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BELLCOMM, INC.
955 L'ENFANT PLAZA NORTH, S.W. WASHINGTON, D. C. 20024

SUBJECT: Trip Report: Discussion of AAP Timelining at Martin Marietta Corporation/Denver Division, February 5, 1969 - Case 610

DATE: February 19, 1969

FROM: A. B. Baker
D. J. Belz

ABSTRACT

On February 5, 1969, the writers met with two groups of Martin/Denver staff members to discuss AAP flight planning and computer models developed at Martin to aid in experiment integration. The writers presented a summary description of a study which examines some of the problems associated with performing all experiments currently assigned to AAP-1/AAP-2. Martin staff members briefed the writers on: (1) current AAP flight planning studies being performed for MSC/FCSD, (2) the Martin Experiments Data Bank System, (3) their activity scheduling program (SAMMIE), and (4) other computer programs developed and being developed under contract with MSFC. Summaries are given of discussions concerning these topics.

(NASA-CR-104004) TRIP REPORT - DISCUSSION OF AAP TIMELINING AT MARTIN MARIETTA CORPORATION/DENVER DIVISION, FEBRUARY 5, 1969 (Bellcomm, Inc.) 43 p

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SUBJECT: Trip Report: Discussion of AAP Timelining at Martin Marietta Corporation/Denver Division, February 5, 1969 - Case 610

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D. J. Belz

MEMORANDUM FOR FILE

On February 5, 1969, the writers met with two groups of Martin/Denver staff members to discuss AAP flight planning studies and computer models developed at Martin to aid in experiment integration.

The compatibility of experiments currently assigned to the AAP-1/AAP-2 mission was discussed with Messrs. J. Steele and C. Hassler. Mr. Steele's group is carrying out a flight planning study for MSC/FCSD in support of ML's request for a detailed study of the implications of integrating the new experiment baseline into the first AAP mission. The writers presented a summary description of a related crew-time compatibility study prepared by D. J. Belz. That study examined some of the problems associated with performing all experiments currently assigned to AAP-1/AAP-2. The results indicated that all experiments might be performed in their entirety on a nominal mission, but only at the expense of violating some of the flight planning groundrules currently in effect within FCSD. The principal violation noted was the inability to maintain every seventh mission day for "mission evaluation" to the exclusion of all experiments not performed within meal periods. In addition, the performance of all experiments results in tight scheduling for at least two crewmen throughout the mission. Additional study results are shown in the attached flip charts, copies of which were transmitted as working papers to Messrs. Steele and Hassler.

The Martin crew-time compatibility study for AAP-1/AAP-2 will attempt to adhere to all current FCSD groundrules; it is expected that some low priority experiments will not be included in the resulting timelines. For that reason they plan to incorporate those experiments not timelined on AAP-1/AAP-2 into their AAP-3A timelines. There was general agreement that the sensitivity of flight plans to scheduling groundrules warrants continuing evaluation of such rules.

Mr. Steele's group has in recent months prepared a number of studies in support of flight planning activities at MSC. These include: (1) proposed groundrules and constraints for flight crew procedures; (2) identification and indexing of tasks required for in-flight activities; and (3) preliminary flight plans for AAP core missions.

During the second part of the day, the writers met with members of the Experiment Analysis and Integration Section who, under contract to MSFC, are responsible for the integration of AAP experiments. Our discussions were primarily concerned with computer models developed by Martin to aid in that activity. Mr. S. Bullard explained that while six models have been developed, only three have been used appreciably: (1) an Experiments Data Bank which is a computerized data storage and retrieval system designed to provide a central source for all data pertaining to experiment characteristics; (2) an automated scheduling model (SAMMIE) designed to aid the scheduler in producing crew time-lines; and (3) a trajectory/orbit model called TRACE which, like BCMASP, produces a variety of spacecraft ephemeris data.

The Experiments Data Bank was designed under the direction of Mr. P. DuCharm. It contains 66 experiment descriptors for each experiment and is currently used to "track" 73 experiments. Input data for each experiment is punched onto twenty data cards in a designated format. Card formats correspond to the formats on standardized data forms shown in Figures 1 and 2. Experiment data within the data bank can be updated by entering new values of descriptors on the appropriately coded punched card(s). The integrity of the data bank is maintained by established limits on the form and range of the data for each descriptor of each experiment. System checks are performed on input data to insure that it conforms to these limits.

The data bank is maintained by a team of ∿25 experiment analysts, each of whom is responsible for maintaining familiarity with ∿3 experiments. These people also prepare and update Experiment Integration Requirements Documents (EIRD's) for MSFC. The data bank is updated frequently and usually contains more current data than is found in the EIRD's. Martin has not used the data bank output directly as an input to their scheduling model because much of the experiment data required by the scheduler is not easily quantifiable.

The computer programs for the data bank are written in COBOL and run on an IBM 360/65, a machine used at Martin primarily for commercial applications. We explored the compatibility of Martin output tapes with Bellcomm's Univac 1108 system. The IBM 360/65 generates a nine-track tape with a packing density of 1600 BPI and different block lengths than the UNIVAC 1108. Mr. DuCharm noted the problem of generating a tape on the 360/65 which could be used by the 1108: a systems program would have to be written to accomplish the required conversion. Such a program would be useful only if Martin continues to maintain current information in the data bank; at present MSFC plans to suspend such updating after April 1, 1969, although Martin's analysts will continue to track experiments and update EIRD's.

The Martin Activity Scheduling Model (SAMMIE) was discussed with Messrs. S. Bullard and M. Brunschwig. Mr. Brunschwig explained that the model was intended to be a simple algorithm which sacrificed sophistication for speed of computation. (A typical run for AAP-1/AAP-2 takes 3-4 minutes on their computer.) The result however is that a substantial amount of hand scheduling must be done and presented to the model as input. The model itself is approximately 150,000 words long and is written in FORTRAN.

Basic daily crew cycles are input to the model and can be modified only by supplying an entire new cycle for the particular day. Such modifications amount to an "overlay" of the basic cycle. In cases of extreme deviation from the basic cycle the complete crew timelines for the days affected are generated by hand and supplied as input in their entirety.

When more than one crewman is required for an experiment, the program presumes they are engaged in that experiment simultaneously. Where this presumption is not valid, as in some AAP medical experiments, the "packing density" of experiments in the timeline generated by SAMMIE may be less than that achievable by hand scheduling. This limitation can in some cases be reduced by hand-scheduling two or more experiments in relation to each other and feeding the group of experiments to SAMMIE as a unit. The user of SAMMIE must be as familiar with experiments as the hand-scheduler to make the most effective use of SAMMIE.

A new scheduling program, SAMMIE II, is being constructed for the ATM experiments. The experiment requirements for ATM are tied to the random occurances of solar activity: SAMMIE II will include the capability to simulate these random occurances as well as to account for unique characteristics of the ATM experiments.

A. B. Baker

D. J. Belz

1025-$\frac{\text{ABB}}{\text{DJB}}$-dcs

Attachments

EXPERIMENT GENERAL INFORMATION

DENVER DIVISION

EXPERIMENT NO.	CN
1 2 3 4 5 6 7	8 9

CC	LN	CROSS REFERENCE NUMBERS		H
10	11	12 13 14 15 16 17 18	19 20 21 22 23 24 25	26
4	5			

ALL CHANGES MUST BE IN RED

DATE ESTABLISHED	DATE LAST REVISED	DATE LAST USED

CC	LN	TITLE
10	11	12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62
1	1	
	2	12 ANALYST 25 / 26 PRINCIPAL INVESTIGATOR 40 / 41 PI ORG 46 / 47 48 / 49 SOURCE REFERENCE 62

CC	LN	OBJECTIVES
10	11	12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62
2	1	
	2	
	3	
	4	

CC	LN	CONSTRAINTS — (ENVIRONMENTAL - OPERATIONAL - OTHER)
10	11	12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62
3	1	
	2	
	3	
	4	
	5	
	6	12 CONSTRAINTS — (CONTINUED) 36 / 37 COMMODITIES REQUIRED 62
	7	12 SAMPLES RETURNED 62

DC 06-8092-03-A (9-68)

FIGURE 1 - Input Format for Martin/Denver Experiment Data Bank

EXPERIMENT

EXPERIMENT NO. (1–7)	CN (8–9)

CC (10)	LN (11)	CROSS REFERENCE NUMBERS (12–25)	H (26)
4	5		

ALL CHANGES MUST BE IN RED

DATE ESTABLISHED	DATE LAST REVISED	DATE LAST USED

CC (10)	LN (11)	CONCURRENT / PREREQUISITE / RELATED EXPERIMENTS (12–60)	CW (61)	SKILL (62)
	1			

CC (10)	LN (11)	CONCURRENT / PREREQUISITE / RELATED EXPERIMENTS (12–29)	30 MSFEB ACTION 36	37 FLIGHT STATUS 42	43 FLIGHT ASSIGNMENTS 54	HARDWARE AVAILABLE	RESERVE
	2						

LN (11)	MISSION CATEGORY (12–17)	OBJECTIVE CODES (18–24)	PREFERRED INCLINATION (25–28)	ORBIT TIME HOURS (29–33)	EQUIPMENT LOCATION: LAUNCH (34–36)	PERF. (37–39)	STORED (40–42)	EED (43–44)	SSD (45)	VOICE (46)	TAPE (47)	TVR (48)	TVX (49)	REAL TIME	No. Com Channels (50–51)	Analog Channels (52–53)	Digital Channels (54–55)	PEAK SAMPLES / SECONDS (56–60)	RESERVE (61–62)
3																			

LN (11)	Orientation Code (12–14)	Stabilization Code (15–17)	FIELD OF VIEW (18–27)	NUMBER MANEUVERS (28–30)	POINTING REQUIREMENTS: ACCURACY DEG. (31–36)	RATES DEG/SEC (37–41)	TARG. CAT. (42)	EQUIPMENT CODES (43–62)
4								

CC (10)	LN (11)	PREFERRED ALTITUDE NAUTICAL MILES / KILOMETERS (12–25)	INITIAL WEIGHT TOTAL LBS / KG (26–32)	RETURN WEIGHT LBS / KG (33–39)	FILM WEIGHT LBS / KG (40–44)	TOTAL VOLUME FT³ / M³ (45–49)	RETURN VOLUME FT³ / M³ (50–56)	DESIRED TIME TOTAL HOURS (57–62)
	1							

LN (11)	PEAK WATTS (12–16)	AVERAGE WATTS (17–21)	STAND-BY WATTS (22–26)	WATT HOURS PER PERFORMANCE (27–31)	DESIRED NO. PERF. (32–34)	MINIMUM NO. PERF. (35–37)	CREW TIME DESIRED TOTAL MAN HOURS (38–42)	CREW TIME - MIN. TOTAL MAN HOURS (43–47)	NO. OF EVA (48–49)	TOTAL EVA HOURS (50–52)	RESERVE (53–56)	MINIMUM TIME TOTAL HOURS (57–62)
2												

EXPERIMENT DATA SUMMARY

[illegible]

[illegible]

FIGURE [illegible] – [illegible] Form For Manned/Unmanned Experiment Data [illegible]

ATTACHMENT

The attachment to this memorandum contains working papers transmitted by the writers to Messrs. J. Steele and C. Hassler of the Martin Marietta Corporation/Denver Division. These working papers summarize a study prepared by D. J. Belz concerning the crew-time compatibility of experiments presently assigned to the AAP-1/AAP-2 mission.

Program _____ Sequence No. ____

WORKING PAPERS

CREW-TIME COMPATIBILITY OF EXPERIMENTS ON AAP-1/AAP-2

WORKING PAPERS

OBJECTIVE

TO DETERMINE WHETHER ALL EXPERIMENTS ASSIGNED BY ML FOR PERFORMANCE ON AAP-1/AAP-2 ARE COMPATIBLE WITH AVAILABLE CREW TIME.

WORKING PAPERS

SCHEDULING APPROACH

90% OF EXPERIMENTS CURRENTLY ASSIGNED TO AAP-1/AAP-2 WERE ASSIGNED IN DIRECTIVE 3C. THEREFORE DETAILED CREW TIMELINES* DEVELOPED FOR THE DIRECTIVE 3C BASELINE WERE MODIFIED TO ACCOMMODATE THE NEW BASELINE.

*"EXPERIMENT SCHEDULING FOR THE AAP-1/AAP-2 MISSION," BELLCOMM MEMORANDUM FOR FILE B68 12040.

WORKING PAPERS

IN-FLIGHT EXPERIMENTS ASSIGNED TO AAP-1

EXPERIMENT		CURRENT BASELINE (AS OF JAN. 8, 1969)	PROGRAM DIRECTIVE 3C BASELINE (MAY 1968 - SEPT. 1968)
NAME	NUMBER		
BONE AND MUSCLE CHANGES (MINERAL BALANCE)	M052 (M071)	X	X
SPECIMEN MASS MEASUREMENT DEVICE.	M056 (M074)	X	X
EFFECTS OF GRAVITY ON SINGLE HUMAN CELLS	S015	X	X
GALACTIC X-RAY MAPPING	S027*		X
THERMAL CONTROL COATINGS	M415*		X
PRECISION OPTICAL TRACKING	T018*	X	X
RADIATION IN SPACECRAFT	D008	X	X

NOTE: (1) ITEMS IN PARENTHESES ARE REVISED NAMES AND NUMBERS OF MEDICAL EXPERIMENTS.

(2) CONSIDERING ONLY EXPERIMENTS THAT REQUIRE CREW PARTICIPATION, "CURRENT" AND "3C" BASELINES ARE IDENTICAL.

*NO CREW TIME REQUIRED

WORKING PAPERS

IN-FLIGHT EXPERIMENTS ASSIGNED TO AAP-2

EXPERIMENT		CURRENT BASELINE (AS OF JAN. 8, 1969)	PROGRAM DIRECTIVE 3C BASELINE (MAY 1968 - SEPT. 1968)
NAME	NUMBER		
IN-FLIGHT VECTORCARDIOGRAM	M018 (M093)	X	X
METABOLIC COSTS OF IN-FLIGHT TASKS	M050 (M171)	X	X
CARDIOVASCULAR FUNCTION	M051 (M092)	X	X
BONE AND MUSCLE CHANGES (MINERAL BALANCE)	M052 (M071)	X	X
HUMAN VESTIBULAR FUNCTION	M053 (M131)	X	X
TIME AND MOTION STUDY	M055 (M151)	X	X
SPECIMEN MASS MEASUREMENT DEVICE	M056 (M074)	X	X
BODY MASS MEASUREMENT DEVICE	M058 (M172)	X	X

NOTE: (1) ITEMS IN PARENTHESES ARE REVISED NAMES AND NUMBERS OF MEDICAL EXPERIMENTS.

(2) IN-FLIGHT PORTIONS OF CURRENTLY BASELINED MEDICAL EXPERIMENTS ARE IDENTICAL TO THOSE BASELINED IN DIRECTIVE 3C.

IN-FLIGHT EXPERIMENTS ASSIGNED TO AAP-2 (CONTINUATION 1)

EXPERIMENT		CURRENT BASELINE (AS OF JAN. 8, 1969)	PROGRAM DIRECTIVE 3C BASELINE (MAY 1968 - SEPT. 1968)
NAME	NUMBER		
ORBITAL WORKSHOP	M402	X	X
ZERO GRAVITY FLAMMABILITY	M479		X
HABITABILITY/CREW QUARTERS	M487	X	X
HEAT EXCHANGER SERVICE	M489		X
JOINING OF TUBULAR ASSEMBLIES IN A SPACE ENVIRONMENT	M492	X	X
SELF CONTAINED ELECTRON BEAM WELDING	M493	X	X
GRAVITY SUBSTITUTE WORKBENCH	M507	X	
ASTRONAUT EVA HARDWARE EVALUATION	M508	X	X
ASTRONAUT MANEUVERING EQUIPMENT	M509	X	X
CARBON DIOXIDE REDUCTION	D017		X
SUIT DONNING AND SLEEP STATION EVALUATION	D019	X	X

COMMENTS

- EXPERIMENTS IN "3C" BASELINE BUT NOT IN CURRENT BASELINE:

EXPERIMENT NUMBER	CREW-TIME REQUIRED (MAN-HOURS)
M479	~17.3*
M489	25. *
D017	NONE

- EXPERIMENTS IN CURRENT BASELINE BUT NOT IN "3C" BASELINE:

EXPERIMENT NUMBER	CREW-TIME REQUIRED (MAN-HOURS)
M507	~7.3*

- RECENT CHANGES IN CREW-TIME REQUIREMENTS OF EXPERIMENTS IN BOTH BASELINES:

M492, M493 — UNKNOWN CHANGES RESULTING FROM EXPERIMENT REDEFINITION TO EMPHASIZE RESEARCH INTO SPACE MANUFACTURING PROCESSES.

*ONE-MAN TIME

IN-FLIGHT EXPERIMENTS ASSIGNED TO AAP-2 (CONTINUATION 2)

EXPERIMENT		CURRENT BASELINE (AS OF JAN. 8, 1969)	PROGRAM DIRECTIVE 3C BASELINE (MAY 1968 - SEPT. 1968)
NAME	NUMBER		
ALTERNATE RESTRAINTS EVALUATION	D020	X	X
EXPANDABLE AIRLOCK	D021	X	X
EXPANDABLE STRUCTURES FOR RECOVERY	D022	X	X
NUCLEAR EMULSION	S009	X	X
MICROMETEOROID COLLECTION	S018	X	X
UV STELLAR ASTRONOMY	S019	X	X
X-RAY/UV SOLAR PHOTOGRAPHY	S020	X	X
UV AIRGLOW HORIZON PHOTOGRAPHY	S063	X	
MULTIBAND TERRAIN PHOTOGRAPHY	S065/S101	X	X (S065)
GEGENSCHEIN/ZODIACAL LIGHT	S073	X	
IN-FLIGHT NEPHELOMETER	T003	X	X
FROG OTOLITH FUNCTION	T004		X
CREW VEHICLE DISTURBANCES	T013		X

COMMENTS

- EXPERIMENTS IN "3C" BASELINE BUT NOT IN CURRENT BASELINE:

EXPERIMENT NUMBER	CREW-TIME REQUIRED (MAN-HOURS)
T004	NONE
T013	~3.75 MAN HOURS; THREE-MAN TIME

- EXPERIMENTS IN CURRENT BASELINE BUT NOT IN "3C" BASELINE:

EXPERIMENT NUMBER	CREW-TIME REQUIRED (MAN-HOURS)
S063	~0.3*
S073	~3.0*

- RECENT CHANGE IN CREW TIME REQUIRED BY EXPERIMENT IN BOTH BASELINES:

  D022 - REQUIREMENT FOR 2 EVA'S ON AAP-1/AAP-2 REDUCED TO 1 EVA BY SPONSORING AGENCY. INCREASES AVAILABLE CREW TIME BY 12. MAN-HOURS (3-MAN TIME).

*ONE-MAN TIME

WORKING PAPERS

IN-FLIGHT EXPERIMENTS ASSIGNED TO AAP-2 (CONTINUATION 3)

EXPERIMENT		CURRENT BASELINE (AS OF JAN. 8, 1969)	PROGRAM DIRECTIVE 3C BASELINE (MAY 1968 - SEPT. 1968)
NAME	NUMBER		
METEOROID IMPACT AND EROSION	T017		X
PRECISION OPTICAL TRACKING	T018		X
FOOT CONTROLLED MANEUVERING UNIT	T020	X	X
METEOROID VELOCITY	T021		X
SURFACE ADSORBED MATERIALS	T023		X
CORONAGRAPH CONTAMINATION MEASUREMENTS	T025	X	X
CONTAMINATION MEASUREMENT	T027	X	X

Program _____ Sequence No. 11

WORKING PAPERS

COMMENTS

EXPERIMENTS IN "3C" BASELINE BUT NOT IN CURRENT BASELINE:

EXPERIMENT NUMBER	CREW-TIME REQUIRED (MAN HOURS)
T017	0.25*
T018	NONE
T021	~ 0.25*
T023	~ 0.75 (EVA - THREE MAN TIME)

*ONE MAN TIME

WORKING PAPERS

MISSION PARAMETERS

PARAMETER	VALUE USED IN COMPATIBILITY ANALYSIS	CURRENT BASELINE	
		VALUE	REMARKS
AAP-1 LAUNCH DATE	AUGUST 15, 1971	AUGUST 1971	ML-15 LAUNCH SCHEDULE
AAP-1 LAUNCH TIME	3:20 PM EST	4:28 PM EST	MSC BRM,* DECEMBER 15, 1968
INITIAL CIRCULAR ORBITAL ALTITUDE	220. NM	210. NM	
ORBITAL INCLINATION	29^0	35^0	
INITIATION TIME OF DEORBIT MANEUVER	661:40 GET†	672:16	MSC BRM,* DECEMBER 15, 1968

NOTE: (1) CHANGES IN LAUNCH TIME, ORBITAL ALTITUDE, AND INCLINATION INVALIDATE DAY/NIGHT CYCLES USED IN EXPERIMENT COMPATIBILITY ANALYSIS.

(2) CURRENT BRM IS ~10.5 HOURS LONGER THAN PREVIOUS BRM ON WHICH COMPATIBILITY ANALYSIS IS BASED.

*BRM ≡ BASELINE REFERENCE MISSION

†GET ≡ GROUND ELAPSED TIME MEASURED FROM AAP-1 LIFTOFF.

EXPERIMENT SENSITIVITY TO ORBITAL PARAMETERS

- D021, D022, T025, AND S020 ARE RESTRICTED IN WHOLE OR IN PART TO PERFORMANCE IN DIRECT SUNLIGHT.
- S019 IS PERFORMED ONLY DURING SPACECRAFT "NIGHT."
- T027 REQUIRES SEPARATE "DAY" AND "NIGHT" OPERATION.
- D008 REQUIRES SEPARATE OPERATION INSIDE AND OUTSIDE THE SOUTH ATLANTIC ANOMALY.

WORKING PAPERS

SCHEDULING GUIDELINES AND ASSUMPTIONS

- CREW ENTERS CM TWO HOURS PRIOR TO AAP-1 LIFTOFF.
- ALL CREWMEN AWAKE DURING INITIAL ENTRY INTO MDA AND OWS.
- DAILY TIME ALLOCATIONS REQUIRED FOR EACH CREWMAN:

ACTIVITY	DURATION (HOURS)
SLEEP	8.
PERSONAL HOUSEKEEPING	1.5
SYSTEMS HOUSEKEEPING	2.
"BREAKFAST"/M052, M056, M058	1.5
"LUNCH"/M052, M056	1.25
"DINNER"/M052, M056	1.25
TOTAL	15.5 (TYPICALLY, 8.5 HOURS/ MAN/DAY AVAILABLE FOR EXPERIMENTS)

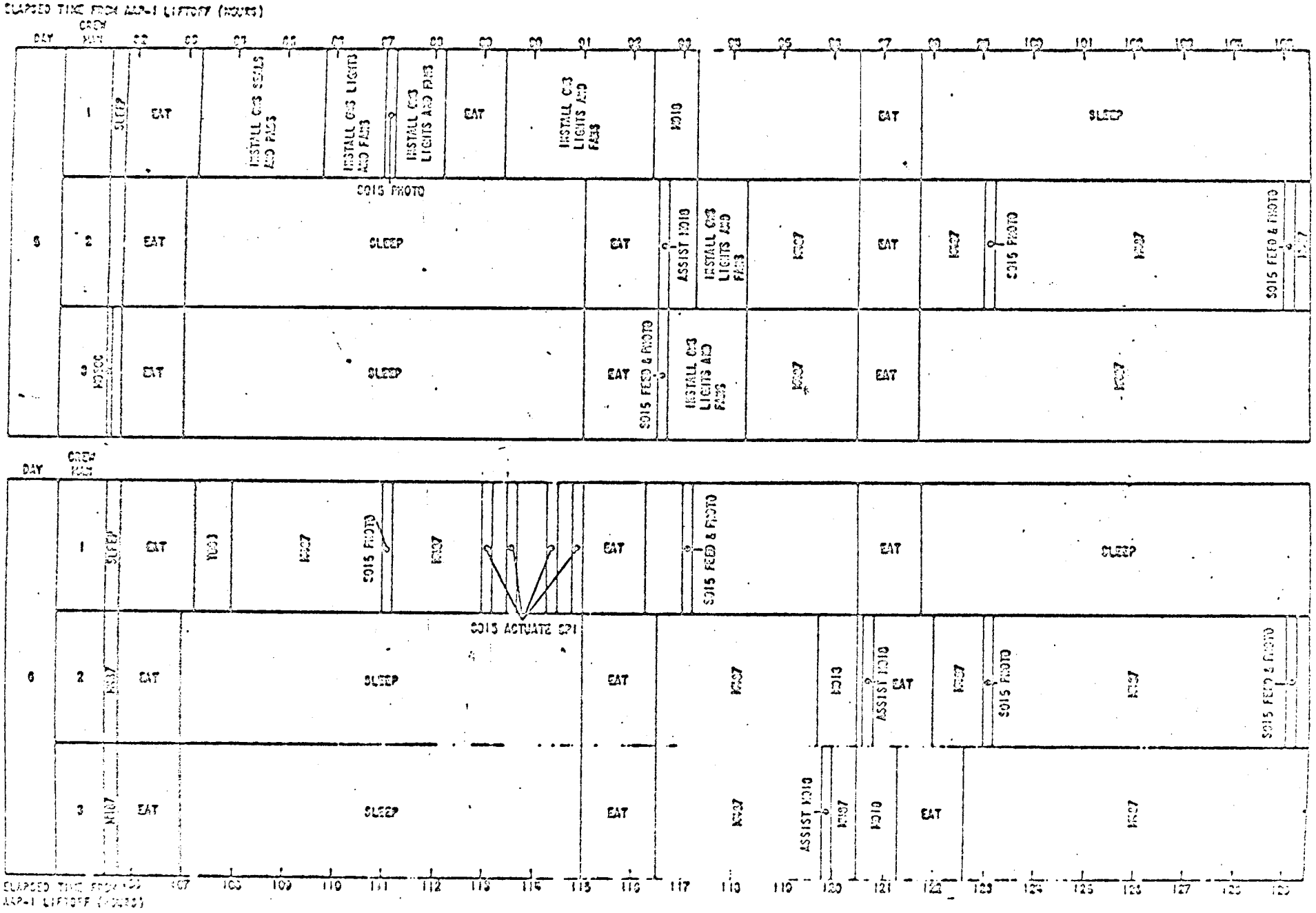
- CREW MEMBERS SHALL TAKE MEALS TOGETHER, WHERE POSSIBLE.
- DURATIONS BETWEEN MEALS FOR EACH CREWMAN: 8. HOURS MAXIMUM; 4. HOURS MINIMUM.
- MAXIMUM CONTINUOUS DURATION WITHOUT SLEEP: 18. HOURS.
- DAYS 8, 14, 21 SHALL BE RESERVED FOR MISSION EVALUATION.
- AT LEAST ONE MAN, AWAKE OR SLEEPING, MUST BE IN CM AT ALL TIMES.

SCHEDULING GUIDELINES AND ASSUMPTIONS (CONTINUED)

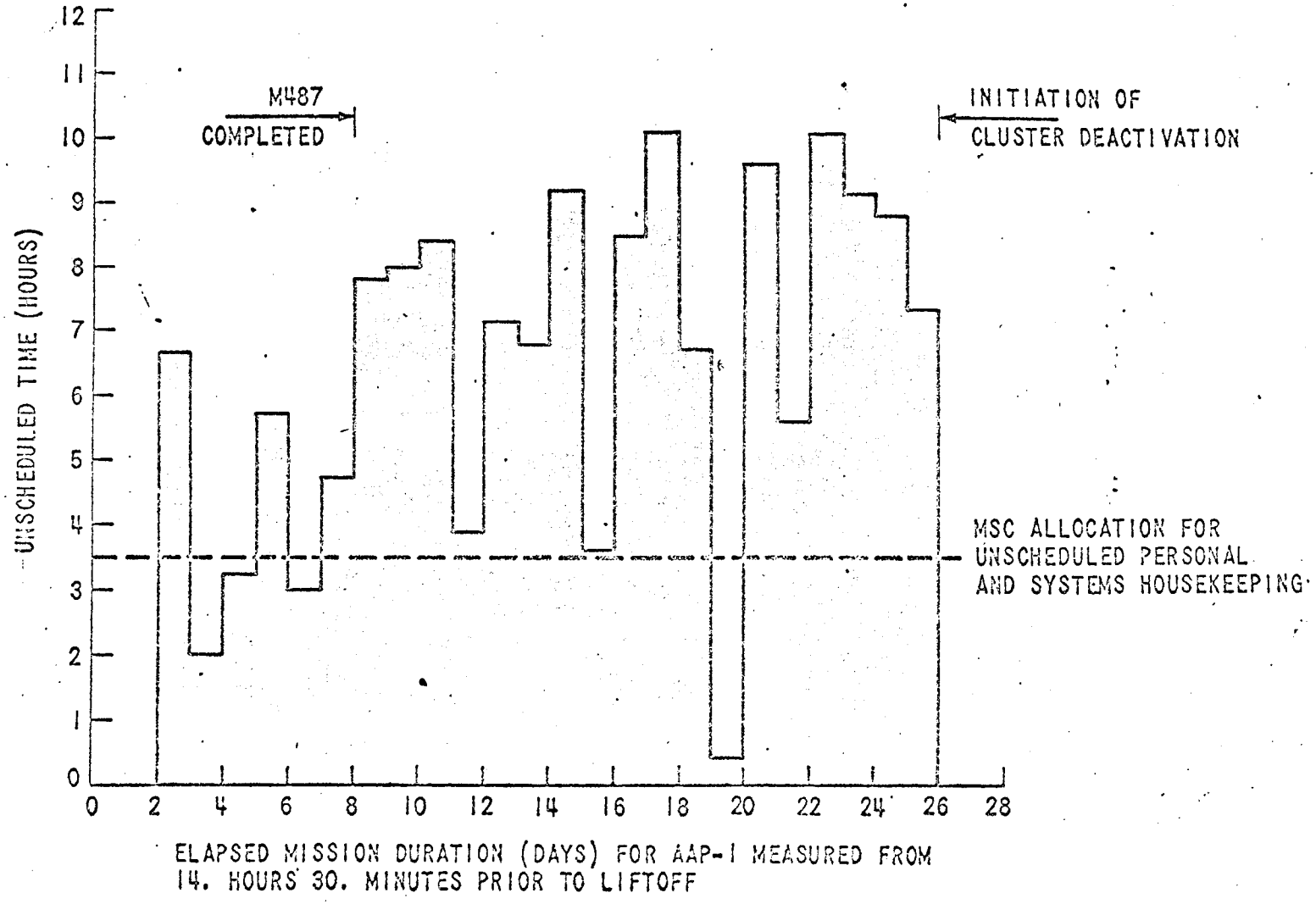
- OWS ACTIVATION SHALL COMMENCE AT COMPLETION OF OWS PRESSURIZATION TO PERMIT INSTALLATION OF SEALS.
- EXPERIMENTS M050, M051, M052, M056, M018, M055, AND M058 SHALL BEGIN AS SOON AS POSSIBLE FOLLOWING MDA ACTIVATION.
- PREPARATION FOR EVA = 2-1/4 HOURS/MAN.
- POST-EVA TIME = 3/4 HOUR/MAN.
- MAXIMUM EVA DURATION = 3 HOURS.
- ALL CREWMEN MUST BE AWAKE DURING EVA.
- DURING EVA ONE MAN SHALL BE IN CM, THE OTHER TWO OUTSIDE VEHICLE'S PRESSURIZED VOLUME.
- LAST TWO DAYS IN ORBIT ARE RESERVED FOR CLUSTER DEACTIVATION, STOWAGE, AND DEORBIT OPERATIONS.

Program _____ WORKING PAPERS _____ Sequence No. _____

SAMPLE OF CREW TIMELINES - AAP-1/AAP-2



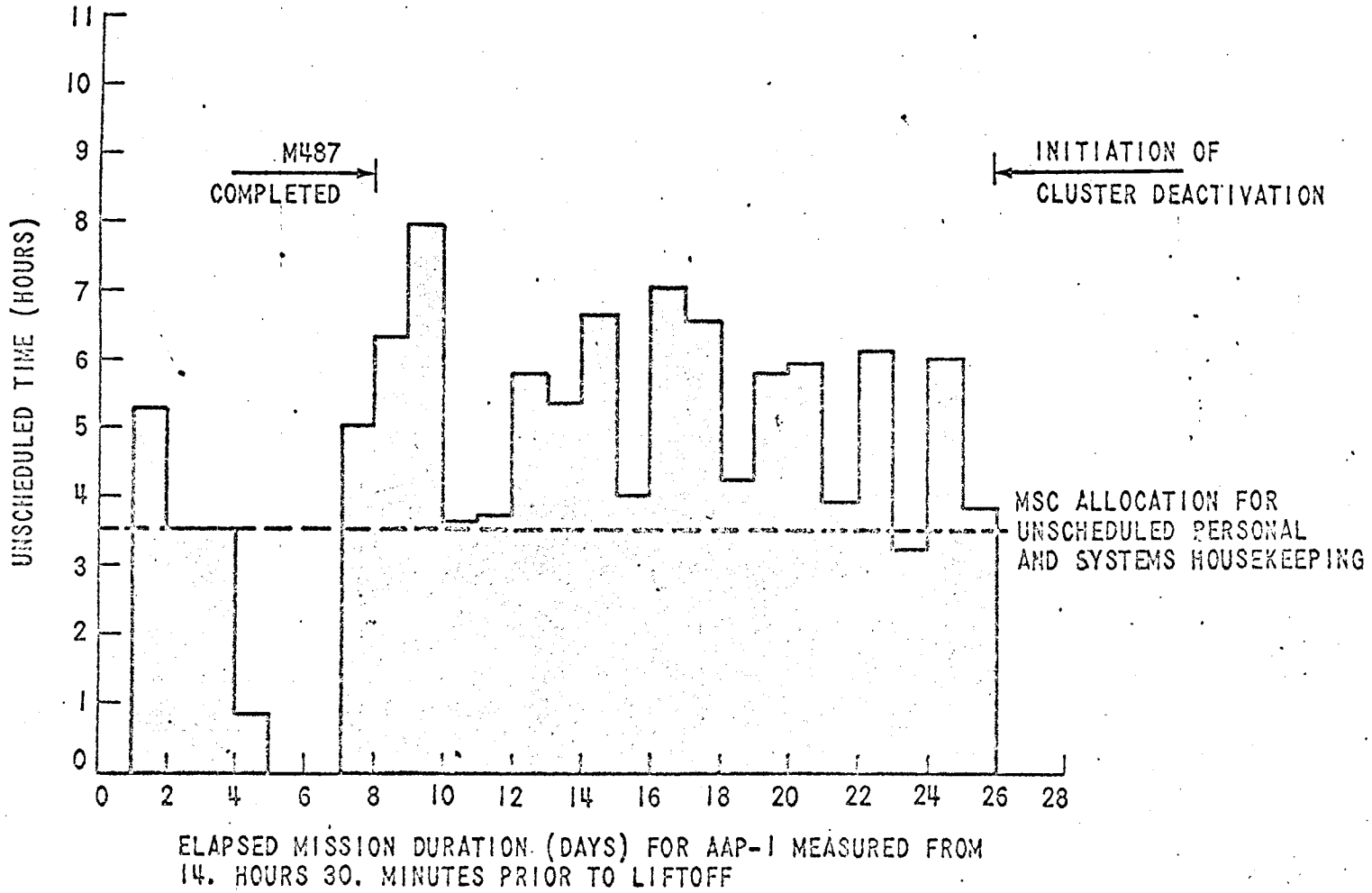
UNSCHEDULED TIME FOR CREWMAN 1 DURING THE AAP-1/AAP-2 MISSION



Program _____ Sequence No. _____

WORKING PAPERS

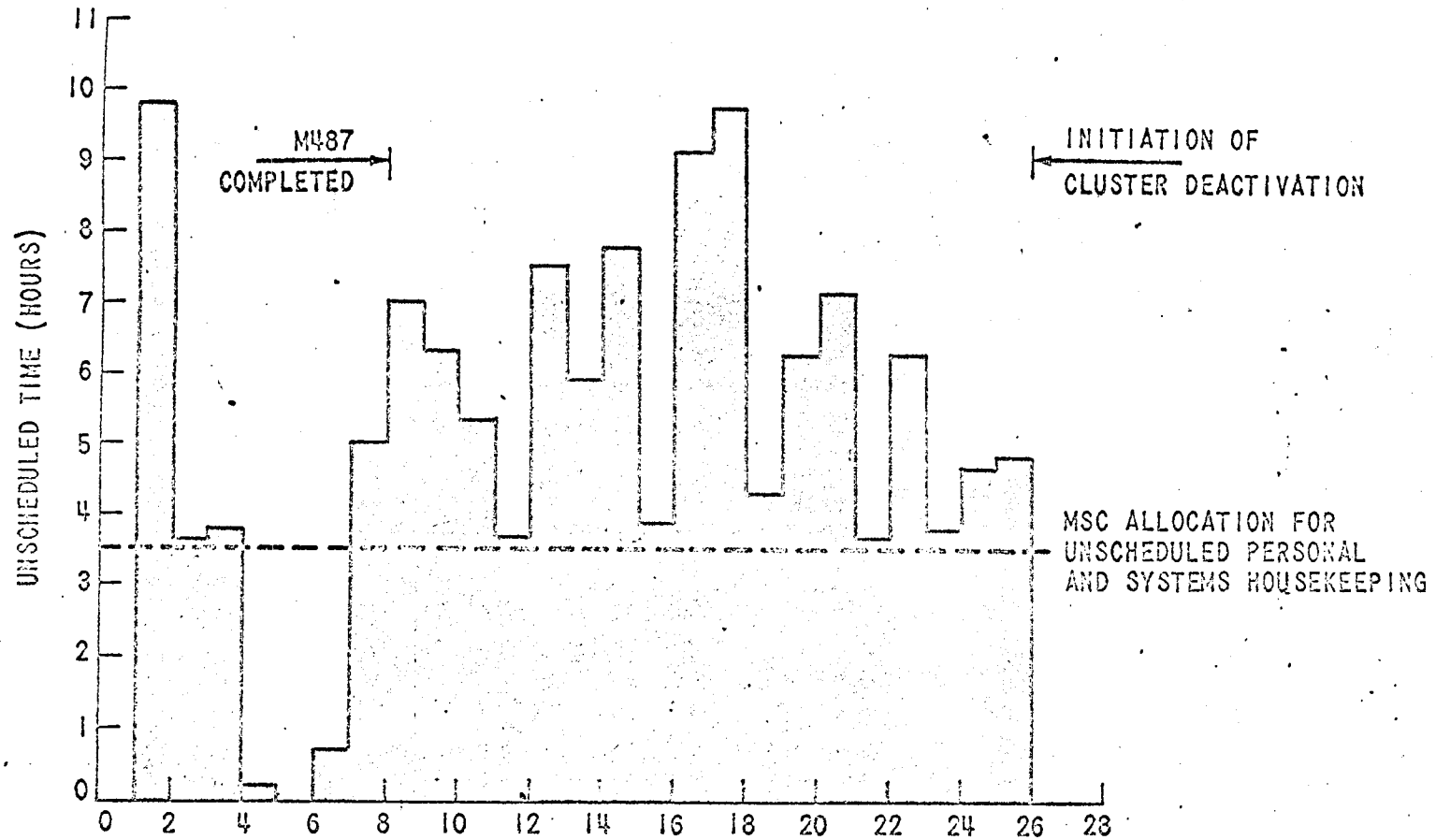
UNSCHEDULED TIME FOR CREWMAN 2 DURING THE AAP-1/AAP-2 MISSION



NOTE: CREWMAN 2 IS ASSUMED TO BE THE PHYSICIAN-ASTRONAUT OF EXPERIMENT M051

WORKING PAPERS

UNSCHEDULED TIME FOR CREWMAN 3 DURING THE AAP-I/AAP-2 MISSION

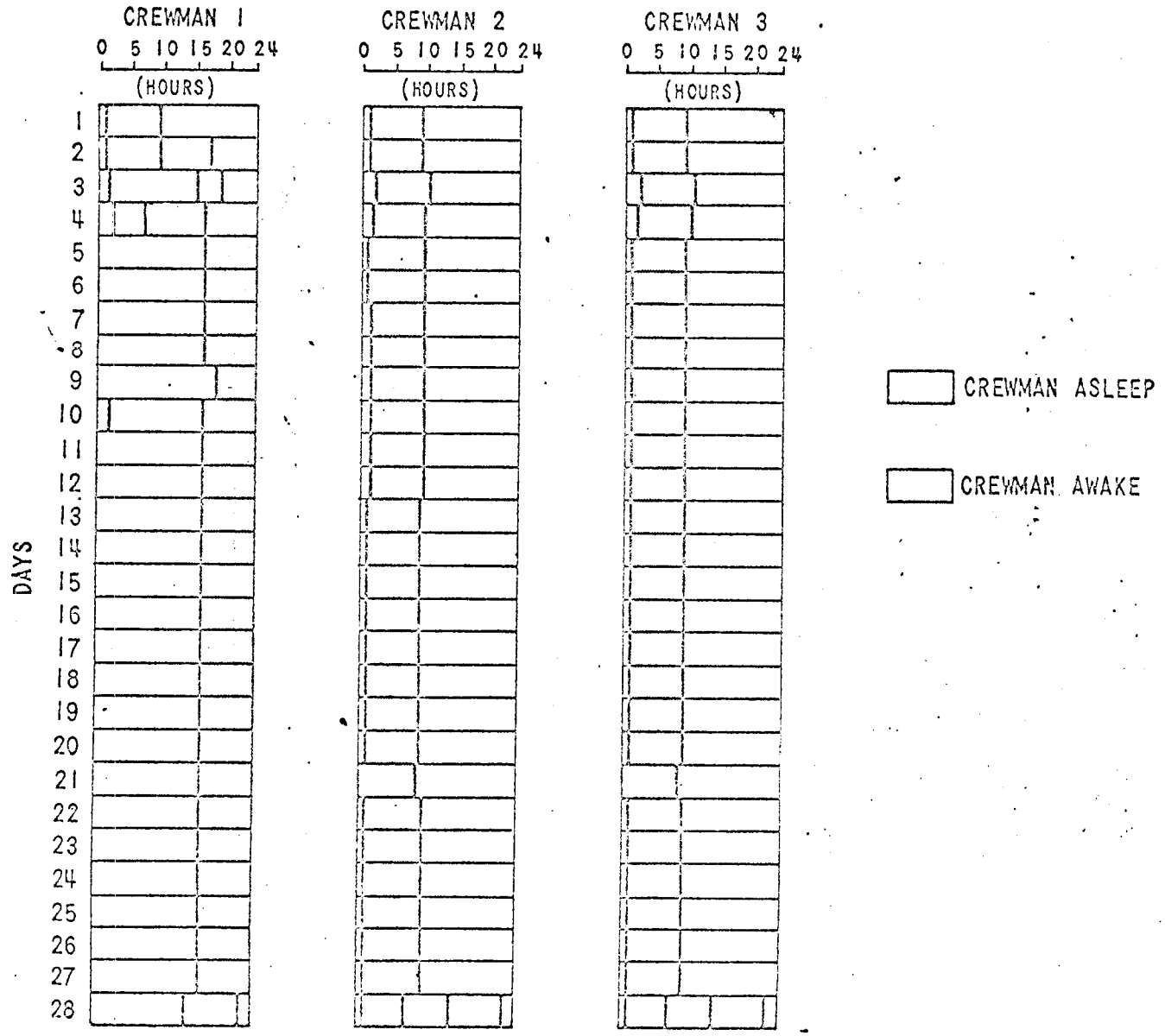


ELAPSED MISSION DURATION (DAYS) FOR AAP-I MEASURED FROM
14. HOURS 30. MINUTES PRIOR TO LIFTOFF

Program _____ Sequence No. _____

WORKING PAPERS

SLEEP PERIODS ALLOCATED TO EACH CREWMAN DURING THE AAP-1/AAP-2 MISSION



WORKING PAPERS

CREW TIME UTILIZATION

- TOTAL FLIGHT-CREW TIME FROM LIFTOFF TO LANDING = 1980. MAN-HOURS
- FLIGHT-CREW TIME AVAILABLE FOR EXPERIMENTS OTHER THAN THOSE PERFORMED DURING MEALTIMES = 683. MAN-HOURS (32% OF TOTAL FLIGHT CREW TIME)
- INDIVIDUAL CREW TIME :

CREWMAN	UNASSIGNED TIME (HOURS : MINUTES)	% OF TOTAL MISSION TIME UNASSIGNED	UNASSIGNED % OF TIME AVAILABLE FOR EXPERIMENTS
1	66 : 12	9.4%	29. %
2	28 : 47	4.3%	13.5%
3	49 : 06	7.4%	23. %

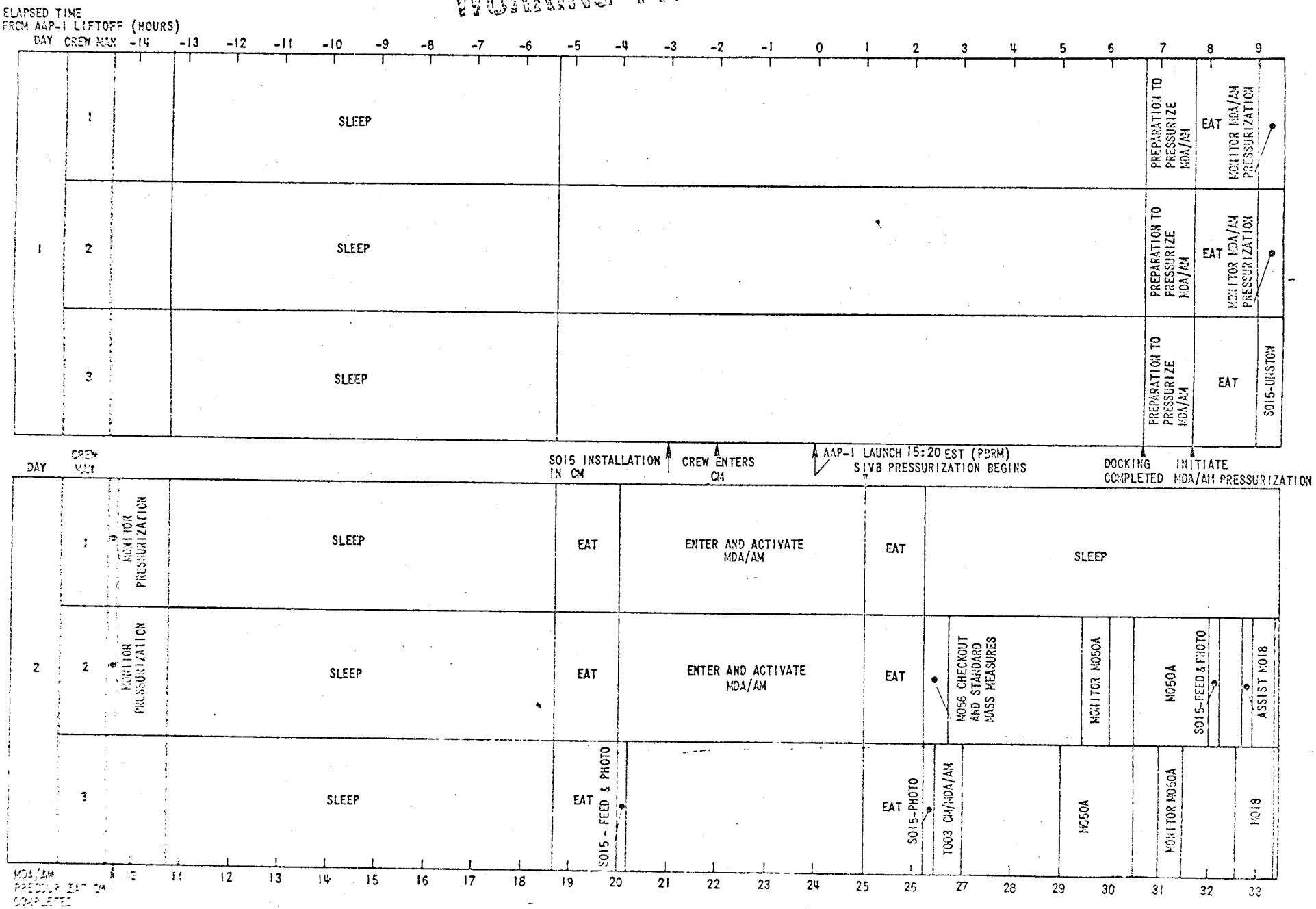
- TOTAL FLIGHT-CREW TIME REMAINING UNASSIGNED : ~144 MAN HOURS (7.3% OF TOTAL FLIGHT-CREW TIME)

WORKING PAPERS

SCHEDULING RESULTS

- ALL EXPERIMENTS ASSIGNED BY ML ON JANUARY 8, 1969 FOR PERFORMANCE ON AAP-1/AAP-2 WERE COMPLETELY SCHEDULED.
- IT WAS NOT FOUND POSSIBLE TO ALLOCATE DAYS EXCLUSIVELY FOR MISSION EVALUATION AND STILL SCHEDULE ALL EXPERIMENTS COMPLETELY.
- SCHEDULE FOR CREWMAN 1 ON DAY 20 IS UNACCEPTABLY TIGHT. (27 MINUTES OF UNSCHEDULED TIME IS INADEQUATE TO MEET PERSONAL AND SYSTEMS HOUSEKEEPING REQUIREMENTS.)
- ALL CREWMEN EAT SIMULTANEOUSLY ON 14 MISSION DAYS; TWO MEALS ARE EATEN SIMULTANEOUSLY BY ALL CREWMEN ON 5 DAYS; ONE MEAL IS EATEN SIMULTANEOUSLY BY ALL CREWMEN ON 9 DAYS.
- TIMELINES DEVELOPED IN THIS STUDY ARE CONSISTENT WITH CONTINUOUS MANNING OF THE CM EXCEPT FOR 2 ISOLATED PERIODS OF 1/2 HOUR TOTAL DURATION.
- STAGGERED SLEEP SCHEDULE AND RELATIVE SCARCITY OF ONE-MAN EXPERIMENTS RESULTS IN CREWMAN 1 HAVING APPRECIABLE FREE TIME DURING AT LEAST HALF THE MISSION.

WORKING PAPERS



WORKING PAPERS

ELAPSED TIME FROM AAP-1 LIFTOFF (HOURS)

41 SIVB PRESSURIZATION ENDS

DAY	CREW MAN	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
3	1	SLEEP	EAT	T003			S015-PHOTO		EAT				M050A	M018	EAT	SLEEP				ON WATCH IN CM					S015 FEED & PHOTO
	2	M018	EAT	SLEEP								EAT	S015 FEED & PHOTO	ASSIST M018			MONITOR M050B	M050B	EAT	INSPECT SIVB					
	3	ASSIST M018	EAT	SLEEP								EAT	MONITOR M050A			M050B		MONITOR M050B	S015-PHOTO EAT	INSPECT SIVB					

DAY	CREW MAN	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
4	1	ON WATCH-CM	EAT	SLEEP				EAT	S015-PHOTO			T003	M050B		M050C		EAT	SLEEP							S015 FEED & PHOTO
	2	INSPECT SIVB	EAT	SLEEP								EAT	MONITOR M050B				M018	ASSIST M018 EAT	S015 PHOTO	INSTALL OWS SEALS AND PADS		M050C		MONITOR M050C	
	3	INSPECT SIVB	EAT	SLEEP								EAT	S015 FEED & PHOTO		MONITOR M050C		ASSIST M018	M018	EAT	INSTALL OWS SEALS AND PADS		MONITOR M050C		M050C	

ELAPSED TIME FROM AAP-1 LIFTOFF (HOURS)

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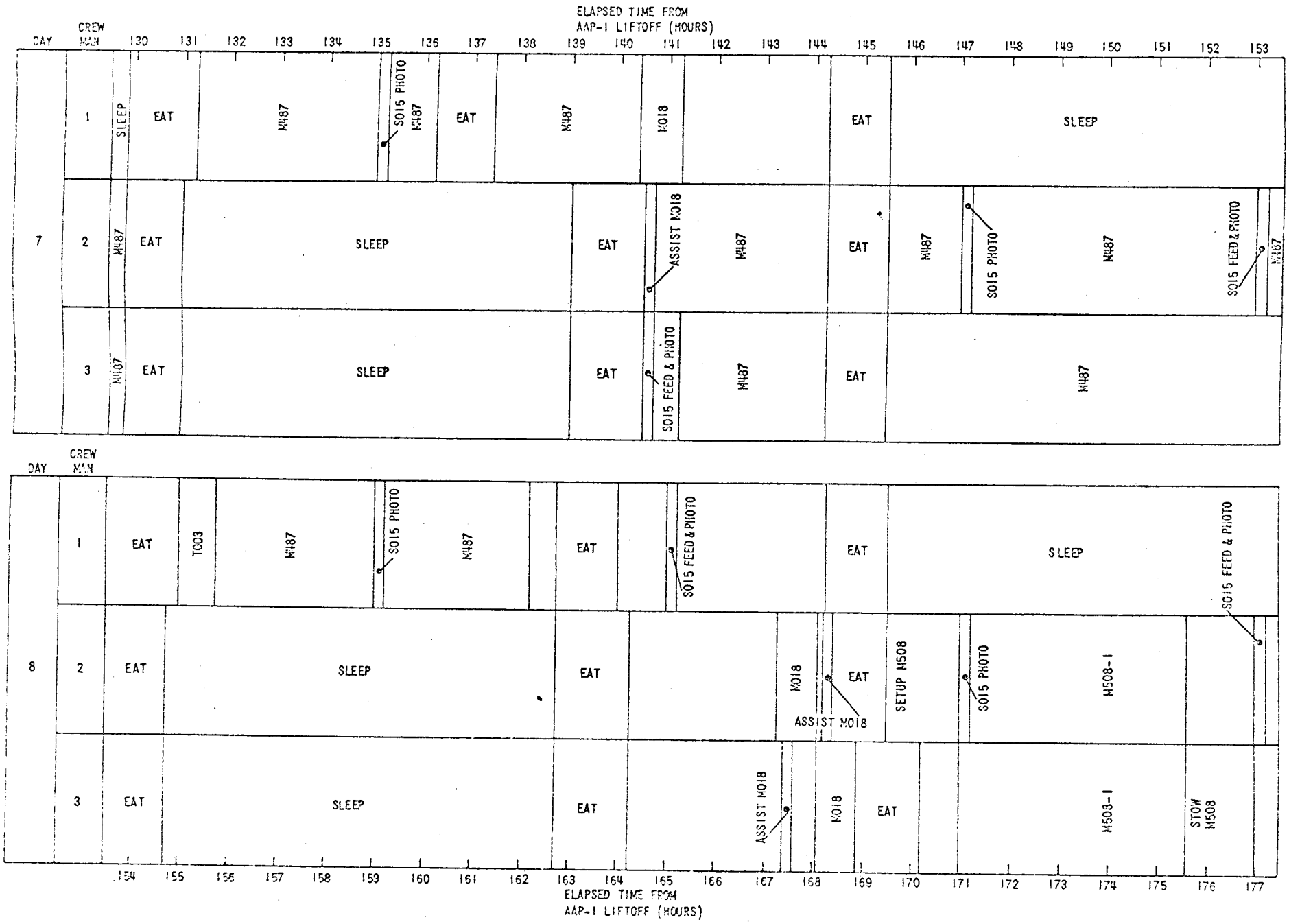
ELAPSED TIME FROM AAP-1 LIFTOFF (HOURS)

DAY	CREW MAN	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
5	1	SLEEP	EAT	INSTALL O/S SEALS AND PADS		INSTALL O/S LIGHTS AND FANS		INSTALL O/S LIGHTS AND FANS	EAT		INSTALL O/S LIGHTS AND FANS		M018				EAT	SLEEP							
	2		EAT	SLEEP (S015 PHOTO)								EAT	ASSIST M018	INSTALL O/S LIGHTS AND FANS	M487		EAT	M487	S015 PHOTO	M487				S015 FEED & PHOTO	M487
	3	M050C	EAT	SLEEP								EAT (S015 FEED & PHOTO)		INSTALL O/S LIGHTS AND FANS	M487		EAT	M487							

DAY	CREW MAN	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129
6	1	SLEEP	EAT	T003	M487		S015 PHOTO	M487				EAT		S015 FEED & PHOTO				EAT	SLEEP						
	2	M487	EAT	SLEEP (S015 ACTUATE BPI)								EAT	M487			M018	ASSIST M018	EAT	M487	S015 PHOTO	M487			S015 FEED & PHOTO	
	3	M487	EAT	SLEEP								EAT	M487		ASSIST M018	M487	M018	EAT	M487						

ELAPSED TIME FROM AAP-1 LIFTOFF (HOURS)

WORKING PAPERS



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ELAPSED TIME FROM AAP-1 LIFTOFF (HRS)

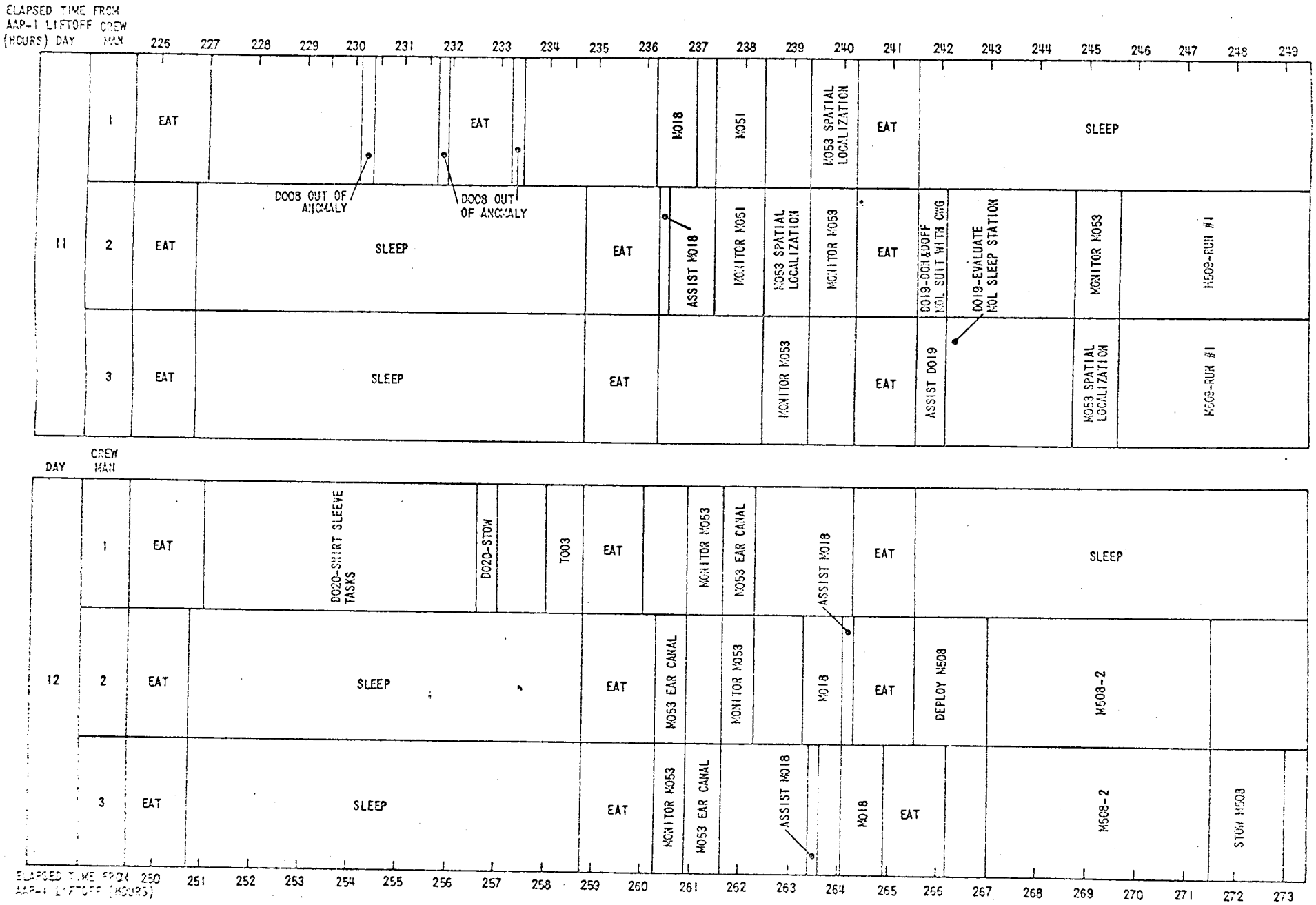
178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201

DAY	CREW MAN																						
9	1	EAT					S015 PHOTO	EAT				M018	S015 FEED & PHOTO	EVA PREPARATION	D022 DEPLOYMENT MONITOR	D021 MONITOR	POST EVA	S015 PHOTO	EAT	SLEEP				
	2	EAT	SLEEP							EAT	ASSIST M018			EVA PREPARATION	D022 DEPLOYMENT EVA	D021 EVA	POST EVA	EAT					S015 FEED & PHOTO
	3	EAT	SLEEP							EAT				EVA PREPARATION	D022 DEPLOYMENT EVA	D021 EVA	POST EVA	EAT					

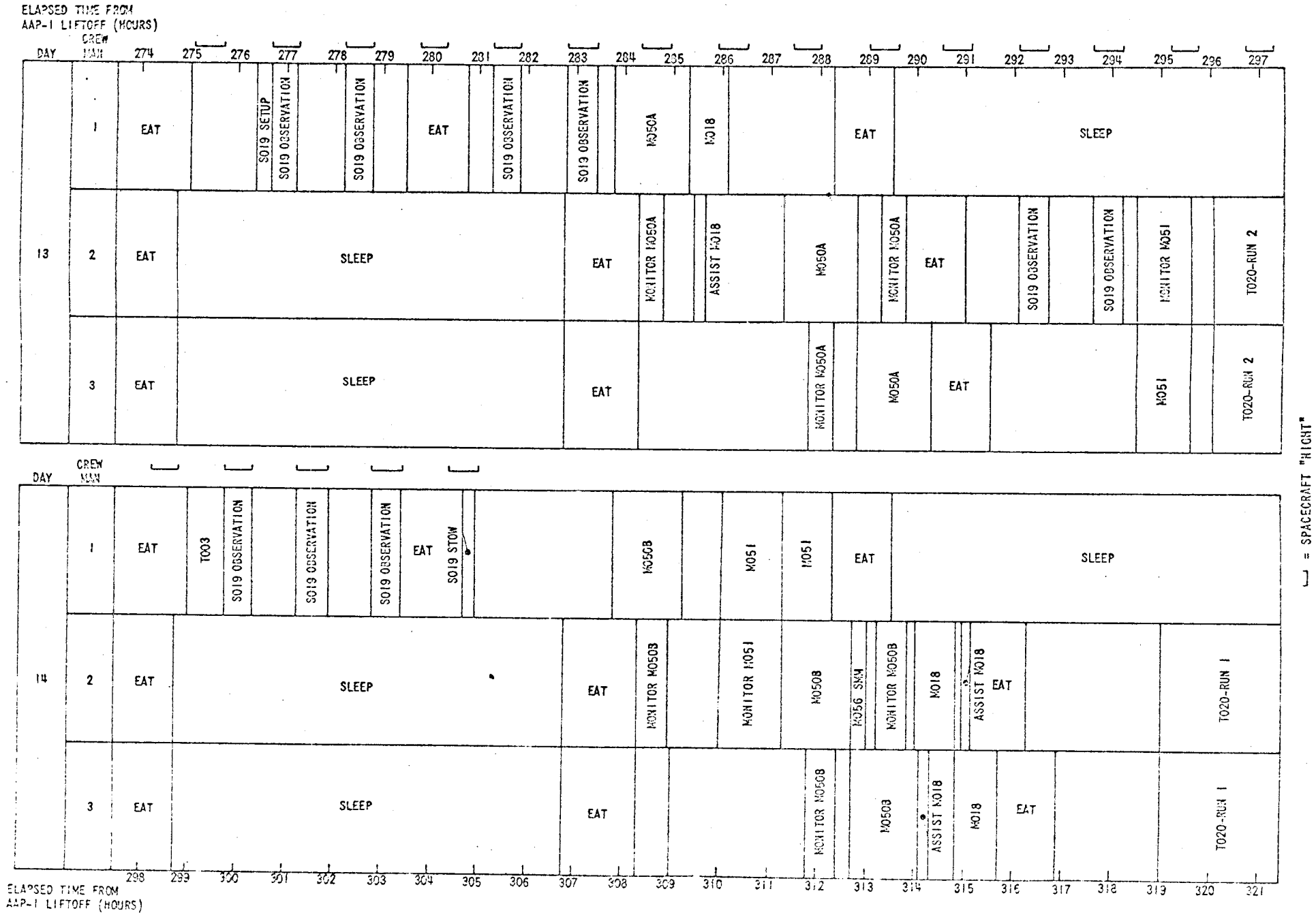
DAY	CREW MAN																						
10	1	SLEEP			EAT	T003	S015 PHOTO		S015 ACTUATE BP2	S015 ACTUATE BP2	S015 ACTUATE BP2	EAT		M053 EAR CANAL		EAT	SLEEP						
	2	EAT	SLEEP									EAT	M053 EAR CANAL	MONITOR M053	MONITOR M053	M018	ASSIST M018	EAT					MONITOR M051
	3	EAT	SLEEP									EAT	MONITOR M053	M053 EAR CANAL		ASSIST M018	M018	EAT	S020 SETUP	S020 OBSERVATION	S020 OBSERVATION	S020 OBSERVATION	S020 OBSERVATION	S020 STOW	M051

ELAPSED TIME FROM AAP-1 LIFTOFF (HRS)

202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225


ELAPSED TIME FROM AAP-1 LIFTOFF (HOURS)
DAY
CREW MAN
226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249
11
1
EAT
EAT
M018
M051
M053 SPATIAL LOCALIZATION
EAT
SLEEP
D008 OUT OF ANOMALY
D008 OUT OF ANOMALY
2
EAT
SLEEP
EAT
ASSIST M018
MONITOR M051
M053 SPATIAL LOCALIZATION
MONITOR M053
EAT
D019-DON&DOFF MOL SUIT WITH CWG
D019-EVALUATE MOL SLEEP STATION
MONITOR M053
M509-RUN #1
3
EAT
SLEEP
EAT
MONITOR M053
EAT
ASSIST D019
M053 SPATIAL LOCALIZATION
M509-RUN #1
DAY
CREW MAN
12
1
EAT
D020-SHIRT SLEEVE TASKS
D020-STOW
T003
EAT
MONITOR M053
M053 EAR CANAL
ASSIST M018
EAT
SLEEP
2
EAT
SLEEP
EAT
M053 EAR CANAL
MONITOR M053
M018
EAT
DEPLOY M508
M508-2
3
EAT
SLEEP
EAT
MONITOR M053
M053 EAR CANAL
ASSIST M018
M018
EAT
M508-2
STOW M508
ELAPSED TIME FROM AAP-1 LIFTOFF (HOURS)
250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273

WORKING PAPERS



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ELAPSED TIME FROM LIFTOFF (HOURS) OF AAP-1

DAY	CREW MAN	322–327	328–332	333–335	336–337	338–345
15	1	EAT	EAT	M050C, M018	EAT	SLEEP
	2	EAT, SLEEP	EAT	MONITOR M050C, ASSIST M018	M050C	MONITOR M050C, EAT, T020-3
	3	EAT, SLEEP	EAT	MONITOR M050C	M050C	M050C, EAT, T020-3

DAY	CREW MAN	346–355	356–357	358–359	360–361	362–369
16	1	EAT, S018	EAT	M053 EAR CANAL	EAT	SLEEP
	2	EAT, SLEEP	EAT	M053 EAR CANAL, MONITOR M053, MONITOR M053	M018, ASSIST M018, EAT	SETUP M508, M508-3
	3	EAT, SLEEP	EAT	MONITOR M053, M053 EAR CANAL	ASSIST M018, M018, EAT	M508-3, STOW M508

ELAPSED TIME FROM LIFTOFF OF AAP-1 (HOURS)

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ELAPSED TIME FROM AAP-1 LIFTOFF (HOURS)

370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393

DAY	CREW MAN																							
17	1	EAT	T003				EAT				M018	M051		M053-SPATIAL LOCALIZATION	EAT	SLEEP								
	2	EAT	SLEEP							EAT	ASSIST M018	MONITOR M051	M053-SPATIAL LOCALIZATION	MONITOR M053	EAT				MONITOR M051			MONITOR M053		
	3	EAT	SLEEP							EAT			MONITOR M053		EAT				M051			M053-SPATIAL LOCALIZATION		

DAY	CREW MAN																							
18	1	EAT	T003							EAT		M053 EAR CANAL			EAT	SLEEP								
	2	EAT	SLEEP							EAT	M053-EAR CANAL	MONITOR M053	MONITOR M053		M018	ASSIST M018	EAT	S020 SETUP	S020 OBSERVATION		S020 OBSERVATION		S020 OBSERVATION		S020 OBSERVATION	S020 STOW
	3	EAT	SLEEP							EAT	MONITOR M053	M053 EAR CANAL	ASSIST M018		M018	EAT								

ELAPSED TIME FROM AAP-1 LIFTOFF (HOURS)

394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417

⌋ = SPACECRAFT "NIGHT"

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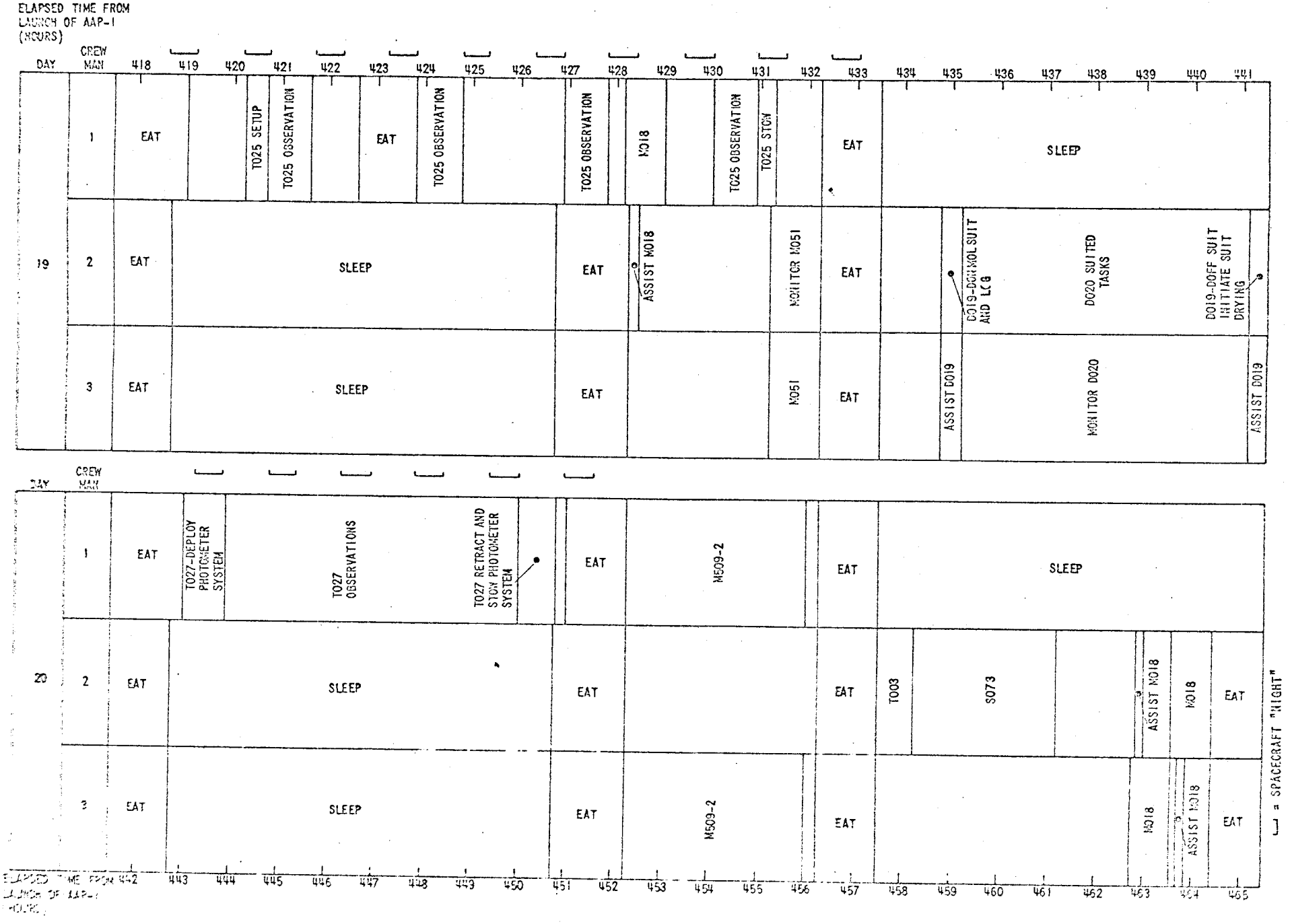

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ELAPSED TIME FROM AAP-1 LIFTOFF (HOURS)

DAY	CREW MAN	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489
21	1	EAT	T027-DEPLOY SAMPLE ARRAY SYSTEM			EAT					M018					M051	EAT	SLEEP							
	2	EAT	SLEEP							EAT	EAT					MONITOR M051	EAT	DEPLOY M508		M508-4					
	3	EAT	SLEEP							ASSIST M018 EAT							EAT			M508-4				STOW M508	

DAY	CREW MAN	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513
22	1	EAT	S063								EAT	M509-4				T003	EAT	SLEEP							
	2	EAT	SLEEP								EAT	M509-4					EAT	M508-5						ASSIST M018	M018
	3	EAT	SLEEP								EAT				SETUP M508		EAT	M508-5				STOW M508		M018	ASSIST M018

ELAPSED TIME FROM AAP-1 LIFTOFF (HOURS)

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ELAPSED TIME FROM AAP-1 LIFTOFF (HRS)

DAY	CREW MAN	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537
23	1	EAT		M507 (ELECTRO-STATIC TABLE)		M507 (WIND TUNNEL)		EAT				M018	T013	DC08-IN ANOMALY	DC08-IN ANOMALY	EAT	DC03-IN ANOMALY	SLEEP							
	2	EAT	SLEEP								EAT	ASSIST M018				EAT		SETUP M508 EQUIP.		M508-6					
	3	EAT	SLEEP								EAT					EAT				M508-6				STOW M508 EQUIP.	

DAY	CREW MAN	533	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561
24	1	EAT	T003		M507 (ELECTRO-STATIC TABLE			EAT	M507 (WIND TUNNEL)			M050A		MONITOR M053	M053 EAR CANAL		EAT		SLEEP						
	2	EAT	SLEEP								EAT	MONITOR M050A	M053 EAR CANAL		MONITOR M053	M050A		MONITOR M050A	M018	ASSIST M018	EAT		M509-3		
	3	EAT	SLEEP								EAT		MONITOR M053	M053 EAR CANAL		MONITOR M050A	M050A		ASSIST M018	M018	EAT		M509-3		

ELAPSED TIME FROM AAP-1 LIFTOFF (HRS)

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ELAPSED TIME FROM
AAP-1 LIFTOFF (HOURS)

DAY	CREW MAN	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585
25	1	EAT						EAT				M050B		M053-SPATIAL LOCALIZATION		M018		EAT	SLEEP						
	2	EAT	SLEEP								EAT	MONITOR M050B		MONITOR M053		ASSIST M018 M050B		MONITOR M050B	EAT		M053 SPATIAL LOCALIZATION	MONITOR M053			
	3	EAT	SLEEP								EAT					MONITOR M050B		M050B	EAT		MONITOR M053	M053-SPATIAL LOCALIZATION		M492	

DAY	CREW MAN	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609
25	1	EAT	T003	T027-RETRACT AND STOW SAMPLE ARRAY SYSTEM				EAT				M050C		M053-EAR CANAL			EAT	SLEEP							
	2	EAT	SLEEP								EAT	MONITOR M050C	M055SMM	MONITOR M053		M050C		MONITOR M050C		M018	ASSIST M018 EAT		M053 EAR CANAL	MONITOR M053		S009-SETUP
	3	EAT	SLEEP								EAT					MONITOR M050C		M050C	ASSIST M018		M018	EAT	MONITOR M053	M053 EAR CANAL		M493

ELAPSED TIME FROM
AAP-1 LIFTOFF (HOURS)

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ELAPSED TIME FROM AAP-1 LIFTOFF (HOURS)

DAY	CREW MAN	610 – 611:00	611:00 – 620	620 – 620:15	620:15 – 624:15	624:15 – 625:30	625:30 – 633
27	1	EAT	CLUSTER DEACTIVATION AND STOWAGE	EAT	DEACTIVATION AND STOWAGE	EAT	SLEEP
	2	EAT	SLEEP	EAT	DEACTIVATION AND STOWAGE	EAT	CLUSTER DEACTIVATION AND STOWAGE
	3	EAT	SLEEP	EAT	DEACTIVATION AND STOWAGE	EAT	CLUSTER DEACTIVATION AND STOWAGE

DAY	CREW MAN	634 – 635:00	635:00 – 642:00	642:00 – 647:30	647:30 – 655:30	655:30 – 656:45	656:45 – 657
28	1	EAT	CLUSTER DEACTIVATION AND STOWAGE	EAT	DEACTIVATION AND STOWAGE	EAT	SLEEP	EAT	DEORBIT PREPARATION
	2	EAT	SLEEP	EAT	DEACTIVATION AND STOWAGE	EAT	SLEEP	EAT	DEORBIT PREPARATION
	3	EAT	SLEEP	EAT	DEACTIVATION AND STOWAGE	EAT	SLEEP	EAT	DEORBIT PREPARATION

ELAPSED TIME FROM AAP-1 LIFTOFF (HOURS)

634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657

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ELAPSED TIME FROM AAP-1 LIFTOFF (HOURS)

DEORBIT BURN | LANDING

DAY	CREW MAN	658 659 660 661 662 663 664 665 666
29	1	DEORBIT PREPARATION (661:40 – 662:10)
	2	DEORBIT PREPARATION
	3	DEORBIT PREPARATION