I-MRD-001G
VOLUME IV

MISSION REQUIREMENTS

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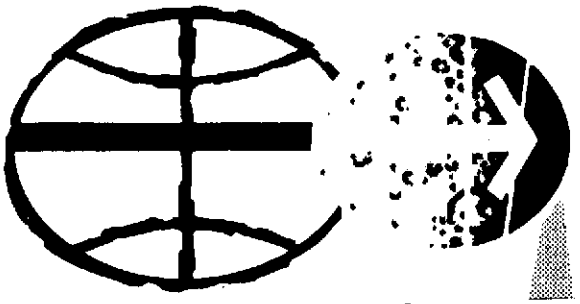

GEORGE C. MARSHALL SPACE FLIGHT CENTER
HUNTSVILLE, ALABAMA

AUGUST 24, 1973

SKYLAB RESCUE MISSION
SL-R

National Aeronautics and Space Administration NASA

I-MRD-001G
VOLUME IV

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SL-R

August 24, 1973

SKYLAB PROGRAM OFFICES
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
JOHNSON SPACE CENTER
AND
MARSHALL SPACE FLIGHT CENTER

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DOCUMENT CHANGE RECORD

Document Title:	Mission Requirements, Skylab Rescue Mission, SL-R
Basic Document No.:	I-MRD-001E, Volume IV
Basic Issue Date:	May 17, 1972

Change 1 — November 1, 1972

Changed to incorporate more detailed Skylab Rescue Vehicle Launch Readiness response times and to supply data previously shown as TBS or TBD in the basic document. This change incorporates CCBD 2X1179/800-72-1304 (SCN 28).

Revision F — May 1, 1973 (No. Changed to I-MRD-001F)

Revised to incorporate CCBD 3X0410/800-73-0411 (SCN 67) and CCBD 3X0428/800-73-0425 (SCN 79). This document supersedes and replaces I-MRD-001E, Volume IV, dated May 17, 1972.

Revision G — August 24, 1973 (No. Changed to I-MRD-001G)

Revised to incorporate CCBD 3X0574 (SCN 139). This document supersedes and replaces I-MRD-001F, Volume IV, dated May 1, 1973.

CONTENTS

TABLES

ILLUSTRATIONS

NOMENCLATURE

AM	Airlock Module
APCS	Attitude and Pointing Control System
ATM	Apollo Telescope Mount
β	Minimum angle between the earth-sun line and the vehicle orbital plane. When viewing orbital plane from direction of sun, β is positive if apparent vehicle motion is counterclockwise and negative if apparent vehicle motion is clockwise.
CM	Command Module
CMG	Control Moment Gyro
COAS	Crewman Optical Alignment Sight
CSM	Command Service Module
ECS	Environmental Control System
ERD	Experiments Requirements Document
EREP	Earth Resources Experiment Package
ESE	Experiment Support Equipment
ETC	Earth Terrain Camera
EVA	Extravehicular Activity
FMAD	Flight Missions Assignment Directive
FMR	Flight Mission Rules
FPR	Flight Performance Reserve
FSP	Flight Scheduling Precedence
GCM	Growth Curve Module
H_a	Height of Apogee
IMSS	In-Flight Medical Support System
IMU	Inertial Measurement Unit
JSC	Johnson Space Center
LMR	Launch Mission Rules
LV	Launch Vehicle
MCC	Mission Control Center
MD	Mission Day
MDA	Multiple Docking Adapter
MOR	Mission Operations Report
MRD	Mission Requirements Document

MRG	Mission Rules Guidelines
MSFC	Marshall Space Flight Center
N/A	Not Applicable
NASA	National Aeronautics and Space Administration
NC1	Phasing Adjustment Maneuver
NM	Nautical Mile
OA	Orbital Assembly
OMSF	Office of Manned Space Flight
OWS	Orbital Workshop
PAD	Program Approval Document
PGNCS	Primary Guidance Navigation Control System
PSM	Propellant Storage Module
RCS	Reaction Control System
SL	Skylab
SLPD	Skylab Program Directive
SL-R	Skylab Rescue Mission
SM	Service Module
SPS	Service Propulsion System
SWS	Saturn Workshop
TBD	To Be Determined
TBS	To Be Supplied
TPI	Terminal Phase Initiation
VHF	Very High Frequency
VTS	Viewfinder Tracking System
X-IOP/Z	Solar Inertial Attitude (See Note: 2, Page 2-3)

FLAG SHEET

MISSION REQUIREMENTS DOCUMENT

SL-R

The purpose of the flag sheet is to identify portions of the Mission Requirements Document (MRD) which are affected by either approved changes or changes pending approval.

A. Included in this change are baseline requirements for experiment data return for a rescue of SL-3, and also updated rendezvous information for rescue of SL-3.

B. All weight reflected in Section 2.3.4.4, except those for medical contents of the IMSS, fecal/vomitus material, and those for Experiment SO15, were derived from Reference 4.

C. Section 2.3.4.5 Experiment Data Stowage Guidelines for Rescue of the SL-4 Crew will be baselined after completion of the SL-3 mission.

1.0 INTRODUCTION

1.1 BACKGROUND

The Skylab (SL) Program objectives are to extend the duration of manned space flight and to carry out a broad spectrum of experimental investigations. Of particular importance are a series of medical experiments associated with the extension of manned space flight, a series of high resolution solar astronomy experiments at the short wavelengths not directly observable from the surface of the earth, and a series of earth survey experiments.

The Skylab Program includes three low earth orbit missions designed to support these objectives. These missions are designated SL-1/SL-2, SL-3 and SL-4. In addition to the three nominal Skylab missions, the program includes the Skylab Rescue Mission (SL-R). The SL-R mission is designed to provide a safe return of the Skylab crew in the event the Command Service Module (CSM) becomes disabled while docked to the Saturn Workshop (SWS). This volume contains mission requirements for the SL-R mission only. The Skylab SL-1/SL-2, SL-3 and SL-4 mission requirements are contained in Volumes I, II and III, respectively, of the Mission Requirements Document (MRD).

SL-R mission configuration will be a CSM (modified with a field installed kit) manned by two crewmen launched on a Saturn IB Launch Vehicle. The SL-R CSM will rendezvous and dock with the SWS (or Orbital Assembly [OA], consisting of the SWS and disabled CSM, if the disabled CSM has not previously been jettisoned). The SWS configuration includes a Multiple Docking Adapter (MDA), Apollo Telescope Mount (ATM), Airlock Module (AM), and an S-IVB stage (modified as an Orbital Workshop [OWS]), previously launched and inserted into orbit on a two-stage Saturn V Launch Vehicle for the SL-1/SL-2 mission.

1.2 SCOPE AND PRECEDENCE

The MRD is prepared in accordance with NASA Headquarters, Office of Manned Space Flight (OMSF), directives and Skylab specification documents as listed in NASA Headquarters Program Directive No. 43C, M-D ML3200.125, dated May 1, 1973 and Cluster Requirements Specification No. RS003M00003, dated August 8, 1969 (References 1 and 2, respectively). The MRD defines mission requirements and functional and performance requirements for implementing the program and mission purposes specified therein. The scope of this MRD volume is the definition of mission operational requirements for the SL-R mission.

The MRD shall provide the basis for mission planning and design by all elements of the Skylab Program. In the event of conflict between the MRD and other mission planning documentation, the MRD shall govern with respect to mission objectives and requirements.

The relationship of the MRD with other program documentation is depicted in Figure 1-1, Skylab Mission Documentation. Performance and design requirements for cluster systems to implement mission requirements are contained in the Cluster Requirements Specification (Reference 2).

Many subsidiary mission documents must be prepared to implement the requirements of this MRD. These documents may expand on, but must not conflict with the contents of the MRD.

1.3 PUBLICATION AND REVISIONS

1.3.1 Publication

Development of the MRD is the joint responsibility of the Skylab Program Offices at the Johnson Space Center (JSC) and the Marshall Space Flight Center (MSFC). Preparation and coordination of this document will be performed under the cognizance of the Mission Requirements Panel with approval and sign-off by both program managers.

1.3.2 Revisions

The document will be revised as required to provide necessary guidelines for supporting activities. All revisions will be handled in the same manner as the basic document and will require joint sign-off by the Skylab Program managers at both the JSC and MSFC.

Requests for changes to the document shall be submitted to either of the Co-chairmen, Mission Requirements Subpanel (P.H. Allen, JSC/KM; R. A. Marmann, MSFC/SL-EI).

1.3.3 Distribution

Distribution of this document is controlled by the Skylab Program Offices at JSC and MSFC. Requests for additions, deletions, or other changes to the distribution list should be forwarded to respective personnel as stated in Paragraph 1.3.2 above. Requests for additions by NASA personnel should be coordinated through their Division (or equivalent) office.

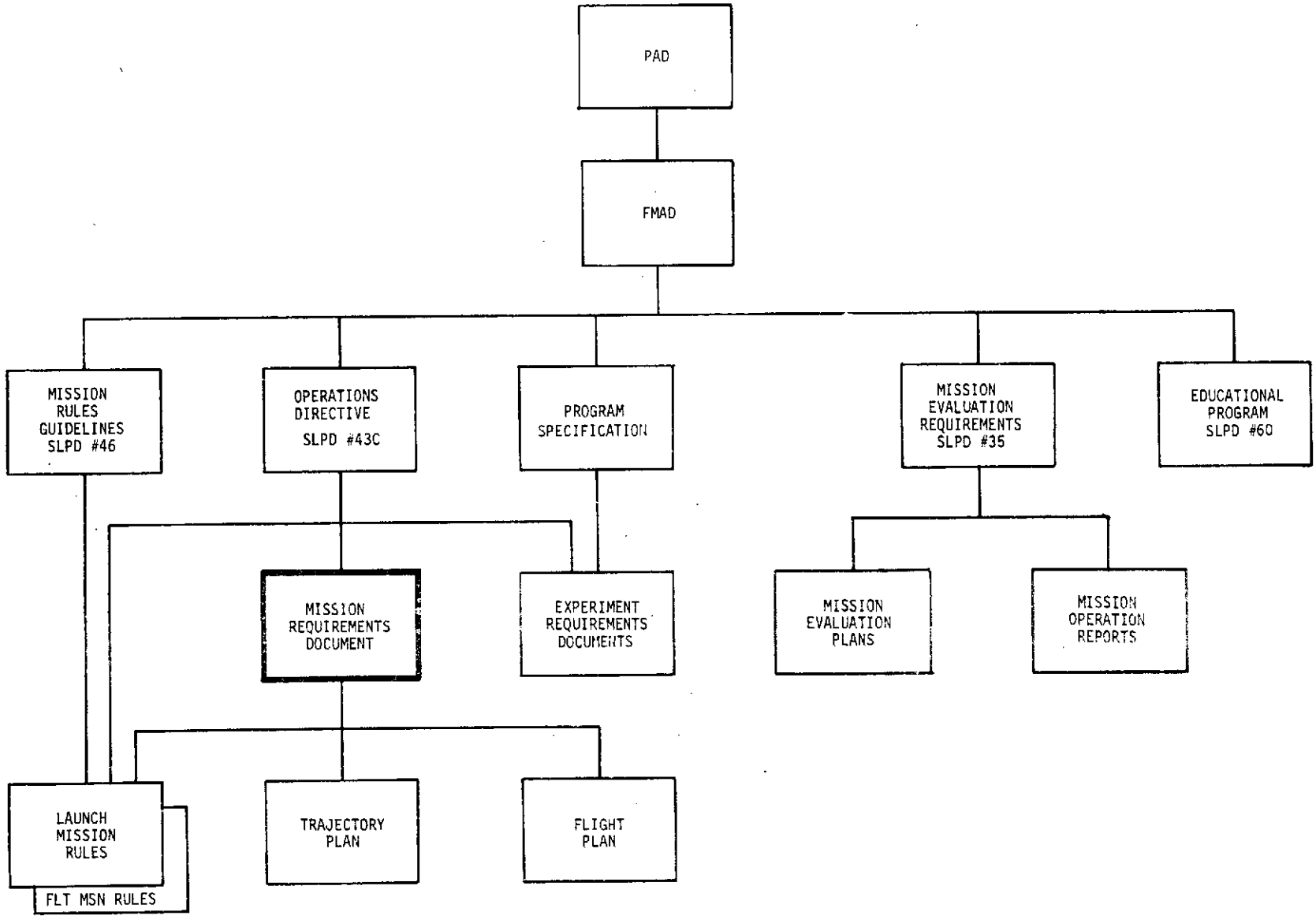


Figure 1-1. Skylab Mission Documentation

2.0 SKYLAB RESCUE MISSION SL-R

2.1 MISSION DEFINITION

The SL-R mission is a contingency mission designed to provide for the safe return to earth of the Skylab crew in the event the docked SL-2, SL-3 or SL-4 CSM should be rendered unusable for a safe return. The SL-R mission will utilize the next-in-line CSM and the corresponding Saturn IB Launch Vehicle as the rescue vehicle for the SL-1/SL-2 or SL-3 crew. The backup CSM and Saturn IB will be used as the rescue vehicle for the SL-4 crew.

The in-line and backup CSM/Launch Vehicle System shall continue in a normal state of launch readiness preparations for the nominal mission until a decision is made to proceed with SL-R space vehicle preparation; then, total systems preparations for launch readiness shall be conducted according to an accelerated schedule. For the in-line mission vehicle, the rescue field modification kit would be installed upon receipt of the rescue call; for the backup CSM (CSM 119)/Launch Vehicle (LV 209), the kit would be installed during the planned test and checkout flow. The SL-R CSM will be launched with two crewmen, rendezvous and dock with the SWS, retrieve the Skylab crew during the short duration docked period, and return safely to earth with five crewmen. The mission will terminate with recovery of the five Skylab crewmen. Prior to undocking and if circumstances permit, the crew will configure the SWS for use on a subsequent mission.

2.2 MISSION PURPOSE

The purpose of the SL-R mission will be a safe return of the crew in the event the CSM becomes disabled while docked to the SWS. Without compromising the above, planning should consider accomplishment of the following (relative priority is not implied in the order of listing):

a) Return selected experiment payload data

b) Perform a diagnosis of the CSM failure

c) Configure the SWS for revisit

2.3 MISSION REQUIREMENTS

2.3.1 Mission Profile Requirements

2.3.1.1 Launch Date

The CSM/Launch Vehicle (LV) system including CSM 119 and LV 209 shall continue in a normal state of launch readiness preparations for the nominal Skylab mission until a decision is made to proceed with preparation of the SL-R mission; then, modification of the CSM and total systems preparation for launch readiness shall be accelerated to the maximum extent practical. All necessary planning shall be accomplished to support implementation of the accelerated rescue preparations at any time after the nominal mission launch. The following times from rescue alert to rescue vehicle launch readiness shall be used for mission planning:

Days from SL Mission Launched	Days to SL-R Ready to Rescue Launch for SL-2	SL-3*	SL-4
0	48 1/2		48 1/2
7	41		41
14	36 1/2		36
21	31 1/2	32	31 1/2
28	25	25	26
35	---	18	19 1/2
44	---	9	15
49	---	9	15
56	---	9	12 1/2

2.3.1.2 Launch Planning

The rescue vehicle launch opportunities will be planned to provide an early (M = 5, 6 or 7) rendezvous capability and, if required, launch vehicle flight performance reserve (FPR) may be used for yaw steering and/or apogee height (h_a) adjustment.

2.3.1.3 Launch Complex

The rescue vehicle will be launched from Complex 39B at Kennedy Space Center (KSC).

2.3.1.4 Insertion Altitudes

The SWS will have been previously inserted into a circular orbit of approximately 237 NM (measured above the mean equatorial reference radius) by a Saturn V Launch Vehicle.

The SL-R CSM will be nominally inserted into an 81- by 120 NM orbit (measured above the mean equatorial reference radius) by a Saturn IB Launch Vehicle, however, h_a may be adjusted.

2.3.1.5 Orbital Inclination

Mission planning shall be based on a northerly launch azimuth.

The rescue CSM will be targeted for rendezvous with the SWS orbiting at a planned orbital inclination of 50 degrees.

2.3.1.6 Rendezvous and Docking

SL-R mission planning shall provide the capability for two options with respect to rendezvous and docking: 1) disabled CSM jettisoned and 2) disabled CSM retained. The selection of the appropriate option will be based on the actual rescue situation.

* Rescue launch readiness revised to reflect current planning as of 8/16/73.

2.3.1.6.1 Disabled CSM Jettisoned

a) Rendezvous

The rendezvous phase of the SL-R mission shall be similar to the nominal Skylab mission rendezvous for docking at the MDA axial port.

The disabled CSM will be jettisoned within 30 degrees of orbital noon with the SWS in the solar inertial (X-IOP/Z) (see following note) attitude. For the actual SL-R mission, a real-time decision of when to jettison will be made based on the specific situation.

b) Docking

Axial docking of the CSM SL-R vehicle shall be performed in the X-IOP/Z attitude and in accordance with the nominal Skylab docking procedures and requirements.

NOTE:

X-IOP/Z: The solar inertial attitude is defined as the principal OA X axis in the orbital plane with the Z axis coincident with the sun line. The -Z axis points directly toward the sun and, at orbital noon, the +X axis is in the direction of the velocity vector. (The OA coordinate system is illustrated in Figure 2-1). The X-IOP/Z mode includes Control Moment Gyro (CMG) desaturation maneuvers performed each orbit on the "night" side of the orbit.

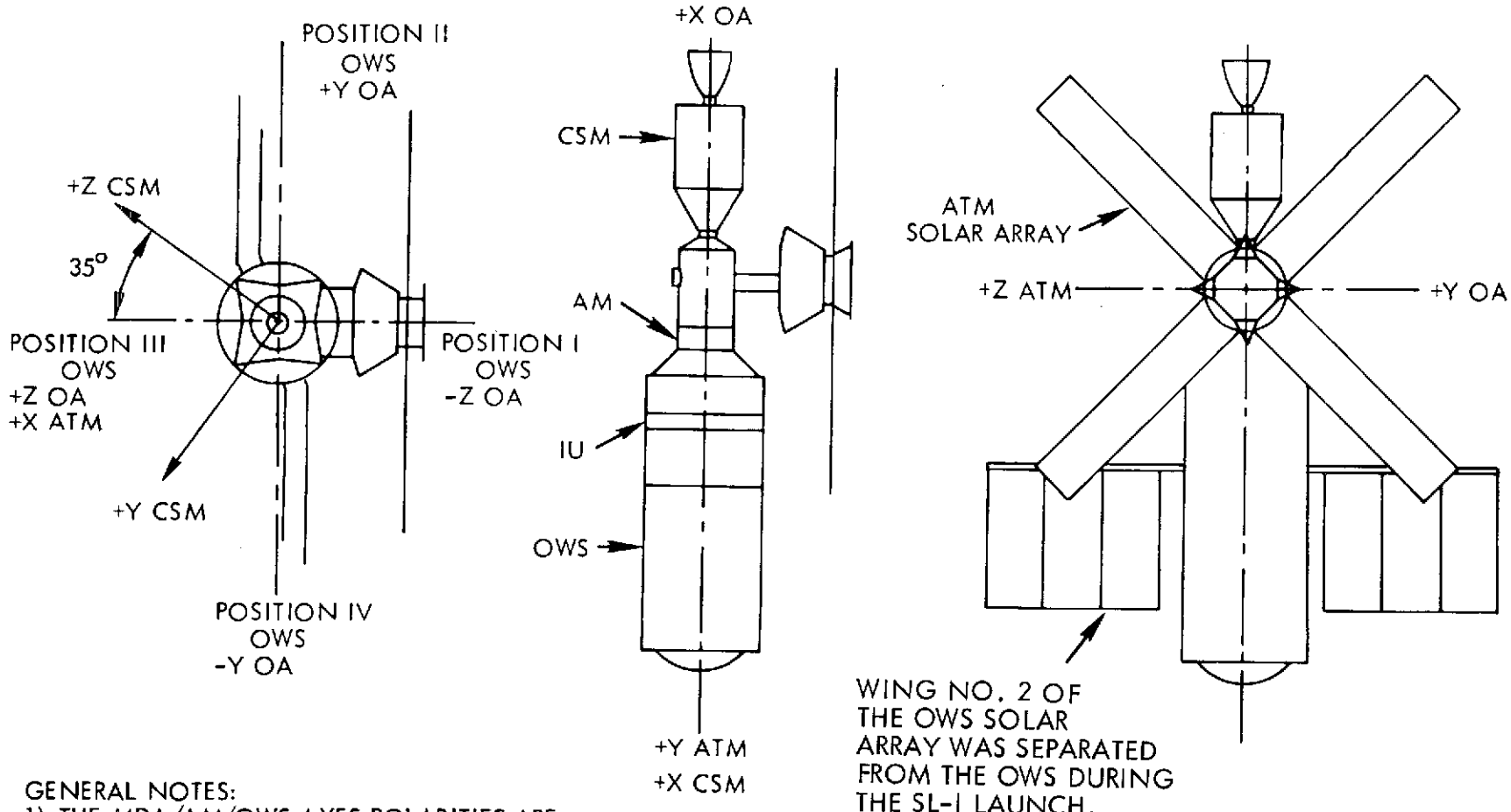
2.3.1.6.2 Disabled CSM Retained

a) Rendezvous

The rendezvous phase of the SL-R mission shall be similar to the nominal Skylab mission rendezvous for docking at the MDA axial port.

b) Docking

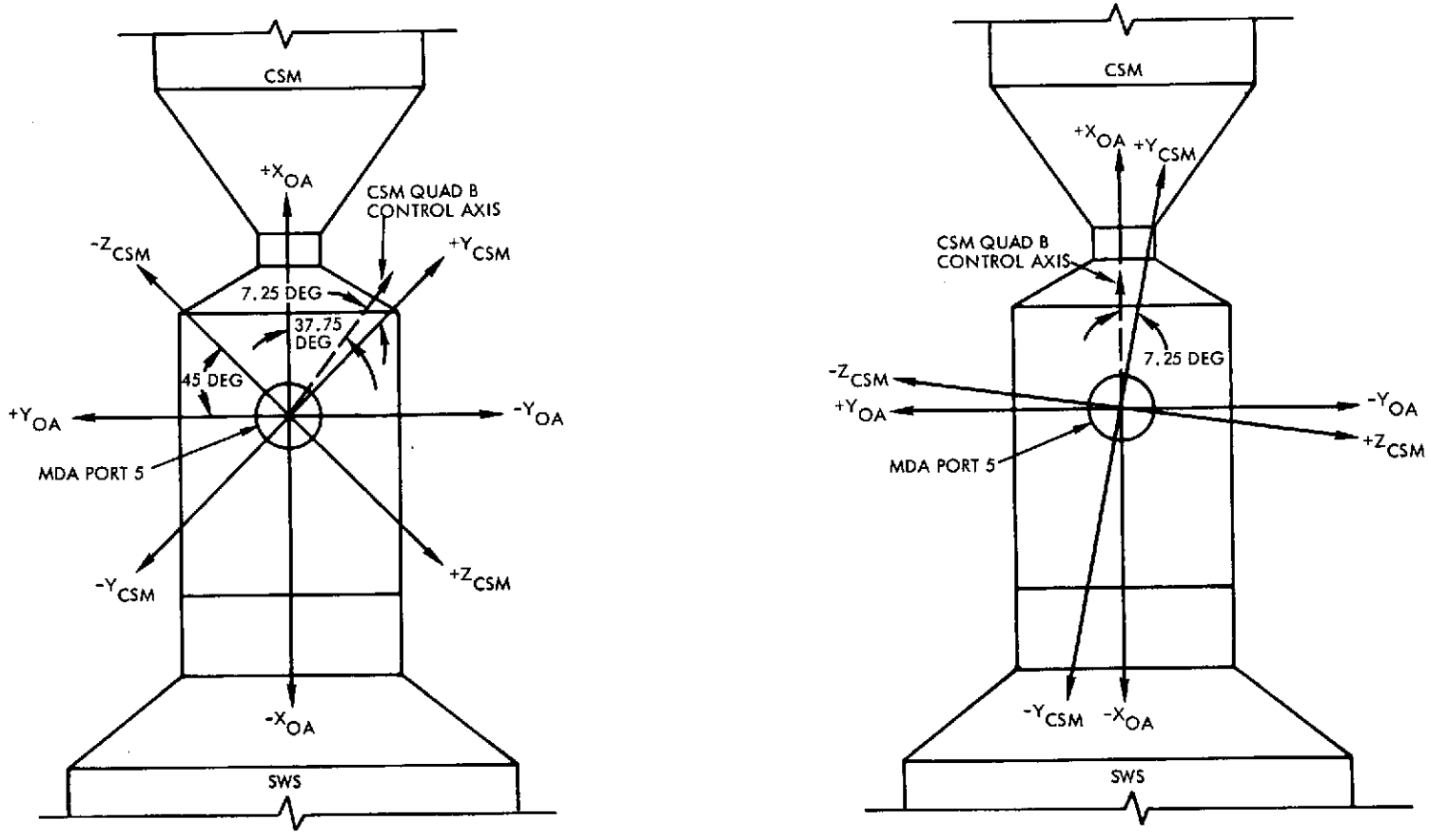
For docking at the radial port, the SWS Attitude and Pointing Control System (APCS) will be commanded to roll the OA 45 degrees clockwise (viewed in the OA +X axis direction) from the X-IOP/Z attitude beginning 10 minutes prior to orbit noon and lasting approximately 30 minutes. This roll position shall be maintained through completion of radial docking in order to provide the proper lighting for the rescue CSM; then, the APCS shall maneuver the OA back to the X-IOP/Z attitude. (The OA radial docked configuration is illustrated in Figure 2-2.)



GENERAL NOTES:

1) THE MDA/AM/OWS AXES POLARITIES ARE THE SAME AS THOSE SHOWN FOR THE OA.
2) THE OA Y AND Z AXES POLARITIES FOR DYNAMIC BODY AXES ARE THE REVERSE OF THOSE SHOWN.
3) THE PURPOSE OF THIS SCHEMATIC IS TO ILLUSTRATE AXES SYSTEMS ONLY.

Figure 2-1. Skylab Orbital Assembly Configuration (Mass Properties Axes System)



GENERAL NOTES:

1) THE $+Z_{OA}$ AXIS IS OUT OF THE MDA PORT 5.
2) THE $+X_{CSM}$ AXIS IS INTO MDA PORT 5.
3) THE FINAL HARD DOCK ORIENTATION IS ILLUSTRATED AFTER A 37.75 DEGREE COUNTERCLOCKWISE ROTATION

Figure 2-2. Skylab Orbital Assembly Radial Docked Configuration (Mass Properties Axes System)

Radial docking shall be accomplished by means of the rescue CSM soft docking at the radial port docking index, performing a roll maneuver to enhance CSM attitude control capabilities, and then hard docking.

The SL-R shall have the capability to damp dynamic attitude transients induced by docking and to maintain the OA in the X-IOP/Z attitude if the APCS were inhibited.

Planning should consider that the docked stay time at either the axial or radial ports shall be of the same duration. The maximum length of time the SL-R CSM may be docked to the MDA radial port shall be 40 hours.

2.3.1.7 Orbital Attitudes

The attitude requirements for the Saturn Workshop are as follows:

a) Prior to CSM rendezvous - X-IOP/Z

b) CSM rendezvous - X-IOP/Z

c) CSM docking - X-IOP/Z (Refer to Section 2.3.1.6.2.b for exception)

d) Docked operations - X-IOP/Z

e) Inertial Measurement Unit alignment - X-IOP/Z

f) CSM undocking - X-IOP/Z

g) SWS stowage - X-IOP/Z

2.3.1.8 Mission Duration

Total nominal mission duration shall be limited to five days from launch to splashdown.

2.3.1.9 Recovery

Recovery shall be similar to the nominal Skylab plan except for unique SL-R requirements due to the return of five crewmen and the uncertainty of the launch day affecting recovery area and lighting. All planned landing areas shall be in water.

2.3.2 Operations Requirements

2.3.2.1 Extravehicular Activity

All extravehicular activity (EVA) periods shall be completed prior to arrival of the rescue CSM. EVA operations shall conform to the nominal Skylab mission EVA requirements.

2.3.2.2 Rendezvous Lighting

Flashing lights on the SWS shall be used during SL-R CSM rendezvous for: (a) acquisition and tracking with the Command Module (CM) sextant to up-date the CSM state vector prior to rendezvous maneuvers; and (b) tracking with the Crewman Optical Alignment Sight (COAS). The lights shall provide continuous coverage through the sextant for a maximum range of 300 NM during darkness.

2.3.2.3 CSM On-Orbit Operation

The rescue CSM shall remain powered up during the docked phase; in the event the peak power loads required would result in low voltages, a descent battery shall supplement the fuel cells.

At least one SL-R crewman shall sleep in the rescue CSM during the docked phase if a sleep period is scheduled.

2.3.2.4 Deorbit Capability

The SM Service Propulsion System (SPS) shall provide the primary deorbit capability for the rescue CSM. The RCS shall provide a backup deorbit capability.

2.3.2.5 Orbital Assembly Attitude Control

Attitude of the cluster during the docked phase shall be X-IOP/Z and attitude control may be maintained with larger than usual attitude deadbands and/or greater than usual propellant consumption permissible.

The APCS shall be the primary system for OA attitude control with a CSM docked to the axial port. OA attitude control shall be attempted with the APCS with two CSM's docked (axial and radial ports) and with one CSM docked to the radial port only; however, the rescue CSM Primary Guidance Navigation and Control System (PGNCS) shall be the primary control system in both of these modes.

2.3.2.6 OA Internal Activities

Provision shall be made for removal of ballast from the rescue CSM, transfer to and stowage in the SWS prior to undocking.

A backup downlink voice capability (assumed axial CSM communications inoperative) shall be provided for communications between MCC-H personnel and crew aboard the OA.

2.3.2.7 ATM Film Retrieval and Stowage

EVA for film retrieval shall be accomplished prior to arrival of the rescue CSM. Any retrieved ATM film stowed in the disabled CSM will be removed prior to jettison of that CSM, and stowed in the SWS. Since only selected portions of this film will be returned by the rescue CSM (see Section 2.3.4), the remaining film will remain stowed in the SWS as candidates for return on a subsequent mission.

2.3.2.8 Budgeting of Electrical Power

Planning shall provide for operation of the rescue CSM fuel cells as outlined in Section 2.3.2.3. There shall be no CSM/SWS electrical interface at the radial docking port.

2.3.2.9 Mission Operational Guidelines

The following operational guidelines are provided for mission planning purposes and are in addition to guidelines provided in other sections of this document:

a) Launch and in-flight rescue planning should minimize deviations from nominal mission planning.

b) The axial docking port of the MDA will be the prime rescue port.

c) The radial docking port of the MDA will be the backup rescue docking port in case the axial port is not usable.

d) Every reasonable effort shall be made to gather data necessary to diagnose the CSM failure.

e) The flight plan for the crew awaiting rescue will be modified to maximize experiment data available for return. Medical experiments, including those that require consumables, will continue at the same intervals as during a nominal mission, if crew and vehicle conditions permit.

f) Propellant Storage Module (PSM) propellants normally reserved for deorbit will be used to complete an off-nominal rendezvous, if required, and provided the SPS is functioning satisfactorily.

g) A disabled docked CSM inspection, if planned, will be performed from the rescue CSM prior to docking.

h) CSM evaporator operation may be performed during docked operations, if required.

i) SL-R mission planning shall preclude exceeding 4.0 g's during a nominal entry.

j) Pre-mission planning shall provide for a five crewman unsuited entry; the capability shall be retained for a five crewman suited entry contingency situation.

k) In the event the disabled CSM cannot be jettisoned, the VHF ranging system shall remain enabled to allow possible acquisition at short ranges.

l) Prior to jettison of the disabled CSM, the Flight Management Team (FMT) will determine what operations and experiment hardware/data onboard the disabled CSM will be transferred to the SWS for stowage. Consideration must be given to those data, etc., which will be candidates for return on a subsequent mission.

2.3.3 Mission Commit Policies and Requirements

The following policies and requirements are repeated verbatim from NASA Headquarters Program Directive 43C:

a) Criteria for initiating a rescue mission shall be included in the Flight Mission Rules of each Skylab mission.

b) The decision to proceed with preparation of the Rescue Mission space vehicle will be made by the Program Director.

c) The decision to initiate the Rescue Mission will be made by Associate Administrator for Manned Space Flight.

2.3.4 Experiment Data Stowage Guidelines

Stowage space designated specifically for the return of experiments data will be provided in two volumes between the two lower couches of the rescue CSM. One volume, the urine specimen return container (which is nominal mission hardware launched aboard the OWS), will be returned at

the location usually occupied by locker A8. The second volume, the SL-R experiment return pallet (rescue kit unique hardware), will be launched and returned in the rescue CSM at the locations usually occupied by lockers A2 and A5. A maximum of 175 pounds of experiment related material will be stowed within the 6.5 to 7.5 cubic feet volume of this pallet (approximately 16 inches wide, 48 inches long, and 18 inches high with a rounded top).

2.3.4.1 Experiment Assignments

Experiment assignments for the nominal missions are specified in the NASA Headquarters Program Directive and are contained in Volumes I, II, and III of the MRD.

2.3.4.2 Experiment Data Return Guidelines

The NASA Headquarters Program Directive 43C has defined guidelines for experiment returns for a rescue mission, and the remainder of this subsection (2.3.4.2) is repeated verbatim from that directive.

The following guidelines are to be used for advance planning and for real-time experiment return selection. The guidelines are divided into two categories; General and Specific. The general guidelines present the approach to be used in the selection of experiment data. The specific guidelines present rules that affect specific experiment groups or specific experiments. For the purpose of the guidelines, the experiment groups are considered to be Medical, ATM, EREP, and Corollary. The Specific Guidelines are considered to be the baseline experiment return package based on nominal experiment accomplishment. The specific rules will be updated after each mission to reflect actual mission accomplishments. In the event of a rescue mission, the Program Director may alter the baseline Specific Guidelines to meet the actual mission and experiment situations. The Program Director will review and approve the experiment data return package.

2.3.4.2.1 General Guidelines

a) Reductions from nominal return affects all experiments.

b) Select data to maximize scientific return with each experiment group rather than maximizing return of single experiments.

c) Selection of data will consider:

   Quantity and quality of data on previous missions; quality of data on the present mission; data return of the present mission by alternate means (telemetry, voice, TV); expected return on any subsequent missions.

d) Experiment data that is not selected for return on a rescue mission will be considered for return on any subsequent missions.

2.3.4.2.2 Specific Guidelines

Guidelines apply to all missions unless otherwise noted.

a) Medical

   1) Select data to maximize information of the status of the crew's health and well being.

2) A nominal weight of 127 lbs. is allowable for urine chiller and contents. The urine chiller will not be returned on a SL-4 rescue if an alternate data return package has a greater scientific return.

3) Up to a nominal weight of 50 lbs. of other medical data will be returned. This will be reduced to 40 lbs. on SL-4.

4) If unable to return ATM film, the 50 and 40 lb. limits above will be increased by 15 lbs.

b) ATM - Up to a nominal weight of 65 lbs. of ATM film will be returned.

c) EREP

1) A nominal weight of 40 lbs. of EREP film and tape shall be returned. On SL-4 this limit is raised by 10 lbs.

If unable to return ATM film, then an additional 15 lbs. of EREP film and tape will be returned.

d) Corollary and Student

1) Corollary and Student Experiment Data will use weight and volume not occupied by the Medical, ATM, and EREP experiment groups.

2) Data will be selected to maximize the number of experiments taken in descending order of FSP.

3) On applicable missions, if unable to return ATM data, S020 data shall be returned.

2.3.4.3 Rescue of the SL-1/SL-2 Crew

This subsection baselines two experiment data return packages using the above defined guidelines. The content of the two packages will be a function of the availability of ATM film for return. Mission planning for rescue of SL-1/SL-2 shall account for both of these packages. The actual rescue return, should SL-R occur, will be developed as a delta to either of these two packages, as necessary, and shall be approved by the FMT.

2.3.4.3.1 Experiment Group Data Return Weight Budgets

The following table summarizes the nominal allowable return weights for each experiment group as defined above:

Experiment Group	Data	Nominal Return Weight (Pounds) W/ATM	Nominal Return Weight (Pounds) W/O ATM	Return Stowage Location
Medical	Urine Container and Contents	127	127	A8
	Other	50	65	Pallet
ATM	Film	65	0	Pallet
EREP	Film, Tape	40	55	Pallet
Corollary/ Student	Various	20	55	Pallet
	TOTAL (Pallet)	175	175	

2.3.4.3.2 Assumptions and Restrictions

The following assumptions and restrictions are subject to verification by subsequent studies and real-time conditions:

a) Data return on the pallet is weight limited rather than volume limited.

b) Data return in the urine container will be limited to that equivalent to a nominal 56-day mission.

c) Selection of return data has not considered special orientation requirements.

d) No allowance has been made for packing aids other than specified normal experiment return containers. Special packing aids (cushions, straps, etc.), if required will subtract from the data return herein specified as applicable to each experiment group.

e) All experiments will be considered completed to the nominal mission baseline requirement. However, feces, vomitus, and urine will be selected in real-time from all such material generated throughout the mission until arrival of the rescue CSM. Experiment M110 blood sampling will be rescheduled to approximate a 56-day mission, except that the fixed blood samples will be processed as close to SL-R launch as possible. A maximum of nine fixed blood samples may be returned (six for a nominal SL-1/SL-2 mission, plus three more drawn close to SL-R launch).

f) Crew logs with the experiment data entries will be returned. Experiment weight allocation for these data, if stowed on the SL-R experiment return pallet, will be a real-time function.

g) The medical experiment data listed as follows does not include urine collection and transfer assemblies (UCTA), contingency urine and fecal collection in the rescue CSM from the rescued crew, or radiation dosimeters (not those of D008) since these are operational items returned whether or not any other experiment data are returned.

2.3.4.3.3 Experiment Group Data Return

The following narrative is summarized in Table 2-1.

a) Medical data will be returned as follows:

1) Urine Specimen Return Container - The weight of the urine return container and contents will be a real-time function of the duration of the wait period prior to the arrival of the rescue CSM. The container has a 56-day capacity which represents a total weight of 127.4 pounds (maximum - container and contents). Contents will include frozen urine for Experiments M071 and M073, and frozen blood for Experiment M110. If the requirement for a rescue mission occurs such that the expected total crew time in orbit will approach or exceed 56 days (i.e., the capacity of the urine specimen return container), special selection of urine samples for ambient return will be required. The urine samples frozen prior to identification of the requirements for the SL-R mission will

Table 2-1. SL-1/SL-2 Experiment Data Return

Experiment Group	Experiment No.*	Item(s) Candidate for Return	Wt. ** (lb)	Return Status W/ATM	Return Status W/O ATM
MEDICAL	M071 M073 M110	Urine specimen return container with contents of frozen urine and blood	127.4 (Max)	X	X
	M071	Fecal and vomitus bundles and return containers	Note 1	X	X
	M131	1 - 16-mm 400-ft film cassette	1.2	X	X
		Otolith goggles and return container	.9	X	X
	M133	Magnetic tape, reels and container	1.1	X	X
	20.16	Potable water sample	.6	X	X
	Note 2	Contents of IMSS			
		M110 whole blood (9 samples max)	<<0.1	X	X
		20.10 microbiology swabs (42 swabs)	1.2	X	X
		20.10 air sampler petri dishes (6 each)	.3	X	X
		Illness microbiology samples (16 swabs max)	.4 (max)	X	X
		TOTAL GROUP RETURN WEIGHT (LB) (NOTE 3)		50	65

Table 2-1. SL-1/SL-2 Experiment Data Return (Continued)

Experiment Group	Experiment No.*	Item(s) Candidate for Return	Wt.** (lb)	Return Status W/ATM	Return Status W/O ATM
ATM	S052	Camera assembly and return container	17.65	X	-
	S054	Cassette and return container	14.40	X	-
	S056	Magazine and return container	14.45	X	-
	Hα1	Film magazine and return container	15.75	X	-
		TOTAL GROUP RETURN WEIGHT (LB)		62.25	0
EREP	S190A	1 set of 6 film cassettes and 2 film containers	11.9	X	-
		2 sets of 6 film cassettes and 4 film containers	23.8	-	X
	S190B	2 ETC film canister assemblies and 2 film canister bags	5.2	X	X
	S191	1 VTS 16-mm 140-ft film magazine and 1 film container	1.2	X	-
		2 VTS 16-mm 140-ft film magazines and 1 film container	2.2	-	X
	S190A S191 S192 S193 S194	2 ESE reels magnetic tape, 2 flange support bands, and 2 tape handling container assemblies	22.2	X	X
		TOTAL GROUP RETURN WEIGHT (LB)		40.5	53.4

Table 2-1. SL-1/SL-2 Experiment Data Return (Continued)

Experiment Group	Experiment No. *	Item(s) Candidate for Return	Wt. ** (lb)	Return Status W/ATM	Return Status W/O ATM
COROLLARY AND STUDENT	S019	Film canister with film, front cover, and return container	14.9	X	X
	S183	Film carousel and return container	7.3	X	X
	Note 4	1 - 16-mm 400-ft film cassette	1.2	-	X
	T003	Filter assembly, log cards, clip, and return container	.4	-	X
	T027/ S073	1 - 16-mm 140-ft film magazine	1.0	-	X
	T025	1 - 35-mm film cassette and cassette container	.3	-	X
	S020	Film magazine, filter, and container	9.0	-	X
	D008	5 passive dosimeters (removed from SL-2 CM)	1.8	-	X
	M555	Crystal growth package and container	9.3	-	X
	M551	Stainless steel specimen and 1 - 16-mm 400-ft film cassette (Note 5)	3.0	-	X
	M553	1 cup with 14 spheres (1 specimen wheel) and container (Note 5)	.4	-	X

Table 2-1. SL-1/SL-2 Experiment Data Return (Continued)

Experiment Group	Experiment No.*	Item(s) Candidate for Return	Wt. ** (lb)	Return Status W/ATM	Return Status W/O ATM
COROLLARY AND STUDENT (CONTINUED)	ED11	Data from EREP	N/A	X	X
	ED12	Data from EREP	N/A	X	X
	ED22	Data from S052	N/A	X	-
	ED23	Data from S019	N/A	X	X
	ED26	Data from S019	N/A	X	X
	ED31	1 - 35-mm film cassette and cassette container	.3	-	X
		15 Petri dishes	1.8	-	X
	ED76	4 detectors and return container	3.0	-	X
	Note 6	16-mm 400-ft film cassette 1.2 lb 16-mm 140-ft film magazine 1.0 lb 35-mm film cassette and cassette container .3 lb	Note 6	-	X
		TOTAL GROUP RETURN WEIGHT (LB)		22.2	56.6
		TOTAL PALLET RETURN WEIGHT ALL GROUPS (LB)		175.0	175.0

Table 2-1. SL-1/SL-2 Experiment Data Return (Continued)

* Corollary and student experiments are arranged in descending order by FSP.

** Weight data derived from Reference 3.

NOTES:

1. Weight of feces and vomitus will be that necessary to bring the "Other" medical data up to 50 lb, or 65 pounds when ATM film not available, after inclusion of M131, M133, 20.16, and contents of the IMSS (see Note 2).
2. Data contents of IMSS returned. Medical data and respective weights are as shown. The maximums apply to a 56-day duration, but may be increased if this time is exceeded. The ED31 petri dishes normally returned in the IMSS are returned as "Corollary and Student" data.
3. Medical group weights shown are for data stowed on the SL-R experiment return pallet. The M071 and M073 frozen urine, and the M110 frozen blood are stowed at a separate location and account for an additional 127.4 lb (maximum) of medical data.
4. Film data for M487, M151 and M516.
5. M551 and M553 share a 400-ft allocation of film (not necessarily the same cassette). Film data returned should document the processing of the M551 stainless steel specimen. Film data for M553, if not on this same cassette, should be given first consideration for return of those items identified in Note 6 when ATM film not returned.
6. Any combination of the 3 types film shown may be returned in the total amount of 2.9 lb if ATM film not returned. Selection will be a real-time decision. (See Note 5 above with respect to M553 film data.) M509, if performed on SL-1/SL-2, should be given consideration for film return after inclusion of T025 data.

not be modified or efforts made to remove them from the frozen stowage trays. After identification of SL-R requirements, urine samples from every third day during approximately midmission may be stowed in the OWS at ambient temperature. M110 requirements preclude omitting or reducing the volume of urine samples on the day before, day of, or the day after blood sampling. These ambient temperature urine samples will be returned in the rescue CSM, but not stowed in the volume of the urine specimen return container.

2) Other Medical Data - The remainder of medical experiments data will be limited to 50 pounds, or 65 pounds should the ATM film be not available for return. These data will include the following:

   a) The data contents of the In-Flight Medical Support System (IMSS) will be returned. These data will include the M110 whole blood samples (up to nine for a 56-day stay), the 20.10 microbiology swabs (42 each) and air sampler petri dishes (six each), the ED31 petri dishes (15 each), and in the event of a crew illness, a maximum of 16 each swabs (illness microbiology samples) contained in transport vials. All of these data will be returned as medical data except the ED31 petri dishes, which will be returned as corollary and student data, and then only if ATM film data are not available for return.

   b) M131 otolith goggles, goggles container, and one 16-mm 400-foot film cassette. Since this film is of a non-designated classification, and data for experiments M487, M151, M516, M551, or M553 could also be recorded thereon, a real-time decision will be required as to the experiment group accountability of this film cassette (See Note 6 of Table 2-1). That amount not accountable to M131 can be added to return of fecal/vomitus to the extent it (non M131 data) is deleted from the corollary group.

   c) M133 magnetic tape, reels and container.

   d) Potable water sample (8 ounces in container) for Operational DTO 20.16.

   e) M071 fecal and vomitus bundles as required to fill the 50 pounds (or 65 pounds as applicable) budget after inclusion of (a), (b), (c), and (d) above. Real-time selection of data will be required. Reduction of returned fecal vomitus material to meet the weight restraints of Table 2-1 will be accomplished by deleting samples near midmission. Samples should be deleted in sequence, up to a maximum of six sequential samples from each crewmember. This sequential deletion may be repeated as required after an interval of seven days of data taking.

b) ATM data to be returned will be subject to real-time evaluation and selection, but will consist of one of the following options:

1) S052 camera assembly and return container - 17.65 pounds
S054 cassette and return container - 14.40 pounds
S056 magazine assembly and return container - 14.45 pounds
Hα1 film magazine and return container - 15.75 pounds

2) S082A magazine assembly and return canister - 58 pounds

3) S082B magazine assembly and return canister - 60 pounds

The baseline package shall contain the first option above which totals 62.25 pounds.

c) EREP data as follows will be returned and will total 40.5 pounds, or 53.4 pounds should ATM film be not available for return. A real-time evaluation and selection will be required to determine which specific sets of film and Experiment Support Equipment (ESE) magnetic tapes produce the most compatible EREP data return.

1) One set of six S190A film cassettes and 2 film containers - 11.9 pounds. Should ATM film be not available for return, an additional set of film cassettes and 2 more containers will be returned - 23.8 pounds.

2) Regardless of ATM film return status, return two S190B Earth Terrain Camera (ETC) film canister assemblies each contained in a film canister bag - 5.2 pounds.

3) One 16-mm 140-foot film magazine and one film container for the S191 Viewfinder Tracking System (VTS) - 1.2 pounds, or two VTS film magazines and one film container - 2.2 pounds - should ATM film be not available for return.

4) Regardless of ATM film return status, return two reels of ESE magnetic tape, each in an ESE tape handling container assembly and with a flange support band - 22.2 pounds.

d) Corollary and student data will make up the remainder of the weight allocation on the SL-R experiment stowage pallet. If the data outlined above are returned, 22.25 pounds, or 56.6 pounds with no ATM film, of corollary and student experiment data may be returned. As previously noted, data are returned in descending order of FSP with consideration given to maximize the number of experiments for which data are returned as opposed to maximizing data for any particular experiment. Because of data or return container packaging, 100 percent of the nominal mission data are returned for the following:

When ATM film returned - S019, ED22, ED23, ED26

When ATM film not available for return - S019, T003, S020, M555, ED23, ED26, ED76

Regardless of ATM film return status, no return payload data will be returned for the following experiments, primarily because of their return weight with respect to FSP: D024, S015 (installed in the SL-2 CM), S009, T027(SA), and M552.

Refer to Table 2-1 for return data for corollary and student experiments.

2.3.4.4 Rescue of the SL-3 Crew

This subsection baselines two experiment data return packages using the above defined guidelines. The content of the two packages will be a function of the availability of ATM film for return. Mission planning for rescue of SL-3 shall account for both of these packages. THE ACTUAL RESCUE RETURN, SHOULD SL-R OCCUR, WILL BE DEVELOPED AS A DELTA TO EITHER OF THESE TWO PACKAGES, AS NECESSARY, AND SHALL BE APPROVED BY THE FMT.

2.3.4.4.1 Experiment Group Data Return Weight Budgets

The following table summarizes the nominal allowable return weights for each experiment group as defined above:

Experiment Group	Data	Nominal Return Weight (Pounds) W/ATM	Nominal Return Weight (Pounds) W/O ATM	Return Stowage Location
Medical	Urine Container and Contents	127	127	A8
	Other	50	65	Pallet
ATM	Film	65	0	Pallet
EREP	Film, Tape	40	55	Pallet
Corollary/ Student	Various	20	55	Pallet
	TOTAL (Pallet)	175	175	

2.3.4.4.2 Assumptions and Restrictions

The following assumptions and restrictions are subject to verification by subsequent studies and real-time conditions:

a) Based on the 175 pound limit as defined in PD43, data return on the pallet is weight limited rather than volume limited. The experiment rescue return identified herein is designed to this weight limit. ANY ADDITIONAL STOWAGE RETURN CAPABILITY WILL BE FILLED BY JOINT LEVEL I/LEVEL II CONFIGURATION CONTROL BOARD AND/OR FMT ACTION.

b) Data return in the urine container will be limited to that equivalent to a nominal 56-day mission.

c) Selection of return data has not considered special orientation requirements.

d) No allowance has been made for packing aids and experiment return containers other than those identified herein. Other packing aids (containers, wraps, cushions, straps, etc.), if required, will subtract from the data return herein specified as applicable to each experiment group.

e) All experiments will be considered completed to the nominal mission baseline requirement. However, feces, vomitus, and urine will be selected in real-time from all such material generated throughout the mission until arrival of the rescue CM.

f) Crew logs with the experiment data entries will be returned. Experiment weight allocation for these data, if stowed on the SL-R experiment return pallet, will be a real-time function.

g) The medical experiment data listed as follows does not include urine collection and transfer assemblies (UCTA), contingency urine and fecal collection in the rescue CSM from the rescued crew, or radiation dosimeters since these are operational items returned whether or not any other experiment data are returned.

2.3.4.4.3 Experiment Group Data Return

The data returns identified in the following narrative are summarized in Table 2-2, and are based on the 175 pound limit per PD43C.

a) Medical data for return on an SL-R mission will require real-time selection of urine, feces, vomitus generated throughout the SL-3 crew on-orbit time. Special requirements may be necessary for M110 blood sampling, processing and stowage.

If the requirement for a rescue mission occurs such that the expected total crew time in orbit will approach or exceed that for a nominal mission (i.e., the capacity of the urine specimen return container may be exceeded), additional urine half-samples (62-ml) will be scheduled to allow at least a half-sample of urine from each crewman each day. The urine samples frozen prior to identification of the requirements for the SL-R mission will not be modified or attempts made to remove them from the sample trays. Should the requirement for a rescue mission occur so late that the requirement for a urine sample from each crewman each day cannot be met by stowing half-samples in the urine specimen return container, special selection of urine samples for ambient return will be required. These urine samples will be frozen and stowed in the OWS food freezer. An attempt will be made to return these samples in a frozen state in the rescue CM. Return stowage will not be in the urine specimen return container, and is not necessarily restricted to the SL-R experiment return pallet.

Experiment M110 blood sampling will continue to schedule toward the baseline SL-3 requirements, except that the fixed blood sample will be processed as close to SL-R launch as possible. Should the SL-R launch after completion of the nominal M110 mission requirements (approximately mission day [MD] 58), an additional blood sample for each crewman will be drawn and processed at approximately the time of SL-R launch. Therefore, a maximum of nine fixed blood samples may be returned (six for a nominal SL-3 mission plus three more drawn close to SL-R launch

Table 2-2. SL-3 Experiment Data Return

Experiment Group	Experiment No.	Nominal Mission Data Return Nomenclature	Nominal Mission Data Return Wt*	Nominal Mission Data Return Qty	SL-R Return W/ATM Qty	SL-R Return W/ATM Wt	SL-R Return W/O ATM Qty	SL-R Return W/O ATM Wt
MEDICAL	M071 M073 M110	Urine specimen return container with contents of frozen urine and blood	127.4 (Max)	1	1	127.4 (Max)	1	127.4 (Max)
	M071	Feces and vomitus, return containers	←		NOTE 1	→		
	M092	Leg band	.5	1	1	.5	1	.5
	M131	16-mm 400-ft cassette	1.2	1	←	NOTE 2	→	
		Otolith goggles, container	1.0	←	NOTE 3	→		
	M133	2 reels magnetic tape, canister	1.2	1	1	1.2	1	1.2
	20.16	Potable water sample, bag	.6	1	1	.6	1	.6
	—	Data contents of IMSS	~4.0	←	NOTE 4	→		
	M071/ M073/ M110	Selected urine and blood specimens	←		NOTE 5	→		
	—	Food Samples	Various	8 (Max)	8	1.7	8	1.7
	S015	Woodlawn Wanderer	22.0	1				
		(GCM subsystem)	(9.8)	(1)	1	9.8	1	9.8
		(Film module)	(2.2)	(1)	1	2.2	1	2.2
		TOTAL GROUP RETURN WEIGHT (LB)	(NOTE 6)			50		65

Table 2-2. SL-3 Experiment Data Return (Continued)

Experiment Group	Experiment No.	Nominal Mission Data Return Nomenclature	Nominal Mission Data Return Wt*	Nominal Mission Data Return Qty	SL-R Return W/ATM Qty	SL-R Return W/ATM Wt	SL-R Return W/O ATM Qty	SL-R Return W/O ATM Wt
ATM	S052	Camera assembly, cover	20.0	2	1	20.0	—	—
	S054	Cassette, container, and shutter override actuator	11.9	2	1	11.9	—	—
	S055A	Telemetry only	N/A	N/A	N/A	N/A	N/A	N/A
	S056	Magazine, container	14.8	2	1	14.8	—	—
	S082A	Magazine, canister	58.0	2	—	—	—	—
	S082B	Magazine, canister	60.0	2	—	—	—	—
	Hα1	Magazine, container	15.8	2	1	15.8	—	—
	Hα2	Telemetry only	N/A	N/A	N/A	N/A	N/A	N/A
		TOTAL GROUP RETURN WEIGHT (LB)				62.5		0

Table 2-2. SL-3 Experiment Data Return (Continued)

Experiment Group	Experiment No.	Nomenclature	Nominal Mission Data Return Wt*	Nominal Mission Data Return Qty	SL-R Return W/ATM Qty	SL-R Return W/ATM Wt	SL-R Return W/O ATM Qty	SL-R Return W/O ATM Wt
EREP	S190A	Film cassette	1.87	30	6	11.2	8	15.0
		Container (3 cassette/ container capacity)	.27	10	2	.5	3	.8
	S190B	ETC film canister assembly, film bag	2.95	6	2	5.9	2	5.9
	S191	16-mm 140-ft magazine	1.0	4	1	1.0	1	1.0
	S190A S191 S192 S193 S194	ESE magnetic tape, reel, support band, and return container	10.87	11	2	21.8	3	32.6
		TOTAL GROUP WEIGHT (LB)				40.4		55.3

Table 2-2. SL-3 Experiment Data Return (Continued)

Experiment Group	Experiment No.**	Nominal Mission Data Return Nomenclature	Nominal Mission Data Return Wt*	Nominal Mission Data Return Qty	SL-R Return W/ATM Qty	SL-R Return W/ATM Wt	SL-R Return W/O ATM Qty	SL-R Return W/O ATM Wt
COROLLARY AND STUDENT	S019	Film canister, front cover	15.3	2	1	15.3	1	15.3
	S183	16-mm 140-ft magazine	1.0	1	1	1.0	1	1.0
	M487	16-mm 400-ft cassette	1.2	1	← NOTE 7 →			
	T003	Filter assembly, log cards, clip, and return container	.4	1	1	.4	1	.4
	S149	Set of 4 cassettes, container	10.9	2	← NOTE 8 →			
	M151	16-mm 400-ft cassette	1.2	14	← NOTE 7 →			
	M516	16-mm 400-ft cassette	1.2	1	← NOTE 7 →			
	T013	16-mm 400-ft cassette	1.2	2	← NOTE 7 →			
	M509	16-mm 400-ft cassette	1.2	4½	← NOTE 7 →			
	S015	Woodlawn Wanderer	22.0	1	See Medical Group			
	S228	Detector Module	.8	1	1	.8	1	.8
	T020	16-mm 140-ft magazine	1.0	3	-	-	2	2.0
		16-mm 400-ft cassette	1.2	1/2	← NOTE 7 →			

Table 2-2. SL-3 Experiment Data Return (Continued)

Experiment Group	Experiment No.**	Nomenclature	Nominal Mission Data Return Wt*	Nominal Mission Data Return Qty	SL-R Return W/ATM Qty	SL-R Return W/ATM Wt	SL-R Return W/O ATM Qty	SL-R Return W/O ATM Wt
COROLLARY AND STUDENT (CONTINUED)	S063	2 35-mm cassettes, and 2 containers	.6	3	1	.6	3	1.8
	D024	Container with 2 panels	5.3	1	—	—	NOTE 9	—
	S230	Pouch with collectors	1.3	1	←		NOTE 10	→
	T002	Voice downlink	N/A	N/A	N/A	N/A	N/A	N/A
	ED11	EREP data	←		Data Duplication			→
	ED12	EREP data, plus specific S191 coverage	←		Data Duplication			→
	ED21	S052 data	←	Data Duplication	→		—	—
	ED22	S052 data	←	Data Duplication	→		—	—
	ED23	S019 canister	←		NOTE 11			→
	ED25	S052 and S054 data	←	Data Duplication	→		—	—
	ED26	S019 canister	←		NOTE 11			→
	ED32	35-mm cassette, container	.3	←	NOTE 12			→
	ED52	35-mm cassette, container	.3	←	NOTE 12			→
		16-mm 400-ft cassette	1.2	1	← NOTE 7			→
		Carrying case assembly, 2 spider container assemblies, and 1 swab	.8	1	1	.8	1	8

Table 2-2. SL-3 Experiment Data Return (Continued)

Experiment Group	Experiment No. **	Nominal Mission Data Return Nomenclature	Wt*	Qty	SL-R Return W/ATM Qty	SL-R Return W/ATM Wt	SL-R Return W/O ATM Qty	SL-R Return W/O ATM Wt
COROLLARY AND STUDENT (CONTINUED)	ED63	16-mm 400-ft cassette	1.2	NOTE 13	← NOTE 7 →			
	ED74	16-mm 400-ft cassette	1.2	NOTE 13	← NOTE 7 →			
		TOTAL GROUP WEIGHT (LB) (NOTE 14)				21.9		53.9

Table 2-2. SL-3 Experiment Data Return (Continued)

* Weight data derived from Reference 4.

** Corollary experiments are in descending order by FSP. Student investigations are in numeric sequence.

NOTES:

1. Weight of feces and vomitus will be that necessary to bring the "Other" medical data up to 50 lb, or 65 lb when ATM film not available, after inclusion of all other medical data returned on the SL-R experiment return pallet.
2. M131 is allocated 400-feet of S0168 16-mm film which weighs 1.2 pounds. Selected portions of these data will be returned and chargeable to M131. (See NOTE 7).
3. The otolith goggles and return container will be returned (with or without ATM film data) only if it is known that the SL-4 mission will not be performed.
4. The data contents of the IMSS and required packing aids will weigh a maximum of approximately 4.0 lb.
5. Miscellaneous data may include three M110 automatic sample processors removed from the urine specimen return container when three additional blood samples are drawn after completion of the nominal M110 baseline requirements, and also urine samples not stowed in the urine specimen return container. These data will not necessarily be stowed on the experiment return pallet.
6. Medical group weights shown are for data stowed on the SL-R experiment return pallet. The M071 and M073 frozen urine and the M110 frozen blood stowed in the urine specimen return container account for an additional 127.4 lb (maximum) of medical data.
7. These experiments, plus M131 and operations/housekeeping, use 16-mm non-dedicated film cassettes, which results in various data on any one cassette. Assuming one cassette is returned for M131, the FMT will select two cassettes, or 26 cassettes should ATM film be not available, for return.
8. Both sets will be returned in locker B6.
9. D024 requires an EVA for data retrieval. It is assumed that if EVA cannot be performed for ATM film retrieval, then EVA also cannot be performed for D024.
10. S230 data will be returned in locker U4.
11. Dedicated film within the primary S019 film canister.
12. The FMT will select up to two cassettes containing ED32 and ED52 data for return.
13. ED63 and ED74 share a 400-ft allocation of S0168 16-mm film. See NOTE 7 for return criteria.
14. Weights shown do not include S149 and S230.

when same occurs after MD58. The remaining blood from these final blood samples will be frozen after separation of the plasma and cellular phases, and placed in the urine specimen return container for return. Three previously processed frozen blood samples will be removed from the urine specimen return container to allow this replacement. An attempt will be made to return these displaced samples in a frozen state.

Medical data will be returned as follows:

1) Urine Specimen Return Container - The weight of the urine return container and contents will be a real-time function of the duration of the wait period prior to the arrival of the rescue CSM. The container has a nominal 56-day capacity which represents a total weight of 127.4 pounds (maximum - container and contents). Contents will include frozen urine for Experiments M071 and M073, and frozen blood for Experiment M110. Not included are those selected urine samples processed and frozen after the urine specimen return container has been filled to its nominal capacity.

2) Other Medical Data - The remainder of medical experiments data will be limited to 50 pounds, or 65 pounds should the ATM film be not available for return. These data will include the following:

   a) The data contents of the In-Flight Medical Support System (IMSS) will be returned. These data will include the 20.10 microbiology swabs (42 each) and air sampler petri dishes (four each), a maximum of eight swabs (illness microbiology samples taken in the event of a crew illness), and M110 fixed whole blood samples (up to nine). Packing aids (approximately two pounds) will be required to preserve the data.

   b) The M131 otolith goggles and goggles return container will be returned if it is known that the SL-4 mission will not be performed, or that M131 will not be conducted on SL-4. Photographic data will also be returned for M131. Since M131 film is of a non-designated classification, and data for experiments M151, M487, M509, M516, T013, T020, ED52, ED63, and ED74 could be intermixed with M131 data, a real-time decision will be required as to the experiment group accountability of the film cassette(s) containing M131 data. That amount not accountable to M131 can be added to the return of other medical data to the extent it (non M131 data) is deleted from the corollary group. See discussion on this type film in the corollary group.

   c) Two reels of M133 magnetic tape and the M133 return container will be returned.

   d) The potable water sample (8 ounces in container) for Operational DTO 20.16 will be returned.

e) The selected blood and urine which could not be stowed in the urine specimen return container will be returned. As previously stated, an attempt will be made to return these samples in a frozen state.

f) If access to the cabin of the disabled SL-3 CM is possible, a crewman will disassemble the S015 experiment package and retrieve the S015 growth curve module (GCM) subsystem and the film module for SL-R return.

g) One M092 leg band will be returned.

h) During the mission, certain food items may be found to be spoiled or otherwise not palatable. Up to eight of these items, approximately 1.7 pounds total, will be selected for return.

i) Based on the SL-2 mission, approximately 99 M071 fecal/vomitus samples are expected to be available for nominal SL-3 return. These samples have an average weight of approximately 0.3 pound each. Fecal/vomitus samples, and return containers as may be deemed necessary, will be returned to the extent that the total medical data on the SL-R experiment return pallet (after first, including items a through h above) does not exceed 50 pounds, or 65 pounds when ATM film data are not available for return. Reduction of returned fecal/vomitus material to meet these weight restrictions, if necessary, will be accomplished by deleting early mission samples.

b) Sixty-five pounds of ATM data may be returned. Subject to real-time evaluation and selection, the following options are available:

1) S052 camera assembly and cover assembly
S054 cassette, return container, and shutter override actuator
S056 magazine assembly and return container
Hα1 film magazine and return container

2) S082A magazine assembly and return canister

3) S082B magazine assembly and return canister

The baseline package shall contain the first option above which totals 62.5 pounds.

c) EREP data as follows will be returned and will total 40.4 pounds, or 55.3 pounds should ATM film be not available for return. A real-time evaluation and selection will be required to determine which specific film and Experiment Support Equipment (ESE) magnetic tapes produce the most compatible EREP data return.

1) Six S190A film cassettes and 2 film containers. Should ATM film be not available for return, eight film cassettes and 3 containers will be returned.

2) Regardless of ATM film return status, return two S190B Earth Terrain Camera (ETC) film canister assemblies each contained in a film canister bag.

3) Regardless of ATM film return status, return one 16-mm 140-foot film magazine for the S191 Viewfinder Tracker System (VTS).

4) Two reels of ESE magnetic tape, each in an ESE tape handling container assembly and with a flange support band. Should ATM film be not available for return, three reels of ESE tape, etc., will be returned.

d) Corollary and student data will make up the remainder of the weight allocation on the SL-R experiment stowage pallet. If the data outlined above are returned, up to 22.1 pounds, or 54.7 pounds with no ATM film, of corollary and student experiment data may be returned. As previously noted, data are returned in descending order of FSP with consideration given to maximize the number of experiments for which data are returned as opposed to maximizing data for any particular experiment.

Regardless of ATM film status, no return payload data will be returned for D024. When ATM film are available, the return weight and/or FSP preclude return of this experiment package. It is assumed that since this experiment requires EVA for data retrieval, it will not be retrieved if ATM cannot be retrieved.

Return for S015 is discussed under medical data.

The following corollary and student data will be returned:

1) One S019 film canister and front cover.

2) One S183 16-mm 140-foot film magazine.

3) T003 filter assembly, log cards, clip and return container.

4) Two sets of four S149 cassettes, and two containers, will be stowed in locker B6 for return. Should the last SL-3 EVA not be performed, only one set (and container) will be available for return. If locker B6 is not available then one S149 set and container will be returned on the SL-R experiment return pallet only when ATM data are not returned. This addition to pallet stowage would require redefinition of the corollary experiments return data.

5) One S228 detector module.

6) Two S063 35-mm film cassettes and two containers.

7) The S230 stowage pouch containing three collector assemblies will be stowed in locker U4 for return. Should the last SL-3 EVA not be performed, only two collector assemblies will be available for return in the pouch (these collectors were retrieved on the first SL-3 EVA). If locker U4 is not available, the S230 data available will be returned on the SL-R experiment return pallet.

8) Experiments M131, M151, M487, M509, M516, T013, T020, student investigations ED52, ED63, ED74, and operations/housekeeping all use non-dedicated type S0168 16-mm 400-foot cassettes. See medical data for discussion on film for M131. Since film operations protocol (Reference 5) does not restrict usage of any one cassette to any one experiment/investigation/operation, documentation for several activities may be recorded on any one cassette. Of the thirty cassettes of this type available for return and exclusive of M131 film return, two cassettes will be returned when ATM data are returned, or 26 cassettes will be returned when ATM data are not returned. Selection of cassettes to be returned will be a real-time function for the FMT.

9) Student investigations ED11 and ED12 are data duplications of EREP data, and ED21, ED22 and ED25 are data duplication of ATM data. Therefore, data return for these investigations will depend on the respective requirements of each investigation being attained by the respective EREP or ATM group, and that the required data within EREP or ATM are part of the SL-R return payload.

10) Data for ED23 and ED26 are dedicated film contained within the S019 film canister. It is assumed that these data will be in the first S019 canister used, since all experiment baseline requirements must be satisfied prior to use of the second S019 canister, and that the first S019 canister will be returned.

11) ED32 and ED52 use non-dedicated 35-mm S0168 film cassettes and have been allocated a specific number of frames equivalent to approximately one 50-frame cassette. Data may be intermixed with operations/housekeeping data. The FMT will select up to two cassettes containing ED32 and ED52 data for return.

12) The ED52 carrying case assembly, containing two spider container assemblies and one IMSS cotton swab wrapped with a spider web, will be returned.

13) When ATM film data are not available for return, the following will be added to that previously identified:

    a) Two T020 16-mm 140-foot film magazines.

    b) The remaining four S063 35-mm cassettes and containers.

2.3.4.5 Rescue of the SL-4 Crew

TBD

REFERENCES

1. NASA Headquarters Program Directive No. 43C, M-D ML3200.125, dated May 1, 1973.

2. Cluster Requirements Specification No. RS003M00003, dated August 8, 1969.

3. TRW Stowage Data Base, dated 4/5/73.

4. TRW Stowage Data Base, dated 8/16/73.

5. All Skylab Missions Photographic Plan, JSC, dated February 14, 1973.