



RE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
JOHN F. KENNEDY SPACE CENTER
KENNEDY SPACE CENTER, FLORIDA 32899

REPLY TO
ATTN OF: AA-SVO-1

JUN

MEMORANDUM

TO: Distribution

FROM: AA/Manager, Apollo-Skylab Programs

SUBJECT: Skylab Operations Directive (SLPD 43C) dated
May 1, 1973

This document is being distributed for your information. A copy
of the briefing note to Dr. Debus is enclosed.

for Robert C. Hock
Robert C. Hock

2 Enclosures

Distribution:

Apollo-Skylab Standard Distribution "M"

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11/6/73

Dr. Debus:

JUL 1 1973

SUBJECT: Revision to Skylab Operations Directive (SLPD 43C)

This revision C to the Skylab Operations Directive incorporates Specification Change Notices (SCN's) 34 through 41. It is being furnished to the KSC Directorates for information only. The SCN's do change the SL-3 and SL-4 launch dates but these changes are obsolete; the other changes in the SCN's do not affect KSC operations. In summary, these changes include:

1. A block of time is set aside for Skylab Student Experiment investigations during each mission and the use of Flight Scheduling Preference (FSP) numbers for these experiments is discontinued.
2. Skylab Education Program TV Requirements are established for each mission.
3. Five in-flight Detailed Test Objectives (DTO's) are added for various experiments.
4. Revision of mission assignments and scheduling instructions are included for several of the experiments.
5. A table listing requirements for in-flight private communications is added. Private conversations will be allowed for the following purposes:
 - a. Crew/Family morale
 - b. Discuss/decide sensitive matters in an extreme operational emergency.
 - c. Doctor/Patient discussion of crew health status.
6. SL-3 and SL-4 launch and recovery dates are revised.
7. Real time planning guidelines are added for all missions.

Robert C. Hock
Robert C. Hock



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
JOHN F. KENNEDY SPACE CENTER
KENNEDY SPACE CENTER, FLORIDA 32899

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RE
Part 1

DEC 14 1973

REPLY TO
ATTN OF: AA-MFP-1 (73-11-5)

MEMORANDUM

TO: Distribution

FROM: AA/Manager, Sciences, Applications,
Skylab and ASTP Programs

SUBJECT: Operations Directive Change Package No. 8,
Skylab Program Directive No. 43C

Attached is a copy of Change Package No. 8 to the Skylab Operations Directive, Program Directive No. 43C and a copy of my Briefing Note to Dr. Debus. The package includes updated pages to the Directive and a change log sheet for recording this and subsequent changes. The package in general contains SL-4 operational planning changes.

William H. Rock
William H. Rock

Attachment: a/s

Distribution:
Skylab ASTP Distribution "M"

DR. DEBUS

588
373
JH 12/16

SUBJECT: Operations Directive Change Package No. 8,
Skylab Program Directive No. 43C

We have received and reviewed the enclosed Change Package No. 8,
to Skylab Program Directive No. 43C, "Operations Directive".

The Change Package No. 8 causes no impact to KSC. Its main purpose
is to reflect SL-4 operational planning changes in the following areas:

1. Maximum SL-4 mission duration up to 85 days.
2. Observation requirements for the comet Kohoutek.
3. Educational TV requirements.
4. Experiment assignments and scheduling
5. Experiment performance red lines.
6. EVA planning.

Copies of the Change Package will be forwarded to the appropriate
Directorates and Offices under separate cover. ✓

William H. Rock
William H. Rock

Enclosure: a/s



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

REPLY TO
ATTN OF: MLO

November 1, 1973

MEMORANDUM

TO: Distribution

FROM: ML/Director, Skylab Program

SUBJECT: Operations Directive Change Package No. 8

Enclosed are updated pages to the Skylab Operations Directive, Program Directive No. 43C. Also enclosed is a change log sheet for recording this and subsequent changes. All holders of the document are requested to insert the new pages in their copies of the Operations Directive.

William C. Schneider

Enclosure

Distribution: See attached list.

OPERATIONS DIRECTIVE CHANGE LOG

CP No.	SCN No.	Date	Pages Affected	Comments
REV C	35	Revision C approved 5/1/73	Renumbered Pages	Revision of ED. TV requirements on Mission SL-1/SL-2.
	36			The inclusion of the seven sub-systems/operational DTO's by title (SL-1/SL-2).
	37			Real-time planning guidelines for all missions.
	38			The revision of mission assignments and scheduling instructions for experiments M131, M509, S019, S150, S183, and T002.
	39			The revision of minimum crew-attended data-taking hours for ATM (SL-4). (From 180 to TBD.)
	40			Skylab Private Conversations
	41			Revision of launch and recovery dates for all missions.
6	42	7/19/73	1,ii,1-2,1-7,3-1 thru 3-11, A-4, A-5, A-8 thru A-16, B-1	Mission SL-3 operational planning changes and general document clean up.
7	43	10/1/73	i,ii,1-2,4-1 thru 4-13, A-1 thru A-5,A-8 thru A-16 A-6a (new), A-17 (new)	Mission SL-4 operational planning changes.

OPERATIONS DIRECTIVE CHANGE LOG

CP No.	SCN No.	Date	Pages Affected	Comments
8	44	11/1/73	4-1, 4-2, 4-4 thru 4-13. 5-3, 5-4, A-3 thru A-5, A-6a, A-8, A-10 thru A-17 A-12a (new)	Mission SL-4 operational planning changes

4.0 SKYLAB MISSION SL-44.1 MISSION DESCRIPTION

Skylab Mission SL-4 will begin when the SL-3 CSM and crew separate from the SWS just prior to reentry. The unmanned portion of the mission will continue until the SL-4 CSM and crew are launched to rendezvous and dock with the SWS. After docking, the SL-4 crew will enter the SWS, reactivate its systems, and proceed to inhabit and operate the orbital assembly for a nominal 56-day mission duration. Dependent on continuous inflight monitoring of the physical condition of the SL-4 crew and the rate at which consumables are expended, the SL-4 mission may be extended up to 85-days duration. During this time the crew will perform systems and operational tests and the assigned experiments. To conclude the mission, the crew will configure the SWS for indefinite unmanned operations, undock the CSM, and return to earth in the Command Module.

4.2 MISSION OBJECTIVES

- (1) Perform unmanned Saturn Workshop operations
 - (a) Obtain data for evaluating the performance of the unmanned SWS.
 - (b) Obtain solar astronomy data by unmanned ATM observations.
- (2) Reactivate the Skylab orbital assembly in earth orbit
 - (a) Operate the orbital assembly (SWS plus CSM) as a habitable space structure for a nominal period of 56 days after the SL-4 launch.
 - (b) Obtain data for evaluating the performance of the orbital assembly.
 - (c) Obtain data for evaluating crew mobility and work capability in both intravehicular and extravehicular activity.
- (3) Obtain medical data on the crew for use in extending the duration of manned space flights
 - (a) Obtain medical data for determining the effects on the crew which result from a nominal space flight duration of 56 days.
 - (b) Obtain medical data for determining if a subsequent manned space flight mission of greater duration than the duration of the SL-4 manned mission is feasible and advisable.

(4) Perform In-Flight Experiments

- (a) Obtain ATM solar astronomy data for continuing and extending solar studies beyond the limits of earth-based observations.
- (b) Obtain earth resources data for continuing and extending multisensor observation of the earth from low earth orbit.
- (c) Perform the assigned scientific, engineering, technology and DOD experiments.
- (d) Obtain comet Kohoutek data for continuing and extending studies of comets beyond the limits of earth based observations.

NOTE FOR DEVELOPMENT EMPHASIS

For hardware development, the above objectives, together with the amplifying remarks, are to be treated as criticality category 2. Individual ATM, Earth Resources, and Medical Experiments shall be considered category 3. Scientific, Engineering, Technology and DOD experiments shall be category 3 or 4, as specified by the development centers. Individual critical elements within an experiment may be category 1 or 2 as appropriate. (See reference 7).

4.3 MISSION REQUIREMENTS4.3.1 Mission Development

- (1) The SL-4 manned mission period shall begin with the initiation of SL-4 launch countdown, and shall terminate with the recovery of the flight crew and Command Module.
- (2) The nominal launch date for the SL-4 space vehicle shall be scheduled to provide a five to eight orbit rendezvous capability on or after November 10, 1973.
- (3) The SL-4 manned flight shall be planned for an open-ended duration beyond a nominal length of 56 days, starting with launch of the manned SL-4 space vehicle and ending with the recovery of the SL-4 Command Module (nominally January 7, 1974.) The final duration flown will be determined in real-time based on weekly reviews of the crew's physical condition and the rates at which consumables are expended. The maximum mission duration for planning purpose shall be 85 days (nominal recovery on February 3, 1974). In any event, the splashdown date shall be adjusted so that the return of the crew to port can be accomplished in the minimum time. Due to the open-ended mission concept, recovery plans shall provide for primary recovery ship availability for any mission duration of 56 days or longer. The Hawaiian "fence" concept shall be utilized if an interim-period recovery becomes necessary.

- (5) The Skylab educational program requires crew participation to prepare for television coverage of selected activities. A minimum of one telecast per day will be scheduled toward a goal of meeting Public Affairs Office requirements in the following general areas:

- Rendezvous
- Habitability/crew quarters demonstrations
- Cluster tours
- Experiment and student investigation operations
- Out-the-Window observations
- Viewfinder-tracking system earth observations
- Science demonstrations
- Science pilot highlights
- Press conference
- Undock and fly-around

In order to support Public Affairs coordination with the television users, emphasis is to be placed upon providing coverage at times that are consistent with pre-mission planning. Timely coordination is to be maintained with Public Affairs to ensure that adequate advance notice is provided for any telecast schedule changes required.

- (6) Television coverage of science demonstrations carries a lower priority than planned coverage of experiments and operational activities.
- (7) Science demonstrations will have lower priority than other Skylab mission activities. Items used to support these demonstrations will be stowed only if there is no competing claim for space or weight. Film used to record science demonstrations will be so allocated only after determination during the mission that it can be done without impact upon other activities.
- (8) Deactivation preceding the end of the SL-4 mission will be accomplished so as to permit a possible SWS revisit.

4.3.4 Comet Observations, Experiments, Student Investigations, and Subsystems/Operational Tests

This section contains requirements and instructions for scheduling observations of comet Kohoutek, experiments, student investigations, and subsystems/operational tests in the mission flight plan. Mission assignments and scheduling requirements and minimum film and tape allocations are given in Annex A, Skylab Experiments.

4.3.4.1 Pre-Mission Planning

Instructions set forth in the subsections below shall be used for preparing the pre-mission flight plans.

4.3.4.1.1 EVA Planning

Up to five EVAs will be baselined for conduct of experiments and programmed repairs; however, expendables to enable one **unscheduled** EVA for system contingencies will be provisioned. Mission planning will reserve those expendables.

4.3.4.1.2 Maneuver Constraints

Maneuvers will be constrained as outlined in the Experiment/Systems Management Criteria document, and will be limited by momentum management. No 180-degree roll maneuvers will be performed.

4.3.4.1.3 Comet Kohoutek Observations

Comet observations shall be scheduled in accordance with the assignment and scheduling instructions presented in Table A-2 of Annex A, and the requirements set forth below:

- (1) Comet observations will be given priority during the period from December 16, 1973, to January 14, 1974.
- (2) The Kohoutek viewing program shall make use of selected ATM and corollary instruments. Priorities for the use of specific instruments for comet Kohoutek observations are set forth in Table A-2 of Annex A. Film shall be budgeted as follows to assure ample quantity is available for the comet observations. The number of frames shown as dedicated to comet Kohoutek observations are minimums. Additional photography shall be planned if crew time and film are available.

FRAMES ALLOCATED FOR KOHOUTEK VIEWING PROGRAM

<u>Instruments</u>	<u>Minimum Frames Dedicated to Comet</u>
S052	2500
S054	1600
S056	100
S082A	2
S082B	160
S019	40
S063	150
S183	12 UV, 16 DAC
S201B	200
S233	40
T025	40

4.3.4.1.4 Group Related Experiments

The group-related experiments comprise the in-flight medical, ATM and EREP experiments. They shall be scheduled in accordance with the assignment and scheduling instructions presented in Table A-2 of Annex A, the minimum film and tape allocations presented in Table A-3 of Annex A, and the requirements set forth below:

- (1) Crew-attended ATM operations including use of ATM instruments for comet Kohoutek observations shall be given scheduling priority for one crewman, exclusive of those periods allocated to EREP, for all daylight passes (plus the necessary night periods) for all identified experiment days. The goal for manned ATM operation above the 400 kilometer observing constraint, excluding ATM checkout but including comet Kohoutek observations, shall range from 230 hours for a nominal 56-day mission to 350 hours for an 85-day mission.
- (2) Unattended ATM operations may be scheduled during any period in which the ATM console is not manned providing such scheduling does not contradict other requirements specified in this document.
- (3) The EREP experiments shall be scheduled for operations with the goal for Z-local vertical passes ranging from 30 for a 56-day mission to 50 for an 85-day mission. The goal for solar-inertial passes for EREP calibration shall be two, regardless of mission duration. The distribution of the Z-local vertical passes shall be planned as required to complete United States coverage and gather data on approved sites in other countries. The S190B experiment shall be scheduled so as to not unduly impact other experiments assigned to the scientific airlock with a goal of operation on at least 50 percent of the Z-local vertical passes identified above. In addition, it is desirable to operate the S190B experiment on the two calibration passes.

4.3.4.1.5 Corollary Experiments

The corollary experiments are those inflight experiments other than the group-related experiments and the student investigations. They shall be scheduled in accordance with the instructions set forth in Section 4.3.4.1.8 below.

4.3.4.1.6. Student Investigations

A number of investigations selected for the Skylab Student Project will be performed aboard the orbital assembly. Student investigations assigned to the SL-4 mission shall be allocated up to 1-1/2 crew manhours per week for performance. The student investigations shall be scheduled to satisfy the requirements given in Table A-2, Annex A. Minimum scheduling requirements for student investigations are presented in paragraph 4.3.4.1.8. below.

4.3.4.1.7 Subsystems/Operational Tests

Subsystems/Operational Tests for mission SL-4 will be approved at Level II and subsequently documented as Detailed Test Objectives (DTO's) in the Mission Requirements Document (MRD). Each DTO shall clearly indicate whether the test is (1) mandatory with respect to crew safety or mission objectives or (2) non-mandatory. Those tests deemed mandatory shall be incorporated into either systems housekeeping, experiment preparation, or other life-systems support activities as appropriate. Those tests deemed non-mandatory shall be scheduled on a non-interference basis with experiments, student investigations and mandatory tests. The following subsystems/operational DTOs shall be scheduled for performance on SL-4:

- (1) Environmental microbiology
- (2) Operational radiation measurements
- (3) Orbital assembly contamination assessments
- (4) Water sample
- (5) Iodine monitoring
- (6) Carbon monoxide monitor
- (7) Taste and aroma tests
- (8) Parasol material
- (9) Food package
- (10) Atmospheric volatile concentrator

In addition to the foregoing subsystems/operational tests, the special DTOs listed below shall be scheduled for performance on SL-4. They shall be planned with the same rigor as the subsystems/operational DTOs but shall be scheduled on the basis that they not interfere in any way with the performance of assigned experiments, student investigations or subsystems/operation tests.

- (1) Blood flow in limbs
- (2) Girth and height measurements and crew profile photographs
- (3) Sweat samples
- (4) Stereo photogrammetry
- (5) Gypsy moth eggs
- (6) Visual observations of the earth

4.3.4.1.8 Scheduling of Corollary Experiments

Corollary experiments shall be scheduled on mission SL-4 in accordance with the following instructions:

- (1) Corollary experiments assigned to mission SL-4 shall be scheduled into those intervals of the crew timeline which have not been allocated to the Kohoutek observations, group related experiments and the necessary life/systems support activities (eat, sleep, off-duty, personal hygiene, and systems housekeeping). The corollary experiments shall be scheduled to satisfy the requirements stated or implied in Tables A-2 and A-3 of Annex A. The minimum film and tape allocations given in Table A-3 includes film allocated for the Kohoutek viewing program as specified in paragraph 4.3.4.1.3 herein. If these requirements cannot be fully accommodated in the mission timeline, the following

experiments may be reduced to not less than the level shown below:

<u>Experiment</u>	<u>Minimum Scheduling Requirements (SI,-4)</u>
M487	Perform individual discussions with each crewman late in mission. Obtain questionnaire data from the same crewman once in each two-week period. Record height of each crewman early, mid, and late in the mission. Photograph eating of a meal, and cleaning of mixing chamber screen in dome twice; also, waste management compartment activity/personal hygiene, and restocking of pantry once.
M509	Perform one unsuited run. (Suited activity beyond the minimum requirement may be planned provided no secondary oxygen package usage is planned prior to the final EVA.)
S019	Perform eight night passes of 32 minutes average duration.
S020	Obtain one photograph of the sun with exposure time of 30 minutes or longer.
S063	Perform four passes of 26 minutes average duration.
S183	Perform eight night passes of 32-minutes average duration.
T002	N/A
T003	Reduce that portion of the experiment that requires daily performance to performance every other day.
T020	Perform one unsuited run. (Suited activity beyond the minimum requirement may be planned provided no secondary oxygen package usage is planned prior to the final EVA.)
ED31	Perform the inoculation session and four photographic sessions.
ED41	One crewman will conduct one test within seven days after launch and one test approximately 50 days after launch.
ED61/62	Plant and expose 24 rice seeds. Perform five photographic sessions of six photographs each.

ExperimentMinimum Scheduling Requirements (SL-4)

ED63

Observe and photograph cytoplasmic streaming of elodea plant two times.

The experiments listed above shall be considered for reduction in order of increasing flight schedule precedence; e.g. an experiment of FSP 200 will be considered for reduction before an experiment of FSP 300. It is recognized, however, that the order in which experiments are actually reduced may depend more on operational considerations than on the FSP. The SL-4 flight plan shall be flagged to indicate which experiments or investigations have been scheduled to less than their full requirements. The Program Director will consider further reduction if necessary.

- (2) Candidate experiments may be scheduled on the mission provided this does not impact the assigned experiments. They will be considered for inclusion in the timeline in order of decreasing FSP.
- (3) Experiments S019, S063, S232, and S183 shall be given prime consideration during those periods in the mission which satisfy their particular observational constraints or offer unique observational opportunities, i.e., lunar cycle constraints, specific celestial field-of-view, concurrent ground observations, etc.

4.3.4.2. Real-Time Planning

The guidelines in this section shall govern real-time flight planning of experiments, student investigations, and subsystems/operational tests during conduct of the SL-4 mission.

4.3.4.2.1. Real-Time Planning of Experiments

The real-time goal for experiments shall be performance of the baseline requirements as defined in the Appendix. Priority for attainment of experiment baseline requirements is group-related experiments followed by corollary experiments in order of decreasing FSP. (During the period December 16, 1973, to January 14, 1974, observations of comet Kohoutek will be given first consideration.)

(1) Increased Scheduling of Experiments

In general, no increase in scheduling beyond baseline requirements will be planned for an experiment until all other assigned activities and candidate experiments are scheduled to the maximum extent possible toward their baseline requirements. Candidate experiments will be scheduled if their performance will not preclude attainment of baseline requirements of

assigned activities capable of performance.

(2) Reduced Scheduling of Experiments

When real-time problems are directly related to individual experiments or experiment disciplines (ATM, EREP, Medical, Corollary of Kohoutek), the following shall apply:

- (a) When crew time has been expended on a comet Kohoutek observation or group-related experiment run, any time scheduled for a repeat of that run shall normally be absorbed within that experiment group.
- (b) When crew time has been expended on a corollary experiment, a rescheduled performance shall normally be absorbed within any timeline allocation remaining for that specific experiment; however, other corollary experiments of lower FSP may be considered for reduction/cancellation in order to accommodate a rerun.

If real-time problems are not directly related to experiment activity, but cause loss of crew time scheduled for experiment performance, each discipline shall absorb the lost time in direct proportion to the total SL-4 crew time allocated to that experiment discipline. When reduced scheduling of experiments must be made within the preceding guidelines, the following general instructions shall also be used as applicable.

- (a) The first level of experiment scheduling reduction shall be from baseline requirement to MSR, if an MSR has been established.
- (b) The second-level of experiment scheduling reduction shall be toward the Performance Redline Scheduling Requirements established in paragraph 4.3.2.4 of this section, and the MRD. Performance of less than redline will not be scheduled. (The FMT will be briefed on plans for second-level reductions or cancellations prior to their implementation.)
- (c) Experiments being considered for first or second-level reductions or cancellations shall be considered in sequence of increasing FSP, if FSP's have been assigned, taking into account other operational constraints.

4.3.4.2.2 Real-Time Planning of Student Investigations

The real-time goal for student investigations shall be performance of the baseline requirements as established in Table A-2 of Annex A and in the MRD.

(1) Increased Scheduling of Student Investigations

Student investigations shall not be scheduled beyond the maximum of 1-1/2 crew manhours per week allocated to student investigations for pre-mission planning. Further, no increase in scheduling beyond baseline requirements will be made for a student investigation until all other assigned and candidate experiments and student investigations are scheduled to the maximum extent possible toward their baseline requirements.

(2) Reduced Scheduling of Student Investigations

When real-time problems are directly related to a specific student investigation and crew time has been expended on the student investigation run, any rescheduled performance of the run shall normally be absorbed within any timeline allocation remaining for that specific student investigation. If the real-time problems are not directly related to student investigations, then the investigations shall lose reschedule time in direct proportion to the total SL-4 crew time allocated to student investigations. In addition, when real-time flight planning indicates that assigned student investigations may not attain baseline requirements, they will be considered for reduction and/or cancellation. Performance redlines, established in paragraph 4.3.4.2.4 of this section and the MRD, represent levels of minimum worthwhile information for student investigations. Performance of less than redline will not be scheduled.

4.3.4.2.3 Real Time Planning of Subsystems/Operational Tests

The real-time for subsystems/operational tests is to satisfy the pre-mission planning for such tests.

(1) Increased Scheduling of Subsystems/Operational Tests

In general, no increase in scheduling of subsystems/operational tests beyond those included in pre-mission flight plans shall be made.

(2) Reduced Scheduling of Subsystems/Operational Tests

Those subsystems/operational tests designated as mandatory in the MRD DTOs shall not be reduced without FMT approval. Non-mandatory tests may be reduced as necessary to permit performance of assigned experiments, student investigations and mandatory subsystems/operational tests.

Performance redlines are established below:

<u>Activity</u>	<u>Performance Redline Scheduling Requirement(SL-4)</u>
Kohoutek Observations	For all instruments used for Kohoutek observations, continue to schedule in accordance with the integrated comet Kohoutek viewing program.
All Medical	Continue to schedule toward baseline requirements; however, repetitive performance of medical experiments may, with flight surgeon concurrence, be deferred to permit performance of ATM and EREP redline requirements. For M151, exclude photographic sessions pertaining to the pressure garment assembly and to repeated removals and installations of experiment hardware.
All ATM	Continue to schedule toward baseline requirements. EVA data retrieval shall be real-time decision.
All EREP	Continue to schedule toward baseline requirements.
M479	Perform six combustion and quench test cycles on selected materials.
S020, T025 S201B	Accomplish one photographic sequence.
D024, M487, M509, M516, M555, M556, thru M566, S009, S019, S063, S073, S149, S183, S228, S230, S232, S233, T003, T020, T053,	
ED11, ED12, ED21, ED22, ED24, ED25, ED31	No specific crew time required
ED41	Perform the inoculation session and one photographic session.
ED41	Conduct one test consisting of two traverses through the maze.
ED61/62	Plant 24 rice seeds and perform one photographic session of seedlings.
ED63	Observe and photograph one cytoplasmic streaming.

<u>Activity</u>	<u>Performance Redline Scheduling Requirement (SL-4)</u>
ED72	Time and photograph the liquid rise through one capillary tube or wick.
ED76	Retrieve and return one neutron flux detector.

4.3.5 Unmanned Operations

The following guidelines apply to the unmanned period of SWS operations between separation of the SL-3 CSM and docking of the SL-4 CSM.

- (a) The SWS shall be controlled and interrogated from the ground during the unmanned period.
- (b) Film for ATM experiments S052 and S054 shall be loaded during the end-of-mission SL-3 EVA for exposure during the unmanned period of SL-4.

5.5.1 General Guidelines

- (1) Reductions from nominal return affect all experiments.
- (2) Select data to maximize scientific return within each experiment group rather than maximizing return of single experiments.
- (3) 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.
- (4) Experiment data that is not selected for return on a rescue mission will be considered for return on any subsequent missions.
- (5) For SL-4, greater consideration should be given to the return of data from comet Kohoutek, and experiments which have had little or no return on previous missions.

5.5.2. Specific Guidelines

Guidelines apply to all missions unless otherwise noted.

(1) Medical

- (a) Select data to maximize information of the status of the crew's health and well being.
- (b) A nominal weight of 127 pounds 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.
- (c) For SL-1/SL-2 and SL-3, up to a nominal weight of 50 pounds of other medical data will be returned. If unable to return ATM film, the 50 pound limit will be increased by 15 pounds.
- (d) On SL-4, other medical data will occupy weight and volume not allocated to ATM, EREP, and corollary experiments. **This will be approximately 30 pounds.**

(2) ATM

- (a) Up to a nominal weight of 65 pounds of ATM film will be returned.
- (b) On SL-4, comet Kohoutek related data will be given first priority.

(3) EREP

- (a) A nominal weight of 40 pounds of EREP film and tape shall be returned.
- (b) If unable to return ATM film, then an additional 15 pounds of EREP film and tape will be returned on SL-2 and SL-3. On SL-4, the 40 pound limit will be raised by 25 pounds.

(4) Corollary and Student

- (a) For SL-2 and SL-3, corollary and student experiment data will use weight and volume not occupied by the medical, ATM, and EREP experiment groups.
- (b) For SL-2 and SL-3, data will be selected to maximize the number of experiments taken in descending order of FSP.
- (c) For SL-4, a nominal weight of 40 pounds of corollary and student data will be returned. If unable to return ATM film, the limit will be raised by 20 pounds.
- (d) For SL-4, priority will be given to returning comet Kohoutek related data. Other corollary data will be selected to maximize the number of experiments taken in descending order of FSP.

Table A-1: Summary of Experiment Mission Assignments

<u>Experiment</u>	<u>Mission Assignment</u>		
	<u>SL-1/SL-2</u>	<u>SL-3</u>	<u>SL-4</u>
<u>Passive</u>			
M415 - Thermal Control Coatings	A		
S071 - Circadian Rhythm - Pocket Mice		A	
S072 - Circadian Rhythm - Vinegar Gnat		A	
S150 - Galactic X-ray Mapping (B)		A	
<u>Medical</u>			
M071 - Mineral Balance	A	A	A
M073 - Bioassay of Body Fluids	A	A	A
M074 - Specimen Mass Measurement	A	A	A
*M078 - Bone Mineral Measurement (B)	A	A	A
M092 - In-Flight Lower Body Negative Pressure	A	A	A
M093 - Vectorcardiogram	A	A	A
*M111 - Cytogenetic Studies of Blood	A	A	A
M112 - Man's Immunity - In vitro aspects	A	A	A
M113 - Blood Volume and Red Cell Life Span	A	A	A
M114 - Red Blood Cell Metabolism	A	A	A
M115 - Special Hematologic Effects	A	A	A
M131 - Human Vestibular Function	A	A	A
M133 - Sleep Monitoring	A	A	A
M151 - Time and Motion Study	A	A	A
M171 - Metabolic Activity	A	A	A
M172 - Body Mass Measurement	A	A	A

* These experiments have pre- and post-flight requirements only.

ATM

S052 - White Light Coronagraph	A	A	A ⊗
S054 - X-Ray Spectrographic Telescope	A	A	A ⊗
S055 - Scanning Polychromator-Spectroheliometer	A	A	A ⊗
S056 - Extreme UV and X-Ray Telescope	A	A	A ⊗
S082A - Coronal Extreme UV Spectroheliograph	A	A	A ⊗
S082B - Chromospheric Extreme UV Spectrograph	A	A	A ⊗

EREP

S190A - Multispectral Photographic Cameras	A	A	A
S190B - Earth Terrain Camera	A	A	A
S191 - Infrared Spectrometer	A	A	A
S192 - Multispectral Scanner	A	A	A
S193 - Microwave Radiometer/Scatterometer and Altimeter	A	A	A
S194 - L-Band Radiometer	A	A	A

LEGEND: See Page A-5

Table A-1: Summary of Experiment Mission Assignments

<u>Experiment</u>	<u>Mission Assignment</u>		
	<u>SL-1/SL-2</u>	<u>SL-3</u>	<u>SL-4</u>
<u>Corollary</u>			
D008 - Radiation in Spacecraft	A		
D024 - Thermal Control Coatings	A	A	A
M479 - Zero Gravity Flammability (revised)			A
M487 - Habitability/Crew Quarters	A	A	A
M509 - Astronaut Maneuvering Equipment	C	A	A
M516 - Crew Activities/Maintenance	A	A	A
** M551 - Metals Melting	A		
** M552 - Exothermic Brazing	A		
** M553 - Sphere Forming	A		
** M555 - Gallium Arsenide Crystal Growth			@
Δ M556 - Vapor Growth of II-VI Compounds		A	C
Δ M557 - Immiscible Alloy Compositions		A	A
Δ M558 - Radioactive Tracer Diffusion		A	A
Δ M559 - Microsegregation in Germanium		A	C
Δ M560 - Growth of Spherical Crystals		A	C
Δ M561 - Whisker-Reinforced Composites		A	C
Δ M562 - Indium Antimonide Crystals		A	A
Δ M563 - Mixed III-V Crystal Growth		A	A
Δ M564 - Metal and Halide Eutectics		A	C
Δ M565 - Silver Grids Melted in Space		A	C
Δ M566 - Copper-Aluminum Eutectics		A	A
S009 - Nuclear Emulsion	A	A	A
S015 - Zero Gravity Single Human Cells		A	
S019 - UV Stellar Astronomy	A	A	A ⊗
S020 - UV/X-Ray Solar Photography			A
S063 - UV Airglow Horizon Photography		A	A ⊗
S073 - Gegenschein/Zodiacal Light			A
S149 - Particle Collection	A	A	A
S183 - UV Panorama	A	A	A ⊗
S201B - UV Electronographic Camera			A ⊗
S228 - Trans-Uranic Cosmic Rays	A	A	A
S230 - Magnetospheric Particle Composition		A	A
S232 - Barium Plasma Observations			A
S233 - Comet Kohoutek Photograph			A ⊗
T002 - Manual Navigation Sightings (B)		A	A
T003 - In-Flight Aerosol Analysis	A	A	A
T013 - Crew Vehicle Disturbance		A	
T020 - Foot-Controlled Maneuvering Unit		A	A
T025 - Coronagraph Contamination Measurement			A ⊗
T027 (SA) - Contamination Measurement (Sample Array)	A		
T027/S073 - Contamination Measurement - Gegenschein/Zodiacal Light (Photometer)	A	A	
T053 - Earth Laser Beacon		A	A

@ M555 may be assigned to SL-4 in the event that S201B is not available when required for SL-4 pre-launch stowage.

** These experiments utilize a common facility, M512-Materials Processing Facility.

Δ These experiments utilize a common facility, M518-Multipurpose Electric Furnace.

Table A-1: Summary of Experiment Mission Assignments

<u>Experiment</u>	<u>Mission Assignment</u>		
	<u>SL-1/SL-2</u>	<u>SL-3</u>	<u>SL-4</u>
<u>Student Investigations</u>			
ED11 - Atmospheric Absorption of Radiant Heat	A	C	A
ED12 - Volcanic Study	A	A	A
ED21 - Libration Clouds		A	A
ED22 - Objects within Mercury's Orbit	A	A	A
ED23 - UV from Quasars	A	C	
ED24 - X-Ray Stellar Classes			A
ED25 - X-Rays from Jupiter		A	A
ED26 - UV from Pulsars	A	A	
ED31 - Bacteria and Spores	A		A
ED32 - In Vitro Immunology		A	
ED41 - Motor Sensory Performance			A
ED52 - Web Formation		A	
ED61/62 - Plant Growth/Plant Phototropism			A
ED63 - Cytoplasmic Streaming		A	A
ED72 - Capillary Study			A
ED74 - Mass Measurement		A	
ED76 - Neutron Analysis	A	A	A
ED78 - Liquid Motion in Zero "G"		C	

LEGEND:

- A - The experiment, or a part of the experiment, is assigned to this mission (refer to the detailed instructions contained in Table A-2).
- C - The experiment, or a part of the experiment, is a candidate for performance on this mission, provided the requirements set forth in Table A-2 will not have been satisfied on an earlier mission (or missions).
- Ⓚ - Instruments from these experiments will be utilized for the comet Kohoutek observations.

EXPERIMENT GROUP	EXPERIMENT NUMBER	TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
Comet Kohoutek Observations	<p>These observations shall make use of instruments from the following experiments:</p> <p><u>ATM</u></p> <p>S052 White Light Coronagraph S054 X-Ray Spectrographic Telescope S055 UV Scanning Polychromator-Spectroheliometer S056 Extreme UV and X-Ray Telescope S082A Coronal Extreme UV Spectroheliograph S082B Chromospheric Extreme UV Spectrograph</p> <p><u>COROLLARY</u></p> <p>S019 UV Stellar Astronomy S063 UV Airglow Horizon Photography - SAL - Window S183 UV Panorama S201B UV Electronographic Camera S233 Comet Kohoutek Photography T025 Coronagraph Contamination Measurement</p>	<p>This observation program is assigned to mission SL-4. Scheduling of instruments for Kohoutek observations shall be considered in sequence of the priorities given below, taking into account other operational constraints.</p> <p style="text-align: center;"><u>Priority</u></p> <p style="text-align: center;"> </p> <p style="text-align: center;">N/A </p> <p style="text-align: center;"> </p> <p style="text-align: center;">3 5 6 4 1 7 2</p>	<p>Additional constraints for the comet Kohoutek observations are given in paragraph 4.3.4.1.3 herein.</p>	

Table A-2 Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
Medical (Cont'd)	M133 - Sleep Monitoring		This experiment shall be performed in 15 sleep-sessions on mission SL-1/SL-2, in 21 sleep-sessions on mission SL-3, and in 8 sleep-sessions on mission SL-4.	N/A
	M151 - Time and Motion Study		This experiment is assigned to missions SL-1/SL-2, SL-3, and SL-4. It shall be performed only in conjunction with other experiments.	420
ATM	S052 - White Light Coronagraph		These experiments are assigned to missions SL-1/SL-2, SL-3, and SL-4. The constraints for each mission are identified in the appropriate pre-mission planning sections herein. Instruments from these experiments shall be utilized in support of the comet Kohoutek observing program in accordance with paragraph 4.3.4.1.3 herein.	N/A
	S054 - X-Ray Spectrographic Telescope			
	S055 - Scanning Polychromator-Spectro-heliometer			
	S056 - Extreme UV and X-Ray Telescope			
	S082A - Coronal Extreme UV Spectroheliograph			
	S082B - Chromospheric Extreme UV Spectrograph			
	S190 - Multispectral Photographic Facility			
	S190A - Multispectral Photographic Cameras			
EREP	S190B - Earth Terrain Camera		These experiments are assigned to missions SL-1/SL-2, SL-3, and SL-4. The constraints for each mission are identified in the appropriate pre-mission planning sections of this document.	N/A
	S191 - Infrared Spectrometer			
	S192 - Multispectral Scanner			
	S193 - Microwave Radiometer/Scatterometer and Altimeter			
	S194 - L-Band Radiometer			

TABLE A-2 Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	M516	- Crew Activities / Maintenance	This experiment is assigned to missions SL-1/SL-2, SL-3 and SL-4	380
	M551	- Metals Melting	This experiment is assigned to mission SL-1/SL-2	190
	M552	- Exothermic Brazing	This experiment is assigned to mission SL-1/SL-2	150
	M553	- Sphere Forming	This experiment is assigned to mission SL-1/SL-2.	160
COROLLARY	M555	- Gallium Arsenide Crystal Growth	This experiment is assigned to mission SL-4 only in the event that S201B is not available when required for SL-4 prelaunch stowage.	200
	M556	- Vapor Growth of II-VI Compounds	This experiment is assigned to mission SL-3 and is a candidate for SL-4. This experiment shall be the last experiment performed in the M518 facility because of the possible toxicity hazard.	350
	M557	- Immiscible Alloy Composition	This experiment is assigned to missions SL-3 and SL-4.	440
	M558	- Radioactive Tracer Diffusion	This experiment is assigned to missions SL-3 and SL-4. This experiment shall be the next to the last experiment performed in the M518 facility because of the possible radiation hazard.	430
	M559	- Microsegregation in Germanium	This experiment is assigned to mission SL-3 and is a candidate for SL-4.	320

TABLE A-2 Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	M560	Growth of Spherical Crystals	This experiment is assigned to mission SL-3 and is a candidate for SL-4.	310
	M561	Whisker-Reinforced Composites	This experiment is assigned to mission SL-3 and is a candidate for SL-4.	360
	M562	Indium Antimonide Crystals	This experiment is assigned to missions SL-3 and SL-4.	480
	M563	Mixed III-V Crystal Growth	This experiment is assigned to missions SL-3 and SL-4.	390
	M564	Metal and Halide Eutectics	This experiment is assigned to missions SL-3 and is a candidate for SL-4.	270
	M565	Silver Grids Melted in Space	This experiment is assigned to missions SL-3 and is a candidate for SL-4.	260
COROLLARY	M566	Copper Aluminum Eutectics	This experiment is assigned to missions SL-3 and SL-4.	400
	S009	Nuclear Emulsion	One nuclear emulsion detector package shall be exposed and retrieved on missions SL-1/SL-2, SL-3, and SL-4.	180
	S015	Zero Gravity Single Human Cells	This experiment is assigned to mission SL-3 (the experiment hardware is integrated in CM 117).	280

TABLE A-2 Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	S019 - UV Stellar Astronomy		This experiment is assigned to missions SL-1/SL-2, SL-3 and SL-4. The extra film carried on SL-3 and SL-4 for S019 activities, excluding comet Kohoutek observations, may be utilized only when additional performances of this experiment will not interfere with achievement of baseline requirements on other experiments. S019 hardware shall be utilized to support the comet Kohoutek observing program in accordance with paragraph 4.3.4.1.3	500
	S020 - UV/X-Ray Solar Photography		This experiment is assigned to mission SL-4 and will be performed during EVA(s).	290
	S063 - UV Airglow Horizon Photography		This experiment is assigned to missions SL-3 and SL-4. S063 hardware shall be utilized to support comet Kohoutek observing program in accordance with paragraph 4.3.4.1.3.	240
COROLLARY	S073 - Gegenschein/Zodiacal Light		This experiment is assigned to mission SL-4.	146
	SL49 - Particle Collection		Three sets of detector cassettes shall be deployed, exposed, and retrieved. One set shall be exposed during the SL-3 unmanned phase, using the anti-solar scientific airlock. One set shall be exposed at the ATM sun shield during the SL-3 manned phase and one during the SL-4 manned phase, using EVA deployments and retrievals.	450

TABLE A-2, Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
COROLLARY	S183 - UV Panorama		This experiment is assigned to all missions. The extra film carried on SL-4 will be utilized to support comet Kohoutek observing program in accordance with paragraph 4.3.4.1.3.	490

TABLE A-2. Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	S201(B) - UV Electronographic Camera		This experiment is assigned to mission SL-4, and in addition, it shall be utilized to support the comet Kohoutek observing program defined in paragraph 4.3.4.1.3.	175
	S228 - Trans-Uranic Cosmic Rays		This experiment is assigned to mission SL-1/SL-2 for deployment of 36 Lexan samples. One sample will be returned on mission SL-3 and the remaining 35 samples will be returned on SL-4. An additional sample packet will be launched, deployed and recovered on SL-4.	275
	S230 - Magnetospheric Particle Composition		This experiment is assigned to SL-3 and SL-4.	165
	S232 - Barium Plasma Observations		This experiment is assigned to mission SL-4.	143
COROLLARY	S233 - Comet Kohoutek Photography		This experiment is assigned to Mission SL-4 to support the comet Kohoutek viewing program defined in paragraph 4.3.4.1.3.	N/A
	T002 - Manual Navigation Sightings (B)		This experiment shall be performed on missions SL-3 and SL-4 at the convenience of the crew and on a non-interference basis with the other experiments.	140
	T003 - In-Flight Aeorsol Analysis		This experiment shall be performed on missions SL-1/SL-2, SL-3, and SL-4.	460
	T013 - Crew/Vehicle Disturbance		This experiment shall be performed in the OWS on Mission SL-3.	340

Table A-2 Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	T020 - Foot Controlled Maneuvering Unit		Each of two crewmen shall perform a set of five experiment runs (three unsuited and two suited). The experiment shall be performed by one crewman on mission SL-3 and by another crewman on mission SL-4. At least one of the crewmen who performs T020 shall also perform one set of experiment runs on M509.	250
	T025 - Coronagraph Contamination Measurement		This experiment is assigned to mission SL-4. In addition to the T025 experiment, the hardware shall be utilized during EVA(s) to support the comet Kohoutek observing program in accordance with paragraph 4.3.4.1.3.	370
COROLLARY	T027(SA) - Contamination Measurement (Sample Array)		One sample array shall be developed, exposed for 120 hours, and retrieved.	170
	T027/S073 - Contamination Measurement Gegenschein/Zodiacal Light (Photometer System)		This joint experiment utilizing the T027 photometer system shall be performed on missions SL-1/SL-2 and SL-3.	410
	T053 - Earth Laser Beacon		This experiment is assigned to missions SL-3 and SL-4.	185

TABLE A-2. Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	ED11	Atmospheric Absorption of Heat	This experiment is assigned to mission SL-1/SL-2 and SL-4, and will use S191 data. It is a candidate for activity on mission SL-3.	
	ED12	Volcanic Study	This experiment is assigned to missions SL-1/SL-2, SL-3 and SL-4. This experiment will use S191, S192, S190A, and S190B data.	
	ED21	Libration Clouds	This experiment will use S052 JOP-10 data and is assigned to missions SL-3 and SL-4.	
	ED22	Objects within Mercury's Orbit	This experiment is assigned to missions SL-1/SL-2, SL-3 and SL-4. This experiment will use S052 JOP-6 data.	N/A
STUDENT	ED23	UV from Quasars	This experiment will require one night pass of S019 during mission SL-1/SL-2. It is a candidate for further activity on SL-3.	
	ED24	X-Ray Stellar Classes	This experiment will use ATM JOP-13 data of one pass of stellar region during mission SL-4.	
	ED25	X-Rays from Jupiter	This experiment will use ATM JOP-13 data of one pass of Jupiter (X-Rays) during mission SL-3 and SL-4.	
	ED26	UV from Pulsars	This experiment will use one night pass of S019 during missions SL-1/SL-2 and SL-3.	
	ED31	Bacteria and Spores	Perform this experiment one time in accordance with MRD during missions SL-1/SL-2 and SL-4.	

TABLE A-2. Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
STUDENT	ED32	In Vitro Immunology	Perform this experiment one time in accordance with MRD during mission SL-3.	N/A
	ED41	Motor Sensory Performance	Perform this experiment one time in accordance with MRD during mission SL-4.	
	ED52	Web Formation	Perform this experiment one time in accordance with MRD during mission SL-3.	
	ED61/62	Plant Growth/Plant Phototropism	Perform this experiment one time in accordance with MRD during mission SL-4.	
	ED63	Cytoplasmic Streaming	Perform this experiment as early as possible during mission SL-4.	
	ED72	Capillary Study	Perform this experiment one time in accordance with MRD during mission SL-4.	
	ED74	Mass Measurement	Perform this experiment one time in accordance with MRD during mission SL-3.	
	ED76	Neutron Analysis	Perform this experiment one time in accordance with MRD during each of missions SL-1/SL-2, SL-3, and SL-4.	
	ED78	Liquid Motion in Zero-G	Perform this experiment one time in accordance with MRD during mission SL-3.	

TABLE A-2. Experiment Assignment and Scheduling Instructions

EXPERIMENT/DATA	SL-4 ALLOCATION *
S019 film canister	1
S020 film magazine	2
S052 film camera	2
S054 film cassette	2
S056 film magazine	1
S063 film cassette	10
S082A film magazine	1
S082B film magazine	1
S183 film magazine	1
S183 film carousel	2
S190A cassette	30
ETC film canister	6
S191 film magazine	3
EREP Mag. Tape	9
S201B film magazine	1
Ho1 film magazine	1
T025 film cassette	2

*NOTE: This table establishes minimum film/tape allocations for selected instruments. Requirements for additional film may be established by Program Offices.

TABLE A-3: SL-4 MINIMUM FILM/TAPE ALLOCATIONS FOR SELECTED INSTRUMENTS



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
JOHN F. KENNEDY SPACE CENTER
KENNEDY SPACE CENTER, FLORIDA 32899

REPLY TO
ATTN OF: AA-SVO-3 (73-8-4)

AUG 31 1973

MEMORANDUM

TO: Distribution

FROM: AA/Acting Manager, Apollo-Skylab Programs

SUBJECT: Operations Directive Change Package No. 6,
Skylab Program Directive No. 43C

Attached is a copy of Change Package No. 6 to the Skylab Operations Directive, Program Directive No. 43C and a copy of my Briefing Note to Dr. Debus. The package includes updated pages to the Directive and a change log sheet for recording this and subsequent changes. The package in general contains SL-3 operational planning changes and general documentation cleanup.

for *William H. Rock*
William H. Rock

Attachment a/s

Distribution
Skylab ASTP
Distribution M

DF-MSS
RM. 3636
KSC HQS.
ATTN. CARMODY
SLD-MQ-1

Feb 20 *To AF*

Dr. Debus:

SUBJECT: Operations Directive Change Package No. 6, Skylab Program Directive
No. 43C

We have received and reviewed the enclosed Change Package No. 6 to Skylab Program Directive No. 43C, "Operations Directive."

The Change Package No. 6 causes no impact to KSC. Its main purpose is to reflect SL-3 operational planning changes and general documentation cleanup.

Copies of this Change Package will be forwarded to the appropriate Directorates and Offices under separate cover.

WR

William H. Rock



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

REPLY TO
ATTN OF:

MLO

JUL 19 1973

MEMORANDUM

TO: Distribution

FROM: ML/Director, Skylab Program

SUBJECT: Operations Directive Change Package No. 6

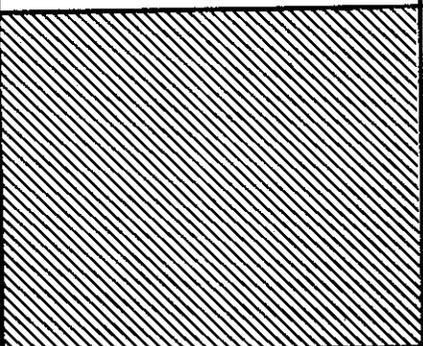
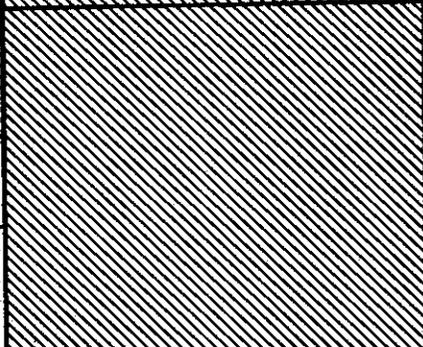
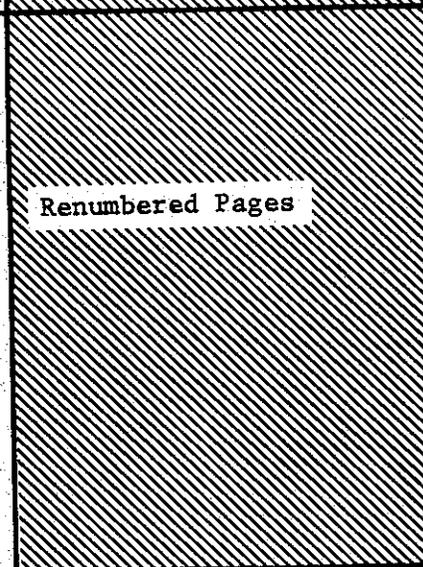
Enclosed are updated pages to the Skylab Operations Directive, Program Directive No. 43C. Also enclosed is a change log sheet for recording this and subsequent changes. All holders of the document are requested to insert the new pages in their copies of the Operations Directive.

William C. Schneider

Enclosure

Distribution: See attached list.

OPERATIONS DIRECTIVE CHANGE LOG

CP No.	SCN No.	Date	Pages Affected	Comments
4 (Cont'd)	28	1/8/73		The addition of a MSR for M487 on Mission SL-1/SL-2.
	29	1/8/73		The completion of ATM scheduling instructions.
	30	1/8/73		The revision (reword) of the EREP calibration requirements (SL-2).
5	31	2/15/73		The addition of experiment data return guidelines for Mission SL-R.
	32	2/15/73		The addition of a mission management section.
	33	2/15/73		The addition of real-time planning (experiments) guidelines for all missions.
REV C	34	Revision C approved 5/1/73	 Renumbered Pages	Resulting Changes: <ul style="list-style-type: none"> o The deletion of all student investigation FSP's. o The revision of student investigation titles. o The addition of student investigation assignments in Table A-2. o The revision of student investigation pre-mission scheduling guidelines for Missions SL-1/SL-2, SL-3 and SL-4.

OPERATIONS DIRECTIVE CHANGE LOG

CP No.	SCN No.	Date	Pages Affected	Comments
REV C	35	Revision C approved 5/1/73	Renumbered Pages	Revision of ED. TV requirements on Mission SL-1/SL-2.
	36			The inclusion of the seven sub-systems/operational DTO's by title (SL-1/SL-2).
	37			Real-time planning guidelines for all missions.
	38			The revision of mission assignments and scheduling instructions for experiments M131, M509, S019, S150, S183, and T002.
	39			The revision of minimum crew-attended data-taking hours for ATM (SL-4). (From 180 to TBD.)
	40			Skylab Private Conversations
	41			Revision of launch and recovery dates for all missions.
6	42	7/19/73	1, 1f, 1-2, 1-7, 3-1 thru 3-11, A-4, A-5, A-8 thru A-16, B-1	Mission SL-3 operational planning changes and general document clean up.

CONTENTS

	<u>Page</u>
1.0 SKYLAB PROGRAM	1-1
1.1 Introduction	1-1
1.2 Document Administration	1-1
1.3 Program Objectives	1-3
1.4 Program Policies and Requirements	1-4
1.5 Documentation	1-7
1.6 Mission Management	1-11
2.0 SKYLAB MISSION SL-1/SL-2	2-1
2.1 Mission Description	2-1
2.2 Mission Objectives	2-1
2.3 Mission Requirements	2-2
2.3.1 Mission Development	2-2
2.3.2 Launch Operations	2-3
2.3.3 In-Flight Operations	2-3
2.3.4 Experiments, Student Investigations, and Subsystem/Operational Tests	2-4
3.0 SKYLAB MISSION SL-3	3-1
3.1 Mission Description	3-1
3.2 Mission Objectives	3-1
3.3 Mission Requirements	3-2
3.3.1 Mission Development	3-2
3.3.2 Launch Operations	3-3
3.3.3 In-Flight Operations	3-3
3.3.4 Experiments, Student Investigations, and Subsystems/Operational Tests	3-3
3.3.5 Unmanned Operations	3-11
4.0 SKYLAB MISSION SL-4	4-1
4.1 Mission Description	4-1
4.2 Mission Objectives	4-1
4.3 Mission Requirements	4-2
4.3.1 Mission Development	4-2
4.3.2 Launch Operations	4-3
4.3.3 In-Flight Operations	4-3
4.3.4 Experiments, Student Investigations, and Subsystems/Operational Tests	4-4
4.3.5 Unmanned Operations	4-8

CONTENTS (Continued)

	<u>Page</u>
5.0 SKYLAB RESCUE MISSION	5-1
5.1 Purpose	5-1
5.2 Mission Description	5-1
5.3 Mission Requirements	5-1
5.3.1 Mission Development	5-1
5.3.2 Mission Commit Policies and Requirements	5-2
5.4 Planning Requirements	5-2
5.5 Experiment Data Return Guidelines	5-2
ANNEX A SKYLAB EXPERIMENTS	A-1
ANNEX B SKYLAB PRIVATE CONVERSATIONS	B-1
APPENDICES	
DEFINITIONS	a-1
ABBREVIATIONS AND ACRONYMS	a-vi
REFERENCES	a-viii
DISTRIBUTION	
<u>TABLES</u>	
TABLE 1.1 SKYLAB BASELINE MISSION DATA	1-2
TABLE A-1 SUMMARY OF EXPERIMENT MISSION ASSIGNMENTS	A-3
TABLE A-2 EXPERIMENT ASSIGNMENT AND SCHEDULING INSTRUCTIONS	A-6
TABLE B-1 SKYLAB PRIVATE CONVERSATIONS	B-1
<u>FIGURES</u>	
FIGURE 1 SKYLAB MISSION DOCUMENTATION	1-10

MISSION	SL-1/SL-2	SL-3	SL-4
OBJECTIVES	Establish the Skylab orbital assembly in earth orbit Obtain medical data Perform in-flight experiments	Perform unmanned SWS operations Reactivate the orbital assembly Obtain medical data Perform in-flight experiments	Perform unmanned SWS operations Reactivate the orbital assembly Obtain medical data Perform in-flight experiments
SPACE VEHICLE/LAUNCH	SL-1	SL-3	SL-4
LAUNCH VEHICLE	SATURN V (S-IC and SII) 513	SATURN IB 207	SATURN IB 208
KSC LAUNCH COMPLEX	39A	39B	39B
PAYLOAD	<u>SATURN WORKSHOP</u> OWS AM MDA ATM Experiments	<u>CSM 117</u> 3-man crew Experiments	<u>CSM 118</u> 3-man crew Experiments
ORBITAL INCLINATION	~50 Degrees	~50 Degrees	~50 Degrees
ORBITAL ALTITUDE	~ 234 NM	~ 234 NM	~ 234 NM
LAUNCH INTERVAL (FROM SL-1 LAUNCH)	-	~ 75 days	~ 179 days
MANNED FLIGHT DURATION	-	Up to 59 days	Up to 56 days

Table 1.1 Skylab Baseline Mission Data

- (16) Where possible, all manual abort requests from the ground during flight will be based on two independent indications of the failure. Crew abort action will normally be based upon two cues.
- (17) The S-IVB stages of the SL-2, SL-3, SL-4 and SL-R launch vehicles shall be capable of controlled deorbit by means of controlled dumping of residual propellant.

1.4.3 Skylab Launch Dates

Close adherence to the currently scheduled Skylab launch dates is essential to obtaining the desired seasonal earth resources data. Any experiment, including individual EREP experiments, which could compromise the May 14, 1973 launch date of SL-1 by not meeting the SWS closeout date, will be subject to review by the Program Director for possible cancellation.

1.4.4 Private Communications for Skylab

The governing requirements for private communications are contained in NASA Administrator memorandum, subject: Private Communications for Skylab, March 29, 1973 (reference 13). For convenience only a summary matrix of these requirements is included in Table B-1 of Annex B.

1.5 DOCUMENTATION

This section has three purposes: (1) to identify key Skylab program and mission documents which include and/or reflect the Program Director's management instructions pertaining to mission planning, requirements, operations and evaluation; (2) to establish responsibilities for the control and orderly development of the Skylab operational documents; and (3) to clarify the relationships that exist among the documents. Figure 1 depicts these documents and their interrelationships.

1.5.1 Mission Requirements Document (MRD)

The MRD is the basis for Skylab mission planning and design. It defines the mission requirements and the functional and performance requirements for implementing the program and mission objectives specified in this Directive. The MRD contains detailed operational requirements for the missions compiled from various sources, including Experiment Requirements Documents (ERDs) and the Data Request Forms (DRFs), which are developed at JSC and MSFC. The MRD shall be consistent with this Directive and shall further amplify the mission objectives and requirements set forth herein. To make the relationship of the MRD to the Operations Directive (OD) clear at all times, each issue of the MRD shall include flag sheets to identify all areas in which the MRD is not consistent with the OD. The MRD shall be jointly prepared and approved by JSC and MSFC, and shall be coordinated under the cognizance of the Mission Requirements Panel, as established in reference 4.

3.0 SKYLAB MISSION SL-3

3.1 MISSION DESCRIPTION

Skylab Mission SL-3 will begin when the SL-2 CSM and crew separate from the SWS just prior to reentry. The unmanned portion of the mission will continue until the SL-3 CSM and crew are launched to rendezvous and dock with the SWS. After docking, the SL-3 crew will enter the SWS, reactivate its systems, and proceed to inhabit and operate the orbital assembly for up to 59 days. During this time the crew will perform systems and operational tests and the assigned experiments. To conclude the mission, the crew will configure the SWS for unmanned operations, undock the CSM, and return to earth in the Command Module.

3.2 MISSION OBJECTIVES

- (1) Perform unmanned Saturn Workshop operations
 - (a) Obtain data for evaluating the performance of the unmanned SWS.
 - (b) Obtain solar astronomy data by unmanned ATM observations.
- (2) Reactivate the Skylab orbital assembly in earth orbit
 - (a) Operate the orbital assembly (SWS plus CSM) as a habitable space structure for up to 59 days after the SL-3 launch.
 - (b) Obtain data for evaluating the performance of the orbital assembly.
 - (c) Obtain data for evaluating crew mobility and work capability in both intravehicular and extra-vehicular activity.
- (3) Obtain medical data on the crew for use in extending the duration of manned space flights
 - (a) Obtain medical data for determining the effects on the crew which result from a space flight of up to 59 days duration.
 - (b) Obtain medical data for determining if a subsequent Skylab mission of greater than 59 days duration is feasible and advisable.

(4) Perform inflight experiments

- (a) Obtain ATM solar astronomy data for continuing and extending solar studies beyond the limits of earth-based observations.
- (b) Obtain earth resources data for continuing and extending multisensor observation of the earth from low earth orbit.
- (c) Perform the assigned scientific, engineering, technology and DOD experiments.

NOTE FOR DEVELOPMENT EMPHASIS

For hardware development, the above objectives, together with the amplifying remarks, are to be treated as criticality category 2. Individual ATM, Earth Resources, and Medical Experiments shall be considered category 3. Scientific, Engineering, Technology, and DOD Experiments shall be category 3 or 4, as specified by the development centers. Individual critical elements within an experiment may be category 1 or 2 as appropriate. (See reference 7).

3.3 MISSION REQUIREMENTS

3.3.1 Mission Development

- (1) The SL-3 manned mission period shall begin with the initiation of SL-3 launch countdown, and shall terminate with the recovery of the flight crew and Command Module.
- (2) The nominal launch date for the manned SL-3 space vehicle shall be July 28, 1973. Mission planning shall allow for at least three launch opportunities within seven days following the scheduled launch date.
- (3) The SL-3 manned flight shall be planned for a duration of 59 days, starting with the launch of the manned SL-3 space vehicle and ending with the recovery of the SL-3 Command Module (nominally September 25, 1973).
- (4) The orbital assembly shall be maintained in a circular orbit at an altitude (\sim 234 NM) that will provide a controlled groundtrack pattern which repeats every 71 revolutions.
- (5) Docking of the mission CSM to the Saturn Workshop shall be planned for the axial docking port of the Multiple Docking Adapter (MDA).

3.3.2 Launch Operations

The following requirements shall be reflected in the Launch Mission Rules and other SL-3 launch planning documentation:

Any space vehicle element or operational support element whose malfunction can limit the SL-3 manned flight to less than 59 days duration shall be considered a mandatory item for launch.

3.3.3 In-Flight Operations

The following requirements and instructions shall be used in developing the SL-3 mission flight plans:

- (1) Approximately one of every seven mission-days shall be scheduled as an off-duty day.
- (2) Each off-duty day shall include performance of experiments M071 and M073, crew rest and recreation, nominal monitoring of spacecraft systems, and crew planning.
- (3) Scheduling of crew activities shall permit rapid crew response to solar flares that may occur when the ATM console is not manned.
- (4) To preserve urine samples, the SL-3 crew shall have access to the activated SWS urine freezer within 24 hours of CSM launch. In any event, all feces and samples of all urine voided after SL-3 lift-off shall be processed in the SWS Waste Management System as soon as it becomes available for use.
- (5) The Skylab educational program requires crew participation to prepare for television coverage of selected activities. A minimum of one telecast per day will be scheduled toward a goal of meeting Public Affairs Office requirements in the following general areas:
 - Rendezvous
 - Habitability/crew quarters demonstrations
 - Cluster tours
 - Experiment and student investigation operations
 - Out-the-window observations
 - Viewfinder-tracking system earth observations
 - Science demonstrations
 - Science pilot highlights
 - Press conference
 - Undock and fly-around
- (6) Crew performance of science demonstrations for television, as required by preceding paragraph (5), shall make use of existing hardware and minor additional items carried up expressly for this purpose.

3.3.4 Experiments, Student Investigations, and Subsystems/ Operational Tests

This section contains requirements and instructions for scheduling in-flight experiments, student investigations and subsystems/operational tests in the mission flight plan. Mission assignments and complementary scheduling requirements are given in Annex A, "Sky-lab Experiments".

3.3.4.1 Pre-Mission Planning

Instructions set forth in the subsections below shall be used for preparing the pre-mission flight plans.

3.3.4.1.1 Group-Related Experiments

The group-related experiments comprise the in-flight medical, ATM, and EREP experiments. They shall be scheduled in accordance with the assignment and scheduling instructions presented in Table A-2 of Annex A, the minimum scheduling requirements found in paragraph 3.3.4.1.5, and the requirements set forth below:

- (1) Crew-attended ATM operations shall be given scheduling priority for one crewman, exclusive of those periods allocated to EREP, for all daylight passes (plus the necessary night periods) for all identified experiment days. It shall be the goal to obtain 230 hours of manned ATM operation above the 400 kilometer observing constraint.
- (2) Unattended ATM operations may be scheduled during any period in which the ATM console is not manned, provided such scheduling does not contradict other requirements specified in this document.
- (3) The ATM experiments (excluding S055) and H-alpha 1, shall each utilize not more than two magazines of film.
- (4) The EREP experiments, excluding S190B, shall be scheduled for operation on 26 Z-local vertical passes and two solar-inertial passes. A goal of four of the Z-local vertical passes shall be planned to gather data on approved European/African/Asian sites. The S190B experiment shall be scheduled so as to not unduly impact other experiments assigned to the scientific airlock. The S190B goal shall be operation on 20 of the 26 Z-local vertical passes identified above.

3.3.4.1.2 Corollary Experiments

The corollary experiments are those in-flight experiments other than the group-related experiments and the student investigations. They shall be scheduled in accordance with the instructions set forth in Section 3.3.4.1.5 below.

3.3.4.1.3 Student Investigations

A number of investigations selected from a national contest of the Skylab Student Project will be performed aboard the orbital assembly. Student investigations assigned to the SL-3 mission shall be allocated up to 1-1/2 crew manhours per week for performance. The student investigations shall be scheduled to satisfy the requirements given in Table A-2, Annex A. Minimum scheduling requirements for student investigations are presented in paragraph 3.3.4.1.5, below.

3.3.4.1.4 Subsystems/Operational Tests

Subsystems/operational tests for Mission SL-3 will be approved at Level II and subsequently documented as Detailed Test Objectives (DTO's) in the Mission Requirements Document (MRD). Each DTO shall clearly indicate whether the test is (1) mandatory with respect to crew safety or mission objectives or (2) non-mandatory. Those tests deemed mandatory shall be incorporated into either systems housekeeping, experiment preparation, or other life/systems support activities as appropriate. Those tests deemed non-mandatory shall be scheduled on a non-interference basis with experiments, student investigations and mandatory tests. The seven subsystems/operational DTO's listed below shall be scheduled for performance on mission SL-3.

- (1) Environmental microbiology
- (2) Operational radiation measurements
- (3) Orbital assembly contamination assessments
- (4) Water sample
- (5) SLA deployment observation
- (6) Iodine monitoring
- (7) Carbon monoxide monitor

3.3.4.1.5 Scheduling of Corollary Experiments

Corollary experiments shall be scheduled on Mission SL-3 in accordance with the following instructions.

- (1) Corollary experiments assigned to Mission SL-3 shall be scheduled into those intervals of the crew timeline which have not been allocated to the group-related experiments and necessary life/systems support activities (eat, sleep, off duty, personal hygiene, and systems housekeeping). The corollary experiments shall be scheduled to satisfy the requirements stated or implied in Table A-2 of Annex A.

If these requirements cannot be fully accommodated in the mission timeline, the following experiments may be reduced to not less than the level shown below:

<u>Experiment</u>	<u>Minimum Scheduling Requirement</u>
M151	Eliminate those portions of the experiment that require photography of crew activities pertaining to PGA and maintenance.
M487	Perform individual discussions with each crewman late in mission. Perform group discussions once in each four week period. Perform seven photographic sequences of crew activities.
M509	Perform two unsuited and one suited set of maneuvers.
M516	Obtain photographs of four specific crew activities.
S019	Perform eight night passes of 32-minutes average duration.
S063	Perform four passes of 26-minute average duration, and 15 UV horizon airglow photographs.
S149	Retrieve and return the one set of cassettes exposed during the unmanned phase of SL-3. Deploy, retrieve, and return one set for the manned portion of SL-3. Deploy one set for the unmanned phase of SL-4.
S183	Perform eight night passes of 32-minutes average duration.
T003	Reduce that portion of the experiment that requires daily performance to performance every other day.
T020	One crewman perform two runs in shirt sleeve operation, and one run suited.
T027/S073	Perform 20 program performances (photometer scans).
ED32	Take three photographs of each of two plates.

- ED52 Take motion pictures of two webs if building is not successful, or one web if a web is spun. Obtain three still photographs of each of two webs.
- ED63 Observe and photograph cytoplasmic streaming of elodea plant two times.
- ED74 Two mass measurements will be performed: one for calibration, and one for a combination of test masses.

The experiments listed above shall be considered for reduction in order of increasing flight scheduling precedence; e.g., an experiment of FSP 200 will be considered for reduction before an experiment of FSP 300. It is recognized, however, that the order in which experiments are actually reduced may depend more on operational considerations than on the FSP. The SL-3 flight plan shall be flagged to indicate which experiments or investigations have been scheduled to less than their full requirements. The Program Director will consider further reduction if necessary.

- (2) Candidate experiments may be scheduled on the mission providing this does not impact the assigned experiments. They will be considered for inclusion in the timeline in order of decreasing FSP.
- (3) Experiments S019, S063, S183, and T027/S073 shall be given prime consideration during those periods in the mission which satisfy their particular observational constraints or offer unique observational opportunities, i.e., lunar cycle constraints, specific celestial field-of-view, etc.

3.3.4.2 Real-Time Planning

The guidelines in this section shall govern real-time flight planning of experiments, student investigations, and subsystems/operational tests, during conduct of the SL-3 mission.

3.3.4.2.1 Real-Time Planning of Experiments

The real-time goal for experiments shall be performance of the baseline requirements as defined in the Appendix. Priority for attainment of experiment baseline requirements is group-related experiments followed by corollary experiments in order of decreasing FSP.

(1) Increased Scheduling of Experiments

In general, no increase in scheduling beyond baseline requirements will be planned for an experiment until all other assigned activities and candidate experiments are scheduled to the maximum extent possible toward their baseline requirements. Candidate experiments will be scheduled if their performance will not preclude attainment of baseline requirements of assigned activities capable of performance.

(2) Reduced Scheduling of Experiments

When real-time problems are directly related to individual experiments or experiment disciplines (ATM, EREP, Medical, Corollary), the following instructions shall apply:

- (a) When crew time has been expended on a group related experiment run, any time scheduled for a repeat of that run shall normally be absorbed within that experiment's group.
- (b) When crew time has been expended on a corollary experiment, a rescheduled performance shall normally be absorbed within any timeline allocation remaining for that specific experiment; however, other corollary experiments of lower FSP may be considered for reduction/cancellation in order to accommodate a rerun.

If the real-time problems are not directly related to experiment activity but cause loss of crew time scheduled for experiment performances, each experiment discipline shall absorb the lost time in direct proportion to the total SL-3 crew time allocated to that experiment discipline.

When reduced scheduling of experiments must be made within the preceding guidelines, the following general instructions shall also be used as applicable:

- (a) The first level of experiment scheduling reduction shall be from baseline requirement to MSR, if an MSR has been established.
- (b) The second-level of experiment scheduling reduction shall be toward the Performance Redline Scheduling Requirements established in paragraph 3.3.4.2.4 of this section. Performances of less than redline will not be scheduled. (The FMT will be briefed on plans for second-level reductions or cancellations prior to their implementation).
- (c) Experiments being considered for first or second-level reductions or cancellations shall be considered in sequence of increasing FSP, if FSPs have been assigned, taking into account other operational constraints.

3.3.4.2.2 Real-Time Planning of Student Investigations

The real-time goal for student investigations shall be performance of the baseline requirements as established in Table A-2 of Annex A and in the MRD.

(1) Increased Scheduling of Student Investigations

Student investigations shall not be scheduled beyond the maximum of 1-1/2 crew manhours per week allocated to student investigations for pre-mission planning. Further, no increase in scheduling beyond baseline requirement will be made for a student investigation until all other assigned and candidate experiments and student investigations are scheduled to the maximum extent possible toward their baseline requirements.

(2) Reduced Scheduling of Student Investigations

When real-time problems are directly related to a specific student investigation and crew time has been expended on the student investigation run, any rescheduled performance of the run shall normally be absorbed within any timeline allocation remaining for that specific student investigation. If the real-time problems are not directly related to student investigations but cause loss of crew time scheduled for student investigations, then the investigations shall lose reschedule time in direct proportion to the total SL-3 crew time allocated to student investigations. In addition, when real-time flight planning indicates that assigned student investigations may not attain baseline requirements, they will be considered for reduction and/or cancellation. Performance redlines, established in paragraph 3.3.4.2.4 of this section, represent levels of minimum worthwhile information for student investigations. Performances of less than redline will not be scheduled.

3.3.4.2.3 Real-Time Planning of Subsystem/Operational Tests

The real-time goal for subsystems/operational tests is to satisfy the pre-mission planning for such tests.

(1) Increased Scheduling of Subsystems/Operational Tests

In general, no increase in scheduling of subsystems/operational tests beyond those included in pre-mission flight plans shall be made.

(2) Reduced Scheduling of Subsystems/Operational Tests

Those subsystems/operational tests designated as mandatory in the MRD DTOs shall not be reduced without FMT approval. Non-mandatory tests may be reduced as necessary to permit performance of assigned experiments, student investigations, and mandatory subsystems/operational tests.

3.3.4.2.4 Performance Redlines

Performance redlines, established below, represent levels of minimum worthwhile information for experiments and student investigations. Performances of less than redline will not be scheduled.

<u>Activity</u>	<u>Performance Redline Scheduling Requirement (SL-3)</u>
All Medical	Continue to schedule toward baseline requirements; however, repetitive performance of medical experiments may, with flight surgeon concurrence, be deferred to permit performance of ATM and EREP redline requirement.
All ATM	Continue to schedule toward baseline requirements. (EVA data retrieval shall be a real-time decision).
All EREP	Continue to schedule toward baseline requirements.
D024, M487, M555, S019, S063, S071, S072, S149, S183, S228, S230, T003, T013, T027/S073	Continue to schedule toward baseline requirement (or minimum scheduling requirement if assigned.)
M509	Perform one unsuited set of maneuvers.
M516	No crew time required.
S009, S015	Activate for duration of mission.
T020	Perform one unsuited run of four tasks: (1) translation across OWS and stop, (2) pitch, (3) roll, (4) yaw.
ED 11, 12, 21, 22, 25, 76	No specific crew time required.
ED26	Photograph one pulsar or one x-ray source in conjunction with S019.
ED23	No performance unless time will permit one performance in conjunction with S019.
ED32	Take one photograph of one plate.
ED52	Obtain motion pictures of web building process or attempt. Obtain one still photograph of one web.
ED63	Observe and photograph one cytoplasmic streaming of the elodea plant.

ED74

Conduct one mass measurement using the calibration mass.

3.3.5

Unmanned Operations

(1) The following guidelines apply to the unmanned period of SWS operations between separation of the SL-2 CSM and docking of the SL-3 CSM.

- (a) The SWS shall be controlled and interrogated from the ground during the unmanned period.
 - (b) Film for ATM experiments S052 and S054 shall be loaded during the end-of-mission SL-2 EVA for exposure during the unmanned period of SL-3. This film will remain in the experiment canisters until the mid-mission SL-3 EVA. No film shall be provided beyond that specified in Table A-2 of Annex A.
- (2) The unmanned period that follows separation of the SL-3 CSM from the SWS will be part of Mission SL-4.

SKYLAB EXPERIMENTS

<u>Experiment</u>	<u>Mission Assignment</u>		
	<u>SL-1/SL-2</u>	<u>SL-3</u>	<u>SL-4</u>
<u>Corollary</u>			
D008 - Radiation in Spacecraft	A		
D024 - Thermal Control Coatings	A	A	
M479 - Zero Gravity Flammability (Revised)			A
M487 - Habitability/Crew Quarters	A	A	A
M509 - Astronaut Maneuvering Equipment	C	A	A
M516 - Crew Activities/Maintenance	A	A	A
**M551 - Metals Melting	A		
**M552 - Exothermic Brazing	A		
**M553 - Sphere Forming	A		
**M555 - Gallium Arsenide Crystal Growth		A	
Δ M556 - Vapor Growth of II-VI Compounds			A
Δ M557 - Immiscible Alloy Compositions			A
Δ M558 - Radioactive Tracer Diffusion			A
Δ M559 - Microsegregation in Germanium			A
Δ M560 - Growth of Spherical Crystals			A
Δ M561 - Whisker-Reinforced Composites			A
Δ M562 - Indium Antimonide Crystals			A
Δ M563 - Mixed III-V Crystal Growth			A
Δ M564 - Metal and Halide Eutectics			A
Δ M565 - Silver Grids Melted in Space			A
Δ M566 - Copper-Aluminum Eutectics			A
S009 - Nuclear Emulsion	A	A	
S015 - Zero Gravity Single Human Cells		A	
S019 - UV Stellar Astronomy	A	A	A
S020 - UV/X-Ray Solar Photography			A
S063 - UV Airglow Horizon Photography		A	A
S149 - Particle Collection	A	A	A
S183 - UV Panorama	A	A	A
S228 - Trans-Uranic Cosmic Rays	A	A	A
S230 - Magnetospheric Particle Composition		A	A

LEGEND:

C - The experiment, or a part of the experiment, is a candidate for performance on this mission, provided the requirements set forth in Table A-2 will not have been satisfied on an earlier mission (or missions).

** - These experiments utilize a common facility, M512-Materials Processing Facility.

Δ - These experiments utilize a common facility, M518-Multipurpose Electric Furnace.

Table A-1; Summary of Experiment Mission Assignments

SKYLAB EXPERIMENTS

<u>Experiment</u>	<u>Mission Assignment</u>		
	<u>SL-1/SL-2</u>	<u>SL-3</u>	<u>SL-4</u>
<u>Corollary (Cont'd)</u>			
T002 - Manual Navigation Sightings (B)		A	A
T003 - In-Flight Aerosol Analysis	A	A	A
T013 - Crew Vehicle Disturbance		A	
T020 - Foot-Controlled Maneuvering Unit		A	A
T025 - Coronagraph Contamination Measurement			A
T027 (SA) - Contamination Measurement (Sample Array)	A		
T027/S073 - Contamination Measurement Gegenschein/Zodiacal Light (Photometer)	A	A	A
<u>Student Investigations</u>			
ED11 - Atmospheric Absorption of Radiant Heat	A	C	
ED12 - Volcanic Study	A	A	C
ED21 - Libration Clouds		A	
ED22 - Objects within Mercury's Orbit	A	A	C
ED23 - UV From Quasars	A	C	
ED24 - X-Ray Stellar Classes			A
ED25 - X-Rays from Jupiter		A	
ED26 - UV from Pulsars	A	A	
ED31 - Bacteria and Spores	A		
ED32 - In Vitro Immunology		A	
ED41 - Motor Sensory Performance			A
ED52 - Web Formation		A	
ED61/62 - Plant Growth/Plant Phototropism			A
ED63 - Cytoplasmic Streaming		A	
ED72 - Capillary Study			A
ED74 - Mass Measurement		A	
ED76 - Neutron Analysis	A	A	A
ED78 - Liquid Motion in Zero "G"			A

LEGEND:

C - The experiment, or a part of the experiment, is a candidate for performance on this mission, provided the requirements set forth in Table A-2 will not have been satisfied on an earlier mission (or missions).

Table A-1; Summary of Experiment Mission Assignments.

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
Medical (Cont'd)	M133 - Sleep Monitoring		This experiment shall be performed in 15 sleep-sessions on Mission SL-1/SL-2, and in 21 sleep-sessions on Mission SL-3.	N/A
	M151 - Time and Motion Study		This experiment is assigned to Mission SL-1/SL-2, SL-3, and SL-4. It shall be performed only in conjunction with other experiments.	420
ATM	S052 - White Light Coronagraph		These experiments are assigned to Mission SL-1/SL-2, SL-3, and SL-4. The constraints for each mission are identified in the appropriate pre-mission planning sections of this document.	
	S054 - X-Ray Spectrographic Telescope		These experiments, excluding S055, shall each utilize not more than:	N/A
	S055 - UV Spectrometer (A)		<u>One</u> magazine of film on SL-1/SL-2	
	S056 - Dual X-Ray Telescope		<u>Two</u> magazines of film on SL-3	
	S082 - UV Spectrograph/Heliograph		<u>One</u> magazine of film on SL-4	
EREP	S190 - Multispectral Photographic Facility		These experiments are assigned to Missions SL-1/SL-2, SL-3, and SL-4.	N/A
	S190A - Multispectral Photographic Cameras		The constraints for each mission are identified in the appropriate pre-mission planning sections of this document.	
	S190B - Earth Terrain Camera			
	S191 - Infrared Spectrometer			
	S192 - Multispectral Scanner			
	S193 - Microwave Radiometer/Scatterometer and Altimeter			
	S194 - L-Band Radiometer			

TABLE A-2 Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	D008 - Radiation in Spacecraft		Four active dosimeter surveys shall be performed on Mission SL-1/SL-2 (the experiment is integrated in CM 116).	220
	D024 - Thermal Control Coatings		Two sample panels shall be retrieved and returned on SL-1/SL-2; the remaining two sample panels shall be retrieved on SL-3.	230
	M479 - Zero Gravity Flammability		A total of five sets of test cycles shall be performed as close to the termination of the SL-4 Mission as possible so as not to contaminate any experiments having sensor equipment external to the spacecraft.	210
COROLLARY	M487 - Habitability/Crew Quarters		This experiment shall be performed on Missions SL-1/SL-2, SL-3, and SL-4.	470
	M509 - Astronaut Maneuvering Equipment		Four experiments runs (three unsuited and one suited) shall be performed by each of three crewmen (nine unsuited and three suited runs total). One crewman shall perform a set of four runs on SL-3 and two crewmen shall perform two sets of four runs each on SL-4. The crewman performing the experiment shall be accompanied by an observer. At least one crewman who performs M509 shall also perform one set of experiment runs on experiment T020.	300

TABLE A-2 Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	M516 - Crew Activities/Maintenance		This experiment is assigned to Missions SL-1/SL-2, SL-3, and SL-4. The fine manipulation maintenance tasks shall be performed on Mission SL-4.	380
	M551 - Metals Melting		This experiment is assigned to Mission SL-1/SL-2.	190
	M552 - Exothermic Brazing		This experiment is assigned to Mission SL-1/SL-2.	150
	M553 - Sphere Forming		This experiment is assigned to Mission SL-1/SL-2.	160
COROLLARY	M555 - Gallium Arsenide Crystal Growth		This experiment is assigned to Mission SL-3.	200
	M556 - Vapor Growth of II-VI Compounds		This experiment is assigned to Mission SL-4. This experiment shall be the last experiment performed in the M518 facility because of the possible toxicity hazard.	350
	M557 - Immiscible Alloy Composition		This experiment is assigned to Mission SL-4.	440
	M558 - Radioactive Tracer Diffusion		This experiment is assigned to Mission SL-4. This experiment shall be the next to last experiment performed in the M518 facility because of the possible toxicity hazard.	430
	M559 - Microsegregation in Germanium		This experiment is assigned to Mission SL-4.	320

TABLE A-2. Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	M560	Growth of Spherical Crystals	This experiment is assigned to Mission SL-4.	310
	M561	Whisker-Reinforced Composites	This experiment is assigned to Mission SL-4.	360
	M562	Indium Antimonide Crystals	This experiment is assigned to Mission SL-4.	480
	M563	Mixed III-V Crystal Growth	This experiment is assigned to Mission SL-4.	390
	M564	Metal and Halide Eutectics	This experiment is assigned to Mission SL-4.	270
	M565	Silver Grids Melted in Space	This experiment is assigned to Mission SL-4.	260
	M566	Copper-Aluminum Eutectics	This experiment is assigned to Mission SL-4.	400
	S009	Nuclear Emulsion	One nuclear emulsion detector package shall be exposed and retrieved on Missions SL-1/SL-2 and SL-3.	180
	S015	Zero Gravity Single Human Cells	This experiment is assigned to Mission SL-3 (the experiment hardware is integrated in CM 117).	280
	S019	UV Stellar Astronomy	This experiment is assigned to Missions SL-3 and SL-4. The extra film carried on SL-3 for this experiment may be utilized only when additional performances of this experiment will not interfere with achievement of baseline requirements on other experiments.	500

TABLE A-2 Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	S020	UV/X-Ray Solar Photography	This experiment is assigned to Mission SL-4.	290
	S063	UV Airglow Horizon Photography	This experiment is assigned to Missions SL-3 and SL-4.	240
	S149	Particle Collection	Four sets of detector cassettes shall be deployed, exposed, and retrieved. One set shall be exposed during the SL-3 unmanned phase and one set during the SL-4 unmanned phase, using the anti-solar scientific airlock. One set shall be exposed at the ATM sun shield during the SL-3 manned phase and one during the SL-4 manned phase, using EVA deployments and retrievals.	450
COROLLARY	S183	UV Panorama	This experiment is assigned to all missions. The extra film carried on SL-3 for this experiment may be utilized only when additional performances of this experiment will not interfere with achievement of baseline requirements on other experiments.	490
	S228	Trans-Uranic Cosmic Rays	This experiment is assigned to Mission SL-1/SL-2 for deployment of the Lexan samples. One sample will be returned on Mission SL-3 and the remaining 35 samples will be returned on SL-4.	275

TABLE A-2. Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	S230 - Magnetospheric Particle Composition		This experiment is assigned to SL-3 and SL-4.	165
	T002 - Manual Navigation Sightings (B)		This experiment shall be performed on missions SL-3 and SL-4 at the convenience of the crew and on a non-interference basis with the other experiments.	140
	T003 - In-Flight Aerosol Analysis		This experiment shall be performed on Missions SL-1/SL-2, SL-3, and SL-4.	460
	T013 - Crew/Vehicle Disturbance		This experiment shall be performed in the OWS on Mission SL-3.	340
COROLLARY	T020 - Foot Controlled Maneuvering Unit		Each of two crewmen shall perform a set of five experiment runs (three unsuited and two suited). The experiment shall be performed by one crewman on Mission SL-3 and by another crewman on Mission SL-4. At least one of the crewmen who performs T020 shall also perform one set of experiment runs on M509.	250

TABLE A-2. Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	T025 - Coronagraph Contamination Measurement		This experiment is assigned to Mission SL-4.	370
COROLLARY	T027 (SA) - Contamination Measurement (Sample Array)		One sample array shall be developed, exposed for 120 hours and retrieved.	170
	T027/S073 - Contamination Measurement Gegenschein/Zodiacal Light (Photometer System)		This joint experiment utilizing the T027 photometer system shall be performed on all missions.	410

TABLE A-2, Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	ED11 - Atmospheric Absorption of Heat		This experiment is assigned to Mission SL-1/SL-2 and will use S191 data. It is a candidate for further activity on Mission SL-3.	
	ED12 - Volcanic Study		This experiment is assigned to Missions SL-1/SL-2 and SL-3 and is a candidate for SL-4. This experiment will use S191, S192, S190A and S190B data.	
	ED21 - Libration Clouds		This experiment will use S052 JOP-10 data and is assigned to Mission SL-3.	
	ED22 - Objects within Mercury's Orbit		This experiment is assigned to Missions SL-1/SL-2 and SL-3 and is a candidate for SL-4. This experiment will use S052 JOP-6 data.	N/A
STUDENT	ED23 - UV from Quasars		This experiment will require one night pass of S019 during Mission SL-1/SL-2. It is a candidate for further activity on SL-3.	
	ED24 - X-Ray Stellar Classes		This experiment will use ATM JOP-13 data of one pass of stellar region during Mission SL-4	
	ED25 - X-Rays from Jupiter		This experiment will use ATM JOP-13 data of one pass of Jupiter (X-Rays) during Mission SL-3.	
	ED26 - UV from Pulsars		This experiment will use one night pass of S019 during Missions SL-1/SL-2 and SL-3.	
	ED31 - Bacteria and Spores		Perform this experiment one time in accordance with MRD during Mission SL-1/SL-2.	

TABLE A-2 Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
STUDENT	ED32	- In Vitro Immunology	Perform this experiment one time in accordance with MRD during Mission SL-3.	
	ED41	- Motor Sensory Performance	Perform this experiment one time in accordance with MRD during Mission SL-4.	
	ED52	- Web Formation	Perform this experiment one time in accordance with MRD during Mission SL-3.	
	ED61/62	- Plant Growth/Plant Phototropism	Perform this experiment one time in accordance with MRD during Mission SL-4.	
	ED63	- Cytoplasmic Streaming	Perform this experiment one time in accordance with MRD during Mission SL-3.	N/A
	ED72	- Capillary Study	Perform this experiment one time in accordance with MRD during Mission SL-4.	
	ED74	- Mass Measurement	Perform this experiment one time in accordance with MRD during Mission SL-3.	
	ED76	- Neutron Analysis	Perform this experiment one time in accordance with MRD during each of Missions SL-1/SL-2, SL-3 and SL-4.	
	ED78	- Liquid Motion in Zero-G	Perform this experiment one time in accordance with MRD during Mission SL-4.	

TABLE A-2. Experiment Assignment and Scheduling Instructions

MORALE	OPERATIONAL	MEDICAL
Purpose Crew/Family Morale	Discuss/decide sensitive matters in an extreme operational emergency.	Doctor/Patient discussion of crew health status-no prescribing or modifying of Flight Plan
Participants Crew/Family	Crew/Program Director & his designees	Crew/Flight Surgeon
Monitors None (Immediate dismissal for illegal monitoring, taping or discussing)	Public Affairs Officer	None
Scheduling In Flight Plan once a week, normally on off-duty day. Changes by Flight Director.	In extreme operational emergency determined by crew/Program Director or in his absence, his designated representative.	Same In Flight Plan Daily
Prior Announcement Policy only. None for individual conversations	PAO will announce decision to have.	Policy only. None for individual conversations.
Real Time None	None	None
Recorded Yes (complete archives)	Yes	Yes
Post Announcement PAO may announce such calls have been made.	PAO will paraphrase the contents of the conversation, assess accuracy with the Program Director, and determine the final material to be released.	No paraphrase of conversations. Flight Surgeon will immediately give a statement on crew status to the Flight Director and PAO and will prepare a daily medical bulletin stating crew medical status for public release. This brief bulletin will be the only public comment on the conversation.
Tape Custody & Access Cont. JSC Director of Flight Crew Operations.	JSC Director of Flight Crew Operations.	JSC Deputy Director of Life Sciences for Medical Operations.
Tape Release /Access Authority Tapes will not be re-leased nor otherwise made available to anyone unless specific written permission of the Administrator has been given.	Program Director & AA for Public Affairs will have access to the tapes or tape transcripts. All other release must be specifically authorized in writing by the Administrator.	If the Flight Surgeon involved lets anyone listen to the tapes, the PAO will also be invited to listen. Tapes or tape transcripts will not be released unless specifically authorized by written permission of the Administrator.

TABLE B-1. SKYLAB PRIVATE CONVERSATIONS

OFFICE OF
MANNED SPACE FLIGHT

SKYLAB PROGRAM

MAY 1, 1973

SKYLAB

OPERATIONS DIRECTIVE

PROGRAM DIRECTIVE NO. 43 C



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SKYLAB

PROGRAM DIRECTIVE NO. 43C

TO: Distribution

FROM:


DIRECTOR, SKYLAB PROGRAM

SUBJECT: Operations Directive for the Skylab Program

This document is the Skylab Operations Directive (SLPD-43C); it supersedes Program Directive No. 43B, dated March 27, 1972. The requirements set forth herein shall be reflected in subsidiary documents for missions and operations, and shall be fully implemented by cognizant elements of the Skylab Program.

This revision of the Operations Directive (SLPD 43C) incorporates Specification Change Notices (SCNs) 1-14, 16, 18, 19, and 21-33, issued against SLPD 43A and SLPD 43B. SCNs 34-41 are baselined in this revision.

OPERATIONS DIRECTIVE CHANGE LOG

CP* No.	SCN** No.	Date	Pages Affected	Comments
1	8	6/1/72	[REDACTED]	T025 Mission Assignment/ Scheduling Instruction Changes
2	9	8/11/72		S019 Mission Assignment/ Scheduling Instruction Changes
3	10	9/20/72		Revision of crew-attended ATM operations scheduling guideline for mission SL-2.
	12	11/10/72		Deletion of M554 from Annex A.
	13	11/10/72		Inclusion of M518 and eleven related corollary experiments (M556-M566). (Realignment of FSP's in Table A-2.)
	14	11/10/72		Revision of Minimum Scheduling Requirements for experiments assigned to Mission SL-1/SL-2 and criteria used for sched- uling candidate experiments.
	16	11/10/72	Inclusion of all the approved student investigations.	

* Change Package - Change to Skylab Program Directive 43, transmitted directly to holders of the document.

** Specification Change Notice - Notice of change transmitted through CCB channels per Skylab Program Directive 34. The original issue of SLPD 43 is the baseline for SCN numbers; SCN's 1-7 were incorporated in SLPD 43B.

OPERATIONS DIRECTIVE CHANGE LOG

CP No.	SCN No.	Date	Pages-Affected	Comments
4	11	1/8/73		The inclusion of S228 into Annex A.
	18	1/8/73		The revision of educational TV requirements (SL-2).
	19	1/8/73		The inclusion of S-IVB deorbit requirement (SL-2, 3, 4, R).
	21	1/8/73		The revision of S020 mission assignment/scheduling instructions.
	22	1/8/73		The inclusion of S230 into Annex A.
	23	1/8/73		The revision of M556-M566 mission assignment/scheduling instructions.
	24	1/8/73		The revision of S063 mission assignment/scheduling instructions.
	25	1/8/73		The revision of S149 mission assignment/scheduling instructions.
	26	1/8/73		The revision of M509 scheduling instructions
27	1/8/73	The revision of T027 mission assignment, and the addition of a minimum scheduling requirement (MSR) on SL-1/SL-2.		

OPERATIONS DIRECTIVE CHANGE LOG

CP No.	SCN No.	Date	Pages Affected	Comments
4 (Cont'd)	28	1/8/73	Renumbered Pages	The addition of a MSR for M487 on Mission SL-1/SL-2.
	29	1/8/73		The completion of ATM scheduling instructions.
	30	1/8/73		The revision (reword) of the EREP calibration requirements (SL-2).
5	31	2/15/73	Renumbered Pages	The addition of experiment data return guidelines for Mission SL-R.
	32	2/15/73		The addition of a mission management section.
	33	2/15/73		The addition of real-time planning (experiments) guidelines for all missions.
REV C	34		Renumbered Pages	<p>Resulting Changes:</p> <ul style="list-style-type: none"> o The deletion of all student investigation FSP's. o The revision of student investigation titles. o The addition of student investigation assignments in Table A-2. o The revision of student investigation pre-mission scheduling guidelines for Missions SL-1/SL-2, SL-3 and SL-4.

OPERATIONS DIRECTIVE CHANGE LOG

CP No.	SCN No.	Date	Pages Affected	Comments
REV C	35		Renumbered Pages	Revision of ED. TV requirements on Mission SL-1/SL-2.
	36			The inclusion of the seven sub-systems/operational DTO's by title (SL-1/SL-2).
	37			Real-time planning guidelines for all missions.
	38			The revision of mission assignments and scheduling instructions for experiments M131, M509, S019, S150, S183, and T002.
	39			The revision of minimum crew-attended data-taking hours for ATM (SL-4). (From 180 to TBD.)
	40			Skylab Private Conversations
	41			Revision of launch and recovery dates for all missions.

CONTENTS

	<u>Page</u>
1.0 SKYLAB PROGRAM	1-1
1.1 Introduction	1-1
1.2 Document Administration	1-1
1.3 Program Objectives	1-3
1.4 Program Policies and Requirements	1-4
1.5 Documentation	1-7
1.6 Mission Management	1-11
2.0 SKYLAB MISSION SL-1/SL-2	2-1
2.1 Mission Description	2-1
2.2 Mission Objectives	2-1
2.3 Mission Requirements	2-2
2.3.1 Mission Development	2-2
2.3.2 Launch Operations	2-3
2.3.3 In-Flight Operations	2-3
2.3.4 Experiments, Student Investigations, and Subsystem/Operational Tests	2-4
3.0 SKYLAB MISSION SL-3	3-1
3.1 Mission Description	3-1
3.2 Mission Objectives	3-1
3.3 Mission Requirements	3-2
3.3.1 Mission Development	3-2
3.3.2 Launch Operations	3-3
3.3.3 In-Flight Operations	3-3
3.3.4 Experiments, Student Investigations, and Subsystems/Operational Tests	3-3
3.3.5 Unmanned Operations	3-8
4.0 SKYLAB MISSION SL-4	4-1
4.1 Mission Description	4-1
4.2 Mission Objectives	4-1
4.3 Mission Requirements	4-2
4.3.1 Mission Development	4-2
4.3.2 Launch Operations	4-3
4.3.3 In-Flight Operations	4-3
4.3.4 Experiments, Student Investigations, and Subsystems/Operational Tests	4-4
4.3.5 Unmanned Operations	4-8

CONTENTS (Continued)

	<u>Page</u>
5.0 SKYLAB RESCUE MISSION	5-1
5.1 Purpose	5-1
5.2 Mission Description	5-1
5.3 Mission Requirements	5-1
5.3.1 Mission Development	5-1
5.3.2 Mission Commit Policies and Requirements	5-2
5.4 Planning Requirements	5-2
5.5 Experiment Data Return Guidelines	5-2
ANNEX A SKYLAB EXPERIMENTS	A-1
ANNEX B SKYLAB PRIVATE CONVERSATIONS	B-1
APPENDICES	
DEFINITIONS	a-1
ABBREVIATIONS AND ACRONYMS	a-vi
REFERENCES	a-viii
DISTRIBUTION	

TABLES

TABLE 1.1 SKYLAB BASELINE MISSION DATA	1-2
TABLE A-1 SUMMARY OF EXPERIMENT MISSION ASSIGNMENTS	A-3
TABLE A-2 EXPERIMENT ASSIGNMENT AND SCHEDULING INSTRUCTIONS	A-6
TABLE A-3 SKYLAB PRIVATE CONVERSATIONS	B-1

FIGURES

FIGURE 1 SKYLAB MISSION DOCUMENTATION	1-10
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1.0 SKYLAB PROGRAM

1.0 SKYLAB PROGRAM

1.1 INTRODUCTION

The Skylab Program has been established for four explicit purposes; to determine man's ability to live and work in space for extended periods; to extend the science of solar astronomy beyond the limits of earth-based observations; to develop improved techniques for surveying earth resources from space; and to increase man's knowledge in a variety of other scientific and technological regimes.

The Skylab will be placed in orbit around the Earth where it will function throughout three long-duration manned flights and two intervening periods of unmanned operation. A different three-man crew will inhabit and operate the orbital assembly as a habitable workshop during each mission, and will perform a number of physical science, biomedical science, earth applications, and space applications experiments. Certain experiments and tests will be performed under ground control during the unmanned periods. Table 1.1 contains a summary of Skylab baseline mission data.

1.2 DOCUMENT ADMINISTRATION

1.2.1 Background

The Operations Directive supersedes and replaces the operations portions of the former AAP Flight Mission Directives (AAP Directives Nos. 3D, 5A, and 14A). This revision, Program Directive 43C, supersedes Program Directive No. 43B, dated March 27, 1972.

1.2.2 Purpose and Scope

The Operations Directive is a plans and requirements document. The Program Director uses it to issue program policies and requirements, mission objectives, and mission planning instructions to the implementing Centers.

The Operations Directive comprises five major sections and one annex. Section 1.0 includes the program objectives, general policies and requirements, and a catalog of major operational documents. Sections 2.0, 3.0, and 4.0 state the description, objectives, and planning requirements for Missions SL-1/SL-2, SL-3 and SL-4, respectively. Requirements for the Skylab Rescue Mission are given in Section 5.0. Annex A contains assignment and scheduling instructions for each of the approved Skylab experiments. The appendix contains a glossary of Skylab Program terms and approved definitions. Included are standard operational terms used in other Skylab documentation.

MISSION	SL-1/SL-2	SL-3	SL-4
OBJECTIVES	Establish the Skylab orbital assembly in earth orbit Obtain medical data Perform in-flight experiments	Perform unmanned SWS operations Reactivate the orbital assembly Obtain medical data Perform in-flight experiments	Perform unmanned SWS operations Reactivate the orbital assembly Obtain medical data Perform in-flight experiments
SPACE VEHICLE/LAUNCH	SL-1	SL-3	SL-4
LAUNCH VEHICLE	SATURN V (S-IC and SII) 513	SATURN IB 207	SATURN IB 208
KSC LAUNCH COMPLEX	39A	39B	39B
PAYLOAD	SATURN WORKSHOP OWS AM MDA ATM Experiments	CSM 117 3-man crew Experiments	CSM 118 3-man crew Experiments
ORBITAL INCLINATION	~50 Degrees	~50 Degrees	~50 Degrees
ORBITAL ALTITUDE	~ 234 NM	~ 234 NM	~ 234 NM
LAUNCH INTERVAL (FROM SL-1 LAUNCH)	-	~ 86 days	~ 179 days
MANNED FLIGHT DURATION	-	Up to 56 days	Up to 56 days

Table 1.1 Skylab Baseline Mission Data

1.2.3 Authority

The Skylab Operations Directive is written under the authority granted the Program Director through the Skylab Program Approval Document (reference 1) and the Flight Mission Assignments Document (reference 2).

1.2.4 Applicability

This directive applies to the Office of Manned Space Flight (OMSF) and to the Manned Space Flight installations.

1.2.5 Publication and Revisions

The Director of Skylab Operations (OMSF, Code MLO) has the responsibility, within the Skylab Program Office, for preparing, coordinating and maintaining this document. This document is under Level I CCB control. Requests for changes should be forwarded through normal CCB channels in accordance with references 5 and 8. Changes will be processed by MLO and approved by the Program Director. Approved changes will be distributed through normal CCB channels and, in addition, MLO will distribute changes directly to SLPD 43C addressees.

1.3 PROGRAM OBJECTIVES

The following objectives are quoted from the Skylab Program Approval Document (reference 1).

- (1) Biomedical and Behavioral Performance - determine and evaluate man's physiological responses and aptitudes in space under zero-gravity conditions and his post-mission adaptation to the terrestrial environment, through a series of progressively longer missions, and to determine the increments by which mission duration can be increased.
- (2) Man-Machine Relationships - to develop and evaluate efficient techniques utilizing man for sensor operation, discrimination, data selection and evaluation, manual control, maintenance and repair, assembly and set-up, and mobility involved in various operations.
- (3) Long Duration Systems Operations - to develop techniques for increasing systems life, for long duration habitability and for long duration mission control. To investigate and develop techniques for in-flight test and qualification of advanced subsystems.

- (4) Experiments - to conduct solar astronomy and other science, technology and applications experiments involving man when his contribution will improve the quality and/or yield of the results.

1.4 PROGRAM POLICIES AND REQUIREMENTS

1.4.1 Launch and Mission Designations

This section establishes official designations for the Skylab launches and missions:

- (1) The planned launches are designated in order of occurrence: SL-1, SL-2, SL-3, and SL-4. The Skylab Rescue launch is designated SL-R.
- (2) The designations for the planned missions are derived by numbering each mission for the launch or launches it embraces. The first mission comprises the unmanned SL-1 launch and the manned SL-2 launch; thus it is designated mission SL-1/SL-2. The second and third missions are designated SL-3 and SL-4, respectively, after the corresponding launches. The Skylab Rescue Mission is designated SL-R.
- (3) The designations established by (1) and (2) are convenient for internal, operational purposes, but may be confusing when used outside the agency, particularly for public affairs purposes. To avoid such confusion, and yet to retain the operational benefits of the current nomenclature, the following designations shall apply:

Acceptable for use outside NASA
and for non-operational NASA use

Acceptable for
operational use

<u>Launch Name</u>	<u>Mission Name</u>	<u>Launch</u>	<u>Mission</u>
Workshop Launch	First Skylab Mission	SL-1	SL-1/SL-2
First Manned Visit		SL-2	
Second Manned Visit	Second Skylab Mission	SL-3	SL-3
Third Manned Visit	Third Skylab Mission	SL-4	SL-4
Rescue Launch	Rescue Mission	SL-R	SL-R

1.4.2 General Mission Policies and Requirements

The following policies and requirements apply to the conduct of all Skylab missions. Requirements which pertain only to specific missions are presented in Sections 2.0 through 5.0. Launch Mission Rules and Flight Mission Rules shall conform to and reflect these requirements as well as those contained in the specific mission sections.

- (1) Flight crew safety shall take precedence over the accomplishment of mission objectives.
- (2) Recommendations that involve change to mission objectives, mission rules, flight plan, launch and/or flight safety, or the requirements stated in SLPD 43C require the Program Director's approval prior to implementation.
- (3) Problems which may affect accomplishment of mission objectives will be jointly resolved by program and operational elements.
- (4) Criteria for initiating a rescue mission shall be included in the Flight Mission Rules for each Skylab mission.
- (5) The decision to proceed with preparation of the Skylab rescue space vehicle will be made by the Program Director.
- (6) The decision to commit the rescue mission will be made by the Associate Administrator for Manned Space Flight.
- (7) The failure of a mandatory or highly desirable item during launch countdown will be reported to the Program Director before action is taken, when time permits. He will also be informed of the estimated time-to-repair and of any recommendations to proceed, hold, recycle, or scrub.
- (8) Only the Program Director may scrub the mission. If a mandatory item fails during launch countdown, it will be corrected prior to launch, holding or recycling the countdown as necessary. If a mandatory item cannot be corrected to permit liftoff within the launch window, the loss will generally result in a scrub. The Program Director, however, has the authority to downgrade an item from the mandatory category and to proceed with the launch after coordination with the appropriate operations and program managers.

- (9) Consideration will be given to the repair of any highly desirable item, but the launch will not be automatically scrubbed for any single highly desirable item. If two or more highly desirable items fail and/or other aggravating circumstances occur, the Program Director may scrub the mission after coordination with the appropriate operations and program managers. All individual Skylab experiments shall be considered as highly desirable items.
- (10) Hold/cutoff guidelines defining procedures and channels for requesting a hold or a cutoff will be established in the Launch Mission Rules.
- (11) The Launch Director will be responsible for all actions in the event of launch site emergencies, except for recovery operations of the flight crew and spacecraft resulting from a pad abort.
- (12) The Launch Operations Manager may send an abort request from the time the launch escape system (LES) is armed until the space vehicle reaches sufficient altitude to clear the top of the umbilical tower. The criteria for sending an abort request will be established in the Launch Mission Rules.
- (13) From liftoff to umbilical tower clearance, the Launch Director and Flight Director will have concurrent responsibility for sending an abort request. The criteria for sending an abort request during the period will be established in the Launch Mission Rules and Flight Mission Rules respectively.
- (14) Complete ground control of the space vehicle passes from KSC to JSC when the space vehicle reaches sufficient altitude to clear the top of the umbilical tower. The KSC Launch Operations Manager will inform the Mission Control Center (MCC) when the space vehicle reaches sufficient altitude to clear the top of the umbilical tower by stating "clear tower" over one of the loops from KSC to MCC.
- (15) In the event of non-catastrophic space vehicle collision with the umbilical tower or other contingencies which do not require immediate action, the KSC Launch Operations Manager will continue to evaluate the extent of damage and will provide information to the Flight Director for any action necessary after umbilical tower clearance.

- (16) Where possible, all manual abort requests from the ground during flight will be based on two independent indications of the failure. Crew abort action will normally be based upon two cues.
- (17) The S-IVB stages of the SL-2, SL-3, SL-4 and SL-R launch vehicles shall be capable of controlled deorbit by means of controlled dumping of residual propellant.

1.4.3 Skylab Launch Dates

Close adherence to the currently scheduled Skylab launch dates is essential to obtaining the desired seasonal earth resources data. Any experiment, including individual EREP experiments, which could compromise the May 14, 1973 launch date of SL-1 by not meeting the SWS closeout date, will be subject to review by the Program Director for possible cancellation.

1.4.4 Private Communications for Skylab

The governing requirements for private communications are contained in NASA Administrator memorandum, subject: Private Communications for Skylab, March 29, 1973 (reference 13). For convenience only a summary matrix of these requirements is included in Table A-3 of Annex A.

1.5 DOCUMENTATION

This section has three purposes: (1) to identify key Skylab program and mission documents which include and/or reflect the Program Director's management instructions pertaining to mission planning, requirements, operations and evaluation; (2) to establish responsibilities for the control and orderly development of the Skylab operational documents; and (3) to clarify the relationships that exist among the documents. Figure 1 depicts these documents and their interrelationships.

1.5.1 Mission Requirements Document (MRD)

The MRD is the basis for Skylab mission planning and design. It defines the mission requirements and the functional and performance requirements for implementing the program and mission objectives specified in this Directive. The MRD contains detailed operational requirements for the missions compiled from various sources, including Experiment Requirements Documents (ERDs) and the Data Request Forms (DRFs), which are developed at JSC and MSFC. The MRD shall be consistent with this Directive and shall further amplify the mission objectives and requirements set forth herein. To make the relationship of the MRD to the Operations Directive (OD) clear at all times, each issue of the MRD shall include flag sheets to identify all areas in which the MRD is not consistent with the OD. The MRD shall be jointly prepared and approved by JSC and MSFC, and shall be coordinated under the cognizance of the Mission Requirements Panel, as established in reference 4.

1.5.1.1 Trajectory Plan

The Trajectory Plan contains detailed trajectory data for the ascent and orbital phases of the mission. The plan is developed from requirements set forth in the MRD. The Trajectory Plan is prepared by JSC. MSFC shall be responsible for the ascent trajectory, and JSC for the orbital trajectory.

1.5.1.2 Flight Plan

The Flight Plan shall identify and schedule all in-flight crew activities required to accomplish the mission objectives and to meet the requirements set forth in the MRD. The Flight Plan is prepared by JSC with inputs from MSFC.

1.5.2 Mission Rules Guidelines (Skylab Program Directive No. 46)

Program Directive No. 46 sets forth requirements on the Mission Rules for both launch and flight phases of each mission. The directive also establishes responsibilities at KSC, JSC, MSFC, and NASA Headquarters for the preparation, coordination, review, and revision of the rules. It is issued by the Program Director, OMSF (ML).

1.5.2.1 Launch Mission Rules

The Launch Mission Rules shall be developed in accordance with Skylab Program Directive No. 46, the Operations Directive and the Mission Requirements Document (MRD). Their purpose is to ensure crew safety and to maximize the probability of mission success by guiding operational decisions in the launch phases of the mission. The Launch Mission Rules are prepared by KSC with inputs from JSC and MSFC. Both JSC and MSFC shall concur in the final Launch Mission Rules.

1.5.2.2 Flight Mission Rules

The Flight Mission Rules shall be developed in accordance with Skylab Program Directive No. 46, the Operations Directive and the Mission Requirements Document (MRD). Their purpose is to ensure crew safety and to maximize the probability of mission success by guiding operational decisions in the flight phases of the mission. The Flight Mission Rules are prepared by JSC with inputs from MSFC. MSFC shall concur in the final Flight Mission Rules.

1.5.3 Skylab Educational Program (Skylab Program Directive No. 60)

Skylab Program Directive No. 60 will define the Skylab Educational Program, identifying tasks, responsibilities and schedules for each aspect of that Program. The Directive will be issued by the Program Director, OMSF (ML).

1.5.4 Mission Evaluation Requirements (Skylab Program Directive No. 35)

Skylab Program Directive No. 35 defines the minimum evaluation and reporting requirements for the Skylab missions. It further assigns responsibilities to insure that mission performance evaluations are accomplished to effectively support real-time mission activities, succeeding Skylab mission flight preparation and operations, and the advancement of space flight science and technology.

1.5.4.1 Mission Evaluation Plan (MEP)

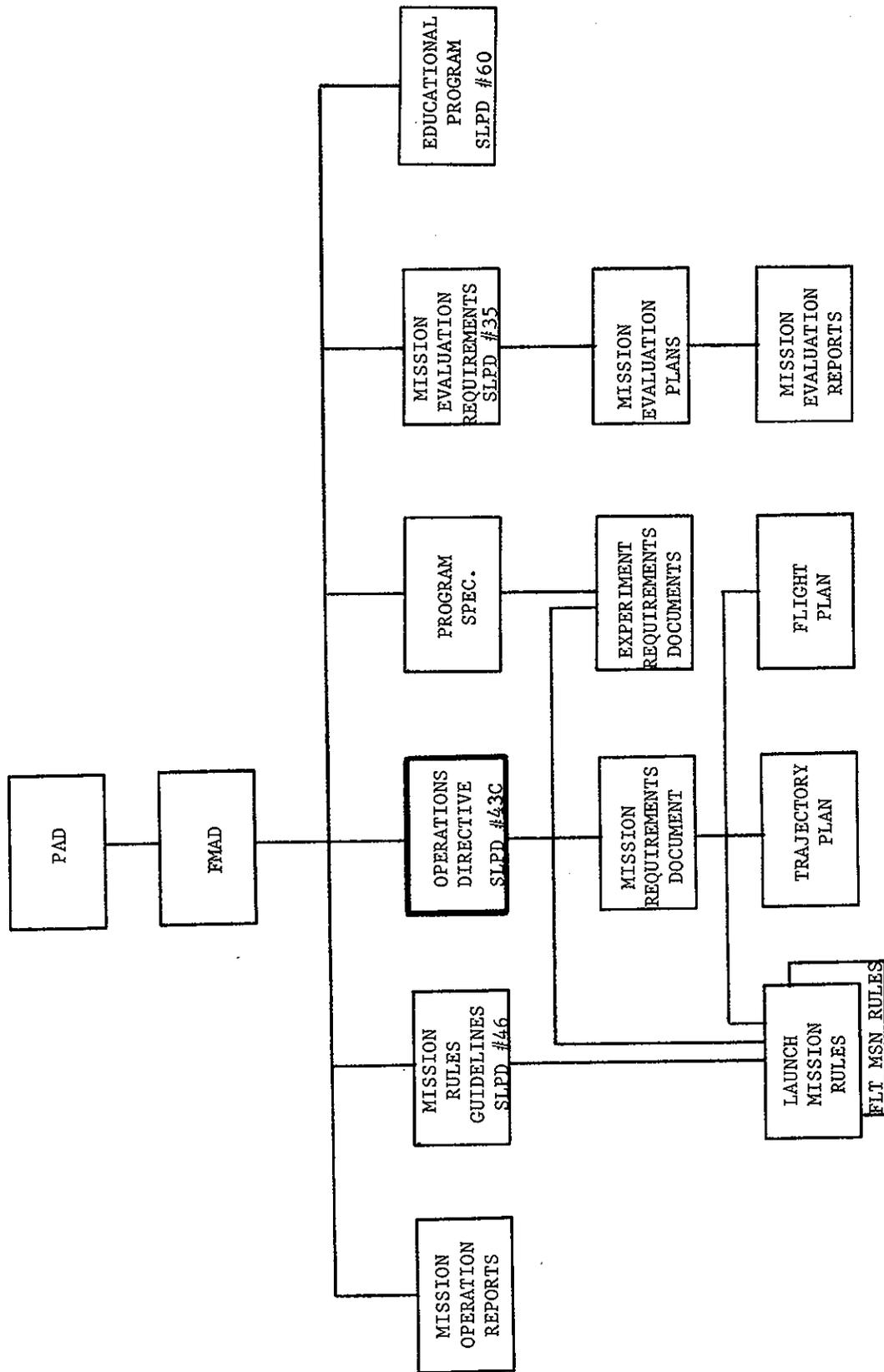
Mission Evaluation Plans shall be prepared by KSC, JSC, and MSFC and submitted to the Program Director for his review. These plans shall be designed to meet the reporting requirements set forth in SLPD 35 and to outline the procedures and schedules by which evaluations from previous missions are made available for the planning of subsequent missions.

1.5.4.2 Mission Operation Report (MOR)

Mission Operation Reports shall be prepared by MLO, approved by the Program Director and the Associate Administrator for Manned Space Flight, and submitted to the Administrator in accordance with schedules established in HQMI 8610.1, "Mission Operation Reports". These reports will be prepared in two basic forms: prelaunch and post-launch, with interim reports as necessary during the mission. The prelaunch MOR will consist of two volumes; Volume I, Mission Description, and Volume II (Supplement), Systems Description. The Systems Description portion of the MOR will also serve as the Systems Description section of the Mission Evaluation Reports (MERs) to be prepared by JSC and MSFC.

1.5.5 Mission Medical Requirements Document (MMRD)

The MMRD will provide for a medical baseline plan for the provision and integration of all medical activities (preflight, in-flight, and post-flight) associated with the Skylab Program. The MMRD will define the medical operations philosophy, responsibilities, and manning for the individual missions, and for the total Skylab Program. The MMRD will provide for planned methods of interacting the in-flight data from the medical experiments with the medical operations data; it will also provide for those methods to be utilized for the purpose of decision on the qualification of man for the next longer increment of weightless flight. The MMRD shall be prepared by JSC.



NOTE: This chart depicts the interrelationships of documents described in Sections 1.2 and 1.5.

FIGURE 1 SKYLAB MISSION DOCUMENTATION

1.5.6 Experiments Requirements Document (ERD)

All Skylab ERD's are established and written under the Skylab Program Specification (reference 3). Thus the formal objectives of each experiment are stated in and controlled through the Program Specification. However, the assignment of experiments to particular missions, and the extent to which each experiment shall be performed on each mission, are controlled by the Program Director through the Operations Directive.

1.6 MISSION MANAGEMENT

The extended duration of the Skylab missions, the complexity and number of mission activities, and the increased emphasis of sponsoring office involvement in Skylab has required the establishment of management support groups to assist the Program Director in resolving and coordinating programmatic and operational issues during the mission period. A Flight Management Team (FMT) will function at JSC during the mission to support and provide guidance to the Flight Operations Team. A Skylab Advisory Group for Experiments (SAGE) will advise the Program Director on major policy issues involving experiments.

1.6.1 Flight Management Team

The FMT will provide a means for the Program Director to receive the advice of all organizations directly involved in carrying out the Skylab missions, and will also provide a means of management communication and coordination among the organizations represented. Specific functions of the FMT will be to:

- (1) Review mission status
- (2) Resolve programmatic issues
- (3) Approve significant deviation to nominal flight planning
- (4) Coordinate appropriate decisions and actions with senior NASA management and other Skylab activities.

The FMT will be chaired by the Program Director. Other team members will be the JSC Skylab Program Manager, MSFC Skylab and Saturn Program Managers, KSC Skylab Program Manager, JSC Director of Flight Operations, and JSC Director of Flight Crew Operations. Various elements of the operational team may participate as approved by the Program Director. The meetings will be held as directed by the Program Director or his representative. The Flight Director will coordinate and provide for appropriate mission briefings.

1.6.2 Skylab Advisory Group for Experiments

The SAGE will advise the Skylab Program Director on major policies and activities associated with the conduct of experiments. It will provide a forum for the various sponsoring offices to remain current with mission activities, discuss problems with other sponsoring offices and provide recommendations to the Program Director. The members of the SAGE will be the Directors from the NASA Headquarters sponsoring offices of the Skylab experiments. The members are:

Skylab Program Director - Chairman
Director Physics & Astronomy Programs
Director Earth Observations Program
Director Manned Space Technology
Director of NASA Life Sciences
Director Advanced Missions

The SAGE will meet weekly and as required during the manned mission period. The Program Director or his representative will conduct these meetings. The Headquarters Program Office will support the SAGE by providing current mission status, reviewing future planning and developing available experiment data as requested. Meetings will be conducted in the Skylab Management Center.

2.0 SKYLAB MISSION SL-1/SL-2

2.0 SKYLAB MISSION SL-1/SL-2

2.1 MISSION DESCRIPTION

Skylab Mission SL-1/SL-2 will comprise two launches: the first, SL-1, will place the unmanned Saturn Workshop (SWS) in near-earth orbit, and the second, SL-2, will place the CSM with its three-man crew in orbit. Once in orbit, the CSM will rendezvous with, and dock to, the SWS. The crew will then enter the SWS, activate its systems, and inhabit and operate the combined CSM and SWS (orbital assembly) for up to 28 days. During this time the crew will perform systems and operational tests and the assigned experiments. To conclude the mission, the crew will configure the SWS for unmanned operations, undock the CSM, and return to earth in the Command Module.

2.2 MISSION OBJECTIVES

- (1) Establish the Skylab orbital assembly in earth orbit.
 - (a) Operate the orbital assembly (SWS plus CSM) as a habitable space structure for up to 28 days after the SL-2 launch.
 - (b) Obtain data for evaluating the performance of the orbital assembly.
 - (c) Obtain data for evaluating crew mobility and work capability in both intravehicular and extra-vehicular activity.
- (2) Obtain medical data on the crew for use in extending the duration of manned space flights.
 - (a) Obtain medical data for determining the effects on the crew which result from a space flight of up to 28 days duration.
 - (b) Obtain medical data for determining if a subsequent Skylab mission of up to 56 days duration is feasible and advisable.
- (3) Perform in-flight experiments.
 - (a) Obtain ATM solar astronomy data for continuing and extending solar studies beyond the limits of earth-based observations.

- (b) Obtain earth resources data for continuing and extending multisensor observation of the earth from low earth orbit.
- (c) Perform the assigned scientific, engineering, technology and DOD experiments.

NOTE FOR DEVELOPMENT EMPHASIS

For hardware development, the above objectives, together with the amplifying remarks, are to be treated as criticality category 2. Individual ATM, Earth Resources, and Medical Experiments shall be considered category 3. Scientific, Engineering, Technology, and DOD Experiments shall be category 3 or 4, as specified by the development centers. Individual critical elements within an experiment may be category 1 or 2 as appropriate. (See reference 7).

2.3 MISSION REQUIREMENTS

2.3.1 Mission Development

- (1) The SL-1/SL-2 mission period shall begin with the initiation of SL-1 launch countdown, and shall terminate with the recovery of the flight crew and Command Module.
- (2) The launch of SL-1 shall be planned for 1730 hours GMT, May 14, 1973. It is highly desirable that a one day scrub/turnaround capability be provided for the SL-1 space vehicle. The launch of SL-2 shall be planned for the first northerly launch opportunity (nominally 1700 hours GMT) on the day following SL-1 launch. In addition, preparations shall allow for at least three SL-2 northerly launch opportunities within the seven days following the SL-1 launch.
- (3) The SL-2 manned flight shall be planned for a duration of 28 days, starting with the launch of the manned SL-2 space vehicle and ending with the recovery of the SL-2 Command Module (nominally June 12, 1973).
- (4) The SWS shall be inserted into a circular orbit of such an altitude ($\sqrt{234}$ NM) that a controlled groundtrack pattern which repeats every 71 revolutions can be maintained by the orbital assembly.
- (5) Docking of the mission CSM to the Saturn Workshop shall be planned for the axial docking port of the Multiple Docking Adapter (MDA).

2.3.2 Launch Operations

The following requirements shall be reflected in the Launch Mission Rules and other SL-1/SL-2 launch planning documentation:

- (1) Any space vehicle element or operational support element whose malfunction can result in the failure of the SWS to achieve a fully deployed and stabilized attitude, and to remain habitable throughout the planned SL-1/SL-2, SL-3, and SL-4 mission sequence, shall be considered a mandatory item for SL-1 launch.
- (2) Any SL-2 space vehicle element or operational support element whose malfunction can limit the SL-2 manned flight to less than 28 days duration shall be considered a mandatory item for launch.

2.3.3 In-Flight Operations

The following requirements and instructions shall be used in developing the SL-1/SL-2 mission flight plans:

- (1) Approximately one of every seven manned mission-days shall be scheduled as an off-duty day.
- (2) Each off-duty day shall include performance of experiments M071 and M073, crew rest and recreation, nominal monitoring of spacecraft systems, and crew planning.
- (3) Scheduling of crew activities shall permit rapid crew response to solar flares that occur when the ATM console is not manned.
- (4) To preserve urine samples, the SL-2 crew shall have access to the activated SWS urine freezer within 24 hours of CSM launch. In any event, all feces and samples of all urine voided after SL-2 liftoff shall be processed in the SWS Waste Management System as soon as it becomes available for use.
- (5) The Skylab Educational Program requires crew participation to prepare for television coverage of selected activities. Public Affairs has identified 19 subjects for TV coverage on Mission SL-1/SL-2. Sufficient crew time shall be allocated to meet this requirement.

2.3.4 Experiments, Student Investigations, and Subsystems/ Operational Tests

This section contains requirements and instructions for scheduling inflight experiments, student investigations and subsystems/operational tests in the mission flight plan. Mission assignments and complementary scheduling requirements are given in Annex A, "Skylab Experiments".

2.3.4.1 Pre-Mission Planning

Instructions set forth in the subsections below shall be used for preparing the pre-mission flight plans.

2.3.4.1.1 Group-Related Experiments

The group-related experiments comprise the in-flight medical, ATM, and EREP experiments. They shall be scheduled in accordance with the assignment and scheduling instructions presented in Table A-2 of Annex A, and the requirements set forth below:

- (1) Crew-attended ATM operations shall be given scheduling priority for one crewman, exclusive of those periods allocated to EREP, S020, and T025, for all daylight passes (plus the necessary night periods) for all identified experiment days. S020 and T025 activities that constrain ATM operations will be approved by Level I action. In no case will the ATM be scheduled for less than 105 daylight hours, excluding ATM checkout, above the 400 kilometer observing constraint.
- (2) Unattended ATM operations may be scheduled during any period in which the ATM console is not manned, provided such scheduling does not contradict other requirements specified in this document.
- (3) The ATM experiments (excluding S055) and H-alpha 1 shall each utilize not more than one magazine of film.
- (4) The EREP experiments, excluding S190B, shall be scheduled for operation on 15 EREP passes. There will be 14 Z-local vertical passes and 1 solar inertial pass. Calibration requirements must be satisfied on the solar inertial pass.
- (5) The S190B experiment shall be scheduled for operation on ten of the Z-local vertical passes identified in (4) above.

2.3.4.1.2 Corollary Experiments

The corollary experiments are those inflight experiments other than the group-related experiments and the student investigations. They shall be scheduled in accordance with the instructions set forth in Section 2.3.4.1.5 below.

2.3.4.1.3 Student Investigation

A number of investigations selected from a national contest of the Skylab Student Project will be performed aboard the orbital assembly. Student investigations assigned to the SL-1/SL-2 mission shall be allocated up to 1-1/2 crew manhours per week for performance. The student investigations shall be scheduled to satisfy the requirements given in Table A-2, Annex A.

2.3.4.1.4 Subsystems/Operational Tests

Subsystems/operational tests for Mission SL-1/SL-2 will be approved at Level II and subsequently documented as Detailed Test Objectives (DTO's) in the Mission Requirements Document (MRD). Each DTO shall clearly indicate whether the test in (1) mandatory with respect to crew safety or mission objectives or (2) non-mandatory. Those tests deemed mandatory shall be incorporated into either systems housekeeping experiment preparation, or other life/systems support activities as appropriate. Those tests deemed non-mandatory shall be scheduled on a non-interference basis with experiments, student investigations and mandatory tests. The seven subsystems/operational DTO's listed below shall be scheduled for performance on Mission SL-1/SL-2.

- (1) Environmental Microbiology
- (2) Operational Radiation Measurements
- (3) Portable CO₂/Dewpoint Monitor
- (4) Orbital Assembly Contamination Assessment
- (5) Internal OWS Temperature Measurements
- (6) Water Sample
- (7) SLA Deployment Observation

2.3.4.1.5 Scheduling of Corollary Experiments

Corollary experiments shall be scheduled on Mission SL-1/SL-2 in accordance with the following instructions.

- (1) Corollary experiments assigned to Mission SL-1/SL-2 shall be scheduled into those intervals of the crew timeline which have not been allocated to the group related experiments and the necessary life/systems support activities (eat, sleep, off-duty, personal hygiene, and systems housekeeping). The corollary experiments shall be scheduled to satisfy the requirements stated or implied in Table A-2 of Annex A. If these requirements cannot be fully accommodated in the mission timeline, the following experiments may be reduced to not less than the level shown.

<u>Experiment</u>	<u>Minimum Scheduling Requirement</u>
D008	Accomplish one performance of each active survey. (Five passive dosimeters are automatically exposed.)
M487	Perform group discussion evaluations, and obtain instrument and photographic data.
M509	Perform one suited set of maneuvers.
S019	Eight night passes of 32 minutes average length. (~100 photographic exposures)
S183	Eight night passes of 32 minutes average length. (~25 photographic exposures)
T003	Reduce that portion of the experiment that requires daily performance, to performance every other day.
T025	Perform three observation periods of one orbit each.
T027 (SA)	Deploy sample array for a 72-hour period.
T027/S073	Perform 15 program performances (photometer scans).

The experiments listed above shall be considered for reduction in order of increasing flight scheduling precedence; e.g., an experiment of FSP 200 will be considered for reduction before an experiment of FSP 300. It is recognized, however, that the order in which experiments are actually reduced may depend more on operational considerations than on the FSP. The SL-1/SL-2 flight plan shall be flagged to indicate which experiments or investigations have been scheduled to less than their full requirements. The Program Director will consider further reduction if necessary.

- (2) Candidate experiments may be scheduled on the mission provided this does not require scheduling the assigned experiments to less than their baseline requirements. They will be considered for inclusion in the timeline in order of decreasing FSP.
- (3) The joint T027/S073 program of photometer scans shall be scheduled to begin early in the mission, before the initiation of the ATM experiments. This does not mean, however, that the start of ATM operations is in any way contingent upon the performance or results of T027/S073.

2.3.4.2 Real-Time Planning

The guidelines in this section shall govern real-time flight planning of experiments, student investigations, and subsystems/operational tests, during conduct of the SL-1/SL-2 mission.

2.3.4.2.1 Real-Time Planning of Experiments

The real-time goal for experiments shall be performance of the baseline requirements as defined in the Appendix. Priority for attainment of experiment baseline requirements is group related experiments followed by corollary experiments in order of decreasing FSP.

(1) Increased Scheduling of Experiments

In general, no increase in scheduling beyond baseline requirements will be planned for an experiment until all other assigned activities and candidate experiments are scheduled to the maximum extent possible toward their baseline requirements. Candidate experiments will be scheduled if their performance will not preclude attainment of baseline requirements of assigned activities capable of performance.

(2) Reduced Scheduling of Experiments

When real-time problems are directly related to individual experiments or experiment disciplines (ATM, EREP, Medical, Corollary), the following instructions shall apply:

- (a) When crew time has been expended on a group related experiment run, any time scheduled for a repeat of that run shall normally be absorbed within that experiment's group.
- (b) When crew time has been expended on a corollary experiment, a rescheduled performance shall normally be absorbed within any timeline allocation remaining for the specific experiment; however, other corollary experiments of lower FSP may be considered for reduction/cancellation in order to accommodate a rerun.

If the real-time problems are not directly related to experiment activity but cause loss of crew time scheduled for experiment performances, each experiment discipline shall absorb the lost time in direct proportion to the total SL-1/SL-2 crew time allocated to that experiment discipline.

When reduced scheduling of experiments must be made within the preceding guidelines, the following general instructions shall also be used as applicable:

- (a) The first level of experiment scheduling reduction shall be from baseline requirement to MSR, if an MSR has been established.
- (b) The second-level of experiment scheduling reduction shall be toward the Performance Redline Scheduling Requirements established in paragraph 2.3.4.2.4 of this section. Performances of less than redline will not be scheduled. (The FMT will be briefed on plans for second-level reductions or cancellations prior to their implementation).
- (c) Experiments being considered for first or second-level reductions or cancellations shall be considered in sequence of increasing FSP, if FSPs have been assigned, taking into account other operational constraints.

2.3.4.2.2 Real-Time Planning of Student Investigations

The real-time goal for student investigations shall be performance of the baseline requirements as established in Table A-2 of Annex A and in the MRD.

(1) Increased Scheduling of Student Investigations

Student investigations shall not be scheduled beyond the maximum of 1-1/2 crew manhours per week allocated to student investigations for pre-mission planning. Further, no increase in scheduling beyond baseline requirement will be made for a student investigation until all other assigned and candidate experiments and student investigations are scheduled to the maximum extent possible toward their baseline requirements.

(2) Reduced Scheduling of Student Investigations

When real-time problems are directly related to a specific student investigation and crew time has been expended on the student investigation run, any rescheduled performance of the run shall normally be absorbed within any timeline allocation remaining for that specific student investigation. If the real-time problems are not directly related to student investigations but cause loss of crew time scheduled for student investigations, then the investigations shall lose reschedule time in direct proportion to the total SL-1/SL-2 crew time allocated to student investigations. In addition, when real-time flight planning indicates that assigned student investigations may not attain baseline requirements, they will be

considered for reduction and/or cancellation. Performance redlines, established in paragraph 2.3.4.2.4 of this section, represent levels of minimum worthwhile information for student investigations. Performances of less than redline will not be scheduled.

2.3.4.2.3 Real-Time Planning of Subsystem/Operational Tests

The real-time goal for subsystem/operational tests is to satisfy the pre-mission planning for such tests.

(1) Increased Scheduling of Subsystems/Operational Tests

In general, no increase in scheduling of subsystems/operational tests beyond those included in pre-mission flight plans shall be made.

(2) Reduced Scheduling of Subsystems/Operational Tests

Those subsystems/operational tests designated as mandatory in the MRD DTOs shall not be reduced without FMT approval. Non-mandatory tests may be reduced as necessary to permit performance of assigned experiments, student investigations, and mandatory subsystems/operational tests.

2.3.4.2.4 Performance Redlines

Performance redlines, established below, represent levels of minimum worthwhile information for experiments and student investigations. Performances of less than redline will not be scheduled.

<u>Activity</u>	<u>Performance Redline Scheduling Requirement (SL-1/SL-2)</u>
M415	No crew time required
All Medical	Continue to schedule toward baseline requirements; however, repetitive performance of medical experiments may, with flight surgeon concurrence, be deferred to permit performance of ATM and EREP redline requirements.
All ATM	Continue to schedule toward baseline requirements. (The required redline performance is to checkout and operate all hardware to verify operational capability. EVA data retrieval shall be a real-time decision.)
All EREP	Continue to schedule toward baseline requirements. (The required redline performance is one Z-local vertical pass or a solar inertial pass to validate the data system.)
D008	Perform two active dosimeter surveys. (Five passive dosimeters are automatically exposed.)

<u>Activity</u>	<u>Performance Redline Scheduling Requirement (SL-1/SL-2)</u>
D024	Continue to schedule toward baseline requirement.
M487	Continue to schedule toward baseline requirement.
M509	Perform one unsuited set of maneuvers.
M516	No crew time required.
M551, M552, M553	Perform operation on one specimen.
M555	Continue to schedule toward baseline requirement.
S009, S015	Activate for duration of mission.
S019	Perform one night pass (~ 12 exposures).
S020	Perform one orbital run for calibration data and feasibility check for simultaneous S020/ATM operation.
S149	Schedule toward baseline requirement.
S183	Perform one night pass (~3 exposures).
S228	Continue to schedule toward baseline requirement.
T003	Perform a set of initial measurements and repeat one measurement, twice during the mission.
T025	Perform one data taking orbit.
T027 SA	Schedule toward baseline requirement.
T027/S073	Perform one contamination data scan and one system monitor scan.
ED11, 12, 22	No crew time required.
ED23, 26	No performance unless time will permit one performance in conjunction with S019.
ED31	Perform the inoculation session and one photography session.
ED76	Deploy, retrieve, and return one neutron flux detector.

3.0 SKYLAB MISSION SL-3

3.0 SKYLAB MISSION SL-3

3.1 MISSION DESCRIPTION

Skylab Mission SL-3 will begin when the SL-2 CSM and crew separate from the SWS just prior to reentry. The unmanned portion of the mission will continue until the SL-3 CSM and crew are launched to rendezvous and dock with the SWS. After docking, the SL-3 crew will enter the SWS, reactivate its systems, and proceed to inhabit and operate the orbital assembly for up to 56 days. During this time the crew will perform systems and operational tests and the assigned experiments. To conclude the mission, the crew will configure the SWS for unmanned operations, undock the CSM, and return to earth in the Command Module.

3.2 MISSION OBJECTIVES

- (1) Perform unmanned Saturn Workshop operations
 - (a) Obtain data for evaluating the performance of the unmanned SWS.
 - (b) Obtain solar astronomy data by unmanned ATM observations.
- (2) Reactivate the Skylab orbital assembly in earth orbit
 - (a) Operate the orbital assembly (SWS plus CSM) as a habitable space structure for up to 56 days after the SL-3 launch.
 - (b) Obtain data for evaluating the performance of the orbital assembly.
 - (c) Obtain data for evaluating crew mobility and work capability in both intravehicular and extra-vehicular activity.
- (3) Obtain medical data on the crew for use in extending the duration of manned space flights
 - (a) Obtain medical data for determining the effects on the crew which result from a space flight of up to 56 days duration.
 - (b) Obtain medical data for determining if a subsequent Skylab mission of greater than 56 days duration is feasible and advisable.

(4) Perform inflight experiments

- (a) Obtain ATM solar astronomy data for continuing and extending solar studies beyond the limits of earth-based observations.
- (b) Obtain earth resources data for continuing and extending multisensor observation of the earth from low earth orbit.
- (c) Perform the assigned scientific, engineering, technology and DOD experiments.

NOTE FOR DEVELOPMENT EMPHASIS

For hardware development, the above objectives, together with the amplifying remarks, are to be treated as criticality category 2. Individual ATM, Earth Resources, and Medical Experiments shall be considered category 3. Scientific, Engineering, Technology, and DOD Experiments shall be category 3 or 4, as specified by the development centers. Individual critical elements within an experiment may be category 1 or 2 as appropriate. (See reference 7).

3.3 MISSION REQUIREMENTS

3.3.1 Mission Development

- (1) The SL-3 manned mission period shall begin with the initiation of SL-3 launch countdown, and shall terminate with the recovery of the flight crew and Command Module.
- (2) The nominal launch date for the manned SL-3 space vehicle shall be August 8, 1973. Mission planning shall allow for at least three launch opportunities within seven days following the scheduled launch date.
- (3) The SL-3 manned flight shall be planned for a duration of 56 days, starting with the launch of the manned SL-3 space vehicle and ending with the recovery of the SL-3 Command Module (nominally October 3, 1973).
- (4) The orbital assembly shall be maintained in a circular orbit at an altitude (\sim 234 NM) that will provide a controlled groundtrack pattern which repeats every 71 revolutions.
- (5) Docking of the mission CSM to the Saturn Workshop shall be planned for the axial docking port of the Multiple Docking Adapter (MDA).

3.3.2 Launch Operations

The following requirements shall be reflected in the Launch Mission Rules and other SL-3 launch planning documentation:

Any space vehicle element or operational support element whose malfunction can limit the SL-3 manned flight to less than 56 days duration shall be considered a mandatory item for launch.

3.3.3 In-Flight Operations

The following requirements and instructions shall be used in developing the SL-3 mission flight plans:

- (1) Approximately one of every seven mission-days shall be scheduled as an off-duty day.
- (2) Each off-duty day shall include performance of experiments M071 and M073, crew rest and recreation, nominal monitoring of spacecraft systems, and crew planning.
- (3) Scheduling of crew activities shall permit rapid crew response to solar flares that may occur when the ATM console is not manned.
- (4) To preserve urine samples, the SL-3 crew shall have access to the activated SWS urine freezer within 24 hours of CSM launch. In any event, all feces and samples of all urine voided after SL-3 lift-off shall be processed in the SWS Waste Management System as soon as it becomes available for use.
- (5) The Skylab Educational Program requires video participation by the flight crew. For planning purposes, one (1) crew man-hour per week shall be allocated as the crew time required to set up the video equipment, to operate the video equipment, and to follow scripts specifically designated for educational TV (this requirement is additive to operational TV requirements).

3.3.4 Experiments, Student Investigations, and Subsystems/ Operational Tests

This section contains requirements and instructions for scheduling inflight experiments, student investigations and subsystems/operational tests in the mission flight plan. Mission assignments and complementary scheduling requirements are given in Annex A, "Skylab Experiments."

3.3.4.1 Pre-Mission Planning

Instructions set forth in the subsections below shall be used for preparing the pre-mission flight plans.

3.3.4.1.1 Group-Related Experiments

The group-related experiments comprise the in-flight medical, ATM, and EREP experiments. They shall be scheduled in accordance with the assignment and scheduling instructions presented in Table A-2 of Annex A, and the requirements set forth below:

- (1) Crew-attended ATM operations shall be given scheduling priority for one crewman, exclusive of those periods allocated to EREP, for all daylight passes (plus the necessary night periods) for all identified experiment days. In no case shall the ATM be scheduled for less than 230 daylight hours, excluding ATM checkout, above the 400 kilometer observing constraint.
- (2) Unattended ATM operations may be scheduled during any period in which the ATM console is not manned, provided such scheduling does not contradict other requirements specified in this document.
- (3) The ATM experiments (excluding S055) and H-alpha 1 shall each utilize not more than two magazines of film.
- (4) Scheduling requirements for the EREP experiments are not firmly established. For planning purposes the following guidelines shall be utilized: The EREP experiments, excluding S190B, shall be scheduled for operation on 26 Z-local vertical passes and two solar-inertial passes; the S190B experiment shall be scheduled for operation on at least 20 of the Z-local vertical passes identified above.

3.3.4.1.2 Corollary Experiments

The corollary experiments are those inflight experiments other than the group-related experiments and the student investigations. They shall be scheduled in accordance with the instructions set forth in Section 3.3.4.1.5 below.

3.3.4.1.3 Student Investigations

A number of investigations selected from a national contest of the Skylab Student Project will be performed aboard the orbital assembly. Student investigations assigned to the SL-3 mission shall be allocated up to 1-1/2 crew manhours per week for performance. The student investigations shall be scheduled to satisfy the requirements given in Table A-2, Annex A.

3.3.4.1.4 Subsystems/Operational Tests

Subsystems/operational tests for Mission SL-3 will be approved at Level II and subsequently documented as Detailed Test Objectives (DTO's) in the Mission Requirements Document (MRD). Each DTO shall clearly indicate whether the test is (1) mandatory with respect to crew safety or mission objectives or (2) non-mandatory. Those tests deemed mandatory shall be incorporated into either systems housekeeping, experiment preparation, or other life/systems support activities as appropriate. Those tests deemed non-mandatory shall be scheduled on a non-interference basis with experiments, student investigations and mandatory tests.

3.3.4.1.5 Scheduling of Corollary Experiments

Corollary experiments shall be scheduled on Mission SL-3 in accordance with the following instructions.

- (1) Corollary experiments assigned to Mission SL-3 shall be scheduled into those intervals of the crew timeline which have not been allocated to the group-related experiments and necessary life/systems support activities (eat, sleep, off duty, personal hygiene, and systems housekeeping). The corollary experiments shall be scheduled to satisfy the requirements stated or implied in Table A-2 of Annex A.
- (2) Candidate experiments may be scheduled on the mission providing this does not impact the assigned experiments. They will be considered for inclusion in the timeline in order of decreasing FSP.

3.3.4.2 Real-Time Planning

The guidelines in this section shall govern real-time flight planning of experiments, student investigations, and subsystems/operational tests, during conduct of the SL-3 mission.

3.3.4.2.1 Real-Time Planning of Experiments

The real-time goal for experiments shall be performance of the baseline requirements as defined in the Appendix. Priority for attainment of experiment baseline requirements is group related experiments followed by corollary experiments in order of decreasing FSP.

(1) Increased Scheduling of Experiments

In general, no increase in scheduling beyond baseline requirements will be planned for an experiment until all other assigned activities and candidate experiments are scheduled to the maximum extent possible toward their baseline requirements. Candidate experiments will be scheduled if their performance will not preclude attainment of baseline requirements of assigned activities capable of performance.

(2) Reduced Scheduling of Experiments

When real-time problems are directly related to individual experiments or experiment disciplines (ATM, EREP, Medical, Corollary), the following instructions shall apply:

- (a) When crew time has been expended on a group related experiment run, any time scheduled for a repeat of that run shall normally be absorbed within that experiment's group.
- (b) When crew time has been expended on a corollary experiment, a rescheduled performance shall normally be absorbed within any timeline allocation remaining for that specific experiment; however, other corollary experiments of lower FSP may be considered for reduction/cancellation in order to accommodate a rerun.

If the real-time problems are not directly related to experiment activity but cause loss of crew time scheduled for experiment performances, each experiment discipline shall absorb the lost time in direct proportion to the total SL-3 crew time allocated to that experiment discipline.

When reduced scheduling of experiments must be made within the preceding guidelines, the following general instructions shall also be used as applicable:

- (a) The first level of experiment scheduling reduction shall be from baseline requirement to MSR, if an MSR has been established.
- (b) The second-level of experiment scheduling reduction shall be toward the Performance Redline Scheduling Requirements established in paragraph 3.3.4.2.4 of this section. Performances of less than redline will not be scheduled. (The FMT will be briefed on plans for second-level reductions or cancellations prior to their implementation).
- (c) Experiments being considered for first or second-level reductions or cancellations shall be considered in sequence of increasing FSP, if FSPs have been assigned, taking into account other operational constraints.

3.3.4.2.2 Real-Time Planning of Student Investigations

The real-time goal for student investigations shall be performance of the baseline requirements as established in Table A-2 of Annex A and in the MRD.

(1) Increased Scheduling of Student Investigations

Student investigations shall not be scheduled beyond the maximum of 1-1/2 crew manhours per week allocated to student investigations for pre-mission planning. Further, no increase in scheduling beyond baseline requirement will be made for a student investigation until all other assigned and candidate experiments and student investigations are scheduled to the maximum extent possible toward their baseline requirements.

(2) Reduced Scheduling of Student Investigations

When real-time problems are directly related to a specific student investigation and crew time has been expended on the student investigation run, any rescheduled performance of the run shall normally be absorbed within any timeline allocation remaining for that specific student investigation. If the real-time problems are not directly related to student investigations but cause loss of crew time scheduled for student investigations, then the investigations shall lose reschedule time in direct proportion to the total SL-3 crew time allocated to student investigations. In addition, when real-time flight planning indicates that assigned student investigations may not attain baseline requirements, they will be considered for reduction and/or cancellation. Performance redlines, established in paragraph 3.3.4.2.4 of this section, represent levels of minimum worthwhile information for student investigations. Performances of less than redline will not be scheduled.

3.3.4.2.3 Real-Time Planning of Subsystem/Operational Tests

The real-time goal for subsystems/operational tests is to satisfy the pre-mission planning for such tests.

(1) Increased Scheduling of Subsystems/Operational Tests

In general, no increase in scheduling of subsystems/operational tests beyond those included in pre-mission flight plans shall be made.

(2) Reduced Scheduling of Subsystems/Operational Tests

Those subsystems/operational tests designated as mandatory in the MRD DTOs shall not be reduced without FMT approval. Non-mandatory tests may be reduced as necessary to permit performance of assigned experiments, student investigations, and mandatory subsystems/operational tests.

3.3.4.2.4 Performance Redlines

Performance redlines, established below, represent levels of minimum worthwhile information for experiments and student investigations. Performances of less than redline will not be scheduled.

<u>Activity</u>	<u>Performance Redline</u>	<u>Scheduling Requirement (SL-3)</u>
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(TBD)

(TBD)

3.3.5 Unmanned Operations

- (1) The following guidelines apply to the unmanned period of SWS operations between separation of the SL-2 CSM and docking of the SL-3 CSM.
 - (a) The SWS shall be controlled and interrogated from the ground during the unmanned period.
 - (b) Film for ATM experiments S052 and S054 shall be loaded during the end-of-mission SL-2 EVA for exposure during the unmanned period of SL-3. This film will remain in the experiment canisters until the mid-mission SL-3 EVA. No film shall be provided beyond that specified in Table A-2 of Annex A.
- (2) The unmanned period that follows separation of the SL-3 CSM from the SWS will be part of Mission SL-4.

4.0 SKYLAB MISSION SL-4

4.0 SKYLAB MISSION SL-4

4.1 MISSION DESCRIPTION

Skylab Mission SL-4 will begin when the SL-3 CSM and crew separate from the SWS just prior to reentry. The unmanned portion of the mission will continue until the SL-4 CSM and crew are launched to rendezvous and dock with the SWS. After docking, the SL-4 crew will enter the SWS, reactivate its systems, and proceed to inhabit and operate the orbital assembly for up to 56 days. During this time the crew will perform systems and operational tests and the assigned experiments. To conclude the mission, the crew will configure the SWS for indefinite unmanned operations, undock the CSM, and return to earth in the Command Module.

4.2 MISSION OBJECTIVES

- (1) Perform unmanned Saturn Workshop operations.
 - (a) Obtain data for evaluating the performance of the unmanned SWS.
 - (b) Obtain solar astronomy data by unmanned ATM observations.
- (2) Reactivate the Skylab orbital assembly in earth orbit.
 - (a) Operate the orbital assembly (SWS plus CSM) as a habitable space structure for up to 56 days after the SL-4 launch.
 - (b) Obtain data for evaluating the performance of the orbital assembly.
 - (c) Obtain data for evaluating crew mobility and work capability in both intravehicular and extravehicular activity.
- (3) Obtain medical data on the crew for use in extending the duration of manned space flights.
 - (a) Obtain medical data for determining the effects on the crew which result from a space flight of up to 56 days duration.

- (b) Obtain medical data for determining if a subsequent manned space flight mission of greater than 56 days duration is feasible and advisable.
- (4) Perform inflight experiments
 - (a) Obtain ATM solar astronomy data for continuing and extending solar studies beyond the limits of earth-based observations.
 - (b) Obtain earth resources data for continuing and extending multisensor observation of the earth from low earth orbit.
 - (c) Perform the assigned scientific, engineering, technology and DOD experiments.

NOTE FOR DEVELOPMENT EMPHASIS

For hardware development, the above objectives, together with the amplifying remarks, are to be treated as criticality category 2. Individual ATM, Earth Resources, and Medical Experiments shall be considered category 3. Scientific, Engineering, Technology and DOD Experiments shall be category 3 or 4, as specified by the development centers. Individual critical elements within an experiment may be category 1 or 2 as appropriate. (See reference 7).

4.3 MISSION REQUIREMENTS

4.3.1 Mission Development

- (1) The SL-4 manned mission period shall begin with the initiation of SL-4 launch countdown, and shall terminate with the recovery of the flight crew and Command Module.
- (2) The nominal launch date for the SL-4 space vehicle shall be November 9, 1973.
- (3) The SL-4 manned flight shall be planned for a duration of 56 days, starting with the launch of the manned SL-4 space vehicle and ending with the recovery of the SL-4 Command Module (nominally January 4, 1974).
- (4) The orbital assembly shall be maintained in a circular orbit at an altitude (\approx 234 NM) that will provide a controlled groundtrack pattern which repeats every 71 revolutions.

- (5) Docking of the mission CSM to the Saturn Workshop shall be planned for the axial docking port of the Multiple Docking Adapter (MDA).

4.3.2 Launch Operations

The following requirements shall be reflected in the Launch Mission Rules and other SL-4 launch planning as appropriate:

Any space vehicle element or operational support element whose malfunction can limit the SL-4 manned flight to less than 56 days duration shall be considered a mandatory item for launch.

4.3.3 In-Flight Operations

The following requirements and instructions shall be used in developing the SL-4 mission flight plans:

- (1) Approximately one of every seven mission-days shall be scheduled as an off-duty day.
- (2) Each off-duty day shall include performance of experiments M071 and M073, crew rest and recreation, nominal monitoring of spacecraft systems, and crew planning.
- (3) Scheduling of crew activities shall permit rapid crew response to solar flares that may occur when the ATM console is not manned.
- (4) To preserve urine samples, the SL-4 crew shall have access to the activated SWS urine freezer within 24 hours of CSM launch. In any event, all feces and samples of all urine voided after SL-4 lift-off shall be processed in the SWS Waste Management System as soon as it becomes available for use.
- (5) The Skylab Educational Program requires video participation by the flight crew. For planning purposes, one (1) crew man-hour per week shall be allocated as the crew time required to set up the video equipment, to operate the video equipment, and to follow scripts specifically designated for educational TV (this requirement is additive to operational TV requirements).

4.3.4 Experiments, Student Investigations, and Subsystems/Operational Tests

This section contains requirements and instructions for scheduling in-flight experiments and subsystems/operational tests in the mission flight plan. Mission assignments and complementary scheduling requirements are given in Annex A, "Skylab Experiments".

4.3.4.1 Pre-Mission Planning

Instructions set forth in the subsections below shall be used for preparing the pre-mission flight plans.

4.3.4.1.1 Group-Related Experiments

The group-related experiments comprise the in-flight medical, ATM, and EREP experiments. They shall be scheduled in accordance with the assignment and scheduling instructions presented in Table A-2 of Annex A, and the requirements set forth below:

- (1) Crew-attended ATM operations shall be given scheduling priority for one crewman, exclusive of those periods allocated to EREP, for all daylight passes (plus the necessary night periods) for all identified experiment days. In no case shall the ATM be scheduled for less than TBD daylight hours, excluding ATM checkout, above the 400 kilometer observing constraint.
- (2) Unattended ATM operations may be scheduled during any period in which the ATM console is not manned, provided such scheduling does not contradict other requirements specified in this document.
- (3) The ATM experiments (excluding S055) and H-alpha 1 shall each utilize not more than one magazine of film.
- (4) Scheduling requirements for the EREP experiments are not firmly established. For planning purposes the following guidelines shall be utilized: the EREP experiments, excluding S190B, shall be scheduled for operation on 20 Z-local vertical passes and two solar-inertial passes; the S190B experiment shall be scheduled for operation on at least 15 of the Z-local vertical passes identified above.

4.3.4.1.2 Corollary Experiments

The corollary experiments are those inflight experiments other than the group-related experiments and the student investigations. They shall be scheduled in accordance with the instructions set forth in Section 4.3.4.1.5 below.

4.3.4.1.3 Student Investigations

A number of investigation selected from a national contest of the Skylab Student Project will be performed aboard the orbital assembly. Student investigations assigned to the SL-4 mission shall be allocated up to 1-1/2 crew manhours per week for performance. The student investigations shall be scheduled to satisfy the requirements given in Table A-2, Annex A.

4.3.4.1.4 Subsystems/Operational Tests

Subsystems/operational tests for Mission SL-4 will be approved at Level II and subsequently documented as Detailed Test Objectives (DTO's) in the Mission Requirements Document (MRD). Each DTO shall clearly indicate whether the test is (1) mandatory with respect to crew safety or mission objectives or (2) non-mandatory. Those tests deemed mandatory shall be incorporated into either systems house-keeping, experiment preparation, or other life/systems support activities as appropriate. Those tests deemed non-mandatory shall be scheduled on a non-interference basis with experiments, student investigations and mandatory tests.

4.3.4.1.5 Scheduling of Corollary Experiments

Corollary experiments shall be scheduled on Mission SL-4 in accordance with the following instructions.

- (1) Corollary experiments assigned to Mission SL-4 shall be scheduled into those intervals of the crew timeline which have not been allocated to the group-related experiments and the necessary life/systems support activities (eat, sleep, off-duty, personal hygiene, and systems housekeeping). The corollary experiments shall be scheduled to satisfy the requirements stated or implied in Table A-2 of Annex A.
- (2) Candidate experiments may be scheduled on the mission provided this does not impact the assigned experiments. They will be considered for inclusion in the timeline in order of decreasing FSP.

4.3.4.2 Real-Time Planning

The guidelines in this section shall govern real-time flight planning of experiments, student investigations, and subsystems/operational tests, during conduct of the SL-4 mission.

4.3.4.2.1 Real-Time Planning of Experiments

The real-time goal for experiments shall be performance of the baseline requirements as defined in the Appendix. Priority for attainment of experiment baseline requirements is group related experiments followed by corollary experiments in order of decreasing FSP.

(1) Increased Scheduling of Experiments

In general, no increase in scheduling beyond baseline requirements will be planned for an experiment until all other assigned activities and candidate experiments are scheduled to the maximum extent possible toward their baseline requirements. Candidate experiments will be scheduled if their performance will not preclude attainment of baseline requirements of assigned activities capable of performance.

(2) Reduced Scheduling of Experiments

When real-time problems are directly related to individual experiments or experiment disciplines (ATM, EREP, Medical, Corollary), the following instructions shall apply:

- (a) When crew time has been expended on a group related experiment run, any time scheduled for a repeat of that run shall normally be absorbed within that experiment's group.
- (b) When crew time has been expended on a corollary experiment, a rescheduled performance shall normally be absorbed within any timeline allocation remaining for that specific experiment; however, other corollary experiments of lower FSP may be considered for reduction/cancellation in order to accommodate a rerun.

If the real-time problems are not directly related to experiment activity but cause loss of crew time scheduled for experiment performances, each experiment discipline shall absorb the lost time in direct proportion to the total SL-4 crew time allocated to that experiment discipline.

When reduced scheduling of experiments must be made within the preceding guidelines, the following general instructions shall also be used as applicable:

- (a) The first level of experiment scheduling reduction shall be from baseline requirement to MSR, if an MSR has been established.
- (b) The second-level of experiment scheduling reduction shall be toward the Performance Redline Scheduling Requirements established in paragraph 4.3.4.2.4 of this section. Performances of less than redline will not be scheduled. (The FMT will be briefed on plans for second-level reductions or cancellations prior to their implementation.)
- (c) Experiments being considered for first or second-level reductions or cancellations shall be considered in sequence of increasing FSP, if FSPs have been assigned, taking into account other operational constraints.

4.3.4.2.2 Real-Time Planning of Student Investigations

The real-time goal for student investigations shall be performance of the baseline requirements as established in Table A-2 of Annex A and in the MRD.

(1) Increased Scheduling of Student Investigations

Student investigations shall not be scheduled beyond the maximum of 1-1/2 crew manhours per week allocated to student investigations for pre-mission planning. Further, no increase in scheduling beyond baseline requirement will be made for a student investigation until all other assigned and candidate experiments and student investigations are scheduled to the maximum extent possible toward their baseline requirements.

(2) Reduced Scheduling of Student Investigations

When real-time problems are directly related to a specific student investigation and crew time has been expended on the student investigation run, any rescheduled performance of the run shall normally be absorbed within any timeline allocation remaining for that specific student investigation. If the real-time problems are not directly related to student investigations, then the investigations shall lose reschedule time in direct proportion to the total SL-4 crew time allocated to student investigations. In addition, when real-time flight planning indicates that assigned student investigations may not attain baseline requirements, they will be considered for reduction and/or cancellation. Performance redlines, established in paragraph 4.3.4.2.4 of this section, represent levels of minimum worthwhile information for student investigations. Performances of less than redline will not be scheduled.

4.3.4.2.3 Real-Time Planning of Subsystem/Operational Tests

The real-time goal for subsystems/operational tests is to satisfy the pre-mission planning for such tests.

(1) Increased Scheduling of Subsystems/Operational Tests

In general, no increase in scheduling of subsystems/operational tests beyond those included in pre-mission flight plans shall be made.

(2) Reduced Scheduling of Subsystems/Operational Tests

Those subsystems/operational tests designated as mandatory in the MRD DTOs shall not be reduced without FMT approval. Non-mandatory tests may be reduced as necessary to permit performance of assigned experiments, student investigations, and mandatory subsystems/operational tests.

4.3.4.2.4 Performance Redlines

Performance redlines, established below, represent levels of minimum worthwhile information for experiments and student investigations. Performances of less than redline will not be scheduled.

<u>Activity</u>	<u>Performance Redline Scheduling Requirement (SL-4)</u>
(TBD)	(TBD)

4.3.5 Unmanned Operations

- (1) The following guidelines apply to the unmanned period of SWS operations between separation of the SL-3 CSM and docking of the SL-4 CSM.
 - (a) The SWS shall be controlled and interrogated from the ground during the unmanned period.
 - (b) Film for ATM experiments S052 and S054 shall be loaded during the end-of-mission SL-3 EVA for exposure during the unmanned period of SL-4. This film will remain in the experiment canisters until the end-of-mission SL-4 EVA. No film shall be provided beyond that specified in Table A-2 of Annex A.
- (2) Guidelines for SWS operations following separation of the SL-4 CSM are TBD.

4.3.4.2.3 Real-Time Planning of Subsystem/Operational Tests

The real-time goal for subsystems/operational tests is to satisfy the pre-mission planning for such tests.

(1) Increased Scheduling of Subsystems/Operational Tests

In general, no increase in scheduling of subsystems/operational tests beyond those included in pre-mission flight plans shall be made.

(2) Reduced Scheduling of Subsystems/Operational Tests

Those subsystems/operational tests designated as mandatory in the MRD DTOs shall not be reduced without FMT approval. Non-mandatory tests may be reduced as necessary to permit performance of assigned experiments, student investigations, and mandatory subsystems/operational tests.

4.3.4.2.4 Performance Redlines

Performance redlines, established below, represent levels of minimum worthwhile information for experiments and student investigations. Performances of less than redline will not be scheduled.

<u>Activity</u>	<u>Performance Redline Scheduling Requirement (SL-4)</u>
(TBD)	(TBD)

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 - (a) The SWS shall be controlled and interrogated from the ground during the unmanned period.
 - (b) Film for ATM experiments S052 and S054 shall be loaded during the end-of-mission SL-3 EVA for exposure during the unmanned period of SL-4. This film will remain in the experiment canisters until the end-of-mission SL-4 EVA. No film shall be provided beyond that specified in Table A-2 of Annex A.
- (2) Guidelines for SWS operations following separation of the SL-4 CSM are TBD.

5.0 SKYLAB RESCUE MISSION

5.0 SKYLAB RESCUE MISSION

5.1 PURPOSE

The purpose of the Skylab Rescue Mission is to rescue a Skylab mission crew in the event a failure of the mission CSM precludes their safe return to Earth.

5.2 MISSION DESCRIPTION

The Skylab rescue mission is a contingency mission which shall provide the capability for the safe return to Earth of a three-man Skylab crew in the event their CSM becomes disabled while docked to the SWS. The rescue mission will utilize the next in-line CSM and its Saturn IB launch vehicle. The backup CSM and Saturn IB shall be used to perform a rescue mission for SL-4.

5.3 MISSION REQUIREMENTS

5.3.1 Mission Development

- (1) Launch and in-flight rescue planning should minimize deviations from nominal mission planning.
- (2) Mission planning should be developed on the basis of a five-day CSM mission.
- (3) The SL-3 CSM shall be capable of returning the SL-2 crew, and the SL-4 CSM capable of returning the SL-3 crew.
- (4) The Backup CSM will be configured for rescue and retained on the pad until the completion of the SL-4 mission.
- (5) All practical measures shall be taken to preserve the SWS for use on a subsequent mission, unless rescue is attempted on the SL-4 mission.
- (6) Mission planning shall provide the capability for two options with regard to rendezvous and docking, namely 1) disabled CSM jettisoned and 2) disabled CSM retained. The selection of the appropriate option will be based on real-time circumstances and determined prior to liftoff of the SL-R vehicle.

- (7) Normal launch preparation activities of the baseline mission CSM and Saturn IB space vehicles shall be conducted until a decision to implement a rescue mission is made. At that point, modification of the CSM and accelerated launch operation activities shall be initiated. Capability shall be provided to install the CSM modification kit at KSC after the rescue mission decision has been made. Modification of the fourth CSM for rescue capability shall be accomplished at an earlier point since this vehicle is not a part of the baseline mission sequence.

5.3.2 Mission Commit Policies and Requirements

- (1) Criteria for initiating a rescue mission shall be included in the Flight Mission Rules of each Skylab mission.
- (2) The decision to proceed with preparation of the Rescue Mission space vehicle will be made by the Program Director.
- (3) The decision to initiate the Rescue Mission will be made by the Associate Administrator for Manned Space Flight.

5.4 PLANNING REQUIREMENTS

Skylab rescue plans shall be developed by KSC and JSC. The purpose of these plans is to define the requirements, activities and schedules associated with the operational planning and conduct of the rescue mission.

5.5 EXPERIMENT DATA RETURN GUIDELINES

The following guidelines are to be used for advance planning and for realtime 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.

5.5.1 General Guidelines

- (1) Reductions from nominal return affects all experiments.
- (2) Select data to maximize scientific return within each experiment group rather than maximizing return of single experiments.
- (3) 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.
- (4) Experiment data that is not selected for return on a rescue mission will be considered for return on any subsequent missions.

5.5.2 Specific Guidelines

Guidelines apply to all missions unless otherwise noted.

(1) Medical

- (a) Select data to maximize information of the status of the crew's health and well being.
- (b) 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.
- (c) 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.
- (d) If unable to return ATM film, the 50 and 40 lb. limits above will be increased by 15 lbs.

(2) ATM

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

(3) EREP

- (a) A nominal weight of 40 lbs. of EREP film and tape shall be returned. On SL-4 this limit is raised by 10 lbs.
- (b) If unable to return ATM film, then an additional 15 lbs. of EREP film and tape will be returned.

(4) Corollary and Student

- (a) Corollary and Student Experiment Data will use weight and volume not occupied by the Medical, ATM, and EREP experiment groups.
- (b) Data will be selected to maximize the number of experiments taken in descending order of FSP.
- (c) On applicable missions, if unable to return ATM data, S020 data shall be returned.

ANNEX A

SKYLAB EXPERIMENTS

ANNEX A

A1.0 SKYLAB EXPERIMENTS

A1.1 PURPOSE

This annex has a three-fold purpose: to identify those experiments that have been approved by the Associate Administrator for Manned Space Flight for implementation on the Skylab Program; to present the mission assignments of the Skylab experiments as approved by the Program Director; and to establish other instructions for scheduling and performing the experiments. Experiment mission assignments are summarized in Table A-1. Detailed assignment and scheduling instructions are given in Table A-2; these represent the full operational requirements for each experiment.

A1.2 TABLE A-1: SUMMARY OF EXPERIMENT MISSION ASSIGNMENTS

Table A-1 summarizes the mission assignments of the Skylab experiments. The experiments are divided into four groups:

- (1) Passive Experiments -- in-flight experiments whose crew support requirements are either insignificant or non-existent.
- (2) Group-related Experiments -- experiments that are closely related to each other either through common study of the flight crew or by integration into a single subsystem. Three sets of group-related experiments are assigned in Table A-1: Medical, Solar Astronomy (ATM), and Earth Resources (EREP).
- (3) Corollary Experiments -- other in-flight experiments that require significant in-flight crew support but which are not as closely related to each other as are the experiments addressed in (2).
- (4) Student Investigations -- experimental investigations selected through the Skylab Student Project that may or may not require in-flight crew support.

A1.3 TABLE A-2: EXPERIMENT ASSIGNMENT AND SCHEDULING INSTRUCTIONS

Table A-2 establishes detailed mission assignment and scheduling instructions for planning and performing the experiments. (Where explicit instructions are not shown in Table A-2, those documented in the MRD shall apply.)

Like Table A-1, it is organized by the groups and subgroups of experiments that are defined in paragraph A1.2. Table A-2 also establishes a flight scheduling precedence (FSP) for each of the corollary experiments. Use of the flight scheduling precedence in mission planning is discussed in Sections 2.3.4, 3.3.4, and 4.3.4, respectively.

SKYLAB EXPERIMENTS

<u>Experiment</u>	<u>Mission Assignment</u>		
	<u>SL-1/SL-2</u>	<u>SL-3</u>	<u>SL-4</u>
<u>Passive</u>			
M415 - Thermal Control Coatings	A		
S071 - Circadian Rhythm - Pocket Mice		A	
S072 - Circadian Rhythm - Vinegar Gnat		A	
S150 - Galactic X-ray Mapping (B)		A	
<u>Medical</u>			
M071 - Mineral Balance	A	A	A
M073 - Bioassay of Body Fluids	A	A	A
M074 - Specimen Mass Measurement	A	A	A
*M078 - Bone Mineral Measurement (B)	A	A	A
M092 - In-Flight Lower Body Negative Pressure	A	A	A
M093 - Vectorcardiogram	A	A	A
*M111 - Cytogenetic Studies of Blood	A	A	A
M112 - Man's Immunity - In vitro aspects	A	A	A
M113 - Blood Volume and Red Cell Life Span	A	A	A
M114 - Red Blood Cell Metabolism	A	A	A
M115 - Special Hematologic Effects	A	A	A
M131 - Human Vestibular Function	A	A	A
M133 - Sleep Monitoring	A	A	
M151 - Time and Motion Study	A	A	A
M171 - Metabolic Activity	A	A	A
M172 - Body Mass Measurement	A	A	A
* These experiments have pre- and post-flight requirements only.			
<u>ATM</u>			
S052 - White Light Coronagraph	A	A	A
S054 - X-Ray Spectrographic Telescope	A	A	A
S055 - UV Spectrometer (A)	A	A	A
S056 - Dual X-Ray Telescope	A	A	A
S082 - UV Spectrograph/Heliograph	A	A	A
<u>EREP</u>			
S190A - Multispectral Photographic Cameras	A	A	A
S190B - Earth Terrain Camera	A	A	A
S191 - Infrared Spectrometer	A	A	A
S192 - Multispectral Scanner	A	A	A
S193 - Microwave Radiometer/Scatterometer and Altimeter	A	A	A
S194 - L-Band Radiometer	A	A	A

LEGEND:

A - The experiment, or a part of the experiment, is assigned to this mission (refer to the detailed instructions contained in Table A-2).

Table A-1: Summary of Experiment Mission Assignments

SKYLAB EXPERIMENTS

<u>Experiment</u>	<u>Mission Assignment</u>		
	<u>SL-1/SL-2</u>	<u>SL-3</u>	<u>SL-4</u>
<u>Corollary</u>			
D008 - Radiation in Spacecraft	A		
D024 - Thermal Control Coatings	A	C	C
M479 - Zero Gravity Flammability (Revised)			A
M487 - Habitability/Crew Quarters	A	A	A
M509 - Astronaut Maneuvering Equipment	C	A	A
M516 - Crew Activities/Maintenance	A	A	A
**M551 - Metals Melting	A		
**M552 - Exothermic Brazing	A		
**M553 - Sphere Forming	A		
**M555 - Gallium Arsenide Crystal Growth	A		
ΔM556 - Vapor Growth of II-VI Compounds			A
ΔM557 - Immiscible Alloy Compositions			A
ΔM558 - Radioactive Tracer Diffusion			A
ΔM559 - Microsegregation in Germanium			A
ΔM560 - Growth of Spherical Crystals			A
ΔM561 - Whisker-Reinforced Composites			A
ΔM562 - Indium Antimonide Crystals			A
ΔM563 - Mixed III-V Crystal Growth			A
ΔM564 - Metal and Halide Eutectics			A
ΔM565 - Silver Grids Melted in Space			A
ΔM566 - Copper-Aluminum Eutectics			A
S009 - Nuclear Emulsion	A		
S015 - Zero Gravity Single Human Cells	A		
S019 - UV Stellar Astronomy	A	A	C
S020 - UV/X-Ray Solar Photography	A	A	A
S063 - UV Airglow Horizon Photography		A	A
S149 - Particle Collection	A	A	A
S183 - UV Panorama	A	A	C
S228 - Trans-Uranic Cosmic Rays	A		A
S230 - Magnetospheric Particle Composition		A	A

LEGEND:

C - The experiment, or a part of the experiment, is a candidate for performance on this mission, provided the requirements set forth in Table A-2 will not have been satisfied on an earlier mission (or missions).

** - These experiments utilize a common facility, M512-Materials Processing Facility.

Δ - These experiments utilize a common facility, M518-Multipurpose Electric Furnace.

Table A-1: Summary of Experiment Mission Assignments

SKYLAB EXPERIMENTS

<u>Experiment</u>	<u>Mission Assignment</u>		
	<u>SL-1/SL-2</u>	<u>SL-3</u>	<u>SL-4</u>
<u>Corollary (Cont'd)</u>			
T002 - Manual Navigation Sightings (B)		A	A
T003 - In-Flight Aerosol Analysis	A	A	A
T013 - Crew Vehicle Disturbance		C	C
T020 - Foot-Controlled Maneuvering Unit		A	A
T025 - Coronagraph Contamination Measurement	A	A	A
T027 (SA) - Contamination Measurement (Sample Array)	A		
T027/S073 - Contamination Measurement Gegenschein/Zodiacal Light (Photometer)	A	A	A
<u>Student Investigations</u>			
ED11 - Atmospheric Absorption of Radiant Heat	A	C	C
ED12 - Volcanic Study	A	C	C
ED21 - Libration Clouds		A	
ED22 - Objects within Mercury's Orbit	A	C	C
ED23 - UV From Quasars	A		
ED24 - X-Ray Stellar Classes			A
ED25 - X-Rays from Jupiter		A	
ED26 - UV from Pulsars	A		
ED31 - Bacteria and Spores	A		
ED32 - In Vitro Immunology		A	
ED41 - Motor Sensory Performance			A
ED52 - Web Formation		A	
ED61/62 - Plant Growth/Plant Phototropism			A
ED63 - Cytoplasmic Streaming		A	
ED72 - Capillary Study			A
ED74 - Mass Measurement		A	
ED76 - Neutron Analysis	A	A	A
ED78 - Liquid Motion in Zero "G"			A

LEGEND:

C - The experiment, or a part of the experiment, is a candidate for performance on this mission, provided the requirements set forth in Table A-2 will not have been satisfied on an earlier mission (or missions).

Table A-1: Summary of Experiment Mission Assignments

EXPERIMENT GROUP	EXPERIMENT NUMBER	TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
PASSIVE	M415 -	Thermal Control Coatings	This experiment is assigned to the SL-2 flight (the experiment hardware is mounted on the Saturn IB 206 launch vehicle)	N/A
	S071 -	Circadian Rhythm - Pocket Mice	These experiments are assigned to Mission SL-3 (the experiment hardware is integrated into SMI17)	N/A
	S072 -	Circadian Rhythm - Vinegar Gnat		
	S150 -	Galactic X-Ray Mapping (B)	This experiment is assigned to Mission SL-3	N/A

TABLE A-2. Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	M071 -	Mineral Balance	<p>These experiments are assigned to Missions SL-1/SL-2, SL-3, and SL-4.</p> <p>*These experiments have pre- and post-flight requirements only.</p> <p>This experiment is assigned to Missions SL-1/SL-2, SL-3 and SL-4. Five Motion Sensitivity (MS) and Oculogyral Illusion (OGI) Threshold tests shall be performed on each of two crewmen for a total of ten tests during SL-1/SL-2. Six MS and OGI threshold tests shall be performed on each of two crewmen for a total of 12 tests on each of missions SL-3 and SL-4.</p>	N/A
	M073 -	Bioassay of Body Fluids		
	M074 -	Specimen Mass Measurement		
	*M078 -	Bone Mineral Measurement		
	M092 -	In-Flight Lower Body Negative Pressure		
	M093 -	Vectorcardiogram		
MEDICAL	*M111 -	Cytogenetic Studies of Blood		
	M112 -	Man's Immunity - In vitro aspects		
	M113 -	Blood Volume and Red Cell Life Span		
	M114 -	Red Blood Cell Metabolism		
	M115 -	Special Hematologic Effects		
	M171 -	Metabolic Activity		
	M172 -	Body Mass Measurement		
	M131 -	Human Vestibular Function		N/A

TABLE A-2 Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
Medical (Cont'd)	M133 -	Sleep Monitoring	This experiment shall be performed in 15 sleep-sessions on Mission SL-1/SL-2, and in 21 sleep-sessions on Mission SL-3.	N/A
	M151 -	Time and Motion Study	This experiment is assigned to Mission SL-1/SL-2, SL-3, and SL-4. It shall be performed only in conjunction with other experiments.	420
ATM	S052 -	White Light Coronagraph	These experiments are assigned to Mission SL-1/SL-2, SL-3, and SL-4. The full requirements in terms of data-taking hours for each mission are identified in the appropriate pre-mission planning sections of this document.	
	S054 -	X-Ray Spectrographic Telescope	These experiments, excluding S055, shall each utilize not more than:	N/A
	S055 -	UV Spectrometer (A)	One magazine of film on SL-1/SL-2	
	S056 -	Dual X-Ray Telescope	Two magazines of film on SL-3	
	S082 -	UV Spectrograph/Heliograph	One magazine of film on SL-4	
EREP	S190 -	Multispectral Photographic Facility	These experiments are assigned to Missions SL-1/SL-2, SL-3, and SL-4.	
	S190A -	Multispectral Photographic Cameras	With the exception of S190B, they shall be scheduled for operation on a total of 60 Z-local vertical passes and five solar-inertial passes.	
	S190B -	Earth Terrain Camera	The S190B experiments shall be scheduled for operation on a minimum of 45 Z-local vertical passes.	N/A
	S191 -	Infrared Spectrometer		
	S192 -	Multispectral Scanner		
	S193 -	Microwave Radiometer/Scatterometer and Altimeter		
	S194 -	L-Band Radiometer		

TABLE A-2 Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	D008	- Radiation in Spacecraft	Four active dosimeter surveys shall be performed on Mission SL-1/SL-2 (the experiment is integrated in CM 116).	220
	D024	- Thermal Control Coatings	Two sample panels shall be retrieved and returned on SL-1/SL-2; the remaining two sample panels shall be retrieved on either SL-3 or SL-4.	230
	M479	- Zero Gravity Flammability	A total of five sets of test cycles shall be performed as close to the termination of the SL-4 Mission as possible so as not to contaminate any experiments having sensor equipment external to the spacecraft.	210
COROLLARY	M487	- Habitability/Crew Quarters	This experiment shall be performed on Missions SL-1/SL-2, SL-3, and SL-4.	470
	M509	- Astronaut Maneuvering Equipment	Four experiment runs (three unsuited and one suited) shall be performed by each of three crewmen (nine unsuited and three suited runs total). One crewman shall perform a set of four runs on SL-3 and two crewmen shall perform two sets of four runs each on SL-4. If a portion of the 12 runs are accomplished as a candidate experiment on SL-1/SL-2, the set of runs for the second crewman on SL-4 shall be reduced accordingly. The crewman performing the experiment shall be accompanied by an observer. At least one crewman who performs M509 shall also perform one set of experiment runs on experiment T020.	300

TABLE A-2 Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	M516 - Crew Activities/Maintenance		This experiment is assigned to Missions SL-1/SL-2, SL-3, and SL-4. The fine manipulation maintenance tasks shall be performed on Mission SL-4.	380
	M551 - Metals Melting		This experiment is assigned to Mission SL-1/SL-2.	190
	M552 - Exothermic Brazing		This experiment is assigned to Mission SL-1/SL-2.	150
	M553 - Sphere Forming		This experiment is assigned to Mission SL-1/SL-2.	160
COROLLARY	M555 - Gallium Arsenide Crystal Growth		This experiment is assigned to Mission SL-1/SL-2.	200
	M556 - Vapor Growth of II-VI Compounds		This experiment is assigned to Mission SL-4. This experiment shall be the last experiment performed in the M518 facility because of the possible toxicity hazard.	350
	M557 - Immiscible Alloy Composition		This experiment is assigned to Mission SL-4.	440
	M558 - Radioactive Tracer Diffusion		This experiment is assigned to Mission SL-4. This experiment shall be the next to last experiment performed in the M518 facility because of the possible toxicity hazard.	430
	M559 - Microsegregation in Germanium		This experiment is assigned to Mission SL-4.	320

TABLE A-2. Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	M560	Growth of Spherical Crystals	This experiment is assigned to Mission SL-4.	310
	M561	Whisker-Reinforced Composites	This experiment is assigned to Mission SL-4.	360
	M562	Indium Antimonide Crystals	This experiment is assigned to Mission SL-4.	480
	M563	Mixed III-V Crystal Growth	This experiment is assigned to Mission SL-4.	390
	M564	Metal and Halide Eutectics	This experiment is assigned to Mission SL-4.	270
	M565	Silver Grids Melted in Space	This experiment is assigned to Mission SL-4.	260
	M566	Copper-Aluminum Eutectics	This experiment is assigned to Mission SL-4.	400
COROLLARY	S009	Nuclear Emulsion	One nuclear emulsion detector package shall be exposed and retrieved on Mission SL-1/SL-2.	180
	S015	Zero Gravity Single Human Cells	This experiment is assigned to Mission SL-1/SL-2 (the experiment hardware is integrated in CM 116).	280
	S019	UV Stellar Astronomy	One hundred-fifty data exposures, requiring the equivalent of 12 night passes averaging 32 minutes each, shall be obtained on each of Missions SL-1/SL-2 and SL-3. The experiment shall be a candidate for further activity on SL-4.	500

TABLE A-2. Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
COROLLARY	S020	UV/X-Ray Solar Photography	This experiment is assigned to all missions. Only one orbital run shall be performed on Mission SL-1/SL-2 and that is for calibration data and to check feasibility of simultaneous S020 and ATM operation. Ten data exposures of the quiet sun and ten data exposures of the active sun shall be obtained on each of the other two missions.	290
	S063	UV Airglow Horizon Photography	A total of 600 data exposures shall be obtained on missions SL-3 and SL-4.	240
	S149	Particle Collection	Four sets of detector cassettes shall be deployed, exposed, and retrieved. One set shall be exposed during the unmanned portion of Mission SL-3, and one set shall be exposed on the manned portion of SL-3. In addition, one set shall be exposed on the unmanned portion of SL-4, and one set shall be exposed on the manned portion of SL-4.	450
	S183	UV Panorama	Thirty-five data exposures shall be obtained on Mission SL-1/SL-2; another 35 data exposures shall be obtained on SL-3. The experiment shall be candidate for further activity on SL-4.	490
	S228	Trans-Uranic Cosmic Rays	This experiment is assigned to Mission SL-1/SL-2 for deployment of the Lexan panel. The experiment will be returned on Mission SL-4.	275

TABLE A-2. Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	S230 - Magnetospheric Particle Composition		This experiment is assigned to SL-3 and SL-4.	165
	T002 - Manual Navigation Sightings (B)		This experiment shall be performed on missions SL-3 and SL-4 at the convenience of the crew and on a non-interference basis with the other experiments.	140
	T003 - In-Flight Aerosol Analysis		This experiment shall be performed on Missions SL-1/SL-2, SL-3, and SL-4.	460
	T013 - Crew/Vehicle Disturbance		This experiment shall be performed in the OWS on either Mission SL-3 or SL-4.	340
COROLLARY	T020 - Foot Controlled Maneuvering Unit		Each of two crewmen shall perform a set of five experiment runs (three unsuited and two suited). The experiment shall be performed by one crewman on Mission SL-3 and by another crewman on Mission SL-4. At least one of the crewmen who performs T020 shall also perform one set of experiment runs on M509.	250

TABLE A-2. Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
	T025 -	Coronagraph Contamination Measurement	Photographs shall be obtained during five data taking periods on Mission SL-1/SL-2, during ten data-taking periods on Mission SL-3 and during ten data-taking periods on Mission SL-4. No more than one cassette of film will be exposed during any data-taking period. In addition, one period of visual observations shall be performed on each of the three missions. One photographic data-taking period per mission may be scheduled to coincide with the period of visual observations.	370
	T027(SA) -	Contamination Measurement (Sample Array)	One sample array shall be developed, exposed for 120 hours and retrieved.	170
COROLLARY	T027/S073 -	Contamination Measurement Gegenschein/Zodiacal Light (Photometer System)	This is a joint experiment utilizing the T027 photometer system. Twenty-three (23) program performances shall be performed on Mission SL-1/SL-2. Forty-five (45) program performances shall be performed on each of Missions SL-3 and SL-4.	410

TABLE A-2. Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
STUDENT	ED11	Atmospheric Absorption of Heat	This experiment is assigned to Mission SL-1/SL-2 and is a candidate for Missions SL-3 and SL-4. This experiment will use S191 data.	
	ED12	Volcanic Study	This experiment is assigned to Mission SL-1/SL-2 and is a candidate for Missions SL-3 and SL-4. This experiment will use S191, S192, S190A and S190B data.	
	ED21	Libration Clouds	This experiment will use S052 JOP-10 data and is assigned to Mission SL-3.	
	ED22	Objects within Mercury's Orbit	This experiment is assigned to Mission SL-1/SL-2 and is a candidate for Missions SL-3 and SL-4. This experiment will use S052 JOP-6 data.	N/A
	ED23	UV from Quasars	This experiment will require one night pass of S019 during Mission SL-1/SL-2.	
	ED24	X-Ray Stellar Classes	This experiment will use ATM JOP-13 data of one pass of stellar region during Mission SL-4	
	ED25	X-Rays from Jupiter	This experiment will use ATM JOP-13 data of one pass of Jupiter (X-Rays) during Mission SL-3.	
	ED26	UV from Pulsars	This experiment will use one night pass of S019 during Mission SL-1/SL-2.	
	ED31	Bacteria and Spores	Perform this experiment one time in accordance with MRD during Mission SL-1/SL-2.	
	ED32	In Vitro Immunology	Perform this experiment one time in accordance with MRD during Mission SL-3.	

TABLE A-2. Experiment Assignment and Scheduling Instructions

EXPERIMENT GROUP	EXPERIMENT NUMBER	EXPERIMENT TITLE	MISSION ASSIGNMENTS/SCHEDULING INSTRUCTIONS	FSP
STUDENT	ED41	Motor Sensory Performance	Perform this experiment one time in accordance with MRD during Mission SL-4.	N/A
	ED52	Web Formation	Perform this experiment one time in accordance with MRD during Mission SL-3.	
	ED61/62	Plant Growth/Plant Phototropism	Perform this experiment one time in accordance with MRD during Mission SL-4.	
	ED63	Cytoplasmic Streaming	Perform this experiment one time in accordance with MRD during Mission SL-3.	
	ED72	Capillary Study	Perform this experiment one time in accordance with MRD during Mission SL-4.	
	ED74	Mass Measurement	Perform this experiment one time in accordance with MRD during Mission SL-3.	
	ED76	Neutron Analysis	Perform this experiment one time in accordance with MRD during each of Missions SL-1/SL-2, SL-3 and SL-4.	
	ED78	Liquid Motion in Zero-G	Perform this experiment one time in accordance with MRD during Mission SL-4.	

TABLE A-2. Experiment Assignment and Scheduling Instructions

ANNEX B

SKYLAB PRIVATE CONVERSATIONS

	MORALE	OPERATIONAL	MEDICAL
Purpose	Crew/Family Morale	Discuss/decide sensitive matters in an extreme operational emergency.	Doctor/Patient discussion of crew health status-no prescribing or modifying of Flight Plan
Participants	Crew/Family	Crew/Program Director & his designees	Crew/Flight Surgeon
Monitors	None (Immediate dismissal for illegal monitoring, taping or discussing)	Public Affairs Officer	None
Scheduling	In Flight Plan once a week, normally on off-duty day. Changes by Flight Director.	Same → In extreme operational emergency determined by crew/Program Director or in his absence, his designated representative.	Same → In Flight Plan Daily
Prior Announcement	Policy only. None for individual conversations	PAO will announce decision to have.	Policy only. None for individual conversations.
Real Time Release	None	None	None
Recorded	Yes (complete archives)	Yes	Yes
Post Announcement	PAO may announce such calls have been made.	PAO will paraphrase the contents of the conversation, assess accuracy with the Program Director, and determine the final material to be released.	No paraphrase of conversations. Flight Surgeon will immediately give a statement on crew status to the Flight Director and PAO and will prepare a daily medical bulletin stating crew medical status for public release. This brief bulletin will be the only public comment on the conversation.
Tape Custody & Access Cont.	JSC Director of Flight Crew Operations.	JSC Director of Flight Crew Operations.	JSC Deputy Director of Life Sciences for Medical Operations.
Tape Release /Access Authority	Tapes will not be re-leased nor otherwise made available to anyone unless specific written permission of the Administrator has been given.	Program Director & AA for Public Affairs will have access to the tapes or tape transcripts. All other release must be specifically authorized in writing by the Administrator.	If the Flight Surgeon involved lets anyone listen to the tapes, the PAO will also be invited to listen. Tapes or tape transcripts will not be released unless specifically authorized by written permission of the Administrator.

TABLE A-3. SKYLAB PRIVATE CONVERSATIONS

APPENDICES

DEFINITIONS

The following are approved definitions of terms used in this and other Skylab Program documents.

- Abort. Mission termination by unscheduled but intentional separation of the spacecraft from the launch vehicle prior to orbital insertion.
- Baseline Requirement for Experiments. The highest level of experiment performance required by this directive as limited in text and tables. (When explicit instructions are not given, those documented in the MRD shall apply.)
- Category. A degree of importance assigned to a space vehicle element or operational support element. Specific categories applicable to Mission Rules are "Mandatory" and "Highly Desirable".
- Constraint A restriction that influences the mission profile, or timeline, and for mission planning purposes cannot be violated.
- Corollary Experiments The experiments other than group-related and passive experiments that require significant in-flight crew support and which are not as closely related to each other as are the group-related experiments.
- Countdown The period of time commencing with start of the official countdown clock. For Launch Mission Rules purposes, task accomplishment during the interval of time prior to start of the official countdown clock is not generally considered time critical.
- Cutoff The automatic or manual command to stop the launch sequence after initiation of the "automatic launch sequence".

DEFINITIONS (Continued)

- Detailed Test Objective Scientific, engineering, or operational objectives which amplify mission objectives or detail a major development purpose or feature of the mission. The accomplishment of a Detailed Test Objective will be an important consideration in determining the degrees of achievement of the mission objectives.
- Experiment Experiments are planned investigations which are conducted in-flight during manned space mission, or which are essentially connected with the in-flight situation. These investigations, which are approved by the Manned Space Flight Experiments Board and assigned by the Headquarters Program Office (ML), are conducted to obtain research information which can contribute to the advancement of science and technology.
- Extravehicular Activity Activity performed in space or in a celestial body by an astronaut external to the space vehicle.
- Flight Scheduling Precedence . . . A number assigned to each of the corollary experiments as an aid in scheduling these activities in the mission flight plans.
- Group-related Experiments . . . Experiments that are closely related to each other either through common study of the flight crew or by integration into a single subsystem. Specifically, these are the medical, solar astronomy (ATM), and earth resources experiments.
- Highly Desirable Item A highly desirable item is a space vehicle element or operational support element that supports and enhances the accomplishment of the mission and/or is essential for the accomplishment of the Detailed Test Objectives.

DEFINITIONS (Continued)

- Hold An interruption or delay of the countdown for any reason, such as unfavorable weather, repair of hardware, or correction of conditions unsatisfactory for launch or flight.
- Hold-Point A predetermined point where the countdown may be conveniently interrupted.
- Instrumentation The equipment that acquires, transmits, and monitors data for performance evaluation of space vehicle and operational support items.
- Intravehicular Activity Activity with one or more of the adverse characteristics of EVA because of reduced gravity and/or pressurized space suit, performed in space or on a celestial body by an astronaut internal to the space vehicle.
- Liftoff The event determined by the instrument unit umbilical disconnect signal; it is the point in time when plus time commences.
- Malfunction A failure; the inability of a system, subsystem, component, or part to perform its required function during test, operation, or end use (reference 6).
- Mandatory Item A mandatory item is a space vehicle element or operational support element that is essential for accomplishment of the mission, which includes pre-launch, flight, and recovery operations that ensure crew safety and effective operational control as well as the attainment of the Mission Objectives.
- Measurement A specific data channel of instrumentation monitoring a single function.
- Mission Objective A statement of the primary purpose of the mission. When used in Center control documentation, the Mission Objective(s) may not be modified, but may be amplified by Detailed Test Objectives.

DEFINITIONS (Continued)

- Operational Support Element. A part of any system or activity that is involved in the countdown, launch, flight, or recovery operations, other than those elements which are a part of the space vehicle itself (e.g., ground support equipment, electrical support equipment, launch support instrumentation, and equipment, facilities, communications, and utilities).
- Orbital Assembly The Saturn Workshop plus a docked CSM.
- Passive Experiments Experiments whose associated in-flight crew support requirements are either insignificant or non-existent.
- Proceed Continue in accordance with prescribed countdown procedures.
- Recycle The countdown is stopped and returned to a designated point or as specified in the Launch Mission Rules.
- Saturn Workshop The space assembly which comprises the Orbital Workshop, Airlock Module, Multiple Docking Adapter, and the Apollo Telescope Mount.
- Scrub An interruption of the launch countdown which requires rescheduling to a later launch window.
- Single Failure Point A single item of hardware which, if it failed, would lead directly to loss of a part, component, system, mission, or crew member (reference 6).
- Space Vehicle Element A part of any launch vehicle, spacecraft or associated flight hardware system.
- Subsystems/Operational Tests Tests which are conducted to either evaluate the performance of a particular subsystem to determine its suitability on future Skylab mission or to determine the method of operating subsystems to obtain optimum results.

DEFINITIONS (Continued)

Turnaround Time. The total time required from a scrub
to the next scheduled liftoff time
(T-0) including recycle and countdown.

ABBREVIATIONS AND ACRONYMS

AM	Airlock Module
ATM	Apollo Telescope Mount
CCB	Configuration Control Board
CM	Command Module
CSM	Command Service Module
DOD	Department of Defense
DRF	Data Request Form
DTO	Detailed Test Objective
EREP	Earth Resources Experiments Package
ERD	Experiment Requirements Document
ETC	Earth Terrain Camera
EVA	Extra-Vehicular Activity
FMAD	Flight Missions Assignment Document
FOMR	Flight Operations Management Room
FSP	Flight Scheduling Precedence
HD	Highly Desirable
IVA	Intra-Vehicular Activity
JSC	Johnson Space Center
KSC	Kennedy Space Center
LC	Launch Complex
LES	Launch Escape System
LO	Liftoff
LV	Launch Vehicle
M	Mandatory
MCC	Mission Control Center
MDA	Multiple Docking Adapter
MEP	Mission Evaluation Plan
ML	Skylab Program Office, OMSF
MLO	Directorate of Operations, Skylab Program Office (OMSF)
MMRD	Mission Medical Requirements Document
MOCR	Mission Operations Control Room
MOR	Mission Operations Report
MRD	Mission Requirements Document
MRC	Mission Rules Guidelines
MSF	Manned Space Flight
MSFC	Marshall Space Flight Center
MSR	Minimum Scheduling Requirement
N/A	Not Applicable
NASA	National Aeronautics and Space Administration
NM	Nautical Mile
OA	Orbital Assembly
OD	Operations Directive
OMSF	Office of Manned Space Flight
OWS	Orbital Workshop
PAD	Program Approval Document
PI	Principal Investigator

RT	Real Time
S-IC	First stage of the SL-1 launch vehicle
S-II	Second stage of the SL-1 launch vehicle
SL	Skylab launch
SL-1	The unmanned Saturn Workshop launch, or the associated space vehicle
SL-2	The first manned Skylab launch, or the associated space vehicle
SL-1/SL-2	The first Skylab mission, comprising space vehicles (and launches) SL-1 and SL-2
SL-3	The second Skylab mission, or the associated manned space vehicle, or the associated launch
SL-4	The third Skylab mission, or the associated manned space vehicle, or the associated launch
SM	Service Module
STDN	Spaceflight Tracking and Data Network
SWS	Saturn Workshop
TBD	To be defined
TBS	To be supplied
TV	Television
UV	Ultraviolet
XUV	Extreme Ultraviolet
Z-LV	Z-Local Vertical Attitude
~	Approximately
>	Greater than

REFERENCES

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