June 1974

NASA TECHNICAL MEMORANDUM

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MSFC SKYLAB OPERATIONS SUPPORT SUMMARY

Skylab Program Office

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George C. Marshall Space Flight Center

Marshall Space Flight Center, Alabama

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16. ABSTRACT

The Skylab mission began May 14, 1973, with the launch of SL-1 and ended February 8, 1974, with SL-4 splashdown. During this time, the Huntsville Operations Support Center (HOSC) was the actionee of 1,882 actions in addition to performing daily routine mission support activities. Almost 200 significant problems were identified during the mission that required thorough investigation and in cases hardware modification to be provided for the next manned mission phase.

Approximately 1,400 civil service and contractor personnel had permanent access to the 10,000 square foot HOSC in Building 4663 and three adjacent trailers. All other support was from remote permanent work stations. Around 300 personnel per shift, 3 shifts per day, were in the HOSC during the entire mission.

This operations report is a summary of the actions and problems MSFC encountered, together with procedures and staffing required to provide the mission support role. This report has been prepared as a reference for future operations planning as well as an evaluation report for the Skylab mission.

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ABBREVIATIONS

ADDT	All Digital Data Tape
AERO	Aero -Astrodynamics
AL	Airlock Module
AOS	Acquisition of Signal
AOSM	Assistant Operations Support Manager for Systems
APCS	Attitude Pointing Control System
AR	Action Request
ASC	Administrative Support Center
ASpC	Assistant Support Coordinator
ASP	Assistant Scheduling Program
ASTN	Astronautics
ASTR	Astrionics
ATM	Apollo Telescope Mount
BBRC	Ball Brothers Research Corporation
BSE	Booster Systems Engineer
CCSD	Chrysler Corporation Space Division
COMM	Communications
COMP	Computation
CS	Crew Systems
CMG	Control Moment Gyro
CSM	Command & Service Module
CWA	Conference Work Area
DDC	Data Dissemination Clerk
DDR	Data Dissemination Room
DIR	Director
DMR	Data Management Room
DOY	Day of Year
DPM	Data Processing Manager
DRF	Data Request Form
DRG	Data Requirements Group
DRM	Data Requirements Manager
DS	Display Specialist
DSM	Data Support Manager
DSO	Data Support Organization
DTO	Detailed Test Objective
D/TV	Digital Television
ECS	Environmental Control System
EI	Engineering Integration
EPS	Electrical Power System
EREP	Earth Resources Experiment Package
FEWG	Flight Evaluation Working Group

ABBREVIATIONS (Continued)

FM	Facilities Manager
FO	Functional Objectives
FOMR	Flight Operations Management Room
GMT	Greenwich Mean Time
GOSS	Ground Operational Support System
GSFC	Goddard Space Flight Center
HFSR	HOSC Facility Support Request
HOSC	Huntsville Operations Support Center
I&C	Instrumentation & Communication
IBM	International Business Machines
ICR	Instrumentation Control Room
ID	Identification
IU	Instrumentation Unit
JOPS	Joint Observing Planning Staff
JSC	Johnson Space Center
KSC	Kennedy Space Center
LCC	Launch Control Complex
LDO	Launch Director Complex
LDX	Long Distance Xerox Network
LIEF	Launch Information Exchange Facility
LOS	Loss of Signal
LV	Launch Vehicle
LVO	Launch Vehicle Operations
MAR	Mission Action Request
MCC	Mission Control Center
MCR	Main Conference Room
MDA	Multiple Docking Adapter
MDAC	McDonnell Douglas Aircraft Company
MDRS	Mission Data Retrieval System
MER	Mission Evaluation Room
MEWG	Mission Evaluation Working Group
MGR	Manager
MLR	Module Lead Representative
MMC	Martin Marietta Corporation
MMP	Momentum Management Processor
MO	Mission Operations
MOC	Mission Operations Computer
MOPS	Mission Operations Planning System
MRD	Mission Requirements Document
MRRS	Mission Requirements Review Staff
MSFC	Marshall Space Flight Center

ABBREVIATIONS (Continued)

MSG	Mission Support Group
MSGL	Mission Support Group Leader
MSLR	Marshall Skylab Representative
MS-C	Management Services - Communication
OA	Orbital Assembly
OCPD	Operations Coordination Procedures Document
OMP	On Line Math Processor
OMR	Operations Management Room
OPS	Operations
OSM	Operations Support Manager
OSR	Operations Support Room
OWS	Orbital Workshop
PABX	Private Automatic Branch Exchange
PD	Program Development
PDRD	Processed Data Requirements Document
PET	Phase Elapsed Time
PL	Personnel Locator
QL	Quick Look
RC	Report Coordinator
RCS	Revision Control Sheet
RPR	Report Preparation Room
R/T	Real Time
RTCC	Real Time Computer Complex
SAC	Support Action Center
SAS	Solar Array System
S&E	Science & Engineering
S&M	Structures and Mechanical
S/C	Space Craft
SCO	Space Craft Operations
SG	Status Generator
SIB-S/C	Saturn IB Space Craft
SIVB	Saturn IVB
SII	Saturn II
SIM	Systems Information Library
SL	Skylab
SLVR	Saturn Launch Vehicle Representative
SpC	Support Coordinator
SRPR	Staff and Report Preparation Room
SSE	Staff Systems Engineer
SSL	Space Sciences Laboratory
STAC	Support Team for Attitude Control

ABBREVIATIONS (Continued)

STDN	Space Tracking Data Network
SWS	Saturn Workshop
TACS	Thruster Attitude Control System
TAR	Target Analysis Room
TCS	Thermal Control System
TM	Telemetry
TTY	Teletype
UCR	Unsatisfactory Condition Report
UT	Universal Time

1.0 MSFC MISSION SUPPORT SUMMARY

The Marshall Space Flight Center, Huntsville, Alabama, was responsible for building, designing, and managing the production of all Skylab systems hardware with the exception of the Command Service Module (CSM), which was the responsibility of JSC. In addition, MSFC was the responsible Center for more than 25 scientific experiments, 10 of which were built by MSFC. The launch vehicles for all phases of the Skylab mission (i.e., SL-1, SL-2, SL-3, and SL-4) were provided by MSFC. Operations support to KSC for launch and JSC for flight was provided from the Huntsville Operation Support Center (HOSC), a facility configured and manned by MSFC Civil Service and contractor support personnel.

A two-stage Saturn V (SA-513) was used as the launch vehicle for SL-1. Prime contractors for SL-1 were the Boeing Company for the S-IC Stage, North American Rockwell for the S-II Stage, and IBM for the Instrument Unit. Two-stage Saturn IB vehicles were used for the remaining launches. Contractors for SL-2, SL-3, and SL-4 were the Chrysler Corporation for the S-IC Stage, McDonnell-Douglas for the S-IVB Stage, and IBM for the Instrument Unit.

Prime contractors for the Saturn Workshop (SWS) were McDonnell Douglas (West) for the dry workshop, which was a modified S-IVB Stage, McDonnell Douglas (East) for the Airlock Module, the Martin Marietta Aerospace Corporation for the Multiple Docking Adapter and overall integration, and MSFC for the Apollo Telescope Mount (ATM), with IBM being prime contrator for the attitude pointing and control system of the ATM.

1.1 Flight Operations Support Functions and Organization

The two principal segments of NASA providing management and support of all Skylab flight activities were the Flight Management Team and the Flight Control/Support Team. Figure 1.1 shows the organizational structure of both teams with the Director of Flight Operations and the Flight Director at JSC being the principal interface between the two.

The Flight Management Team, which included Center Directors and Program Managers, was alerted to mission problems by the Flight Control/Support Team. The Flight Management Team provided program decisions based upon recommendations and options provided by the Support Team.

MSFC provided operations support to perform those functions necessary to support the MSFC Program Manager for Skylab in his design and integration responsibilities. Support was provided from the Huntsville Operations Support Center (HOSC) to program office respresentatives at JSC. The support to JSC from the HOSC through the FOMR is depicted in Figure 1.1. The FOMR provided a single interface between JSC flight operations and the MSFC and JSC Program Offices with their respective support organizations. Support requests upon MSFC originated by the flight control organization were forwarded through the FOMR to the HOSC, and the response went back the same way.

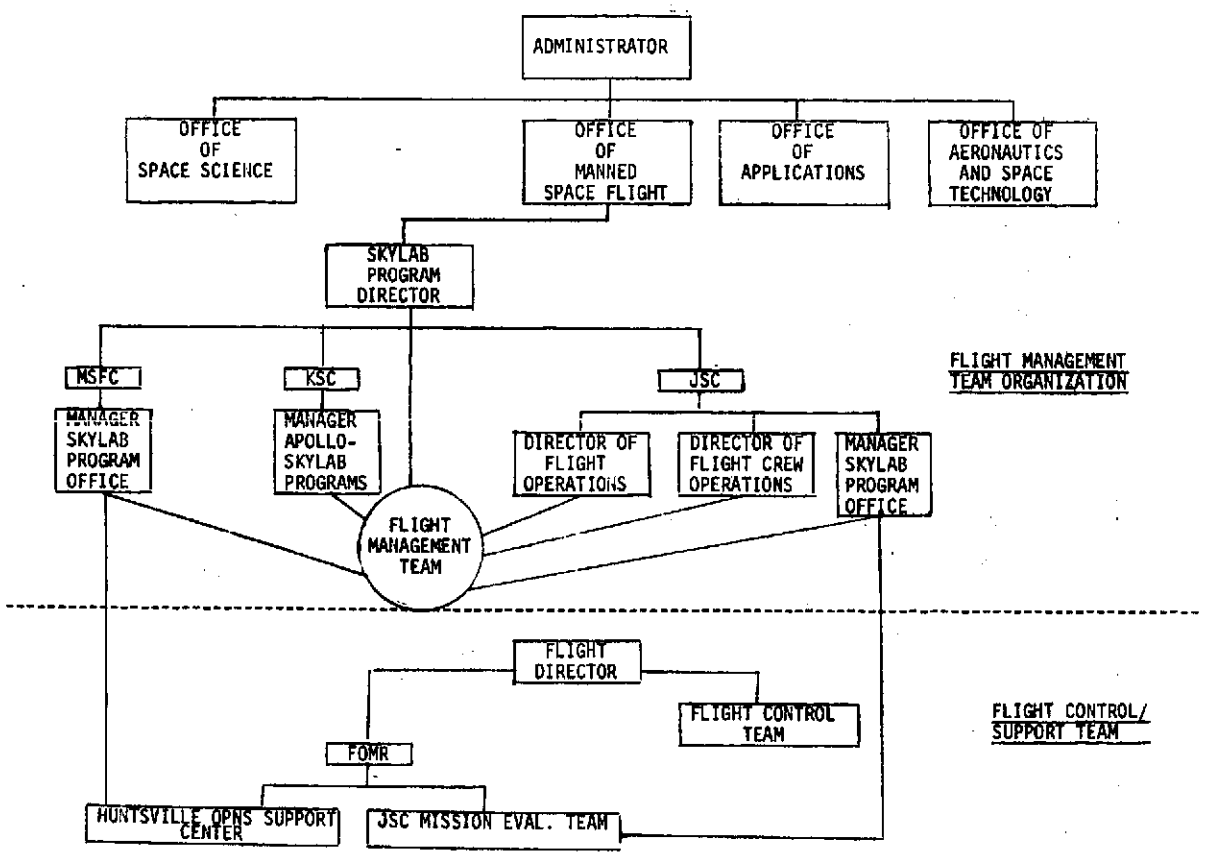


FIG. 1.1: SKYLAB FLIGHT MANAGEMENT AND CONTROL SUPPORT TEAM ORGANIZATIONS

1.1.1 MSFC FOMR Functions

The prime functions of the FOMR were:

a. To provide information through the FOMR Manager to the Flight Operations Team on the performance, design, and limitations of all MSFC-designed or contracted flight hardware, software, and experiments.

b. To evaluate the mission status through the HOSC in terms of current capabilities, objectives accomplished, and mission time remaining, and to recommend changes in experiments and DTO requirements.

c. To provide MSFC approval of the daily FOMR report and the HOSC input to that report.

d. To serve as principal interface between the flight director and the HOSC on all actions and problems concerning MSFC hardware, software, and experiment responsibilities such as systems simulations and contingency analysis.

1.1.2 MSFC HOSC Functions

The prime functions of the HOSC Staff were:

a. To provide information to the MSFC Senior Program Office Representative on the performance, design, and limitations of all MSFC-designed or contracted flight hardware, software, and experiments.

b. To evaluate the mission status and to recommend changes in experiments and DTO requirements.

c. To provide a daily report to the FOMR.

d. To provide system simulations and contingency analysis as required on all problems concerning MSFC hardware, software, and experiment responsibilities.

1.1.3 MSFC Support Organizations

The HOSC was established to provide the required support by uniting almost 600 program office, laboratory, and contractor engineers into 10 specific systems-oriented mission support groups with a leader and an alternate. Figure 1.2 shows the MSFC support organizations. The numbers shown with the mission support groups represent the number of people directly supporting in the HOSC. The numbers in parenthesis represent preflight planning.

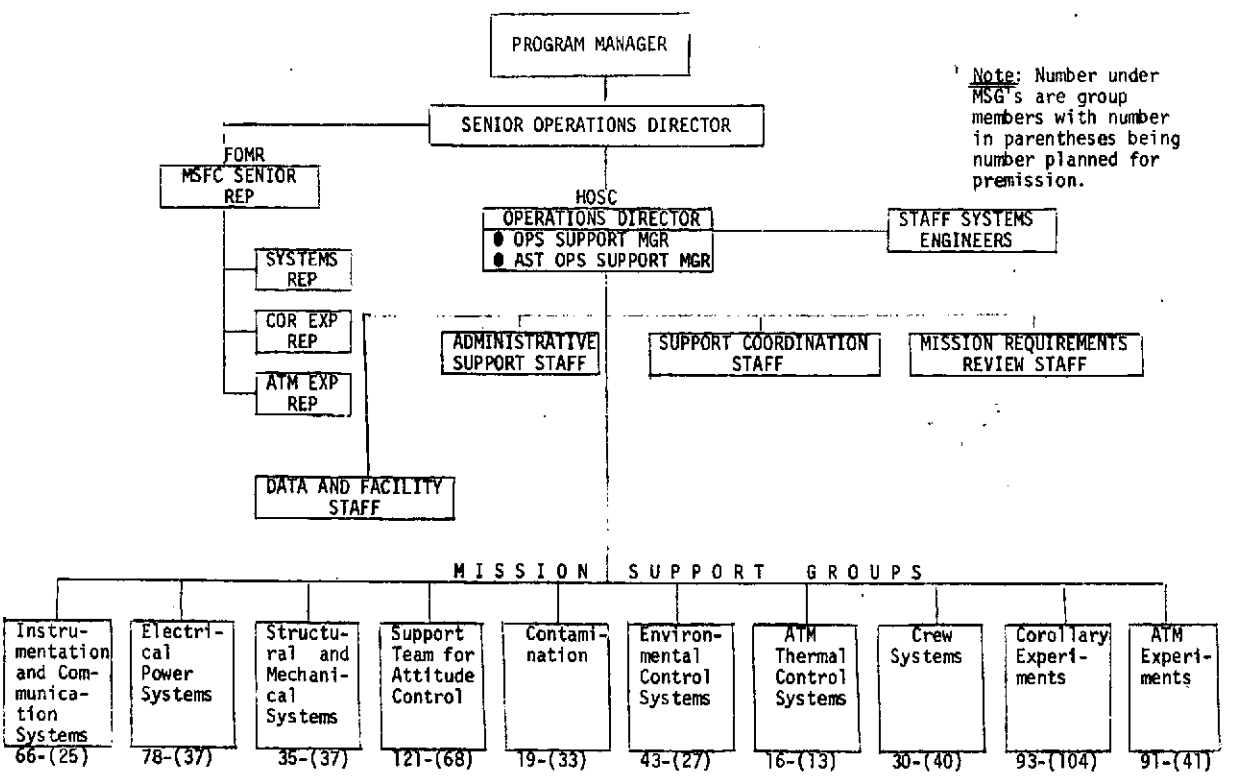


FIG. 1.2: MSFC SKYLAB SUPPORT ORGANIZATION

1.1.4 Mission Action Requests (MAR)

Actions were assigned to MSFC from the FOMR on specific hardware problems or questions concerning design characteristics, data, etc. These were formal requests on standard forms and were responded to likewise.

1.1.5 Action Requests (AR)

Actions originating within the HOSC, termed AR's, were assigned to specific problems or questions where no MAR had been issued, and were actions considered necessary by the Operations Director (OD). This happened in many cases when a specific problem had been previously covered by a mission rule and required no MAR (the information was provided to JSC before the mission), but an AR was necessary to provide follow-up action.

1.2 Launch Operations and Booster Flight Support Function and Organization

The HOSC also provided launch operations and booster flight support to KSC and JSC, respectively. Figure 1.3 shows the organizational interfaces for this activity.

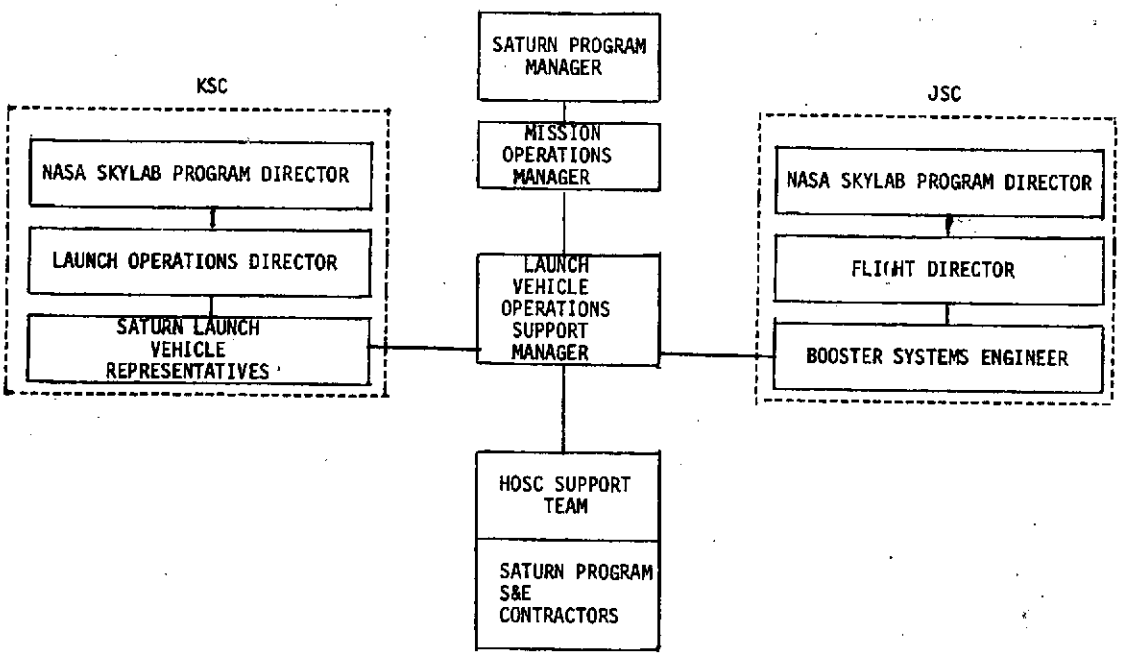


FIG. 1.3: SKYLAB LAUNCH AND BOOSTER FLIGHT HOSC SUPPORT INTERFACES

1.2.1 Launch Support

Launch Operations Support to KSC included the following:

a. Approving deviations or waivers to test and checkout requirements, test and checkout specifications, and criteria and mission rules.

b. Resolving significant technical problems that occurred during prelaunch testing.

c. Ground and flight wind monitoring during the terminal countdown and a go/no go recommendation to the Launch Director.

d. Simulations and troubleshooting by the Saturn Systems Development Facility (Breadboard) of known or potential launch vehicle problems.

e. Target update math model analysis to confirm the Saturn IB performance capability to achieve the rendezvous target parameters computed by JSC.

1.2.2 Booster Flight Support

Saturn launch vehicle flight control responsibility was assigned to the MSFC Booster Systems Engineer (BSE) and his staff who were permanently based at JSC. Launch vehicle support from the HOSC was provided directly to the BSE. The HOSC support function was as follows:

a. Provide technical information and advice to the BSE upon request on any vehicle systems.

b. Provide predicted vehicle flight dynamics based on measured prelaunch winds.

c. Verification of Saturn IB performance capability to achieve the rendezvous target parameter computed by JSC.

1.3 Premission Planning

1.3.1 Initial Planning

A number of operations support planning tasks were defined about 18 months before the SL-1 launch. A manager was designated for each task with the responsibility to plan, organize, develop, and document all necessary premission preparations. The overall planning was coordinated by the Mission Operations Office by conducting monthly Operations Support Planning Meetings. These meetings were attended by all task managers, representatives from all major MSFC organizations involved, and prime contractor representatives. The following is a list of the initial planning tasks.

a. Operations Coordination

b. FOMR Operations

c. Mission Requirements

d. Mission Evaluation

e. Operations Support Requirements/ Data Management

f. Data Processing and Display System

g. Communications System

h. HOSC Facilities

i. Auto Scan

j. Logistics and Project Control

k. Target Update Team

l. Prelaunch Wind Monitoring Team

m. APCS Simulation Support

n. Saturn SDF Support

o. Power System Breadboard Support

p. Neutral Buoyancy Simulator

q. Thermal Math Models

1.3.2 Documentation

The documentation shown in Table I.1 was used to complete the definition of the MSFC operations support functions, organization, facilities, and procedures.

1.3.3 Significant Changes to Premission Plans

The initial plans were for MSFC to support the Skylab mission on a minimum basis by manning the HOSC continuously with staff personnel only. The primary support functions would be provided by the Mission Support Groups during normal working days, five days per week, and contingency or urgent mission action requests from the FOMR during nights or weekends would be provided by personnel on call. Premission plans did not include the need for a senior operations director or an operations director. However, as a result of the meteoroid shield and SAS Wing 2 problems, several adjustments in staffing and support were necessary. The major adjustments were:

a. The addition of a Senior Operations Director (SOD) in charge of operations personnel at JSC and MSFC.

b. The addition of an Operations Director (OD) who was responsible for HOSC support. His principal function was to pursue ongoing problems and establish priorities.

c. The initiation of around-the-clock, seven days per week support by all mission support groups. This required addition of three times as many people as was originally planned in some areas.

TABLE I.1

MSFC MISSION SUPPORT DOCUMENTATION

		ORIG. RESP.
FOMR OPERATIONS PLAN	DESCRIBES MSFC SUPPORT FUNCTIONS TO MSC: FOMR MANNING AND RESPONSIBILITIES; INTERFACES AND SIMULATION REQUIREMENTS.	JSC/MSFC(MO)
MSFC/ KSC SKYLAB OPERATIONS PLAN	DESCRIBES KSC/MSFC SUPPORT FUNCTIONS TO KSC OPERATIONS INTERFACES. ESTABLISHES TESTS BEING SUPPORTED, AND LEVEL OF SUPPORT REQUIRED ON SITE AND AT THE HOSC.	SL-EI
TECHNICAL SUPPORT OPERATIONS PLAN	DESCRIBES RESPONSIBILITIES, PROVEDURES, AND FACILITIES FOR RESPONDING TO OPERATIONS REQUESTS FOR LAUNCH VEHICLE DESIGN ENGINEERING ASSISTANCE.	SAT
MISSION EVALUATION PLAN	DESCRIBES MSFC MISSION EVALUATION ORGANIZATION, TASKS, AND REPORTING.	SL-EI
OPERATIONS SUPPORT PROCEDURES	DEFINES MISSION SUPPORT PROCEDURES, INCLUDING STAFF MANNING REQUIREMENTS, INTERFACES WITH MISSION SUPPORT GROUPS, AND MISSION REPORTING.	MO
MISSION TRAINING PLAN	DESCRIBES THE TRAINING PLANS AND CURRICULA FOR THE MSFC SUPPORT ORGANIZATION.	MO
SIMULATION PLAN	ESTABLISHES SCHEDULE AND REQUIREMENTS FOR MSFC SUPPORT PERSONNEL FOR INTERNAL AND MCC SIMULATIONS.	MO
MISSION MANNING PLANS	DELINEATES SPECIFIC MANNING ESTABLISHED FOR THE MSFC SUPPORT ORGANIZATION DURING EACH PRELAUNCH TEST OR MISSION PHASE.	MO
MISSION REQUIREMENTS REVIEW PLAN	CONTAINS PROCEDURES FOR MISSION REQUIREMENT CHANGES, MISSION AND EXPERIMENT PRIORITY CHANGES AND TIMELINE CHANGE REVIEW.	SL-EI

TABLE I.1 (Cont'd)

		ORIG. RESP.
WIND MONITORING PLAN	DEFINES PROCEDURES, MANNING, AND COMPUTER PROGRAMS UTILIZED BY HOSC PERSONNEL IN MONITORING AND ANALYZING THE EFFECTS OF WINDS ON THE VEHICLE IN FLIGHT AND ON THE PAD.	S&E-AERO-D
SATURN SDF PLAN	DEFINES PROCEDURES, MANNING, AND SIMULATION BREADBOARD CAPABILITIES FOR SKYLAB OPERATIONS SUPPORT.	S&E-ASTR-S
POWER SYSTEMS BREADBOARD PLAN	DEFINES PROCEDURES, MANNING, AND SIMULATION BREADBOARD CAPABILITY OF THE SKYLAB POWER SYSTEMS AS USED FOR SKYLAB OPERATIONS SUPPORT.	S&E-ASTR-S
APCS SIMULATION PLAN	DEFINES PROCEDURES, MANNING, AND SIMULATION MODES FOR USING THE APCS SIMULATOR FOR SKYLAB OPERATIONS SUPPORT.	S&E-ASTR-S
TARGET UPDATE PLAN	DEFINES PROCEDURES, MANNING, AND ANALYSIS PERFORMED TO VERIFY THE L/V PERFORMANCE CAPABILITY TO ACHIEVE RENDEZVOUS.	S&E-AERO-M
THERMAL CONTROL SYSTEM SIMULATION PLAN	DESCRIBES THE PROCEDURES, MANNING, AND SIMULATION MODES AND CAPABILITY FOR USE OF THE MSFC THERMAL CONTROL COMPUTER PROGRAM FOR SKYLAB OPERATIONS SUPPORT	S&E-ASTN-P
NEUTRAL BUOYANCY FACILITY	DESCRIBES THE PROCEDURES, MANNING, MODES, AND CAPABILITY FOR THE USE OF THE MSFC NEUTRAL BUOYANCY FACILITY FOR SKYLAB OPERATIONS SUPPORT.	S&E-PT-M
DATA MANAGEMENT PLAN	DEFINES OVERALL SYSTEM FOR MSFC REQUIREMENTS AND DATA MANAGEMENT INCLUDING USER PROCEDURES AND THE FLOW OF DATA.	MO
DATA PROCESSING IMPLEMENTATION PLAN	DEFINES MSFC PLANS FOR PROCESSING SKYLAB DATA. DEFINES DATA PROCESSING SYSTEMS, PROCEDURES, INTERFACES, AND WORKLOAD DISTRIBUTION. APPENDIX TO INCLUDE MISSION DISPLAY PLAN.	S&E-COMP-R
LIEF COMMUNICATIONS CONTROL	DEFINES THE LIEF COMMUNICATIONS, BOTH INTERNAL AND INTER-CENTER, REQUIRED FOR SKYLAB.	A&TS-MS-C

d. The method for transmission of ADDT data from the JSC data base to MSFC was changed throughout the mission. The initial plan was to use electronic transmission direct from the JSC data base. This was not satisfactory and the system evolved through mailing of all tapes to finally a recording of data on tapes and transmitting them electronically using a tape-to-tape transmission technique.

1.4 HOSC Facilities Overview

The Huntsville Operations Support Center (HOSC), the facility from which MSFC provided operational support to KSC and JSC for launch and orbital phases of Skylab missions, is located in the west end of A-Wing, Building 4663 (MSFC Computation Laboratory), on Martin Road. The functional areas are located on the first and second floors. The basement is used for communications equipment, storage, auxiliary work areas and a lounge area. The area allocated to HOSC is approximately 10,000 square feet. A floor plan showing the configuration of functional areas to support the Skylab program is presented in Figures 1.4 and 1.5.

1.4.1 Internal Communication

HOSC internal communications were based on a hybrid telephone system, consisting of the LIEF network and an independent PABX telephone exchange. (For detailed information relative to the LIEF, refer to document A&TS-MS-C 67-01, January 9, 1970.) The LIEF and PABX line numbers were intermixed on common telephone instruments throughout the HOSC. Access to the LIEF or PABX lines was obtained by various instruments, including six-6-button telephones, 18-button call directors, 24-button call directors, 30-button call directors, Observer Monitor Units, 6-button Speaker Phones, and single-line phones.

The PABX was an HOSC-dedicated telephone exchange system. This phone system was a typical Bell System exchange, with touchtone operation, internal three-digit numbers, and centralized answering point, with some specialized features such as three-party conference capability and camp-on capability. A listing of HOSC internal communications is shown in Table I.2.

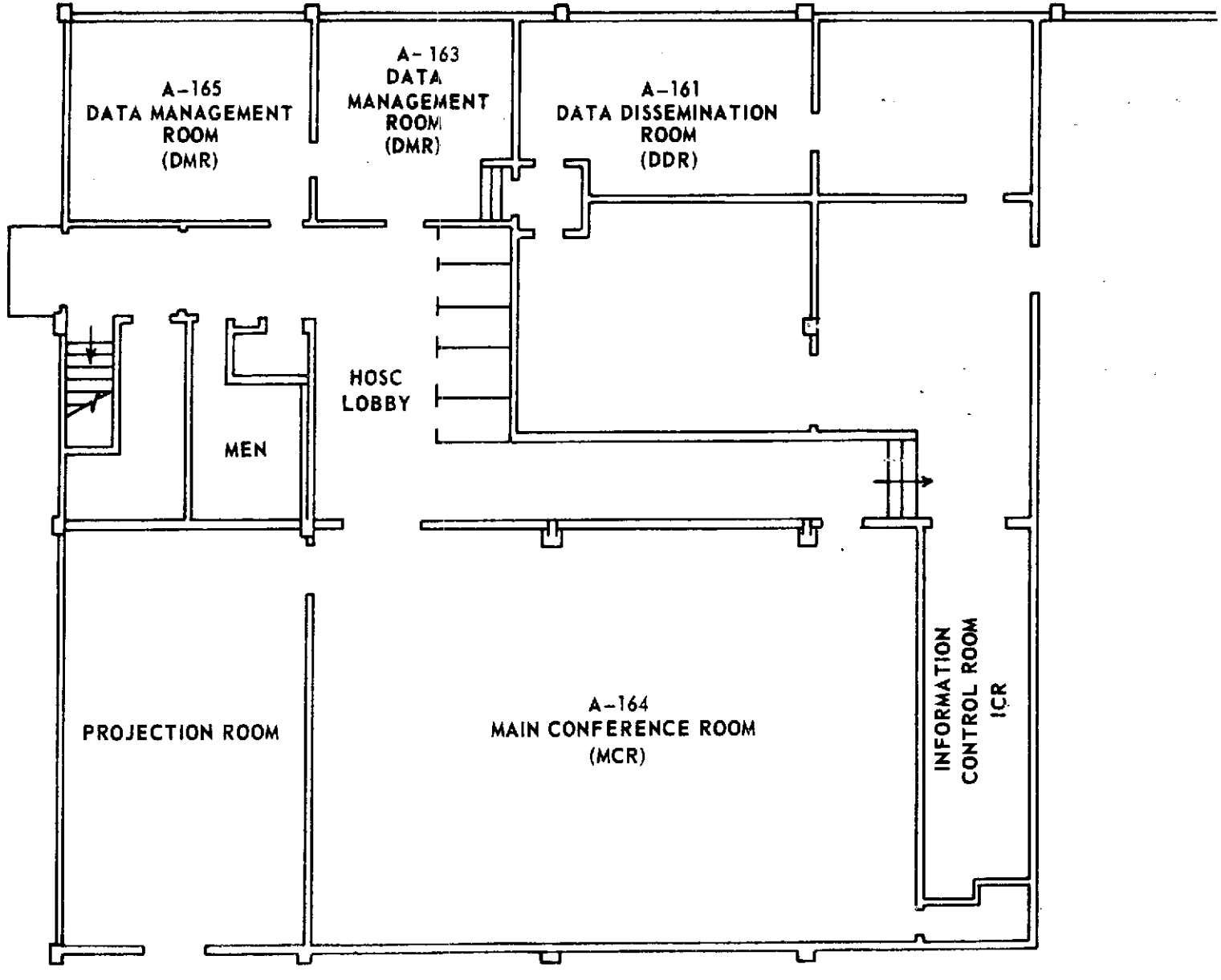


FIGURE 1.4: HOSC FLOOR PLAN (FIRST FLOOR)

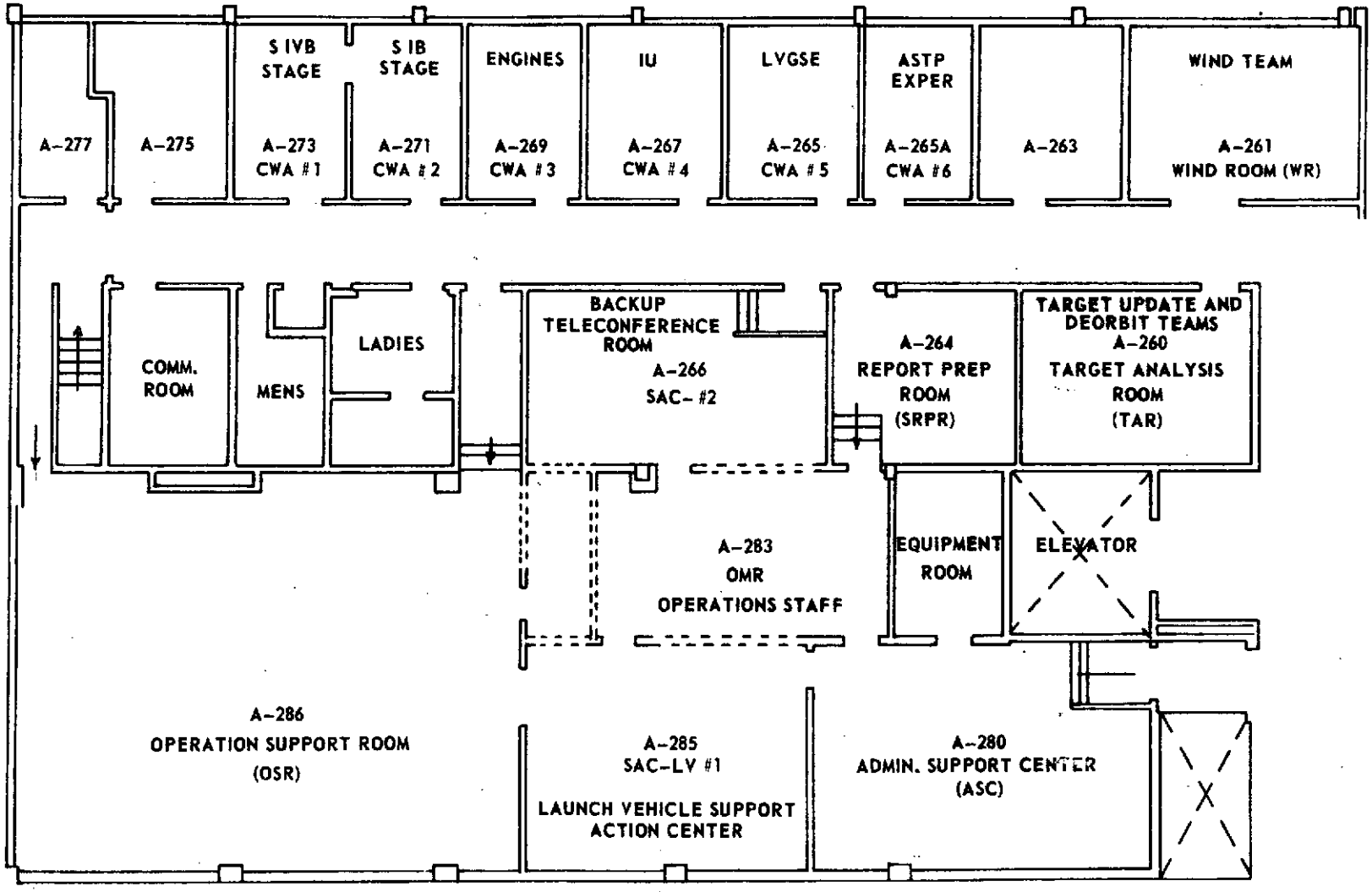


FIGURE 1.5: HOSC FLOOR PLAN (SECOND FLOOR)

I.4.2 Video Data Distribution Equipment

The HOSC video data distribution equipment included T. V. Monitors, video distribution matrix, remote matrix controllers, and Hard Copy subsystem. The number of T. V. Monitors, matrix control units and hard copy controllers assigned to each working area was determined by the size of the area and the number of disciplines involved.

TABLE I.2

COMMUNICATIONS

PABX PHONES	Primarily for use within HOSC. Essentially intercom system.
OD LOOP	Internal problem coordination loop for discussions with OD or OSM.
FLIGHT DIRECTOR	Monitor only. Flight Director conversations at JSC.
GOSS	Monitor only. Air to ground or Capcom - astronaut conversations.
ATM EXP	Monitor Only. Experiment coordination loop at JSC.
PROP	Coordination loop between HOSC and JSC. Primarily used by two experiments MSG's.
NETWORK	Coordination loop between HOSC and JSC. Primarily used by cluster systems groups. Most conferences with Flight Director/Flight Controllers and MSFC are on this loop.
FOMR	Coordination loop between HOSC and MSFC FOMR Senior Representative. Used by OD and OSM.
HOSC CONF	Backup coordination loop between HOSC and MSFC FOMR Representatives. Used for problem statusing, etc.

1.4.3 Timing Data Distribution

The three basic time formats distributed through the HOSC were:

Universal Time (GMT) (HMS)

Countdown Time/Ground Elapsed Time (EHMS)

Time in Time Base (DHMS)

A switchable Timing Indicator was included in all CWA's which included the capability, local to the indicator, to be switched between CDT/GET and TITB.

1.4.4 Other Facilities

Three trailers located just outside of the HOSC were used for supporting facilities, as well as a number of remote facilities.

1.4.4.1 Trailers

Trailers outside the HOSC were used for:

a. Sleep

b. Conference work area for contractor support

c. Auto scan work area.

1.4.4.2 Remote Areas

A number of mission support groups required remote facilities to support Skylab by providing simulator and/or other functions. These functions and the facilities utilized are listed in Table I.3. All remote facilities were provided T.V. and voice communications. Monitoring capability for operational voice loops was also provided.

TABLE I. 3

SKYLAB REMOTE FACILITIES/FUNCTIONS

FUNCTION	BUILDING LOCATION
STAC SUPPORT	IBM AND 4487
ATTITUDE POINTING AND CONTROL SYSTEM SIMULATOR	4487
INSTRUMENTATION AND CONTROL SUPPORT	4487
CREW SYSTEMS SUPPORT	4619
ATM EXPERIMENTS GROUP	4656
THERMAL / ECS WAR ROOM	4666
NEUTRAL BUOYANCY SIMULATOR	4706
SATURN IB SYSTEMS DEVELOPMENT FACILITY (BREADBOARD)	4436
SATURN V SYSTEMS DEVELOPMENT FACILITY (BREADBOARD)	4708
ELECTRICAL POWER SYSTEM (BREADBOARD)*	4436

*No TV Provided.

1.5 Mission Summary

1.5.1 Mission Objectives

The four basic objectives of the Skylab Program were successfully accomplished between May 25, 1973, and February 8, 1974. These objectives were:

a. Determine man's ability to live and work in space for an extended period of time.

b. Extend the science of solar astronomy beyond the limits of earth-based observations.

c. Survey earth resources from space and develop and improve techniques for doing so.

d. Increase man's knowledge in a variety of other scientific and technological regimes.

1.5.2 SL-1 Summary

SL-1 consisted of the orbital workshop (OWS) which was a modified S-IVB Stage, a multiple docking adapter (MDA), an airlock module (AM), an Apollo Telescope Mount (ATM), and a payload shroud, which was jettisoned after orbital insertion. The combined configuration made up an experimental laboratory known as the Saturn Workshop (SWS). The configuration with the command service module (CSM) attached was then termed the Orbital Assembly (OA).

SL-1 was launched on May 14, 1973, at 13:30:00 EDT from Launch Complex (LC) 39A. The launch vehicle was SA-513, a two-stage Saturn V vehicle. The SWS was inserted into a near circular orbit of 233.9 by 235.2 NM altitude at an inclination of 50.0 degrees and a descending node of 153.26 degrees.

During boost flight, problems developed when the meteoroid shield was lost and the OWS Solar Array System (SAS) wing number 1 only partially deployed. SAS wing number 2 was completely torn away just after separation from the spent second stage. Other subsequent problems developed and have been analyzed and are discussed in detail in TMX-64814, "Skylab Mission Report - Saturn Workshop." All problems that were investigated by MSFC are listed in Appendix A.

1.5.3 SL-2 Summary

SL-2 was launched from launch complex 39B at 09:00:00 EDT on May 25, 1973, ten days later than originally planned because of the mission problems associated with the SL-1 SWS failures. The CSM was successfully placed into an 80.8 by 188.7 NM altitude earth orbit from which rendezvous with the SWS was begun. The Skylab astronauts successfully deployed a parasol sun shield, carried aboard SL-2, which permitted temperatures in the OWS to decrease to near nominal levels. Later, the crew successfully deployed the SAS wing 1 by cutting the meteoroid shield fragments that were preventing deployment. This increased the electrical power available by approximately 75 percent. The CSM was deorbited June 22, 1973, with splashdown in the Pacific Ocean, completing the 28-day SL-2 mission.

1.5.4 SL-1/SL-2 Problems and Actions

A total of 1,089 mission action requests were issued by the FOMR, and 369 action requests were issued by the HOSC during the SL-1/SL-2 mission. The three hardware problems to which the highest number of actions were assigned were related to the meteoroid shield, thermal shield, and SAS deployment problems.

During the first manned phase, 166 mission action requests were issued by the FOMR, and 124 action requests were issued by the HOSC. The three problems requiring the most actions were related to the problems involving the OWS refrigeration loops, the S055 door, and rack rate gyro oscillations.

1.5.5 SL-3 Summary

SL-3 was launched from Launch Complex 39B using mobile launcher 1, at 07:10:50 EDT July 28, 1973. The CSM was successfully placed in an 80.9 by 122.1 NM altitude earth orbit from which rendezvous with the SWS was accomplished. The Skylab crew successfully deployed a twin-pole solar sail over the parasol sun shield which was gradually deteriorating due to exposure. The astronauts also carried along and successfully installed an electronic equipment package termed a "6-pak" to replace the rack-mounted control rate gyros which experienced excessively high drift rates and oscillations. The SL-3 mission was extended to 59 days with deorbit and splashdown occurring on September 25, 1973, in the Pacific Ocean just off the coast of California.

1.5.5.1 SL-3 Problems and Actions

A total of 853 mission action requests and 330 action requests were issued during the SL-3 mission. The three hardware problems requiring the most actions were related to rack rate gyro oscillations, the AM coolant loop, and the condensate system.

During the second unmanned phase, the AM tape recorder and coolant loop problems, along with S055 main power that could not be turned off, required the highest number of actions. A total of 140 mission action requests and 86 action requests were issued.

1.5.6 SL-4 Summary

Launch of SL-4 occurred on November 16, 1973, at 08:01:23 a.m., CST, as scheduled, from Launch Complex 39B, utilizing mobile launcher 1. All boost events occurred nominally with the CSM being inserted into an 80.5 by 120.0 altitude earth orbit from which rendezvous with the SWS was successfully accomplished. After docking, the SL-4 crew reactivated the SWS systems, which included reservicing the AM primary coolant loop, and inhabited and operated the Orbital Assembly for a mission that was extended from 56 to 84 days. During all but eleven days of the

final mission phase, control moment gyro (CMG) problems were experienced. However, the mission was successfully completed and all planned vehicle maneuvers for Earth Resources Experiment Package passes and Comet Kohoutek photography were completed without compromise. The mission lasted 84 days, 1 hour, 15 minutes, and 32 seconds. Splashdown occurred at 10:17 a.m., CDT, on February 8, 1974, in the Pacific Ocean, 153 miles Southwest of San Diego, California.

1.5.6.1 SL-4 Problems and Actions

The total number of mission action requests issued during SL-4 was 719 with a total of 165 action requests issued. The CMG 1 failure, the C&D coolant loop problem, and the S054 filter wheel problem required the most actions during that period.

2.0 SKYLAB LAUNCH VEHICLE SUPPORT TEAMS

For the first several hours of each mission phase, the HOSC was configured to accommodate target update, launch and deorbit support activities in parallel with Orbital Assembly support. This was accomplished by rearranging work area assignments for specific time periods. These specific time periods were keyed to significant events that could release or require a change in support personnel. Events used were (a) SL-1 launch minus eight hours to insertion; (b) SL-1 insertion through T+6 hours; (c) SL-2, 3, 4 launch minus eight hours to insertion; (d) insertion through T+6 hours.

Four specific support teams provided technical information to the Saturn Program Manager at KSC and Booster Systems Engineers (BSE) at JSC for problem-solving and launch go/no go decisions: Launch Support Team, Wind Team, Target Update Team, and Deorbit Team. The Launch Support Team functioned during all four events described in (a) - (d) above. The Wind Team and Target Update Team functioned during (a) and (c), and the Deorbit Team functioned during (d) only. Figure 2.1 shows membership and flow of information generated by the four teams.

2.1 Launch Support Team

Saturn Launch Vehicle support from Huntsville was provided similar to Apollo, in accordance with Apollo Program Directive No. 56, "Technical Support for Resolving Significant Technical Problems from Space Vehicle Rollout Through Mission Completion," and MSFC Program Directive 8080.7, "MSFC Technical Support Operations Plan."

The principal channel for MSFC support to KSC was through the Saturn Launch Vehicle Representative at KSC, and in his absence, through the MSFC Resident Office. An additional five to ten on-site engineers were provided for CDDT and launch.

2.1.1 Booster Systems Engineers

The launch vehicle flight control responsibility was assigned to the MSFC Booster Systems Engineer and his supporting staff at JSC. Launch vehicle support from the HOSC was

provided directly to the BSE with one exception; after SL-1 insertion, support from the HOSC was provided to the FOMR, and the BSE assumed additional responsibilities during activation.

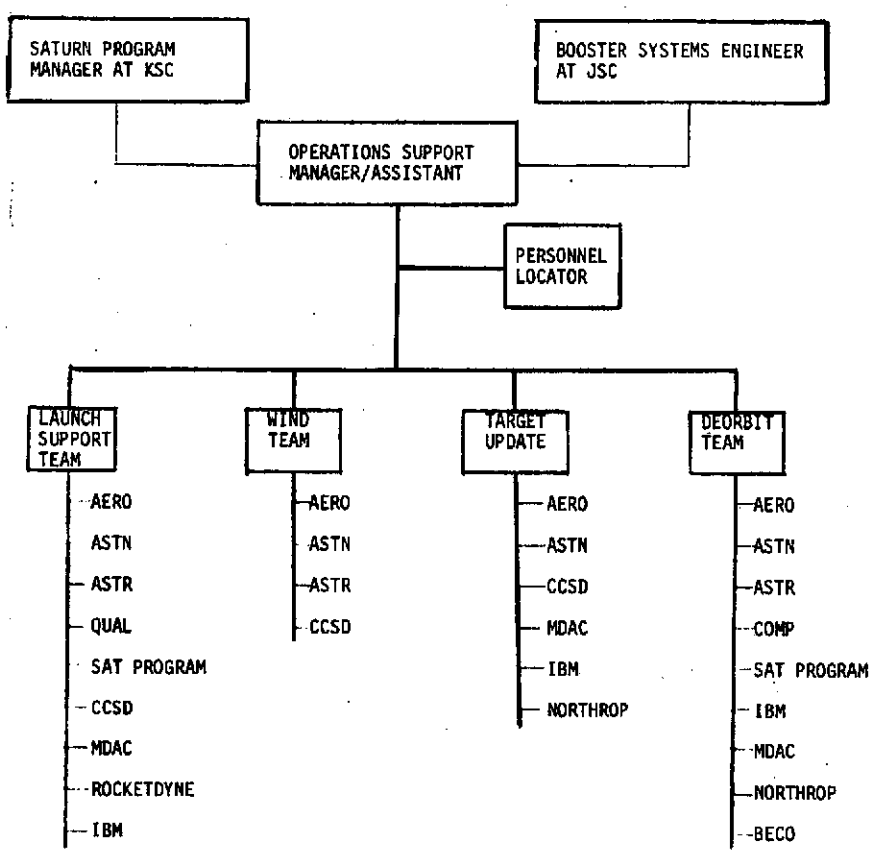


FIG: 2.1 SKYLAB LAUNCH VEHICLE SUPPORT TEAMS

2.1.1.1 SL-1 Launch Vehicle Flight Controller Tasks

Launch vehicle flight controller tasks during the SL-1 flight include:

a. Flight control of the S-IC and S-II powered flights and Saturn Workshop separation from the spent S-II stage.

b. Monitoring and confirmation of initiation of orbital safing of the spent S-II stage.

c. Primary flight control of the Saturn Workshop deployment and activation functions controlled by the IU, in conjunction with the JSC Orbital Assembly systems flight controllers.

2.1.1.2 Saturn IB Launch Vehicle Flight Controllers Tasks

For the Saturn IB launches (SL-2, 3, and 4), the Launch Vehicle Flight Controllers had the following responsibilities:

a. In conjunction with the JSC Flight Dynamics Officer, updating prelaunch target parameters of the Saturn IB to permit CSM rendezvous with the Saturn Workshop.

b. Exercising flight control to protect crew safety and enhance mission success during the Saturn powered ascent to orbit until CSM separation, similar to Apollo.

c. Exercising flight control of S-IVB/IU orbital operations, including the S-150 (Thermal Control Coating), T018 (Precision Optical Tracking), and M415 (Galactic X-Ray Mapping) experiments; and real time commands for deorbit operations.

2.1.1.3 MSFC Support to the Booster System Engineer (BSE)

MSFC support functions to the BSE included:

a. Providing technical information and advice upon BSE request on any vehicle systems problem.

b. Providing predicted vehicle flight dynamics based on measured prelaunch winds.

c. Verifying Saturn IB performance capability to achieve the rendezvous target parameters computed by JSC.

2.2 Target Update Team

The time of the day of the SL-1 launch established the framework for the launch sequences on all other missions that used the Saturn Workshop (SWS) as a target. The phase angle between the manned CSM and the SWS was considered in defining the Saturn IB launch window because this affected the type and duration of rendezvous. A variable launch azimuth technique was used for launch of the three Saturn IB's. This technique allowed a daily 16-minute plane launch window, eight minutes either side of the optimum (in-plane) payload point. Target updates were made for each Saturn IB launch at approximately T-8 hours and again at T-37 minutes. JSC generated the command loads and targeted parameters to be loaded onto the launch vehicle digital computer in the Instrument Unit (IU) using the latest SL-1 SWS tracking data. The HOSC was asked to verify the launch vehicle capability to meet target conditions. A target update math model analysis was used to aid in this verification.

The target update team consisted of membership from AERO and ASTN Laboratories and Chrysler Corporation Space Division, IBM, Northrup and McDonnell Douglas. In addition, the Launch Support Team provided inputs as required.

2.3 Wind Monitoring Team

This team provided go/no go recommendations and advisory support to KSC in the event of marginal wind conditions for launch and certain other pad activities. Vehicle structural bending moment effects were calculated from ground winds and compared against vehicle capabilities. The actual wind profile, measured before launch, was used in a flight dynamics math model to predict the acceptability of structural and control effects. Predicted vehicle inflight dynamics responses were provided to the JSC flight controllers and the crew. A similar team provided input for the CSM

at JSC, and joint recommendations were issued. The HOSC provided a wind report to KSC at intervals of T-8 hours, T-4 hours, and T-1 hour with the latter report containing the launch go/no go recommendation.

This team consisted of membership from AERO, ASTN, and ASTR Laboratories with Chrysler Corporation Space Division supporting.

2.4 Deorbit Team

The SIVB/IU (Saturn IB's) stages remained in orbit for up to six hours with a controlled deorbit executed during the fourth revolution of SL-2, 3, and 4. This was accomplished by orienting the vehicle in a retrograde attitude with the Auxiliary Propulsion System (APS) and then dumping the propellant residuals through the engine to produce the impulse for controlled deorbit from the launch vehicle parking orbit. Thrust vector control was used to maintain proper attitude orientation during propellant dumping. MSFC had lead responsibility for conducting premission analysis and planning and real time activities for deorbit. The Deorbit Team computed in real time the capability of obtaining the propulsive force required for deorbit , the dump durations, and the dump execute times. The deorbit maneuver was implemented by BSE ground command. All team activities were conducted from the HOSC at MSFC with the exception of flight control activities, which was the responsibility of the BSE. S-IVB/IU/SLA deorbit was targeted for the Pacific Ocean and all impacts occurred in the predicted target area, as shown in Table II. 1. (Reference S&E-AERO-M Postflight Analysis as reported in the SL-2, SL-3 and SL-4 Flight Evaluation Reports).

2.4.1 Organization

The deorbit team was composed of membership from MSFC and their contractors. Specific responsibilities are shown in Table II. 2 by organizational elements.

TABLE II.I
SKYLAB DEORBIT SUMMARY

	FOOTPRINT LATITUDE/LONGITUDE (DEG) TO	LATITUDE/LONGITUDE (DEG)
SL–2 REAL TIME PREDICTED	17.6 N / 178.3 E	44.8 N / 216.3 E
ACTUAL	28.5 N / 189.0 E	38.3 N / 203.0 E
SL–3 REAL TIME PREDICTED	14.7 N / 176.4 E	35.2 / N 198.0 E
ACTUAL	21.7 N / 182.6 E	27.5 N / 188.4 E
SL–4 REAL TIME	9.8 N / 174.9 E	31.5 N / 195.5 E
ACTUAL	24.5 N / 187.7 E	30.1 N / 193.8 E

TABLE II.2

DEORBIT TEAM ORGANIZATION

RESPONSIBILITIES	ORGANIZATION
OPERATIONS SUPPORT MANAGER (TEAM CHAIRMAN)	MO
BOOSTER SYSTEMS ENGINEER	MO/MDAC/IBM
SYSTEMS ENGINEERING/MISSION PLANNING	SAT-E
IU STAGE SYSTEMS	SAT-IU/IBM
S-IVB STAGE SYSTEMS	SAT-SIVB/S&E-ASTN/MDAC
SOFTWARE & FLIGHT SEQUENCE	S&E-S/P-A/IBM
COMPUTER AND DISPLAY SUPPORT	S&E-COMP-RDP
TRAJECTORY ANALYSIS GROUP	S&E-AERO-MDAC
S-IVB ENGINE PERFORMANCE GROUP	S&E-ASTN-SAS/MDAC
S-IVB CONSUMABLES GROUP	S&E-ASTN/MDAC
ASTRIONICS SYSTEMS	S&E-ASTR

3.0 SKYLAB ORBITAL OPERATION SUPPORT PERFORMANCE ANALYSIS

HOSC orbital support for Skylab was not originally intended to be continuous, 7 days per week. However, the severity of the loss of meteoroid shield and the Solar Array System (SAS) wing 2 quickly erased original plans and initiated an all-out effort by contractor and civil service personnel to provide flight support technical back-up to their counterparts in Mission Control. This support was provided through established channels using established procedures, data support, facilities and support positions. This section is a summary and support performance analysis of problems and actions that required MSFC involvement during the mission.

3.1 Problems

A total of 187 consecutive numbers were used to identify MSFC hardware or software problems. Of the 187, four were declared void and should not have been listed. The remaining 183 were investigated in detail and were declared either a discrepancy or anomaly, an anomaly being more severe than a discrepancy. Anomalies were tagged to known hardware failures, whereas discrepancies were not considered to be complete loss of hardware, software, or experiment capability. In several cases, discrepancies were determined to have been a one-time occurrence that did not continue. Forty-three problems were tagged as anomalies. However, discrepancies were investigated to the same degree as anomalies and required the same closeout reports from responsible mission support groups. Premission plans were to provide only closeout reports for anomalies. This did not work in reality because reports were required weekly to update the status of problems, and very often a problem was not determined to be an anomaly until after the investigation. Therefore, using two separate problem classifications was really insignificant and is not recommended for future use.

Problems that required a high number of action items assigned were not always the most significant. For instance, no official HOSC actions were assigned to the meteoroid shield failure during boost; an investigation board was assigned to that problem. Then during SL-4, there was a Control Moment Gyro (CMG) 2

performance degradation that resulted in 12 separate actions, some of which required daily updates, but the CMG never failed. The three problems that resulted in the highest number of actions being assigned were M-156-72, Vehicle Rate Gyro oscillations, with 46 actions; M-217-95, AM primary and secondary coolant loops low pump inlet pressure with 44 actions; 173-M-63, elevated temperatures in the OWS refrigeration system as a result of no thermal shielding with 32 actions.

3.1.1 Skylab Problems Cumulative Total

Figure 3.1 indicates that the problems occurred at the highest rate during SL-2 and at the lowest rate during the second unmanned period.

The SL-1/SL-2 mission related problems requiring the highest number of actions involved the hardware problems related to the loss of the meteoroid shield, SAS1 deployment, and thermal shield deployment.

During the first unmanned period, the problems requiring the most actions involved the OWS refrigeration loop, the S055 door, and the rate gyro oscillations.

During the Skylab 3 manned phase, the three most significant problems concerning action activity were rate gyro oscillations, Airlock Module coolant loop, and the condensate system.

The second unmanned phase did not require a significant number of actions for any one particular problem. However, during the SL-4 mission, a very significant number of actions were required for CMG problems and the control and display coolant loop problem.

3.1.2 Problem Tracking List

The entire problem tracking list is shown, together with closeout status, in Appendix A.

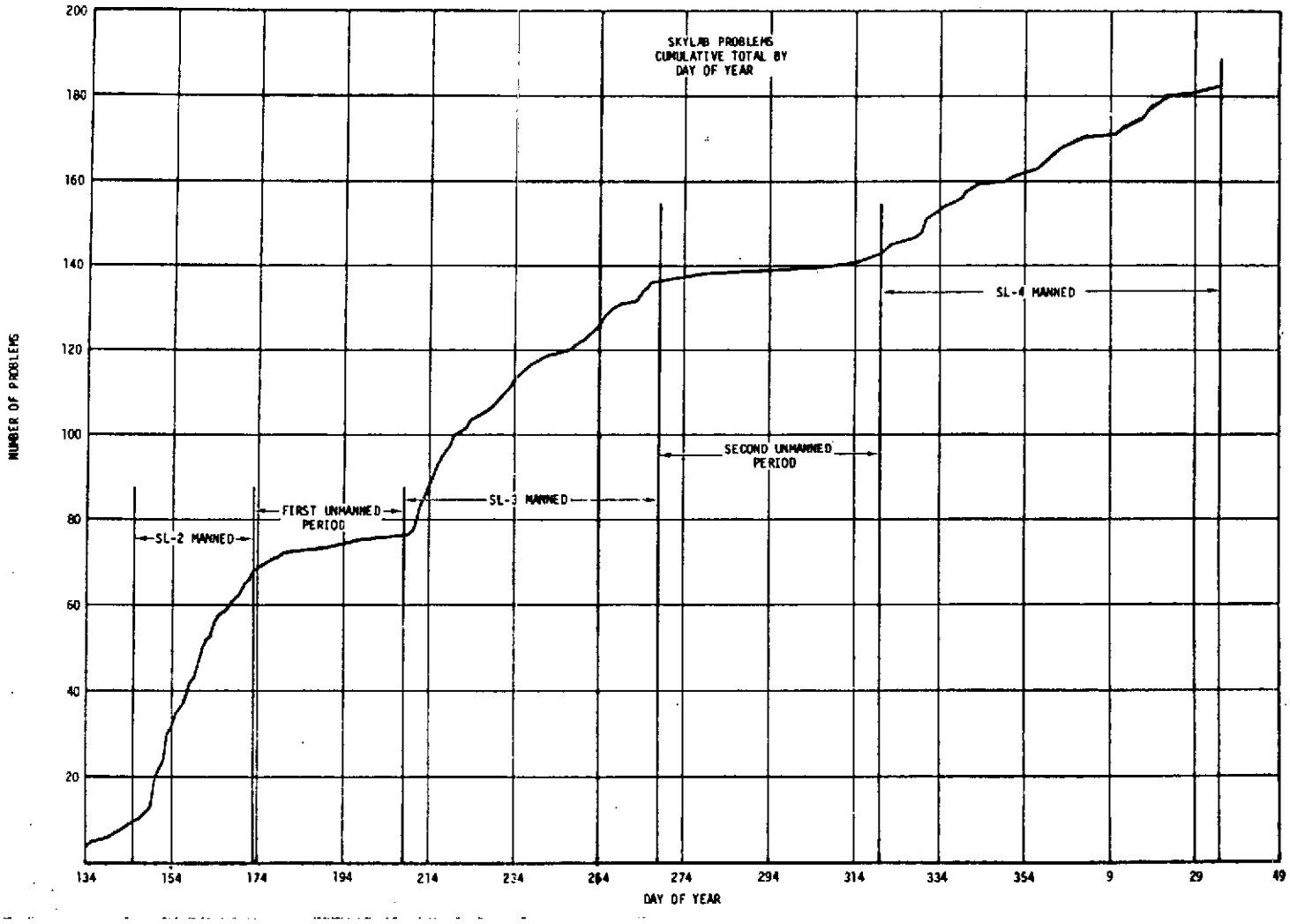


FIG. 3.1: CUMULATIVE TOTAL OF SKYLAB PROBLEMS

3.2 Analysis of HOSC Requests/Responses to Actions

The HOSC responded to 1,882 official actions during the Skylab mission. Response was as expected, more early than late. Of particular significance is the fact that the majority of the required response times were less than 8 hours, then centered on 24 hours and centered on 48 hours. More actions were generated on Tuesdays and Thursdays than other days, and Saturday was the day with the lowest action activity.

3.2.1 Action Request Analysis

A total of 2,972 Mission Action Requests (MAR's) were issued by JSC during the Skylab mission and 1,074 Action Requests (AR's) were issued by MSFC. Of these, MSFC was the actionee for 1,138 MAR's and 744 AR's, for a total of 1,882 actions. These numbers were derived from statistical analysis using all MAR and AR paper flow through the HOSC as the principal input. Figure 3.2 summarizes the Mission Action Requests on a cumulative basis by day of the year. In addition, the number of requests per day is shown. Figure 3.3 contains identical information for Action Requests. The highest rate of actions occurred just after activation during manned periods and early in the SL-1 activation phase when many problems occurred almost simultaneously as a result of launch phase problems. Of particular significance is the fact that the rate of actions being generated decreased significantly after SL-3, indicating better than expected systems performance.

3.2.1.1 Guidelines for Action Request Analysis

a. All AR's transferred to MAR's are included in MAR's charts only.

b. AR's and MAR's which were assigned to more than one MSG or laboratory were tabulated under each responding group.

c. When an AR was reassigned an MAR the initiation date of the MAR was used for tabulation purposes.

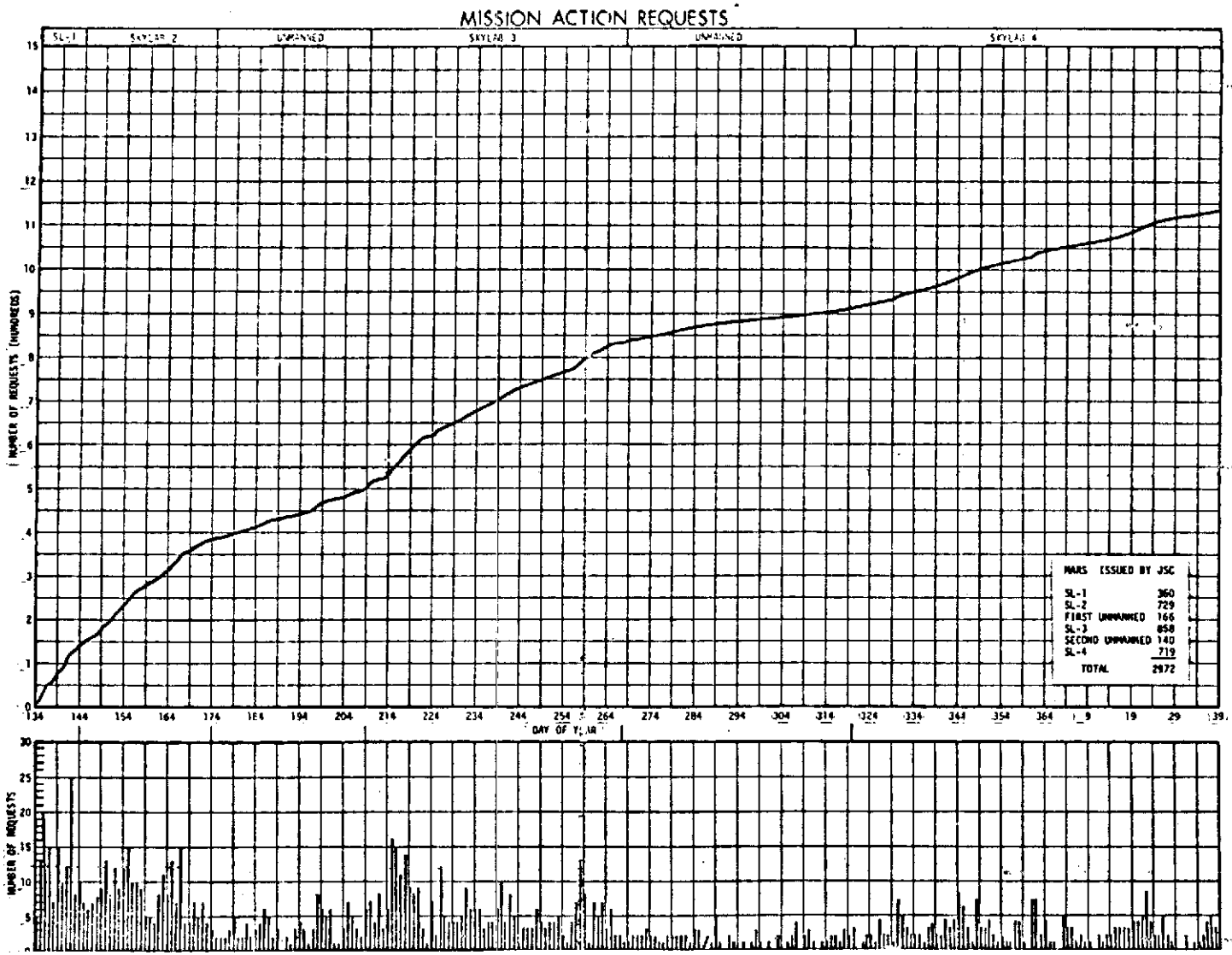


FIG. 3.2: CUMULATIVE TOTAL OF MAR's ISSUED DURING SKYLAB MISSION

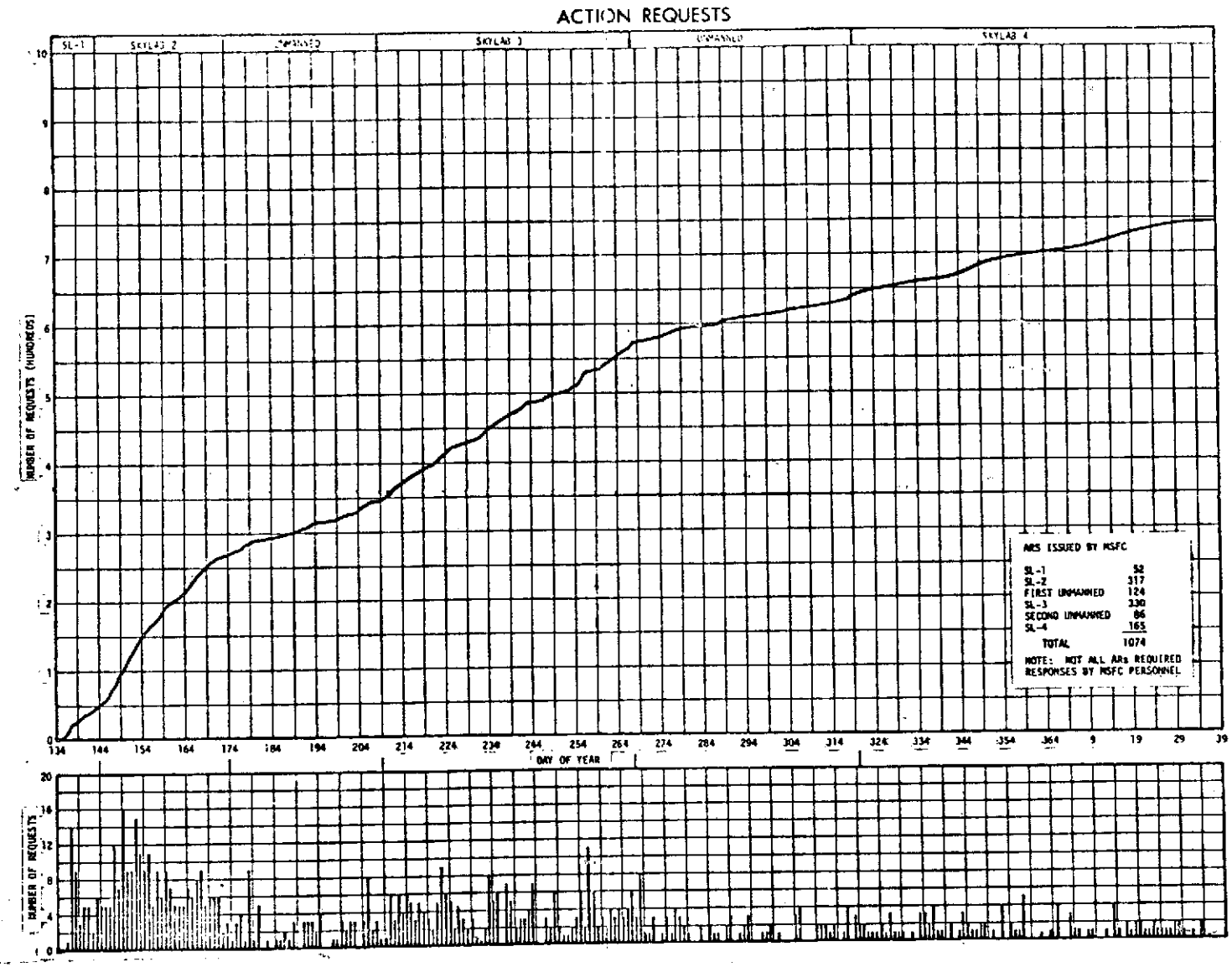


FIG. 3.3: CUMULATIVE TOTAL OF AR's ISSUED DURING SKYLAB MISSION

d. Cancelled AR's and MAR's were counted in the overall total but not in the MSG breakdown.

e. "Information Only" MAR's were not counted in the MAR chart.

f. "Information Only" AR's were counted in the AR total charts and in the MSG breakdowns.

g. AR's which required inputs on a daily basis were counted in the totals and MSG breakdowns only once.

h. AR's or MAR's which requested data such as DRF's, special tapes, CCATS command history, etc., were counted in the total charts and not in the MSG breakdowns.

i. HMAR's were counted in the MAR total and in the MSG breakdowns.

3.2.1.2 Total Actions Assigned to MSFC

The analysis was divided into two segments: those action requests (AR's) initiated at MSFC and those mission action requests (MAR's) initiated at JSC requesting MSFC to provide mission support. Cumulative totals of the number of action requests received by MSFC were tabulated and plotted daily. Each AR and MAR was reviewed to identify the Marshall MSG or laboratory assigned action. Totals for each MSG and laboratory were developed and are shown in Table III. 1, Tables III. 2 and III. 3 show separate breakdown of of MAR's and AR's, respectively. Further identification was made as to the subject matter of the response. For example, some requests were related to flight plan changes while others asked for detailed analytical responses. These separate categories are defined as follows:

TABLE III. I

TOTAL MSFC ACTIONS - SKYLAB MISSION

	ACTIONS	ANALYSIS OR DATA INPUT REQUESTED	FLIGHT PLAN RELATED	PROCEDURE RELATED	DOCUMENTATION RELATED	STOWAGE RELATED	HARDWARE PROBLEM RELATED
ECS/TCS	570	297	102	69	84	18	134
APCS	583	309	102	64	90	18	128
EPS	517	242	103	64	90	18	124
STR. & MECH.	400	191	78	41	71	19	120
I&C	376	165	79	33	81	18	76
CREW SYSTEMS	385	156	81	44	79	25	75
CONTAMINATION	265	91	74	11	71	18	30
ATM EXP.	426	175	102	43	84	22	111
ATM TCS	270	95	81	6	70	18	22
COROLLARY EXP.	483	170	99	37	146	31	60
ASTN	11	9	1	0	1	0	6
ASTR	3	2	0	1	0	0	2
AERO	5	5	0	0	0	0	1
MDAC-W	21*	15	2	1	0	0	7
MDAC-E	10	8	1	1	0	0	4
IBM	5	4	0	1	0	0	1
MMC	9	7	2	0	0	0	3
LAUNCH VEHICLES	2	1	1	0	0	0	0
TOTALS**	4341	1942	908	416	867	205	914

* PROVIDE HARDWARE - 3

** CONTAINED IN THE TOTALS ARE 222 ACTIONS COMMON TO ALL MSGs.

TABLE III. 2

MAR COMPOSITE SUMMARY - TOTAL SKYLAB MISSION

MARs	ACTIONS (MARs)	ANALYSIS OR DATA INPUT REQUESTED	FLIGHT PLAN RELATED	PROCEDURE RELATED	DOCUMENTATION RELATED	STOWAGE RELATED	HARDWARE PROBLEM RELATED
ECS/TCS	326	193	48	47	32	6	90
APCS	289	164	42	41	36	6	56
EPS	249	126	42	40	35	6	58
STR. & MECH.	180	101	29	26	18	5	68
I&C	164	83	29	22	24	6	34
CREW SYSTEMS	168	78	30	27	24	9	37
CONTAMINATION	98	40	25	5	17	6	9
ATM EXP.	200	96	46	25	25	8	61
ATM TCS	96	38	32	2	18	6	11
COROLLARY EXP.	204	94	41	24	32	13	30
ASTN	5	5	0	0	0	0	2
AERO	3	3	0	0	0	0	0
MDAC-W	7*	4	1	1	0	0	1
MDAC-E	2	1	0	1	0	0	0
IBM	5	4	0	1	0	0	1
MMC	1	1	0	0	0	0	0
LAUNCH VEHICLES	2	1	1	0	0	0	0
TOTALS**	1994	1032	366	262	261	80	458

* PROVIDE HARDWARE - 1

** CONTAINED IN THE TOTALS ARE 63 ACTIONS COMMON TO ALL MSGs.

TABLE III. 3

AR COMPOSITE SUMMARY TOTAL SKYLAB MISSION

ARs	ACTIONS (ARs)	ANALYSIS OR DATA INPUT REQUESTED	FLIGHT PLAN RELATED	PROCEDURE RELATED	DOCUMENTATION RELATED	STOWAGE RELATED	HARDWARE PROBLEM RELATED
ECS/TCS	244	104	54	22	52	12	44
APCS	294	145	60	23	54	12	72
EPS	268	116	61	24	55	12	66
STR. & MECH.	220	90	49	15	53	13	52
I&C	212	82	50	11	57	12	42
CREW SYSTEMS	217	78	51	17	55	16	38
CONTAMINATION	172	51	49	6	54	12	21
ATM EXP.	226	79	56	18	59	14	50
ATM TCS	174	57	49	4	52	12	21
COROLLARY EXP.	279	76	58	13	114	18	30
ASTN	6	4	1	0	1	0	4
ASTR	3	2	0	1	0	0	2
AERO	2	2	0	0	0	0	1
MDAC-W	14*	11	1	0	0	0	6
MDAC-E	8	7	1	0	0	0	4
MMC	8	6	2	0	0	0	3
TOTALS**	2347	910	542	154	606	133	456

* PROVIDE HARDWARE - 2

** CONTAINED IN THE TOTALS ARE 159 ACTIONS COMMON TO ALL MSGs.

a. Analysis or Data Input Requested

This type of response was usually technical in nature requiring investigation of an anomaly, guidelines on how to perform some test or operation, answers to questions, etc.

b. Flight Plan Related

These responses contained review/evaluation of flight plan changes, answers to how specific flight plan operations should be performed, guidelines, etc.

c. Procedure Related

These responses were special procedures for trouble-shooting, testing, special patches, etc., which are developed after a problem appears.

d. Documentation Related

These responses related to formal documents some of which may require CCB action to incorporate changes. Typical documents were the Mission Requirements Document, Flight Mission Rules, Command Procedures Handbook, Operational Data Book, Malfunction Procedures, etc.

e. Stowage Related

These responses identified special items for CSM stowage, review of stowage changes, etc.

f. Hardware Problem Related

These were all the AR's and MAR's identified with the problems contained on the MSFC Skylab Problem Tracking List. Special problem tabulations, such as "Meteoroid Shield Related," were included in the hardware problem total. The breakout to special problems was done when numerous AR's or MAR's were related to one specific problem.

3.2.1.3 Daily Action Activity

A tabulation of actions generated during each day of the week indicated that Tuesdays and Thursdays were the most active (see Table III.4). This is directly related to the fact that contractor and laboratory personnel available for Skylab support but committed to other assignments were not available on weekends. This is evidenced by the fact that Saturday and Sunday were lower activity days.

3.2.2 Response Time Analysis

All actions assigned to MSFC by JSC had a requested response time. This requested response time was used by the OD and HOSC staff to help determine when the MSFC required response time would be. Also, all actions generated within the HOSC had a required response time. An analysis of response to assigned actions indicates that response by all technical elements was as expected. Figure 3.4 shows the required response times as issued from the HOSC. It can be seen that the majority of required response times were very short (less than 8 hours), centered on 24 hours, or centered on 48 hours.

The actual responses of the Mission Support Groups are shown in Figure 3.5, which shows a very smooth and definite trend of submitting responses as early as possible. This is evidenced by the number of early response times as compared to the number of response times requested.

TABLE III.4

ACTION ACTIVITY BY DAY OF WEEK

	S	M	T	W	T	F	S
MARS							
SL-1 UNMANNED	10	12	37	27	25	7	15
SL-2 MANNED	27	35	37	36	37	35	35
FIRST UNMANNED PERIOD	11	12	20	19	22	19	11
SL-3 MANNED	51	46	58	37	46	44	53
SECOND UNMANNED PERIOD	9	10	15	9	15	13	12
SL-4 MANNED	28	41	39	23	37	36	27
TOTAL :	136	156	206	151	182	154	153
ARS							
SL-1 UNMANNED	5	5	2	7	19	9	3
SL-2 MANNED	31	29	32	31	23	40	27
FIRST UNMANNED PERIOD	4	11	17	18	11	14	7
SL-3 MANNED	33	24	46	28	40	31	25
SECOND UNMANNED PERIOD	3	12	10	14	18	11	6
SL-4 MANNED	22	14	13	7	18	14	13
TOTAL:	98	95	118	105	127	119	82

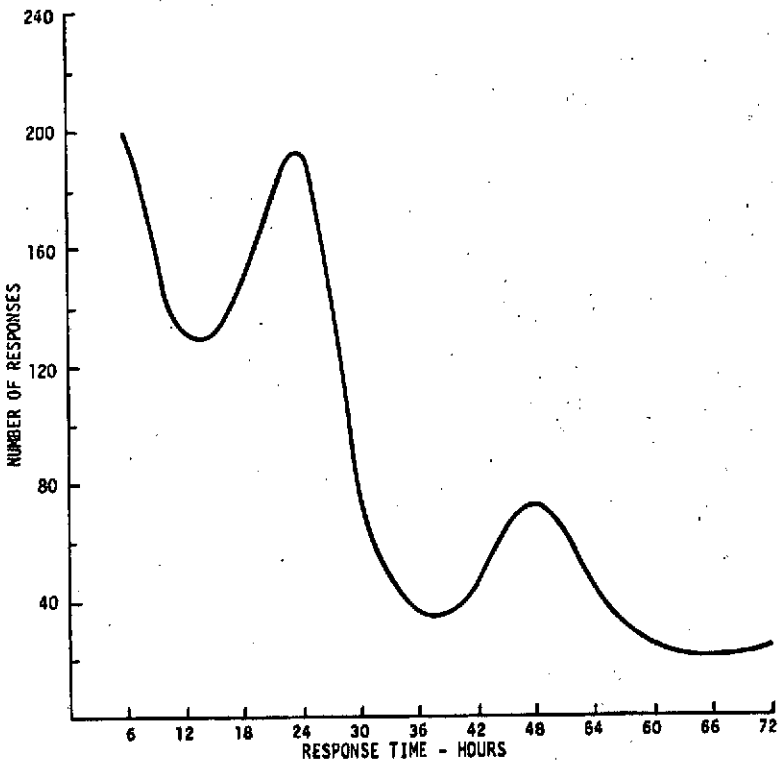


FIG. 3.4: RESPONSE TIMES REQUESTED BY MISSION OPERATIONS

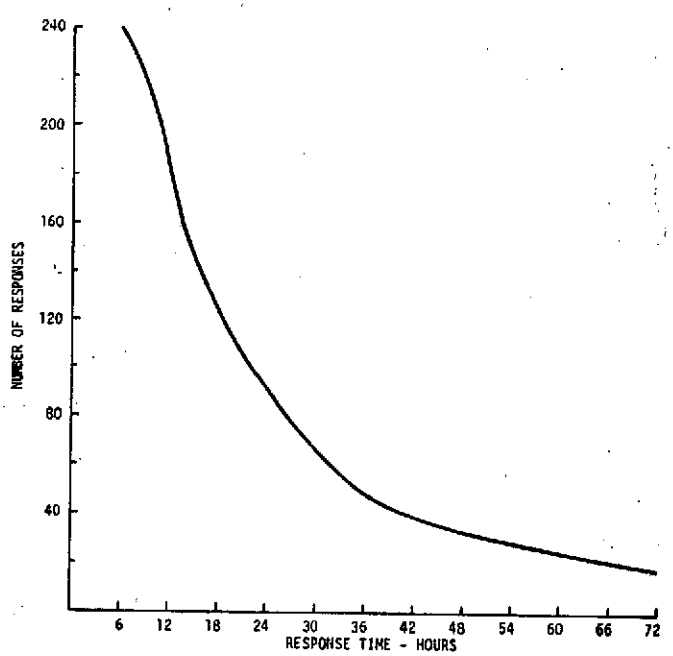


FIG. 3.5: ACTUAL RESPONSE TIMES OF MISSION SUPPORT GROUPS

Better than adequate response by the Mission Support Groups is further evidenced in Figure 3.6. Here, a negatively skewed curve is shown where early responses are to the negative or largest area side of the curve. This would produce a mean or average response well into the early side of the distribution.

3.2.2.1 Guidelines for Response Time Analysis

a. MAR response times were considered from the HOSC-assigned times - not JSC-assigned times.

b. The latest MSG response received was used to determine the actual response time.

c. Only written responses were considered in the analysis because of the requirement of time verification.

d. If there was no response in the master HOSC MAR or AR file, it was assumed there was no response.

e. Periodic responses (usually daily) were not considered. This type of response became routine for the MSG's and was part of their normal assignment.

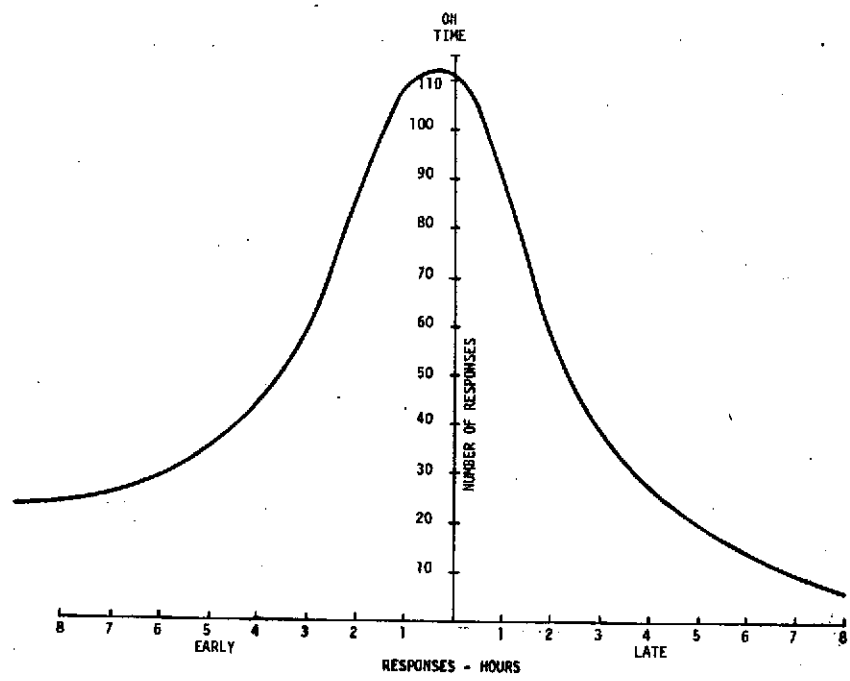


FIG. 3.6: DISTRIBUTION OF RESPONSE TIMES - EARLY AND LATE

4.0 SUPPORT MANNING AND PROCEDURES

4.1 MSFC Skylab Support Position Summaries

From May 14, 1973, until February 8, 1974, the Huntsville Operations Support Center (HOSC) continuously supported the Skylab mission. The HOSC support personnel included civil service, module and support contractors. A senior operations director (SOD) was in charge of MSFC support personnel at both JSC in the Flight Operations Management Room (FOMR) and at the HOSC. MSFC support to JSC included a FOMR staff, and HOSC staff, and ten mission support groups, as shown in Figure 4.1 and summarized in the following section of this report. The position summaries fall into five distinct categories: managment, support coordination staff, data and facility staff, mission requirements review staff, and administrative support staff. The numbers shown under each mission support group represent the actual number of people required during the mission with the number in parenthesis representing pre-mission planning.

4.1.1 Management

The principal management positions for operations support were the senior operations director (SOD), MSFC FOMR personnel and the operations director (OD). The SOD and OD were not included in pre-mission planning. Pre-mission plans were for the operations support manager and his assistant to assume overall management. However, because both positions were fixed, i.e., tied to a telephone coordination loop with the FOMR, they could in no way be responsible for coordinating the many actions and problems that occurred while at a position that required constant monitoring of mission loops. This was quickly realized and management personnel were inserted to assure the program manager that all problems and actions were being recognized and worked.

4.1.1.1 Senior Operations Director (SOD)

The Senior Operations Director was the chief of MSFC operations support activities both at the FOMR and at MSFC. He reported directly to the Program Manager and Center Director on operations activities. The position required manning from 7:00 a.m. to 7:00 p.m. daily, seven days/week and on call at any time.

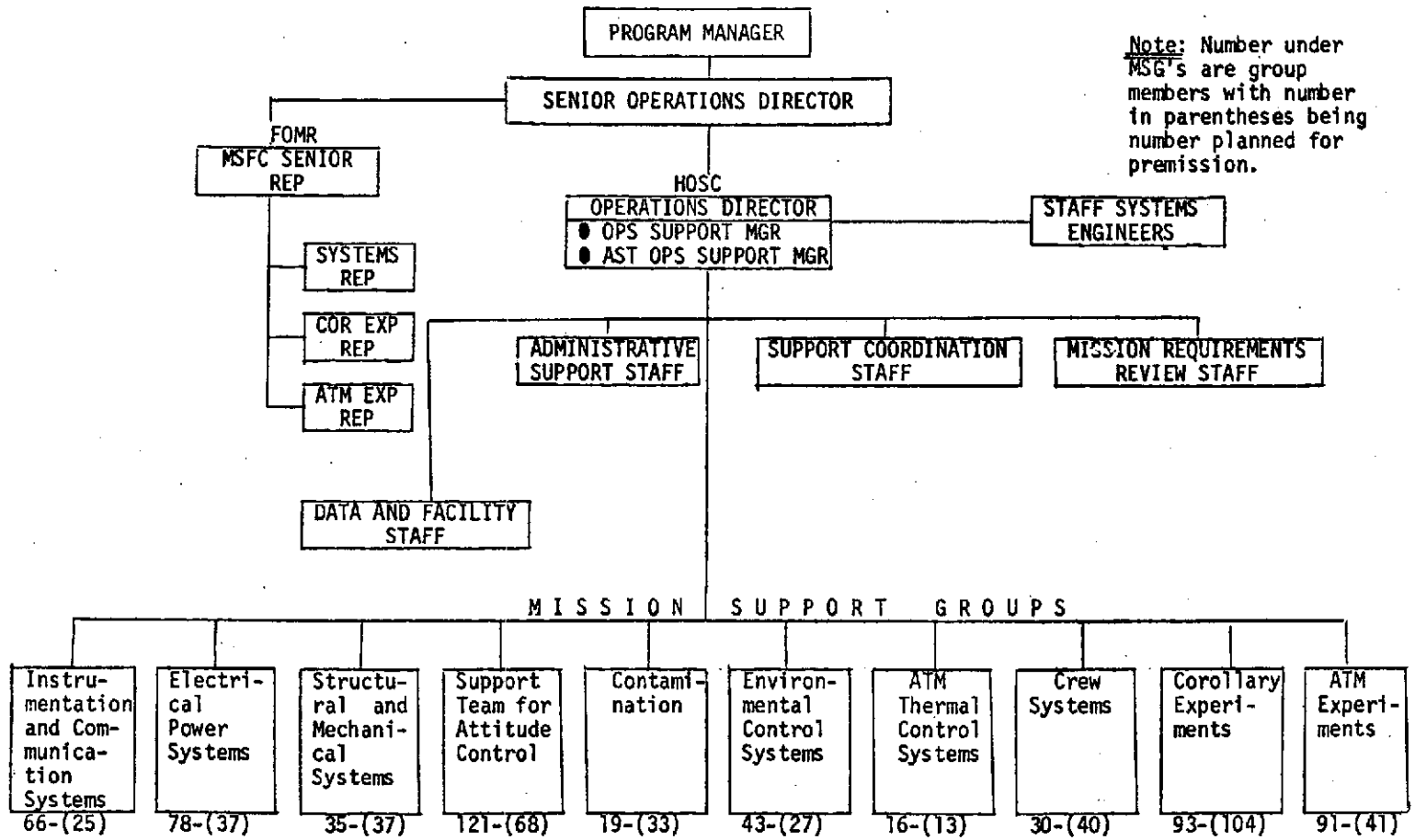


FIGURE 4.1: MSFC SKYLAB SUPPORT ORGANIZATION

4.1.1.2 FOMR Staff Positions

Flight Operations management support for Skylab provided the flight director an interface for detailed technical support from the design, checkout and testing organizations responsible for the vehicle systems. The JSC Skylab Program Office provided the interface for the JSC CSM and experiment hardware and for Skylab mission requirements modifications. The MSFC Skylab Program Office provided the interface for MSFC-designed or MSFC-contracted flight systems, software and experiments. Overall activities of the FOMR were directed by the FOD Manager who was the interface between the flight operations team and the JSC/MSFC Skylab program office senior representatives in the FOMR. Figure 4.2 shows the FOMR management support interfaces.

4.1.1.2.1 Senior Program Representative (SPR)

The SPR had the overall responsibility for providing detailed technical support to flight operations team for all flight systems, software and experiments. He provided the required policy-level adjustments to experiment priorities and planned mission activities, provided support to the Skylab flight management team, and received and approved the HOSC input to the FOMR daily/weekly report. The position required 3 shifts/day, 7 days/week.

4.1.1.2.2 Systems Engineer (SE)

The Systems Engineer provided detailed technical support to the flight operations team for all MSFC flight systems and software. The position required 3 shifts/day, 7 days/week.

4.1.1.2.3 ATM Experiment Engineer (ATM EE)

The ATM Experiment Engineer provided detailed technical support to the flight operations team for all ATM experiments. The position required 3 shifts/day, 7 days/week.

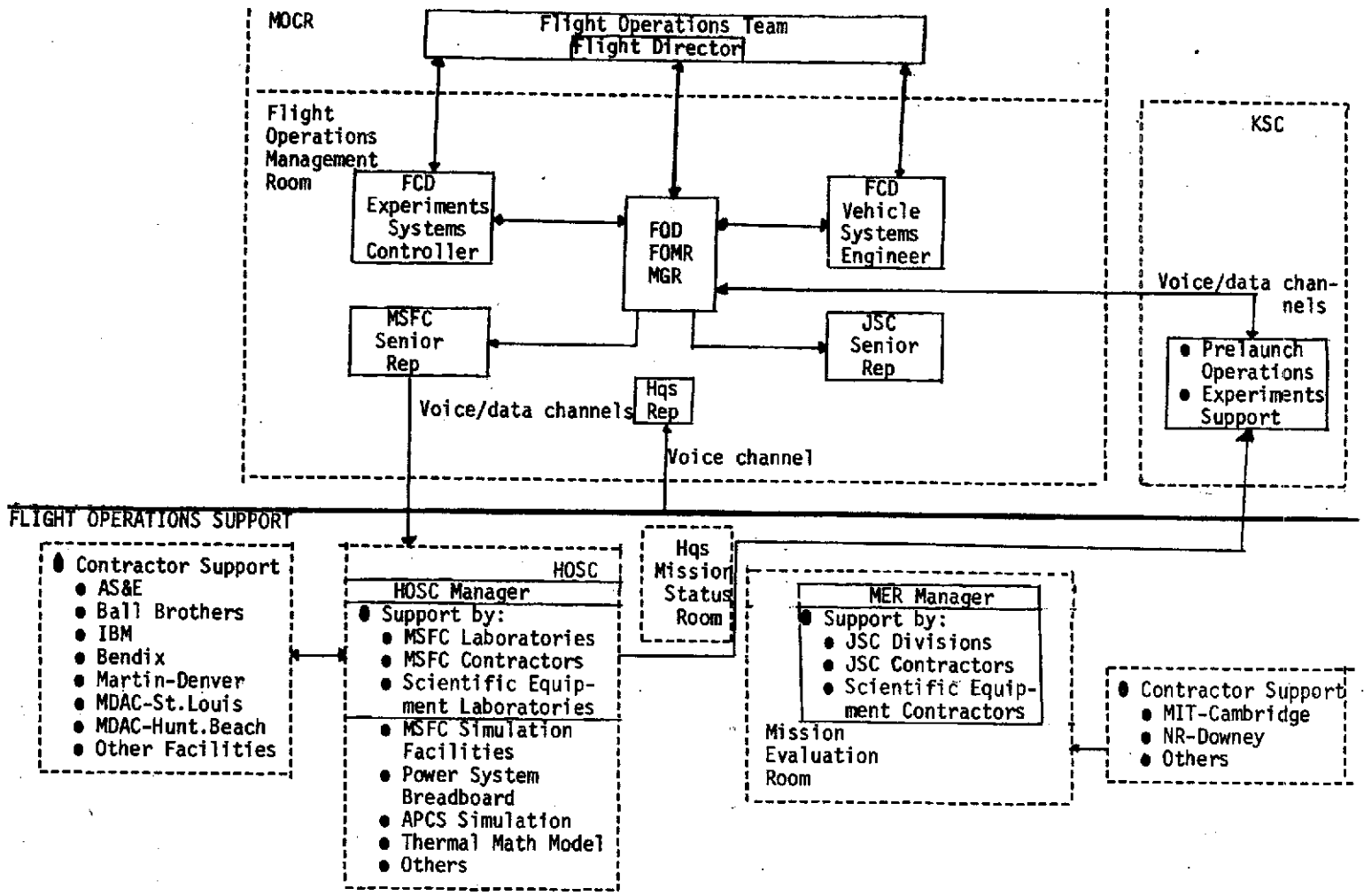


FIG. 4.2 : FOMR MANAGEMENT SUPPORT INTERFACES

4.1.1.2.4 Corollary Experiment Engineer (COR EE)

The COR EE provided detailed technical support to the flight operations team for all Corollary experiments. The position required 3 shifts/day, 7 days/week.

4.1.1.3 Operations Director (OD)

The OD provided overall management of the HOSC technical support to JSC. All actions required OD approval before being assigned or responded to. The OD conducted a tag-up meeting each execute shift at 0830 and called tag-up meetings or conducted them on the OD loop during other shifts. He had the responsibility to assure that proper actions were initiated on any anomalies or deviations that occurred, and maintained a position log to assure continuity in handovers. The position required 3 shifts/day, 7 days/week.

4.1.1.4 Operations Support Manager (OSM) and Assistant (AOSM)

The OSM and his assistant provided primary interface between MSFC support organizations, the FOMR and the BSE. They assigned FOMR Mission Action Requests and HOSC Action Requests to the appropriate Mission Support Groups and maintained their status. Both positions were manned 24 hours/day, 7 days/week.

4.1.2 Support Coordination Staff

One position was added to the support coordination staff after the mission began. This was the mission status engineer who maintained specific technical data charts and distributed that data periodically. The OSM/AOSM served in a management capacity by assuming OD duties if the OD was not available, in addition to managing the support coordination staff.

4.1.2.1 Staff Systems Engineer (SSE)

The SSE coordinated specific actions assigned by the OD and reviewed the response by HOSC on all actions. He prepared minutes of significant technical briefings or tag-up meetings when requested by the OD. The position required 2 engineers/shift, 3 shifts/day, 7 days/week.

4.1.2.2 Support Coordinator (SpC)

The SpC maintained a log of all official actions and the action status board, assured that all actions were distributed to the proper support personnel and updated the status recorder every 4 hours. (Note: The status recorder consisted of a black phone with a tape recorder containing an up-to-date mission status with significant messages for support personnel.) The position required 1 man/shift, 3 shifts/day, 7 days/week. This position was interchangeable with ASpC.

4.1.2.3 Assistant Support Coordinator (ASpC)

The ASpC monitored the Flight Director and GOSS loops, and tracked AOS and LOS of station passes, alerting HOSC personnel for station contact, and recorded all voice downlink for future use. He alerted the OSM/AOSM of significant events or problems heard over loops, and maintained the mission status on the internal HOSC status generator. This position required 1 man/shift, 3 shifts/day, 7 days/week and was interchangeable with the SpC.

4.1.2.4 Personnel Locator (PL)

The Locator maintained a current list of support personnel, including address and telephone number, and tracked key personnel 24 hours per day, throughout the mission. The position required 3 shifts/day, 7 days/week.

4.1.2.5 Report Coordinator (RC)

The Report Coordinator prepared the HOSC input to the MSFC Daily and Weekly Report to FOMR. He identified, tracked and documented significant deviations and anomalies, and maintained the Skylab Problem Tracking List and Board. The OD's signature was required for daily/weekly reports and the SOD's signature was required for Problem Report closeout. The position required 2 shifts/day, 7 days/week.

4.1.2.6 Mission Status Engineer (MSE)

The MSE coordinated and maintained significant technical data in chart form, including data on consumables such as 0_2, N_2, H_2O, TACS, and significant parameters being closely monitored as a result of problems. The data included significant OWS temperatures and CMG 2 bearing heater on/off commands. Position required 3 shifts/day, 7 days/week.

4.1.3 Data and Facility Staff

The data and facility staff functions were not changed from pre-mission planning, even though the type of data being received and requested changed significantly.

4.1.3.1 Data Support Manager (DSM)

The DSM provided overall management interface with other Centers in data and communications requirements, scheduling, and flow, and served as the manager of facility and data system operations, resources and priorities. The position required 3 shifts/day, 7 days/week.

4.1.3.2 Facilities Manager (FM)

The Facilities Manager served as the interface for facilities including data equipment and communications equipment and was responsible for implementing HOSC configuration and facilities operations. The position required 3 shifts/day, 7 days/week.

4.1.3.3 Data Requirements Manager (DRM)

The DRM provided direction for disposition and action of all data requests, and acted as a single point of contact for interface with the data support organization and other Centers in matters of data management. The position required 3 shifts/day, 7 days/week.

4.1.3.4 Data Processing Manager (DPM)

The DPM was responsible for management, planning, implementation, operation, and assessment of the data operations functions. The position required 3 shifts/day, 7 days/week.

4.1.3.5 Data Acquisition Specialist/Schedules (DAS)

The DAS was responsible for scheduling data flow from other Centers as defined by requirements approved by the DSM. He maintained the status of ground support system and the data flow and processing system. The position required 3 shifts/day, 7 days/week.

4.1.3.6 Data Dissemination Clerk (DDC)

The Data Dissemination Clerk operated the Data Distribution Room and serviced the data pickup and delivery windows. The position required 3 shifts/day, 7 days/week.

4.1.3.7 Mission Support Groups (MSG)

The primary functions of the HOSC, i.e., technical support to JSC through the FOMR, were provided by technical specialists assigned to the HOSC organization from various organizations within the Center's structure. There were ten technical support organizations, each with a leader and an alternate leader, who were responsible both administratively and functionally for their particular team. Each team had module and support contractors available on site within the HOSC. Contractor plant support was provided through their liaison team members who were within the HOSC and through their civil service program office counterparts.

Table IV. 1 lists the mission support groups and their functions. Table IV. 2 shows MSFC organizations and contractors who provided membership to each group.

The contamination Mission Support Group was on call 24 hours/day. All other mission support groups were required in the HOSC 3 shifts/day, 7 days/week.

4.2 Procedures Summary

The procedures used by the Huntsville Operations Support Center (HOSC) support personnel and staff during the Skylab mission are summarized in this section. The procedures provide the basic formal flow and function to be performed in response to mission support activities and requirements initiated either at JSC by the FOMR or internally at the HOSC.

4.2.1 Action Requests

4.2.1.1 Mission Action Requests (MAR) were the official method of levying FOMR requirements on the HOSC.

a. JSC Form 1214A (Figure 4. 3), the most commonly used, was issued by the FOMR to either JSC or MSFC requesting action.

b. JSC Form 1214B (Figure 4. 4) was used when joint actions were requested by the FOMR requiring both the MER and HOSC to participate.

c. Action annotations (Figure 4. 5) were attached by the Administrative Support Center (ASC) to all MAR's upon receipt. These were filled out by the OSM before distribution.

4.2.1.2 Response to all MAR's was provided on the FOMR/Mission Evaluation Action Request (Continuation Sheet), Figure 4.6.

TABLE IV.1

MISSION SUPPORT GROUP MATRIX

SYSTEM EXPERIMENT GROUPS	MODULE PROJECT OFFICES	LABORATORIES	CONTRACTORS (ON-SITE)
1. Structures and Mechanics	X	X	X
2. Electrical Power System	X	X	X
3. Environmental Control System	X	X	X
4. ATM Thermal Control System	X	X	X
5. STAC-Attitude & Pointing Control	X	X	X
6. Crew Systems	X	X	X
7. Instrumentation & Communications	X	X	X
8. Contamination	X	X	
9. ATM Experiments	X	X	X
10. Corollary Experiments	X	X	X

FUNCTIONS

1. Action Responses to Operations Director.	1. Concurrence & Support on Systems Inputs to Operations Director	1. Coordinate Lab Activities	1. Coordinate Contractor Activities
2. Daily/Weekly Systems Assessment Inputs and status of problem reports to Report Coordinator	2. FRR Reports to Program Manager	2. Lab Inputs to Program Manager for FRR	2. Direct Home Plant Support
3. FRR Systems Assessment Inputs to Senior Operations Director	3. Module Evaluation Reports	3. Discipline Evaluation Reports	
	4. Contractor Direction		

TABLE IV. 2

MISSION SUPPORT GROUPS

PROBLEM GROUP	ASTR	ASTN	AERO	QUAL	PT	SSL	EI	ATM	AL	SW	DP	MDAC W	MDAC E	MMC MDA	MMC INT	IBM	OTHER
1. Structures & Mechanics		L	X				X	X	X	X		X	X	X			
2. Electrical Power System	L			X	X		X	X	X	X		X	X	X	X		
- C & W	X			X			X	X	X	X			X				
- C & D	X			X		X	X	X	X					X			
3. Environmental Control System		L	X	X	X		X	X	X	X		X	X	X	X		
- OWS HSS		X		X		X	X			X		X					
4. ATM Thermal Control System		L	X				X										
5. STAC - Attitude & Pointing Cont	L	X	X	X	X		X	X		X		X				X	
6. Crew Systems	X	L	X		X		X	X	X	X							
- Stowage	X	X	X				X		X	X		X	X	X	X		
7. Instrumentation & Communication	L	X	X	X			X	X	X	X		X	X		X		
- ATM	X			X		X	X	X	X								
- AM/MDA/OWS	X						X		X	X		X	X	X	X		
8. Contamination		X	X			X	L	X	X	X	X						
9. ATM Experiments	X	X				X		L									BB, PE, AS&E
10. Corollary Experiments	X	X			X	X			X	X	L	X	X	X	X	X	

TABLE IV.2 (cont.)

PROBLEM GROUP	CSE	ASTR	ASTN	AERO	QUAL	PT	SSL	EI	ATM	AL	SW	DP	MDAC W	MDAC E	MMC MDA	MMC INT	IBM	OTHER
10. Corollary Experiments (Continued)																		SAT-IU MSC (PI) SAT-V MMC at MSC LA RC-PI NRL DUDLEY OBS. UNIV.OF WISC. (P.I.) SAT-IU FRENCH @ MSC (P.I. AT CONTR) UAH Bendix/Denver

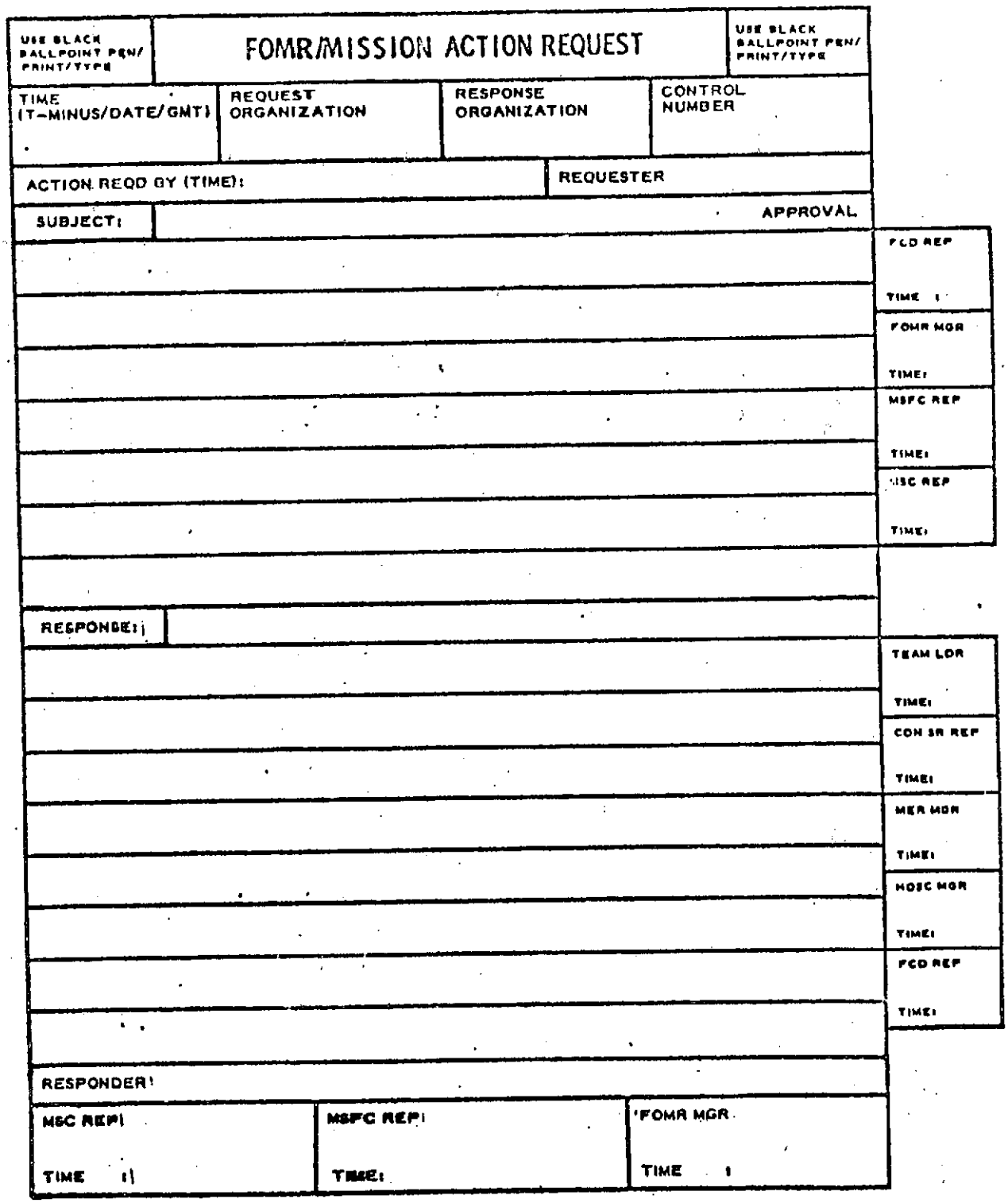


FIG. 4.3: FOMR/MISSION ACTION REQUEST

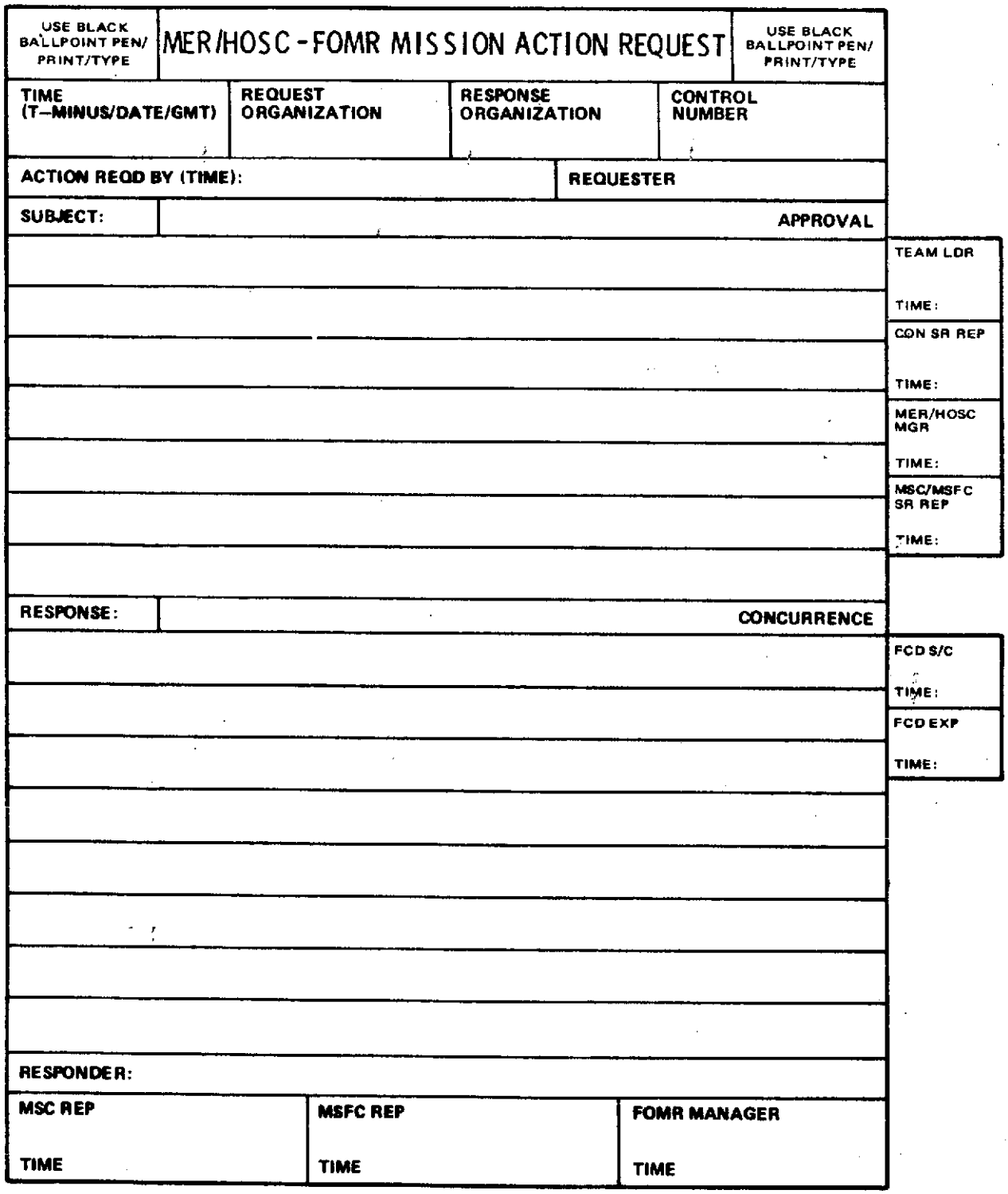


FIG. 4.4: MER/HOSC - FOMR MISSION ACTION REQUEST

ACTION ANNOTATION

Assigned to:

Group _____ Name _____

Type: U _____ R _____

Response Due _____ (DOY GMT)

Time Assigned _____ (DOY GMT)

MO-MGR Form 111 (Feb 73) (OT)

FIG. 4.5: ACTION ANNOTATION

(PLEASE USE BLACK BALL POINT PEN)

TIME (T-MINUS/GMT)	REQUEST ORGANIZATION	RESPONSE ORGANIZATION	CONTROL NUMBER

FIG. 4.6: FOMR/MISSION EVALUATION ACTION REQUEST (cont. sheet)

4.2.1.3 HOSC - Action Request (AR)

The AR was the formal internal documentation used to obtain support from HOSC elements. The OD made final determination if an AR was required,but recommendation for an AR could be made by HOSC staff members or Mission Support Group Leaders. The OD usually assigned action to the SSE, OSM/AOSM, or MSG Leader to write an AR. An AR form is shown in Figure 4.7.

4.2.1.4 Response to all AR's was provided in the FOMR/Mission Evaluation Action Request (Continuation Sheet), shown in Figure 4.6. Note: MAR and AR responses used the same form.

4.2.1.5 Response to an AR or MAR was signed by the OD after submittal by the MSGL or other actionee and approval by the SSE and the OSM or AOSM.

4.2.1.6 MAR's and AR's were classified either urgent or routine by the OSM/AOSM. Urgent actions usually required response within 8 hours or less or required special computer time, etc., which made the response time critical. Urgent actions were handcarried to the actionee and marked with a red urgent sticker. Routine actions were handled through the normal HOSC mail distribution system. Immediate verbal verification was made in either case with the assigned Mission Support Group Leaders.

4.2.2 Action Item Accounting and Filing

All MAR/AR's were tracked, and a file of appropriate actions was maintained by the Support Coordinator. This was accomplished by:

4.2.2.1 Logging in all MAR's and AR's upon receipt and closeout, using assigned MAR numbers and assigning AR numbers. The numbering system used was sequential for AR's and MAR's. However, MAR suffixes were by system, i.e., SWS, AX, EX, etc.

4.2.2.2 Maintaining an action item file that was subdivided to reflect MAR or AR open, responded to, or closed. An action was not considered closed until notification was made by the FOMR that the response was acceptable by the Flight Operations Team. The third shift Support Coordinator retired the closed action item file to file cabinets each day. This file was accessible primarily to the OSM/AOSM.

4.2.2.3 Maintaining an action status board of all MAR/AR's.

4.2.2.4 Compiling and distributing an action status list. The form for the listing is shown in Figure 4.8. Distribution was made before the morning briefing, before the afternoon daily review meeting, and before the end of the second shift.

4.2.3 Problem Tracking

The Report Coordinator identified, posted, and tracked all MSFC anomalies and discrepancies that occurred during the mission. This was accomplished as follows:

4.2.3.1 Identification

a. Monitoring Loops; reading all MAR/AR's; maintaining a current copy of the Flight Director's Master Anomaly List; feedback from review of voice tapes; data analysis and identification by MSG's.

b. True hardware failures were termed anomalies. Problems that were correctable or only partial failures were termed discrepancies.

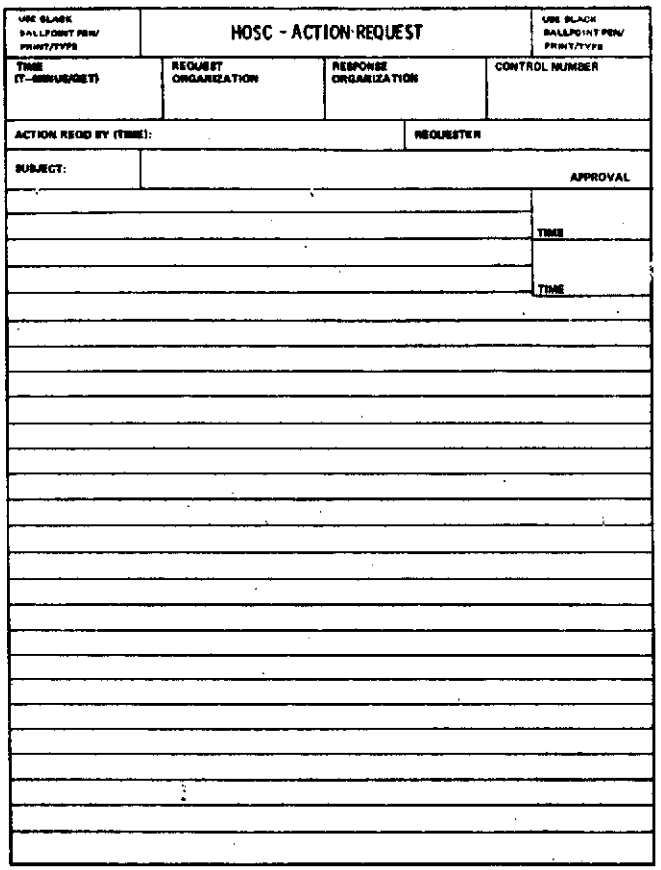


FIG. 4.7: HOSC - ACTION REQUEST

MAR/AR	TITLE	LEAD	OPENED	CLOSED	REMARKS

FIG. 4.8: MARS/ARS OPENED OR CLOSED

4.2.3.2 Posting

A Problem-Tracking Board listed all problems (anomalies and discrepancies) until closed using an assigned tracking number. A list of potential problems was maintained by the Systems Engineers on a potential problem tracking board. Potentials were either eliminated by the SSE together with the RC, or transferred to the Problem Tracking Board.

4.2.3.3 Tracking

All problems were numbered sequentially, 1 through 187. The sequential number was preceded by the day-of-year on which the problem occurred, and an M denoting MSFC hardware; i.e., 359-M-146, DOY/MSFC/Problem Number.

A tracking list (Figure 4.9) was maintained and updated daily to reflect the status of problems being tracked. Closed problems were maintained on the list for one week after final closeout, then dropped. The list was published daily.

Problem Reports were another source for problem tracking. These 1- to 2-page reports (Figure 4.10) were updated weekly until final closeout. Final closeout required the conclusions reached as to the cause of problem, no further action, no further investigation, and signature of the Senior Operations Director.

The Mission Status Engineer maintained and collected significant data pertaining to potential and ongoing problems, together with consumables. These data, posted on chart form on a Rev-to-Rev basis, were compiled daily on a standard form, published and distributed. An example of the consumables is shown in Figure 4.11. Thruster Attitude Control System (TACS) usage, refrigeration system temperature, and battery depth of discharge are examples of other parameters that were compiled and distributed daily.

SKYLAB PROBLEM TRACKING LIST - - MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS

FIG. 4.9: SKYLAB PROBLEM TRACKING LIST - - MSFC

MISSION PROBLEM REPORT NO: _____

STATEMENT OF PROBLEM:

DISCUSSION:

REQUIRED DATE FOR RESOLUTION:

PERSONNEL ASSIGNED:

ACTION PROGRESS:

SCHEDULED COMPLETION DATE:

EFFECT ON SUBSEQUENT MISSIONS:

CONCLUSIONS:

CORRECTIVE ACTION:

FIG. 4.10: MISSION PROBLEM REPORT

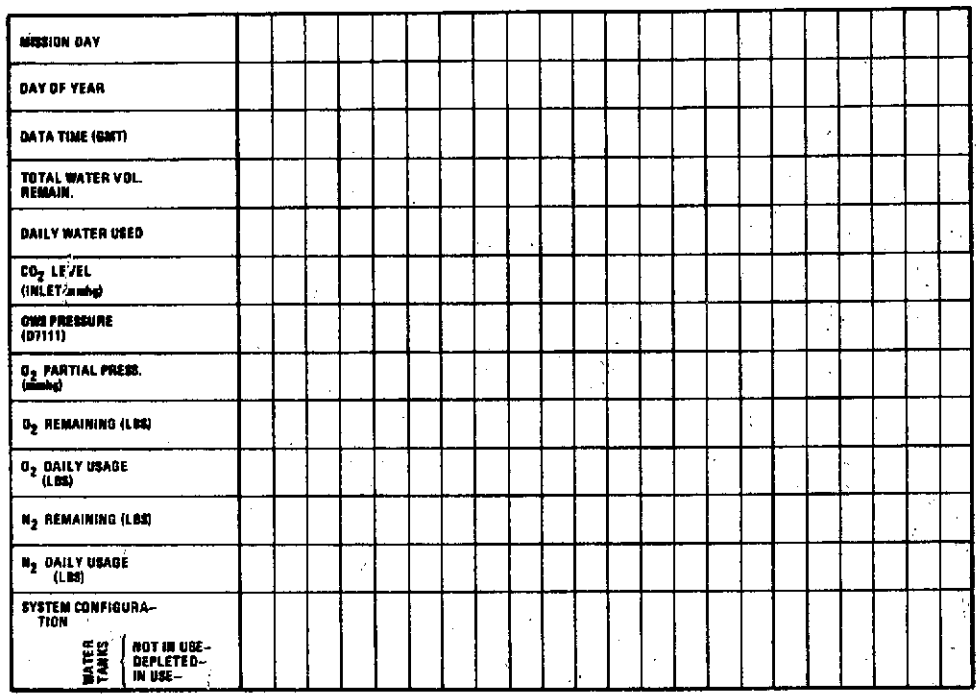


FIG. 4.11: DAILY SUMMARY

4.2.4 Reporting

Daily reports were published by the FOMR during the manned phase, and weekly reports were published throughout the entire mission. HOSC report contributions to the FOMR reports were:

4.2.4.1 A daily narrative of hardware or software problems encountered or significant events or actions accomplished that related to a previously encountered problem. This narrative included SWS systems, corollary experiments, ATM experiments, and the status of significant deviations from the planned Summary Flight Plan for the day.

4.2.4.2 An update to the previous day's Problem Tracking List; i.e., any status changes to open problems were reported on a daily basis.

4.2.4.3 Comsumables reported were included on a standard form shown in Figure 4.12.

WATER REMAINING (LBS)*	at
DAILY WATER USED (LBS)	
O_2 REMAINING (LBS)	at
DAILY O_2 USED (LBS)	
N_2 REMAINING (LBS)	at
DAILY N_2 USED (LBS)	
TACS REMAINING (LB-SEC)	at
DAILY TACS USED (LB-SEC)	

* WATER REMAINING IS USABLE WATER AND IS BASED UPON ACTUAL LOADED WEIGHTS.

FIGURE 4.12 CONSUMABLES STATUS

4.2.4.4 Weekly report inputs were different from daily report inputs in two areas:

a. The problem tracking list included all open problems and problems closed since the previous weekly report.

b. Problem reports were included for all open problems and problems closed since the previous weekly report.

4.2.4.5 HOSC report inputs to FOMR were distributed internally at MSFC and used as a daily MSFC report. Problem report inputs to FOMR on a weekly basis were not included in the internal daily distribution but complete Skylab Problem Tracking Lists were included.

4.2.4.6 Daily and Weekly Reports required the signature of the MSFC Operations Director.

4.2.4.7 Although report inputs were accepted verbally, written inputs were preferred. Figure 4.13 is a standardized form used for daily report inputs.

Originating MSG:_____ DATE_____

Input to FOMR Report:

Input to MSFC Internal Report:

MSG Leader Signature_____

NOTE

Report inputs to be written in a concise and clear manner so as to fit in space provided.

FIGURE 4.13 SAMPLE OF DAILY REPORT INPUT FORM

4.2.4.8 A typical daily report input to the FOMR and a FOMR Report are shown in Appendix B.

4.2.5 Flight Planning

The Mission Requirements Review Staff coordinated MSFC inputs to the daily flight planning activity. This was accomplished as follows:

4.2.5.1 All flight plans prepared by JSC were forwarded to MSFC for review.

4.2.5.2 The MRRS reviewed all flight plans and distributed them, as appropriate, to all MSG's for review and comment. Proposed changes to flight plans, mission requirements, and systems operating constraints were coordinated with the MSG's to facilitate a determination of impacts on the respective system.

4.2.5.3 Status of the implementation of all MSFC-initiated changes to the JSC flight planning data base was maintained.

4.2.5.4 Distribution of the following Flight Planning information was directed by the MRRS.

a. Daily Execute Package

b. Summary Flight Plan

c. Flight Plan Revisions

d. Abbreviated Timelines

e. Others

4.2.6 Administrative Support Center (ASC)

This support activity included the reproduction and dissemination of all official HOSC activities as well as records-keeping and library functions. This activity was done by one Chief Clerk, two typists/clerks, and a courier as follows:

4.2.6.1 All received actions were via LDX. The clerk logged actions in and out denoting the time of transmission or receipt. A file copy was made and the original was sent before the return of the Support Coordinator.

4.2.6.2 Information was transmitted to contractor plants via magnafax, and logged.

4.2.6.3 All reproduction of flight plans, reports, actions, and other Skylab official business was either managed or done by the ASC. Transmitted and received flight plans, reports, etc., were logged in/out and a file copy made. The original flight planning material was returned to the MRRS and daily/weekly reports were returned to the Report Coordinator. All other original business material was returned to the Support Coordinator after distribution and a file copy was made by the ASC.

4.2.6.4 Typing required by the HOSC staff was done by the ASC. Typing required by Mission Support Groups at the HOSC was also provided by the ASC.

4.2.7 Mission Status Dissemination

Mission status information was controlled and disseminated to authorized personnel by the HOSC staff with limited hard copy distribution . This was accomplished as follows:

4.2.7.1 HOSC activity schedules and major mission timelines information was available from the HOSC status recorder, phone number 453-4240.

4.2.7.2 HOSC personnel and MSFC remote support areas were kept informed of significant events, schedules, and status information via the status generator.

4.2.7.3 A document reader was used to display AOS/LOS of ground stations.

4.2.7.4 Action status boards and lists were maintained.

4.2.7.5 Problem tracking boards and lists were maintained.

4.2.7.6 An HOSC mail distribution system was established whereby all actions, flight plan material, and daily reports were distributed to an established group of support personnel within the HOSC.

4.2.7.7 A second group of personnel received significant documentation through the regular MSFC mail channels. This distribution list was standardized.

4.2.7.8 A small group of MSFC top management personnel received significant material via courier service from the ASC. This distribution list was standardized.

4.2.8 Facility and Data Support

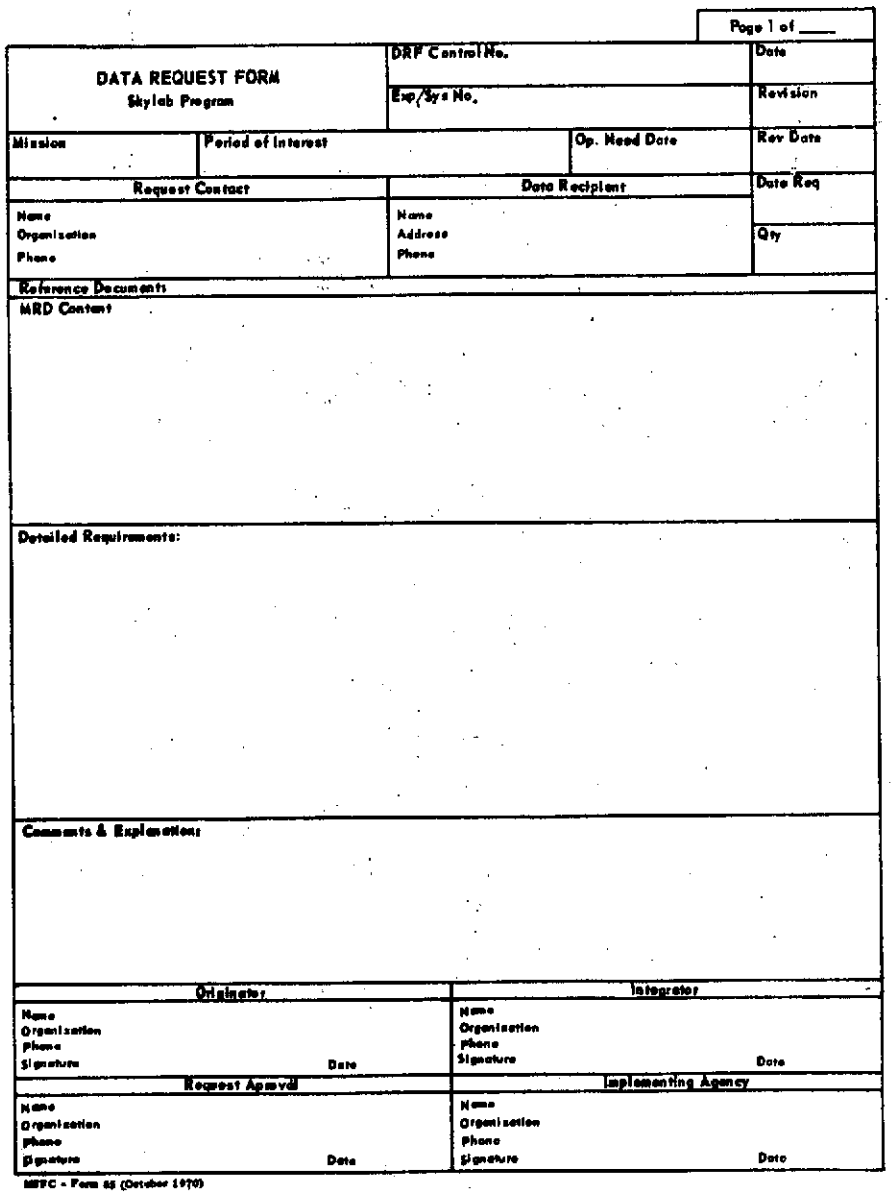
4.2.8.1 Functions

Facility and support elements were manned 24 hours/day during the Skylab missions. The Data Support Manager (DSM) provided overall management of the HOSC facility and data systems operation, resources, and priorities. The Data Requirements Manager (DRM) and Facilities Manager (FM) functioned under DSM authority. The DRM and the data processing manager (DPM) provided overall management for ensuring timely processing of requirements and data, and the distribution of requested data. The DRM provided direction for establishing data requirements and the coordination of the requirements with implementing organizations. The DPM ensured that the MSFC processing schedule and output were compatible with requester needs. The Facility Manager (FM) controlled use of the Operations Support Room (OSR), its associated equipment, including MOPS and special video channel assignments, and data display to the Conference Work Areas (CWA's) and remote support areas. In addition, the FM was responsible for implementing HOSC configuration and facilities operation and troubleshooting any discrepancies or unsatisfactory conditions.

4.2.8.2 Data Requests

Data Request Forms (DRF's) were the official documentation forms, MSFC Form 65, for requesting

data. The DRM responded to all requestors regarding disposition, and coordinated any implementation problems or deviations from the requirement. A sample form (MSFC Form 65) is shown in Figure 4.14. A continuation sheet (MSFC Form 65-1) was used when needed.



Page 1 of ____

DATA REQUEST FORM
Skylab Program

DRF Control No.
Exp/Sys No.
Date
Revision
Rev Date
Date Req
Qty

Mission
Period of Interest
Op. Need Date

Request Contact
Name
Organization
Phone

Data Recipient
Name
Address
Phone

Reference Documents
MRD Content

Detailed Requirements:

Comments & Explanation:

Originator
Name
Organization
Phone
Signature
Date

Integrator
Name
Organization
Phone
Signature
Date

Request Approval
Name
Organization
Phone
Signature
Date

Implementing Agency
Name
Organization
Phone
Signature
Date

MSFC - Form 65 (October 1970)

FIG. 4.14: DATA REQUEST FORM

4.2.8.3 Data Processing and Distribution

Nominal data processing timelines were established for all applicable requirements. Within the system at MSFC, each data batch was routinely converted and ordered for further processing; discrete listings and data books were generated; any special time-critical operations processing was accomplished in the order of a six-hour time frame from data receipt at MSFC. The remainder of the processing was scheduled at Slidell with data transfer by air freight. The classification of each requirement for processing was identified, and the schedule for data delivery made known to each requestor. All data were distributed at the Data Support Room by the Data Dissemination Clerk.

4.2.8.4 MOPS Data

MSFC maintained three Mission Operations Planning System (MOPS) terminals in the OSR for which a usage and logging system was established and controlled by the FM. MOPS data request forms are shown in Figure 4.15

4.2.8.5 Data System and Data Flow

Overall data system and data flow status was maintained and disseminated by the Data Acquisitions Specialist (DAS), who was responsible to the DRM. Status overview relative to real time, ADDT, and MOPS data was provided for D/TV display on the Status Generator as significant changes to the user were incurred. Status Reports were made by the DSM at scheduled meetings and as required by the OD.

4.2.8.6 Unsatisfactory Condition Report (UCR)

The UCR Form (Figure 4.16) provided a means of documenting information on detected problems for followup actions. However, the UCR was not used in lieu of verbally reporting any problems requiring immediate action necessary to provide satisfactory and safe HOSC operation and mission support. It was intended to eliminate recurring problems and provide permanent solutions by correctly defining and eliminating the cause. After ascertaining that an unsatisfactory condition not covered by normal operating procedures existed, the following actions were taken.

MOPS DATA REQUEST

IN

NO._____

TIME_____

R.M._____

ROUTINE

URGENT

OUT

TIME_____

DATE_____

REQUESTOR: NAME:_____ EXT:_____

MSG:_____

REQUEST DATE:_____ REQUEST TIME:_____ CST/GMT

APPLICATION

- ☐ ASP
- ☐ MDRS
- ☐ ADDT
- ☐ CPDS (STATE INFORMATION TO BE COPIED)

_____

VEHICLE

- ☐ OWS/AM/MDA
- ☐ ATM
- ☐ CSM

FORMAT NUMBER & TYPE (5 MAX)

1. _____ ____
2. _____ ____
3. _____ ____
4. _____ ____
5. _____ ____

KEY PARAMETERS: (10 MAX)

1. _____ 6. _____
2. _____ 7. _____
3. _____ 8. _____
4. _____ 9. _____
5. _____ 10. _____

SAMPLING PERIOD: START TIME _____ GMT/MGMT
DDD:HH:MM:SS

STOP TIME _____ GMT/MGMT
DDD:HH:MM:SS

SAMPLING RATE: _____ (MUST BE LESS THAN OR EQUAL TO ONBOARD RATE)
(LIMIT YOUR SEARCH TO 60 SAMPLES OR LESS)

JUSTIFICATION: _____

(FOR URGENT REQUESTS) _____

_____

APPROVAL: _____
MSG LEADER

OPERATOR RESPONSE:

- ☐ NO DATA AVAILABLE FOR TIME INTERVAL
- ☐ INCORRECT FORMAT (PROGRAM DISCREPANCY)
- ☐ RESTRICTED FORMAT
- ☐ UNAUTHORIZED SECURITY CODE
- ☐ DATA SUPPLIED IS FOR A DIFFERENT TIME INTERVAL

INITIAL _____

FIG. 4.15 MOPS DATA REQUEST

HOSC UNSATISFACTORY CONDITION REPORT

URGENT ____
ROUTINE ____
INFORMATION ____

UCR NUMBER _____
DATE _____

SYSTEM: (check)

DISPLAY ____ COMMUNICATIONS ____
FACILITY ____ PROCEDURE ____
OTHER _____

CONDITION: (describe in detail)

ORIGINATOR | ORGANIZATION | TIME/DATE NOTED | DATE NEEDED

STATUS: PROBABLE PROBLEM: _____

ASSIGNED TO: _____ DATE: _____

ESTIMATED COMPLETION: _____ PRIORITY: _____

ACTION TAKEN:

SIGNATURE _____ ORGANIZATION _____ DATE _____

FIG. 4.16 HOSC UNSATISFACTORY CONDITION REPORT

The implementor briefly described the cause and the corrective action taken in the "Action Taken" section of the UCR, and signed, dated, and returned it to the Display Specialist. The Display Specialist returned a copy of the completed UCR and the solution to the originator.

4.2.9 Shift Schedules

4.2.9.1 Prime Schedule for Shifting

The HOSC Staff was divided into five teams for most of the positions being manned during the Skylab mission. Each Mission Support Group Leader was responsible for establishing a workable shifting schedule, and the Senior Operations Director gave overall approval of all shifting and positions. The schedule used most and by the majority of the positions being manned 24 hours per day was as follows:

a. Midnight to 8 shift - on 6 days, off 3 days

b. 8 to 4 shift - on 6 days, off 3 days

c. 4 to 12 shift - on 6 days, off 6 days

d. Repeat (a) through (c) through a 30 day cycle.

A shift schedule for five teams is shown in Figure 2.23.

4.2.9.2 DSO Shifting Schedule

One significant exception to the prime shift schedule was an established TVA shift schedule. This schedule was union-approved and has been successfully used by TVA. It took five teams into consideration and was completely cycled in five weeks. Of particular significance was the fact that an office week was part of the schedule and eleven days off could be obtained by taking five days of leave during the office week. The Data Support Organization used this schedule. Figure 4.17 shows the 5-team shift arrangement as used by TVA, along with the prime schedule.

SHIFT	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S
12 - 8	1 1 1 1 1 2 2	2 2 2 2 2 3 3	3 3 3 3 3 4 4	4 4 4 4 4 5 5	5 5 5 5 5 1 1
8 - 4	2 2 2 5 3 3 3	3 3 3 1 4 4 4	4 4 4 2 5 5 5	5 5 5 3 1 1 1	1 1 1 4 2 2 2
4 - 12	3 3 4 4 4 4 4	4 4 5 5 5 5 5	5 5 1 1 1 1 1	1 1 2 2 2 2 2	2 2 3 3 3 3 3
O/WOR OFFICE	5 5 5 5	1 1 1 1	2 2 2 2	3 3 3 3	4 4 4 4
OFF DAYS	5 3 3 1 1 4 4 2 2 5	1 4 4 1 5 5 3 3 2 2	1 1 5 5 3 3 2 4 4 2	3 1 1 3 2 2 5 5 4 4	3 3 1 1 5 5 4 4 2 2 4

35 DAY CYCLE

DSO SHIFTING SCHEDULE (TVA)

SHIFT	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M
12 - 8	1 1 1 1 1 1 2	2 2 2 2 2 3 3	3 3 3 3 4 4 4	4 4 4 5 5 5 5	5 5
8 - 4	4 4 4 5 5 5 5	5 5 1 1 1 1 1	1 2 2 2 2 2 2	3 3 3 3 3 3 4	4 4
4 - 12	3 3 3 3 3 3 4	4 4 4 4 4 5 5	5 5 5 5 1 1 1	1 1 1 2 2 2 2	2 2
OFF DAYS	4 4 4 1 5 5 5 3 2 2 2 2 2	1 1 5 5 5 2 2 3 3 3 3 3 4 4	2 1 1 1 3 3 3 4 4 4 4 5 5 5	2 2 2 4 4 4 3 1 1 1 1 5 5 5	3 3 1 1

30 DAY CYCLE

FIG. 4.17 HOSC PRIME SHIFTING SCHEDULE

Although this schedule was not prime, it has much merit in that all teams have the same off-days during a cycle, and the cycle is ended in exactly 35 days and is therefore repeatable. The prime schedule was not repeatable. However, the eleven days off made it difficult to resume a position and be up-to-date on existing problems.

4.2.10 Facility Access Control

4.2.10.1 Pre-Mission Plans

A baseline access list was prepared before the mission, and badges for access to the HOSC were issued. These badges were color-coded to denote access areas. A guard was placed at the entrance to the HOSC to control access.

4.2.10.2 Changes to Access Control

As a result of the numerous problems encountered early in the mission, a very significant increase occurred in the need for access to the HOSC by

additional support personnel. Since problems naturally attracted personnel interested in the program who did not have a support role, it was necessary to limit access to the HOSC only to personnel having a legitimate mission support function to perform. This was accomplished as follows:

a. HOSC staff personnel and Mission Support Group Leaders and their alternates were designated as sponsors for specific areas within the HOSC, and as such approved the badging of personnel within their area.

b. A baseline was made and subsequent badging was authorized only after determination of: (1) why required, (2) why not previously required, and (3) person being replaced.

The console area used a quota system which was controlled by each MSGL.

4.2.11 Procedures Control

4.2.11.1 Permanent Changes

Changes to the "Operations Coordination Procedures" and the "Facility Operations" required the approval of the Manager, Mission Operations Office with the concurrence of the Senior Operations Director. Permanent changes necessary to improve operations were submitted in writing for consideration and approval.

4.2.11.2 Temporary Changes

Temporary deviations to the documented procedures were authorized as necessary by the OD and/or OSM on duty. Such authorization applied only to the shift in progress.

5.0 DATA SUPPORT AND FACILITIES

A Data Support Organization (DSO) was established to provide overall management of data acquisitions, data processing, data dissemination, data display and overall facility operation. The facilities were expanded to accommodate Skylab while retaining the Saturn support capability.

Original plans were to provide data, real time and ADDT, directly from remote sites through JSC, then to MSFC over established data lines. However, end-to-end data flow demonstrations were not completed before the mission, resulting in a real problem during the mission. ADDT data transmission was not resolved satisfactorily until late in the mission. This section summarizes the data support activity and facility problems that transpired primarily during mission support activities.

5.1 Data Systems Analysis

Three basic types of data were used during the Skylab mission: preflight, flight, and postflight. Preflight data are defined as data generated before liftoff which were required for aid in the use of flight data, which include calibration, ephemeris, math models, photographic data, etc. Postflight data are defined as data generated or processed for scientific and engineering evaluation and were not in direct support to the ongoing mission. This section deals primarily with flight data, which are defined as data generated from liftoff through the remainder of the orbital mission period. Flight data include telemetry, voice, recoverable items, and ground-based correlation and reference data.

The flight data disseminated during the Skylab mission via the Data Support Organization are summarized in Table V.1. No preflight data are included in the summary, and only photographic prints and 16-MM film are included as being postflight data. These data shown were used primarily for mission operations and by no means represent the amount of data accumulated during the mission for scientific postflight analysis. However, the fact that one-half million feet of Kinescope film were disseminated along with one-quarter million feet of freeze frame video tape is an indication of the vast amount of data used basically for mission support.

TABLE V.1

DATA DISSEMINATION SUMMARY

MISSION PERIOD / DATA TYPE	PRE-FLIGHT	SL-1/2	UN-MANNED	SL-3	UN-MANNED	SL-4	POST-FLIGHT	TOTAL
7 TRACK MAGNETIC TAPE (REELS)	0	2675	2075	3750	3375	5175	0	17050
9 TRACK MAGNETIC TAPE (REELS)	0	321	249	450	405	621	0	2046
DATA BOOK & AUTOSCAN (PRINTOUTS)	0	24336	21216	36816	31200	52416	0	165984
PHOTOGRAPH (PRINTS)	0	0	2335	0	1812	0	1505	5652
16 M M FILM (FEET)	0	0	14700	0	22820	0	16240	53760
FREEZE FRAME VIDEO TAPE (FEET)	0	0	0	104400	0	158400	0	262800
QUICK LOOK TRANSCRIPT (PAGES)	0	103200	0	230100	0	327600	0	666900
EDITED TRANSCRIPT (PAGES)	0	100800	0	212400	0	302400	0	615600
DEBRIEFING TRANSCRIPT (COPIES)	0	14	0	14	0	14	0	42
CREW LOG (COPIES)	0	22	0	22	0	19	0	63
KINESCOPE (FEET)	0	95160	0	153400	0	286520	0	535080

5.1.1 Station Coverage Summary

During the 273 days of the Skylab mission, 19,192 station passes were displayed in the HOSC. This means that real time data were received over 8.2 hours each day. A total of 2,238 hours were available to the HOSC, about 400 hours of which were lost, primarily due to problems within the D/TV system. Table V.2 summarizes the ground station coverage for the entire mission.

5.1.2 Real Time Data System

The HOSC received real time data from Skylab 34 percent of the time during the entire mission. The data were received from the Mission Operations Computer (MOC) at JSC. The MOC reformatted the data it received from the remote sites, and buffered and transmitted it to the HOSC at an average rate of one (1) sample/sec. This rate varied as a result of data line loading by very active parameters. In order to reduce line loading, the Remote Site Data Processor (RSDP) incorporated a software algorithm which tested each parameter before transmission to the MOC, compared the data change to a preset value (PCM count change), and transmitted or discarded the data in real time. This preset value established a corridor which the counts had to exceed before the measurement value would be transmitted. This corridor could be updated (widened or narrowed) by a decision of the Flight Controller. The data transmitted to MSFC depended on the corridors chosen. JSC had the capability to see every sample of the measurements transmitted; however, the HOSC could only see the data approximately once per second.

The real time data were used by the MSFC computers to drive various displays. Table V.3 summarizes the display system support. Preventive maintenance caused more down time than all other problems combined including a lightning hit which knocked out the computer for an extended period during a severe thunderstorm. Preventive maintenance was scheduled during low activity periods. One computer (Consoles Program) was used to drive the event lights, analog meters, strip charts and decimal indicators, while a second computer (D/TV Program) was used

TABLE V.2

STATION COVERAGE SUMMARY

SCHEDULED COVERAGE

o TOTAL MISSION DAYS	272 DAYS
o SKYLAB ORBITS PREDICTED (MAY 14, 1973 TO FEB 10, 1974)	3926 REVOLUTIONS
o GROUND TRACK ORBIT REPEAT	71 REVS. REPEATED 55.29 TIMES. THE 71 REVS. RETRACE PATH EVERY 5.02 DAYS
o PREDICTED STATION PASSES (INCLUDING STATION OVERLAP)	19,904 PASSES (2368.86 HOURS)
o UP TIME AT JSC	2323.31 HOURS
o NONAVAILABILITY TO HOSC	85.02 HOURS

ACTUAL COVERAGE BY HOSC

o STATION PASSES COVERED	19,192 PASSES
o AVERAGE PASSES PER DAY	70.55 PASSES/DAY
o AVERAGE LENGTH OF STATION PASS	6.99 MIN/PASS
o AVERAGE NUMBER OF HOURS PER DAY OF STATION COVERAGE	8.22 HOURS/DAY (34.25%)
o DATA AVAILABILITY TO HOSC	2238.29 HOURS
OF HOSC AVAILABLE DATA:	
o NO DATA	61.32 HOURS (2.75%)
o NO D/TV	349.57 HOURS (15.6%)

TABLE V.3

DISPLAY SYSTEM SUPPORT SUMMARY

SCHEDULED TIME UP - 2368.86 hrs.
UP TIME AT JSC - 2323.31 hrs.
NONAVAILABILITY TO HOSC - 85.02 (MOC PROBLEM, HOSC DESELECTED)
R/T DATA TRANSMITTED TO HOSC - 2238.29

DISPLAY SYSTEM SUPPORT SUMMARY

SYSTEM	HOURS OF LOST R/T DATA DUE TO				% HOURS OF LOST R/T DATA DUE TO		
	PM	NATURE (LOST R/T DATA)	EQUIP. & PGM ERROR (LOST R/T DATA)	TOTAL	NATURE/PM	EQUIP. & HOSC PGM ERROR	TOTAL % DOWN TIME
1108-3G	11.40	47.38	17.61	76.39	2.62	.79	3.41
DDP-224	-	36.41	22.31	58.72	1.63	1.90	2.63
D/TV SYS	-	31.66	256.59	288.25	1.42	11.46	12.88
516 INTERFACE	-	1.6	-	1.6	.071	-	.071
DATALINE	-	1	-	1	.044	-	.044
LOST RT DATA		SUM OF DDP-224, 516, DATALINE		61.32			2.75
LOST DTV DATA		SUM OF DDP-224, 516, DATALINE, D/TV		349.57			15.62

LEGEND:
MOC: MISSION OPERATIONS COMPUTER AT JSC
PM: PREVENTIVE MAINTENANCE
NATURE: BAD WEATHER, I.E., LIGHTNING
PGM: PROGRAM ERROR

to drive the Digital Television equipment. If the main CPU for the D/TV malfunctioned, a third computer was brought on-line as a backup; however, this backup reduced the D/TV capability from 20 to 8 channels because of reduced memory availability. A display format, as well as other display requirements, was developed and documented in the HOSC Display Plan and the Data Users Handbook. When the CSM was activated, the MOC was not able to deliver display data to the MOCR and simultaneously transmit all the data MSFC required. During these times, a MOPS contingency plan was implemented to supply data to the MSG's. In addition, the TV microwave channel was used for MOCR displays in the HOSC, these modes being controlled by the OSM. The D/TV and other pertinent data were disseminated to the mission support groups via the video matrix, which had 80 outputs with a capability to select one of 59 inputs. The outputs were TV monitors located in the consoles of the OSR, in each CWA, the WAR rooms and other remote areas of supporting activity. Most areas having an output monitor had a matrix selector switch which allowed selection of its inputs. The Master Matrix Panel in the Information Control Room (ICR) allowed complete control over all inputs and all outputs. An auxiliary control panel located in the OMR allowed switching of the matrix inputs to the remote areas and the OMR.

Other video data included items such as site acquisition and loss times, Mission Status Generator, downlink TV from the spacecraft, Network Video (ABC, CBS, NBC), and PAO news and press conferences from other NASA centers.

5.1.3 All Digital Data Tape System

The All Digital Data Tape (ADDT) system was used to transmit downlinked data from the remote site to JSC and from JSC to MSFC. The ADDT data were received at MSFC either by electronic transmission or by air transportation.

At MSFC, the ADDT data were processed to output:

a. Engineering Data Books

b. User Tapes (9 and 7 track) - fixed and compressed

c. Inputs to special analysis programs (engineering and scientific)

d. Autoscan outputs

The initial plan for electronic transmission was to transmit four six-hour blocks for each day from the JSC data base. This was done from computer to computer.

The JSC ADDT computers were essentially loaded to capacity, especially when the site input and MSFC output occurred simultaneously. Therefore, large quantities of ATM and ASAP data were lost to archives (approximately 20 days out of 77). Most of the AM data and their subframes remained within the system. Therefore, two batches were transmitted by electronic transmission, and the remaining two batches were sent by air transportation, effective DOY 142.

Approximately 90% of the data retrieved was brought in by air, even though constant attempts were being made to bring it in by electronic transmission. Electronic transmission is defined here as the transfer of data directly from the data base, as it became available, to the DTV and then onto the transmission line to MSFC. The problems encountered here which limited data retrieval and resulted in data being purged to archives were numerous, the main ones being:

a. Program limitations: When the ADDT system was fully loaded, i.e. while it was taking in data from the sites and at the same time responding to data requests from MDRS and MOPS, it did not have the capability of transferring data onto the transfer line to MSFC at a 50 Kilobit rate. In fact, at times this capability was down to 3 Kilobits, resulting at times in a backlog of data in the data base which got purged to archives.

b. Data line problems to MSFC, or hardware problems at MSFC which prevented receipt of data, similarly caused a backlog of data in the JSC data base, resulting in requested data being lost to archives.

Because electronic transmission was ineffective and air transport was neither timely nor cost effective, a new technique called tape-to-tape transmission was introduced on DOY 227 during the first part of the second manned mission.

After DOY 227, all data requested were received. This improvement was made possible by a program change which permitted MDRS to cut a tape as soon as the data were available. The tape could then be transmitted to MSFC independently when the system permitted and at a much faster rate. The data missed earlier was subsequently obtained from analog tapes shipped in from the tracking sites. During the second unmanned period, DOY 232 to DOY 318, the number of requests per day increased to 10 on a continual basis. This is significant in that five or six should be a good average. The increase in requests was caused by a 16-hour per day operation of the playback system from the sites. This caused the data to be backlogged at the site and to be fragmented into as many as three and four different data bases. It was then necessary for Data Acquisition to generate three to four data requests to complete a six-hour block of data.

The tape-to-tape data transmission proved satisfactory and provided the necessary data to MSFC for processing. The earlier mode of transmitting ADDT data electronically proved ineffective due to the delay caused by computer system overload and the inability to have all data properly time-sequenced before its transmission to MSFC. The interim air shipment of tapes was marginal in providing data for processing in a timely manner and was therefore not acceptable on a continuing basis.

5.1.4 Mission Operations Planning System

Four MOPS terminals were provided at the HOSC for data retrieval from the JSC computers. Each of the

terminals was manned on a 24-hour daily basis during the manned mission periods. Reduced manning schedules were employed during unmanned periods. The primary MOPS usage involved accessing the MCC Data Retrieval System (MDRS) for the fulfillment of specific data requests (by time interval) selected from a fixed format library of discipline-oriented tabular and graphic displays. The MDRS data bases were loaded in alternate sequence, such that when the current data base reached 90-95% of its capacity, the static data base was purged to become the new current data base. The former current data were then closed to inputs, thus assuring a file of chronologically sequenced data for the latest 18 to 36 hours of telemetry from Skylab. As the MSG personnel became more familiar with the data requirements, their particular field for special format reconfigurations were used to output only those parameters of interest, rather than relying on fixed formats.

The Activity Scheduling Program (ASP) was used primarily to secure daily flight plans for review of planned activities; as-flown flight plans for evaluation of completed activities; sunrise/sunset tables and predicted site acquisition tables to be used in experiment planning and real time support scheduling; and trajectory print displays to establish revolution start times, equator crossings, beta angles, flight path angles and geodetic coordinates to be used in maintaining status board entries, experiment scheduling, and various other functions associated with review of mission requirements. Periodic requests for such outputs as Camera/Film usage and General Pointing information were generated to fill specific needs of MSG members. Additional access was provided to the Data Acquisition Statusing System (DASS), Crew Procedures Data System (CPDS), and the MDRS Trajectory application on a limited basis. The Online Math Processor (OMP) was also available. A total of 435,916 pages were obtained from the four MOPS terminals during the entire mission. A summary of the type of requests, together with the application and total requests for each mission phase, is shown in Table V.4.

Near real time data output from MOPS served to bridge the time interval between the HOSC real time displays and the availability of ADDT. In addition, contingency procedures were developed to provide non-real time data in lieu of real time displays

TABLE V.4

DATA REQUEST SUMMARY

MOPS DATA REQUESTS BY TYPE

	NORMAL	URGENT	SPECIAL	CONTINGENCY	
SL-1	336	78	-	-	UNMANNED
SL-2	1203	148	145	-	
	373	37	287	2	UNMANNED
SL-3	2266	280	1341	1	
	459	21	386	-	UNMANNED
SL-4	2768	331	1924	7	

MOPS REQUESTS BY APPLICATION

	ASP	MDRS	DASS	CPDS	
SL-1	69	336	9	-	UNMANNED
SL-2	145	1348	2	1	
	32	661	-	4	UNMANNED
SL-3	87	3797	-	3	
	34	828	-	4	UNMANNED
SL-4	322	4640	61	-	

SKYLAB OPERATIONS DATA SUMMARY

MISSION	FORMATS	PAGES
SL-1/SL-2	7625	70490
SL-3	18737	180963
SL-4	18522	184463

Data period covered from 14 May 1973 to 9 February 1974.

occasioned by loss of display capability. The contingency mode was entered upon the loss of real time displays for two consecutive station passes, and continued until such time as displays were restored. Contingency data were distributed by the Administrative Support Center.

5.1.5 Voice Transcripts

Quicklook (Real time and Dump) voice transcripts were transmitted tape-to-tape via an MTST communications terminal. These transcripts were nominally received at MSFC about four hours after the real time, and were available to users each day at 0800 a.m. The edited versions of the quick-look transcripts were available to users in batches covering about two weeks, and were shipped from JSC about every three or four weeks.

5.1.6 Facsimile

Transmittal of written material between MSFC and FOMR at JSC was soon discovered to be necessary due to the technical content and procedural nature of the data interchange. Therefore, the planned Magnafax was largely replaced by a higher speed Long Distance Xerox (LDX) machine. The Magnafax transmission was used primarily between MSFC and prime contractors.

5.1.7 LDX

A Long Distance Xerox (LDX) system was used for transmitting actions, reports and other information between the HOSC and FOMR and between the HOSC and KSC during launch activities. This system required approximately 30 seconds per page to receive or transmit and was used to almost full capacity during the early SL-1/SL-2 missions. This usage decreased significantly only during the SL-4 mission. AR's, MAR's, Flight Plans, Summary Flight Plans, Daily Reports and inputs, Crew Procedure Changes and other mission related documentation were included in the vast amount of information transmitted via LDX.

5.1.8 Photographic Kinescope Data

A photographic kinescope data plan was generated to identify processing and handling of film data returned from the missions, and the master merged video required from JSC.

The photographic and video kinescope data requirements during the early mission were much greater than anticipated due to attempts to photograph the Saturn Workshop in orbit to resolve the anomalies experienced during the SL-1 launch. The kinescope data disseminated during each mission phase is summarized in Table V.1.

5.2 Facilities Evaluation

Facilities as referred to in this section include the buildings and the display system, communications system, and other equipment. Some overlap exists between the evaluation of the data system and the facilities. However, the evaluation here pertains to the equipment used for display and not the data being displayed. The HOSC and its supporting facilities are described in section 1.4 and Figures 1.4 and 1.5.

Unsatisfactory Condition Reports (UCR) were used to assess the adequacy of the facility and supporting equipment. One outstanding factor that presented itself from the UCR compilation was that 55 percent of all reported unsatisfactory conditions concerned the display system; communications 16 percent; facility 15 percent; and procedures 12 percent. Procedures will not be addressed in this section.

Table V.5 summarizes Skylab UCR's by types and correlates the percentages of each. The percentage of UCR's not returned to the originator means, in most cases, that the condition was not as reported and did not warrant a formal answer to the initiator. In most cases, this was resolved verbally.

5.2.1 UCR Compilation

Figure 5.1 and Tables V.6 and V.7 present the UCR's vs. date and number, compiled by mission phase and a UCR matrix, respectively. UCR's written during simulations (between 1/17/73 and 5/10/73) were also included for a specific purpose. A number of problems were detected; for example, 356 total UCR's were written during simulations with only 119 being written during the actual mission. This means that 74 percent of the facility problems were reported before the mission during simulations. This was expected because display formats were checked out during simulations. Display problems were the most prominent ones both before and during the mission.

TABLE V.5

UCR PERCENTAGES BY TYPES

	TOTAL WRITTEN	478		
	TOTAL RETURNED	417		
	TOTAL NOT RETURNED	61		
	% RETURNED	87.24		
	% NOT RETURNED	12.76		
COMMUNICATIONS:	TOTAL WRITTEN	75	% OF TOTAL	15.69
	TOTAL RETURNED	56	% RETURNED	74.67
	TOTAL NOT RETURNED	19	% NOT RETURNED	25.33
DISPLAY:	TOTAL WRITTEN	264	% OF TOTAL	55.23
	TOTAL RETURNED	231	% RETURNED	87.50
	TOTAL NOT RETURNED	33	% NOT RETURNED	12.50
FACILITY:	TOTAL WRITTEN	73	% OF TOTAL	15.27
	TOTAL RETURNED	69	% RETURNED	94.50
	TOTAL NOT RETURNED	4	% NOT RETURNED	5.5
PROCEDURE:	TOTAL WRITTEN	58	% OF TOTAL	12.13
	TOTAL RETURNED	54	% RETURNED	93.10
	TOTAL NOT RETURNED	4	% NOT RETURNED	6.9
OTHER:	TOTAL WRITTEN	8	% OF TOTAL	1.67
	TOTAL RETURNED	7	% RETURNED	87.50
	TOTAL NOT RETURNED	1	% NOT RETURNED	12.50

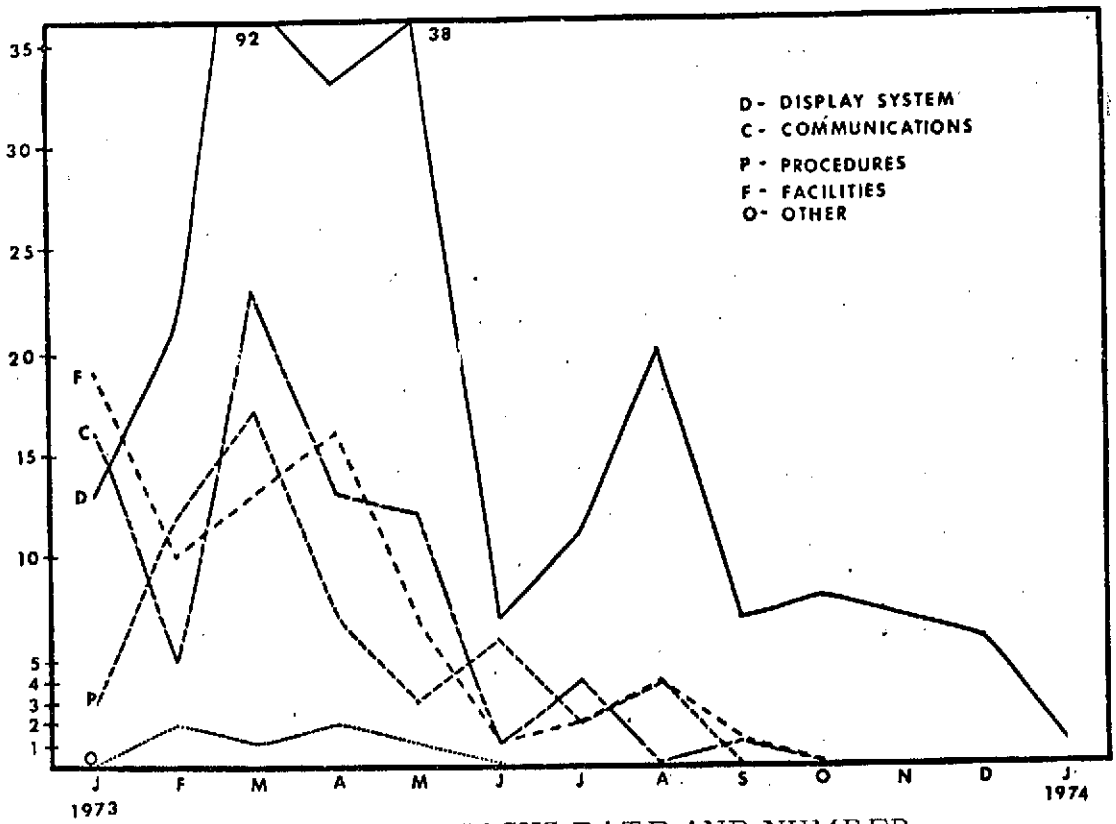


FIG. 5.1: UCR's VERSUS DATE AND NUMBER

5.2.2 Display

The original display system configuration included one Honeywell DDP-224 computer to distribute displays to 70 analog meters, 300 discrete lights, two eight-channel strip charts, two digital readouts, and at least three D/TV channels but no more than eight. Original plans were to operate the systems 8 hours/day 5 days per week, except during launch, activation, and other high activity periods.

As a result of the early onboard problems and problems that continued to accrue throughout the mission, the system was run continuously in a high activity mode. Since the D/TV system was not specifically designed for high activity, the number of UCR's in the display area during the mission was expected to be high.

Twenty channels of D/TV were driven continuously with no scheduled maintenance on the system. The large scale computer driving the 20-channel D/TV system was regularly

TABLE V.6

NUMBER OF UCR's BY MISSION PHASE

	1973					1974		
UCR TYPES	PREMISSION 1/17-5/10	SL-1 5/14-5/25	SL-2 5/25-6/22	UNMAN 6/22-7/28	SL-3 7/28-9/25	UNMAN 9/25-11/16	SL-4 11/16-2/8	TOTAL
DISPLAY	182	5	16	12	26	14	9	264
COMM	65	3	2	3	2	0	0	75
FACILITY	63	1	1	2	5	0	1	73
PROCEDURE	41	1	6	2	4	2	2	58
OTHER	5	1	0	0	1	1	0	8
TOTAL	356	11	25	19	38	17	12	478

G-2

TABLE V.7

UCR MATRIX

UCR TYPES	NO. WRITTEN	AVG. TIME TO COMPLETE (DAYS)	NO. PREMISSION	NO. SL-1	NO. MANNED	NO. UNMANNED
DISPLAY	264	5.381	182	5	51	26
COMM	75	6.786	65	3	4	3
FACILITY	73	5.130	63	1	7	2
PROCEDURE	58	3.056	41	1	12	4
OTHER	8	4.857	5	1	1	1
TOTAL	478	5.218	356	11	75	36

scheduled for six hours weekly preventive maintenance; however, the D/TV maintenance was performed as required to keep the system operating.

5.2.3 MCC Data Retrieval System (MDRS)

The MOPS terminals gave MSFC access to MDRS, which provided a near real time detail data source. The MSG's used the MDRS as a prime source of data for detail problem solving.

The MDRS provided universal plots, event plots, special reports, and universal tabular printouts, in addition to other specialized outputs, e.g., limit sensing.

The downtime for the MDRS decreased steadily as the mission progressed (see Figure 5.2), indicating that knowledge of the system increased steadily throughout the mission. The peak point, occurring in October 73, resulted from a lightning strike.

5.2.4 Activity Scheduling Program (ASP1)

Figure 5.3 shows the ASP1 down time and reflects the same trend as that of the MDRS. Of course, ASP1 was used more than the MDRS because of the steady routine functions such as flight plans. However, ASP down time steadily decreased as the mission progressed.

5.2.5 Terminal

Down time shows no specific trend since maintenance specialists were provided for the MOPS terminal. The October 73 lightning strike is also reflected in the down time shown in Figure 5.4.

5.2.6 Other

Section 5.1.2 describes the real time data system; Table V.3 reflects the display system components and the down time and cause of down time for each.

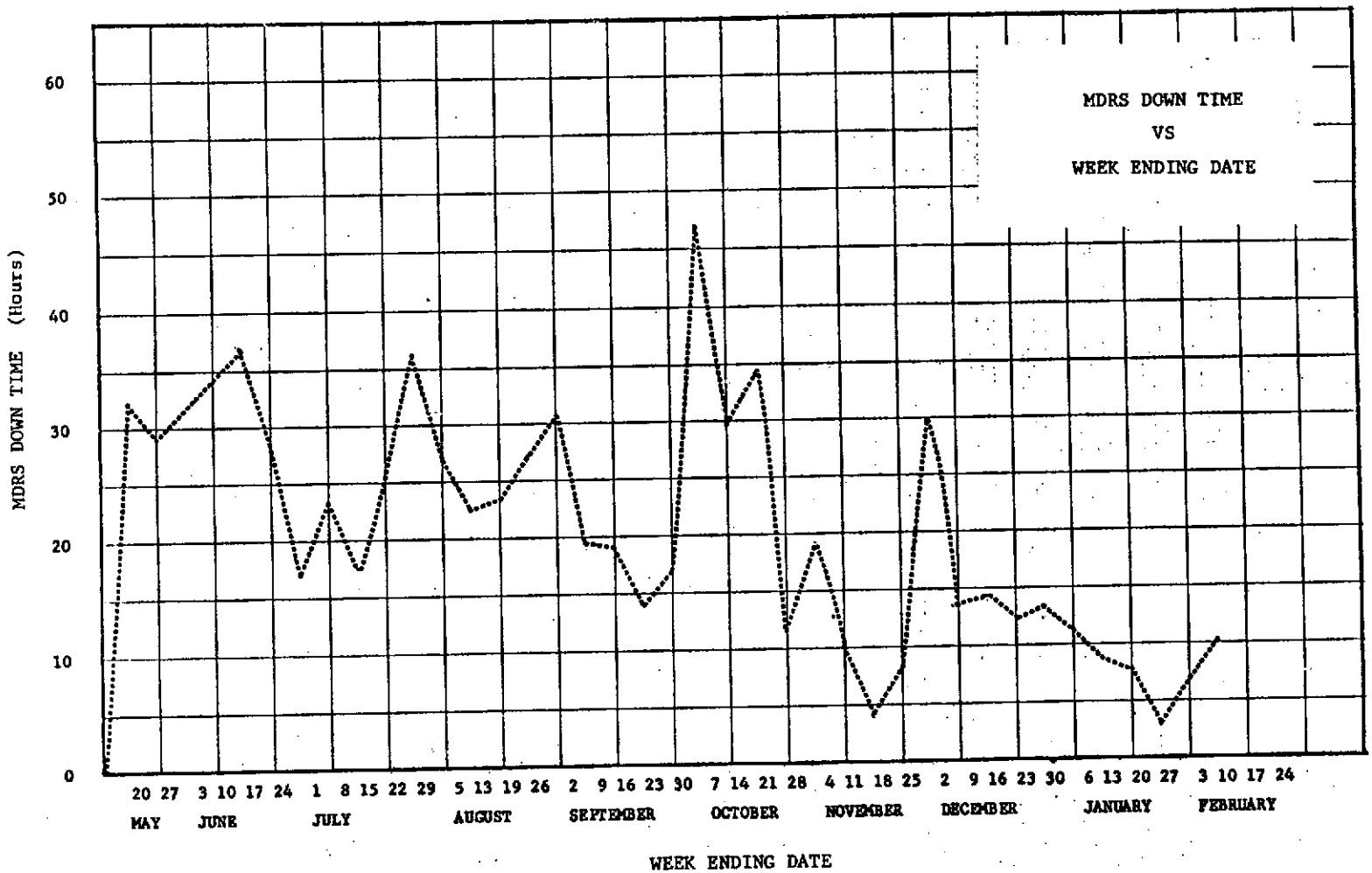


FIG. 5.2: MDRS DOWN TIME VERSUS WEEK ENDING DATE

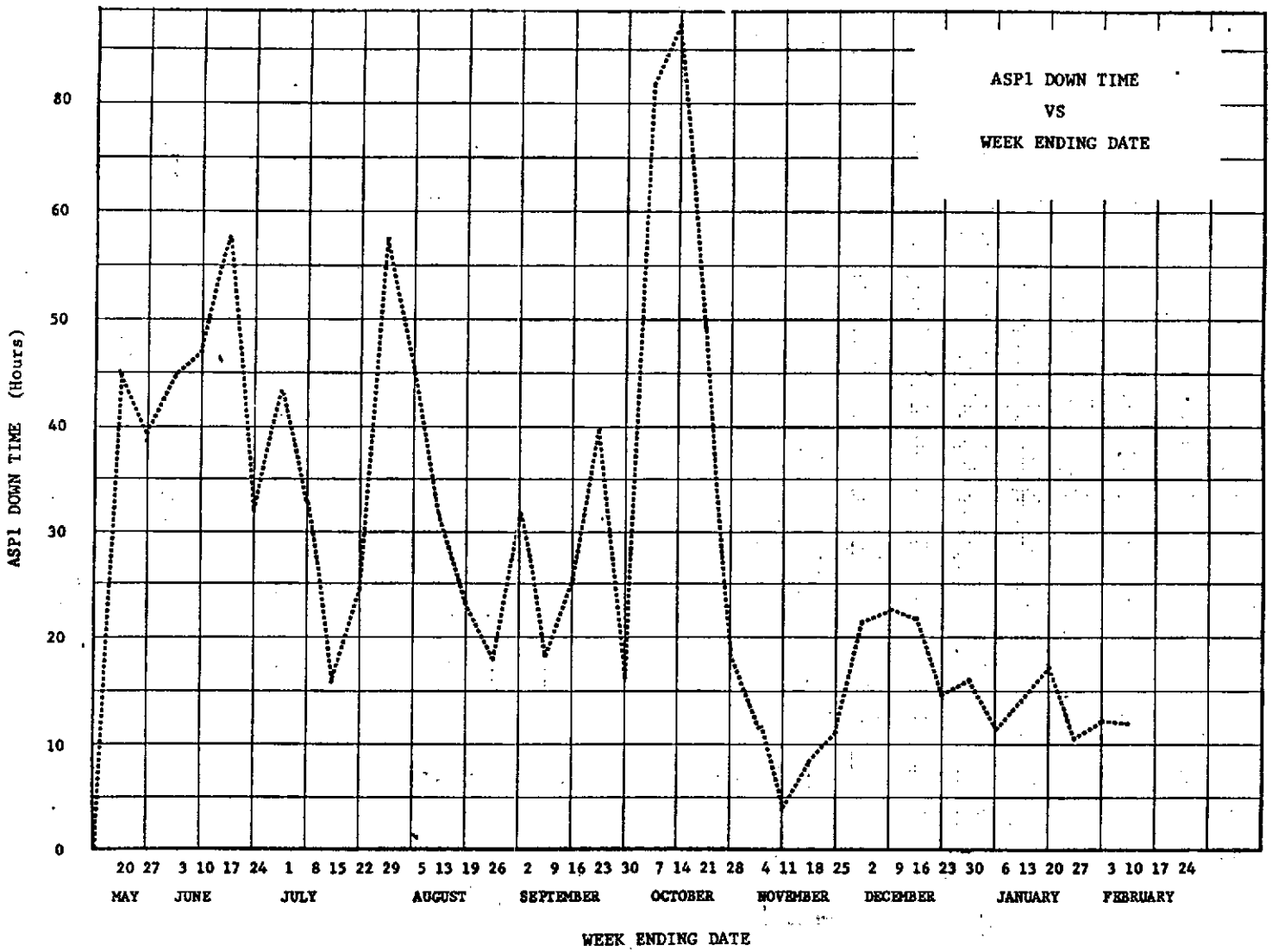


FIG. 5.3: ASP1 DOWN TIME VERSUS WEEK ENDING DATE

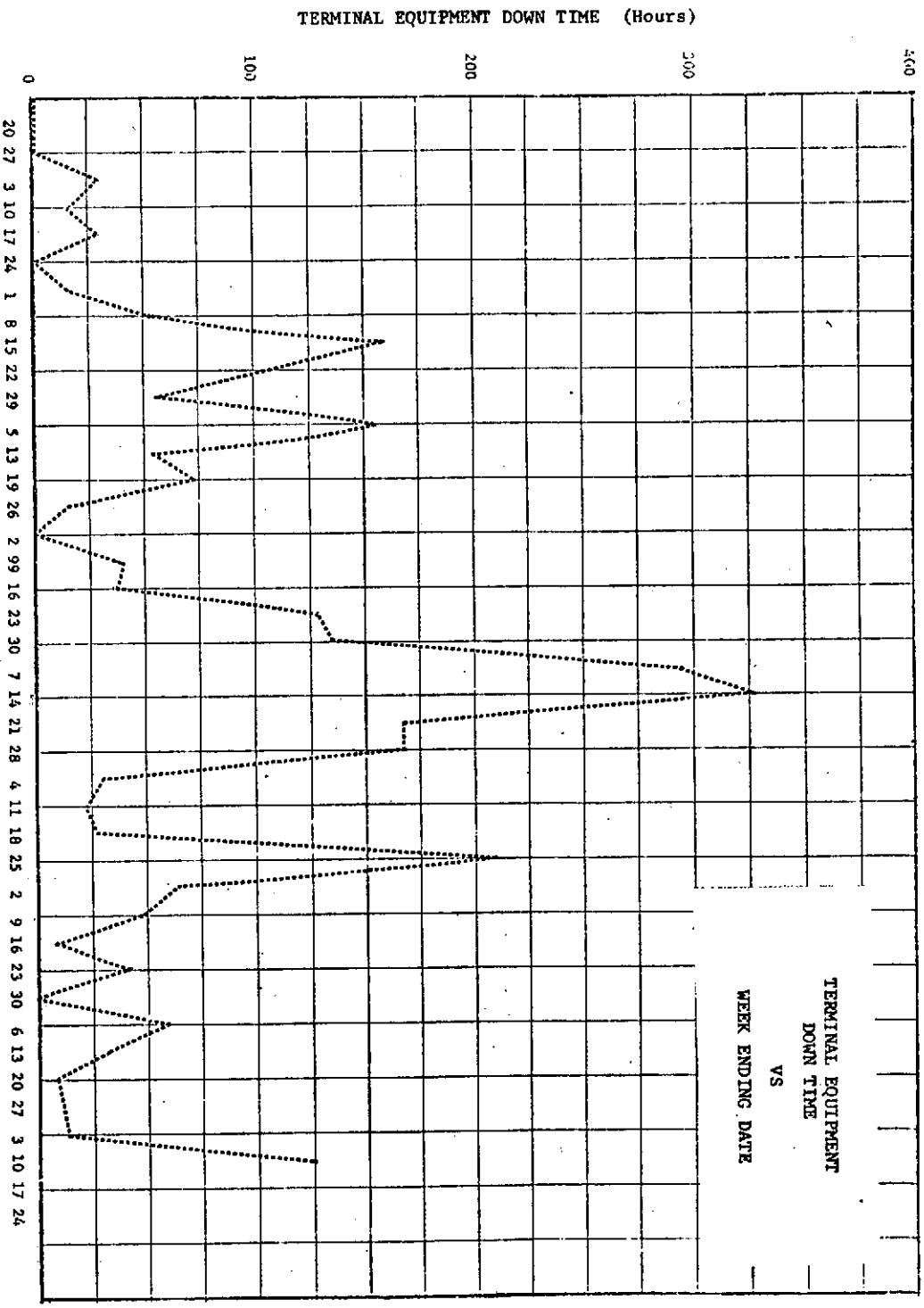


FIG. 5.4: TERMINAL EQUIPMENT DOWN TIME VERSUS WEEK ENDING DATE

5.2.7 HOSC Facility Problems - Skylab Program

Many facility problems were encountered during the HOSC operation for the Skylab Program. Although most of the problems were solved and did not significantly affect HOSC operation, there were a few problems that seriously impaired operational efficiency. The more serious problems, which will be discussed first, are shown in Figure 5.5.

5.2.7.1 Real Time Data Loss

Real time data loss, due to all causes, is shown in Table V.3 and discussed in Section 5.1.2.

5.2.7.2 Power Outages

HOSC support was affected by three main types of power-induced equipment failures, i.e., lightning strikes (6), power surges (5), and power outages (12). All the supporting computers and air conditioning equipment were automatically shut down during these failures. The computers had to be reinitialized, and air conditioners restarted.

5.2.7.3 Communications

Communications discrepancies on MSFC-controlled lines and equipment were of no serious consequence to HOSC operations. Problems were corrected in a reasonable time, and workarounds were available in the event of a discrepancy with local lines and equipment. JSC-controlled voice loop problems created no serious difficulties since other voice loops were available if a loop was defective. However, JSC-controlled data line problems were more serious, especially the ADDT line. The main problem with the data lines was caused by atmospheric disturbances creating signal fading between microwave towers. Since real time data was constantly updated during station passes, and MOPS data could be recalled, there was no serious problem with a signal fade. Because of rewinding data tapes and restarting computers, calling for close cooperation between JSC and MSFC, signal fade caused serious problems with ADDT data transferred to MSFC. Signal fade causes gaps in the ADDT transfer, which created parity errors, and rendered

the received data useless. This was more predominant during the winter months when weather fronts moved across the microwave transmission system. Thus, many hours were lost restarting and retransmitting the ADDT data. Equipment problems with the data lines were few and the resulting data loss was almost insignificant. See the attached table for a breakdown of the MSFC communication problems.

5.2.7.4 Central Hard Copier

The central hardcopier suffered numerous breakdowns and was used sparingly during the first two months after SL-1 launch. It was operating normally and needed little maintenance the remainder of Skylab HOSC support.

5.2.7.5 Television System

More problems occurred with the television system than any other system (see Figure 5.5). Problems were usually with the TV monitors, i.e., adjustments, tube replacements, etc., and were of little consequence to the HOSC operation.

5.2.7.6 Air Conditioning

Most air conditioning and air handling equipment problems were associated with power outages. Although some difficulty was encountered in adjusting individual room temperatures, this problem did not interfere with HOSC support.

5.2.7.7 D/TV

The D/TV System experienced periodic breakdowns which progressively worsened during the mission. The primary problems were in the video discs and the character font. The D/TV System had more non-scheduled downtime than any HOSC real time support system. The actual amount of real time data lost (in hours) is shown in section 5.2, Table V.3.

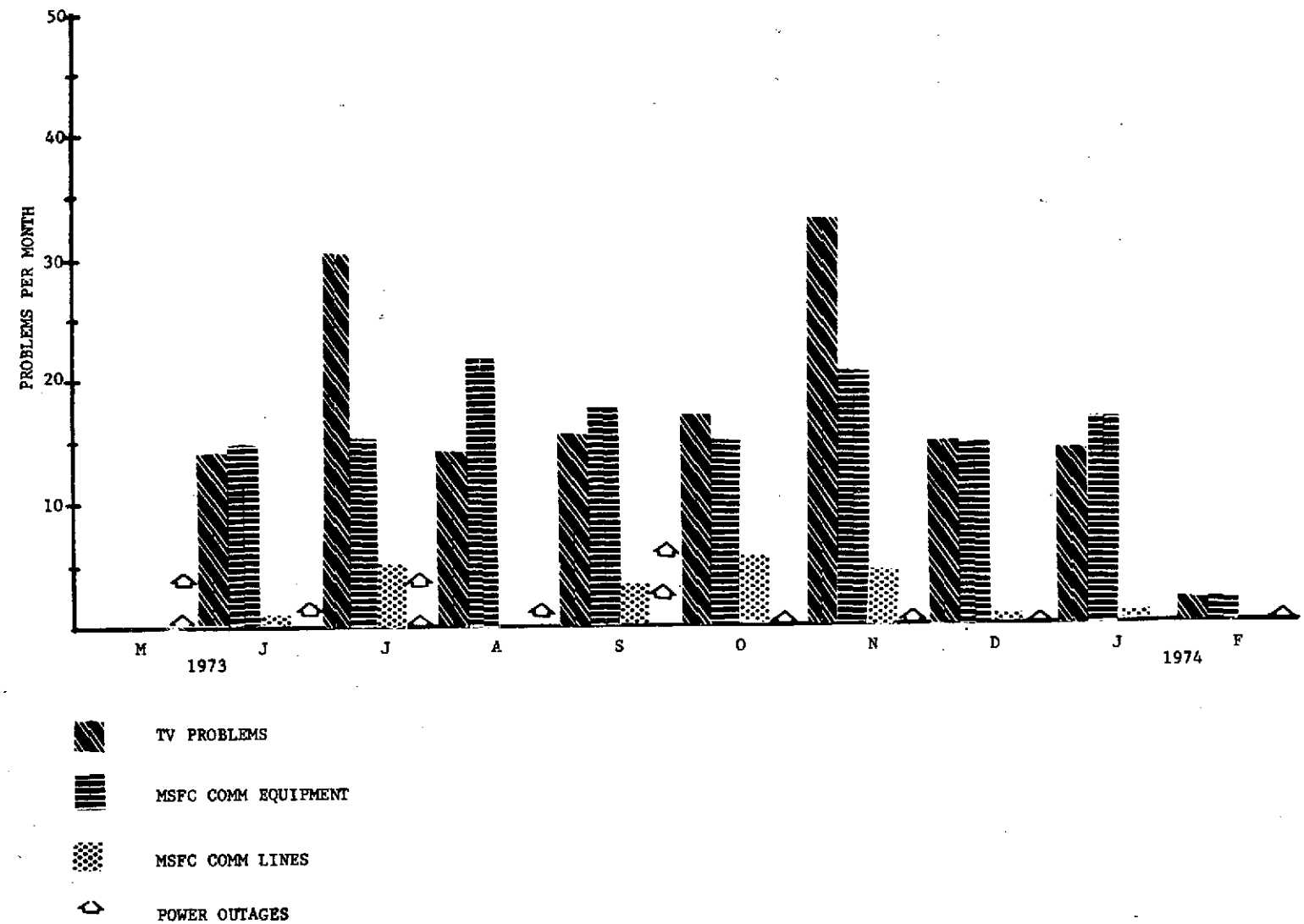


FIG. 5.5: FACILITY PROBLEMS

5.2.7.8 Other Problems

Minor problems in the following areas were encountered, but they did not significantly affect the HOSC support function.

a. MOPS equipment.

b. Timing.

c. AB Dick Hardcopiers.

d. Document Reader.

e. Telephone Instrument Labeling.

f. Furniture.

g. Plumbing.

APPENDIX A

SKYLAB PROBLEM TRACKING LIST

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
1 DOY 134	METEOROID SHIELD FAILURE DURING BOOST. (ANOMALY).	MEWG/CLARK	INVESTIGATION BOARD EVALUATION COMPLETE. CLOSED.
2 DOY 134	SOLAR ARRAY WING 2 MISSING AND WING 1 FAILED TO DEPLOY AS A RESULT OF ITEM 1. (ANOMALY). REF: ZO-248; AR-74; AR-174.	S&M/CS EUDY/THOMPSON	WING 1 RELEASED BY EVA. CLOSED.
3 DOY 139	AM COOLANT SWITCHOVER TO SECONDARY SYSTEM. (DISCREPANCY). REF: AR-31.	ECS/HOPSON	GROUP 2 SWITCHOVER ENABLED DURING STOWAGE PERIODS OR WHEN MANNED AND ONLY ONE LOOP IS OPERATING. CLOSED.
4 DOY 143	CBRM #15 OFF LINE. (ANOMALY). REF: AR-54; SWS-672; AR-185; SWS-870; SWS-415; SWS-427	EPS/WOOSLEY	CLOSED. BROUGHT BACK ON LINE DURING EVA.
5 DOY 134	ATM AFT ANTENNA HIGH REFLECTED POWER. (ANOMALY) REF: SWS-71; SWS-908.	I&C/ADAIR	DECISION TO REMAIN ON FORWARD ANTENNA. CLOSED.
6 DOY 134	EXCESSIVE RATE GYRO DRIFT. (ANOMALY). REF: SWS-81; AR-48; SWS-660; AR-186; AR-337; AR-367; AR-370.	STAC/CHUBB WOJTALIK	ATTRIBUTED TO BUBBLES IN RATE GYRO FLUID. SIX PACK TO BE CARRIED ON SL-3 AND AVAILABLE FOR INSTALLATION. CLOSED.
7 DOY 143	QUAD-REDUNDANT VENT VALVE MALFUNCTION. (DISCREPANCY). REF: SWS-481; AR-93; AR-176; AR-244; SWS-805.	ECS/HOPSON	TROUBLESHOOTING ON DAY 162 SHOWS ALL 4 VALVES CLOSED. CLOSED.
8 DOY 144	HIGH ATM CANISTER PRESSURE INDICATION. (DISCREPANCY) REF: AR-100	ATM/TCS VANIMAN	OUTGASSING LOADS GREATER THAN EXPECTED HAVE NOW DIMINISHED. NO FURTHER PROBLEMS ARE EXPECTED. CLOSED.
9 DOY 146	SECONDARY CONDENSATE HEATER TEMP NOT DISPLAYED WHEN HEATER ON LIGHT IS ILLUMINATED. (DISCREPANCY). REF: AR-101.	EPS/WOOSLEY	PROBLEM CLEARED ON DAY 163 AFTER CREW CYCLED THE SWITCH. CLOSED.
10 DOY 150	FINE SUN SENSOR PRIMARY PITCH READOUT APPEARS TO BE LOST. (DISCREPANCY). REF: AR-113; AR-143.	STAC/CHUBB	RECOMMENDED RECOVERY PROCEDURE WAS SUCCESSFUL. IMPLEMENTED BY CREW. CLOSED.
11 DOY 148	NOISE SPIKES ON $PPCO_2$ MEAS. (DISCREPANCY). REF: AR-94.	I&C/ADAIR	DUE TO TRANSIENTS PRODUCED BY TAPE RECORDER OPERATION. CAUSES NO DATA PROBLEMS. CLOSED.
12 DOY 150	H-ALPHA TV PICTURE JIGGING (DISCREPANCY). REF: AR-106.	ATM/EXP WHITE/HASSLER	DUE TO OPTICAL CHARACTERISTICS WITHIN THE INSTRUMENT. NO IMAGE DEGRADATION DETECTED. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
13 DOY 150	$PPCO_2$ OF MOL SIEVE A AND B INLET READ LOW. (DISCREPANCY). REF: AR-108; ZO-514; AR-193; AR-265; AR-331; AR-410.	ECS/LITTLES	FAILURE ANALYSIS ON RETURNED CARTRIDGES INDICATE THAT THEY WERE GOOD. M171 MASS SPECTROMETER WILL BE USED WITH CO_2 SENSORS TO DERIVE CO_2 LEVELS. A CALIBRATION CARTRIDGE WILL BE ON SL-3.[2] CLOSED.
14 DOY 150	EXCITATION OF ATM SPAR BENDING MODES. (DISCREPANCY). REF: AR-109; AR-169; AR-201; AR-137; AR-199; SWS-705; AR-153; ZO-577; AX-705.	STAC/CHUBB	CREW SHOULD NOT MAKE UNUSUAL MOVES WHILE IN EXPERIMENT POINTING MODE. CLOSED.
15 DOY 150	S055 HIGH VOLTAGE HAS HIGH VOLTAGE TRIPOUT PROBLEM. (DISCREPANCY). REF: AR-111; AR-330; AX-537.	ATM/EXP. WHITE	ALL BUT TWO TRIPOUTS HAVE CORRESPONDED TO HIGH ELECTRON/PROTON FLUX BELTS AND THE NUMBER 5 POWER SUPPLY TRIP CIRCUIT IS OVERLY SENSITIVE TO THIS FLUX BELT. CLOSED.
16 DOY 149	CABIN PRESSURE DROP AFTER APPROX. 149:16:58. (DISCREPANCY). REF: SWS-508; AR-105.	ECS/LITTLES	ATTRIBUTED TO LBNP (M092) OPERATION. CLOSED.
17 DOY 152	CBRM #3 OFF LINE. (ANOMALY). REF: AR-131; AR-124; AR-405; SWS-1117; SWS-1118.	EPS/WOOSLEY	ATTEMPTS TO TURN ON DOY 210 (CYCLED 5 TIMES) FAILED. IF ATTEMPTS FAIL, CBRM 3 HAS BEEN TURNED OFF FOR THE REMAINDER OF MISSION. CLOSED.
18 DOY 152	UNEXPLAINED 2 MIB'S FIRING OF TACS (DISCREPANCY). REF: AR-150.	STAC/CHUBB	TACS DESAT FIRINGS BECAUSE RATE SPIKES REFLECTED IN MOMENTUM. CLOSED.
19 DOY 153	SUN PRESENCE FLAG APPEARS JUST BEFORE DAY FLAG. (DISCREPANCY). REF: AR-151.	STAC/CHUBB	PROBLEM HAS CLEARED ITSELF. WILL CONTINUE TO MONITOR TIMES. CLOSED.
20 DOY 150	AM SECONDARY COOLANT LOOP INVERTER 1 C.B. OPEN. (DISCREPANCY). REF: AR-134; AR-116; SWS-1245; SWS-1760.	EPS/WOOSLEY	TROUBLESHOOTING PROCEDURE SUBMITTED. NO FURTHER ACTION PLANNED UNLESS ADDITIONAL FAILURES OCCUR. CLOSED.
21 DOY 150	S082A FRAME REMAINING COUNTER DOES NOT DECREMENT. (ANOMALY). REF: AR-165; AX-642; AX-703; AX-679.	ATM/EXP. WHITE	EVA CHANGED CAMERA; OPERATION SATISFACTORY. CLOSED.
22 DOY 153	OWS BUS 1 AND 2 C&W INDICATION. (DISCREPANCY) REF: AR-168.	EPS/WOOSLEY	CIRCUIT BREAKERS WERE CYCLED AND SYSTEM IS OPERATING PROPERLY. CLOSED.
23 DOY 151	S052 OPERATE LIGHT BLINKING AND FILM COUNTER FAILURE. (DISCREPANCY). REF: AX-574.	ATM/EXP. WHITE	PROBLEM HAS CLEARED ITSELF; OPERATION NOMINAL. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
24 DOY 153	S082A C&D PANEL OPERATE LIGHT DOES NOT GO OFF WHEN OPERATING MODE TERMINATES. (DISCREPANCY). REF: AX-627; AR-301.	ATM/EXP. WHITE	PERMANENT OPERATIONAL ANOMALY CAUSING CREW INCONVENIENCE. PROBLEM ISOLATED TO SNEAK CIRCUIT BETWEEN C&D PANEL AND ATM C&D LOGIC DISTRIBUTOR. CLOSED.
25 DOY 153	PORTABLE TV CAMERA FAILURE. (ANOMALY).	I&C/ADAIR	PROBLEM ISOLATED TO CAMERA AND NOT THE TELEVISION SYSTEM. CLOSED.
26 DOY 153	MDA WALL HEATER C.B. CONTROL 2 OPENED. (DISCREPANCY). REF: AR-178; SWS-901; AR-268.	EPS/ECS WOOSLEY LITTLES	CIRCUIT BREAKERS WERE CYCLED AND SYSTEM IS OPERATING PROPERLY. CLOSED.
27 DOY 154	RATE GYRO 1 IN Z AXIS FAILED HARDOVER; SWITCH TO BACKUP STRAPDOWN CONTROL. (ANOMALY) REF: AR-177; AR-331; SWS-1030; AR-150; AR-222; AR-342.	STAC/CHUBB	RELATED TO RELAY SWITCHING PROBLEM. PROBLEM HAS CLEARED, BUT MAY RECUR IF GYRO IS SWITCHED FROM FINE TO COARSE SCALE. CLOSED.
28 DOY 155	S054 THERMAL SHIELD DOOR FAILED CLOSED. (ANOMALY). REF: AX-634; AX-671; AX-641; CX-682; AR-198; AR-407.	ATM/EXP. WHITE	EVA SUCCESSFULLY OPENED DOOR PERMANENTLY. CLOSED.
29 DOY 154	S183 FILM MAGAZINE DID NOT RETURN TO CARROUSEL. (ANOMALY). REF: AR-180.	COR.EXP. DESANCTIS	SPECTROGRAPH CLEARED AND OPERATED PROPERLY DOY 155. CLOSED.
30 DOY 153	CREW REPORT OF TACS FIRING DAY 153, NONE COMMANDED AT ATMDC. (DISCREPANCY). REF: SWS-658.	STAC/CHUBB	SOUNDS OF TACS FIRINGS ASSOCIATED WITH OTHER EQUIPMENT. CLOSED.
31 DOY 155	HIGH RATE GYRO TEMPERATURE INDICATIONS. (ANOMALY). REF: AR-189; SWS-35; SWS-618; AR-99; SWS-674; SWS-797.	STAC/CHUBB/ WOJTALIK	NO CATASTROPHIC CONDITIONS ARE ANTICIPATED AT THIS TEMPERATURE (66.5°C). GYRO WILL FUNCTION FOR REQUIRED LIFE. CLOSED.
32 DOY 155	LOW CAPACITY PERFORMANCE OF CBRM'S 6, 7, 8, AND 16. (DISCREPANCY). REF: SWS-631; SWS-1156; SWS-1196; AR-465; SWS-1216; SWS-1228; AX-1437.	EPS/WOOSLEY	CBRM 7 CAPACITY TEST PERFORMED DOY 226. CAPACITY IS 12.2 AMPERE HOURS. CLOSED.
33 DOY 156	Y3 GYRO OSCILLATION. (ANOMALY). REF: SWS-709; AR-207; AR-282; AR-418; AR-337.	STAC/CHUBB WOJTALIK	VOID. TRANSFERRED TO PROBLEM 72.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
34 DOY 157	LOW REG. OUTPUT CBRM 17 DURING DAYLIGHT PORTION OF ORBIT. (ANOMALY). REF: SWS-737; AR-387; ZO-1101; SWS-1154; AR-542; SWS-1435.	EPS/WOOSLEY	SHORT EXTERNAL TO CBRM. TROUBLESHOOTING PLANNED SUBMITTED FOR SL-3. IMPLEMENTATION TBD. CLOSED.
35 DOY 157	STAR TRACKER FAILURE TO ACQUIRE AND LOSS OF LOCK. (DISCREPANCY). REF: AR-219; AR-283; AR-334; AR-343; SWS-736; AR-304; AR-419; SWS-1128; SWS-1141.	STAC/CHUBB RAPS/LEE	STAR TRACKER OPERATES PROPERLY. TWO CAUSES FOR FAILURE TO ACQUIRE AND LOSS OF LOCK ARE CONTAMINATION AND MANEUVERS AFFECTING THE Z-AXIS BY TWO DEGREES OR MORE. CLOSED.
36 DOY 158	S054 POWER COULD NOT BE TURNED OFF.(ANOMALY). REF: AR-142; AR-226; AX-895.	ATM/EXP,EPS, I&C/WHITE/ WOOSLEY/ADAIR	ONLY KNOWN WAY IS BY POWERING DOWN CONTROL DIST BUSSES.FILM MAGAZINE CHANGED OUT ON EVA. CLOSED.
37 DOY 158	AM PRIMARY AND SECONDARY COOLANT LOOP CONTROL VALVES MALFUNCTIONED.(ANOMALY). REF: AR-248; ZO-840; SWS-854; AR-264; AR-266; SWS-871; SWS-884; AR-297; SWS-977; IV-967; SWS-1033; SWS-881; IV-890; SWS-947; SWS-1056; AR-349; ZO-1189; ZO-1190.	ECS/HOPSON	MALFUNCTION PROCEDURES PERFORMED AND BOTH LOOPS OPERATING PROPERLY. EVA PROCEDURE WAS MODIFIED SO THAT BYPASS VALVE WOULD NOT BE PLACED IN "EVA" POSITION AND EVA'S WERE PERFORMED SATISFACTORILY. CLOSED.
38 DOY 158	S054 DOOR INDICATED OPEN WHEN DOOR WAS CLOSED (DISCREPANCY). REF: AX-781; AR-249; AR-231; AX-798; ZO-798.	EPS/ATM/EXP. WOOSLEY/WHITE	DOOR DRIVE MECHANISM FAILURE RESULTS IN THE APPARENT FAILURE OF THE DOOR POSITION INDICATOR. DOOR PINNED OPEN. CLOSED.
39 DOY 160	CAUTION AND WARNING FIRE SENSOR FAILED TEST. (DISCREPANCY). REF: AR-250; AR-275; SWS-902.	EPS/WOOSLEY	RECOMMEND FAILED FSCP BE RETAINED AS A SPARE: SIDE 1 IS GOOD. TWO PANEL LOCATIONS IN OWS DO NOT USE SIDE 2. CLOSED.
40 DOY 161	BATTERY CHARGE ALERT LIGHT CANNOT BE RESET. (DISCREPANCY). REF: ZO-830.	EPS/WOOSLEY	PROBLEM ASSOCIATED WITH CBRM 15 OFFLINE. OPERATION NORMAL WITH CBRM 15 BACK ON. CLOSED.
41 DOY 160	PREMATURE CUTOFFS OF S056 ACTIVE 1 MODES. (ANOMALY). REF: AX-831; AR-251; AR-299; AR-335; AX-952; AX-961; AX-1641.	ATM/EXP. WHITE	(SEE PROBLEM 113). FAILURE ANALYSIS ON THE SL-2 FAILED MAGAZINE INDICATES PROBLEM CAUSED BY MECHANICAL DRAG IN FILM MAGAZINE. CLOSED.
42 DOY 161	S052 CAMERA FAILURE. (ANOMALY). REF: AR-254.	ATM/EXP. WHITE	PRELIMINARY CAMERA ANALYSIS RESULTS INDICATED THE PROBLEM IS NOT IN THE CAMERA. PRINCIPAL INVESTIGATOR IS ANALYZING FLIGHT FILM FOR CAUSE OF JAMMING AND WILL REPORT UPON COMPLETION. NO FURTHER MSFC EFFORT. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
43 DOY 162	S054 READY/OPERATE LIGHTS INOPERATIVE. (DISCREPANCY). REF: AX-838; AR-249.	ATM/EXP. WHITE	DOOR POSITION INDICATOR DETERMINES READY/OPERATE. LIGHT OPERATION. (SEE PROBLEM 38). CLOSED.
44 DOY 161	CBRM 6 REMAINED ON AFTER BEING COMMANDED OFF 3 TIMES. (ANOMALY). REF: AR-263.	EPS/WOOSLEY	ATTRIBUTED TO A FAILED TRANSISTOR, NO FURTHER ATTEMPTS WILL BE MADE TO TURN THE REGULATOR OFF. CLOSED.
45 DOY 159	AM TAPE RECORDER NO. 1 FAILURE. (DISCREPANCY). REF: AR-233; CM-470.	I&C/ADAIR	REPLACED WITH SPARE. RECORDER EXCEED SPECIFIED LIFE. RECORDER WILL NOT BE RETURNED FOR FAILURE ANALYSIS. CLOSED.
46 DOY 161	S009 MOTOR/DRIVE TRAIN STALLS ON CLOSE CYCLE. (ANOMALY). REF: AR-258; AR-302; EX-869.	COR.EXP./ DESANCTIS	ATTRIBUTED TO DRIVE MOTOR FAILURE. RESUPPLY ON SL-3. CLOSED.
47 DOY 162	T027/S073 TRIPOD UNIT MOUNTING PROBLEM. (DISCREPANCY). REF: AR-257.	COR.EXP./ DESANCTIS	ADJUSTMENT MECHANISM MISDRILLED CAUSING 4 INCHES OFF-SET. CLOSED.
48 DOY 163	LOW SIGNAL STRENGTH ON AM TRANSMITTER A10 (ANOMALY). REF: AR-276; AR-277; AR-294; AR-285; SWS-934; AR-371; SWS-1087; SWS-921.	I&C/ADAIR	PROBLEM ATTRIBUTED TO TRANSMITTER. TRANSMITTER MANAGEMENT WILL BE UTILIZED FOR REMAINDER OF MISSION. CLOSED.
49 DOY 164	M512 ELECTRON BEAM GUN POWER CUTOFF FAILURE. (DISCREPANCY). REF: AR-278; CX-905-R1; AR-321; CX-905; AR-309; CX-978.	COR.EXP./ DESANCTIS	ATTRIBUTED TO A HIGH AMPERAGE RELAY INTERMITTENT FAILURE. NOT REQUIRED FOR SL-3 OR SL-4. CLOSED.
50 DOY 164	S055 DOOR FAILED TO OPEN AT SUNRISE. (DISCREPANCY). REF: AR-279; AR-281; AX-954; AR-293; AX-906; AR-407; AX-1151; AX-1134.	ATM/EXP. WHITE	AUTO DOOR SWITCH APPARENTLY LEFT IN "INHIBIT" POSITION. NOW WORKING PROPERLY. CLOSED.
51 DOY 164	WATER DROPLET FORMATION ON WARDROOM WINDOW. (DISCREPANCY). REF: AR-284; AR-286; SWS-992; SWS-936; SWS-981; AR-338; SWS-1119; SWS-1065; AR-358; SWS-1049; AR-421; CX-1239; SWS-1538; AR-606; AR-540-16; AR-615; CX-1589; AR-540-20	ECS/HOPSON (LEAD) EPS/ WOOSLEY, S&M/ EUDY, CONTAM/ DAVIS	WINDOW EVACUATED, BUT NOT BACK-FILLED WITH DESSICATED AIR. FOG NO LONGER EXISTS. CLOSED.
52 DOY 165	POSSIBLE CONTAMINANT ON S052 OCCULTING DISK. (DISCREPANCY). REF: AX-939; AX-991; AX-1786; IV-1782.	CR.SYS.(LEAD) THOMPSON ATM/EXP/WHITE CONTAM/DAVIS	REOPENED. PROBLEM HAS RECURRED ON SL-3 AFTER EVA-2. "WHISKERS" ON DISC WERE REMOVED DURING DOY 265 EVA. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
53 DOY 165	PRESSURE LOW AND DECREASING ON 150 PSI N_2 REGULATOR OUTLET. (DISCREPANCY). REF: AR-296; SWS-946; SWS-985; SWS-1000; AR-379; AR-631; AR-658; AR-659.	ECS/LITTLES	REOPENED. PROBLEM RECURRED DURING SL-3. PERIODICALLY TURNING 1 REGULATOR OFF RESTORES PERFORMANCE. CLOSED.
54 DOY 167	CLOGGED WATER DISPENSER VALVE IN WASTE MANAGEMENT COMPARTMENT. (ANOMALY). REF: SWS-979; ZO-938; AR-298; AR-412.	S&M/EUDY	VALVE REPLACED. WILL RESUPPLY SPARE ON SL-3. SEAL MATERIAL BEING CHANGED FROM NEOPREME TO VITON. CLOSED.
55	SO82 READY/OPERATE LIGHT INDICATION DEFECTIVE (DISCREPANCY). REF: AR-301.	ATM/EXP. WHITE	VOID. SAME AS NO. 24.
56 DOY 168	POSSIBLE LEAK IN AIRLOCK CONDENSATE SYSTEM DURING DECOUPLING. (DISCREPANCY). REF: SWS-1003; SWS-1016; SWS-1018; SWS-1120; AR-331.	E&M/EUDY	MALFUNCTION PROCEDURE PERFORMED DOY 244, PRESS VALVE NOT CYCLED BACK TO "OFF" AND DUMP Q.D. DISCONNECTED. DELTA P OKAY AND DAILY DUMPS DISCONTINUED. CLOSED.
57 DOY 169	SO56 DOOR FAILED TO OPEN. (DISCREPANCY). REF: AX-1014; AR-407; AX-1173.	EPS/WOOSLEY	PROCEDURE FOR DOOR OPERATION PROVIDED AND AGREED UPON. CLOSED.
58 DOY 168	TO27/SO73 RETRACTION DIFFICULTY. (DISCREPANCY). REF: EX-1002; CX-1067; CX-1032; AR-345; AR-274; EX-775.	COR.EXP./ DESANCTIS	CREW CORRECTED PROBLEM BY DOCKING EXISTING J-8 CONNECTOR THAT WAS 20 DEGREES OFF LOCKED POSITION. CLOSED.
59 DOY 170	SO54 BINARY PICTURE COUNTER AND SHUTTER DURATION COUNTER RESET TO 000 SEVERAL TIMES DURING MISSION. (DISCREPANCY). REF: AX-1071.	ATM/EXP WHITE	PROBLEM EXPECTED TO CONTINUE THROUGH MISSION. CAUSED BY TRANSIENTS FROM MORE THAN ONE SOURCE. NO LOSS OF SCIENTIFIC DATA IS BEING EXPERIENCED. CLOSED.
60 DOY 171	OWS SOLAR ARRAY GROUP 4 CURRENT READS LOW. (DISCREPANCY). REF: AR-351; SWS-1060.	EPS/WOOSLEY	SHORT TO STRUCTURE RESULTING ONLY IN LOWER THAN ACTUAL CURRENT MEASUREMENTS. CORRECTION FACTOR BEING USED. CLOSED.
61 DOY 171	X-RAY/RF ACTIVITY HISTORY PLOTTER FAILED. (ANOMALY). REF: AX-1054.	EPS/WOOSLEY	NO RESUPPLY AND REPLACEMENT. CLOSED.
62 DOY 172	SO55 DOOR TM INDICATED NOT OPEN/NOT CLOSED AT COMPUTER SUNSET 172:14:50. (DISCREPANCY) REF: AX-1078; AX-1086; AX-1088; AR-407; AX-1134; AR-381; AX-1140; SWS-1138; AR-420; AR-293; AR-414; AR-293; AX-1151; SWS-1242.	HENRY(LEAD) EPS/WOOSLEY TCS/VANIMAN S&M/EUDY ATM-EXP/WHITE STAC/CHUBB	DOOR WILL BE LEFT OPEN DURING EXPERIMENT DAY (0800 TO 2400) UNTIL SL-3. PROCEDURE FOR DOOR OPERATION PROVIDED AND AGREED UPON. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
63 DOY 173	ELEVATED TEMPS IN OWS REFRIGERATION SYSTEM. (ANOMALY). REF: AR-368; BX-1080; AR-409; SWS-1082; SWS-1090; SWS-1083; AR-372; AR-402 AR-399; SWS-1106; AR-413; AR-388; AR-391; SWS-1124; AR-411; AR-431; AR-458; ZO-1180; SWS-1153; AR-478; ZO-1185; SWS-1242; SWS-124[illegible]; SWS-1248; AR-591; AR-592; ZO-1522; AR-734; SWS-1859; SWS-1977; SWS-2062; SWS-2092.	ECS/HOPSON	CURRENTLY OPERATING ON PRIMARY LOOP AND ALL TEMPS ARE WITHIN SPECIFICATION VALUES. J-5 CABLE DISCONNECTED ON DOY 266 PROVIDING CAPABILITY FOR INDEPENDENT LOOP OPERATION. NO FURTHER ACTION IS PLANNED. CLOSED.
64 DOY 173	AM TAPE RECORDER 1 FAILURE. (ANOMALY). REF: AR-369; AR-375; AR-356; AR-373; AR-456.	I&C/ADAIR	FAILED RECORDER 1 (S/N 22) DISASSEMBLY ON DOY 227 SHOWED DRIVE BELT 5 BROKEN. REPAIR KIT AND PROCEDURE IN WORK. CLOSED.
65 DOY 174	ATM WATT HR METER RESET TO 0 AND STAYING THERE. (DISCREPANCY). REF: AR-376.	EPS/STAC WOOSLEY/CHUBB	SUSPECTED ONE TIME OCCURRENCE THAT HAS CLEARED ITSELF. CLOSED.
66 DOY 171	OXYGEN BOTTLE 6 TEMP. RISE 5° F/DAY AND APPROACHING LIMIT. (DISCREPANCY). REF: AR-378; SWS-1109.	ECS/S&M HOPSON/EUDY	INVESTIGATION SHOWS NO PROBLEM. TEMPERATURE DECREASING WITH DECREASING BETA ANGLE. CLOSED.
67 DOY 176	HIGH OWS FILM VAULT TEMP. (DISCREPANCY). REF: ZO-1075; AR-380; AR-359.	ECS/HOPSON	FILM VAULT TEMP EXCEEDED 100°F LIMIT. DECREASED TO BELOW LIMIT ON DOY 178. DECREASE CONTINUES WITH DECREASING BETA ANGLE. FILM WAS NOT DEGRADED. CLOSED.
68 DOY 178	TEFLON GUIDE ON SO56 RETURN MAGAZINE MISSING. (DISCREPANCY). REF: AR-396.	S&M/EUDY ATM EXP/WHITE CS/THOMPSON	SL-2 CREW TO BE QUESTIONED ABOUT MISSING GUIDE. NO PROBLEMS ARE ANTICIPATED ON SL-3, IF CAMERA INSTALLATION RECOMMENDATIONS ARE FOLLOWED. CLOSED.
69 DOY 147	2 CBRM 13 SOLAR ARRAY MODULES OPEN. (ANOMALY) REF: AR-437.	EPS/WOOSLEY	DATA ANALYSIS SHOWS NEGLIGIBLE SYSTEM EFFECTS. CLOSED.
70 DOY 189	GENERATION OF FINE SUN SENSOR FALSE WEDGE COUNTS. (DISCREPANCY). REF: AR-432.	STAC/APPLE-GATE	PROBLEM ISOLATED TO A SHORTER THAN REQUIRED DELTA TIME BETWEEN 2 DISCRETES. CLOSED.
71 DOY 180	PROTON SPECTROMETER HAS LOST 12 OF 13 DATA CHANNELS (ANOMALY). REF: AR-444.	COR.EXP. DESANCTIS	LOSS OF MEASUREMENTS IS DUE TO LOW TEMPERATURE RESULTING FROM THE INADEQUACY OF THE THERMAL SHROUD. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
72 DOY 156	VEHICLE RATE GYRO OSCILLATIONS, Y3, Z1, Y2. (ANOMALY). REF: SWS-709; AR-207; AR-282; AR-418;AR-337;AR-442;SWS-1202;AR-466;SWS-1212; SWS-1194;SWS-1187;AX-1176;SWS-1254;AR-472; AR-492;AR-495;ZO-1299;AR-514;SWS-1399; SWS-1374;AR-543;SWS-1435;SWS-1434;AR-567; SWS-1491;SWS-1505;AR-607;AR-609;AR-610; ZO-1548;AR-617;AR-618;AR-626;SWS-1633; SWS-1658;SWS-1650;SWS-1676;AR-643;SWS-1690; SWS-1677;AR-655;SWS-1711;AR-647;SWS-1460; SWS-1729;SWS-1749.	STAC/ WOJTALIK	X5, Y1, Y5, Y1, Z5, AND Z3 NOW CONTROLLING WITH X6, Y6, AND Z6 IN STANDBY CHANGE WAS MADE BECAUSE OF SINGLE FAILURE POINT IN THE SIX PACK POWER LINE. 6 PACK MANEUVERS CONDUCTED DOY 239 TO DETERMINE 6 PACK MISALIGNMENT TO VEHICLE AXES. MISALIGNMENTS VERY SMALL AND DO NOT RECOMMEND ATMDC PROGRAM PATCH TO COMPENSATE. CLOSED.
73 DOY 197	ECP PITCH RATE GYRO FAILURE (ANOMALY). REF: AR-452; ZO-1183; SWS-1215; SWS-1208.	STAC/ APPLEGATE	CONSIDER PRIMARY UP/DN RATE GYRO FAILED. A PLUG-IN MODULE WHICH DIFFERENTIATES FSS OUTPUTS TO DETERMINE CANISTER RATES WAS CARRIED UP ON SL-3 AS A BACKUP. IMPLEMENTATION PROCEDURE IS ONBOARD SKYLAB. CLOSED.
74 DOY 160	FAILURE TO GET C&W OCCURRED WHEN SUS PUMP 1 WAS ACTIVATED. (DISCREPANCY).	EPS/CROWELL	INFLIGHT USAGE OF SUS PUMP 1 INDICATES SENSOR FAILED PER EVA ON DOY 218 AND PERIODIC ACTIVATION PER HOUSEKEEPING TASK 10-A. CLOSED.
75 DOY 135	OWS HATCH LEAK DURING PRESSURIZATION. (DISCREPANCY).	S&M/EUDY	ONE-TIME OCCURRENCE ATTRIBUTED TO CHECK VALVE CONTAMINATION WHICH CLEARED ITSELF. CLOSED.
76 DOY 197	EPC RATE GYRO NULL SHIFTS. (DISCREPANCY). REF: SWS-1208	STAC/ APPLEGATE	OPERATING ON REMAINING RATE GYROS. CLOSED.
		SKYLAB 3	
77 DOY 150	CBRM 4 CHARGER WENT OFF WHEN REGULATOR WAS COMMANDED OFF. (DISCREPANCY). REF: SWS-1247.	EPS/WOOSLEY	PROBLEM WAS DUPLICATED WITH COMPONENT FAILURES. DISCREPANCY HAS NOT RECURRED SINCE DOY 150. CLOSED.
78 DOY 209	MOLE SIEVE B SECONDARY FAN C/B OPENED WHEN SWITCH TURNED TO SECONDARY. (DISCREPANCY). REF: AR-496; SWS-1409; AR-500-7A.	EPS/WOOSLEY	CARRY-UP JUMPER CABLE TO POWER SIEVE B FAN FROM SIEVE A INVERTER PLANNED FOR SL-4. CLOSED.
79 DOY 210	MALFUNCTION OF WMC PRESSURE METER/TRANSDUCERS IN THE WASTE SYSTEM. (DISCREPANCY).REF:AR-503 REF: AR-503.	S&M/EUDY ECS/HOPSON I&C/ADAIR	D7125 HAS FAILED. D7104 READING APPROXIMATELY 0.05 PSIA HIGH. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
80 DOY 211	S055 DOOR DID NOT OPEN ON DAY SIGNAL. (DISCREPANCY). REF: AX-1296; AX-1298; AR-511; AR-516; AX-1341; AR-535; AX-1390; AX-1456; AR-526; AR-620.	EPS/WOOSLEY	RAMP LATCHES REMOVED DURING EVA ON DOY 218. SATISFACTORY OPERATION ON ONE MOTOR. CLOSED.
81 DOY 211	CONDENSATE DELTA P DECREASED TO ZERO INDICATING LEAK. (DISCREPANCY). REF: AR-506; AR-508; AR-513; SWS-1302; AR-518; AR-502; SWS-1339; SWS-1339 R1; AR-552; AR-553; SWS-14021 CX-1423; AR-562; SWS-1461; SWS-1539; SWS-1551; CX-1589; SWS-1284.	ECS/HOPSON	NO FURTHER T/S PLANNED. NO EVIDENCE OF LEAK SINCE 245:05:20, THE LAST TIME TANK WAS DUMPED. LEAK PROBABLY AT A QD AND MAY BE RANDOMLY EXPERIENCED AS QD'S ARE EXERCISED. CLOSED.
82 DOY 212	STAR TRACKER SHUTTER DID NOT CLOSE DURING DUMP AT 212:00:36. (DISCREPANCY). REF: AR-510; SWS-1315; AR-586; AR-724; AR-540-41; SWS-1919; SWS-2093; AR-800.	STAC/APPLEGATE	PROBLEM OCCURRED DOY'S 212, 222, 249, AND 264. PROCEDURE ESTABLISHED TO PREVENT DAMAGE TO STAR TRACKER IF PROBLEM RECURS. CLOSED.
83 DOY 212	ED52 AUTOMATIC CAMERA ACTUATOR MALFUNCTION. (DISCREPANCY). REF: AR-519; BX-1319; BX-1438; BX-1512.	COR.EXP/WALLS	MANUAL DAC CAMERA OPERATION PROCEDURE BEING UTILIZED. CLOSED.
84 DOY 213	DUMPED VOICE RECORDING ON CHANNEL B GARBLED. (DISCREPANCY). REF: AR-520; AR-524; SWS-1373.	I&C/ADAIR	CARRY-UP WORKAROUND BEING CONSIDERED FOR SL-4. CLOSED.
85 DOY 212	S149 EXPERIMENT RETRACTION PROBLEM. (DISCREPANCY).	COR.EXP/DESANCTIS	WARM-UP PERIOD NECESSARY TO CORRECT PROBLEM. CLOSED.
86 DOY 213	T027/S073 UNIVERSAL EXTENSION MECHANISM POWER PROBLEM. (ANOMALY). REF: AR-534; CX-1359; AR-535; AR-539; AR-525; CX-1365; CX-1338	COR.EXP/DESANCTIS	T027/S073 WAS EJECTED ON DOY 216. CLOSED.
87 DOY 212	ED-63 ELODEA PLANT DEATHS IN GROUND TEST UNIT. (DISCREPANCY). REF: ZO-1451; AR-565; BX-1537.	COR.EXP/DESANCTIS	SCIENCE PILOT OBSERVED NO STREAMING ON TWO SLIDES FROM ONE PLANT ON DOY 223. REQUEST FOR OBSERVATION OF OTHER TWO PLANTS PRIOR TO MISSION DAY 20 HAS BEEN MADE. CLOSED.
88 DOY 214	VIDEO TAPE RECORDER PROBLEM. (ANOMALY). REF: AR-530; AR-565; ZO-1515; AR-582.	I&C/ADAIR	FAILED VTR REPLACED ON DOY 219. REPLACEMENT FUNCTIONING PROPERLY. PROBLEM IS IN THE ELECTRONICS UNIT. CARRY-UP REPLACEMENT BEING INVESTIGATED. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
89 DOY 215	MALFUNCTION OF OWS LOW LEVEL MUX B.(ANOMALY) REF: AR-536; SWS-1380; AR-556; AR-561; AR-589; AR-711.	I&C/ADAIR	MALFUNCTION INTERMITTENT AND NOT EXPLAINED.OPERATED 1-1/2 HOURS ON DOY 233. LOW TEMP/HIGH TEMP TEST RESULTS ARE INCONCLUSIVE. T/S NOT RECOMMENDED DUE TO HIGH RISKS AND NON-CRITICALITY OF MEASUREMENTS.CLOSED.
90 DOY 214	MALFUNCTION OF ATM ACI PULSE WIDTH MODULATOR ASSEMBLY (MASTER) IN I/LCA. (ANOMALY). REF: AR-540-18; AR-622; SWS-1721; SWS-1581; ZO-1855.	EPS/WOOSLEY	VARIABLE LIGHTING ON I/LCA NOT AVAILABLE FOR REMAINDER OF MISSION. NO FURTHER TROUBLESHOOTING PLANNED. CLOSED.
91.	CBRM'S 17 AND 16 REGS OFF WHEN CREW TURNED ROTARY SWITCH ON C&D PANEL. (DISCREPANCY). REF: AR-555; AR-574; SWS-1478; AR-595; SWS-1543.	EPS/WOOSLEY	ATTRIBUTED TO AN INTERMITTENT CONDITION OR AN INADVERTENT REG OFF SWITCH OPERATION. CLOSED.
92 DOY 216	HARD SHORT ON ATM TV BUS 2. (ANOMALY) REF: SWS-1385; AR-550; AX-1386; SWS-1407; AX-1469; AR-575.	EPS/WOOSLEY	SHORT LOCATED IN POWER TRANSFER DISTRIBUTOR. LOCATION OF SHORT AND EXTENT OF DAMAGE CANNOT BE ASSESSED. OPERATING ON ATM TV BUS 1. CLOSED.
93 DOY 217	S052 DOOR OPEN WHEN SHOULD HAVE BEEN CLOSED. (DISCREPANCY). REF: AR-554.	EPS/WOOSLEY S&M/EUDY	FALSE DOOR OPEN INDICATION ATTRIBUTED TO SNEAK CIRCUIT AS A RESULT OF RELAY TIMING. CLOSED.
94 DOY 216	HIGH ATM CANISTER PRESSURE. (DISCREPANCY). REF: AX-1397.	ATM/TCS/ VANIMAN	CAUSE OF PRESSURE INCREASE UNKNOWN. PRESSURE HAS RETURNED TO NORMAL. CLOSED.
95 DOY 217	AM PRIMARY AND SECONDARY COOLANT LOOPS LOW PUMP INLET PRESSURE. (DISCREPANCY). REF: SWS-1414;AR-560;SWS-1428;AR-568;CX-1432; SWS-1481;AR-572;AR-593;AR-611;SWS-1562; AR-621;SWS-1608;SWS-1621;SWS-1628;AR-638; SWS-1673; SWS-1680;SWS-1683;SWS-1697;AR-656; AR-654; SWS-1712;SWS-1477;AR-669;AR-670-R1; SWS-1745;SWS-1747;AR-682;AR-646;SWS-1773; SWS-1815;SWS-1836;SWS-1745-R2;AR-540-47; SWS-2019;SWS-2024;SWS-2028;SWS-2063;SWS-2082 SWS-2126;SWS-2135;SWS-2210;SWS-2216;SWS-2239	ECS/HOPSON S&M/KRAUS	PRIMARY LOOP SUCCESSFULLY RESERVICED ON DAY 323 AND IS OPERATING NORMALLY. CLOSED.
96	S052 READY/OPERATE LIGHT FLICKERED. (DISCREPANCY). REF: AR-563.	ATM.EXP/ WHITE	PROBLEM HAS NOT RECURRED AND DOES NOT AFFECT EXPERIMENT OPERATION. UNDER INVESTIGATION. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
97 DOY 219	TELEPRINTER PAPER FEED FAILURE.(ANOMALY). REF: SWS-1463; AR-608	I&C/REED	HEAD REPLACED. REPAIR OF FAILED SHAFT ASSEMBLY AND CARRY-UP REPLACEMENT BEING EVALUATED. CLOSED.
98 DOY 219	S056 DOOR FAILED TO OPEN. (DISCREPANCY). REF: AR-571; AX-1494; AX-1546; AR-640.	EPS/WOOSLEY	RAMP LATCH REMOVAL SCHEDULED FOR DOY 236 EXTRA-VEHICULAR ACTIVITY. CLOSED.
99 DOY 220	MOLE SIEVE A PRIMARY TIMER FAILED TO SWITCH. (DISCREPANCY). REF: AR-569; SWS-1480.	ECS/HOPSON	PRIMARY TIMER SELECTED AT 224:20:01. BEDS HAVE CYCLED NORMALLY SINCE THEN. CLOSED.
100 DOY 220	S082B FILM TRANSPORTER INDICATION FAILURE (K-132). (DISCREPANCY).	ATM.EXP./ WHITE	CAMERA/MAGAZINE REPLACEMENT DURING EVA ON DOY 236 SOLVED THE PROBLEM. FAILURE ANALYSIS TO BE PER-FORMED ON FAULTY UNIT AFTER RETURN. CLOSED.
101 DOY	MOLE SIEVE A AND B HEAT EXCHANGER OUT TEMPS READ LOW ONBOARD. (DISCREPANCY). REF: AR-579; AR-598.	EPS/WOOSLEY I&C/ADAIR	GROUND MEASUREMENTS ARE VALID. CLOSED.
102 DOY 223	VIDEO TAPE RECORDER AUDIO PROBLEM. (DISCREPANCY). REF: AR-605.	I&C	DEGRADED AUDIO ON VTR TAPE DUMP DOY 223. PROBLEM ISOLATED TO HAND HELD MIKE. MIKE BEING STOWED. NO FURTHER ACTION ANTICIPATED. CLOSED.
103 DOY 223	CREW REPORTED WMC SQUEEZER LEAKS APPROXI-MATELY 1 OUT OF 5 OPERATIONS (DISCREPANCY). REF: AR-612.	S&M/EUDY CSD/THOMPSON	A CHANGE IN OPERATING TECHNIQUE RESULTED IN SATIS-FACTORY OPERATION. CLOSED.
104 DOY 224	CREW READOUTS OF CMG 1 AND 3 OUTER GIMBAL ANGLES HAVE INDICATED "OSL" A NUMBER OF TIMES.(DISCREPANCY). REF: AR-613; SWS-1632.	I&C/ADAIR EPS/WOOSLEY	ATTRIBUTED TO INTERMITTENT RELAY OPERATION. PROCEDURE FOR CLEARING PROBLEM WHEN IT OCCURS HAS BEEN PROVIDED. CLOSED.
105 DOY 224	CONTROL SYSTEM ANOMANY CAUSED EXCESSIVE TACS USAGE DURING GG DUMP FOLLOWING EREP 9 AND EREP CAL MANEUVERING. (ANOMALY). REF: SWS-1563; SWS-1578; ZO-1585; AR-618; AR-610RT; AR-627; SWS-1805.	STAC/CHUBB	ALL SEQUENCES ASSOCIATED WITH ANOMALY CAN NOW BE EXPLAINED. A LARGE X AXIS MOMENTUM BUILDUP COUPLED WITH A Z RATE GYRO DISCOMPARE CAUSED THE PROBLEM. MANNED MANAGEMENT CRITERIA HAS BEEN UPDATED TO PRE-CLUDE RECURRENCE. CLOSED.
106 DOY 228	T013 FORCE MEASURING UNIT NO. 2 LOAD CELLS 4 AND 5 OFF SCALE HIGH. (ANOMALY).	COR.EXP./ DESANCTIS	MALFUNCTION PROCEDURE UNSUCCESSFUL. NO ADDITIONAL MALFUNCTION PROCEDURES PLANNED. CLOSED.
107 DOY 229	BROKEN ICOM/XMIT SWITCH ON -Z SAL STATION. (ANOMALY). REF: AR-540-26.	I&C/ADAIR	CREW REPLACED UNIT ON DOY 230. PROBLEM CONSIDERED TO BE RANDOM FAILURE OF SWITCH. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
108 DOY 231	S082A APERTURE DOOR FAILED TO INDICATE CLOSED. (DISCREPANCY). REF: AX=1652; AX-1670; AR-640.	EPS/WOOSLEY	RAMP LATCH REMOVAL SCHEDULED FOR DOY 236 EVA. CLOSED.
109 DOY 231	C AND D BATTERY CHARGE ALERT LIGHT ON AND FLAG IS BARBERPOLE. (DISCREPANCY). REF: SWS-1655.	EPS/WOOSLEY	ATTRIBUTED TO AN INTERMITTENT SHORT IN POWER TRANSFER DISTRIBUTOR. CLOSED.
110 DOY 233	MULTIPLE DOCKING ADAPTER AFT LIGHTS 2 AND 4 FAILED. (DISCREPANCY). REF: AR-660-R1, ZO-1855.	EPS/WOOSLEY	LIGHTS OPERATING WILL BE CONTROLLED DURING SL-4 BY INDIVIDUAL SWITCHES ON LIGHTS. CLOSED.
111 DOY 232	DURING LINE-OF-SIGHT ROLL, EPC DROVE OFF OF SUN. (DISCREPANCY). REF: AR-639.	STAC/CHUBB	PRESENT OPERATION IS SATISFACTORY. HSL SIMULATION CONFIRMED PROBLEM CAUSED BY WEDGE COUNTER ERRORS. RECOMMENDATIONS TO PREGLUDE RECURRENCE FORWARDED TO FOMR. CLOSED.
112 DOY 234	S056 HUNG UP TWICE IN PATROL MODE SHORT. (DISCREPANCY). REF: AR-563.	ATM EXP/WHITE	DATA ANALYSIS AND X-RAY SCIENCE AT JSC VERIFIED MODES WERE NORMAL. CLOSED.
113 DOY 234	S056 OPERATE LIGHT REMAINED ILLUMINATED IN ACTIVE 1 LONG MODE FILTER POSITION 1. (DISCREPANCY). REF: AR-653.	ATM EXP/WHITE	TRANSFERRED TO PROBLEM 132. CLOSED.
114 DOY 236	AM SEC COOLANT LOOP TCVB STUCK IN COLD FLOW POSITION AFTER DOY 236 EVA. (DISCREPANCY). REF: AR-677; SWS-1763; SWS-1773.	ECS/HOPSON	TCVB OPERATING OK EXCEPT THAT IT PRECLUDES WATER COOLING FOR EVA. CLOSED.
115 DOY 236	S052 THERMAL SHIELD DOOR OPEN (SHOULD HAVE BEEN CLOSED) DURING EVA. DOY 236 (DISCREPANCY). REF: AR-663; AX-1813;AR-554.	EPS/WOOSLEY	SIMILAR PROBLEM OCCURRED ON DOY 217. SUSPECTED TO BE DUE TO A RELAY RACE. USE ATM MAL PROCEDURE TO ACTIVATE ALT. MOTOR AND CIRCUITRY. CLOSED.
116 DOY 237	TIME REFERENCE SYSTEM EXHIBITED ERRATIC BEHAVIOR. (DISCREPANCY). REF: AR-664;AR-685; SWS-2004;AR-785;AR-793;SWS-2076;AR-826.	I&C/ADAIR	PROBLEM COULD NOT BE DUPLICATED AT STU/ST. LOUIS, OR DURING INFLIGHT TESTS. BOTH SYSTEMS ARE PRESENTLY OPERATIVE. CLOSED.
117 DOY 226	LOW CAPACITY PERFORMANCE OF CBRM'S. (DISCREPANCY). REF: SWS-1695; AR-641; SWS-1730; SWS-1728.	EPS/WOOSLEY	REF: PROBLEM 155-M-32. TESTS ON CBRM'S 5,7,8,10, AND 18 SHOW CAPACITY OF 12.1-13.1 AMP-HR. ONLY NORMAL DEGRADATION EXPECTED FOR THE REMAINDER OF THE MISSION. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
118 DOY 238	DURING CBRM 7 CAPACITY TEST DOY 238, REGULATOR WOULD NOT SWITCH OFF. (OTHER REGS WITH SAME PROBLEM ARE 6 AND 16). (DISCREPANCY). REF: AR-675; AR-595; AR-263.	EPS/WOOSLEY	REGULATOR RELAYS ARE STUCK IN THE "ON" POSITION. OPERATION IS SATISFACTORY. TROUBLESHOOTING PROCEDURE SUBMITTED BUT IMPLEMENTATION NOT REQUIRED. CLOSED.
119 DOY 240	DECREASE IN OWS HEAT EXCHANGER GAS FLOW. (DISCREPANCY). REF: SWS-1793; AR-686; AR-717; SWS-1885.	ECS/LITTLES	DECREASED 50 PERCENT SINCE BEGINNING OF SL-2. HEAT FLOW EXCHANGERS WERE CLEANED DOY 251 AND GAS FLOW INCREASED TO NORMAL LEVELS. CLOSED.
120 DOY 244	ED-78 PISTON FAILED TO MOVE WHEN RELEASE BUTTON WAS PRESSED.(DISCREPANCY).REF:AR-712.	COR.EXP./ DESANCTIS	ED78 HARDWARE IN M512 FACILITY POSSIBLE FOR LATE IN SL-4 MISSION. CLOSED.
121 DOY 242	CONDENSATE DUMP SYSTEM BLOCKAGE.(DISCREPANCY) REF: AR-706.	ECS/HOPSON	PROBLEM RECURRED DOY 244 AND DUMP PROBE WAS REPLACED. TROUBLESHOOTING DOY'S 250 AND 251 SHOWED NO OBSTACLES. PROBE CONSIDERED SOUND AND ACCEPTABLE FOR SPARE. MOST LIKELY CAUSE OF PROBLEM WAS ICE. DUMPS, WATER AND CONDENSATE, RESTRICTED. CLOSED.
122 DOY 247	CREW AWAKENED BY LOUD THUMP AT APPROX. 247:07:25. (DISCREPANCY).REF: AR-715.	ALL MSG'S	STAC, EPS, ECS, TCS, S&M, AND ATM EXP. REPORT NO EVIDENCE OF ANOMALY. CLOSED.
123 DOY 248	LOSS OF 1/2 S082B FRAMES TAKEN IN AUTO MODE. (DISCREPANCY). REF: AR-725.	ATM/EXP. WHITE	AUTO TIMER BEING DEVELOPED BY MSFC TO BE INSTALLED BY SL-4 CREW. CLOSED.
124 DOY 249	DIFFICULTIES CLOSING TRASH AIRLOCK. (DISCREPANCY). REF: AR-728; SWS-1911;AR-733.	CREW SYST/ THOMPSON; S&M/EUFY	TAL OPERATION IS NORMAL. SL-2 CREW USED TWO MAN OPERATION DUR TO AMOUNT OF FORCE NECESSARY TO COMPRESS LID SEAL. CLOSED.
125 DOY 251	H-ALPHA TWO DOOR FAILED TO CLOSE. (DISCREPANCY). REF: AR-729; AX-1931; AX-1979; AX-2090; AR-840.	EPS/WOOSLEY S&M/EUDY ATM EXP./WHITE	PIN PULLED AND DOOR LATCHED OPEN ON FIRST EVA OF SL-4. CLOSED.
126 DOY 252	FAILURE TO GET S082B FILM TRANSPORT INDICATION FOR SHORT EXPOSURES. (DISCREPANCY). REF: AX-1928.	ATM/EXP/ WHITE	DUE TO SWITCH BOUNCE OF FILM TRANSPORT MICROSWITCH. CAMERA WILL BE CHANGED OUT NEXT EVA. CLOSED.
127 DOY 252	S082A DOOR FAILED TO CLOSE. (DISCREPANCY). REF: AR-743; AX-1964; AX-1979.	S&M/EUDY	OPERATION SATISFACTORY WITH TWO MOTORE. CLOSED.
128 DOY 254	Y3 RACK RATE GYRO OSCILLATION. (DISCREPANCY) REF: AR-741; AR-760.	STAC/CHUBB	OSCILLATIONS ARE A FUNCTION OF VEHICLE DISTURBANCES EXCITING THE 1.6 Hz BENDING MODE. THEY DO NOT COUPLE INTO THE CMG SYSTEM. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
129 DOY 256	CBRM 5 CHARGER MALFUNCTION. (ANOMALY). REF: AR-754; AR-751.	EPS/WOOSLEY	CBRM 5 AND 3 TO BE INTERCONNECTED TO FORM 1 CBRM DURING SL-4 EVA. CLOSED.
130 DOY 256	AM TAPE RECORDER 3 FAILURE (S/N 28). (ANOMALY). REF: AR-750; AR-769; SWS-2015; SWS-2034.	I&C/ADAIR	EXCEEDED LIFETIME OF 1000 HOURS. T/S PROCEDURE PERFORMED ON DOY 260 REVEALED TAPE WAS OFF DRIVE CAPSTANS AND IDLERS. TAPE NOW POSITIONED CORRECTLY AND RECORDER IS STOWED. CLOSED.
131 DOY 256	REGULATOR VOLTAGE TALKBACK ON C&D PANEL 130 FOR REGS 1-12. (DISCREPANCY). REF: AR-775.	EPS/WOOSLEY	ATTRIBUTED TO A RELAY FAILURE IN THE POWER TRANSFER DISTRIBUTOR. CLOSED.
132 DOY 257	S056 FILM TRANSPORT HANGUPS. (DISCREPANCY). REF: AX-2005; AR-768.	ATM.EXP./ WHITE	INVESTIGATION INDICATES MOTOR TORQUE IS INADEQUATE TO COMPENSATE FOR SLIGHT INCREASES IN DEAG. ADDITIONAL HANGUPS EXPERIENCED DOY'S 19,27, AND 28. PERIODIC CONTINUATION OF HANGUPS EXPECTED. CLOSED.
133 DOY 259	NOISY IMAGE ON TV MONITOR NO. 1. (DISCREPANCY) REF: AX-2042;AX-2097;AR-803;AR-810;AR-846; ZO-2157.	I&C/ADAIR	MONITOR INOPERATIVE DOY 265. TROUBLESHOOTING DOY 266 INCONCLUSIVE. SPARE CARRY-UP MONITOR PLANNED FOR SL-4. CLOSED.
134 DOY 263	S082B FRAMES REMAINING COUNTER FAILED TO DECREMENT AND TRANSPORT SWITCH DID NOT INDICATE FILM TRANSPORT. (DISCREPANCY). REF: AX-2073.	ATM/EXP/ WHITE	CAMERA POWERED DOWN AND REMOVED DURING DOY 265 EVA. FAILURE ANALYSIS SHOWED NORMAL CAMERA OPERATION. FAILURE TO DECREMENT AND FILM TRANSPORT INDICATION RESULTED WHEN END OF FILM WAS REACHED. CLOSED.
135 DOY 264	FAULTY WMC WASHCLOTH SQUEEZER SEAL. (DISCREPANCY). REF: AR-801.	CREW SYST/ THOMPSON S&M/EUDY	REPLACED BY CREW. CREW RECOMMENDS SL-4 REPLACEMENT. TWO SPARE SEALS WILL BE SUPPLIED ON SL-4. CLOSED.
136 DOY 264	POSSIBLE S052 FILM CAMERA JAM. (DISCREPANCY).	ATM/EXP/ WHITE	MAGAZINE CHANGED DURING DOY 265 EVA AND RETURNED ON SL-3. CAMERA FOUND TO BE JAMMED. CAUSE CONCLUDED TO BE LARGER THAN NOMINAL DIAMETER OF TAKE-UP REEL AT END OF FILM DUE TO GREATER THAN NOMINAL FILM THICKNESS. CLOSED.
137 DOY 265	FOUR CYCLE OSCILLATION ON AUDIO CHANNEL B. (DISCREPANCY). REF: AR-804.	I&C/ADAIR	ONE-TIME OCCURRENCE. PROBLEM NO LONGER EXISTS. CLOSED.
138 DOY 266	POSSIBLE MALFUNCTION OF PUMP A IN C&D COOLANT LOOP. (DISCREPANCY). REF: SWS-2104; AR-806; EX-2101; AR-809; AR-808.	ECS/LITTLES	REPLACED FILTER RETURNED ON SL-3 WAS CLEAN. THEREFORE, PUMP A FAILURE CONCLUDED. PUMPS B AND C AVAILABLE FOR C&D COOLING. NO FURTHER ACTION PLANNED. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
139 DOY 278	SO55 MAIN POWER (LOW VOLTAGE) WILL NOT TURN OFF BY RF COMMANDS. (DISCREPANCY). REF: AR-844; AX-2146; AX-2199; AR-875.	ATM EXP/ WHITE EPS/WOOSLEY	PRESENT PLANS ARE TO KEEP SO55 POWERED UP DURING SL-4 EVA'S C&D CONFIGURED FOR SECONDARY INSTRUMENT POWER. ADDITIONAL T/S (IF NECESSARY) WILL PROBABLY TAKE PLACE AT END OF SL-4 MISSION.
140 DOY 278	SL-3 SO82A FILM DEGRADED (STREAKED). (DISCREPANCY).	ATM EXP/ WHITE	MODIFIED CAMERAS WILL BE FLOWN ON SL-4. CLOSED.
141 DOY 293	CBRM 9 BATTERY STOPPED CHARGING PREMATURELY. (DISCREPANCY). REF: AR-866.	EPS/WOOSLEY	SUSPECTED ONE TIME OCCURRENCE. CLOSED.
142 DOY 307	CMG NO. 1 WHEEL SPEED DECREASE AND CURRENT INCREASE. (DISCREPANCY). REF: SWS-2219.	STAC/CHUBB	OPERATION RETURNED TO NORMAL AFTER CMG HEATERS CAME ON. CLOSED.
143 DOY 315	AM TAPE RECORDER NO. 3 (S/N 23). MALFUNCTION. (DISCREPANCY). REF: AR-900; AR-901; SWS-2237, AR-904; AR-908.	I&C/ADAIR	EXP. 2/DATA 2 FAST TOWARD OFF COMMAND EXECUTED REVOLUTION 2634. COMMAND DSM 514 REMOVED THE GROUND CAPABILITY. CREW WORKAROUND PROCEDURE AVAILABLE IF NEEDED. MOST PROBABLE CAUSE IS CONTAMINATED FAST FORWARD COMMAND RELAY. CLOSED.
144 DOY 318	EPC UP/DOWN LOCK FAILURE. (DISCREPANCY). REF: AR-907; AR-910; AR-911; AR-937.	ASTR / WOJTALIK	DOY 318 FAILURE OCCURRED WITH EPC SYSTEM ON PRIMARY EPEA. SIMILAR PROBLEM OCCURRED DOY 334 WITH SYSTEM ON SECONDARY EPEA. LOCK LATER RELEASED BY GROUND COMMAND SYSTEM NOW APPEARS NORMAL. CLOSED.
145 DOY 321	ATM C&D COOLANT LOOP FLOW ERRATIC WITH PUMP B IN LOOP. (DISCREPANCY). REF: AR-913; MPR 266-M-138; AR-914; SWS-2342; AR-936; SWS-2415; AR-962; SWS-2462; AR-964; SWS-2487; SWS-2505; SWS-2540; SWS-2599.	ECS/LITTLES	FILTER INSPECTION AND GAS REMOVAL PROCEDURE SUCCESSFUL ON DOY 352. CREW REPORTED CONTAMINATION ON FILTER, BUBBLES AND FORM AT QUICK DISCONNECT. AFTER LIQUID/GAS SEPARATOR PROCEDURE, LOOP FLOW WAS 295 LB/HR ON PUMP B, 280 LB/HR ON PUMP C. FILTER WAS REPLACED. CLOSED.
146 DOY 327	CONTROL MOMENT GYRO NO. 1 FAILURE (ANOMALY). REF: AR-923; SWS-2307; SWS-2333; SWS-2338; SWS-2357; AR-929; AR-932; AR-942; SWS-2414; SWS-2446; ZO-2452; AR-959; SWS-2471;SWS-2448.	STAC/CHUBB ATM/TCS/ VANIMAN	PATCH TO LIMIT CMG GIMBAL RATES DELIVERED 12/19/73. PATCH TO PROVIDE AN OSCILLATING TACS ONLY MODE HAS BEEN DEVELOPED IN THE EVENT ANOTHER CMG FAILS. ANALYSIS ATTRIBUTES FAILURE TO COMBINATION OF BEARING RETAINER INSTABILITY AND INSUFFICIENT

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
147 DOY 328	CBRM 5 CHARGER ON/OFF CONTROL RELAY FAILED CLOSED. (DISCREPANCY). REF: AR-926.	EPS/WOOSLEY	SUSPECT WELDED RELAY CONTACTS. GROUND CAN CONTROL AVAILABLE. CLOSED.
148 DOY 330	OWS FILM VAULT DOOR LATCH MALFUNCTION. (DISCREPANCY). REF: SWS-2340.	CREW SYS/ THOMPSON S&M/EUDY	CORRECTIVE ACTION SUBMITTED. IMPLEMENTATION IS CREW'S OPTION. CLOSED.
149 DOY 330	S056 BERYLLIUM COUNTER DOES NOT SHOW COUNTS ON C&D PANEL. (DISCREPANCY). REF: AX-2344.	ATM.EXP/	SUSPECTED TO BE DUE TO A FAILED RELAY FOR WHICH NO CORRECTIVE ACTION IS POSSIBLE DUE TO INACCESSIBILITY. NO IMPACT ON DATA RESULTS FROM THE FAILURE. CLOSED.
150 DOY 331	S054 FILTER WHEEL MALFUNCTION. (DISCREPANCY) REF: AX-2350; AR-933; AR-982.	ATM.EXP/ WHITE	FILTER WHEEL STOWED IN POSITION 3 DURING DOY 359 EVA. CREW VERIFIED WHEEL WAS STUCK BETWEEN POSITIONS 5 AND 6. CLOSED.
151 DOY 333	SPEAKER INTERCOM ASSEMBLY FAILURE. (NO. 131) IN THE MDA. (DISCREPANCY). REF: AR-931.	I&C/ADAIR	REPLACED WITH THE ONE REMAINING ONBOARD SPARE ON DOY 334. RECOMMEND FAILED SIA BE PUT ON RETURN STOWAGE LIST FOR POSTMISSION FAILURE ANALYSIS. CLOSED.
152 DOY 334	VEHICLE VIBRATIONS REPORTED BY CREW. (DISCREPANCY). REF: AR-941; AR-941-R1; AR-984.	ALL MSG'S	CREW REPORTED TWO 10-SECOND VIBRATIONS DOY 334. ON DOY 353 CREW HEARD "KLUNKETY" SOUND AGAIN, BUT FELT LESS VIBRATION. CAUSE OF BOTH EVENTS UNKNOWN. INVESTIGATION REVEALS NO CORRELATION WITH CMG NO. 2 PROBLEMS. (REF: PROB. NO. 157). CLOSED.
153 DOY 335	S183 RELEASED SMALL PIECE OF GLASS WHEN CARROUSEL DOOR OPENED. (DISCREPANCY). REF: CX-2390; CX-2399; SX-2390-R1; AR-975;AR-976; CX-2558.	COR EXP/ DESANCTIS	CREW HAS PROCEDURE FOR CARROUSEL 1-1 ON OPERATION TO AVOID ADVANCING SC-5 FILM PLATES PAST FILM GATE. CREW TRANSCRIPT INDICATES 2-2 IS STILL OUT OF SYNC, BUT TM INDICATES NORMAL PERFORMANCE.
154 DOY 337	S052 TV IMAGE DISPLAYED FAINT SPOT AT 12 O'CLOCK POSITION. (DISCREPANCY).REF: AR-951.	I&C/ADAIR	BLACK STREAK ALSO APPEARED ON IMAGE ON DOY 340. SPOT DUE TO PROBLEM WITH VIDICON TUBE. STREAK CAUSED BY AGC RESPONSE TO SPOT. NO CORRECTIVE ACTION POSSIBLE, BUT NO DATA IS BEING LOST. MSFC RECOMMENDS NORMAL S052 OPERATION. CLOSED.
155 DOY 339	S082A DOOR FAILED TO CLOSE VIA C&D CONTROL. (DISCREPANCY). REF: AR-961; AR-961-R1, AX-2466; AX-2469; AX-2493.	EUDY,WOOSLEY, WHITE, THOMPSON	T/S DOOR ASSUMED STUCK IN FULL OPEN POSITION. EXPERIMENT OPERATIONS RESUMED WITH DOOR NOT BEING PINNED. DOOR WILL BE PINNED OPEN ON NEXT EVA. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
156 DOY 338	ED63 ELODEA PLANTS APPARENTLY DEAD. (DISCREPANCY). REF: AR-953	COR.EXP./ DESANCTIS	FURTHER CREW OBSERVATIONS ON DOY 340 AND GROUND EVALUATION OF INFORMATION CONFIRMS PLANS HAVE PERISHED. PLANTS DISPOSED OF IN THE TRASH AIRLOCK AND VIALS WERE STOWED. CLOSED.
157 DOY 339	CMG 2 INVERTER TEMPERATURE INCREASE, WHEEL SPEED DECREASE AND PHASE A CURRENT INCREASE (DISCREPANCY). REF: AR-955; AR-963; AR-965; AR-971; SWS-2530; AR-980; AR-987; AR-1026; SWS-2889; AR-1063; SWS-2939; SWS-2957.	STAC/CHUBB	LOAD RELIEF PATCH AND HEATER MANAGEMENT APPARENTLY EXTENDING BEARING LIFE TO MISSION COMPLETION. CLOSED.
158 DOY 342	SAS 13, 14, AND 15 PERFORMANCE DEGRADED. (DISCREPANCY). REF: AR-952.	EPS/WOOSLEY	SAS 15 VOLTAGE DROPS APPROXIMATELY 6 VOLTS WHEN TEMPERATURE RISES TO 82°F. VOLTAGE RETURNS TO NORMAL AT TRIP BACK. SAS 13 AND 14 VOLTAGE DROPS OCCUR AT LOWER TEMPERATURES AND DO NOT OCCUR EACH ORBIT, ONLY INTERMITTENTLY. NO CORRECTIVE ACTION POSSIBLE. CLOSED.
159 DOY 349	LOW LEVEL MULTIPLEXER P EXCESSIVELY NOISY MEASUREMENTS. (DISCREPANCY). REF: AR-978.	I&C/ADAIR	MEASUREMENTS INVOLVED ARE COMMON TO A SECOND LEVEL TIER SWITCH IN MUX P. THE TIER SWITCH CANNOT BE REPAIRED OR REPLACED BUT ALTERNATE MEASUREMENTS EXIST FOR 6 OF THE 8 NOISY MEASUREMENTS. CLOSED.
160 DOY 350	ATM C&D/DAS LOCKOUT. (DISCREPANCY). REF: AR-979.	EPS/WOOSLEY STAC/CHUBB	PRIMARY ENABLE WAS MASKED OUT. DAS AND KEPBOARD ELECTRONICS NOW OK. EMI GENERATED BY CYCLING POWER SWITCHES ON C&D WAS PROBABLY ONTO DATA LINES. PROCEDURE TO ENTER 5 DIGITS TO CLEAR DAS PROVIDED. CLOSED.
161 DOY 350	S054 CRT DISPLAY LOSES LOWER 40% OF IMAGE INTERMITTENTLY. (DISCREPANCY).REF:AX-2537	ATM EXP/ WHITE	SUSPECT INTERMITTENT COMPONENT FAILURE IN CRT SWEEP LOGIC. NO CORRECTIVE ACTION POSSIBLE, BUT PROBLEM NOT EXPECTED TO AFFECT ROUTINE EXPERIMENT OR CREW OPERATIONS. CLOSED.
162 DOY 356	AM TRANSMITTER "C" FAILURE TO RESPOND TO "ON" COMMANDS. (DISCREPANCY). REF:AR-989.	I&C/ADAIR	OCCURRED DOY'S 335, 353, AND 356. DOY 356, CIRCUIT BREAKER WAS TRIPPED. LOSS OF XMTR "C" WOULD RESULT IN LOSS OF REAL TIME DATA OVER SOME SITES. THIS LOSS WOULD RESULT IN NO SIGNIFICANT MISSION IMPACT. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
163 DOY 357	AM LOW LEVEL MULTIPLEXERS ERRATIC. (ANOMALY). REF: AR-991; AR-992; SWS-2666.	I&C/ADAIR	SIMULATIONS TO DUPLICATE PROBLEM COMPLETED. PROBLEM IS IN BASIC CIRCUITRY OF THE INSTRUMENTATION SYSTEM AND CANNOT BE CORRECTED. SECONDARY SYSTEM IS OPERATING ADEQUATELY TO COMPLETE THE MISSION; PRIMARY CAN BE USED AS BACKUP. CLOSED.
164 DOY 354	S055 GRATING POSITION COUNTER INCREMENTS 80 STEPS ON C&D. (DISCREPANCY). REF: AX-2593.	ATM.EXP./ WHITE EPS/WOOSLEY	TELEMETRY INDICATES CORRECT GRATING POSITION. CREW WORKAROUND PROVIDED. CLOSED.
165 DOY 358	ATM C&D COOLANT LOOP FLOW FLUCTUATIONS. (DISCREPANCY). REF: 321-M-145;SWS-2675.	ECS/LITTLES	LIQUID/VAPOR SEPARATOR USED TO REMOVE GAS FROM LOOP DOY 004. PUMPS C AND B OPERATED WITH NORMAL FLOW RATES. EXPECT THAT LOOP DEGASSING WILL BE NECESSARY EVERY 2 OR 3 WEEKS. CLOSED.
166 DOY 361	SUSPECTED FAILURE OF THE STAR TRACKER OUTER GIMBAL ENCODER. (ANOMALY). REF: SWS-2634; SWS-2635; AR-1001; SWS-2668.	STAC/CHUBB	FAILURE WAS DUPLICATED IN LAB DOY 362 BY FAILING THE LIGHT SOURCE IN THE OUTER GIMBAL OPTICAL ENCODER. THE STAR TRACKER IS NOT CONSIDERED USEABLE FOR THE REMAINDER OF THE MISSION. CLOSED.
167 DOY 361	TV INPUT STATION 642 HAS BROKEN PIN ON CONNECTOR J-3 (ANOMALY). REF: SWS-2636.	I&C/ADAIR	INPUT STATION WAS REPLACED BY SPARE ON DOY 364. CAUSE OF BROKEN PIN UNKNOWN. NO FURTHER ACTION PLANNED. CLOSED.
168 DOY 361	S054 EXPOSURE TIMES ARE 260 SECONDS INSTEAD OF 256 SECONDS. (DISCREPANCY). REF: 2627.	ATM EXP/ WHITE	PROBLEM IS IN TM AND NOT IN ACTUAL LENGTH OF EXPOSURES. SHUTTER OVERRIDE ADAPTER INSTALLED DOY 259 EVA CAUSES SOME ELECTRONICS TO BE BYPASSED RESULTING IN TM ERROR. CLOSED.
169 DOY 364	S082B OUTER DOOR FAILED IN INTERMEDIATE POSITION. (DISCREPANCY). REF: AX-2651; AR-1003.	ATM EXP/ WHITE S&M/EUDY EPS/WOOSLEY	DOOR OPENED FULLY VIA GROUND COMMAND ON PRI MOTOR. S082B AND XUV MON DOOR HAVE BEEN OPENED VIA GROUND COMMAND AND MOTOR POWER DISABLED. DOORS WILL REMAIN OPEN PERMANENTLY. CLOSED.
170 DOY 003	LOSS OF INTEGRAL LIGHTING ON THE ATM C&D. (ANOMLAY). REF: SWS-2677.	EPS/WOOSLEY	A SHORT EXISTS ON THE INTEGRAL LIGHTING BUS; LOADS ARE HARD WIRED AND CANNOT BE ISOLATED. NO FURTHER TROUBLE-SHOOTING RECOMMENDED. BACKGROUND LIGHTING NOT REQUIRED FOR CONSOLE OPERATION. CLOSED.
171 DOY 003	BROKEN "E" CLIP ON S183 CARROUSEL SHAFT. (DISCREPANCY). REF: AR-1107.	COR.EXP/ DESANCTIS	CARROUSEL 2-2 WILL BE USED FOR FUTURE OPERATIONS. IF CARROUSEL 1-1 IS REQUIRED, USE WILL BE ATTEMPTED USING ESTABLISHED PROCEDURES. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
172 DOY 003	S082B POINTING REFERENCE SYSTEM HAS OSCILLATIONS IN THE PRIMARY MIRROR DRIVE SYSTEM. (DISCREPANCY). REF: AX-2698.	ATM.EXP./ WHITE	FBU TESTING AND A SPECIAL MALFUNCTION PROCEDURE WERE CONDUCTED DOY 009. RESULTS INDICATE A DECREASE IN PRS SENSITIVITY. ATM MPC WILL BE USED FOR S082B LIMB OFFSET POINTING OFF THE DISK. CLOSED.
173 DOY 011	OWS HIGH LEVEL MULTIPLEXER J REFERENCE VOLTAGE VARIATIONS. (DISCREPANCY).	I&C/ADAIR	MEASUREMENT SHIFTS ARE CORRELATABLE TO SHIFTS ON HIGH REFERENCE AND MAY BE CORRECTED. CLOSED.
174 DOY 012	ED 72 MALFUNCTION. (ANOMALY). REF: AR-1023; AR-1037.	COR.EXP./ DESANCTIS	EXPERIMENT EQUIPMENT HAS BEEN DISCARDED THROUGH TRASH AIRLOCK. PROCEDURE TO OBTAIN DATA UTILIZING OTHER ONBOARD MATERIALS WAS SUBMITTED TO JSC, BUT WAS DISAPPROVED. CLOSED.
175 DOY 010	PROBABLE FAILURE OF ONE OF TWO HEATER ELEMENTS IN WR H_2O HEATER. (DISCREPANCY).	S&M/EUDY	PROCEDURE FOR REPLACEMENT OF HEATER AND A SPARE IS ONBOARD. CLOSED.
176 DOY 016	H-ALPHA FILM CAMERA FAILURE TO ADVANCE. (DISCREPANCY). REF: AX-2779; AR-1025.	ATM.EXP./ WHITE	PROBLEM CLEARED BY CREW REINITIALIZING SYSTEM DOY 016. CLOSED.
177 DOY 017	NOISE INTERFERENCE OF APPROXIMATELY 6 HERTZ ON AUDIO SYSTEM CHANNEL B. (DISCREPANCY). REF: AR-1038.	I&C/ADAIR	TROUBLESHOOTING DOY 21 ISOLATED PROBLEM TO AMPLIFIERS WITHIN THE 2 AUDIO LOAD COMPENSATORS. NO CORRECTIVE ACTION POSSIBLE. WORKAROUND PROCEDURE IMPLEMENTED DOY 029. CLOSED.
178 DOY 019	S019 ARTICULATED MIRROR SYSTEM ROTATION CONTROL KNOB SLIPPAGE, SPRINGINESS, AND INTERPLAY BETWEEN ROTATION AND TILT.		THIS PROBLEM ERRONEOUSLY LISTED ON MSFC TRACKING LIST. (S019 IS A JSC EXPERIMENT). VOID.
179 DOY 017	AIRLOCK MODULE TRANSMITTER B PROBLEM (DISCREPANCY). REF: AR-1035.	I&C/ADAIR	AM XMTR WAS NOT ON AT CRO AOS 017:22:16. PROBLEM RECURRED AT 020:23:54 OVER VAN. SUSPECTED TO BE CAUSED BY CORONA. PROCEDURE TO MINIMIZE PRESSURES IN AREA OF QUADRIPLEXER SUBMITTED. CLOSED.
180 DOY 021	S183 POWER LOSS CONCURRENT WITH JAMMED DAC FILM MAGAZINE. (DISCREPANCY). REF: AR-1044; AR-1045; CX-2338; CX-2879.	COR.EXP./ DESANCTIS	WORKAROUND VERIFIED ON GROUND EQUIPMENT AND SUCCESS FULLY IMPLEMENTED ON MD 73. EXPERIMENT OPERATIONS SATISFACTORY MD 74, AND MD 75. CLOSED.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
181 DOY 021	H-ALPHA 1 APERTURE DOOR NOT CLOSING PROPERLY. (DISCREPANCY). REF: AX-2888.	S&M/EUDY EPS/WOOSLEY ATM.EXP/ WHITE	DOOR DISABLED AND RE-ENABLED BY GROUND COMMAND AND PROPER OPERATION RESULTED. DOOR FAILED TO OPEN AUTOMATICALLY ON DOY 025 BUT DID OPEN AFTER CREWMAN RE-ENABLED IT. OPERATION WAS SATISFACTORY TO COMPLETE THE MISSION. CLOSED.
182 DOY 015	DEGRADATION OF H-ALPHA 1 TV IMAGE. (DISCREPANCY). REF: AR-1039; AR-1050.	ATM.EXP/ WHITE	PROBLEM IS WITH VIDICON, CREW TURNS OFF WHEN NOT IN USE. CLOSED.
183 DOY 022	APPARENT FAILURE OF H-ALPHA 1 FRAMES REMAINING COUNTER. (DISCREPANCY).	EPS/WOOSLEY ATM.EXP./ WHITE	NO CORRECTIVE ACTION POSSIBLE. CAMERA OPERATES PROPERLY; RECOMMEND OPERATION BE CONTINUED. FILM USAGE WILL BE ESTIMATED DAILY. CLOSED.
184 DOY 029	FAILURE OF ONE OF TWO ELEMENTS IN WMC WATER HEATER. (DISCREPANCY).	S&M/EUDY	ONE OF THE TWO PARALLEL HEATING ELEMENTS HAS OPENED, A FAILURE MODE OBSERVED DURING QUAL TESTS. A SPARE IS AVAILABLE IF NEEDED. CLOSED.
185 DOY 031	WATER IN SHOWER BLOWER. (DISCREPANCY).	S&M/EUDY	TWO OTHER BLOWERS ARE AVAILABLE IF THE CREW DECIDES SHOWERS ARE DESIRABLE BEFORE THE END OF THE MISSION. THEY ARE THE VACUUM CLEANER AND THE SUIT DRYING STATION. CLOSED.
186 DOY 034	SPT'S SUIT WATER QD LEAKED DURING EVA DOY 034. (DISCREPANCY).	ECS/HOPSON	VOID. JSC HARDWARE.
187 DOY 034	CONDENSATE TANK LEAKED TO CABIN PRESSURE AFTER DOY 034 EVA.	ECS/HOPSON	LEAK AT A QUICK DISCONNECT SUSPECTED. QD ON PNL 217 UNMATED AND CAPPED ON DOY 035; THIS EFFECTIVELY STOPPED THE LEAK. CLOSED.

APPENDIX B

PART 1. HOSC INPUT TO FOMR DAILY REPORT

PART 2. FOMR DAILY REPORT

SKYLAB

HOSC INPUT TO FOMR DAILY MISSION REPORT

Reporting Period: 2200 CST Dec 3, to 2200 CST Dec 4, 1973

MSFC Skylab Operations Director

A. MISSION REQUIREMENTS REVIEW STATUS

Mission Day 19 Summary Flight Plan Revision F was executed as planned with no significant deviations.

B. SATURN WORKSHOP SYSTEMS PERFORMANCE

1. EREP pass 10 was performed using a new approach to the Z local vertical (ZLV) attitude maneuver. The vehicle was in the ZLV attitude from one orbit noon until the next noon. Thruster Attitude Control System (TACS) usage was 158 pound-seconds.

2. Verification of an Apollo Telescope Mount Digital Computer (ATMDC) patch to ramp in Control Moment Gyro (CMG) gimbal rate commands is in progress. The patch is intended to relax bearing loads on the CMG's during dump maneuvers and EREPS.

3. Some problems have been experienced during DOY 338 with teleprinter messages being either too light or fading. This was first reported after the crew changed the teleprinter paper which was low. After several attempts to clear the problem using the new paper, both paper and cartridge were replaced. Messages were then reported to be readable but lighter than normal. The crew then tightened the four calfax fasteners on the cartridge and reported at 339:02:27 that the first part of the message had gaps and then improved. Investigation of the problem is continuing.

C. EXPERIMENT SYSTEMS PERFORMANCE

1. Apollo Telescope Mount Experiments

   a. The Hydrogen-Alpha 1 heat rejection window temperature was observed to increase from 63 degrees F at 337:12:00 to

82 degrees F at 338:02:00. The thermal shield door was open most of the time during the observed increase in temperature. At approximately 338:04:00 the thermal shield door was closed and the window temperature dropped to approximately 67 degrees F in approximately 5 hours. The temperature will be monitored closely for the next few days to insure that a problem does not exist. Similar conditions existed on DOY's 235 and 263 and were attributed to the thermal shield door being open.

b. The crew reported that the S082A (Extreme Ultraviolet Spectroheliograph) door failed to open at sunrise around 338:23:44. The door ramp latch assembly was removed during EVA on DOY 236. Satisfactory Door Operation was restored by ground command using two motor operation.

2. Corollary Experiments

Corollary Experiment Operations were as expected.

SKYLAB PROBLEM TRACKING LIST--MSFC 12/04/73 TIME (GMT)339:04:00

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
145. DOY 321	ATM C&D COOLANT LOOP FLOW ERRATIC WITH PUMP B IN LOOP. (DISCREPANCY) REF: AR-913, MPR 266-M-138, AR-914, SWS-2342, AR-936	ECS/LITTLES	LOOP FLOW ON PUMP C HAS BEEN SIMILAR TO FLOW ON PUMP B SINCE PUMPS SWITCHED ON DOY 336. MSFC HAS RECOMMENDED THAT LOOP REMAIN ON PUMP C WITH EREP VALVE IN FLOW POSITION. MSFC ALSO RECOMMENDS NO FILTER CHANGE. PRESENT FLOW RATE ADEQUATE TO MEET COOLING REQUIREMENTS.
146. DOY 327	CONTROL MOMENT GYRO NO. 1 FAILURE (ANOMALY) REF: AR-923, SWS-2307, SWS-2333, SWS-2338, SWS-2357, AR-929, AR-932, AR-942, SWS-2414	STAC/CHUBB ATM TCS/ VANIMAN	1 CMG CONTROL BEING UTILIZED. FLT. PROG. PATCH BEING VERIFIED TO PROVIDE CMG GIMBAL RATE AND ACCELERATION LIMITS DURING OR WITHIN 200 SEC OF A GG DUMP.
151. DOY 333	SPEAKER INTERCOM ASSEMBLY FAILURE (NO. 131) IN THE MDA. (DISCREPANCY) REF: AR-931	I&C/ADAIR	REPLACED WITH THE ONE REMAINING ON-BOARD SPARE ON DOY 334. RECOMMEND FAILED SIA BE PUT ON RETURN STOWAGE LIST FOR POST MISSION FAILURE ANALYSIS. CLOSED

CONSUMABLES STATUS

WATER REMAINING (LBS)*	3,225	at	10:04:00
DAILY WATER USED (LBS)	29		
O_2 REMAINING (LBS)	3,533	at	10:04:00
DAILY O_2 USED (LBS)	11		
N_2 REMAINING (LBS)	740	at	10:04:00
DAILY N_2 USED (LBS)	0		
TACS REMAINING (LB-SEC)	27,259	at	10:04:00
DAILY TACS USED (LB-SEC)	158		

* WATER REMAINING IS USABLE WATER AND IS BASED UPON ACTUAL LOADED WEIGHTS.

Date Distributed: December 5, 1973

SKYLAB

DAILY MISSION REPORT NO. 19

Reporting Period: 2200* day 337 to 2200 day 338,
10:00 p.m., Dec. 3, 1973, to 10:00 p.m.,
Dec. 4, 1973.

Approved /s/ Jay F. Honeycutt
FOMR Manager

Approved /s/ Frank C. Littleton
JSC Senior Representative

Approved /s/ Axel Rothe
MSFC Senior Representative

*Times are local Houston throughout, unless otherwise noted.

A. MISSION STATUS

One Earth Resources Experiment Package pass was accomplished today using the technique of maneuvering to and from Z-local vertical at orbit noon. Only 158 pound-seconds of thruster attitude control propellant was used. Subsequent Earth Resources Experiment Package passes will use this same maneuver technique when possible.

During the Earth Resources Experiment Package pass, the S190A (Multispectral Photographic Facility) cameras malfunctioned . All six malfunction lights came on when data take was initiated, even though the preparatory checks seemed satisfactory. Onboard malfunction procedures did not correct the problem and data was not obtained for the pass. The other Earth Resources Experiment Package instruments operated nominally later in the day, a new malfunction procedure was uplinked and exercised. All elements of the experiment system functioned correctly except the forward motion compensation. The circuit breaker for this component would not stay latched. This is under study and will be reported to the Flight Management Team.

Other planned experiments and housekeeping operations were performed as scheduled.

Command and service module fuel cells were shutdown and power transfer accomplished.

The Mark I crew exercise device malfunctioned and a corrective procedure is being prepared.

The crew is in good health.

B. ACCOMPLISHED TODAY

1. EXPERIMENTS

a. Apollo Telescope Mount:

Manned hours today: 4 hours 50 minutes

COMMENTS:

Routine synoptic data and data on the active region 87/92 complex during limb transit were taken. One anomaly was experienced when the S082A (Extreme Ultraviolet Coronal Spectroheliograph) door failed to open on daylight cycle 285. Both motors were inhibited and reenabled. The door subsequently opened and closed successfully when commanded.

b. Earth Resources Experiment Package:

Pass No: 10 (Eighth pass this mission)

Revolution No. 2946

Data take start, longitude: 151.1°W

Data take end, longitude: 89.1°W

Initial data acquisition for tasks: 1

Mandatory task-site objectives met: 3

Task-site objectives completed: 3

Other task-site objectives met: 9

Earth Resources Experiment Package aircraft operations: (Passes 10)

Sites requiring aircraft data: 0

Accomplished: 0

Sites pending: 1 (1 site accomplished today).

COMMENTS:

The eighth Earth Resources Experiment Package pass of this mission was performed over track 6. Data were obtained from the Pacific Ocean west of Seattle, Washington, through Mexico and into South America.

c. Biomedical Experiments:

(1) M071 (Mineral Balance):

The daily measurements were taken on each crewman (Functional Objectives 1 through 5).

(2) M073 (Bioassay of Body Fluids):

The daily sample was taken from each crewman (Functional Objective 1).

(3) M092 (Lower Body Negative Pressure):

This experiment was performed today on the Pilot (Functional Objective 5).

(4) M093 (Vectorcardiogram):

This experiment was performed today on the Pilot (Functional Objective 5).

(5) M171 (Metabolic Activity):

This experiment was performed on the Pilot (Functional Objective 3).

(6) M131 (Human Vestibular Function):

This experiment was performed on the Commander (Functional Objective 3).

d. Corollary Experiments:

(1) T003 (Inflight Aerosol Analysis):

Pre-sleep and post-sleep readings at crew station 11 were obtained (Functional Objective 2, which continues daily throughout the mission).

(2) M487 (Habitability/Crew Quarters):

Photographs of Waste Management Compartment Activity and Personal Hygiene were obtained (Functional Objective 17).

(3) T053 (Earth Laser Beacon Assessment):

Functional Objective 5 was accomplished.

(4) S233 (Kohoutek Photometric Photograph):

The scheduled comet photographs were obtained (Functional Objectives 23 and 24).

(5) S019 (Ultraviolet Stellar Astronomy):

Functional Objective 2 was accomplished.

2. SYSTEMS/OPERATIONAL DETAILED TEST OBJECTIVES

a. Operational Radiation Measurements - DTO 20.11:

Van Allen Belt dosimeter, electron-proton spectrometer, and personal radiation dosimeter data were obtained (Functional Objective 19).

b. Gypsy Moths - DTO 20.30:

Daily observation of the eggs to detect hatching was continued (Functional Objective 2). No hatching has occurred.

c. Iodine Monitoring - DTO 20.17:

Functional Objective 3 was accomplished.

3. STUDENT INVESTIGATIONS

ED-63 (Cytoplasmic Streaming):

The plants were observed (Functional Objective 2) and are apparently dead.

4. SCIENCE DEMONSTRATIONS

None performed.

C. FLIGHT CREW STATUS

The crew remains in good health. The Pilot's M092 (Lower Body Negative Pressure) run was completed without difficulty.

D. HARDWARE STATUS

1. JOHNSON SPACE CENTER

a. Command and Service Module:

All systems performed nominally. The power transfer from the command and service module fuel cell to the Orbital Workshop was completed satisfactorily.

b. Experiments:

The S190A (Multispectral Photogrphic Facility) cameras failed to operate during todays Earth Resources Experiment Package pass.

c. Government Furnished Equipment:

Equipment performance was nominal, except for the Mark I exerciser.

2. MARSHALL SPACE FLIGHT CENTER

a. Saturn Workshop Systems Performance:

(1) Earth Resources Experiment Package pass 10 was performed using a new approach to the Z local vertical attitude maneuver. The vehicle was in the Z local vertical attitude from one orbit noon until the next noon. The thruster attitude control system usage was 158 pound-seconds.

(2) Verification of an Apollo Telescope Mount digital computer patch to ramp in control moment gyro gimbal rate command is in progress. The patch is intended to relax bearing loads on the control moment gyro's during dump maneuvers and Earth Resources Experiment Package passes.

(3) Some problems have been experienced during day-of-year 338 with teleprinter messages being either too light or fading. This was first reported after the crew changed the teleprinter paper which was low. After several attempts to clear the problem using the new paper, both paper and cartridge was replaced. Messages were then reported to be readable but lighter than normal. The crew then tightened the four calfax fasteners on the cartridge and reported at 339/02:27 that the first part of the message had gaps and then improved. Investigation of the problem is continuing.

b. Experiment Systems Performance:

(1) Apollo Telescope Mount Experiments:

(a) The Hydrogen-Alpha 1 heat rejection window temperature was observed to increase from 63 degrees Fahrenheit at 337/12:00 to 82 degrees Fahrenheit at 338/02:00. The thermal shield door was open most of the time during the observed increase in temperature. At approximately 338/04:00 the thermal shield door was closed and the window temperature dropped to approximately 67 degrees Fahrenheit in approximately 5 hours. The temperature will be monitored closely for the next few days to insure that a problem does not exist. Similar conditions existed on day-of-year 235 and 263 and were attributed to the thermal shield door being open.

(b) The crew reported that the S082A (Extreme Ultraviolet Spectroheliograph) door failed to open at sunrise around 338/23:44. The door ramp latch assembly was removed during an extravehicular activity on the second visit (day-of-year 236). Satisfactory door operation was restored by ground command using two motor operation.

(2) Corollary Experiments:

Corollary experiment operations were satisfactory.

E. CONSUMABLES STATUS

Consumable	Used	Remaining
Water, pounds	29	3225
Oxygen, pounds	11	3533
Nitrogen, pounds	0	740
Thruster attitude control system propellant, pound-seconds	158	27,259

F. TELEVISION STATUS

Telecast TV-28 of Scientist Pilot discussing of Apollo Telescope Mount procedures and techniques was performed.

G. ITEMS FOR FLIGHT MANAGEMENT TEAM

190A (Multispectral Photographic Facility) camera status.

SKYLAB PROBLEM TRACKING LIST--MSFC

TIME (GMT) 339:04:00

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
145. DOY 321	ATM C&D COOLANT LOOP FLOW ERRATIC WITH PUMP B IN LOOP. (DISCREPANCY) REF: AR-913, MPR 266-M-138, AR-914, SWS-2342, AR-936	ECS/ LITTLES	LOOP FLOW ON PUMP C HAS BEEN SIMILAR TO FLOW ON PUMP B SINCE PUMPS SWITCHED ON DOY 336. MSFC HAS RECOMMENDED THAT LOOP REMAIN ON PUMP C WITH EREP VALVE IN FLOW POSITION. MSFC ALSO RECOMMENDS NO FILTER CHANGE. PRESENT FLOW RATE ADEQUATE TO MEET COOLING REQUIREMENTS.
145. DOY 327	CONTROL MOMENT GYRO NO. 1 FAILURE (ANOMALY) REF: AR-923, SWS-2307, SWS-2333, SWS-2338, SWS-2357, AR-929, AR-932, AR-942, SWS-2414	STAC/CHUBB ATM TCS/ VANIMAN	1 CMG CONTROL BEING UTILIZED. FLT. PROG. PATCH BEING VERIFIED TO PROVIDE CMG GIMBAL RATE AND ACCELERATION LIMITS DURING OR WITHIN 200 SEC OF A GG DUMP.
151. DOY 333	SPEAKER INTERCOM ASSEMBLY FAILURE (NO. 131) IN THE MDA. (DISCREPANCY) REF: AR-931	I&C/ADAIR	REPLACED WITH THE ONE REMAINING ON-BOARD SPARE ON DOY 334. RECOMMEND FAILED SIA BE PUT ON RETURN STOWAGE LIST FOR POST MISSION FAILURE ANALYSIS. CLOSED

SKYLAB PROBLEM TRACKING LIST--

TIME (GMT)_____

NO.	DESCRIPTION	ACTION ASSIGNED TO	ACTION PROGRESS
	No change to problem tracking list.		

APPROVAL

MSFC SKYLAB OPERATIONS SUPPORT SUMMARY

by

James R. Martin

The information in this report has been reviewed for security classification. Review of any information concerning Department of Defense or Atomic Energy Commission programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.

This document has also been reviewed and approved for technical accuracy.

Walton G. Clarke
WALTON G. CLARKE
Manager, Operations Engineering Office

REIN ISE JUN 17 1974
Skylab Program Manager

F. Fletcher Kurtz
FLETCHER KURTZ
Manager, Mission Operations Office