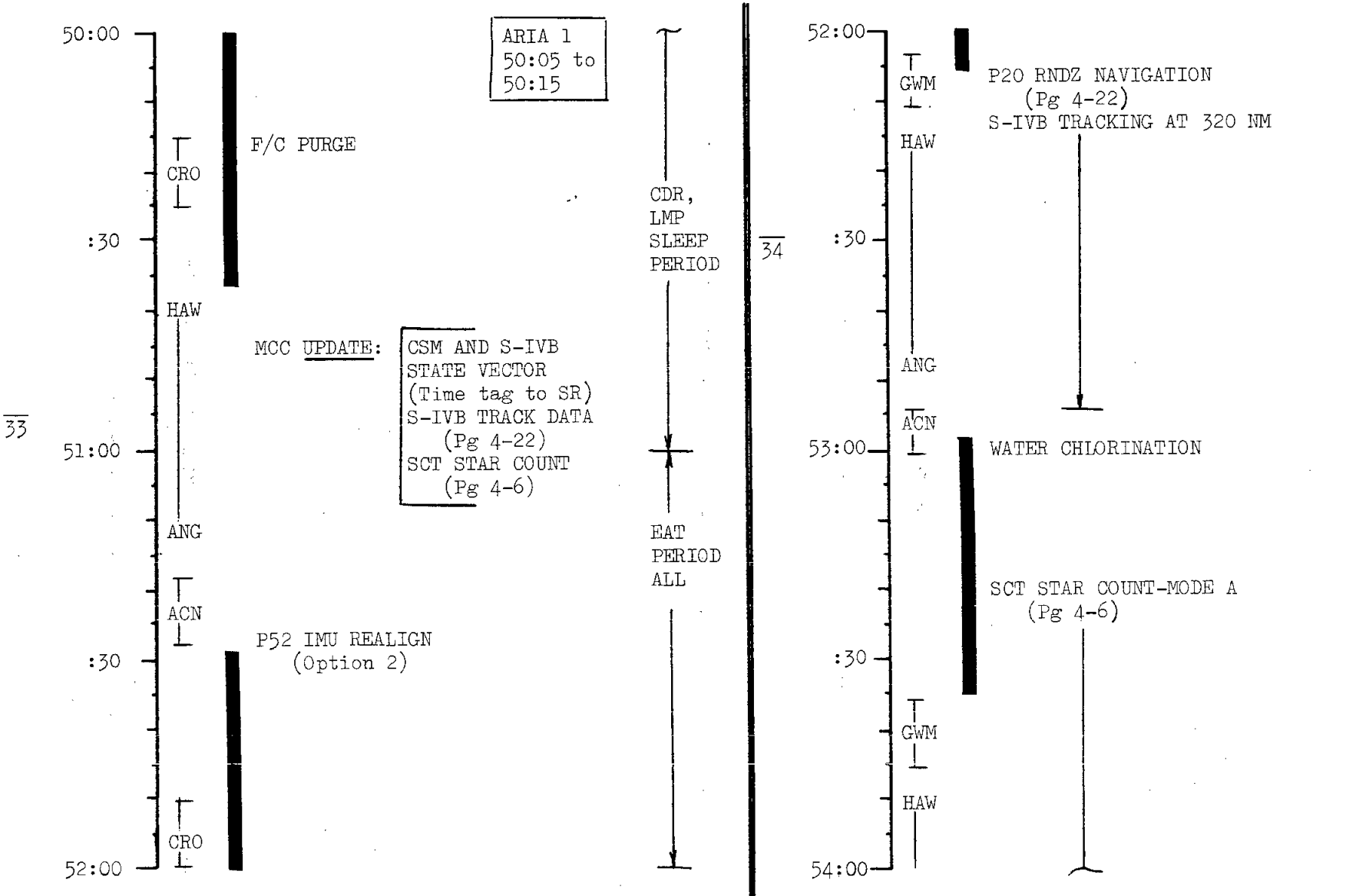
FLIGHT PLAN



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)

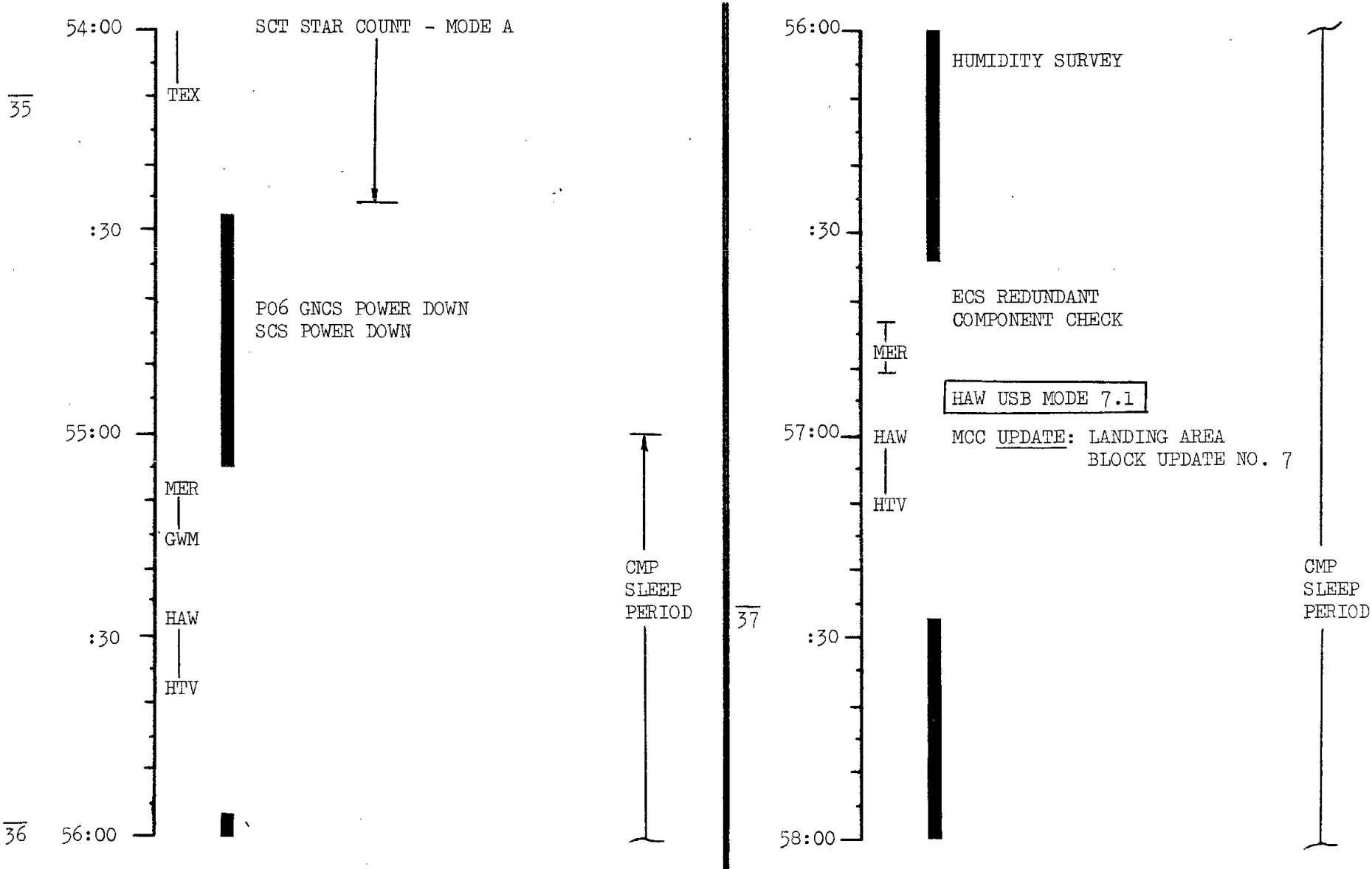
FLIGHT PLAN



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)

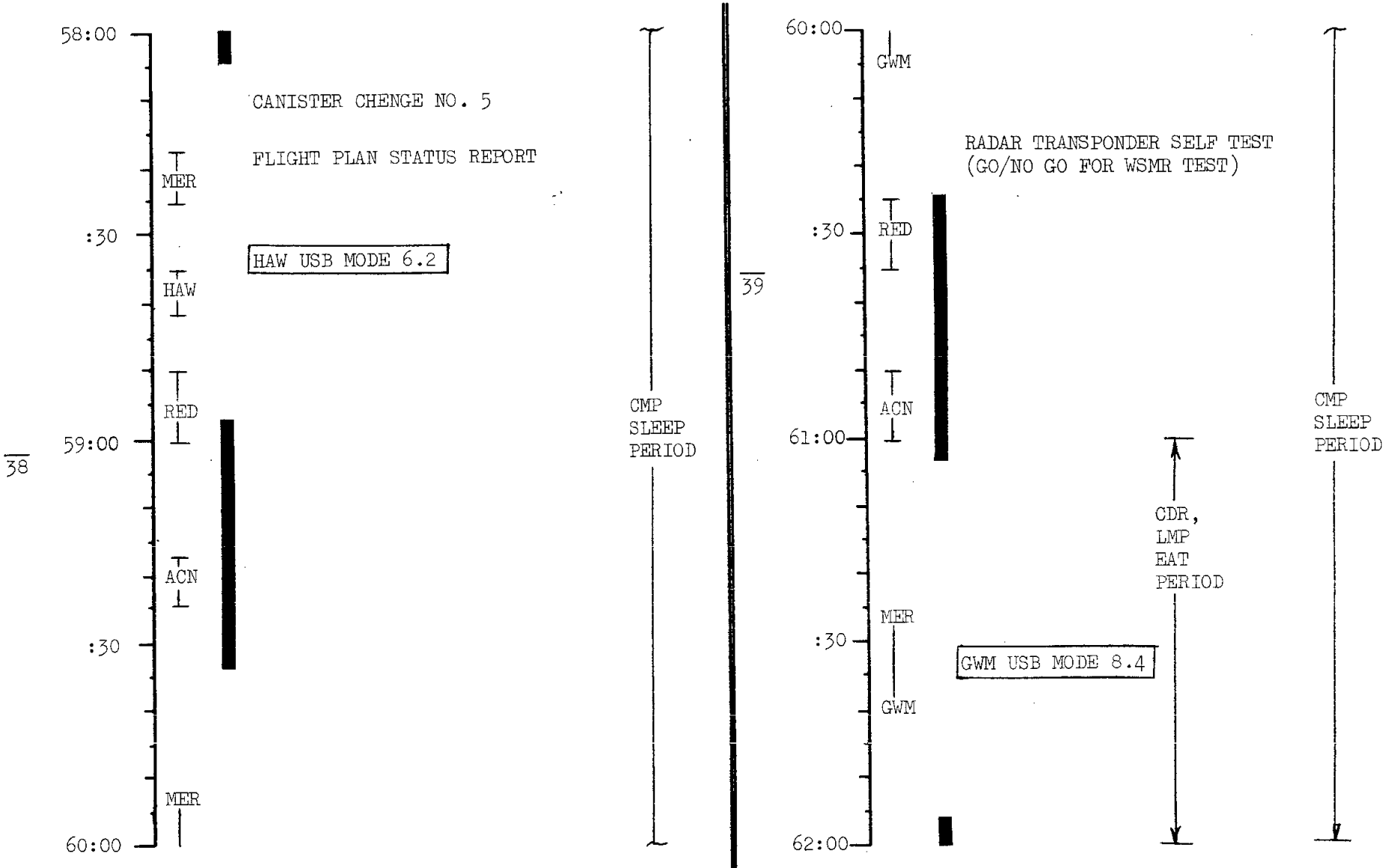
FLIGHT PLAN



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)

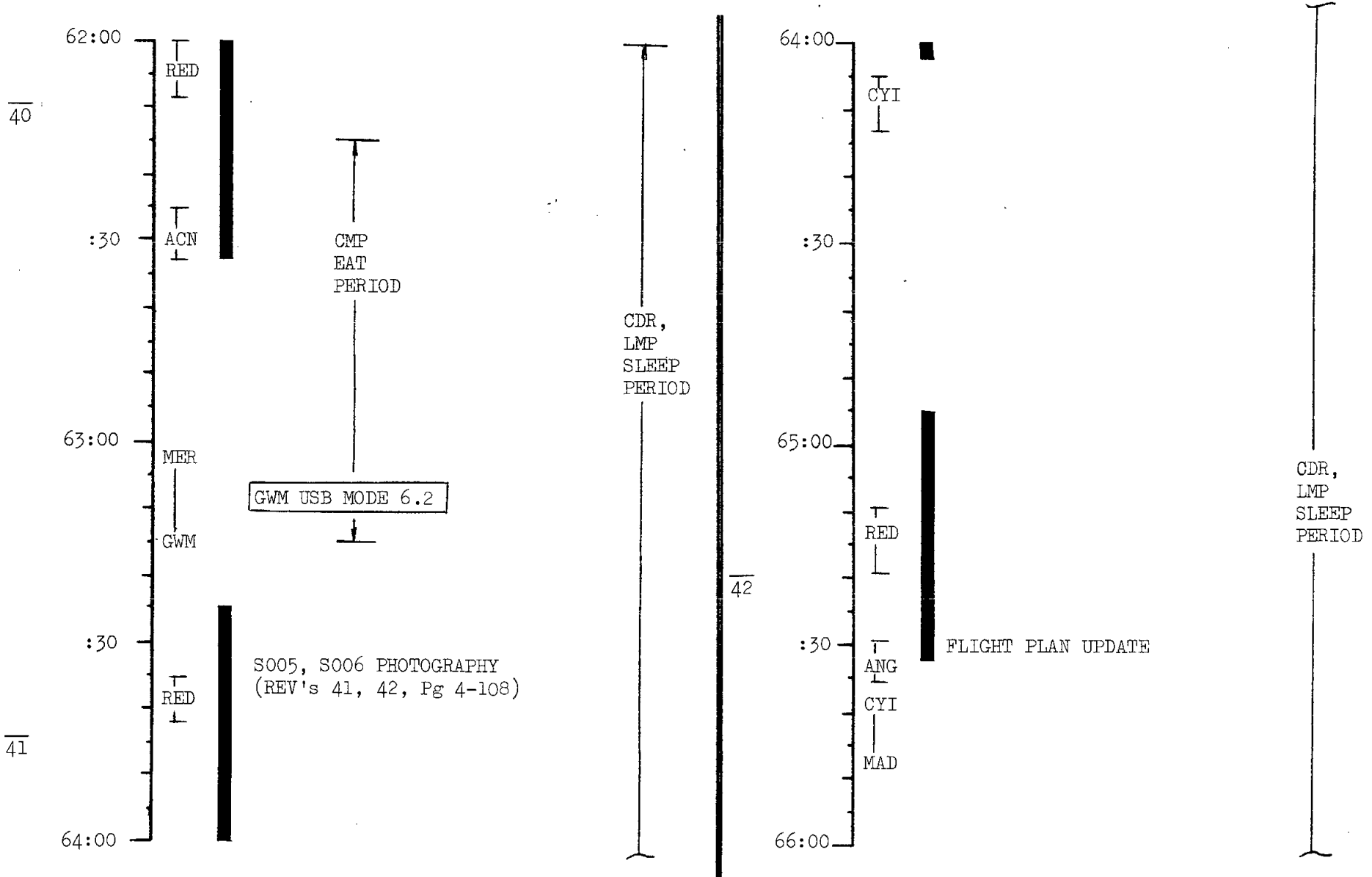
FLIGHT PLAN



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)

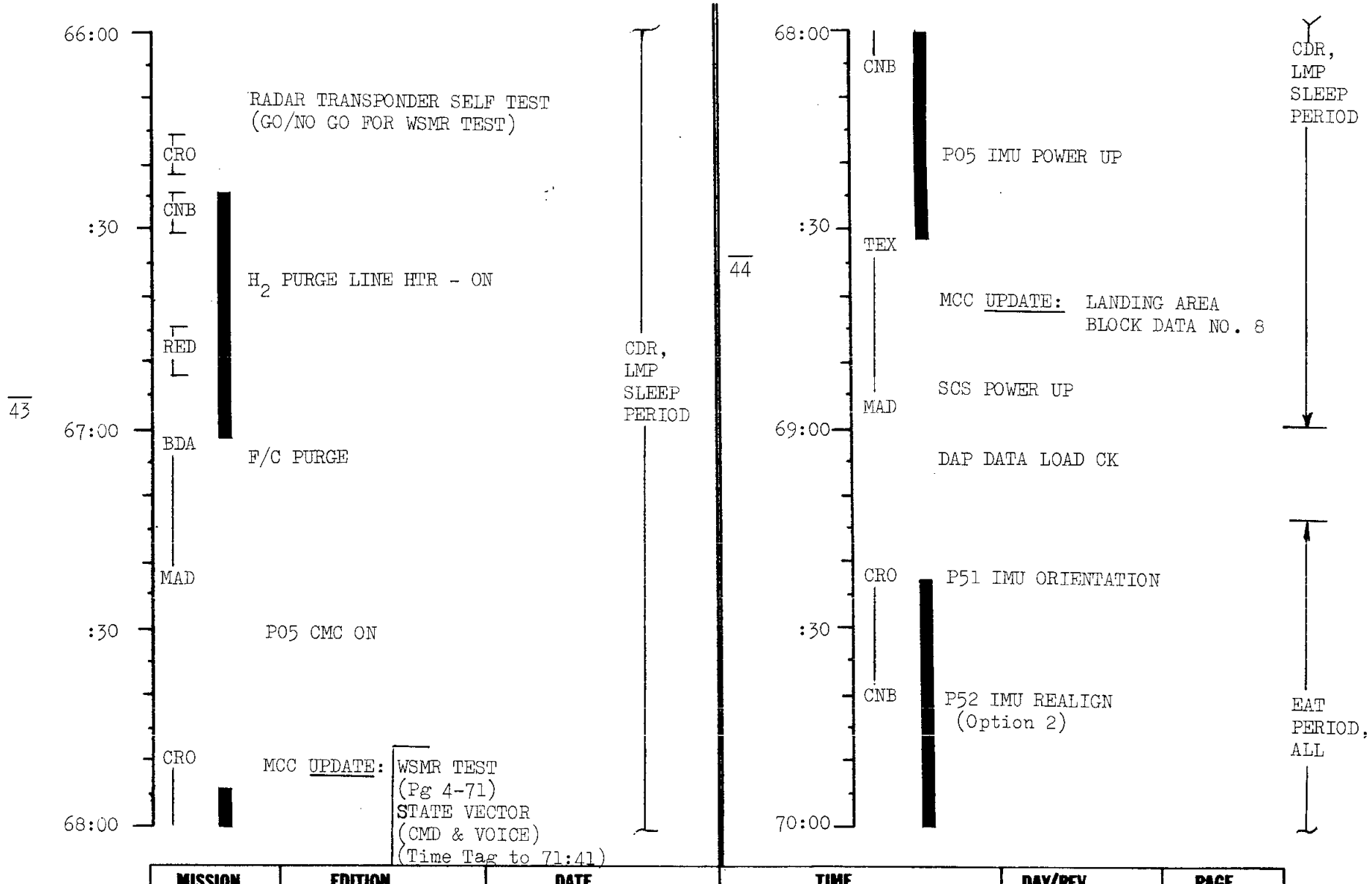
FLIGHT PLAN



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)

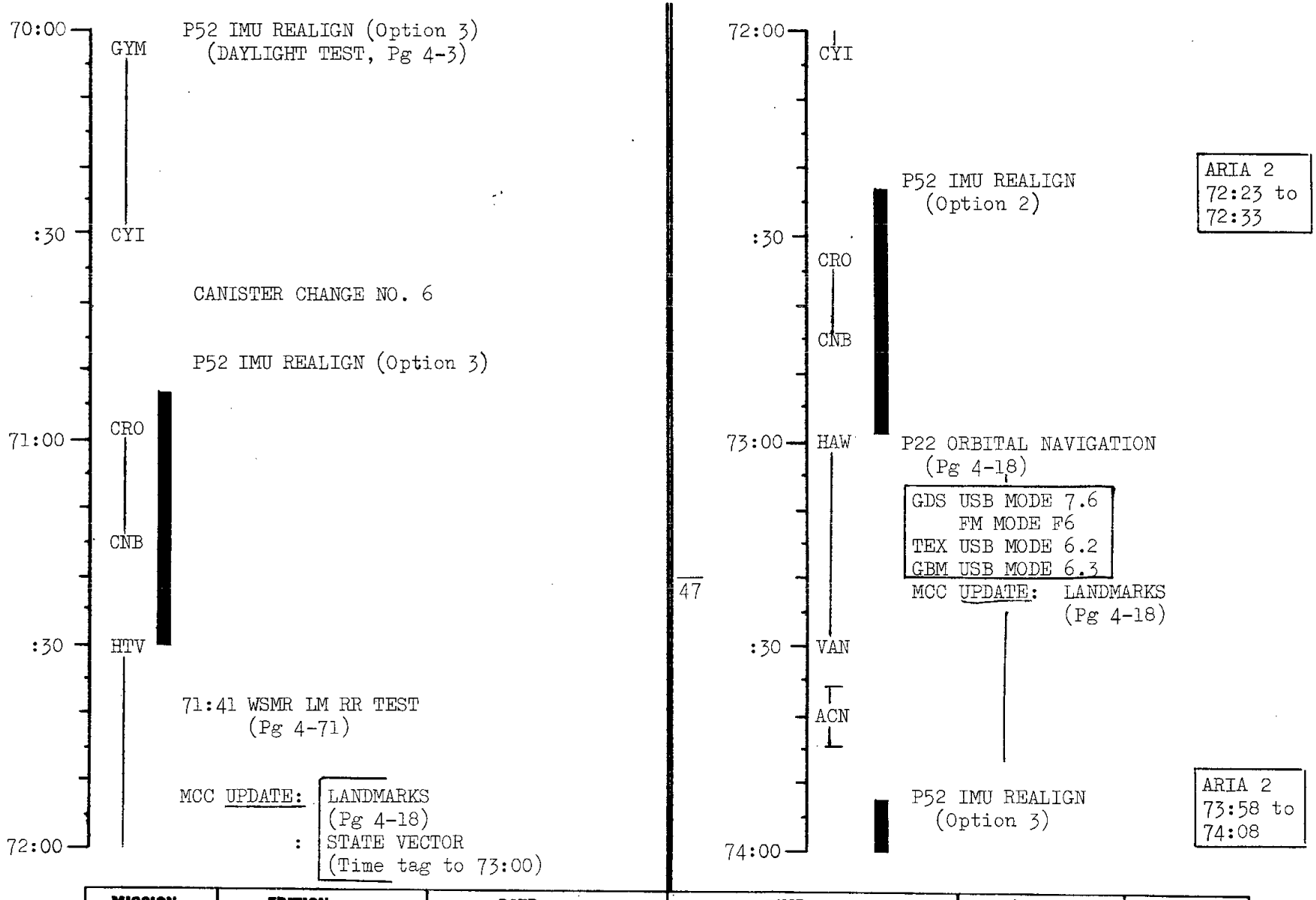
FLIGHT PLAN



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)

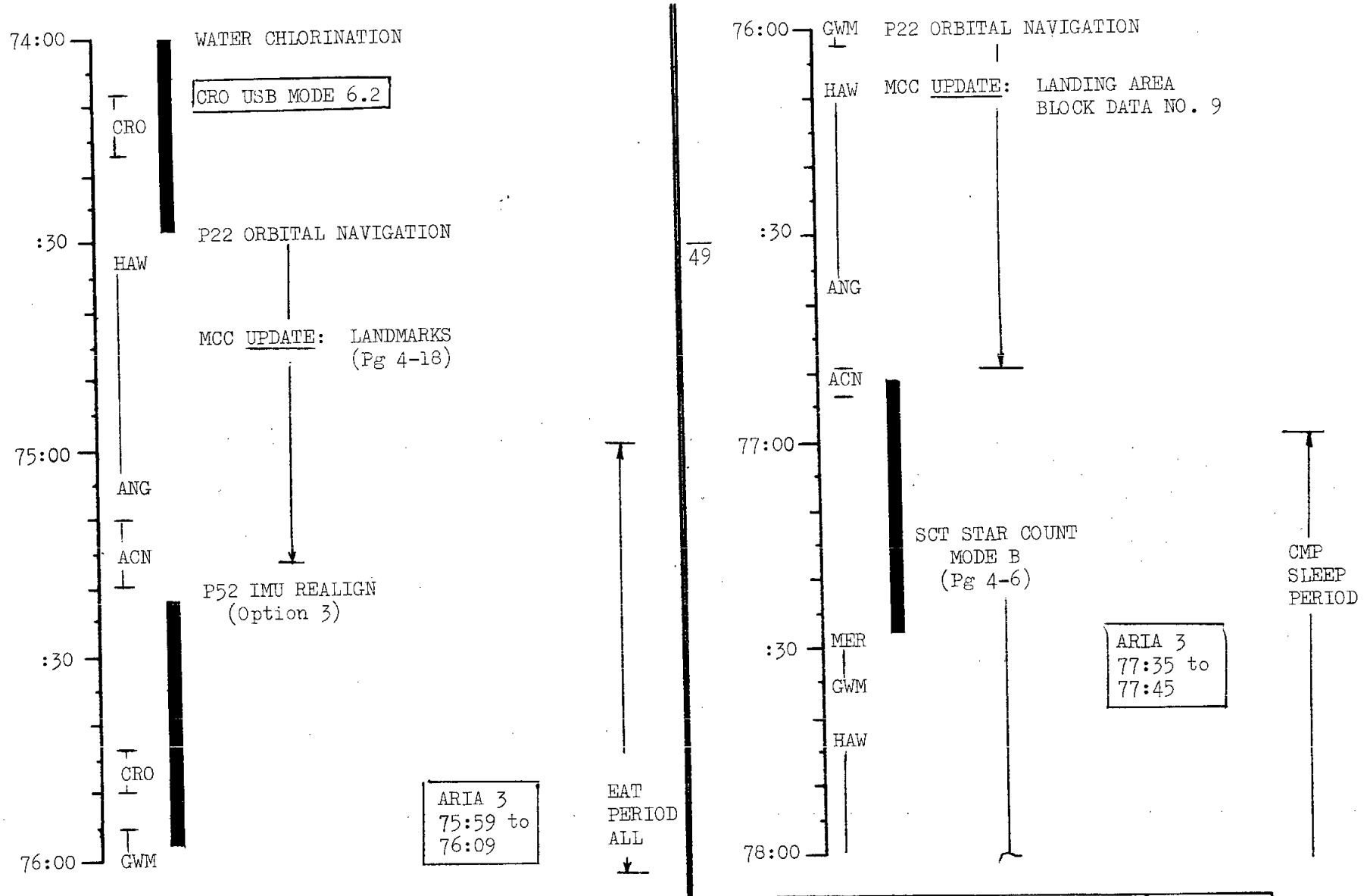
FLIGHT PLAN



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)

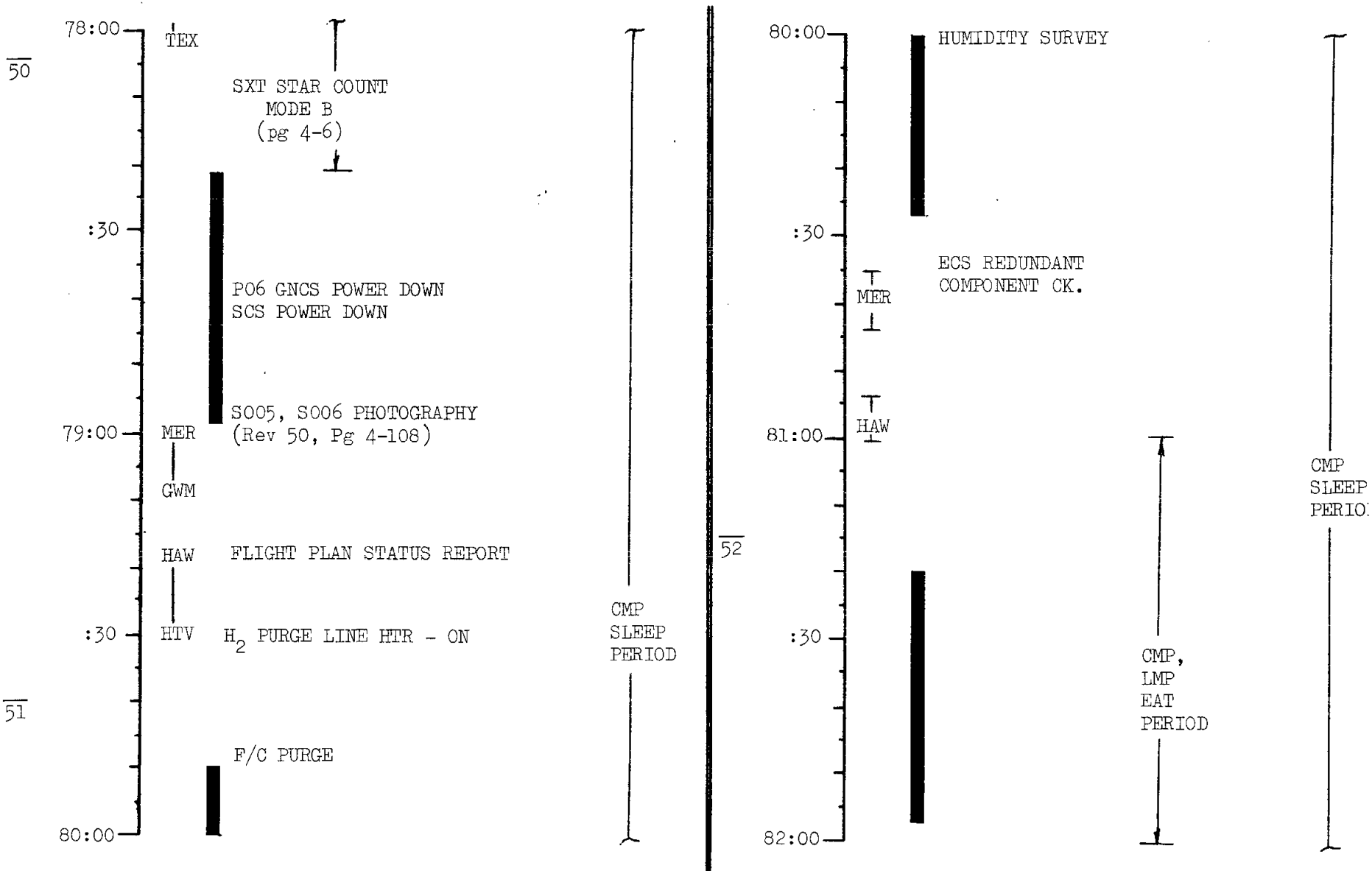
FLIGHT PLAN



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

MSC FORM 1186 (SEP 67)

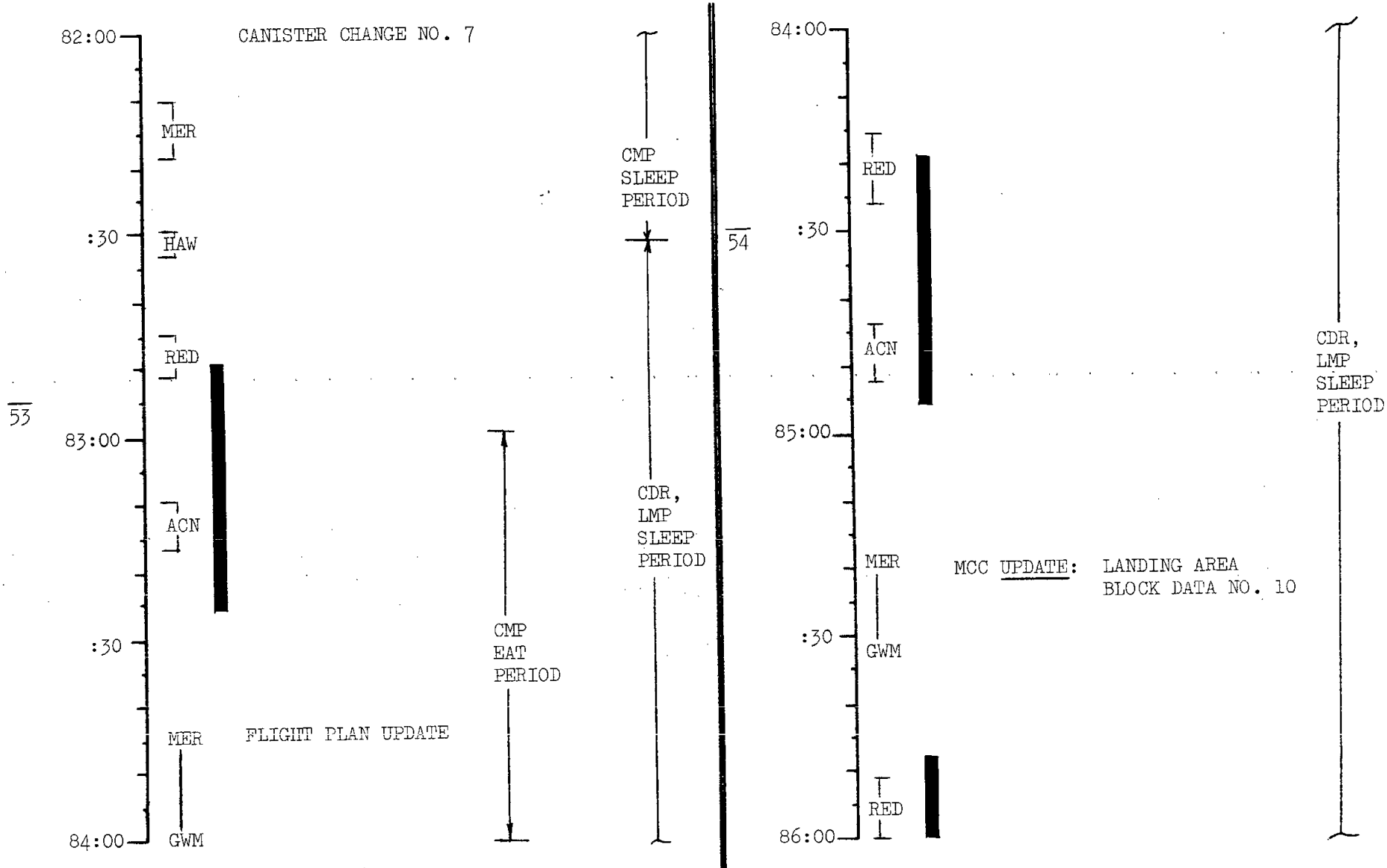
FLIGHT PLAN



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)

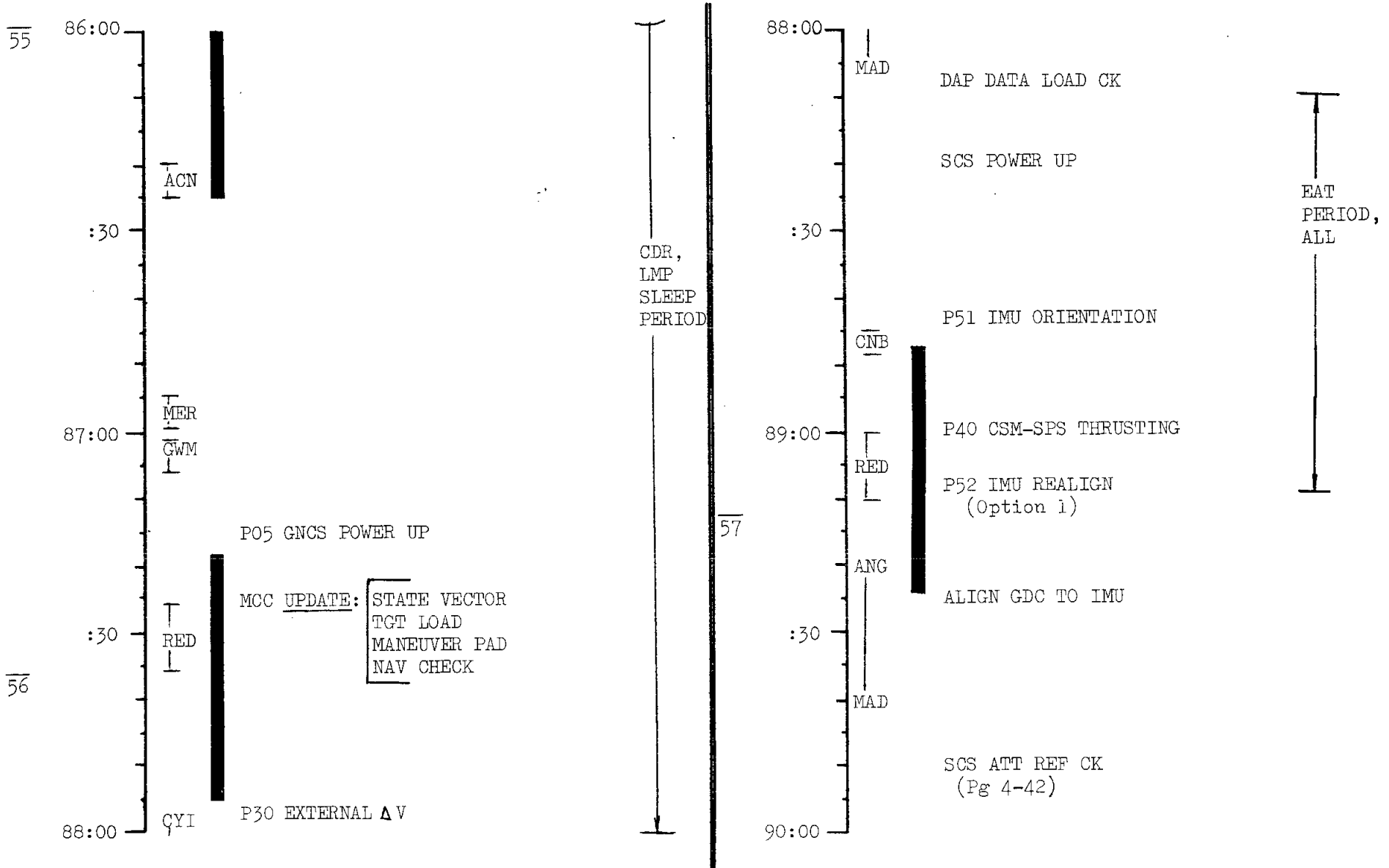
FLIGHT PLAN



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)

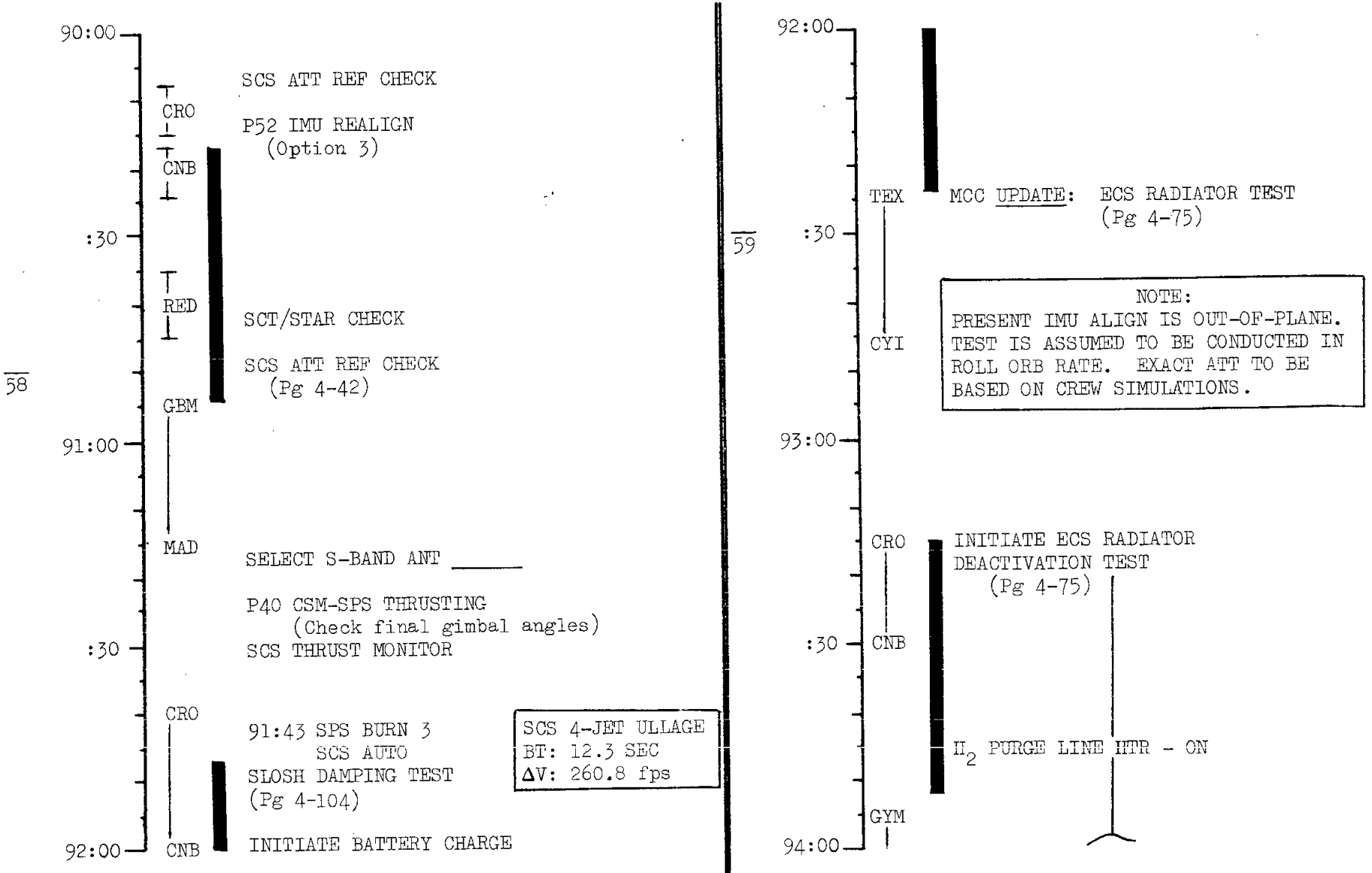
FLIGHT PLAN



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)

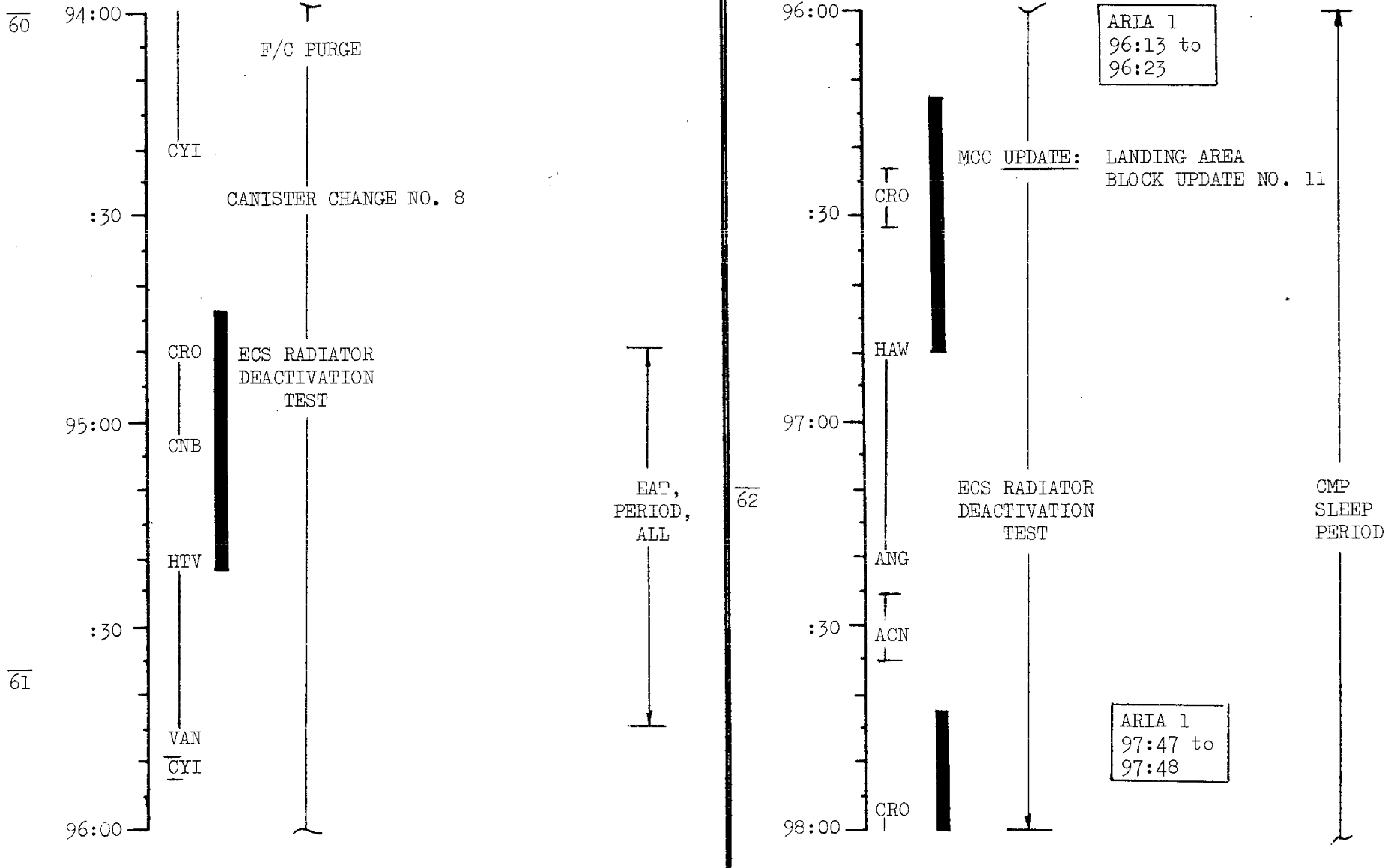
FLIGHT PLAN



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

MSC FORM 1186 (SEP 67)

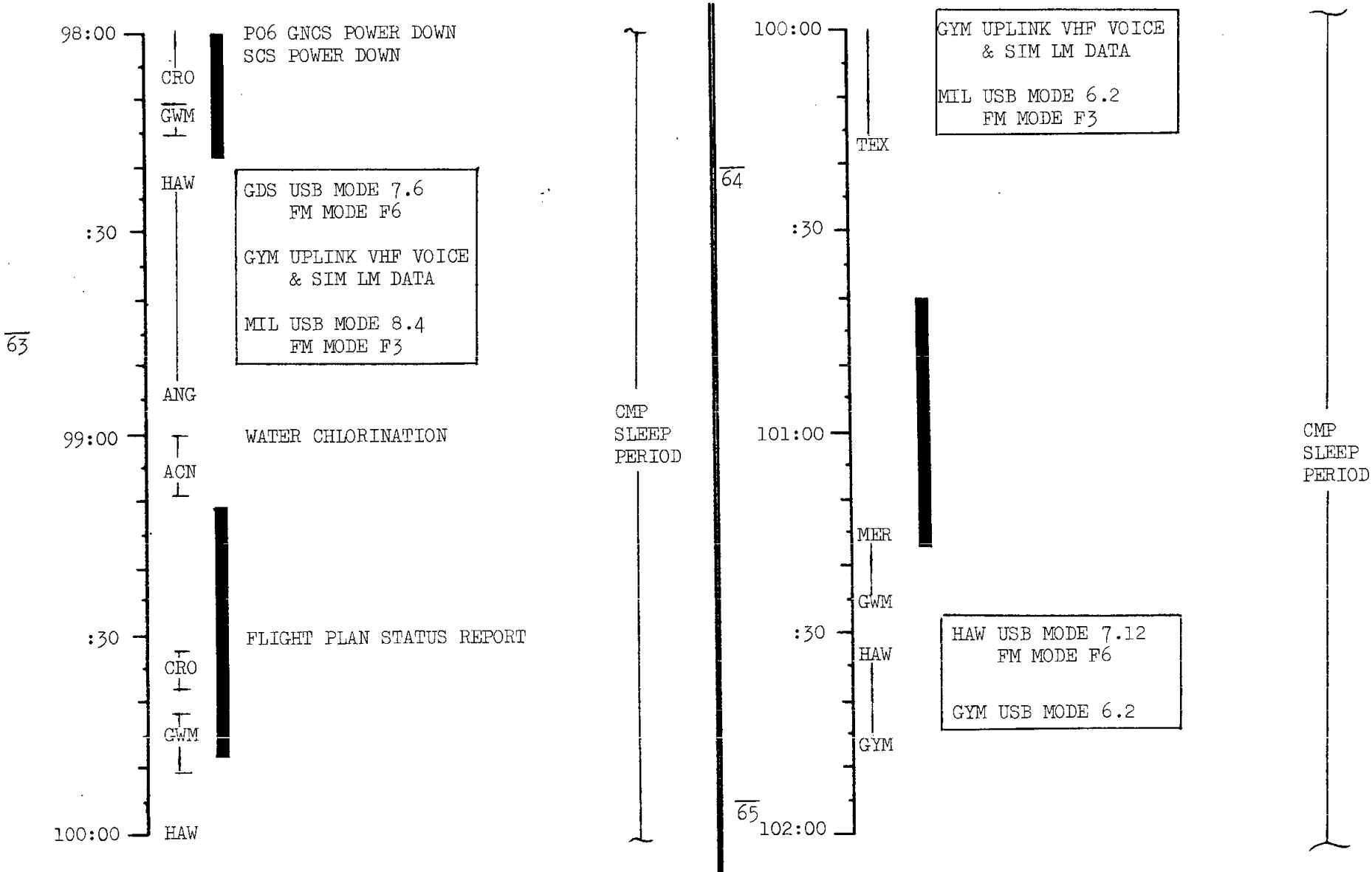
FLIGHT PLAN



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)

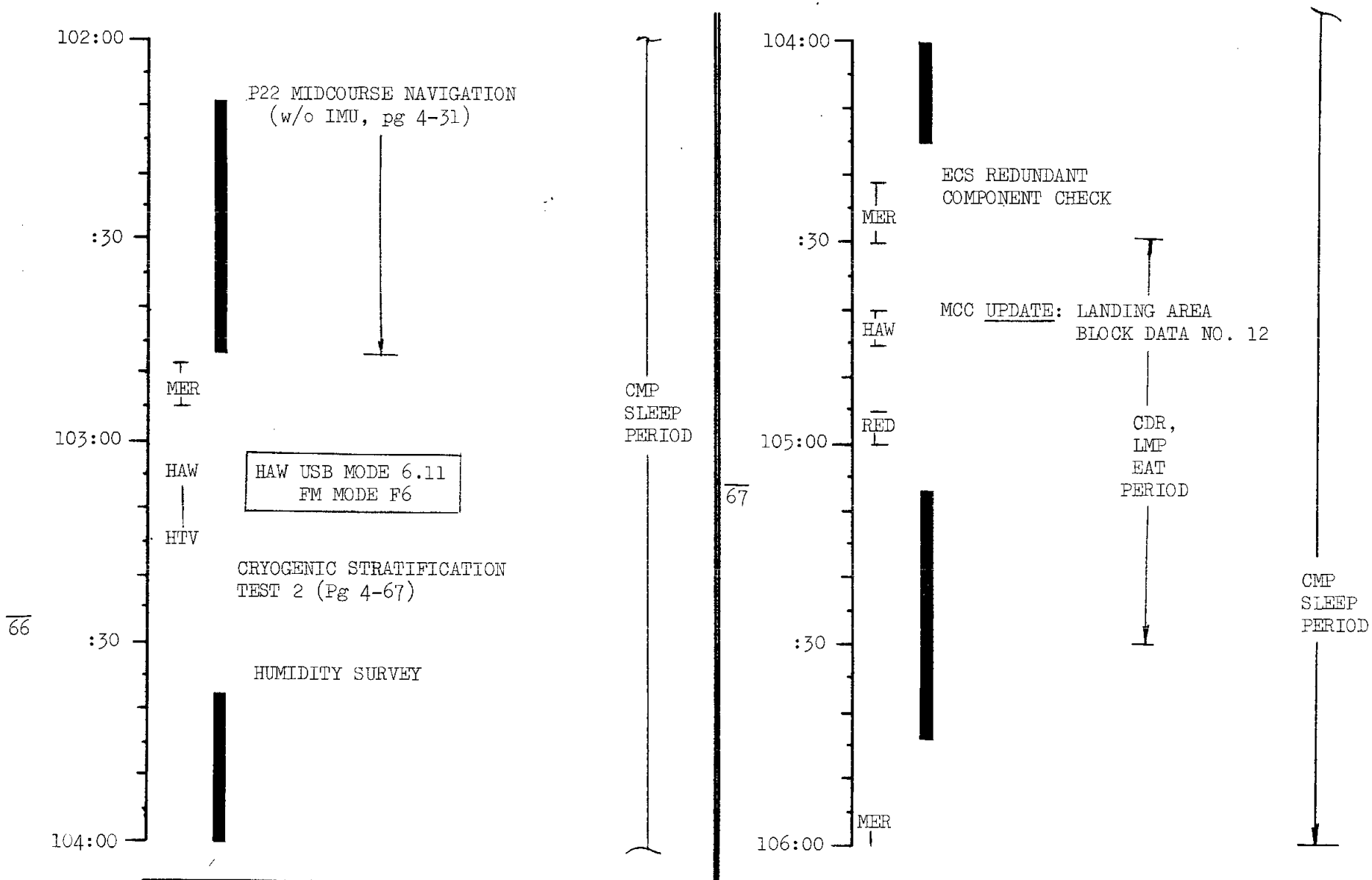
FLIGHT PLAN



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)

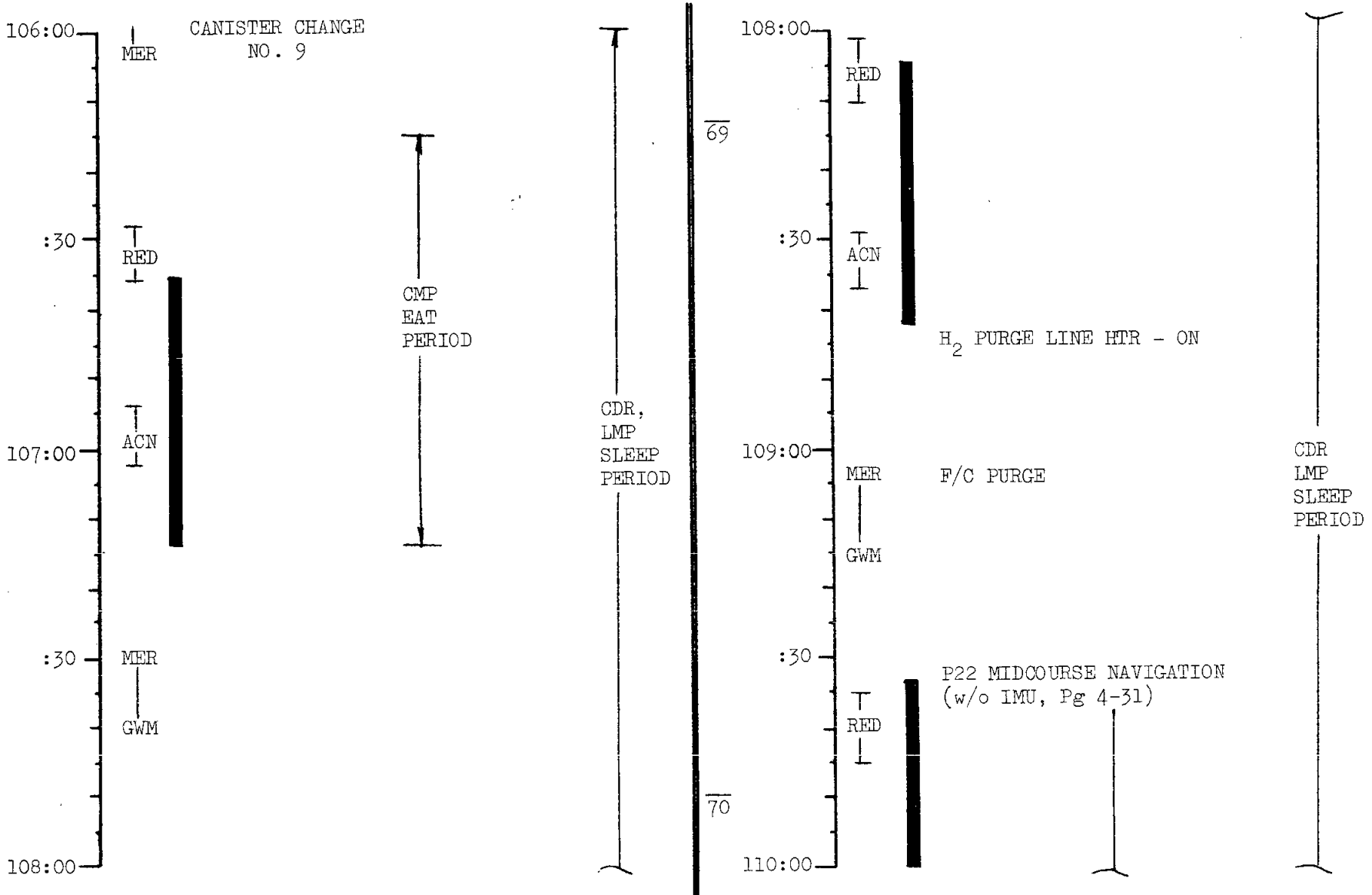
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	102:00-106:00	4/65-67	2-39

MSC FORM 1186 (SEP 67)

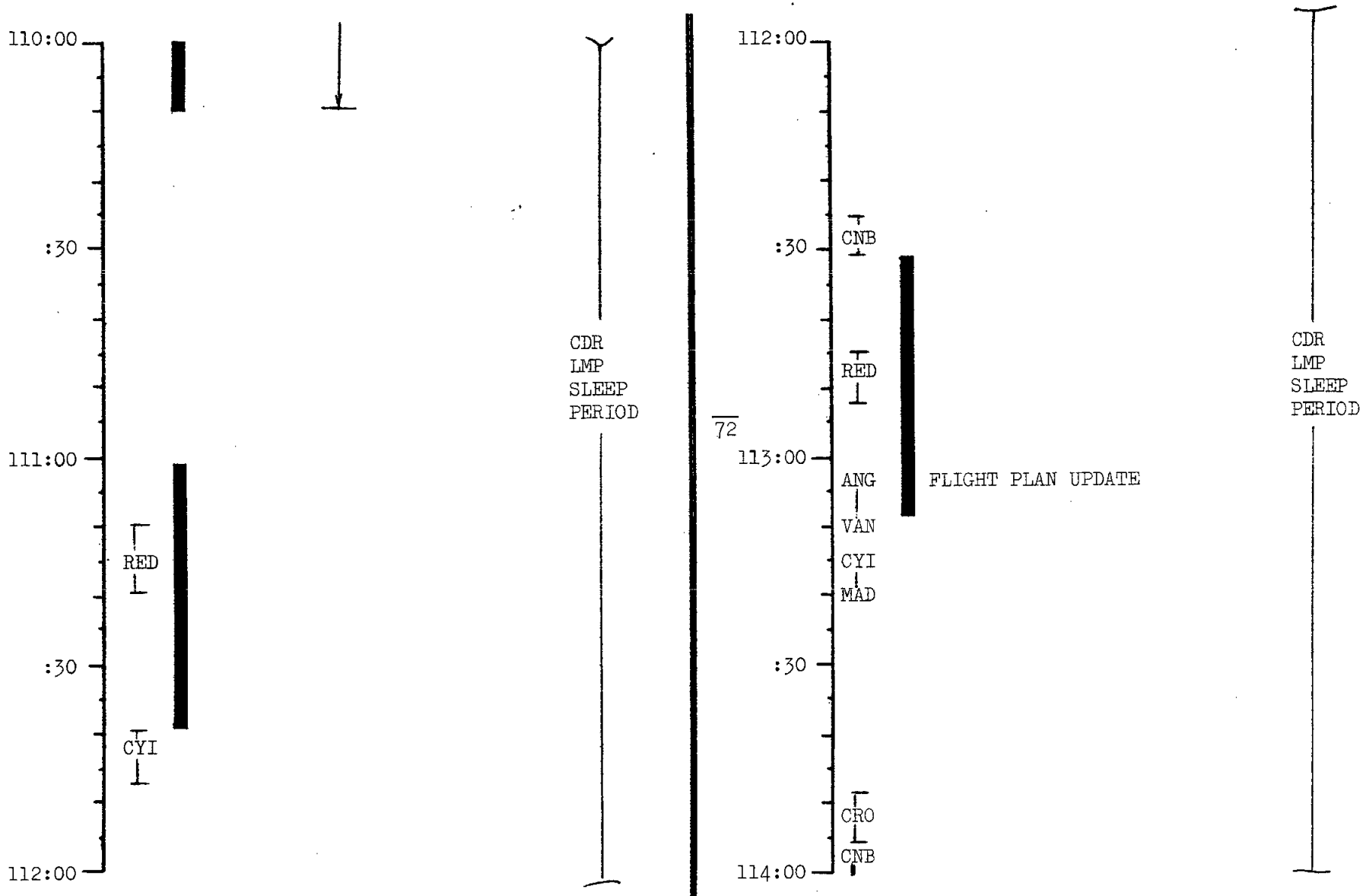
FLIGHT PLAN



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



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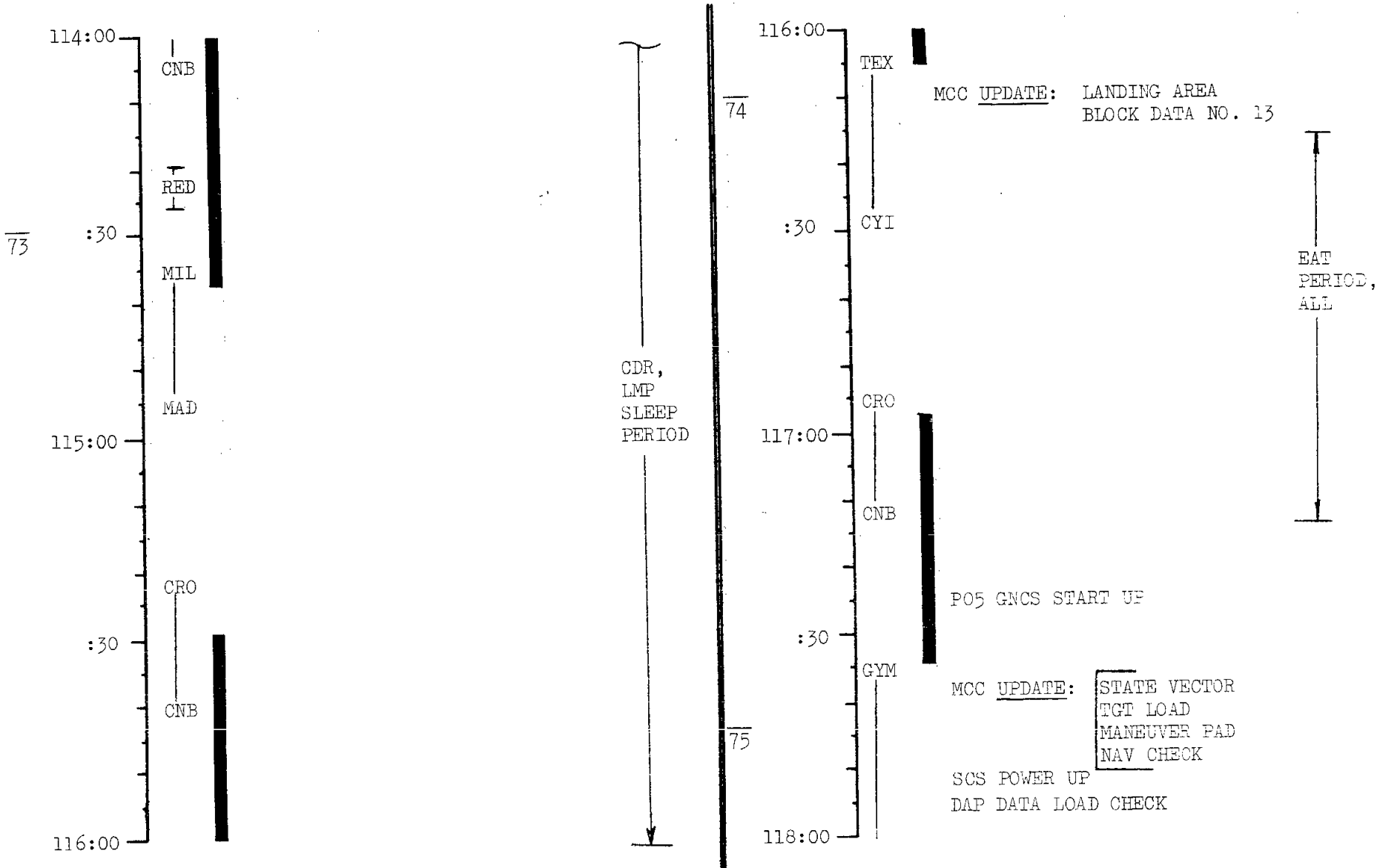
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	110:00-114:00	4/70-72	2-41

MSC FORM 1186 (SEP 67)

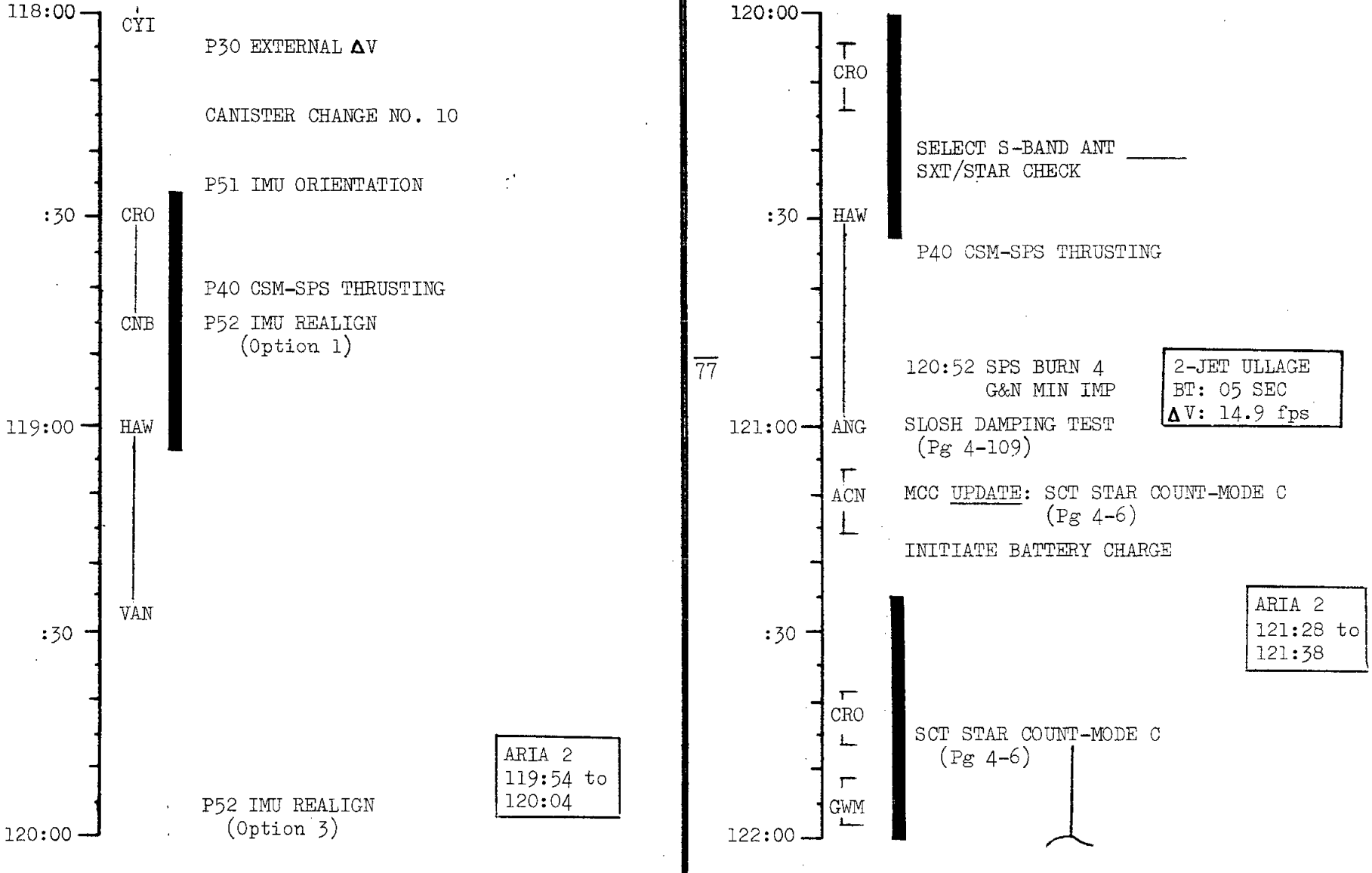
FLIGHT PLAN



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)

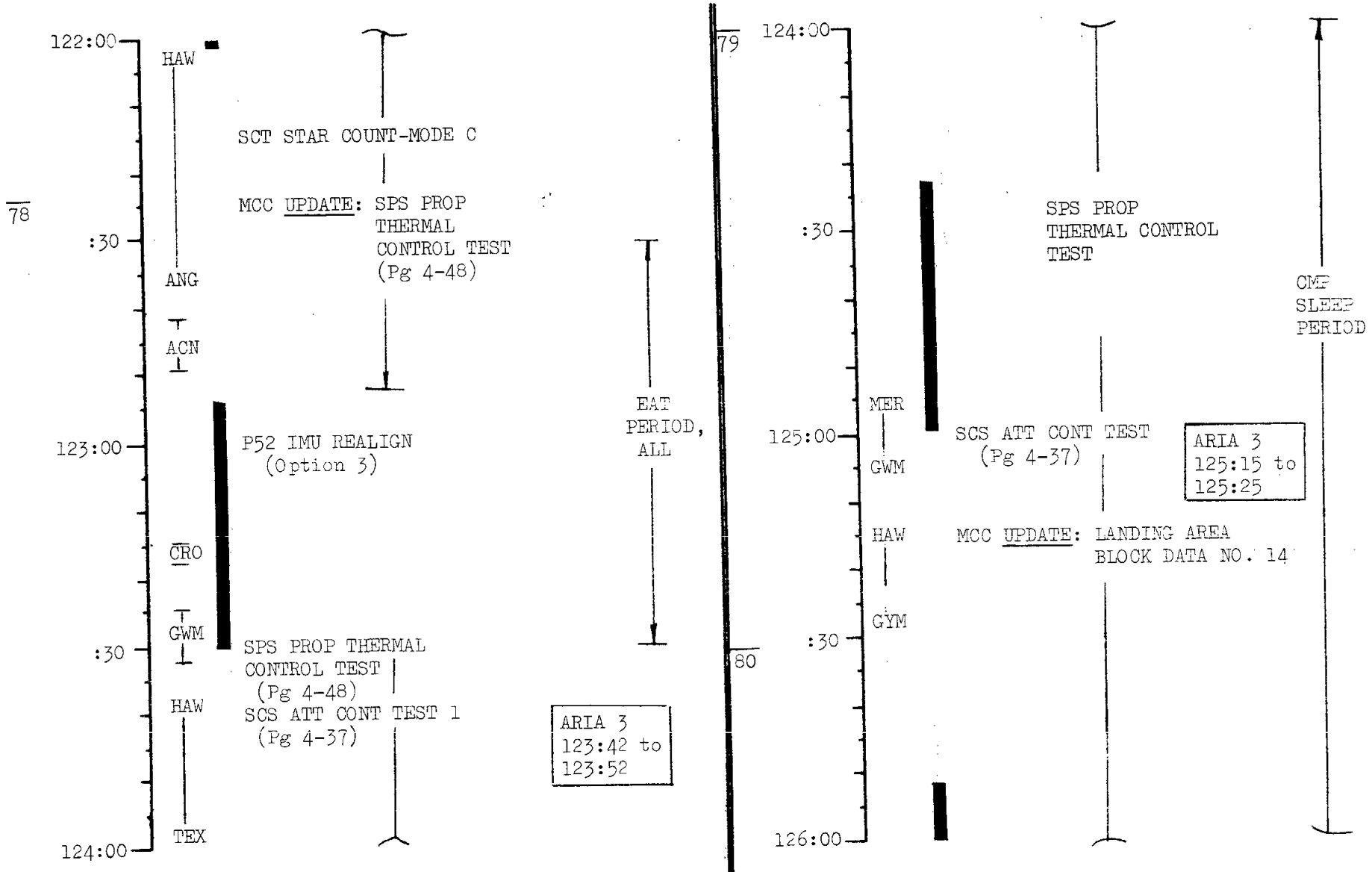
FLIGHT PLAN



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)

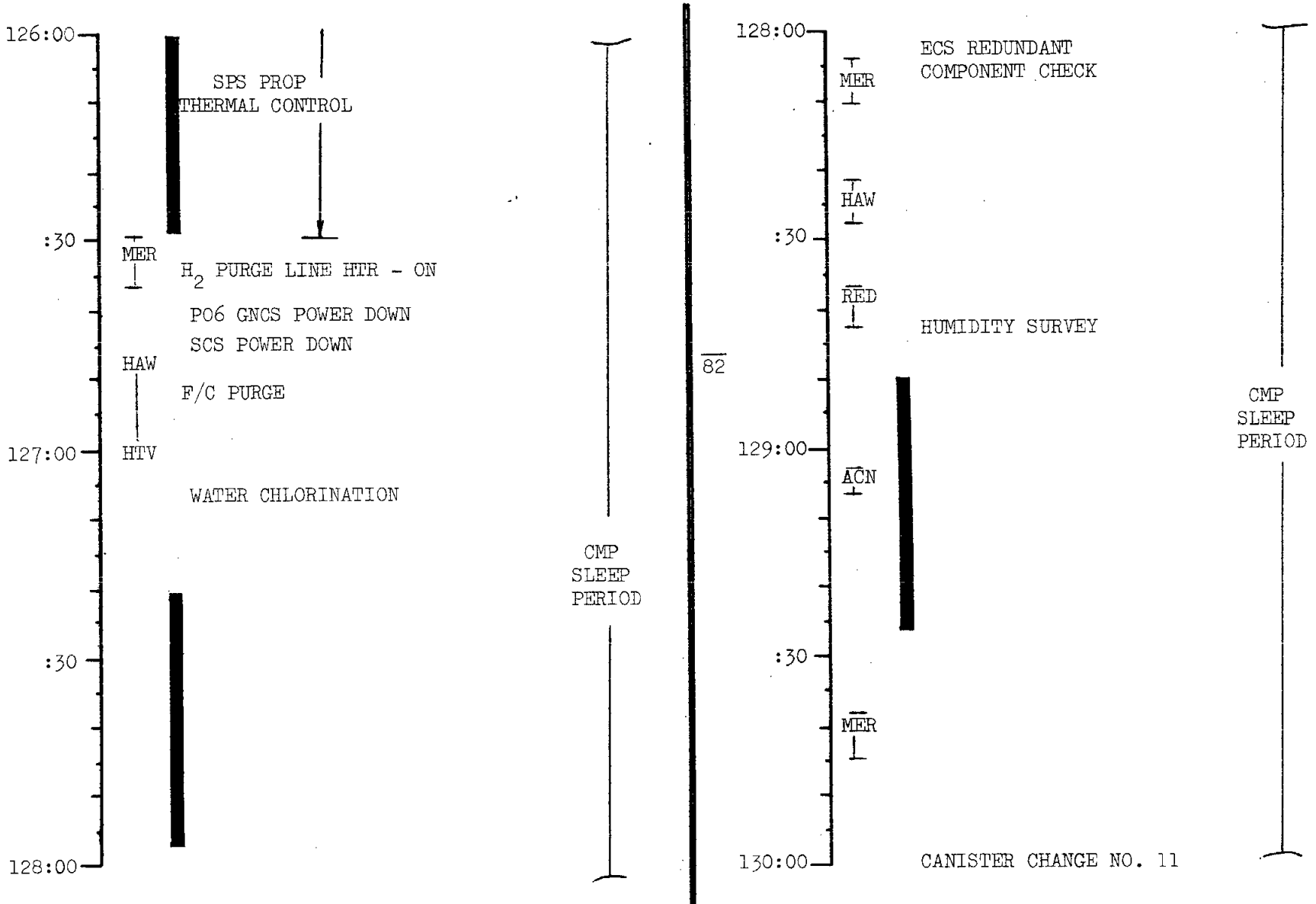
FLIGHT PLAN



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)

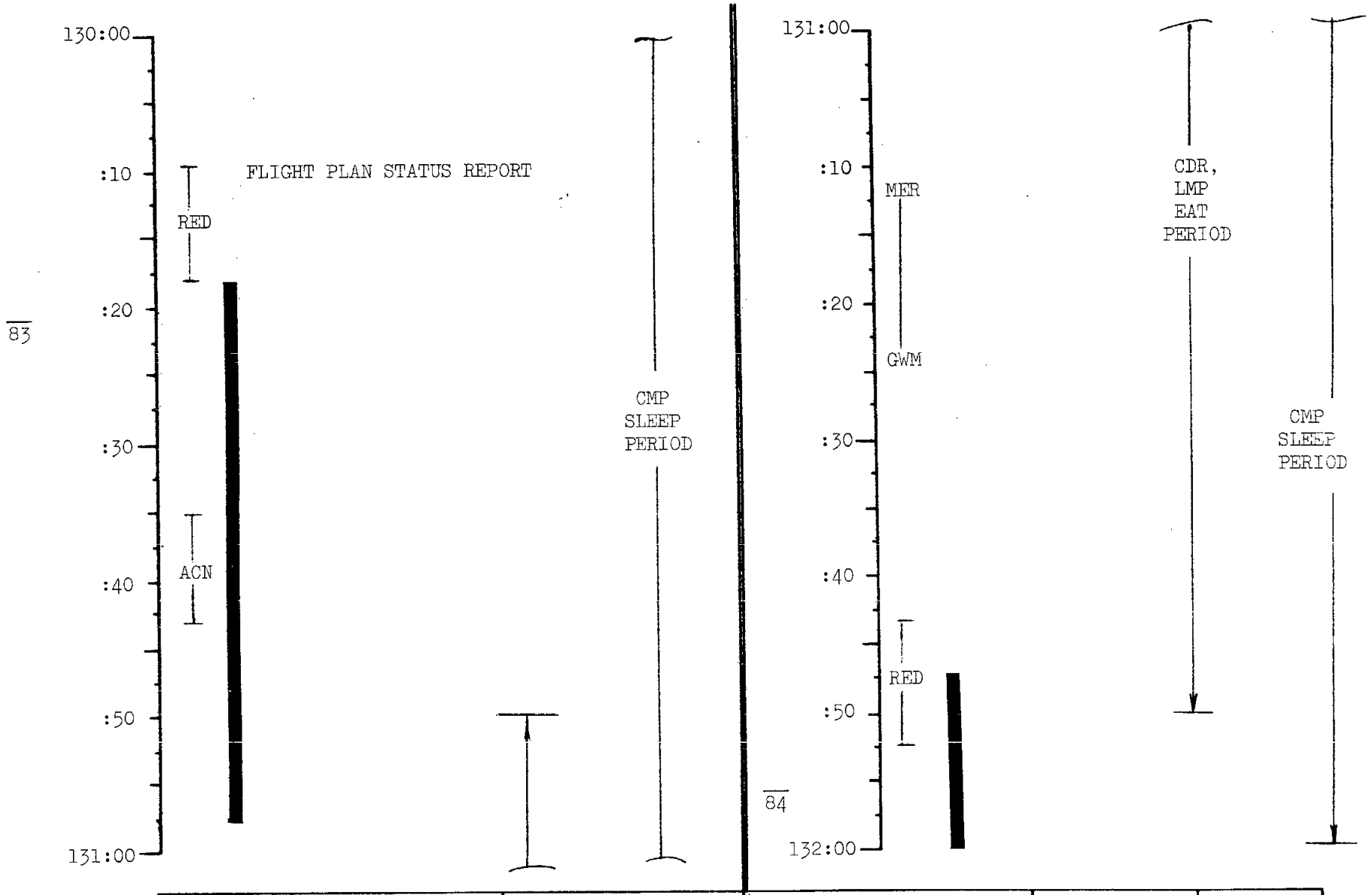
FLIGHT PLAN



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)

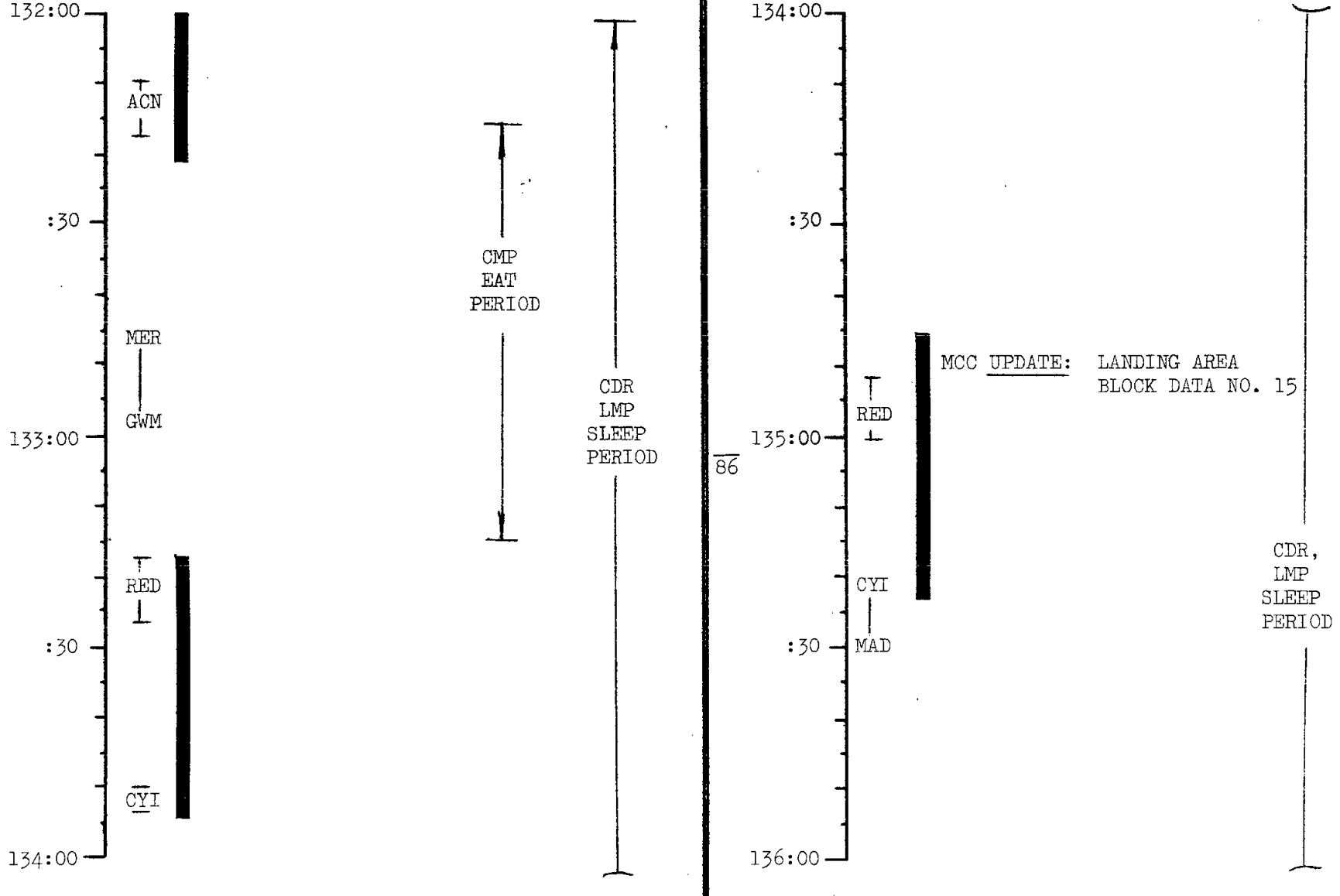
FLIGHT PLAN



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)

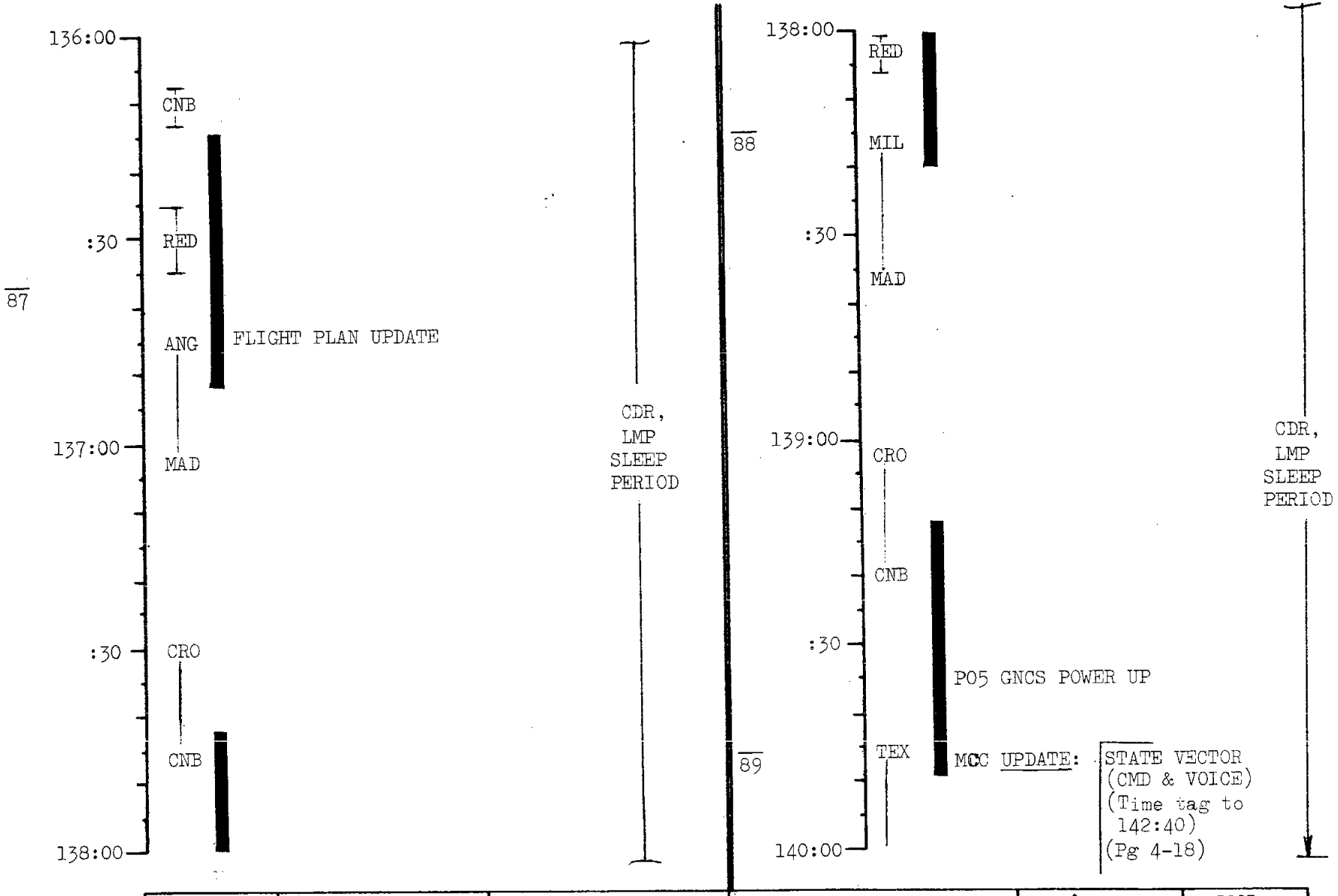
FLIGHT PLAN



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)

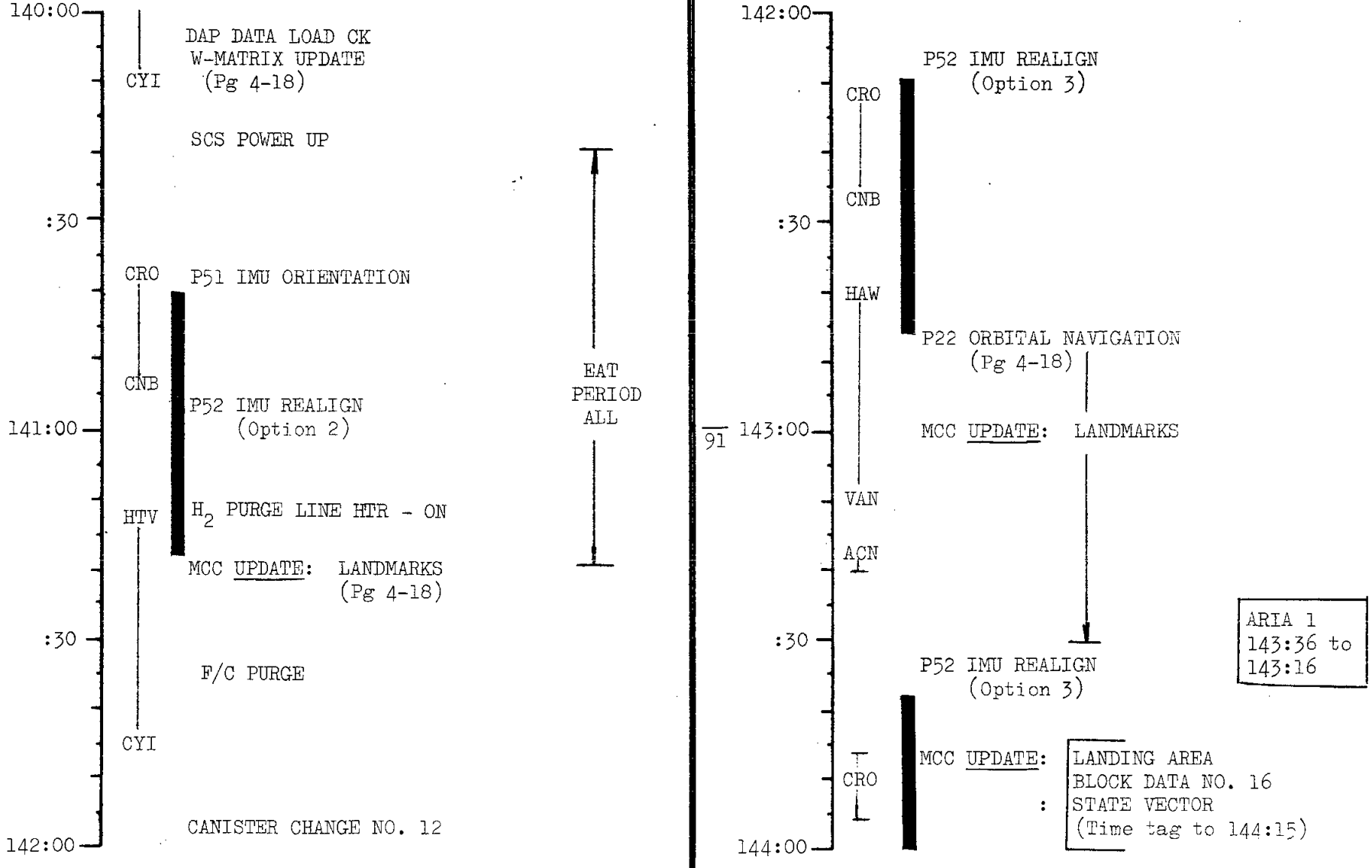
FLIGHT PLAN



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

MSC FORM 1186 (SEP 67)

FLIGHT PLAN



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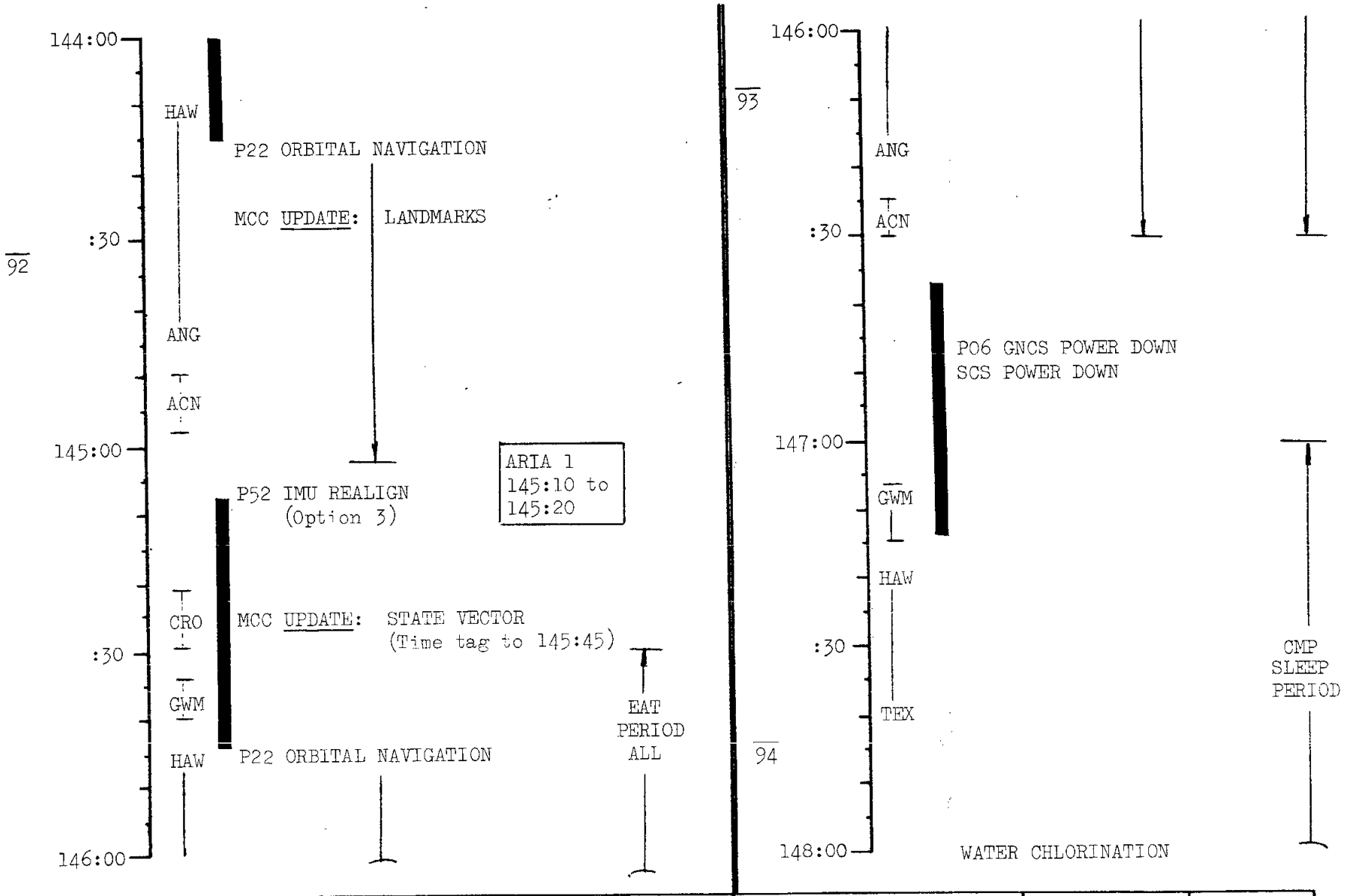
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
AS-205/101	PRELIMINARY	MAY 31, 1968	140:00-144:00	5/89-91	2-49

MSC FORM 1186 (SEP 67)

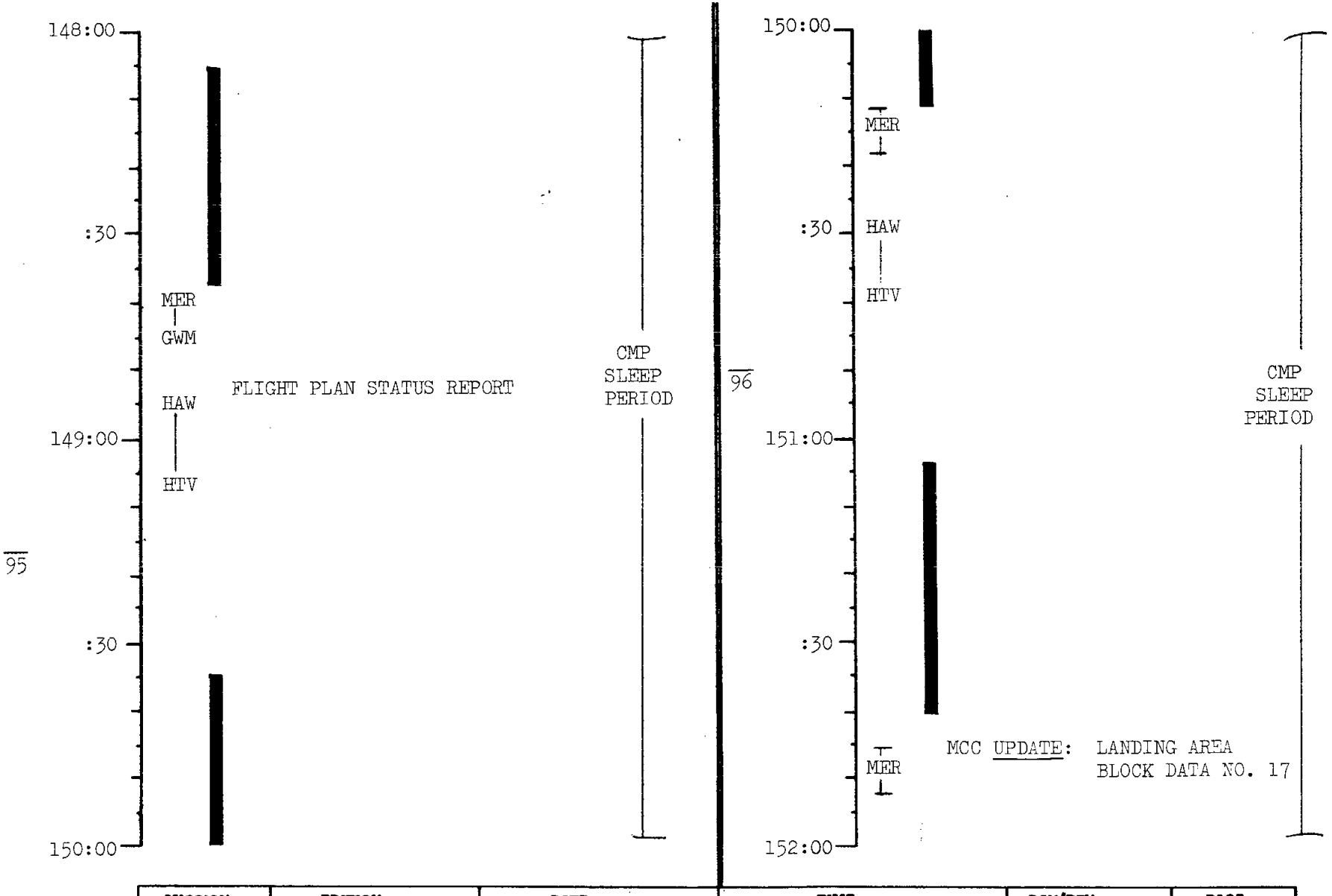
FLIGHT PLAN



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)

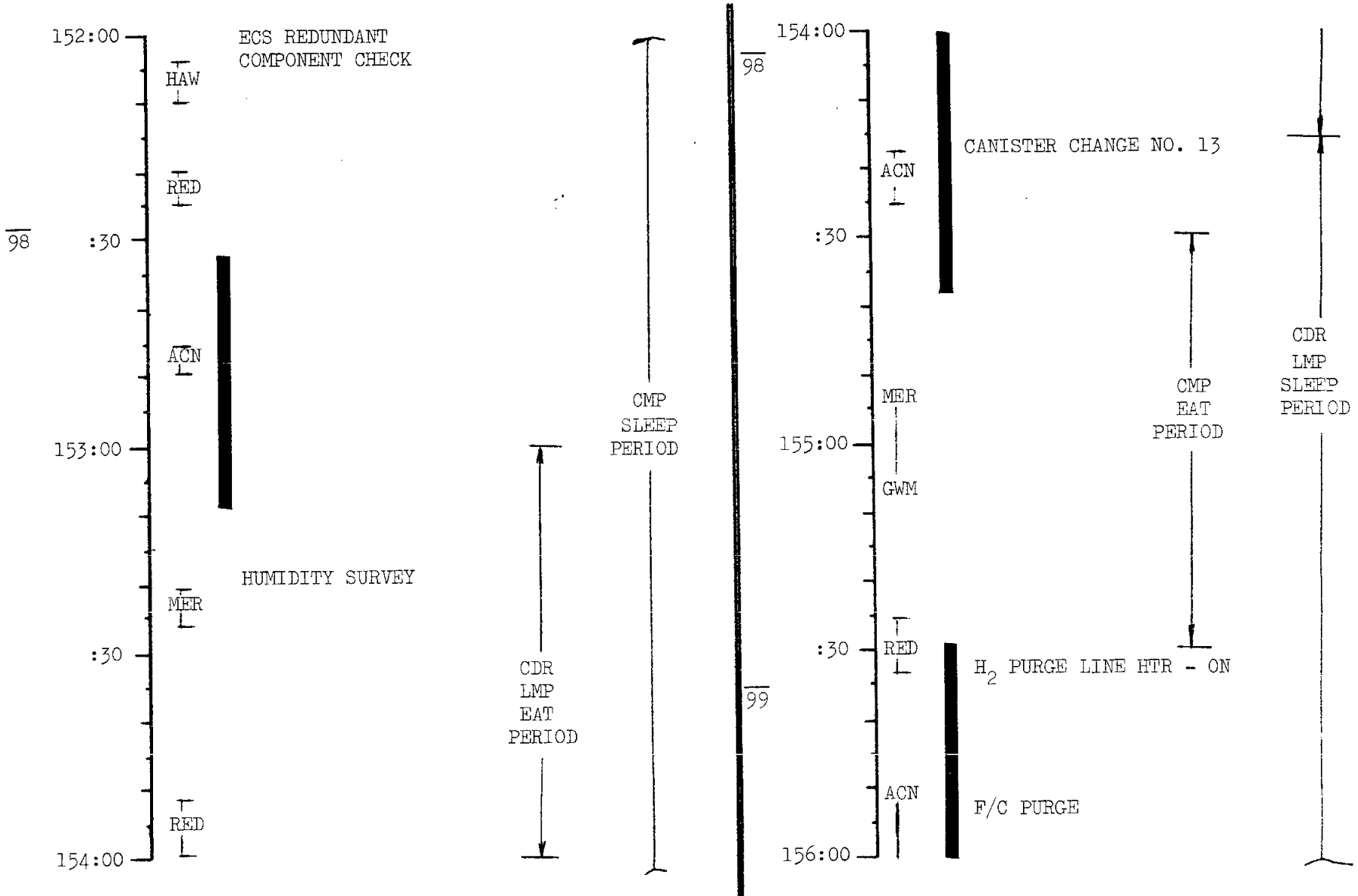
FLIGHT PLAN



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)

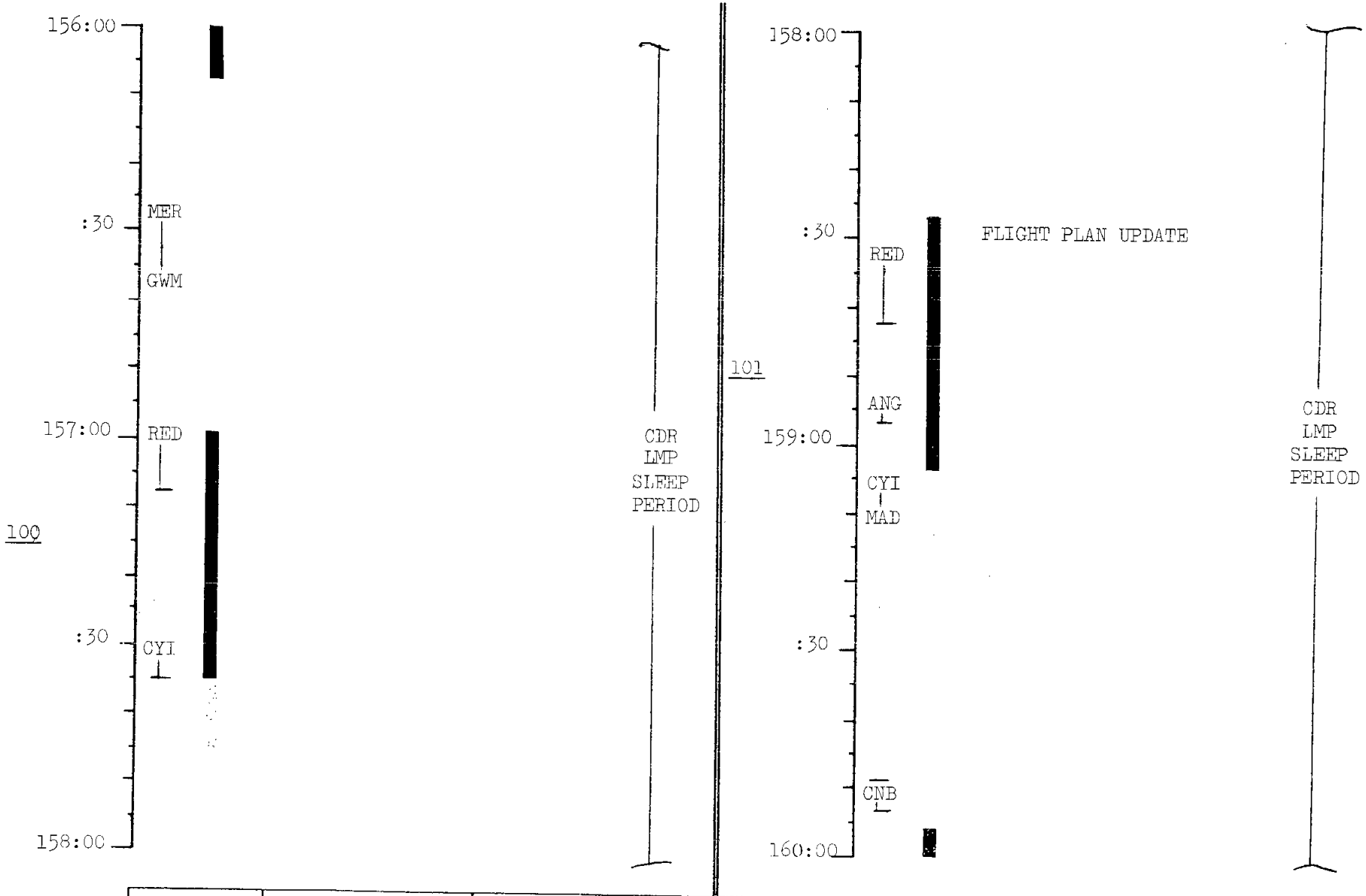
FLIGHT PLAN



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)

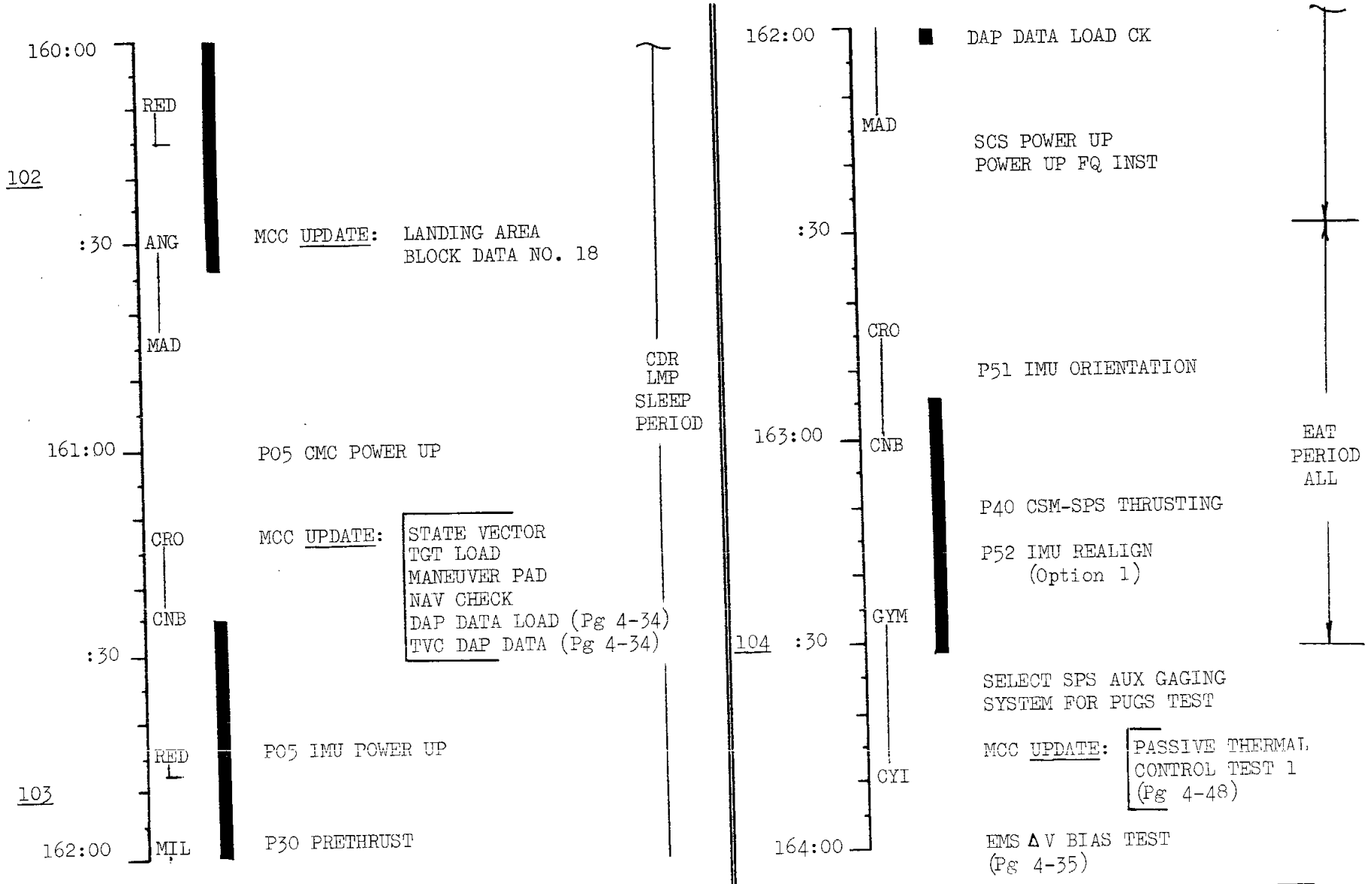
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	156-160	6/99-101	2-53

MSC FORM 1186 (SEP 67)

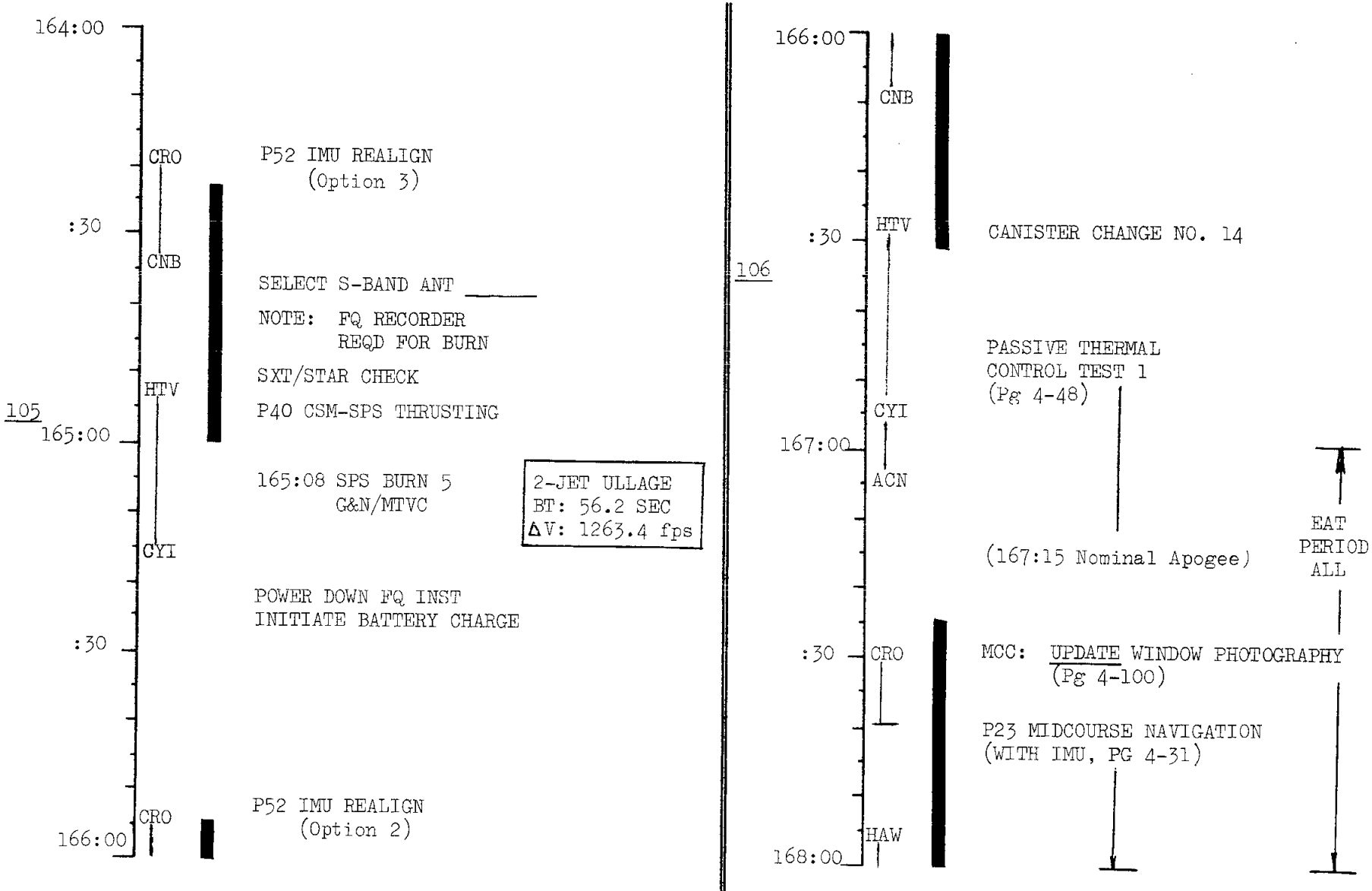
FLIGHT PLAN



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

MSC FORM 1186 (SEP 67)

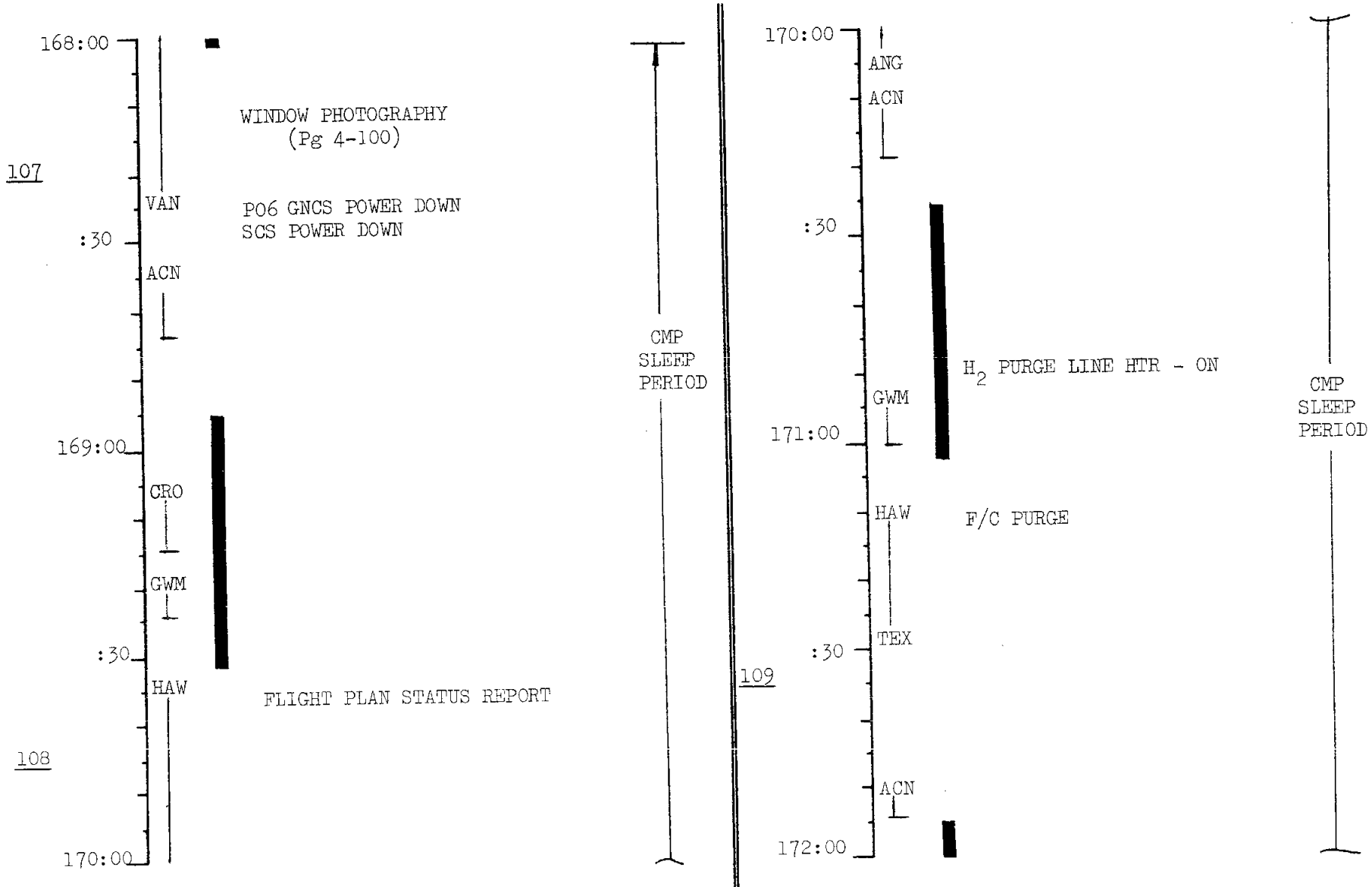
FLIGHT PLAN



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

MSC FORM 1186 (SEP 67)

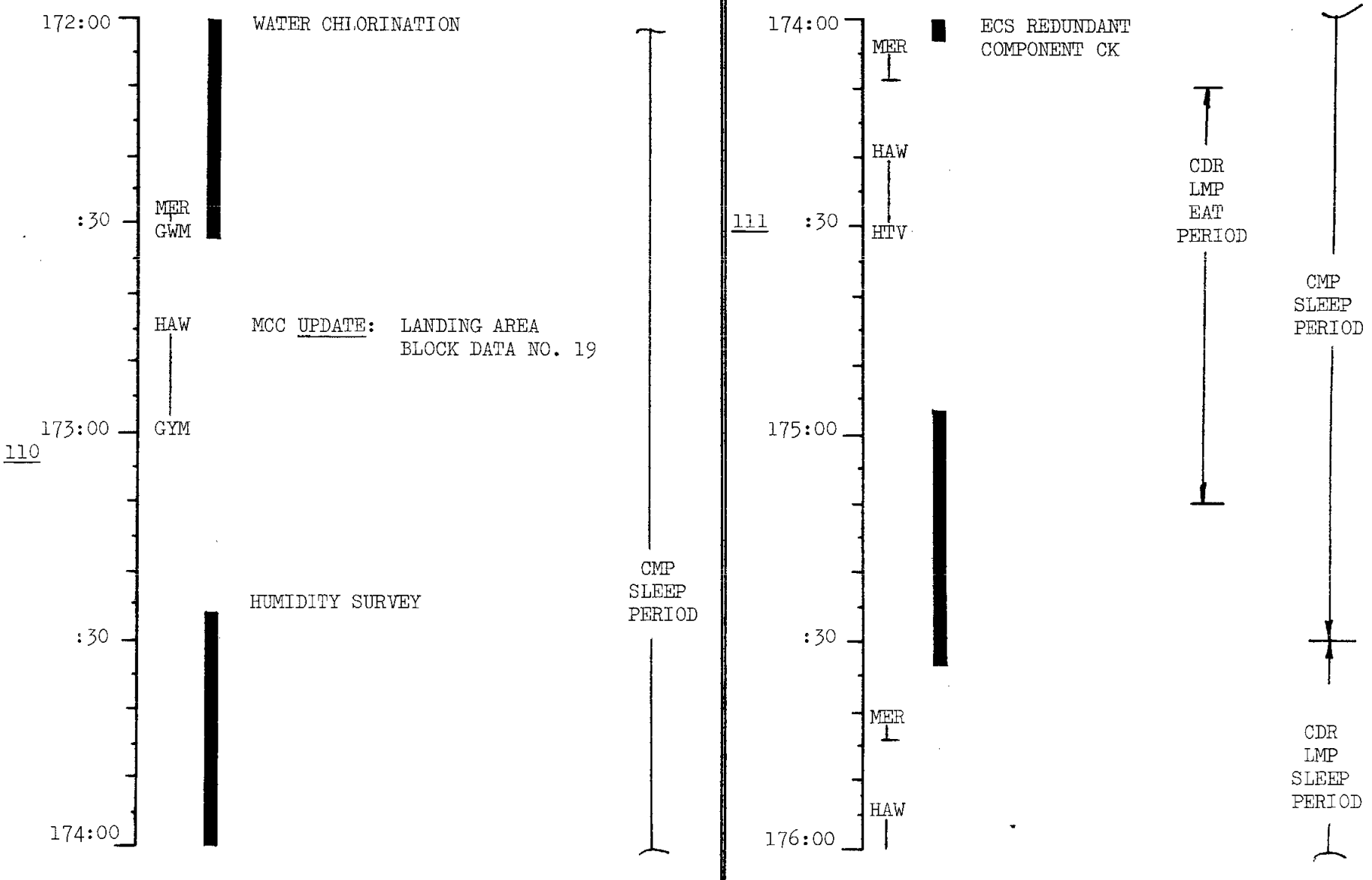
FLIGHT PLAN



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

MSC FORM 1186 (SEP 67)

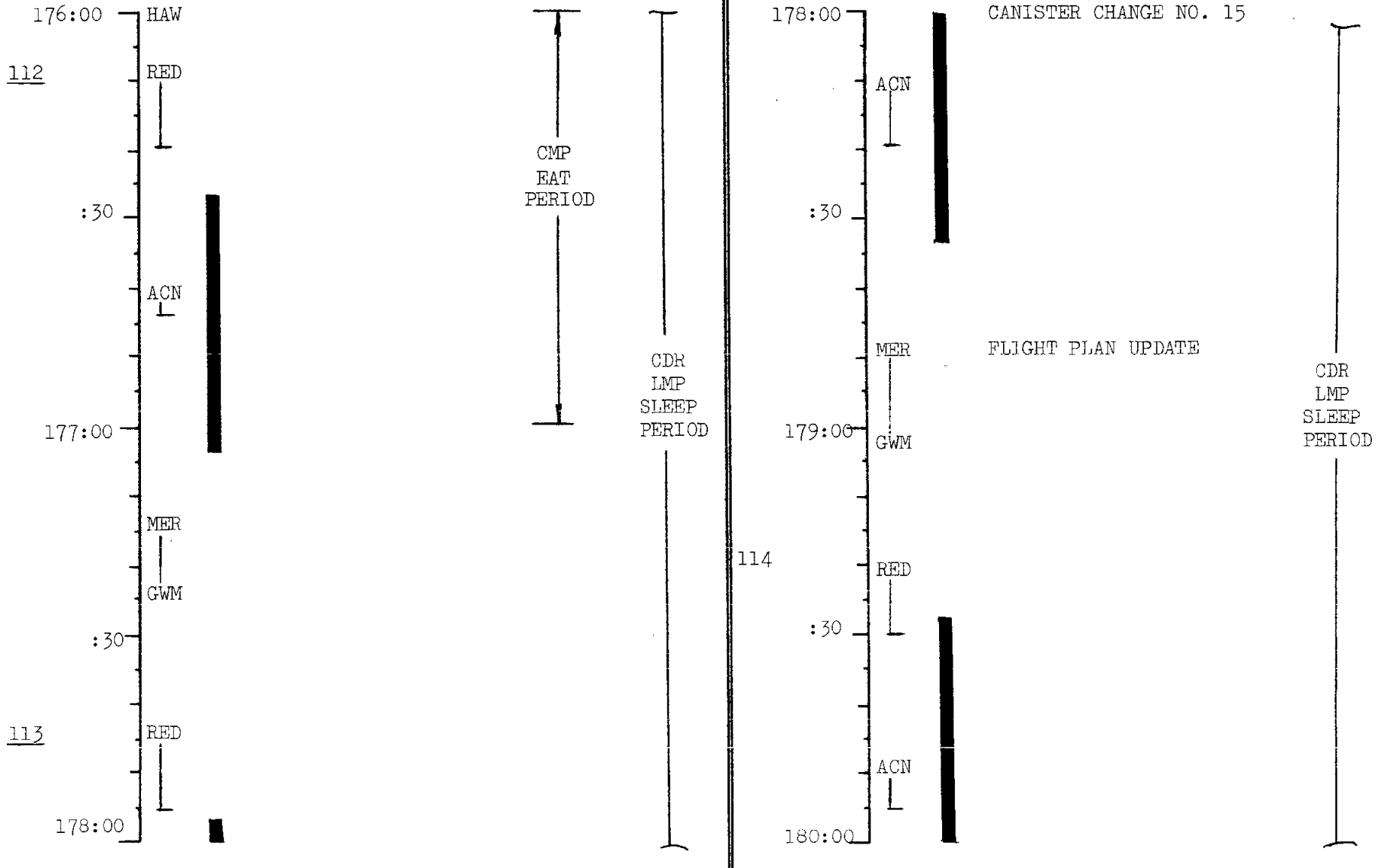
FLIGHT PLAN



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)

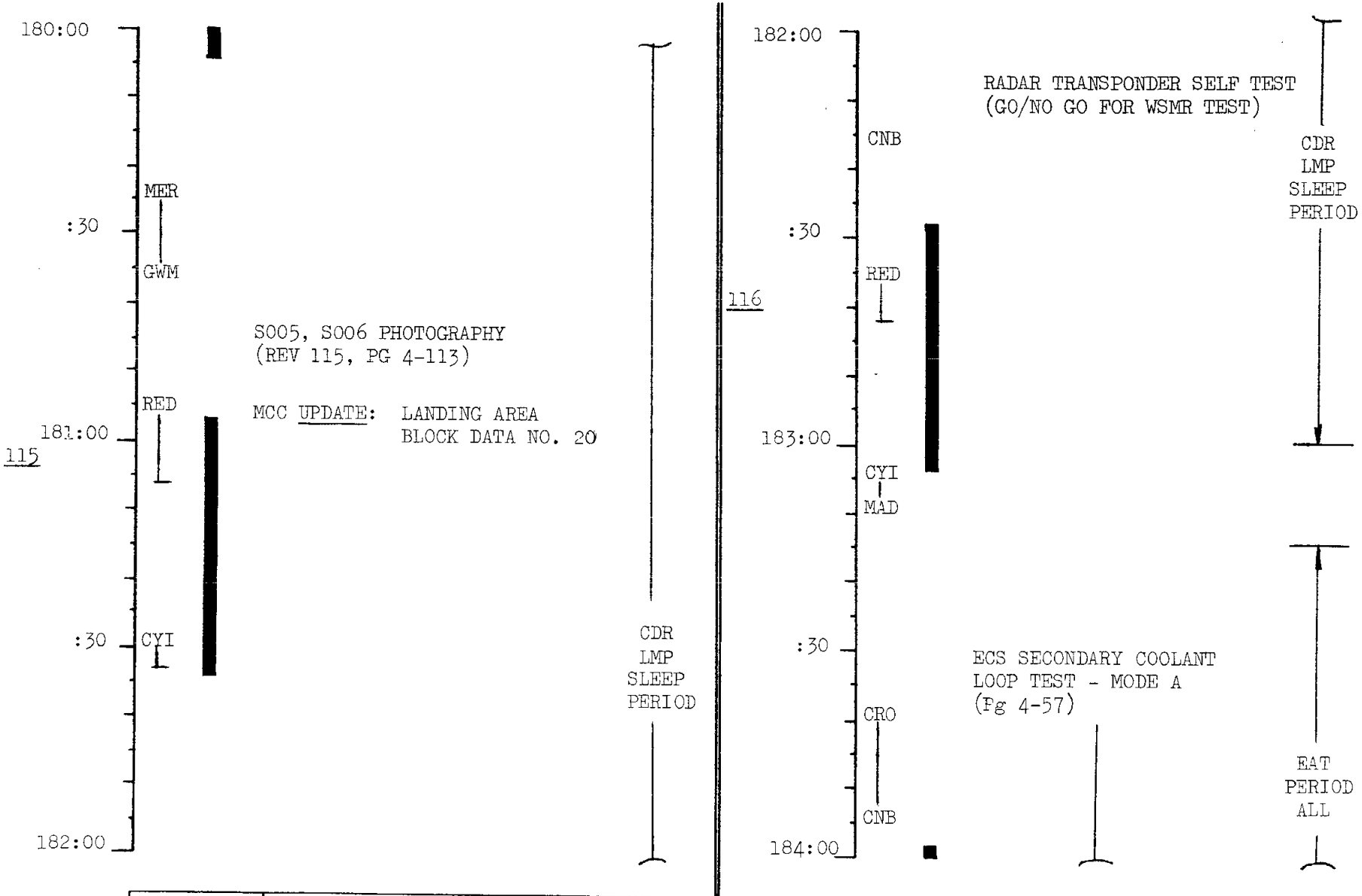
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	176-180	7/111-114	2-58

MSC FORM 1186 (SEP 67)

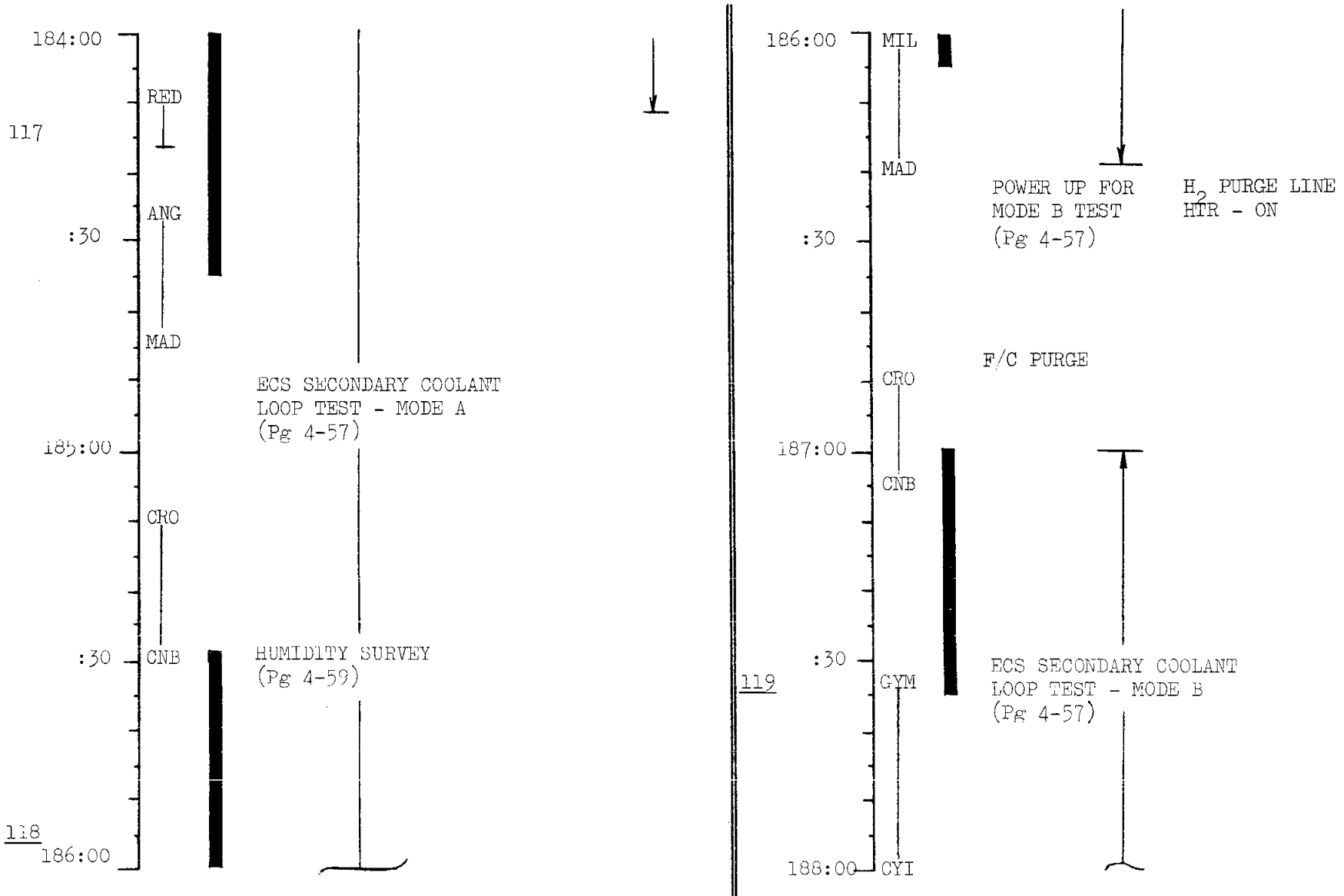
FLIGHT PLAN



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

MSC FORM 1186 (SEP 67)

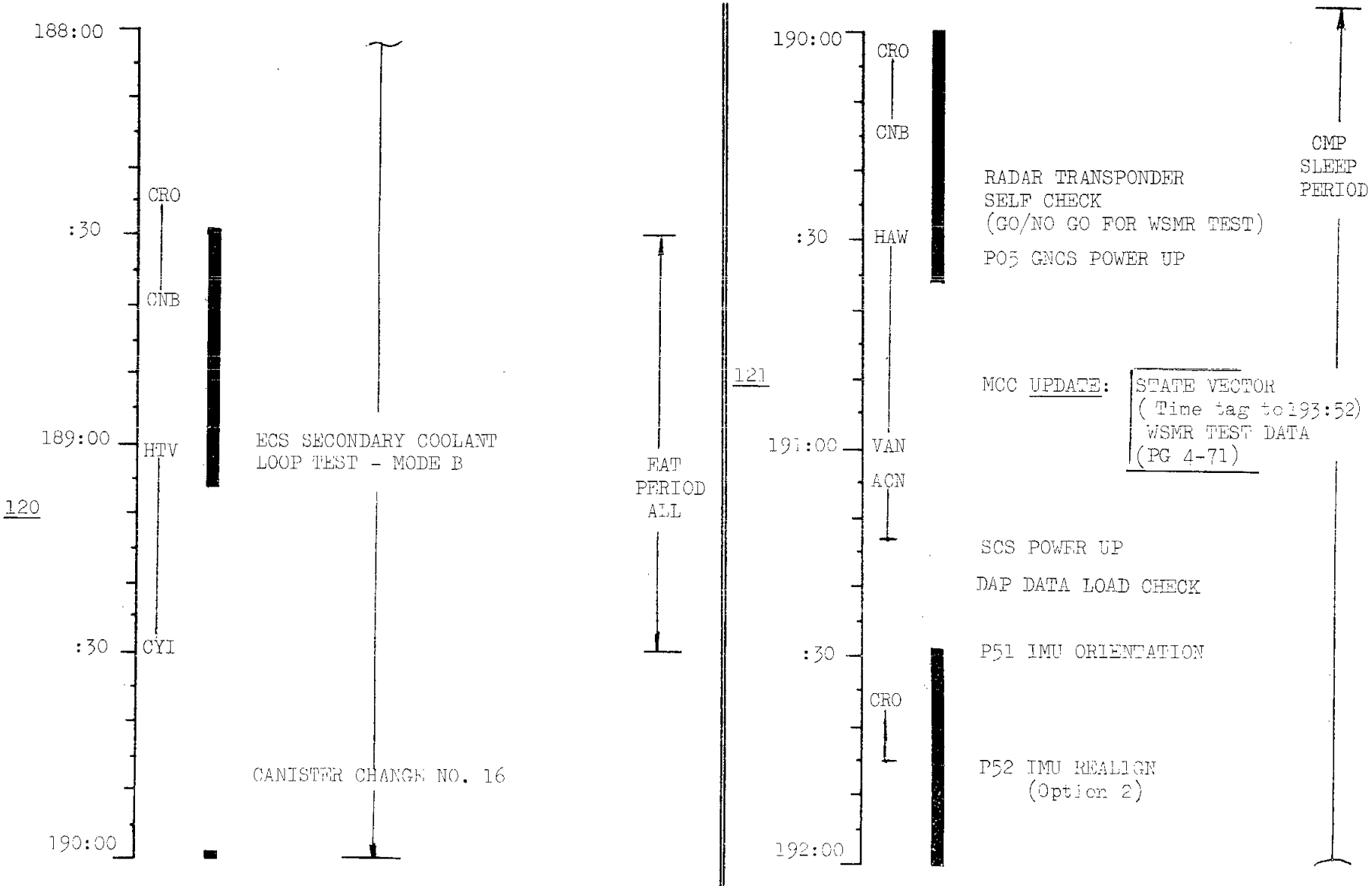
FLIGHT PLAN



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)

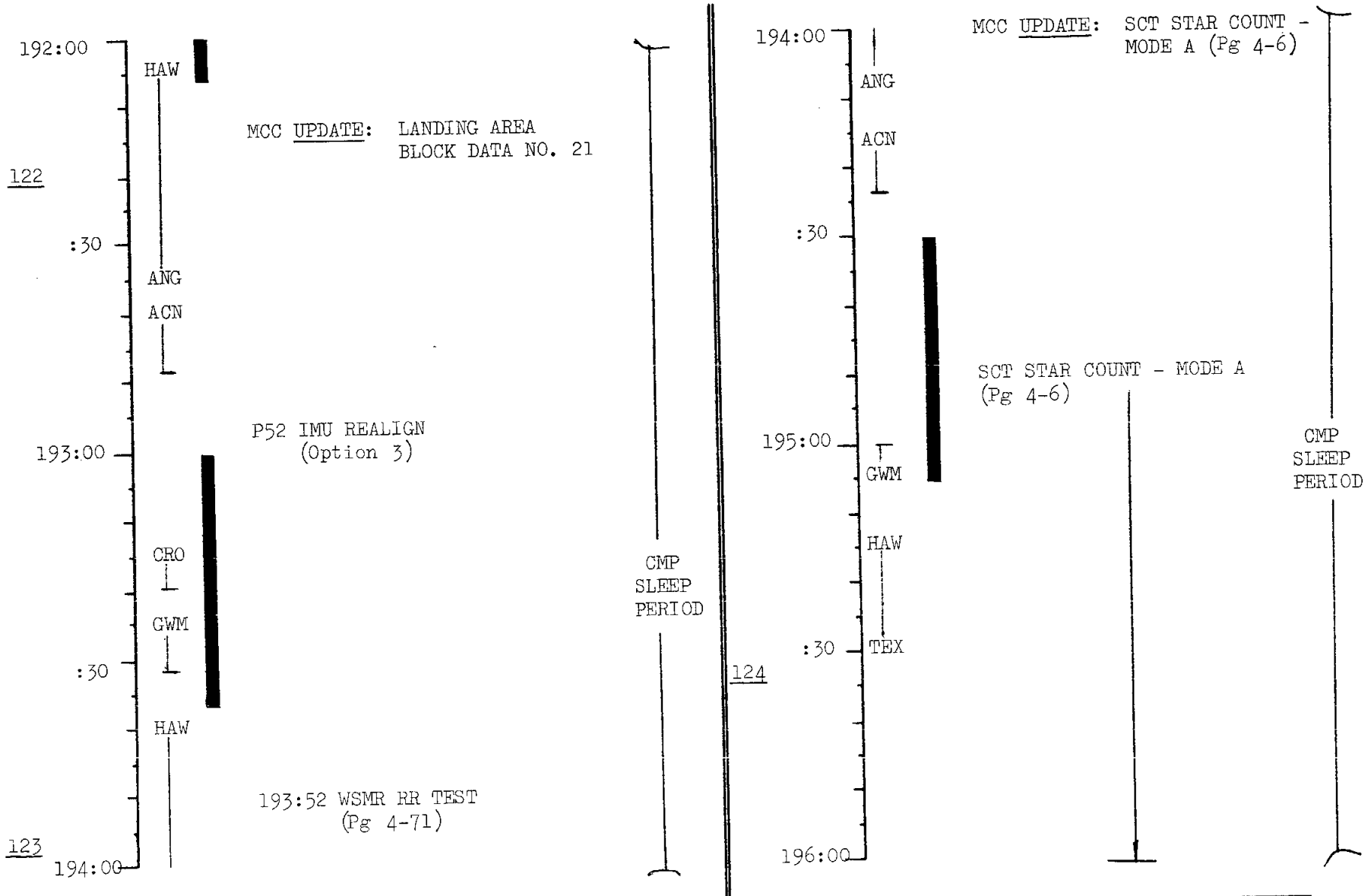
FLIGHT PLAN



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)

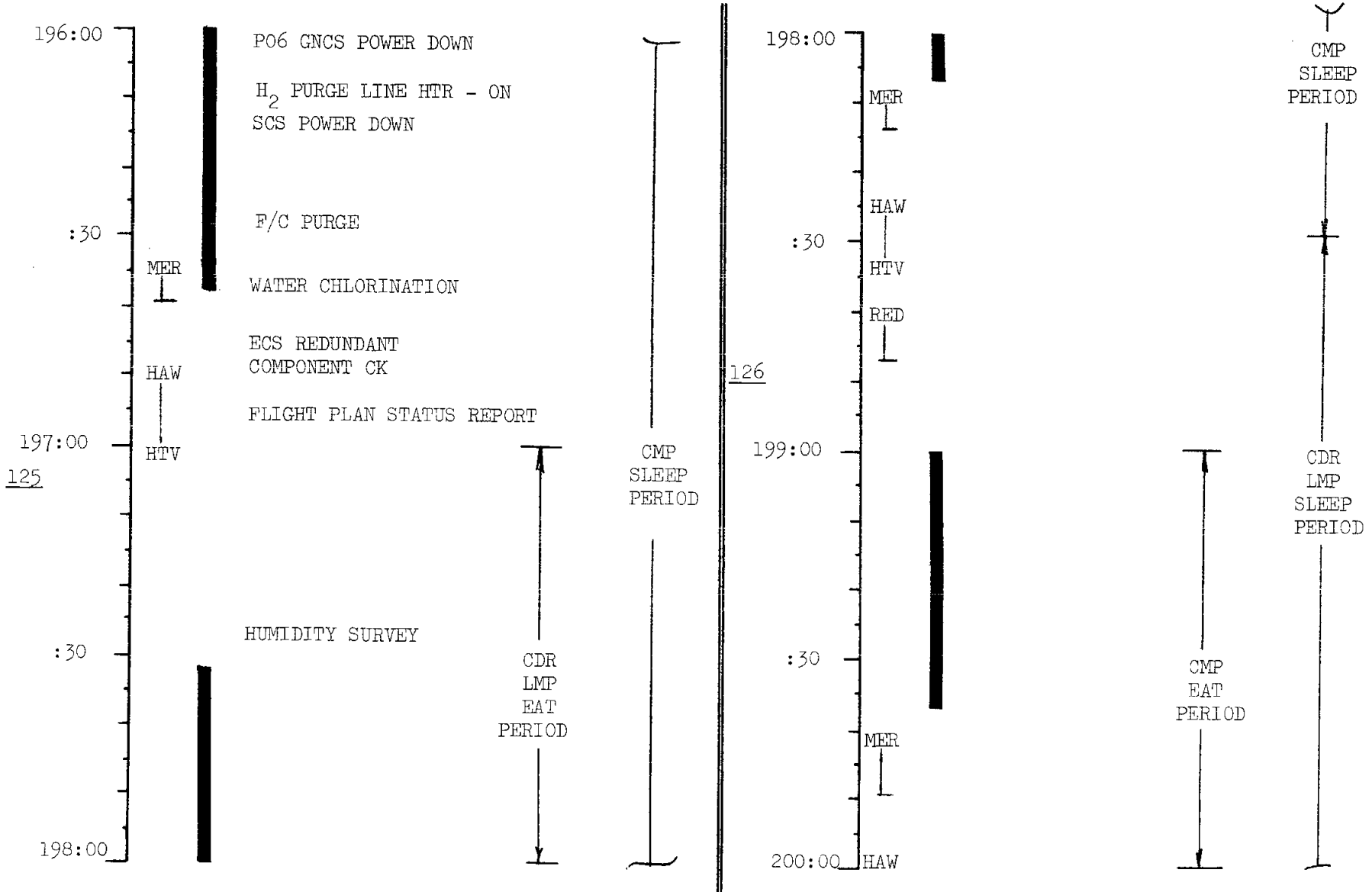
FLIGHT PLAN



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)

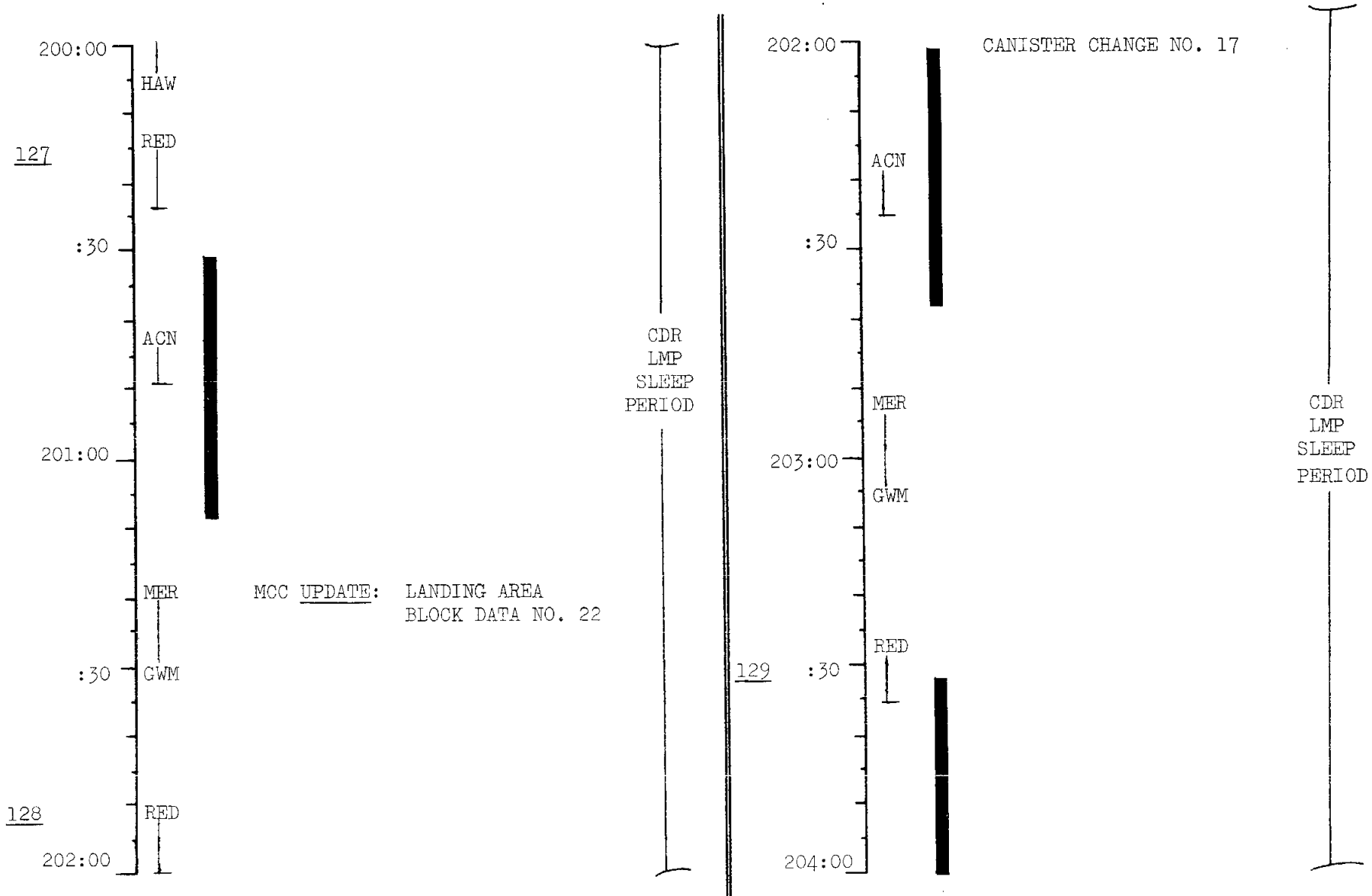
FLIGHT PLAN



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)

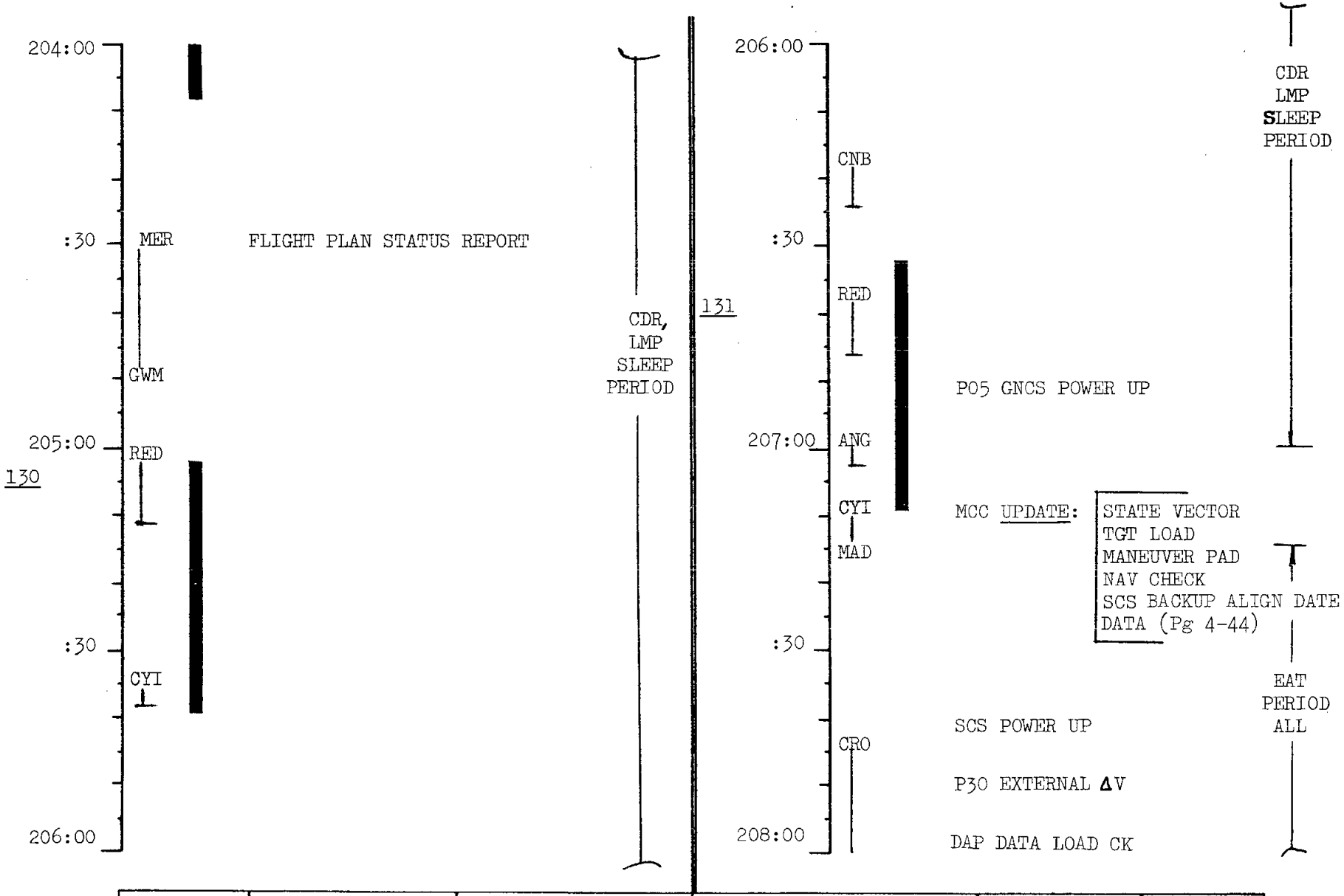
FLIGHT PLAN



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)

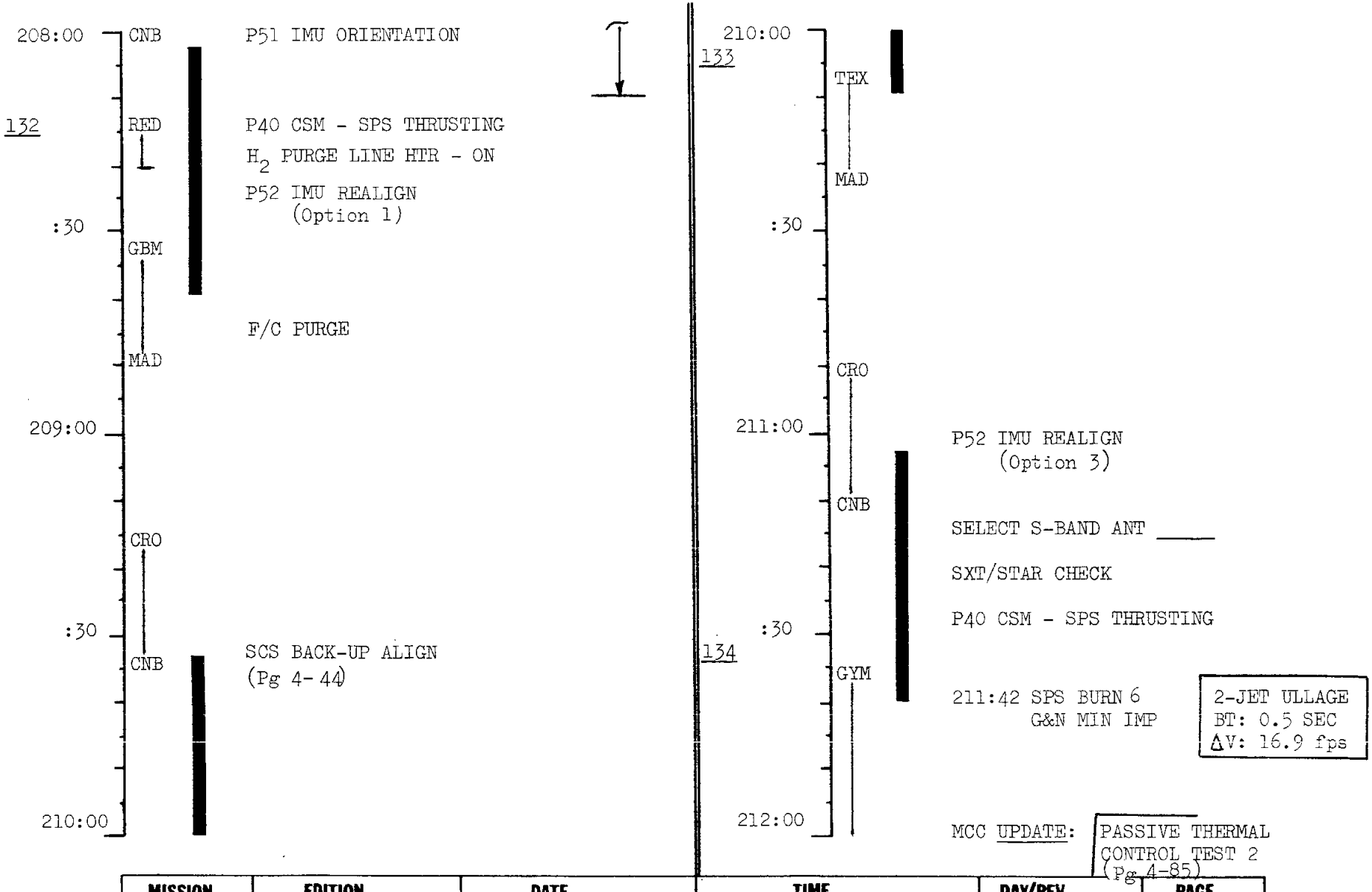
FLIGHT PLAN



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)

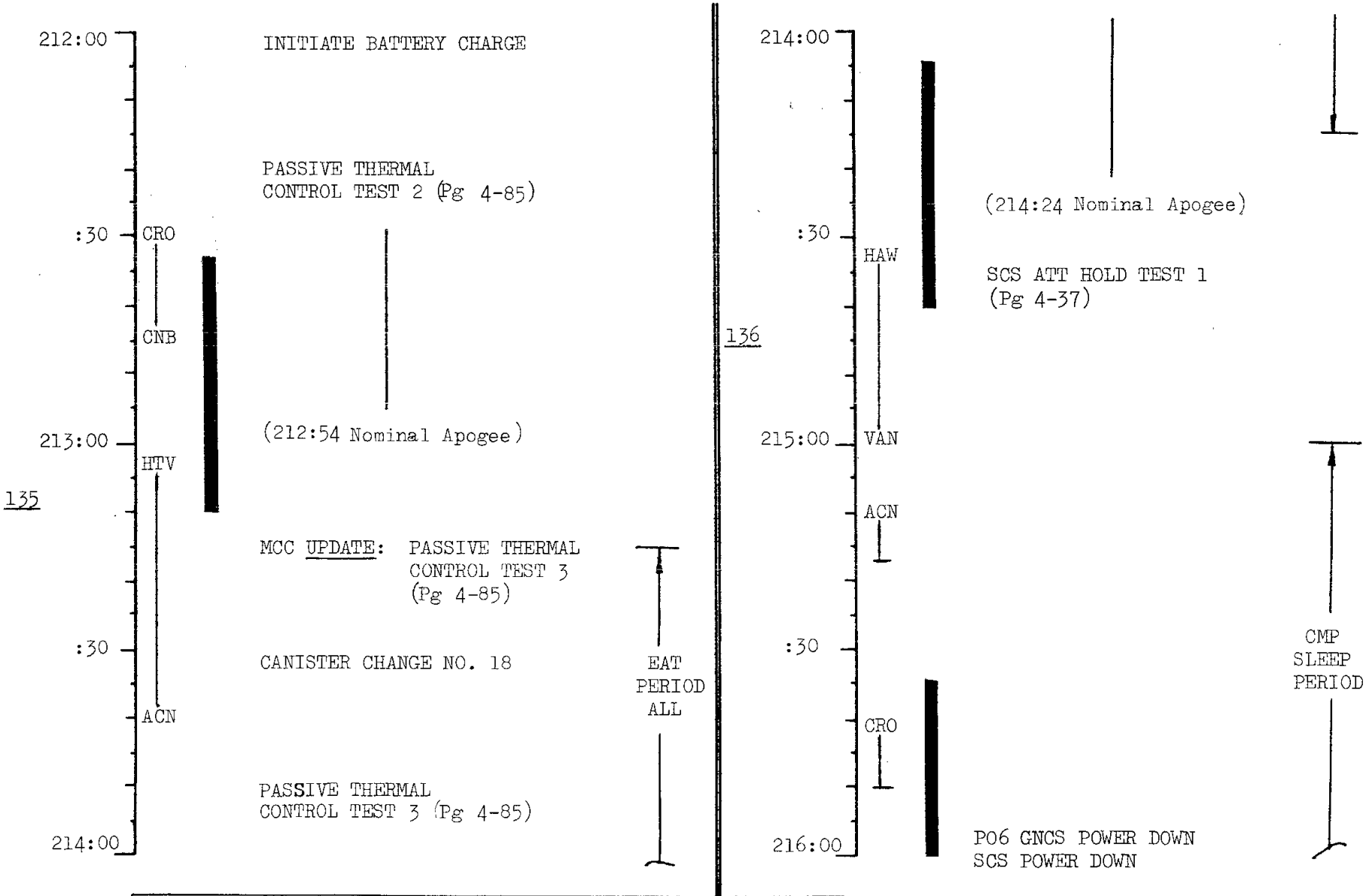
FLIGHT PLAN



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)

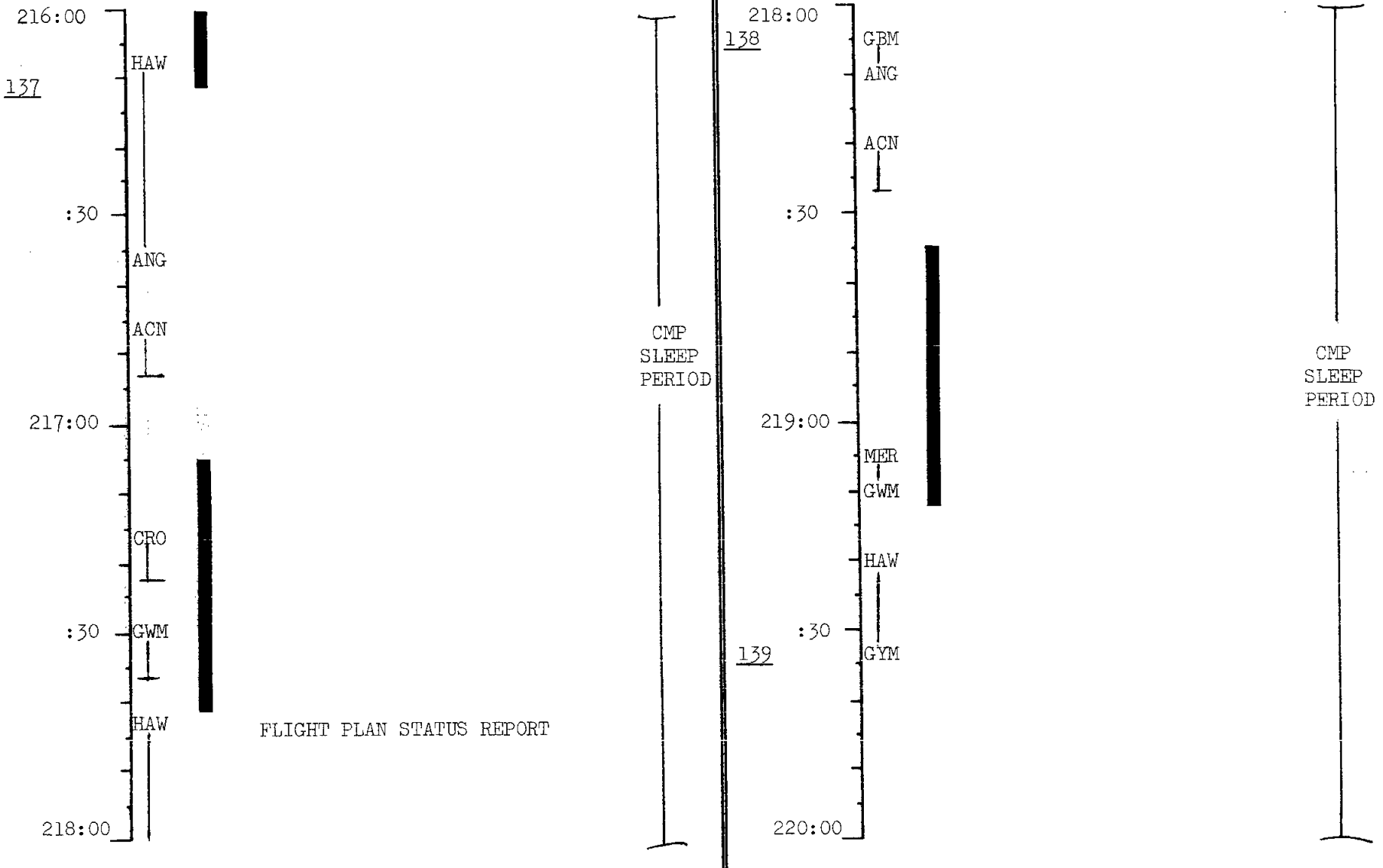
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	212-216	8/134-136	2-67

MSC FORM 1186 (SEP 67)

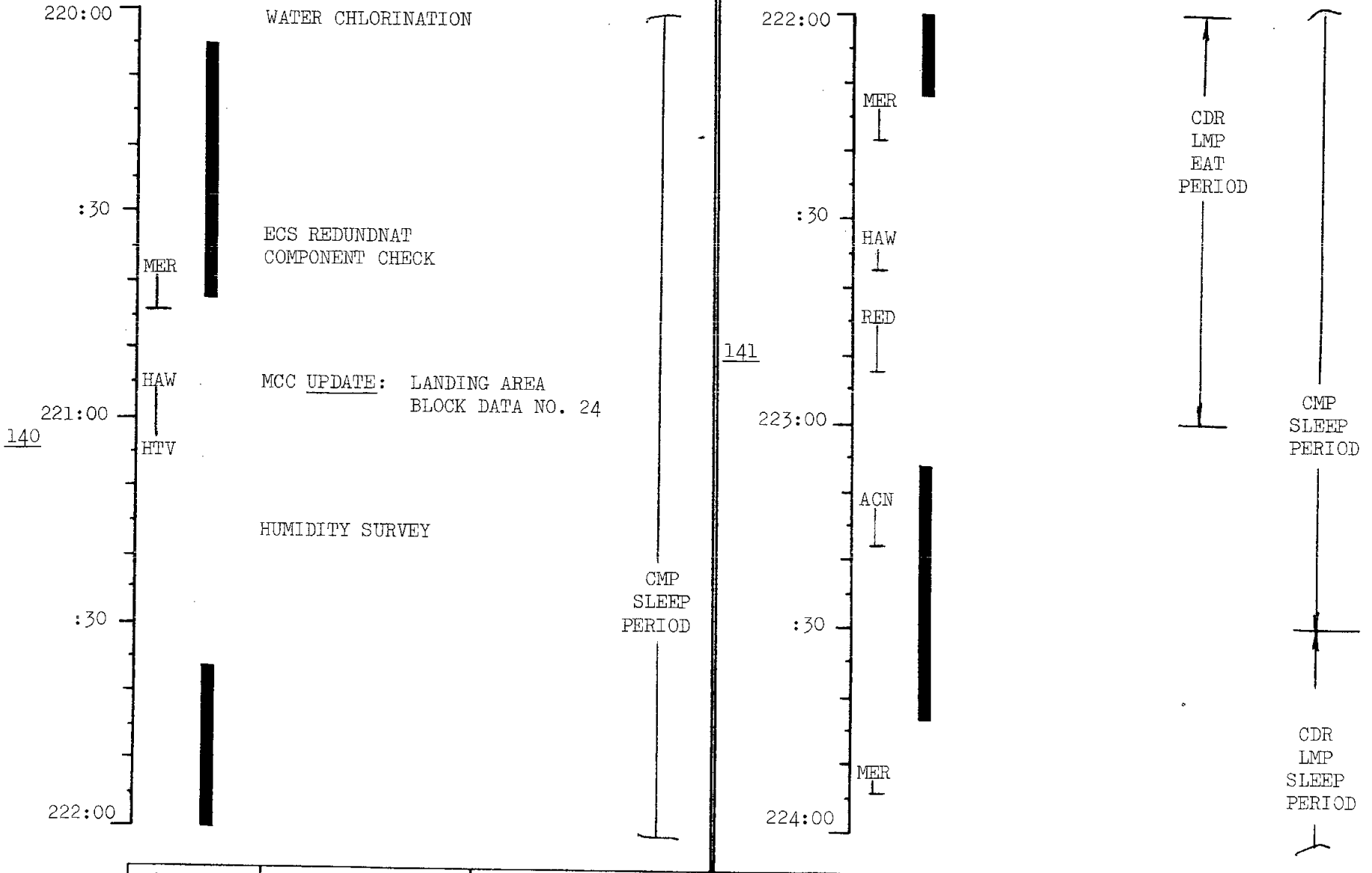
FLIGHT PLAN



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)

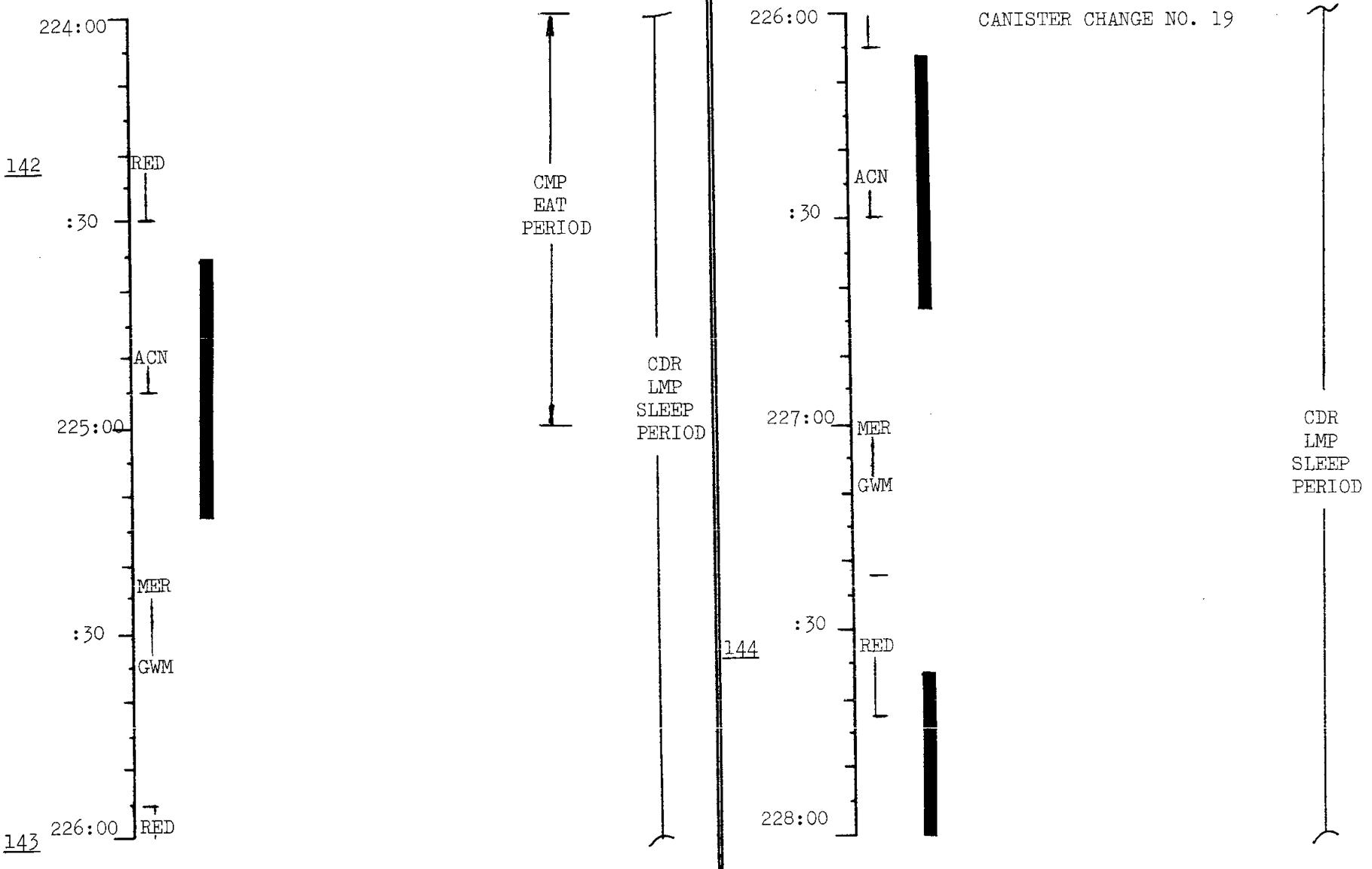
FLIGHT PLAN



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)

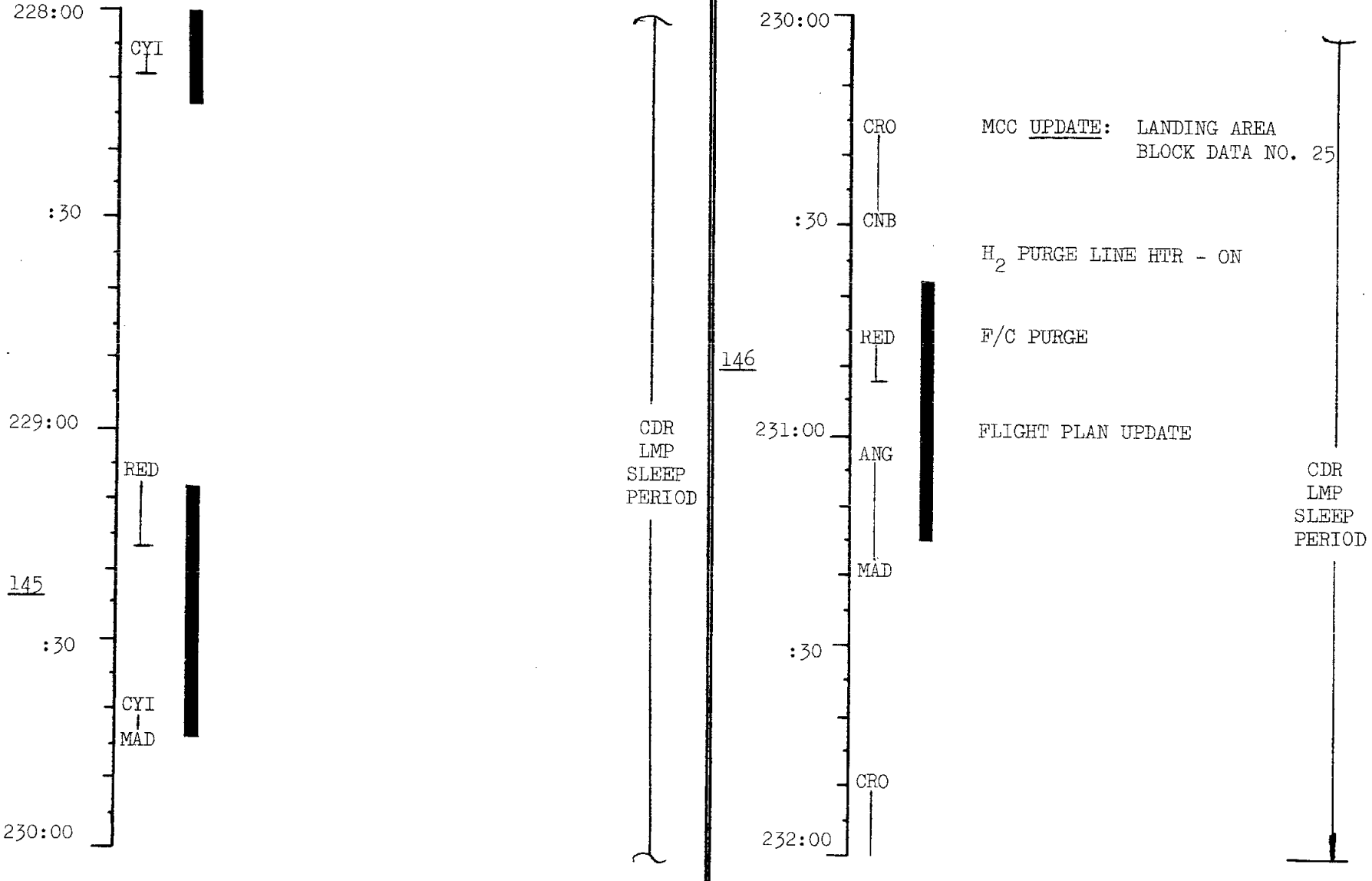
FLIGHT PLAN



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

MSC FORM 1186 (SEP 67)

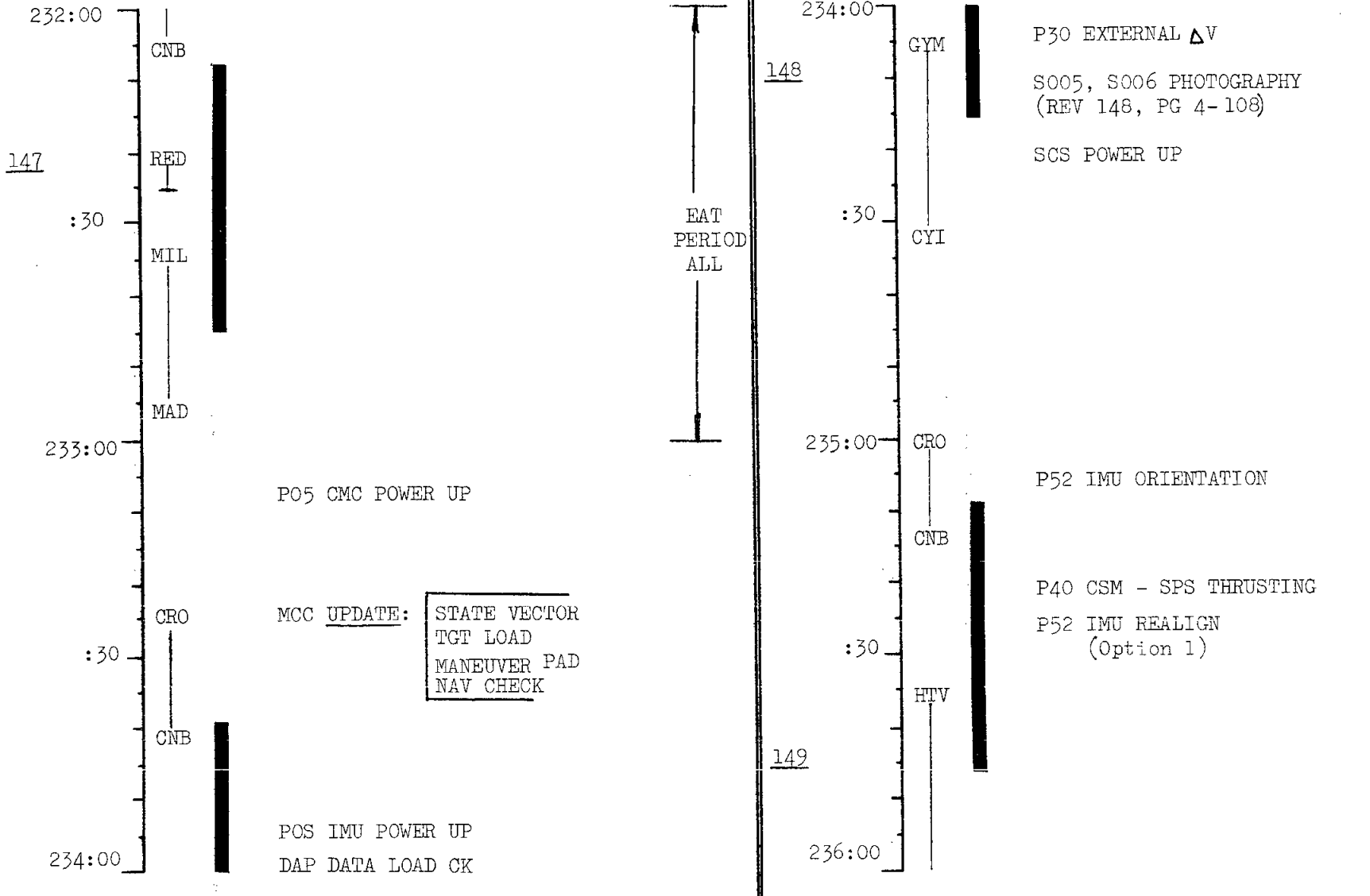
FLIGHT PLAN



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)

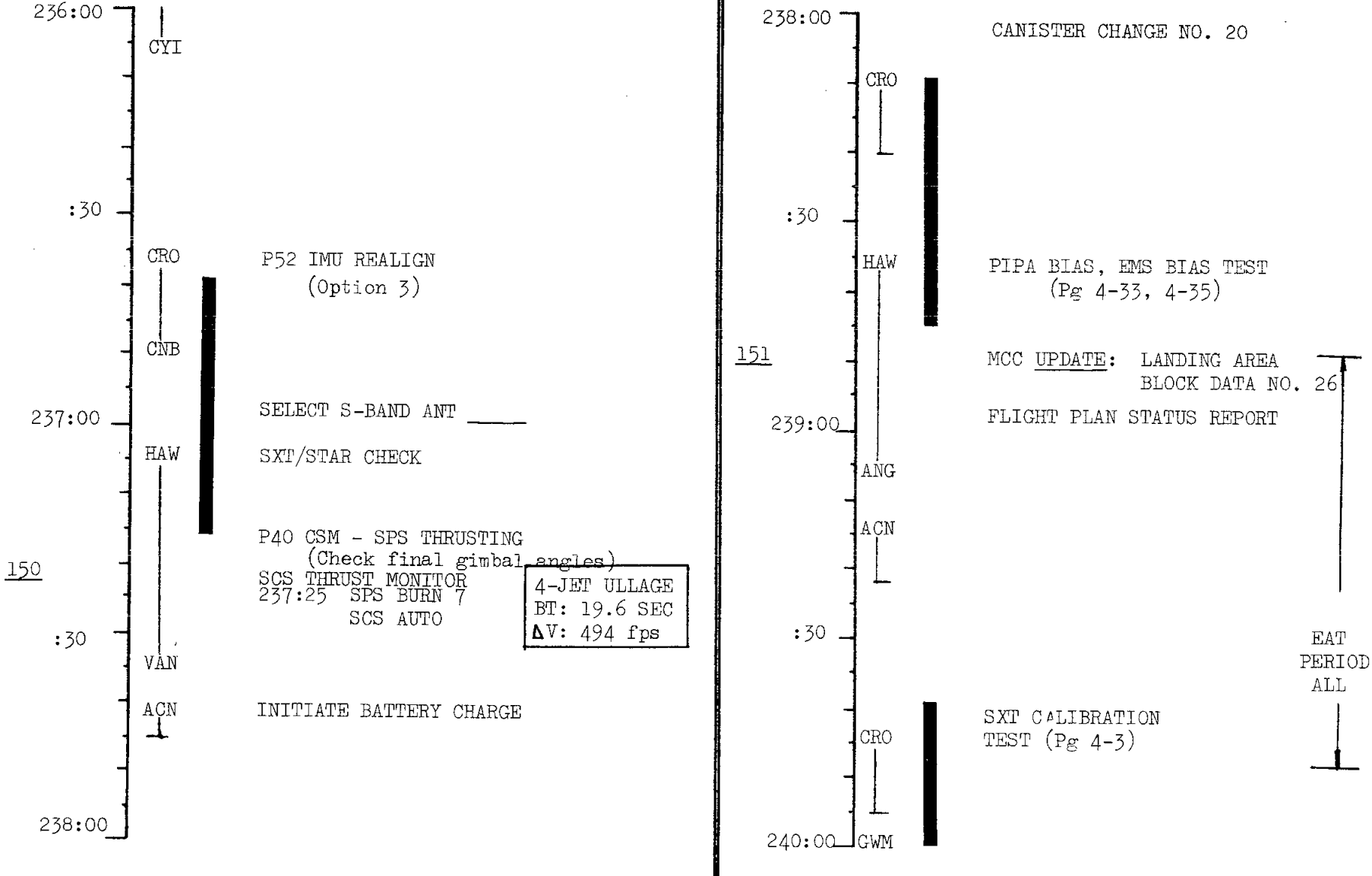
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	232-236	9/146-149	2-72

MSC FORM 1186 (SEP 67)

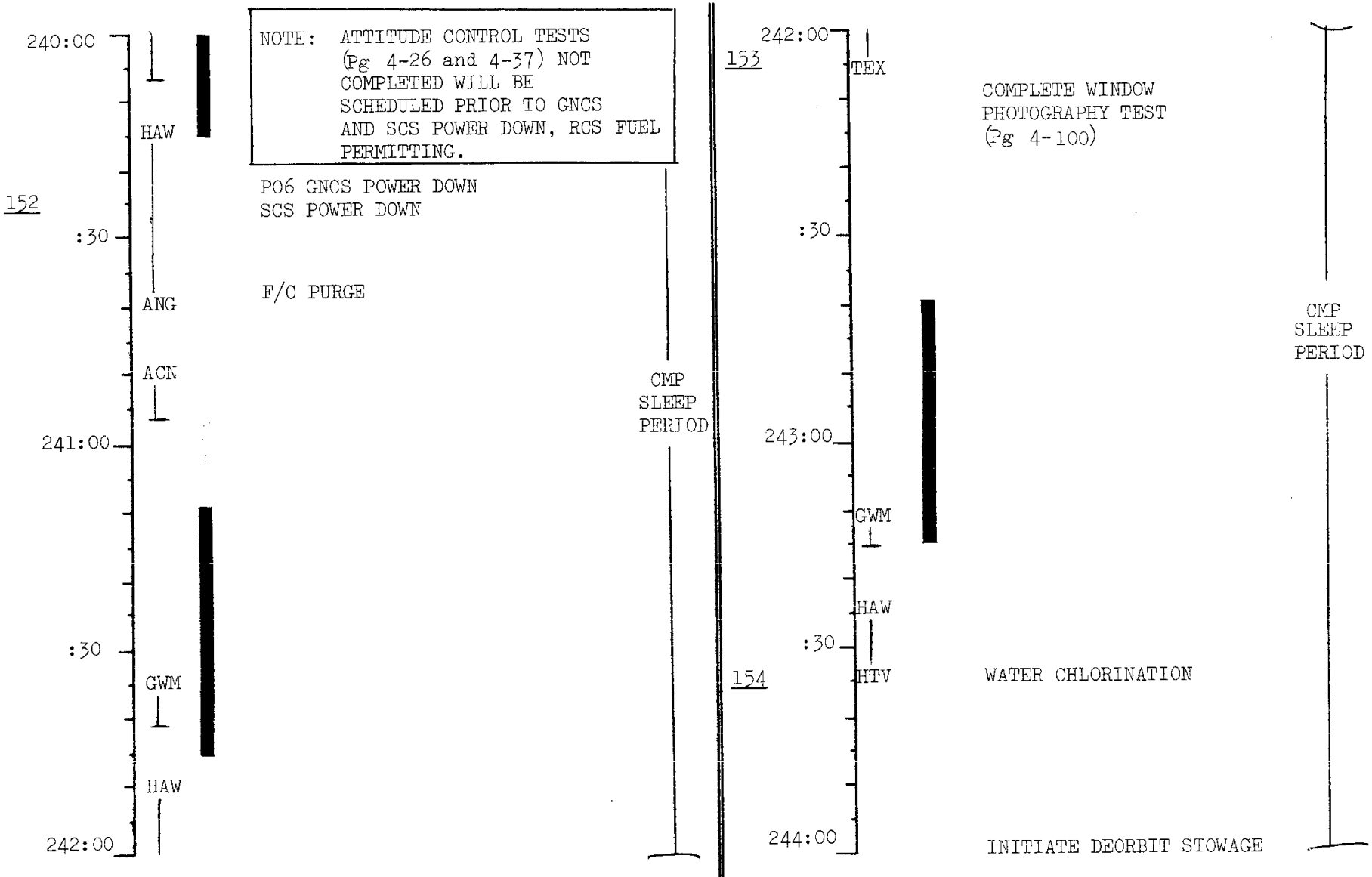
FLIGHT PLAN



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)

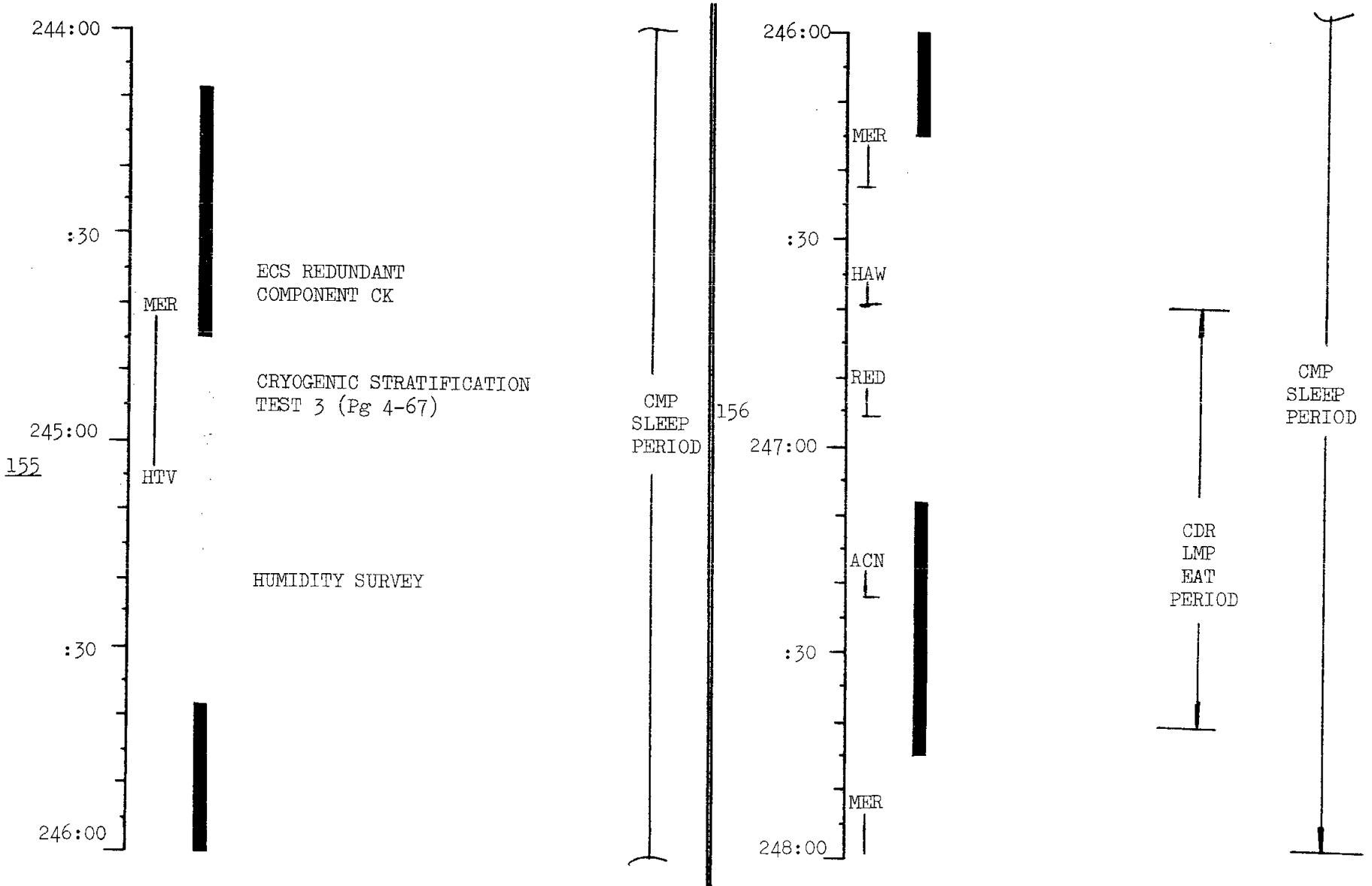
FLIGHT PLAN



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)

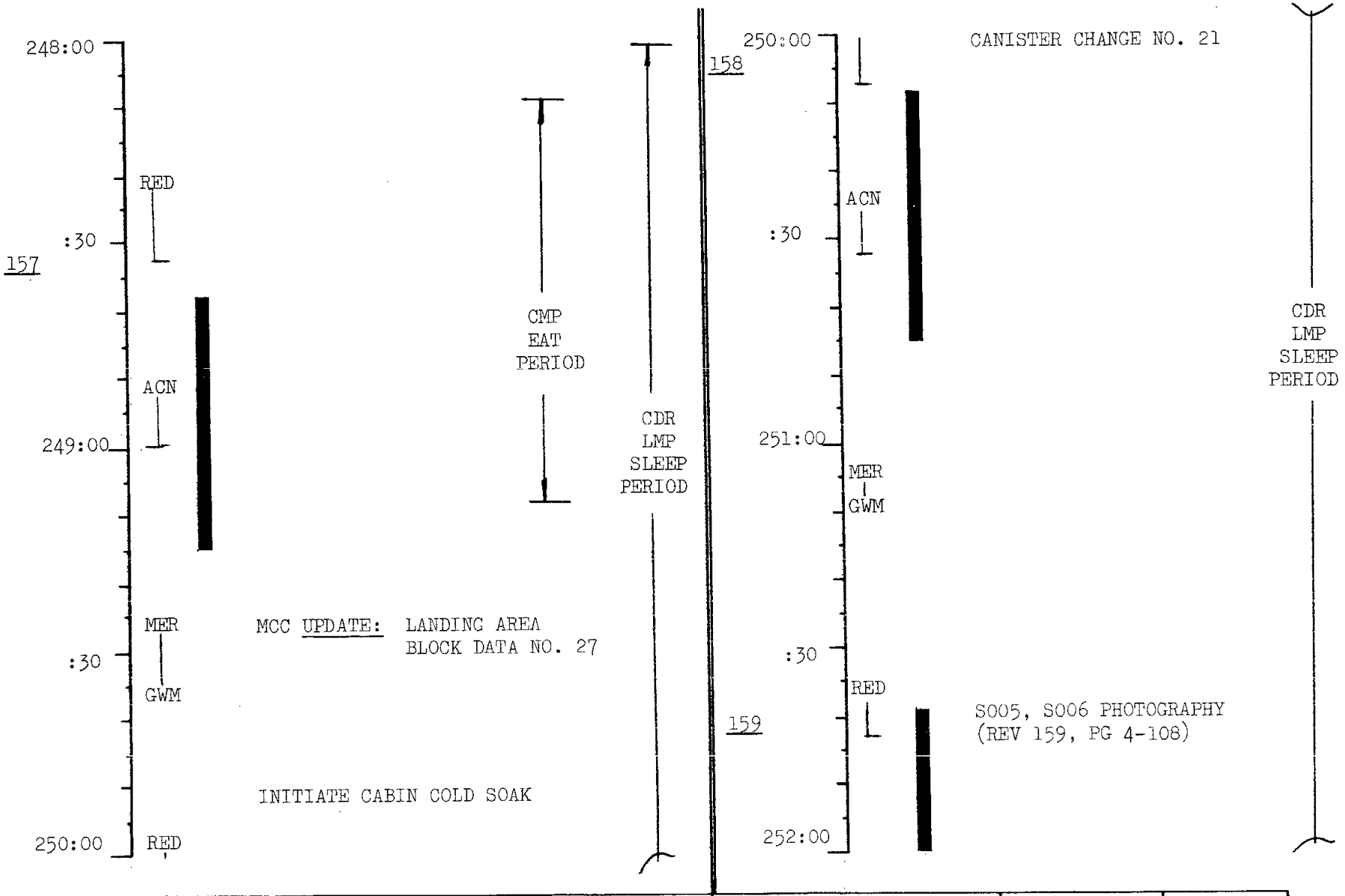
FLIGHT PLAN



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)

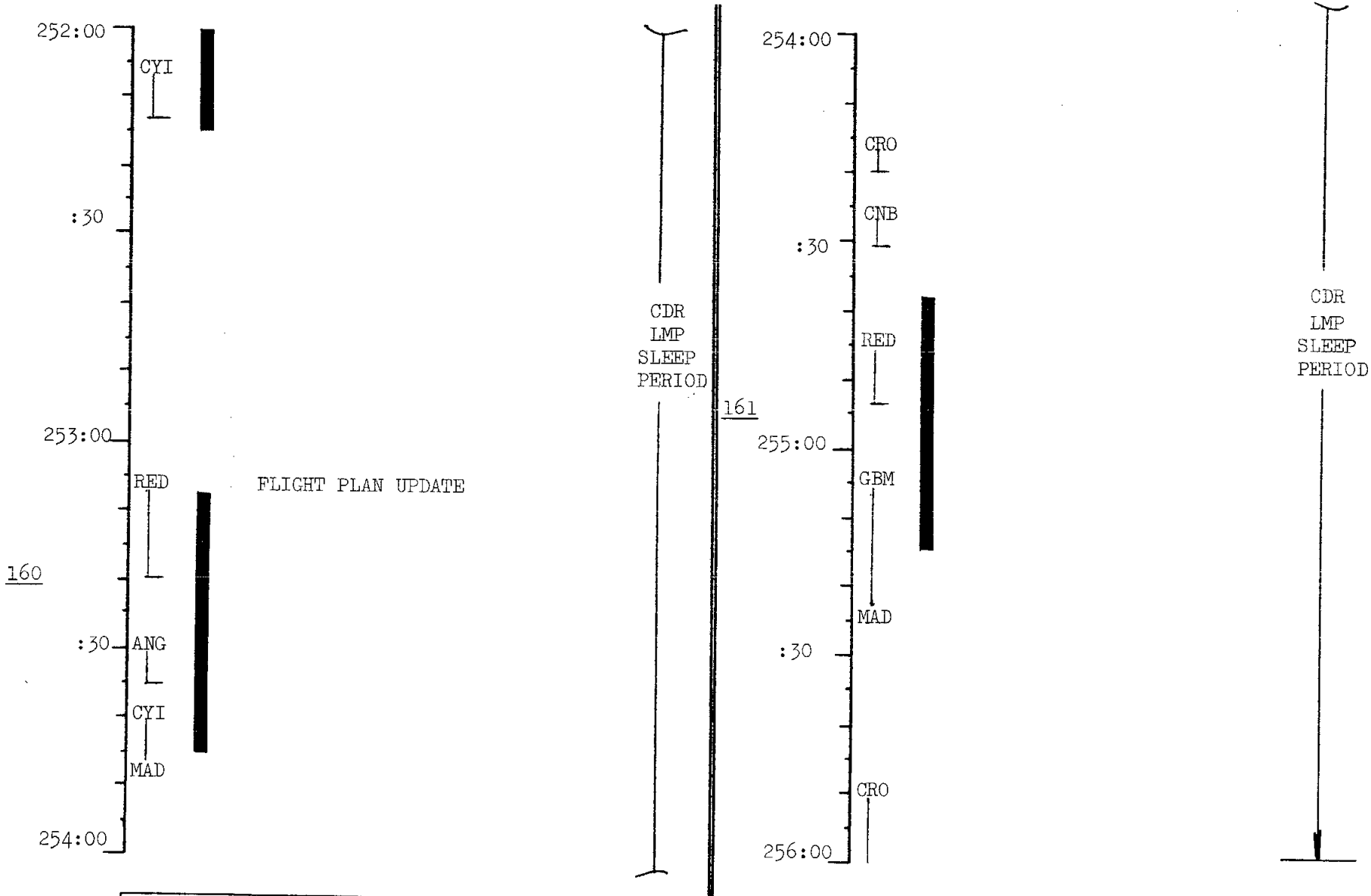
FLIGHT PLAN



MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	248-252	10/156-159	2-76

MSC FORM 1186 (SEP 67)

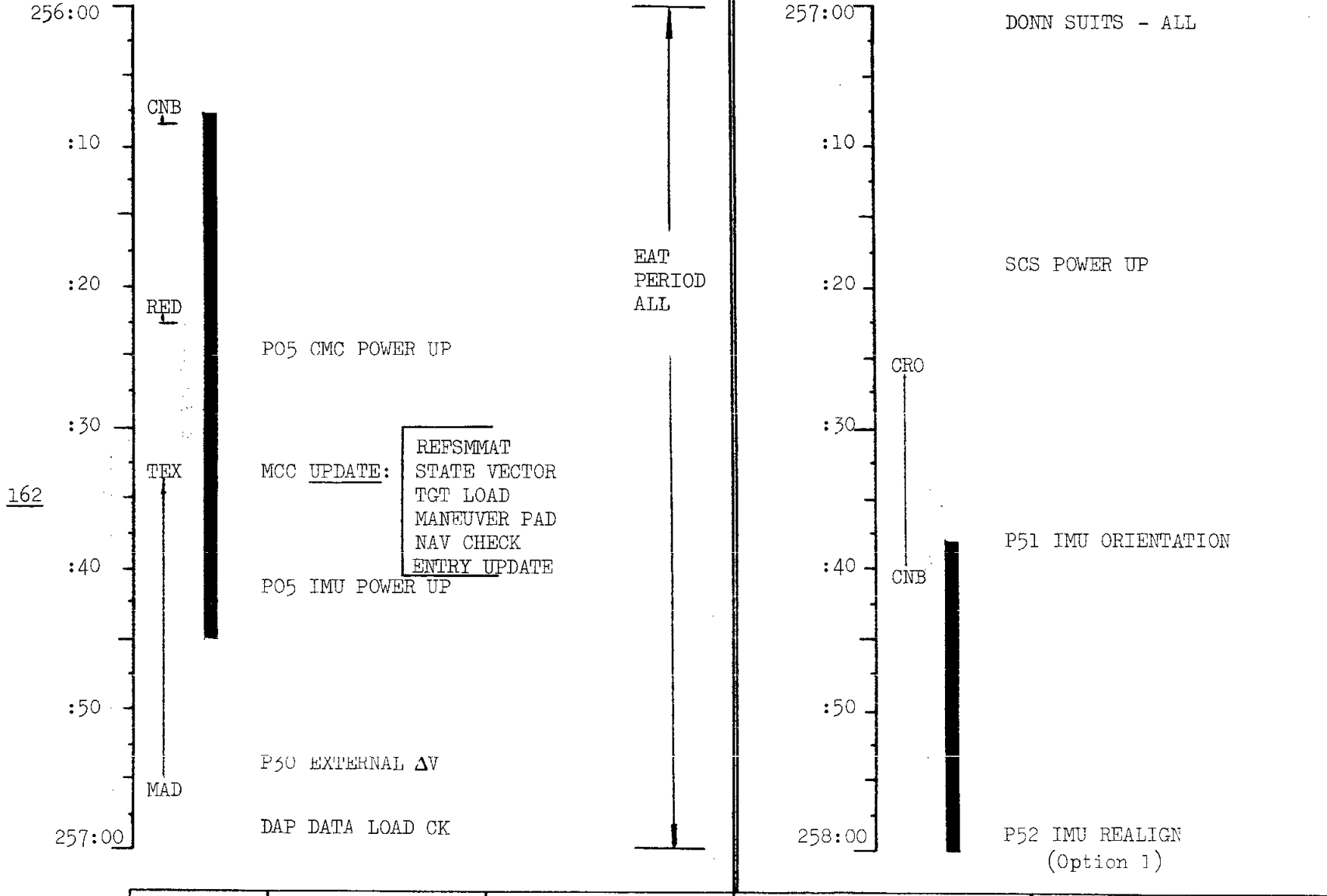
FLIGHT PLAN



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



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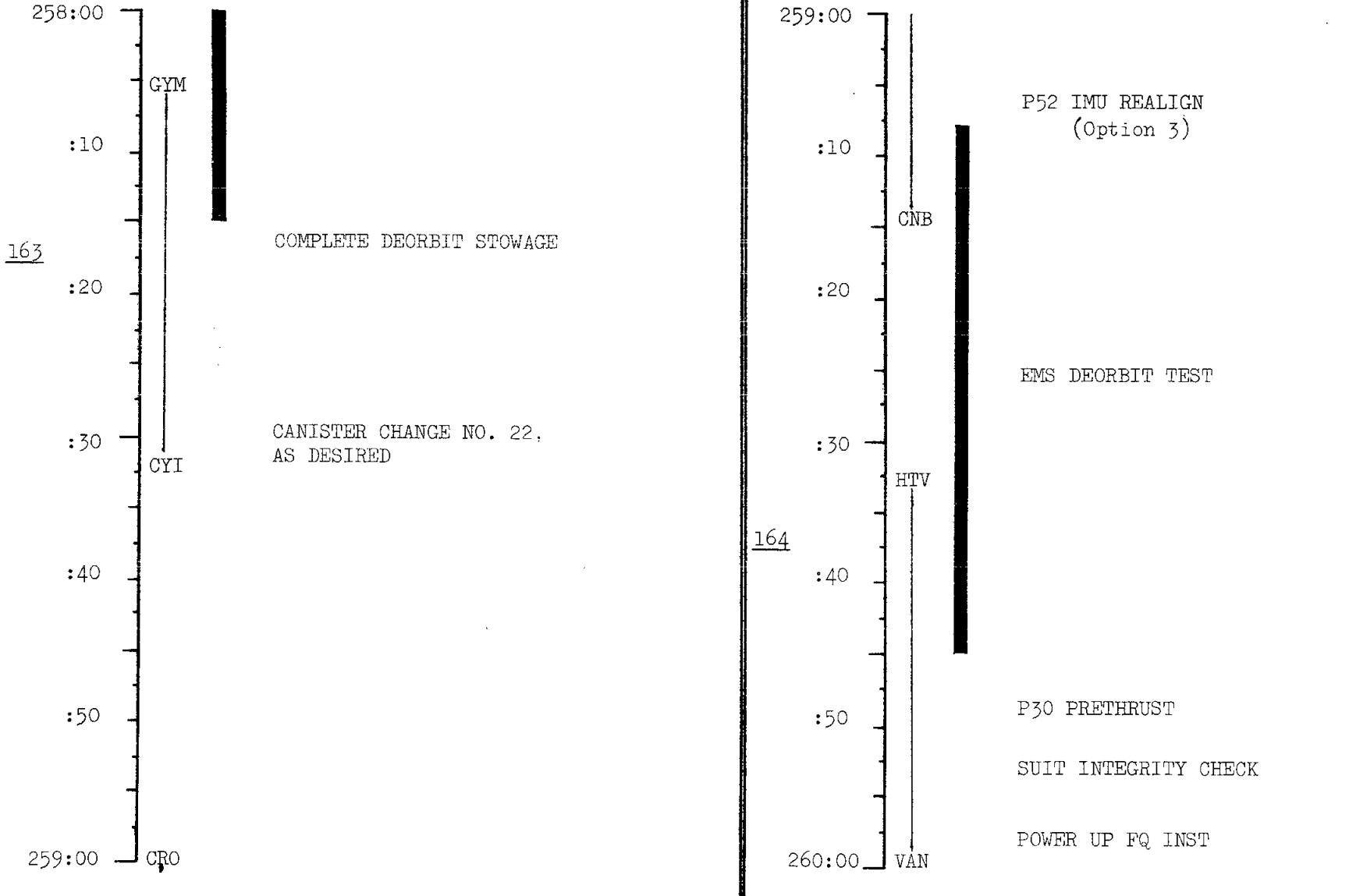
MISSION	EDITION	DATE	TIME	DAY/REV	PAGE
205/101	PRELIMINARY	MAY 31, 1968	256-258	10/161-162	2-78

MSC FORM 1186 (SEP 67)

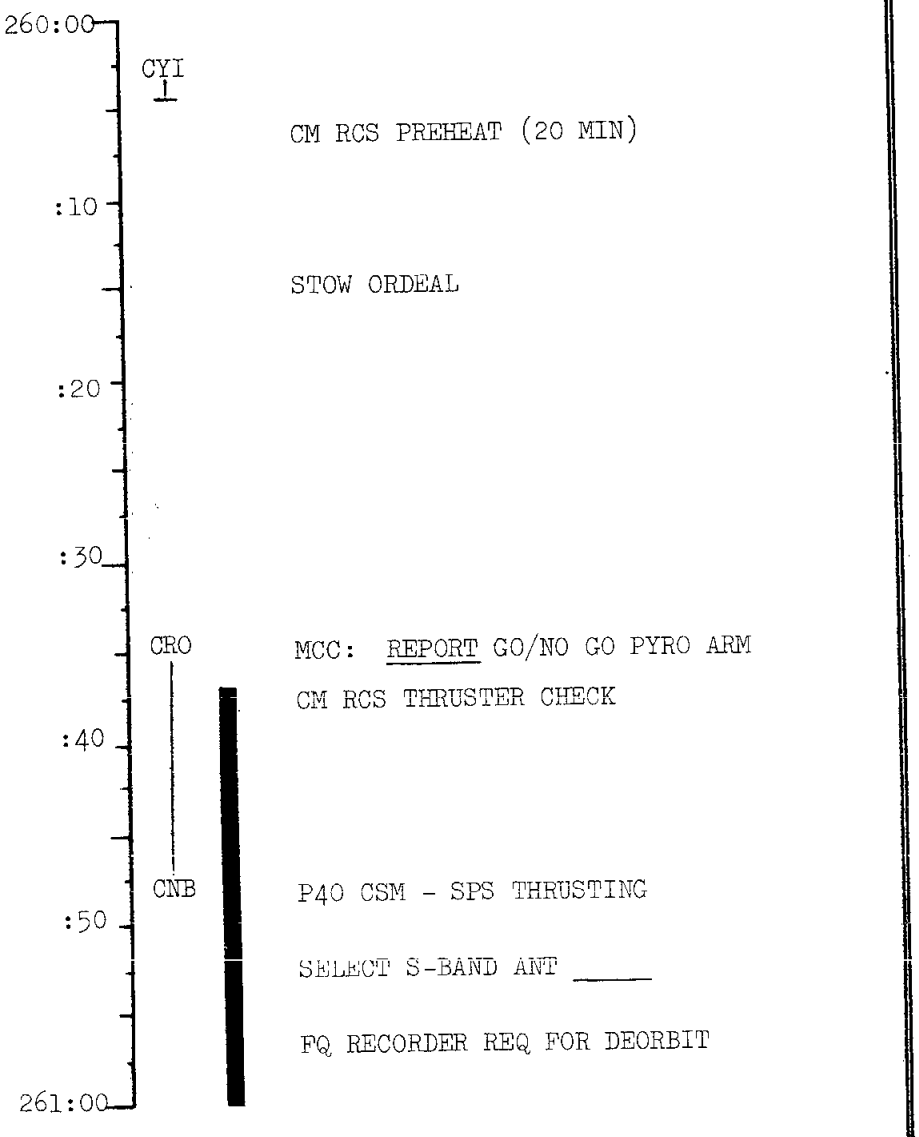
FLIGHT PLAN



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



CM RCS PREHEAT (20 MIN)

STOW ORDEAL

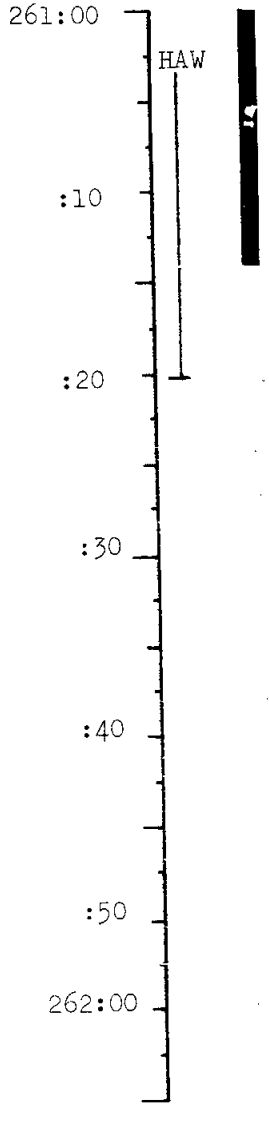
MCC: REPORT GO/NO GO PYRO ARM

CM RCS THRUSTER CHECK

P40 CSM - SPS THRUSTING

SELECT S-BAND ANT _____

FQ RECORDER REQ FOR DEORBIT



-5:30 GIMBAL DRIVE CHECK

261:08 DEORBIT
G&N Δ V

4-JET ULLAGE
BT: 9.9 SEC
ΔV: 259 fps

+5.24 CM/SM SEP

+10:33 400K

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

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.

AS-205/101 SM-RCS BUDGET

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. Flow Rate: 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. Steady State Isp: A value of 276 seconds was assumed (MMDB, Table 4-1).

6. Propellant Quantity:

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

7. Deorbit Philosophy: 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)	RCS PROPELLANT PER DAY	RCS PROPELLANT CUMULATIVE	RCS PROPELLANT 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 $\simeq$ 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

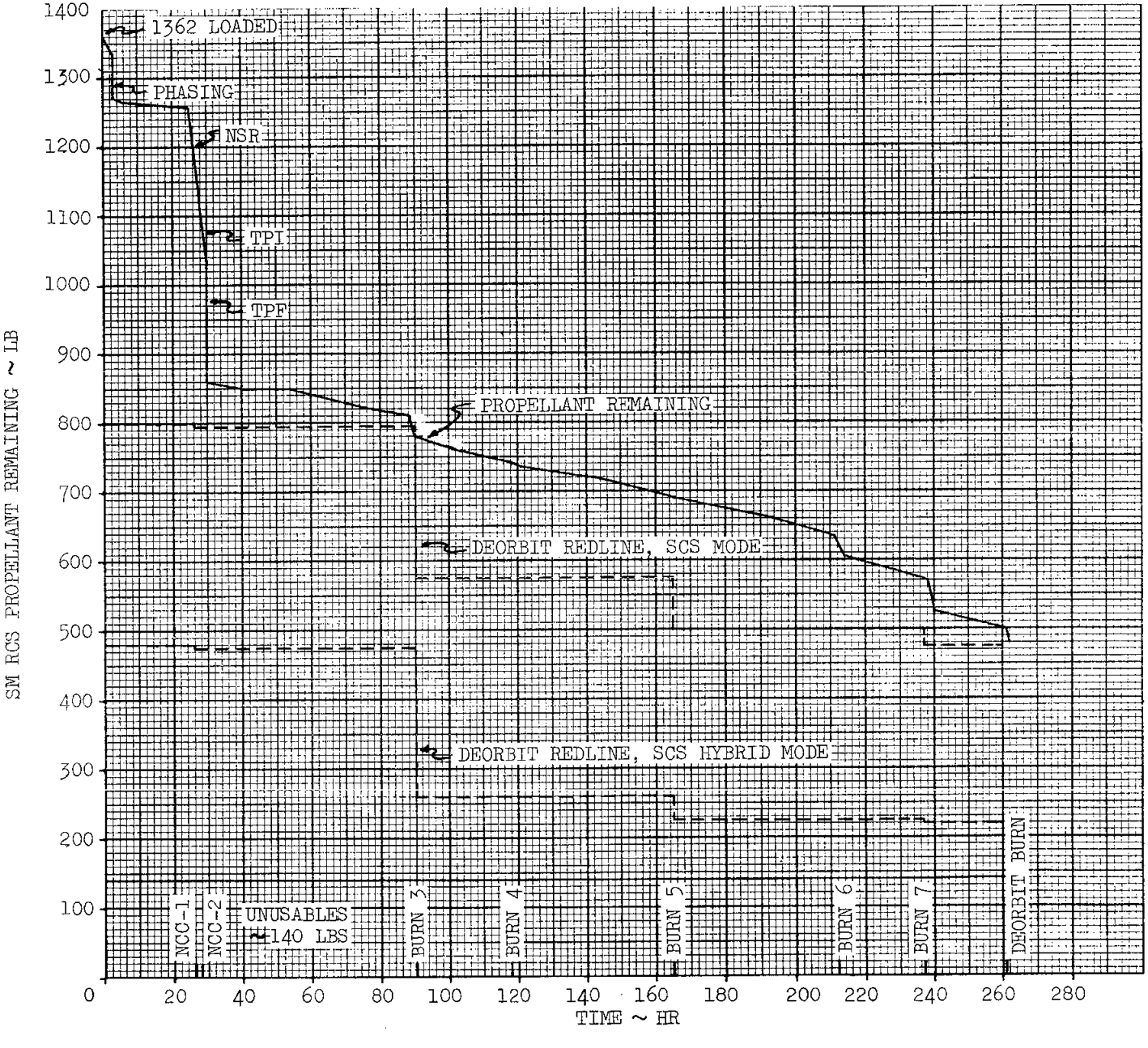


TABLE VIII

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 ≈32300		
			+X, 5 sec, Sep ΔV ≈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	
			±Y, ΔVel≈0.5 fps	4.5	
			±X, ΔVel ≈0.5 fps	4.1	
			Yaw 90° @ 2°/sec & Att Hold, 0.2°lb.	3.0	
			±Z, ΔVel≈0.5 fps	4.5	
			±X, ΔVel≈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	1.4	
			Att Hold 0.5° db, 20 min	6.0	
			SUBTOTAL	8.4	534.9
17	73:00	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	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 Est. Orbital Rate, MI P, Y&R	1.0	
			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 Est. Orbital Rate, MI P, Y&R	1.0	
			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	GNCS/P-52 - 3 axis Orient/MI	1.0	
		SCS Att. Ref. Ck.	Null FDAI Att Error, 0.5° db 10 Min	0.5	
		SPS Burn 3	SCS - 3 axis orient/MI & Att Hold 15 min	6.0	
			SCS - Ullage, 4 jet, 15 sec	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	1.0	
			Est. Orbital Rate, MI P, Y&R 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	1.0	
			Est. Orbital Rate, MI P, Y&R 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	1.0	
			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	6.0	
			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	0.7	
			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	1.5	
			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	1.5	
			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	23.1	
			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 1.8	
			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	7.4	
			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	2.7	
			Ullage 4 Jets, 15 sec	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

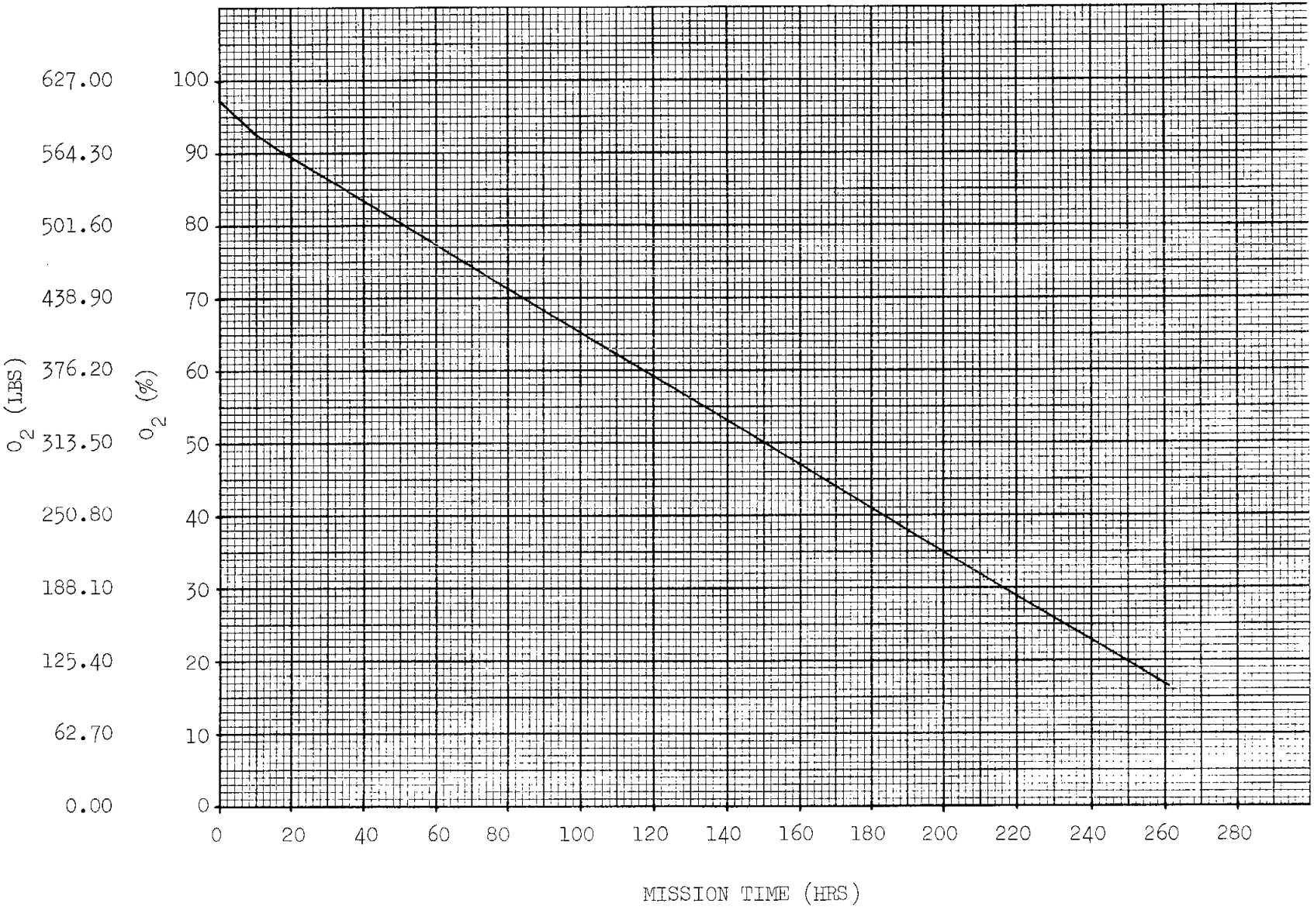


FIGURE 5: NOMINAL MISSION H_2 PROFILE

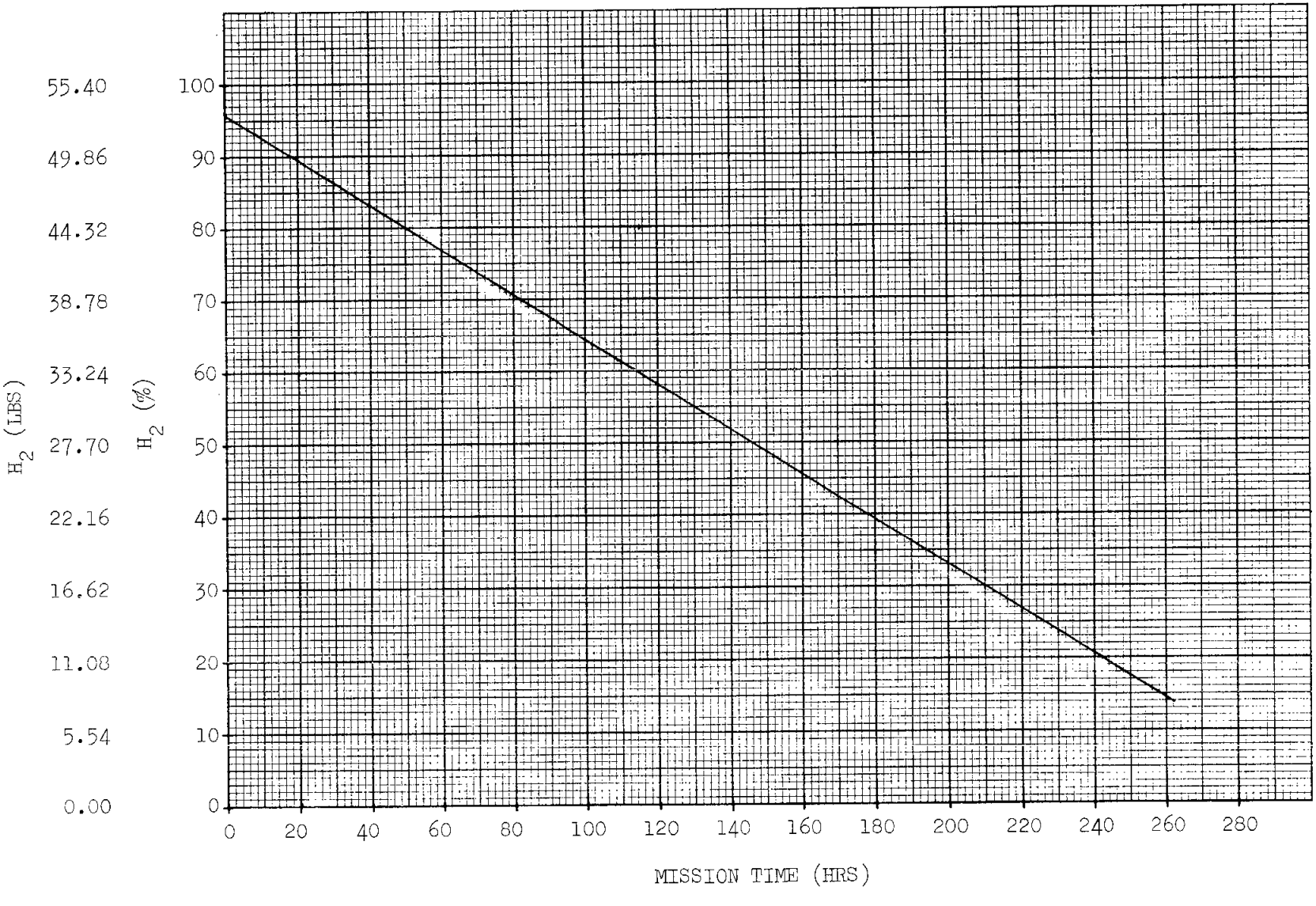


TABLE IX
CREW CHECKLIST PROCEDURE/CONSUMABLES DATA SUMMARY
(AVERAGE ELECTRICAL POWER LOADS)

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_2O 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		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
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 update 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.

IMU ALIGNMENT - CREW LOG

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.

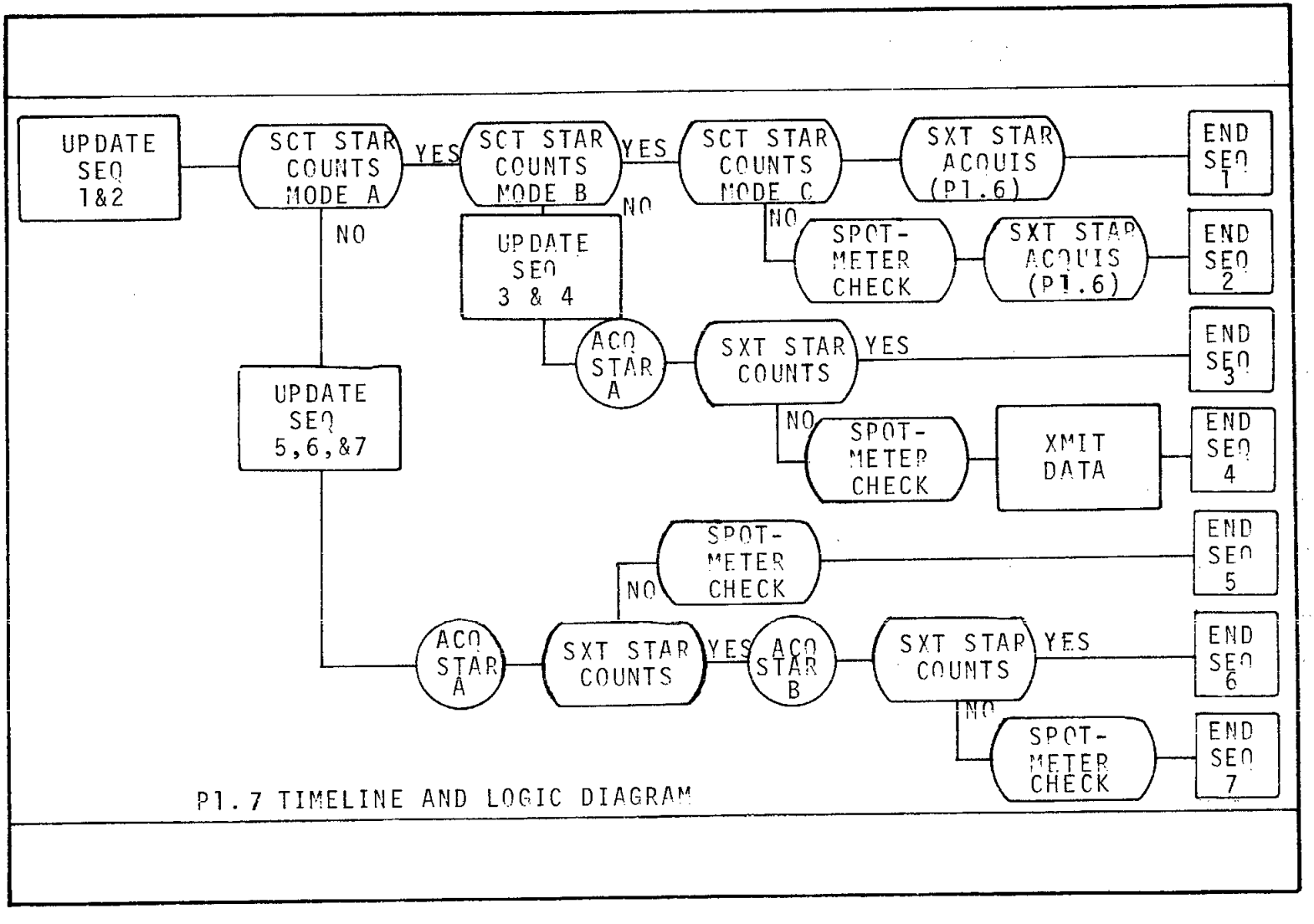
SEQ 3: The first S/C configuration and lighting geometry (Mode A) allows sufficient stars to be seen through the SCT. Insufficient stars are seen in Modes B and C. Astronaut receives update to perform SXT star counts on subsequent rev. Sufficient stars are seen with the SXT.

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

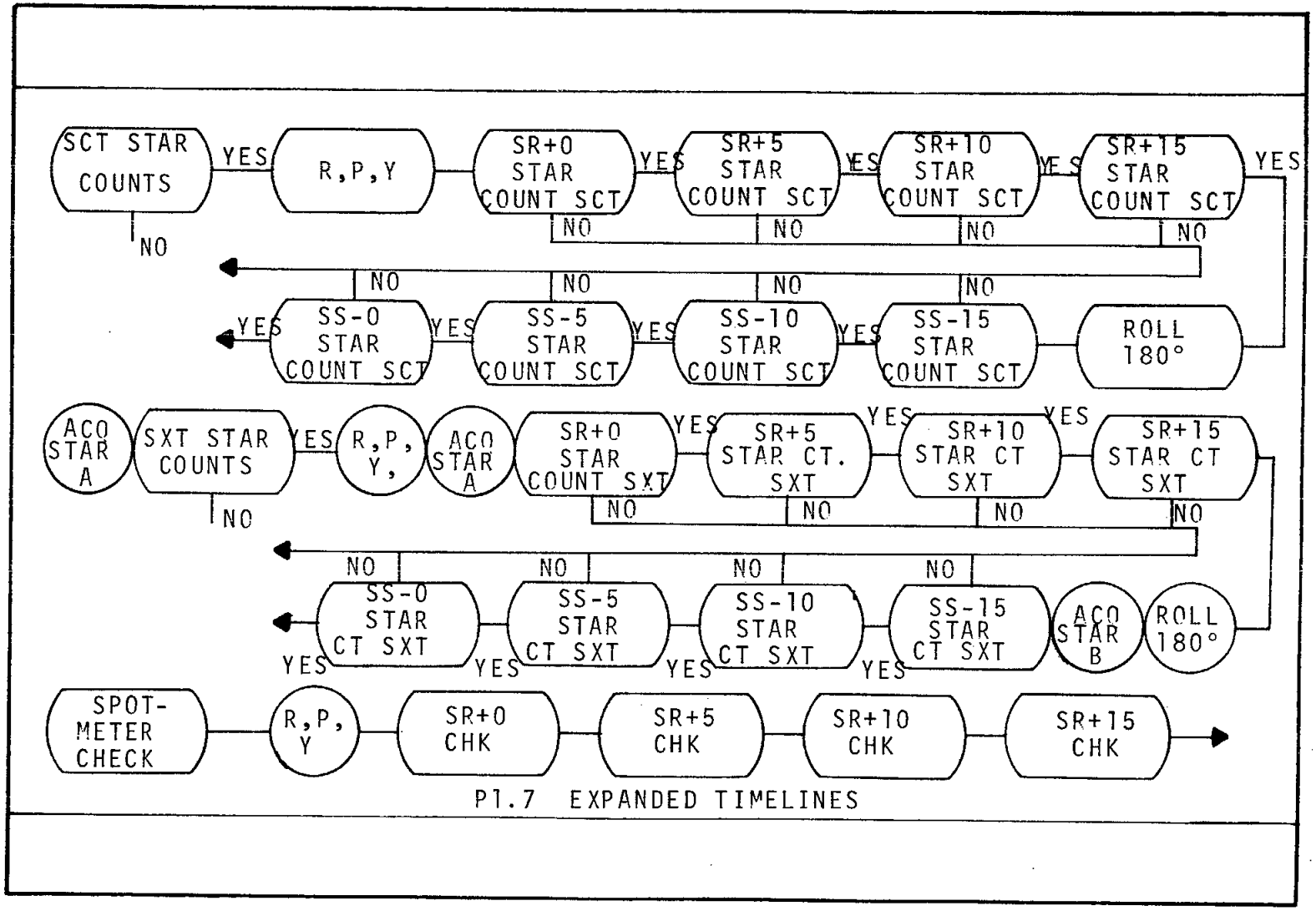
SEQ 5: Insufficient stars seen through SCT in first S/C configuration (Mode A). Astronaut receives update to perform SXT star counts on 2 following revs. Sufficient stars seen on both revs (different S/C configurations).

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 initially 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 $_{SS}$_____spacecraft sunset minus 15 min.
  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 darkness 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 interval in which the number of stars noted is above 50.

ALTERNATE PROCEDURE

If stars cannot be seen through the SCT, proceed 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 - SCT STAR COUNT

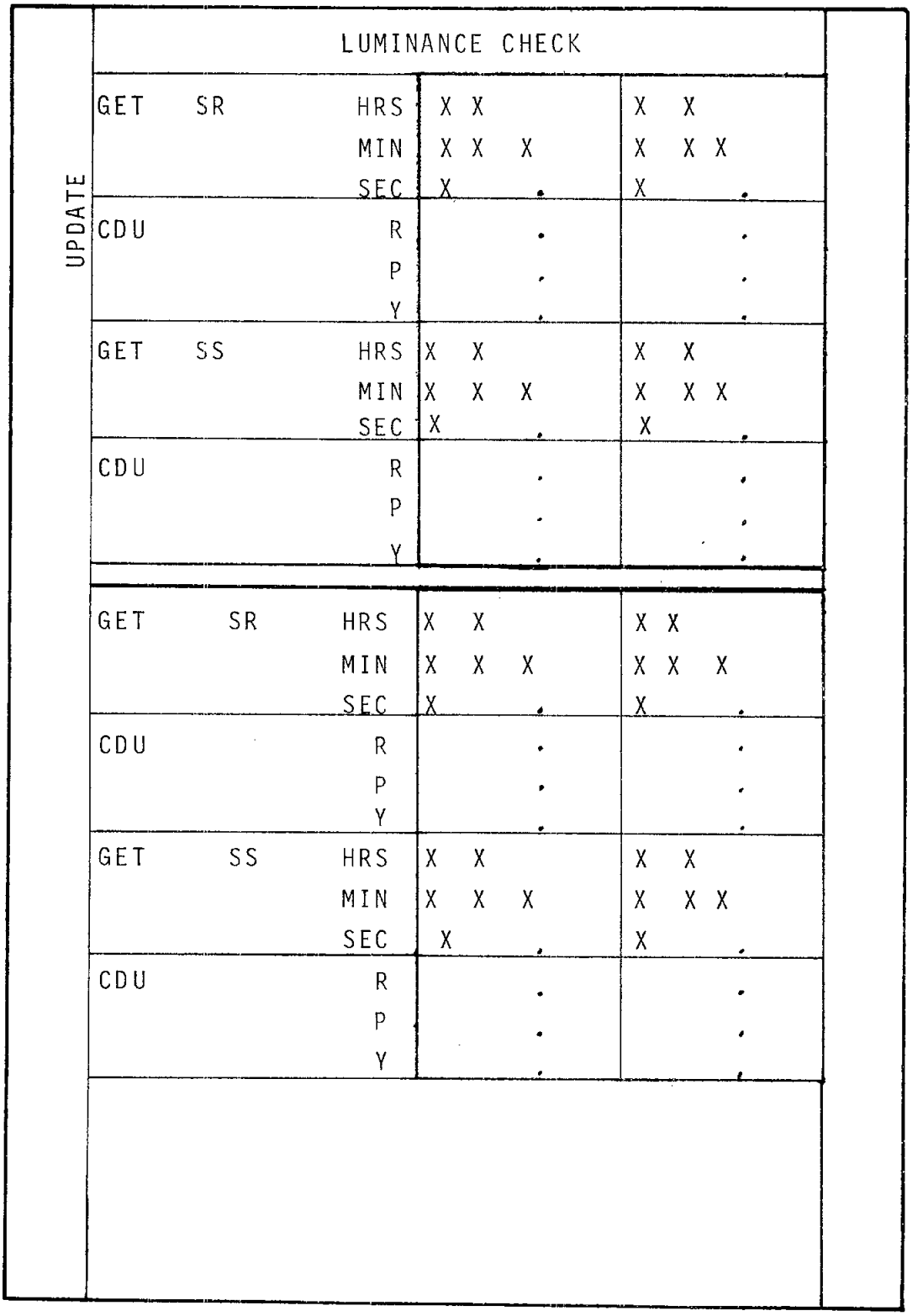
UPDATE				
MODE A, B, C				
GET ALIGN	HRS	X X	X X	
	MIN	X X X	X X X	
	SEC	X .	X .	
GET SR	HRS	X X	X X	
	MIN	X X X	X X X	
	SEC	X .	X .	
CDU	R	.	.	
	P	.	.	
	Y	.	.	
GET SS	HRS	X X	X X	
	MIN	X X X	X X X	
	SEC	X .	X .	
CDU	R	.	.	
	P	.	.	
	Y	.	.	
MODE				
GET ALIGN	HRS	X X	X X	
	MIN	X X X	X X X	
	SEC	X .	X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

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			

UPDATE - LUMINANCE CHECK



UPDATE	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	.	.

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	X X X	X X X
NO. STARS VISUAL			
NAV STAR	B	X X X	X X X
NO. STARS VISUAL			

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.

Procedures: (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

Crew Log:

- 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

UPDATE

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	.	.

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:

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.

UPDATE - SXT TRACKING

UPDATE

SXT TRACKING				
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

CREW LOG

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 ± all axes.
5	Minimum impulse
6	Translation ±X, ±Y, ±Z.
7	Acceleration cmd @ 0.3°/sec ± all axes.
8	Automatic maneuver @ 0.05, 0.5 and 5°/sec.
9	Manual maneuver @ 0.05, 0.5 and 4°/sec ± all axes.

NOTES

- Jet select 2-2-2 (all rotational tests)
- Desired vehicle rate ≈ 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.

CREW LOG - GNCS ATT CONTROL

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			

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

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.

CREW LOG - SPS BURN

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 V06N33		HR	X X	X X
		MIN	X X X	X X X
		SEC	X .	X .
	V06N42	HA	X .	X .
		HP	X .	X .
		ΔV	.	.
		ΔV_C	X .	X .
P40 V06N86LCVERT		VGX	.	.
		VGY	.	.
		VGZ	.	.
	V06N22	R	.	.
		P	.	.
		Y	.	.
		ΔV_C	X .	X .
	V06N85	VGX (CONT)	.	.
		VGY (CONT)	.	.
		VGZ (CONT)	.	.
	V06N44	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 demonstration 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.

CREW LOG - MIDCOURSE NAVIGATION

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 correction 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	.

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:

SCS ATT CONTROL

TEST NO.	FUNCTION
1	Max deadband (±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 ±X, ±Y, +Z
7	Manual direct @ 0.5°/sec ± all axes.
8	Rate command @ 1.5°/sec
9	Max deadband (±8°) high rate for 1.5 to 2.5 hrs.
10	Min deadband (±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.

Crew Log:

Complete for indicated tests.

CREW LOG - SCS ATT CONTROL

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)	:	:	

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.

CREW LOG - SCS ATT REF CK

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	.	.

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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.

CREW LOG - SCS ATT REF ALIGN

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

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:

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.

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	

CREW LOG - SPS COLD SOAK

CREW LOG

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

CREW LOG - CM/RCS THRUSTER TEMP

CREW LOG

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 .

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

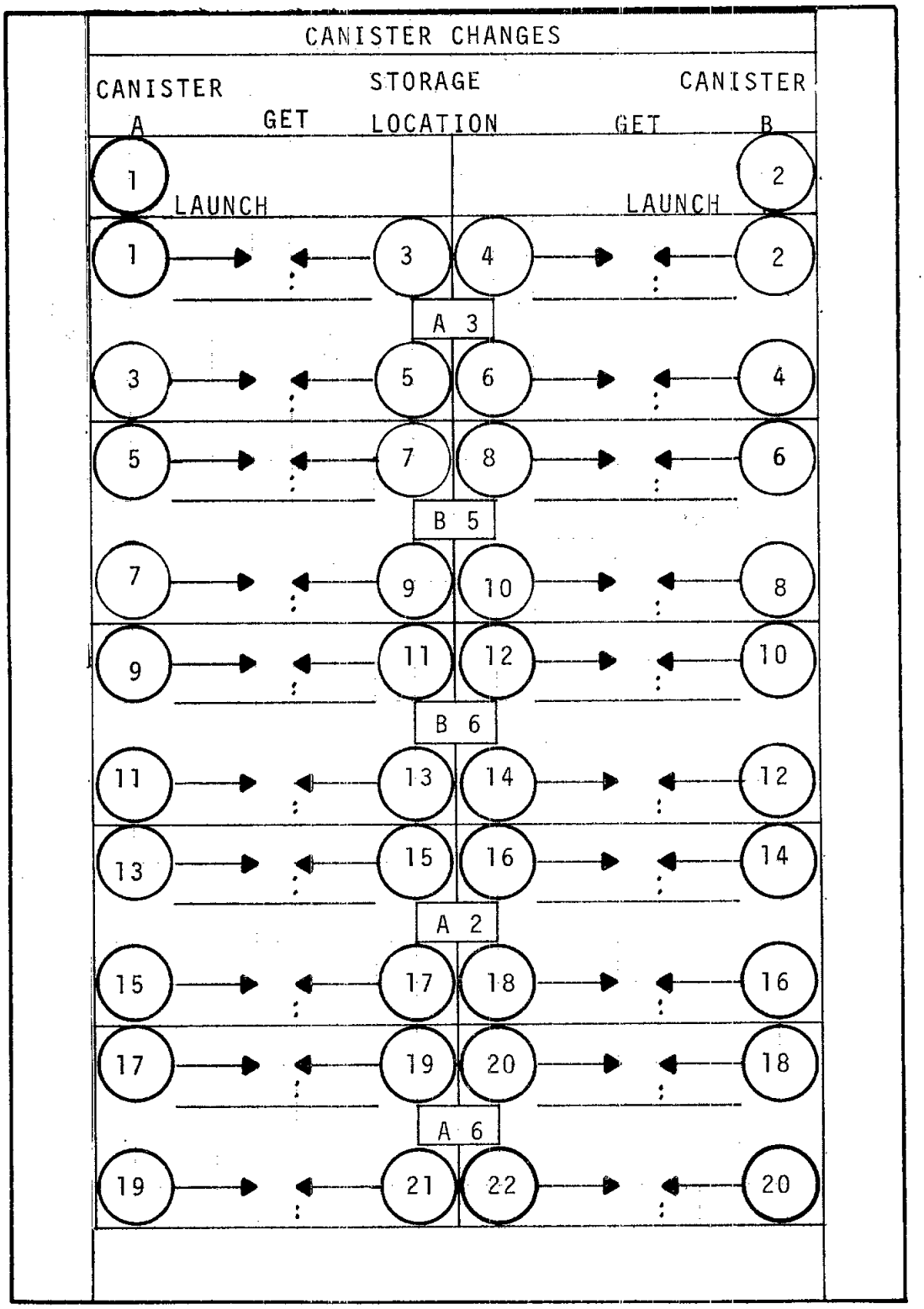
Procedures:

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.

CREW LOG - HUMIDITY SURVEY

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		

POSTLANDING VENTILATION (P4.10)

Purpose:

To demonstrate the capability of the postlanding ventilation circuit to provide a habitable environment 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 ±5%
Test 2 - 60 ±5%
Test 3 - 15 ±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

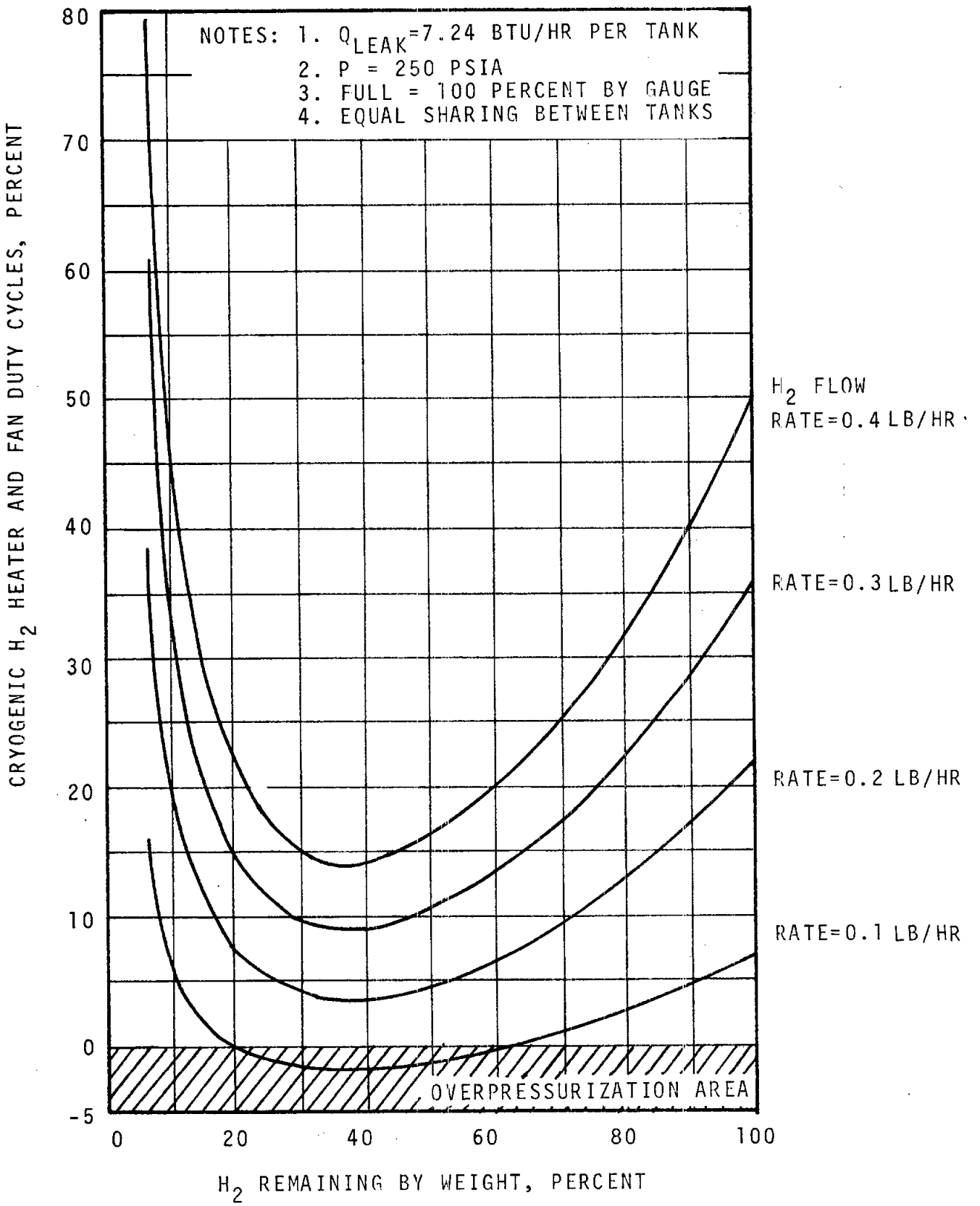
Crew Log:

. Complete for each test.

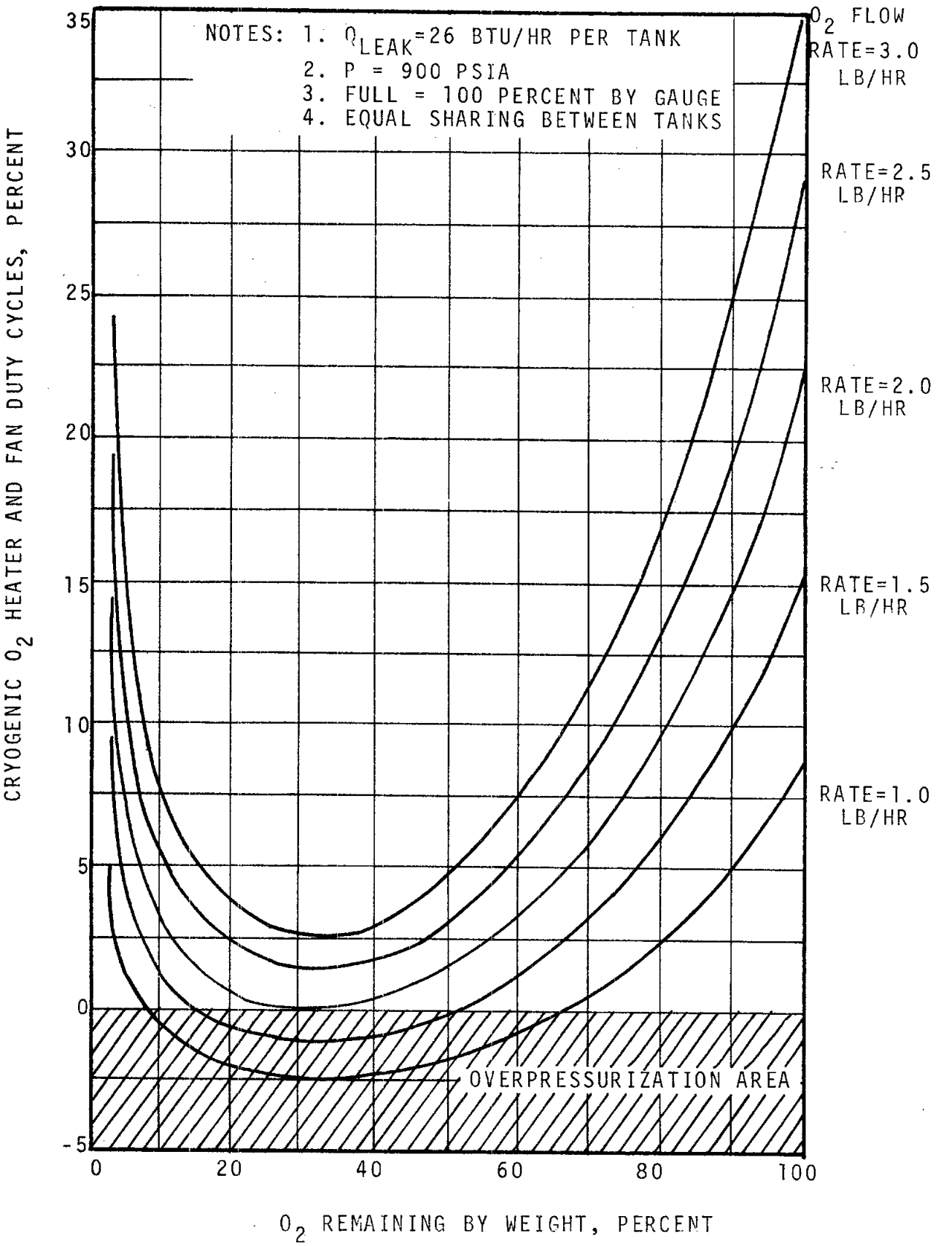
CREW LOG - CRYOGENICS TEST

CRYOGENICS						
			H2		O2	
GET	HRS		X X		X X	
STEP #1	MIN:SEC		X :		X :	
GET	HRS		X X		X X	
STEP #2	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	HRS		X X		X X	
STEP #3	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



CRYOGENIC O_2 HEATER AND FAN DUTY CYCLES



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 checklist. 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 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 - WSMR TEST

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	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 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)

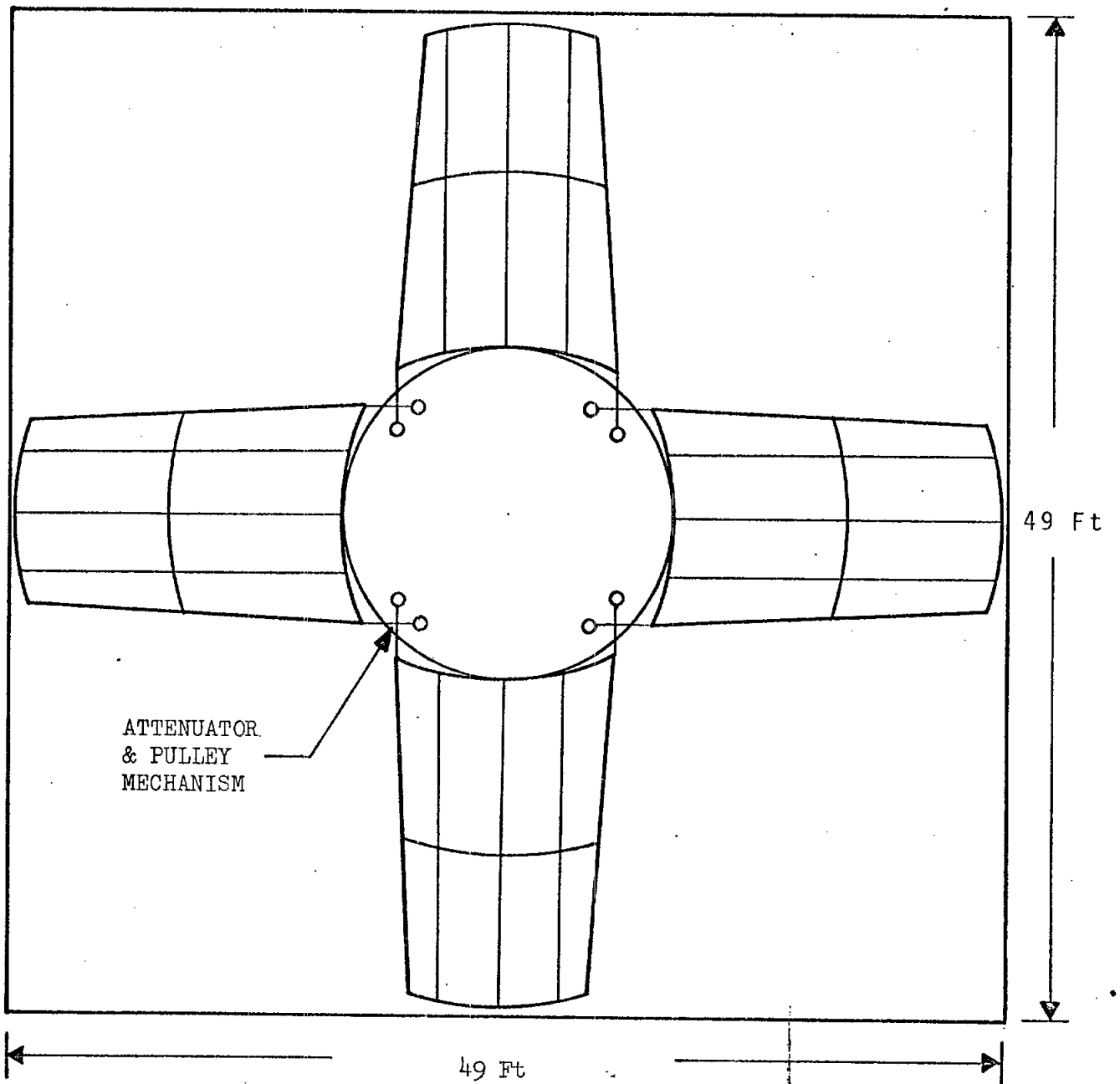
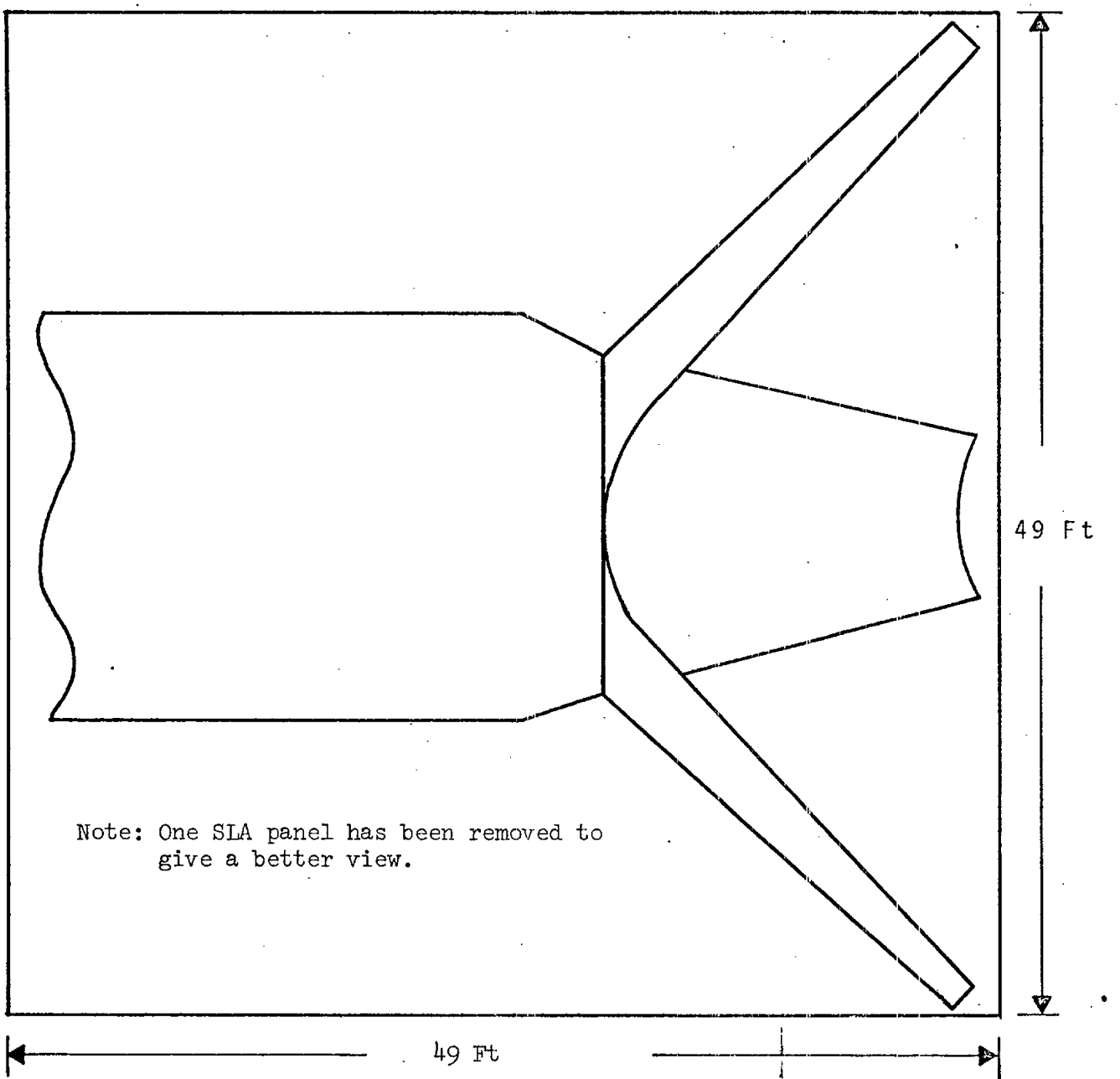


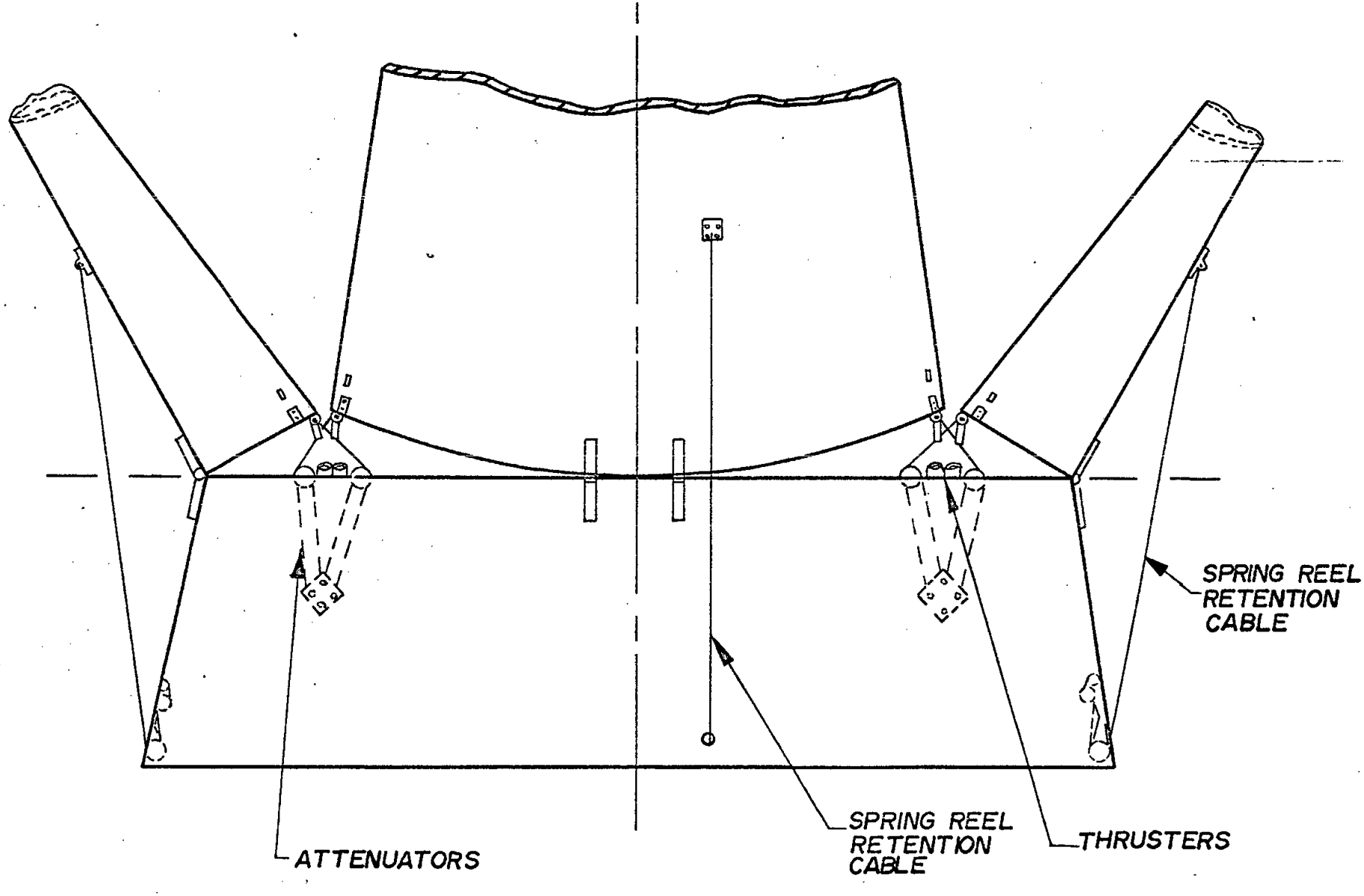
Figure 7.- Desired view for side photography, still camera 80mm lens, range 75 feet. (SIDE VIEW - Nominal SLA Deployment)



(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



PASSIVE THERMAL CONTROL PROCEDURE (S7.24)

Purpose:

To determine the initial coning angles when the spacecraft is placed in the passive thermal mode of operation 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)
- 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

UPDATE

PASSIVE THERMAL CONTROL			
GET ALIGN	HRS	X X	X X
	MIN	X X X	X X X
	SEC	X .	X .
GET_1	HRS	X X	X X
	MIN	X X X	X X X
	SEC	X .	X .
GET_2	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 .
GET_2	HRS	X X	X X
	MIN	X X X	X X X
	SEC	X .	X .
GET_2	HRS	X X	X X
	MIN	X X X	X X X
	SEC	X .	X .
CDU	R	.	.
	P	.	.
	Y	.	.

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

UPDATE

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 simulated 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
S0368 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:

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	
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

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 orthogonal 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, photographs 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
S0368 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:			

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 translation 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 photography as time permits or as per ground update.
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.

	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	

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

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

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

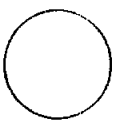
W27E - Panama Canal area

W27F - Special weather

W27G - Satellite studies

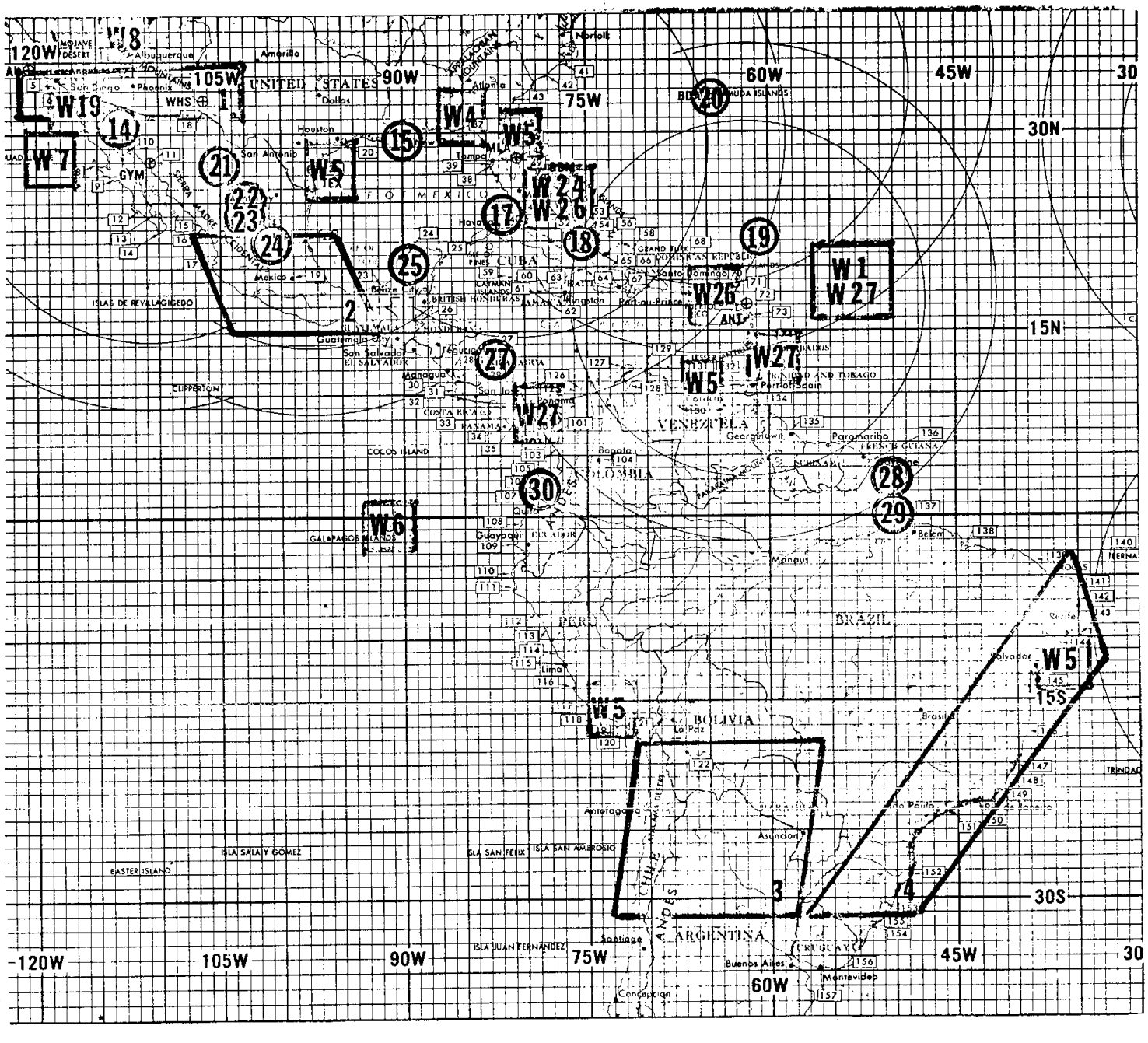
MAP LEGEND

S005 TERRAIN STRIP PHOTOGRAPHY



S005 TERRAIN STEREO PHOTOGRAPHY

S006 WEATHER PHOTOGRAPHY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90W
75W
60W
45W
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30N
15N
15S
30S
UNITED STATES
MEXICO
CUBA
BAHAMAS
JAMAICA
HAITI
DOMINICAN REPUBLIC
PUERTO RICO
BERMUDA ISLANDS
BRITISH HONDURAS
GUATEMALA
EL SALVADOR
HONDURAS
NICARAGUA
COSTA RICA
PANAMA
COLOMBIA
VENEZUELA
GUYANA
SURINAM
FRENCH GUIANA
TRINIDAD AND TOBAGO
ECUADOR
PERU
BRAZIL
BOLIVIA
CHILE
ARGENTINA
URUGUAY
PARAGUAY
GALAPAGOS ISLANDS
ISLAS DE REVILLAGIGEDO
CLIPPERTON
COCOS ISLAND
EASTER ISLAND
ISLA SALA Y GOMEZ
ISLA SAN FELIX
ISLA SAN AMBROSIO
ISLA JUAN FERNANDEZ
Albuquerque
Amarillo
Houston
Dallas
San Antonio
Tampa
Atlanta
Norfolk
Mexico
Guatemala City
San Salvador
Managua
San Jose
Panama
Bogota
Quito
Guayaquil
Lima
La Paz
Santiago
Buenos Aires
Montevideo
Asuncion
Caracas
Georgetown
Paramaribo
Belem
Manaus
Brasilia
Salvador
Rio de Janeiro
Sao Paulo
Kingston
Port-au-Prince
Santo Domingo
Nassau
Belize
Merida
Concepcion
Antofagasta
W1
W2
W3
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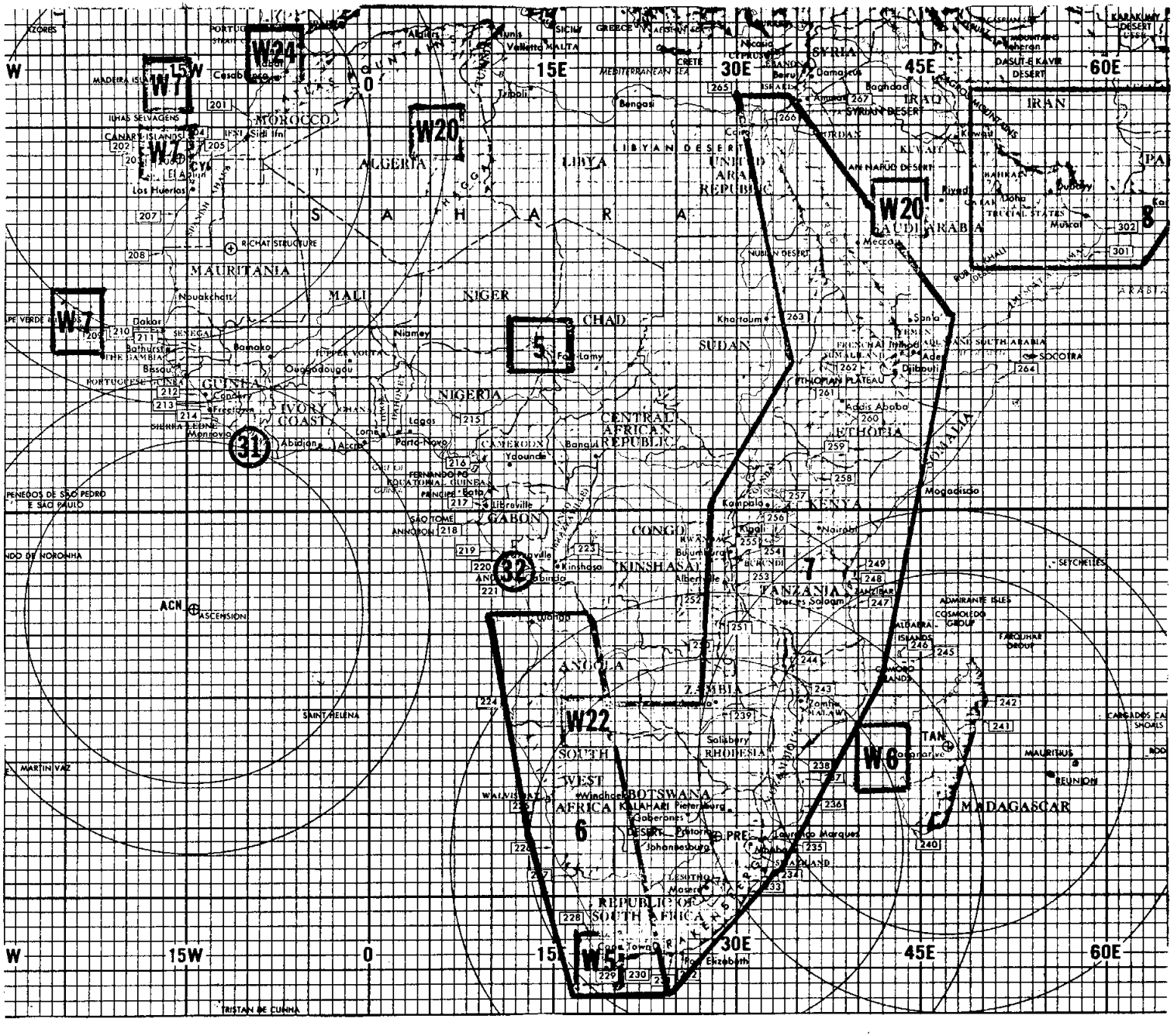
WHS
GYM
ANJ
BDA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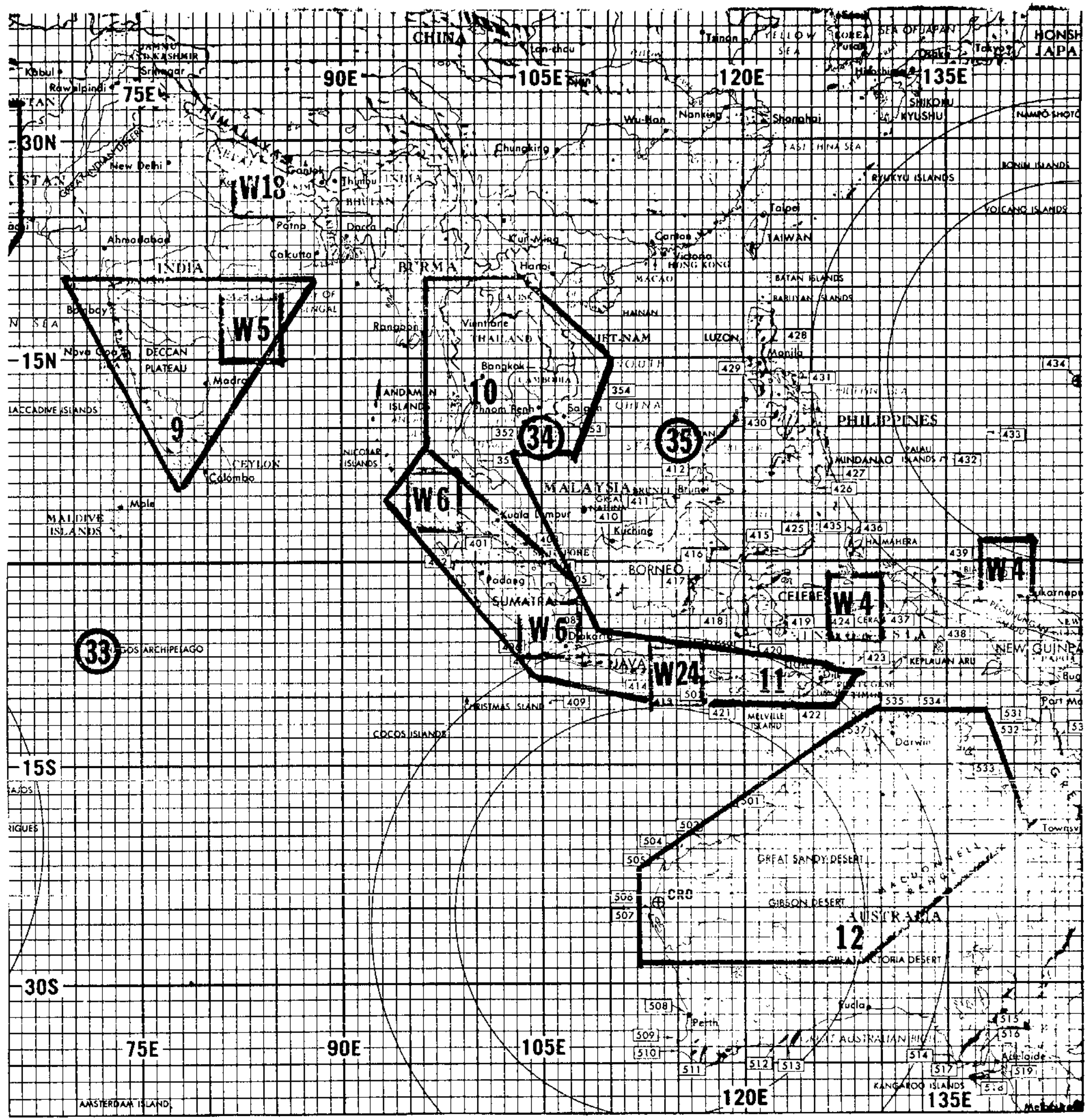
MOROCCO
ALGERIA
LIBYA
MAURITANIA
MALI
NIGER
CHAD
SUDAN
NIGERIA
GUINEA
IVORY COAST
CENTRAL AFRICAN REPUBLIC
CAMEROON
GABON
CONGO
KINSHASA
ANGOLA
ZAMBIA
TANZANIA
KENYA
ETHIOPIA
SOMALIA
SAUDI ARABIA
IRAN
IRAQ
SYRIA
LIBYAN DESERT
SAHARA
SOUTH WEST AFRICA
BOTSWANA
RHODESIA
REPUBLIC OF SOUTH AFRICA
MADAGASCAR
ASCENSION
SAINT HELENA
TRISTAN DA CUNHA
MAURITIUS
SEYCHELLES



CHINA
30N
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90E
105E
120E
135E
Kabul
Rawalpindi
Srinagar
New Delhi
Ahmadabad
Calcutta
Patna
Bombay
Nova Goa
Madras
Colombo
Male
INDIA
DECCAN
PLATEAU
CEYLON
MALDIVE
ISLANDS
LACCADIVE ISLANDS
BHUTAN
Dacca
BURMA
Rangoon
ANDAMAN
ISLANDS
NICOBAR
ISLANDS
Chungking
Kun-Ming
Hanoi
Vientiane
THAILAND
Bangkok
Phnom Penh
Saigon
VIET-NAM
HAINAN
Canton
Victoria
HONG KONG
MACAO
Lan-chou
Wu-Han
Nanking
Shanghai
Taipei
TAIWAN
YELLOW
SEA
KOREA
SEA OF JAPAN
Tokyo
SHIKOKU
KYUSHU
RYUKYU ISLANDS
BONIN ISLANDS
VOLCANO ISLANDS
BATAN ISLANDS
LUZON
Manila
PHILIPPINES
MINDANAO
HALMAHERA
MALAYSIA
Kuala Lumpur
Kuching
BORNEO
CELEBES
SUMATRA
Padang
JAVA
Djakarta
CHRISTMAS ISLAND
COCOS ISLANDS
CHAGOS ARCHIPELAGO
AMSTERDAM ISLAND
MELVILLE ISLAND
Darwin
NEW GUINEA
KEPLAUAN ARU
GREAT SANDY DESERT
GIBSON DESERT
AUSTRALIA
GREAT VICTORIA DESERT
Eucla
Perth
Adelaide
KANGAROO ISLANDS
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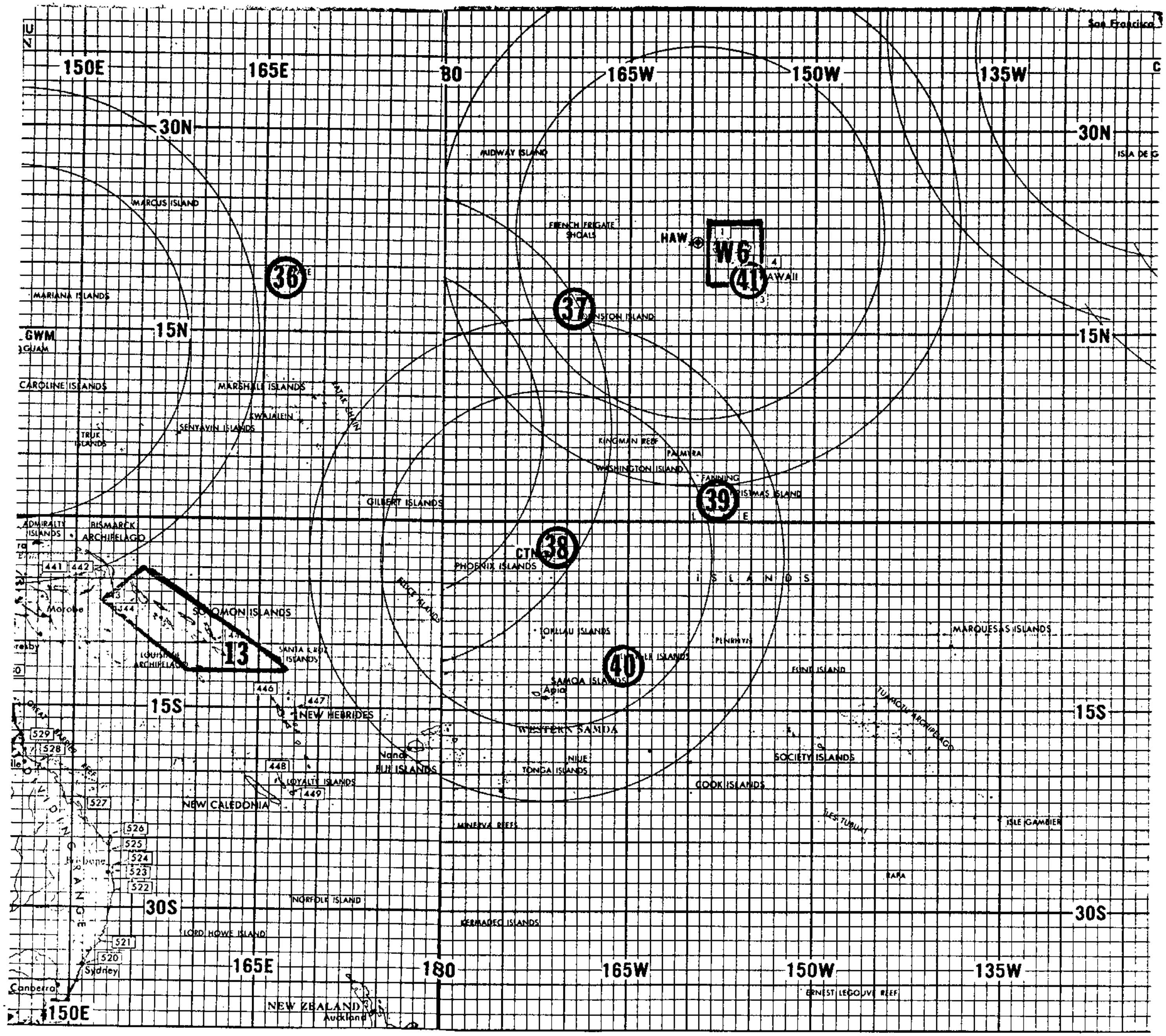

150E
165E
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San Francisco
MIDWAY ISLAND
MARCUS ISLAND
FRENCH FRIGATE SHOALS
HAW
W6
HAWAII
MARIANA ISLANDS
GWM
GUAM
JOHNSTON ISLAND
CAROLINE ISLANDS
MARSHALL ISLANDS
KWAJALEIN
SENYAVIN ISLANDS
TRUK ISLANDS
KINGMAN REEF
PALMYRA
WASHINGTON ISLAND
FANNING
CHRISTMAS ISLAND
GILBERT ISLANDS
ADMIRALTY ISLANDS
BISMARCK ARCHIPELAGO
CTN
PHOENIX ISLANDS
SOLOMON ISLANDS
Morobe
ELLICE ISLANDS
TOKELAU ISLANDS
MARQUESAS ISLANDS
SANTA CRUZ ISLANDS
LOUISIADE ARCHIPELAGO
SAMOA ISLANDS
Apia
FLINT ISLAND
NEW HEBRIDES
WESTERN SAMOA
NIUE
TONGA ISLANDS
FIJI ISLANDS
SOCIETY ISLANDS
COOK ISLANDS
LOYALTY ISLANDS
NEW CALEDONIA
MINERVA REEFS
ISLE GAMBIER
NORFOLK ISLAND
KERMADEC ISLANDS
LORD HOWE ISLAND
Sydney
Canberra
NEW ZEALAND
Auckland
ERNEST LEGOUVE REEF
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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

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 (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)			ELEC PWR (kw)	RCS (LB)	H_2 (LB/HR)	O_2 (LB/HR)			
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 Alnmts/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 Alnmt/w Alnmt 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 (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)			ELEC PWR (kw)	RCS (LB)	H_2 (LB/HR)	O_2 (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	29.3/ 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 GAN 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)

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 (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)			ELEC PWR (kw)	RCS (LB)	H_2 (LB/HR)	O_2 (LB/HR)			
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/G&N (<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)

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 (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)			ELEC PWR (kw)	RCS (LB)	H_2 (LB/HR)	O_2 (LB/HR)			
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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-62	During earth orbit (drifting flight)
Htr & Fan Test (90% Qty)	-1														1	Varies (>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)

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 (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)			ELEC PWR (kw)	RCS (LB)	H_2 (LB/HR)	O_2 (LB/HR)			
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)

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 (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)			ELEC PWR (kw)	RCS (LB)	H_2 (LB/HR)	O_2 (LB/HR)			
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), &	-1		70	See Remarks											1	N/A	1829	N/A	0.163	1.29	-	-	Schedule TBD
MSFN to CSM (259.7) (Duplex A)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
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), &	-4		10	" "											1	N/A	1829	N/A	0.163	1.29	-	-	
MSFN to CSM (296.8) (Duplex B)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
41. L/V PRPLNT PRESS. DISPLAYS	S20.14	41	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4-96	
Fuel/Oxid Display Readings Before & After	-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
Vent Period				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	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		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)

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 (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)	(216-240)	10 (240-END)			ELEC PWR (kw)	RCS (LB)	H_2 (LB/HR)	O_2 (LB/HR)			
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	-1		100	02:30											3	00:07	N/A	N/A	N/A	N/A	—	—	
Mnvr				—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
				—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
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; cryogenics 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.