NEWS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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FOR RELEASE:
July 23, 1973

PRESS KIT

PROJECT: SKYLAB 3
Second Manned Mission

contents

NOTE: Details of the Skylab spacecraft elements, systems, crew equipment and experimental hardware are contained in the Skylab News Reference distributed to the news media. The document also defines the scientific and technical objectives of Skylab activities. This press kit confines its scope to the second manned visit to Skylab and briefly describes features of the mission.

(NASA-News-Release-73-131) NEXT SKYLAB CREW GOES UP 28 JULY (NASA) 45 p N76-71755

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FOR RELEASE:
July 23, 1973

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NEXT SKYLAB CREW GOES UP JULY 28

Three American astronauts will begin a two-month stay in space July 28 when the second Skylab crew is launched into orbit to man the Skylab space station. The second crew will further extend the long-term quest for knowledge about man's home planet, his Sun and himself which was begun by the Skylab 2 mission lasting 28 days.

The Skylab 3 crew will live and work aboard the space station for up to 56 days while measuring the human adaptability to long-duration spaceflight, conducting solar astronomy experiments above the distorting effects of the atmosphere, and surveying conditions and resources down on the fragile spacecraft Earth. Launched May 14, the Skylab space station is in an orbit tilted 50 degrees to the equator and ranges over most of the Earth's populated regions -- from the Canadian Border to the tip of Argentina.

-more-

Early in the space station's launch, known as Skylab 1, an aluminum micrometeoroid shield tore loose, taking with it one of the large power-generating solar array panels on the Skylab Workshop, and causing higher-than-normal temperatures in the Workshop living space. The first Skylab crew launch was delayed for 10 days while sunshields were fabricated and the crew was trained in erecting the shields. Once the temperatures were brought down by the parasol-like device that was deployed and the remaining solar array was freed by an innovative EVA repair using tools aboard Skylab, the space station settled down to a more or less normal operation.

The contingency repairs performed in-flight by the Skylab 2 crew of Charles Conrad, Joseph Kerwin and Paul Weitz, yielded an unexpected return by demonstrating that man can indeed tackle difficult repair and construction tasks in space.

In spite of the adversities at the outset of the first manned Skylab mission, all planned operational objectives were met, and much of the expected experimental data were gathered.

Taking up where the first crew left off, the second Skylab crew will double the information gained from medical experiments that measure man's physical responses to long-term exposure to weightlessness and other aspects of the space environment. The Sun and its influence upon life on Earth will again come under scrutiny as the Skylab crew focuses the astronomical telescopes and instruments of the Skylab space station toward our star some 93 million miles across space.

Closer to home, Skylab's Earth Resources Experiment Package (EREP) will scan and photograph physical and environmental features of the Earth's surface and atmosphere in 26 planned EREP "passes." Additionally, a group of scientific and technological experiments will be conducted during the 56 days of flight, including seven investigations selected in a nationwide competition among high school students.

Skylab 3 crewmen are Alan L. Bean, commander; Dr. Owen K. Garriott, science pilot; and Jack R. Lousma, pilot. Bean is a US Navy captain, Garriott a civilian scientist-astronaut, and Lousma a US Marine Corps major. Bean was lunar module pilot on the second manned lunar landing, Apollo 12, and with Apollo 12 commander Charles "Pete" Conrad, explored the region around the Surveyor III landing site. Garriott and Lousma have not flown in space.

Liftoff for Skylab 3 is scheduled for 7:08 a.m. EDT, July 28 atop a Saturn IB from NASA Kennedy Space Center Launch Complex 39, Pad B. Rendezvous and docking will occur during the fifth command/service module orbit after a standard rendezvous maneuver sequence.

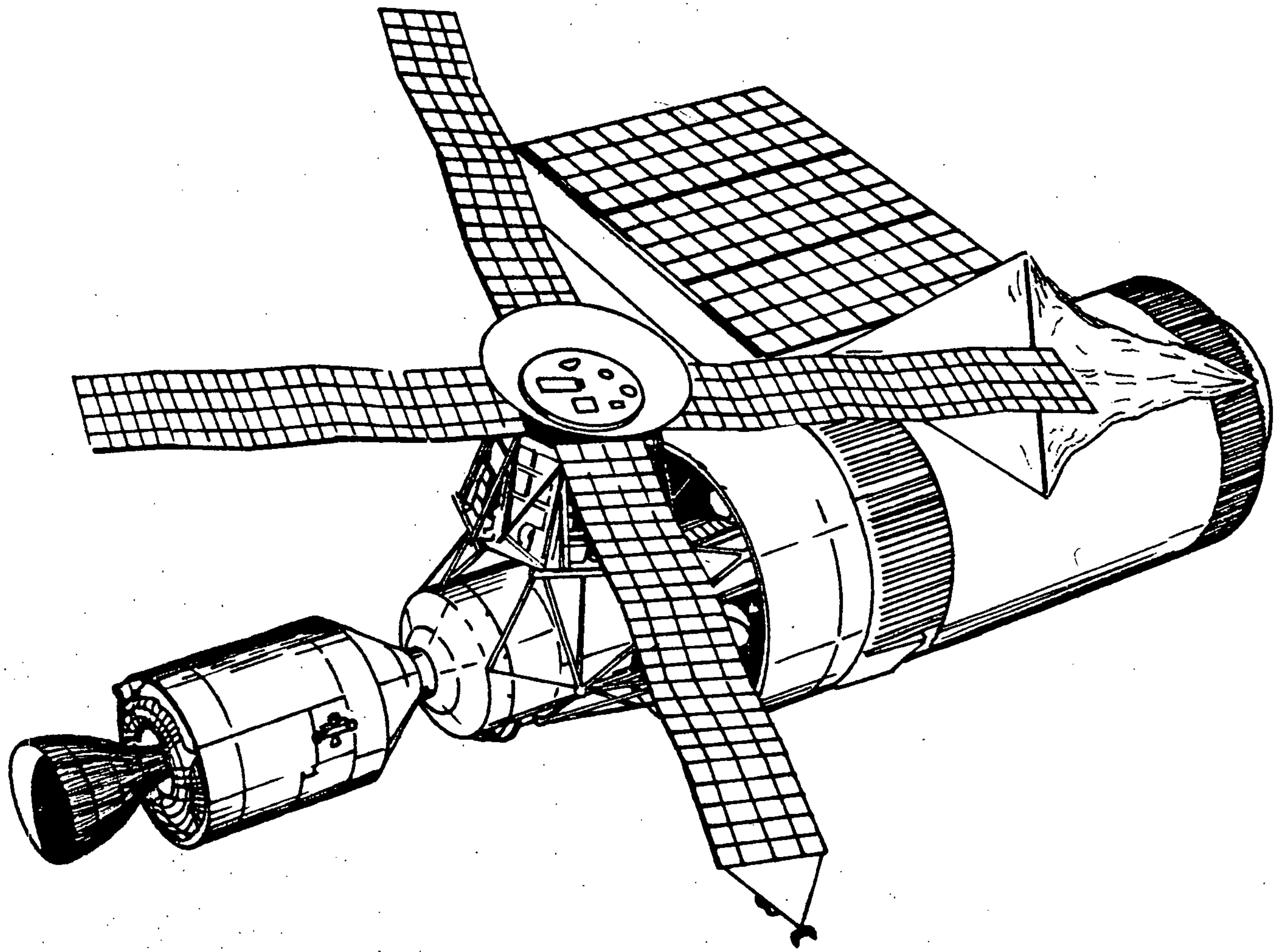
After docking with the space station, the Skylab crew will open the hatch, enter Skylab and begin to activate the station's systems. Skylab crew work days begin at 6 a.m. and end at 10 p.m. Houston time, Central Daylight.

Three EVAs are scheduled for the second crew: one to deploy a twin-boom sunshield to replace the parasol erected by the previous crew, and to the Sun end of the Apollo Telescope Mount (ATM) to retrieve and replenish film cannisters. The second and third EVAs will be for ATM retrieval and replacement.

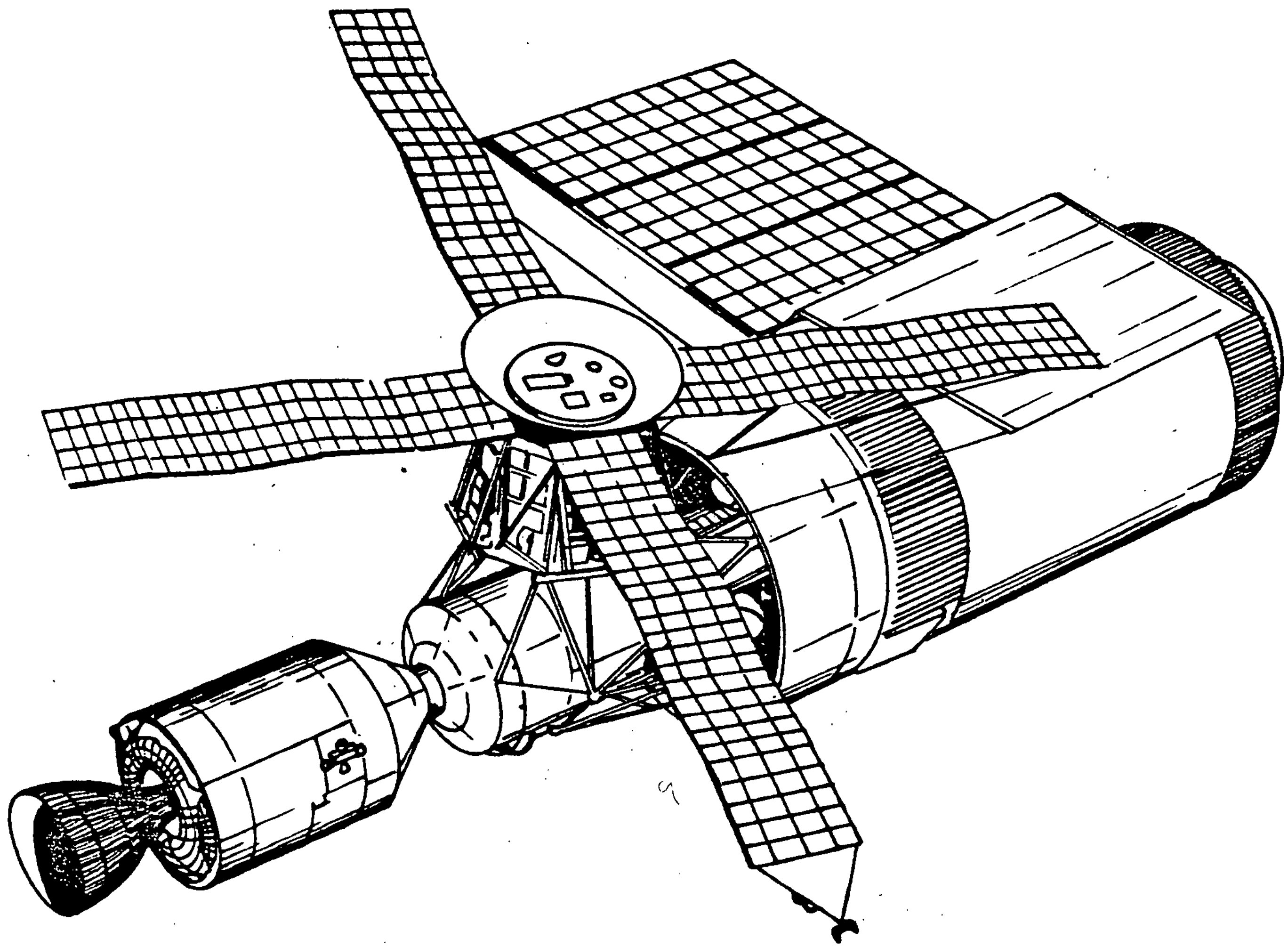
On September 22 the crew will undock the CSM from Skylab to deorbit and land in the eastern Pacific, about 1,830 km (990 nm) southwest of San Diego. Command module splashdown will be at 8:38 p.m. EDT September 22. Prime recovery vessel will be the landing platform-helicopter (LPH) USS New Orleans.

The launch vehicles for the Skylab program are Saturn multi-stage rockets developed by the NASA-Marshall Space Flight Center for the Apollo Program. A two-stage Saturn V placed the unmanned Skylab cluster into Earth orbit. This was the 13th flight of a Saturn V. The smaller Saturn IB vehicles carry Skylab crews into orbit to rendezvous and dock with the orbiting space station. The seventh Saturn IB to be launched will transport the Skylab 3 crew.

(END OF GENERAL RELEASE ; BACKGROUND INFORMATION FOLLOWS)



How Skylab appeared at end of the first manned visit.



How Skylab would look with twin-boom sunshade installed.

OBJECTIVES OF THE SKYLAB PROGRAM

The Skylab Program was 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.

Skylab, the first space system launched by the United States specifically as a manned orbital research facility, will provide a laboratory with features which cannot be found anywhere on Earth. These include: a constant zero gravity environment, Sun and space observation from above the Earth's atmosphere, and a broad view of the Earth's surface.

Dedicated to the use of space for the increase of knowledge and for the practical human benefits that space operations can bring, Skylab will pursue the following:

Physical Science - Increase man's knowledge of the Sun, its influence on Earth and man's existence, and its role in the universe. Evaluate from outside Earth's atmospheric filter, the radiation and particle environment of near-Earth space and the radiations emanating from the Milky Way and remote regions of the universe.

Life Science - Increase man's knowledge of the physiological and biological functions of living organisms - human, other animal, and tissues - by making observations under conditions not obtainable on Earth.

Earth Applications - Develop techniques for observing Earth phenomena from space in the areas of agriculture, forestry, geology, geography, air and water pollution, land use and meteorology.

Space Applications - Augment the technology base for future space activities in the areas of crew/vehicle interactions, structures and materials, equipment and induced environments.

The first Skylab mission achieved its three specific objectives. They were as follows:

1. Establish the Skylab orbital assembly in Earth orbit.

a. Operate the spacecraft cluster (including CSM) as a habitable space structure for up to 28 days after the launch of the crew.

b. Obtain data for evaluating the total spacecraft performance.

c. Obtain data for evaluating crew mobility and work capability in both intravehicular and extravehicular 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 from low Earth orbit.

b. Obtain Earth resources data for continuing and extending multisensor observation of the Earth from low Earth orbit.

c. Perform the assigned scientific, engineering and technology experiments.

The Gemini 7 mission had demonstrated that man could readily adapt to space flight for up to two weeks without ill effects. Now Skylab has pushed forward the threshold of human adaptability to spaceflight by doubling Gemini 7's time in space with the first Skylab crew.

SKYLAB MAJOR EVENTS

(Central Daylight Time)

MISSION	LAUNCH	LANDING	DURATION DAY:HR:MIN
SL-1	MAY 14 - 12:30P CDT (134:17:30 GMT*)		
SL-2	MAY 25 - 8:00A CDT (145:13:00 GMT)	JUNE 22 - 8:50A CDT (173:13:50 GMT)	28:00:50
SL-3	JULY 28 - 6:08A CDT (209:11:08 GMT)	SEPT 22 - 7:38P CDT (266:00:38 GMT)	56:13:30
SL-4	TBD	TBD	56 DAYS

* DAY OF YEAR: HR: MIN in Greenwich Mean Time

OBJECTIVES OF THE SECOND MANNED SKYLAB MISSION

The second Skylab mission officially began June 22 when the first CSM and its crew separated from the space station just prior to reentry. The unmanned portion of this SL-3 mission will continue until the second crew is launched. After docking, the SL-3 crew will enter Skylab, 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.

The four objectives of the second Skylab mission are as follows:

1. <u>Perform unmanned Saturn Workshop operations</u>

a. Obtain data for evaluating the performance of the unmanned station.

b. Obtain solar astronomy data by unmanned ATM observations.

2. <u>Reactivate and Man Skylab in Earth orbit</u>

a. Operate the cluster (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 space station.

c. Obtain data for evaluating crew mobility and work capability in both intravehicular and extravehicular activity.

3. <u>Obtain medical data on the crew for use in extending the duration of manned space flights</u>

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. <u>Perform in-flight experiments</u>

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 observations from Earth orbit.

c. Perform the assigned scientific, engineering, technology and DOD experiments.

MISSION PROFILE: Launch, Docking and Deorbit

Skylab 3, the second manned visit to the Skylab space station, will be launched at 7:08 am EDT July 28 from NASA Kennedy Space Center Launch Complex 39 Pad B for a fifth-orbit rendezvous with the space station. The Skylab space station, designated Skylab 1, was launched into an initial 431x432.9km (233 by 234 nm) orbit which is expected to be 424.6 by 439.5km (229x237 nm) at Skylab 3 rendezvous.

The standard five-step rendezvous maneuver sequence will be followed to bring the Skylab 3 CSM into the space station's orbit---two phasing maneuvers, a corrective combination maneuver, a coelliptic maneuver, terminal phase initiation and braking. The CSM will dock with Skylab's axial docking port at about eight hours 20 minutes after launch.

After verifying that all docking latches are secured, the Skylab 3 crew will begin actication of the space station, but will sleep aboard the command module the first night.

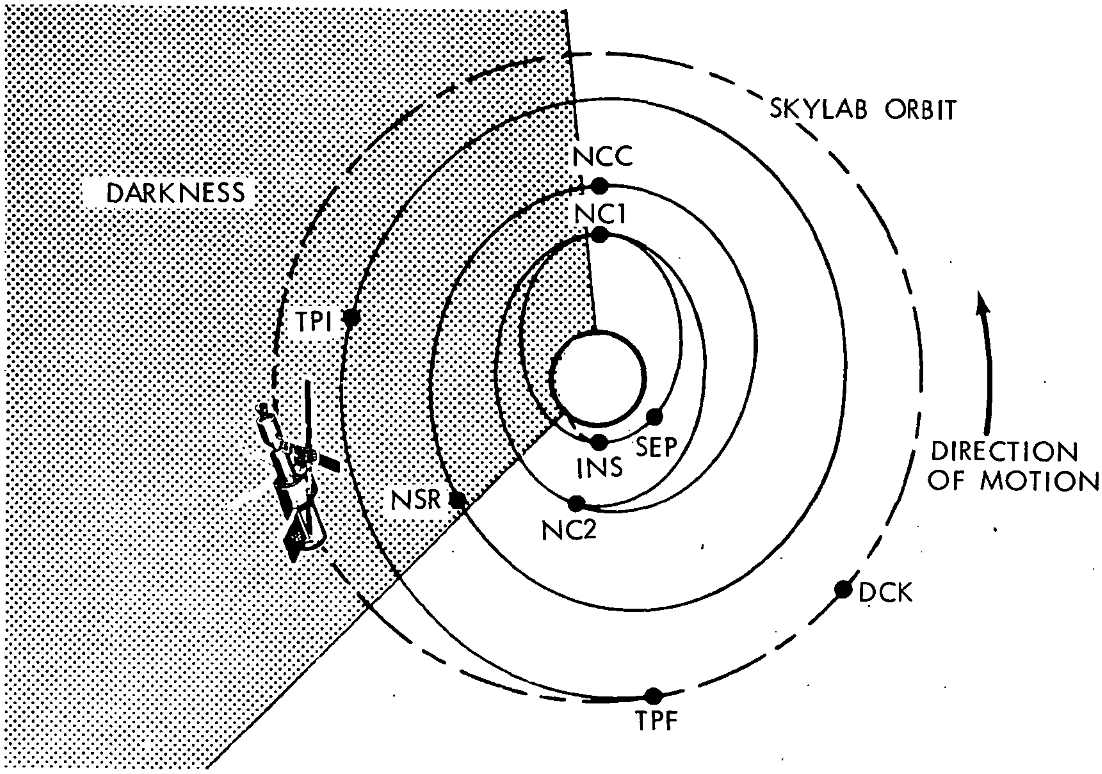
Timekeeping will be on a ground-elapsed-time (GET) basis until Skylab 3 GET of eight hours, after which timing will switch over to day of year (DOY), or mission day (MD), and Greenwich Mean Time (GMT or "Zulu") within each day. Mission day 1 will be the day the crew is launched.

At the completion of the 56-day manned operation period, the crew will board the CSM, undock and perform two deorbit burns---the first of which will lower CSM perigee to 166.5 km (90 nm) and the second burn will again lower perigee to an atmospheric entry flight path. Splashdown will be in the eastern Pacific about 1830 km (990 nm) southwest of San Diego, Calif. after 874 CSM revolutions. Splashdown coordinates are 23°28' N, 129°26'W. Command module touchdown time will be 8:38 pm EDT September 22.

Skylab 3 (Second manned launch)

Event	Date	Time (EDT)
Launch	July 28	7:08:50 a.m.
Orbital insertion		7:18:53 a.m.
CSM/S-IVB separation, 3 fps RCS		7:33:50 a.m.
Phasing 1 (NC1), 221.1 fps SPS		9:26:19 a.m.
Phasing 2 (NC2), 158 fps SPS		11:42:12 a.m.
Corrective combination (NCC), 29.6 fps SPS		12:28:21 p.m.
Coelliptic (NSR), 19.2 fps SPS		1:05:21 p.m.
Terminal Phase initiate (TPI), 20.9 fps SPS		2:21:12 p.m.
Terminal phase finalize (TPF), 27.3 fps SPS		2:54:54 p.m.
Docking		3:38:50 p.m.
Orbit trim burn 1, 2.4 fps RCS	August 1	10:04:18 a.m.
Orbit trim burn 2, 1.4 fps RCS	August 26	10:36:11 p.m.
Orbit trim burn 3, 1.3 fps RCS	Sept. 17	9:26:12 p.m.
Undocking	Sept. 22	3:21:33 p.m.
Separation, 5 fps RCS		4:08:19 p.m.
Shaping burn, 258.5 fps SPS		4:55:33 p.m.
Deorbit burn, 191.9 fps SPS		7:57:11 p.m.
Entry interface (400,000 feet)		8:22:35 p.m.
Landing at 23°28' N x 129°26' W		8:38:29 p.m.

RENDEZVOUS SEQUENCE



		TIME, G.E.T., HR:MIN:SEC	DELTA V, ADDED FT. PER SECOND	RESULTANT PERIGEE/APOGEE, N. MI.
INS	INSERTION	00:10:03.1	—	81/120
SEP	SEPARATION MANEUVER	00:25:00.0	3.0	81/121
NC1	PHASING 1	02:17:29.4	221.1	120/208
NPC	PLANE CHANGE	PLANE CHANGE, IF NECESSARY		
NC2	PHASING 2	04:33:22.8	158.0	202/215
NCC	CORRECTIVE COMBINATION	05:19:31.7	29.6	208/228
NSR	COELLIPTIC	05:56:31.7	19.2	219/227
TPI	TERMINAL PHASE INITIATION	07:12:22.0	20.9	223/234
TPF	TERMINAL PHASE FINALIZATION	07:46:04.0	27.3	230/238
DCK	DOCKING	08:30:00	—	—

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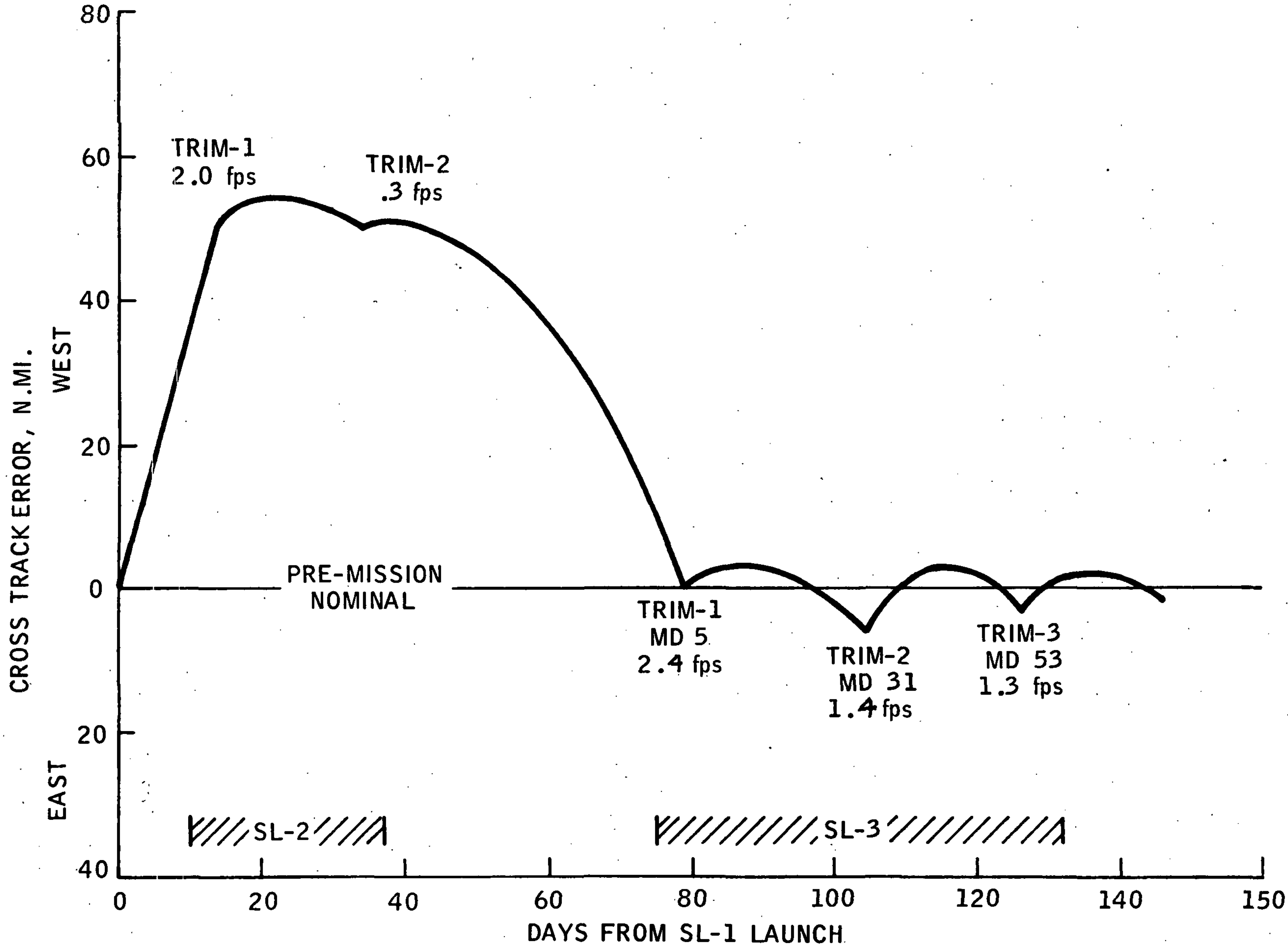
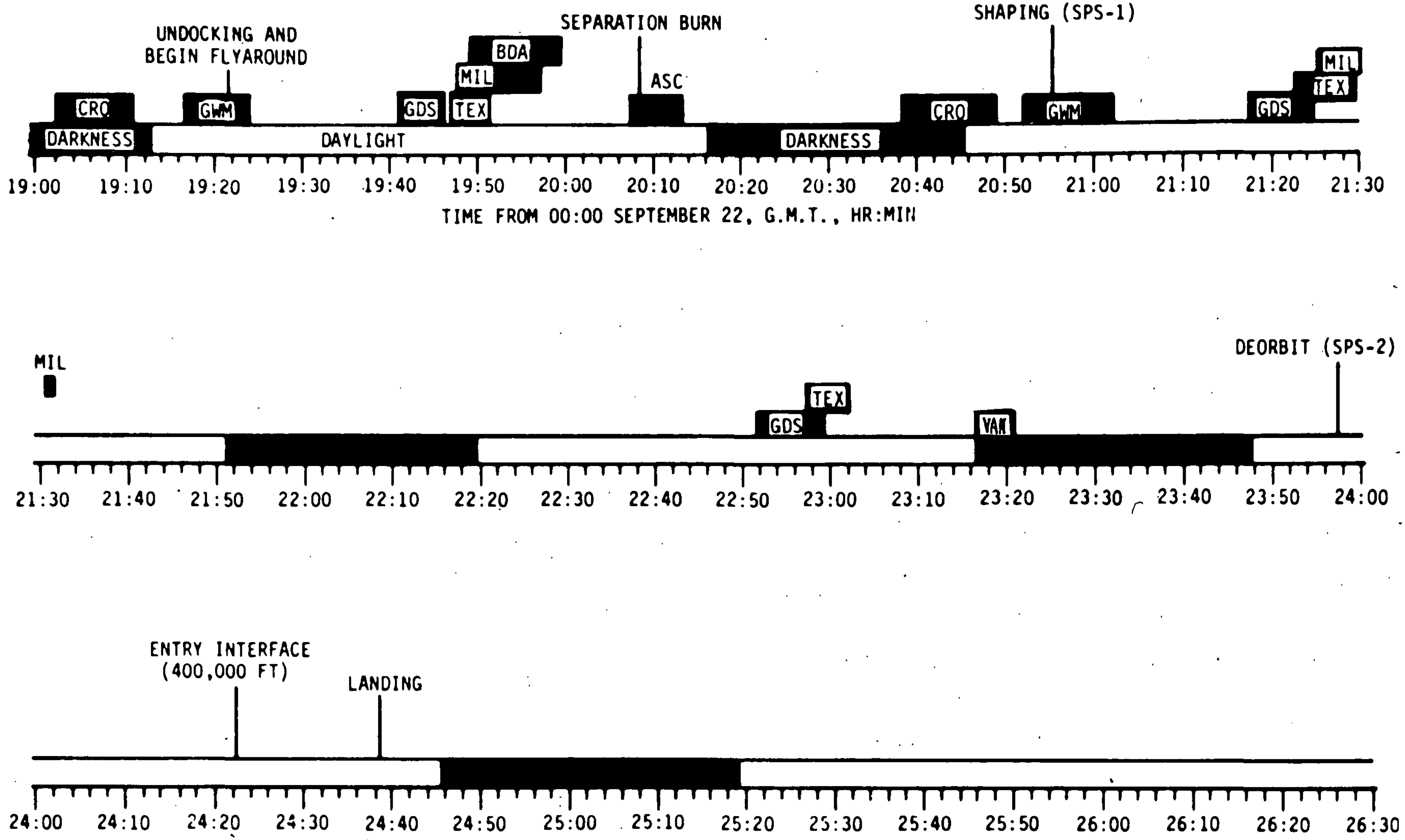
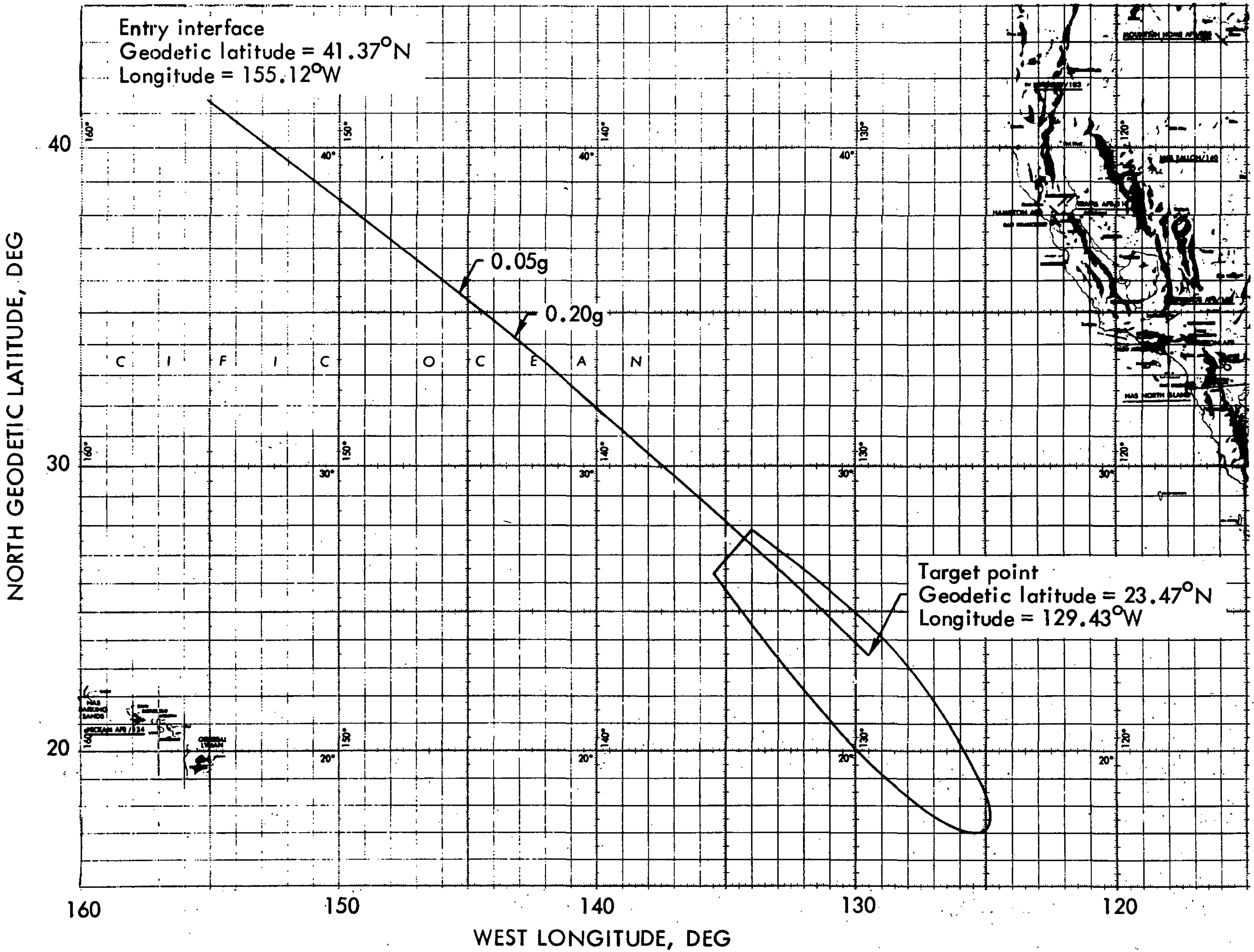
ORBIT TRIM ADJUSTMENT MANEUVERS



END OF MISSION SEQUENCE FOR SL-3 SPS DEORBIT





CM reentry track and maneuver envelope SW of NAS North Island, San Diego

COUNTDOWN AND LIFTOFF

After the May 25 launch of the first crew to man Skylab the mobile launcher was brought back to the Vehicle Assembly Building at the NASA Kennedy Space Center in Florida. The stages of the next Saturn IB launch vehicle and boilerplate spacecraft were erected on the mobile launcher, beginning May 28.

Integrated testing of the launch vehicle stages was conducted while the spacecraft underwent thorough testing, including simulated flights in the altitude chamber, in the Manned Spacecraft Operations Building at KSC's industrial area.

On June 8, the flight spacecraft was moved to the VAB and erected atop the launch vehicle three days later, the fully assembled space vehicle was moved to Launch Couplex 39, Pad B for pad integration and final tests prior to the launch countdown.

The countdown for this third Skylab launch differs from previous ones in that the Countdown Demonstration test CDDT and the final countdown have been incorporated into a single launch countdown. The early portion of the count will include launch vehicle cryogenic fueling and final countdown activities without astronaut participation.

Following the simulated T-0, the count will be recycled to the T-47 hour mark instead of recycling for a dry test with crew participation, then going through the entire count again as had been done on earlier missions.

Key events in the final count, beginning at T-47 hours include:

T-45 hours 30 minutes	Install launch vehicle batteries
T-39 hours	Launch vehicle power transfer test
T-36 hours	Command service module cryogenic fueling. Takes approximately 6 hours
T-26 hours	Complete CSM mechanical buildup. Takes approximately 12 hours
T-9 hours	Begin clearing pad area
T-8 hours	Replenish RP-1 (first stage fuel)

T-6 hours 50 minutes	Begin launch vehicle cryogenic propellant load. (Loading takes approximately 3 hours - replenish continues through remainder of countdown)
T-4 hours	Primary damper retracted
T-3 hours 45 minutes	CSM closeout crew on station
T-2 hours 40 minutes	Flight crew enters spacecraft
T-1 hour 51 minutes	Emergency detection system tests (to T-1 hour, 21 minutes)
T-57 minutes	Clear closeout crew from pad area
T-45 minutes	Retract swing arm 9 to park position
T-44 minutes	Arm Launch Escape System
T-42 minutes	Final launch vehicle range safety check (to T-35 minutes)
T-35 minutes	Last target update of the LYDC for rendezvous with the OWS
T-15 minutes	Hold for liftoff adjustment - maximum 2 minutes
T-5 minutes	Swing arm 9 fully retracted
T-3 minutes 7 seconds	Start automatic sequence
T-50 seconds	Launch vehicle transfer to internal power
T-3 seconds	Ignition sequence starts
T-0	Liftoff

SL-3 (SATURN IB) LAUNCH EVENTS

Time Hrs	Min	Sec	Event	Vehicle Wt Kilograms (Pounds)*	Altitude Meters (Feet)*	Velocity Mtrs/Sec (Ft/Sec)*	Range Kilometers (Naut Mi)*
00	00	00	First Motion	586,647 (1,293,314)	90 (295)	1.8 (5.9)	0 (0)
00	01	13	Maximum Dynamic Pressure	375,026 (826,776)	12,599 (41,334)	473 (1,552)	4.2 (2.3)
00	02	16	Inboard Engine Cutoff	190,013 (418,900)	56,167 (184,275)	1,976 (6,483)	57 (31)
00	02	19	Outboard Engine Cutoff	184,822 (407,455)	59,152 (194,069)	2,033 (6,669)	62 (34)
00	02	21	S-IB/S-IVB Separation	184,059 (405,774)	60,522 (198,562)	2,032 (7,781)	65 (35)
00	02	22	S-IVB Ignition	138,028 (304,294)	61,821 (202,826)	2,064 (6,771)	67 (36)
00	02	49	Launch Escape Tower Jettison	132,141 (291,317)	86,160 (282,676)	2,119 (6,953)	117 (63)
00	09	03	S-IB Stage Impact	45,370 (100,021)	0 (0)	90 (295)	503 (271)
00	09	53	S-IVB Engine Cutoff	30,749 (67,789)	158,402 (519,692)	7,561 (24,807)	1,807 (975)
00	10	03	Orbit Insertion	30,694 (67,668)	158,544 (520,157)	7,568 (24,829)	1,881 (1,015)

*English measurements given in parentheses

SKYLAB EXPERIMENTS

The Skylab space station carries the largest array of experimental scientific and technical instruments the United States has ever flown in space, a total of 58. They fall into four general categories: life sciences, Earth resources, solar physics and corollary. Data received will permit 200 principal investigators to supervise 271 scientific and technical investigations. While most of the detailed experiment runs are planned pre-mission, there are occasions when specific observations are scheduled in real-time to take advantage of an unique opportunity, such as the solar flare and Hurricane Ava that developed during the first manned mission.

Skylab medical experiments are aimed toward measuring man's ability to live and work in space for extended periods of time, his responses and aptitudes in zero gravity, and his ability to readapt to Earth gravity once he returns to a one-g field.

Earth resources experiments (EREP) employ six devices to advance the technology of remote sensing and at the same time gather data applicable to research in agriculture, forestry, ecology, geology, geography, meteorology, hydrology, hydrography and oceanography through surveys of site/task combinations such as mapping snow cover and water runoff potentials; mapping water pollution; assessing crop conditions; determining sea state; classifying land use; and determining land surface composition and structure. On days that EREP passes are scheduled, the JSC News Center will publish site/task guides identifying principal investigators, specific locations or areas and scientific disciplines. The second manned mission has 26 EREP passes scheduled, including one pass over the Japanese island chain. Eleven EREP passes were run on the first manned visit out of 15 that had been scheduled.

ATM solar astronomy experiments utilize an array of eight telescopes and sensors to expand knowledge of our planet's Sun and its influence upon the Earth. Almost 82 hours, 80 percent of the premission scheduled ATM experiment time, were logged by the first Skylab crew while gathering some 17,000 frames of ATM film. Some 45,000 frames of ATM film will be available for the next manned mission.

A wide range of experiments falls into the corollary category, ranging from stellar astronomy and materials processing in zero-g to the evaluation of astronaut manuvering devices for future extravehicular operations.

Seven experiments selected through a national secondary school competition in the Skylab Student Project are also assigned to the second manned mission.

Experiments assigned to second Skylab mission are listed below

In-flight medical experiments (on all missions):

M071	Mineral Balance
M073	Bioassay of Body Fluids
M074	Specimen Mass Measurement
M092	Lower Body Negative Pressure
M093	Vectorcardiogram
M110, M113, M114, M115	Series, Hematology and Immunology
M131	Human Vestibular Function
M133	Sleep Monitoring
M151	Time and Motion Study
M171	Metabolic Activity
M172	Body Mass Measurement

(These are three ground-based medical experiments - M078, M111 and M112 involving pre- and post-flight data.)

Earth Resources Experiment Package (EREP) experiments (on all missions):

S190	Multispectral Photographic Facility comprised of:
S190A	Multispectral Photographic Cameras
S190B	Earth Terrain Camera
S191	Infrared Spectrometer
S192	Multispectral Scanner
S193	Microwave Radiometer/Scatterometer and Altimeter
S194	L-Band Radiometer

The ATM experiments (on all missions):

S052	White Light Coronagraph
S054	X-Ray Spectrographic Telescope
S055A	Ultraviolet Scanning Polychromator-Spectroheliometer
S056	Extreme Ultraviolet and X-Ray Telescope
SC82A	Coronal Extreme Ultraviolet Spectroheliograph
S082B	Chromospheric Extreme Ultraviolet

(Two hydrogen-alpha telescopes are used to point the ATM instruments and to provide TV and photographs of the solar disk.)

The corollary experiments:

	M508	Astronaut Maneuvering Equipment
	M512	Materials Processing Facility
	M516	Crew Activities/Maintenance Study
*	M555	Gallium Arsenide Crystal Growth
*	S015	Zero-g Single Hunman Cells
	S019	Ultraviolet Stellar Astronomy
	S063	Ultraviolet Airglow Horizon Photography
#	S071	Circadian Rhythm Pocket Mice
#	S072	Circadian Rhythm Vinegar Gnats
	S073	Gegenschein/Zodiacal Light
	S149	Particle Collection
	S150	Galactic X-Ray Mapping
	S230	Magnetospheric Particle Collection
	T003	Inflight Aerosal Analysis
	T020	Foot-Controlled Maneuvering Unit

The student investigations:

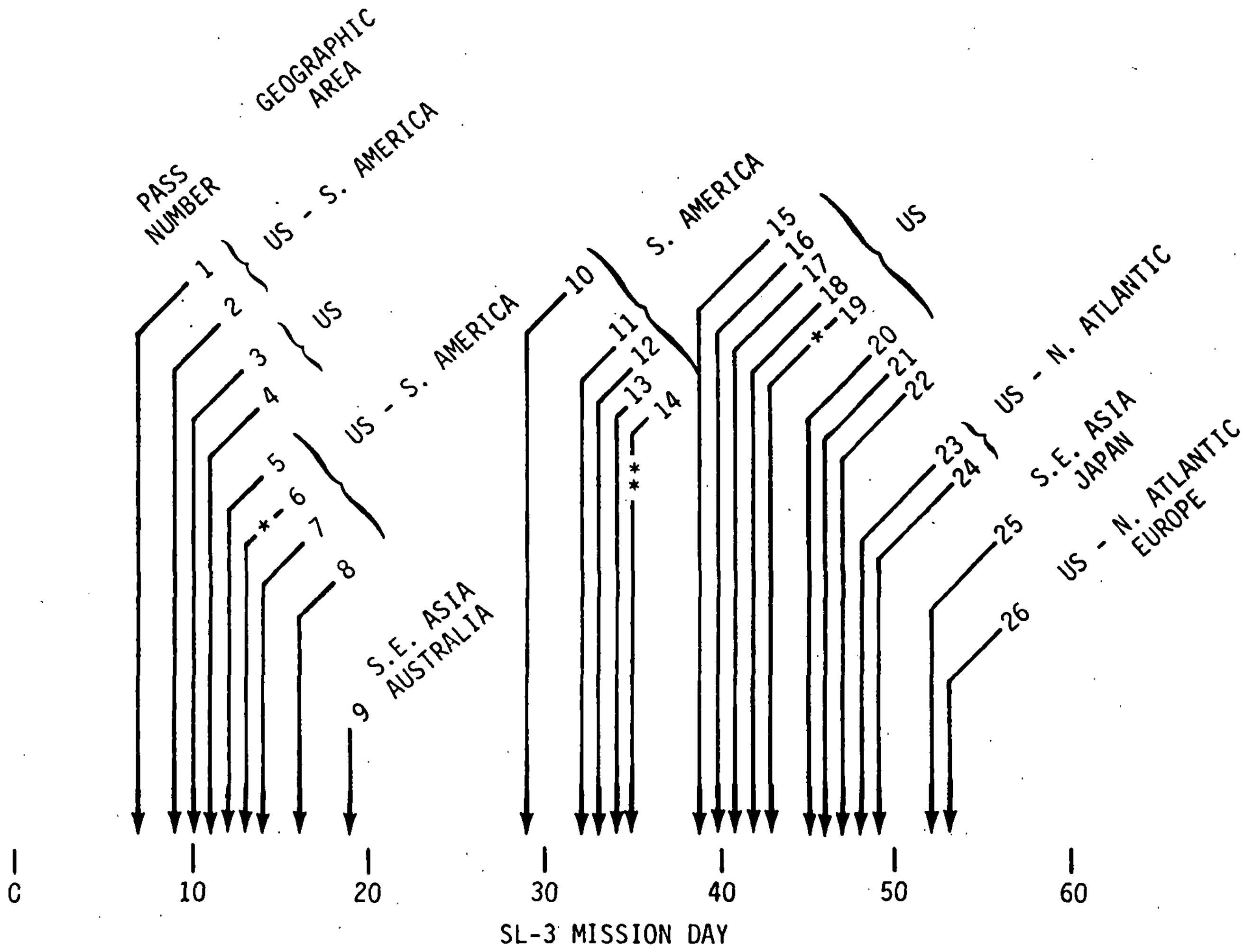
#	ED21	Libration Clouds
#	ED25	X-Rays from Jupiter
#	ED32	In-Vitro Immunology
#	ED52	Web Formation
#	ED 63	Cytoplasmic Streaming
#	ED74	Mass Measurement
	ED76	Neutron Analysis

* Deferred from Skylab 2

Unique to Skylab 3

(Details of the above experiments may be found in Skylab Experiments Overview, available from the Government Printing Office (Stock No. 3300-0461) $1.75/copy; or from experiment booklets and manuals in the KSC and JSC Newsrooms.)

PLANNED EREP PASSES



*LUNAR CALIBRATION AFTER EREP PASS. **AND AFRICA.

REAL-TIME FLIGHT PLANNING

Time was when pre-mission flight plans were followed "by the numbers" with few changes except those caused by systems malfunctions. Skylab flight planning, however, is almost wholly done in real-time, with the pre-mission flight plan serving mainly as a guide to Mission Control Center flight planners. Each day's flight plan is designed to yield the highest experiment data return.

Teleprintered to the Skylab space station early in the morning before the crew wakens, the daily flight plan takes advantage of unique opportunities that enhance data gathering for particular experiments. For example, forecasts of cloud-free EREP sites and ground observatory predictions of unusual solar activity have a bearing upon when EREP passes and ATM runs are scheduled in the flight plan.

The Skylab flight planning cycle begins at midnight Houston time (CDT) with a team of flight planners in Mission Control Center drafting a "summary flight plan" for the following crew work day that will start 32 hours later. This first team is relieved by the so-called "execution" team (day team) of flight controllers which carries out the existing detailed flight plan for the immediate day. Then the flight planners on the next, or "swing" shift develop from the summary flight plan a detailed flight plan for the following day, nailing down the activity details first summarized in the early morning hours --- and so on in leapfrog fashion.

Daily flight plans pivot around experiment requirements which have to be resolved, optimum crew time use, and mission objectives still have to be met. Proposed summary flight plans embrace the viewpoints of Skylab systems engineers, experiment principal investigators, flight surgeons, mission management, the flight crew and the weatherman's forecast for potential EREP survey sites. Precedence is given to mandatory operations, ATM, EREP and medical experiments, with other experiments and operations filling the remaining time.

Revised summary flight plans will be reproduced daily and distributed to newspersons at the JSC Newsroom, and the daily crew teleprinter "loads" will be available for review at the query desk.

DAILY CREW ACTIVITY

Skylab crew work days in space are not a whole lot different from work days on Earth. The normal day starts at 6 a.m. and runs until 10 p.m. CDT. Days off, however, are fewer and farther between.

Breakfast is at 7 a.m., lunch at noon and dinner at 6 p.m. CDT --- except for the man on duty at the ATM console during lunch, who shifts his meal time so that he can be relieved at the console. Eight hours of sleep are normally scheduled each day.

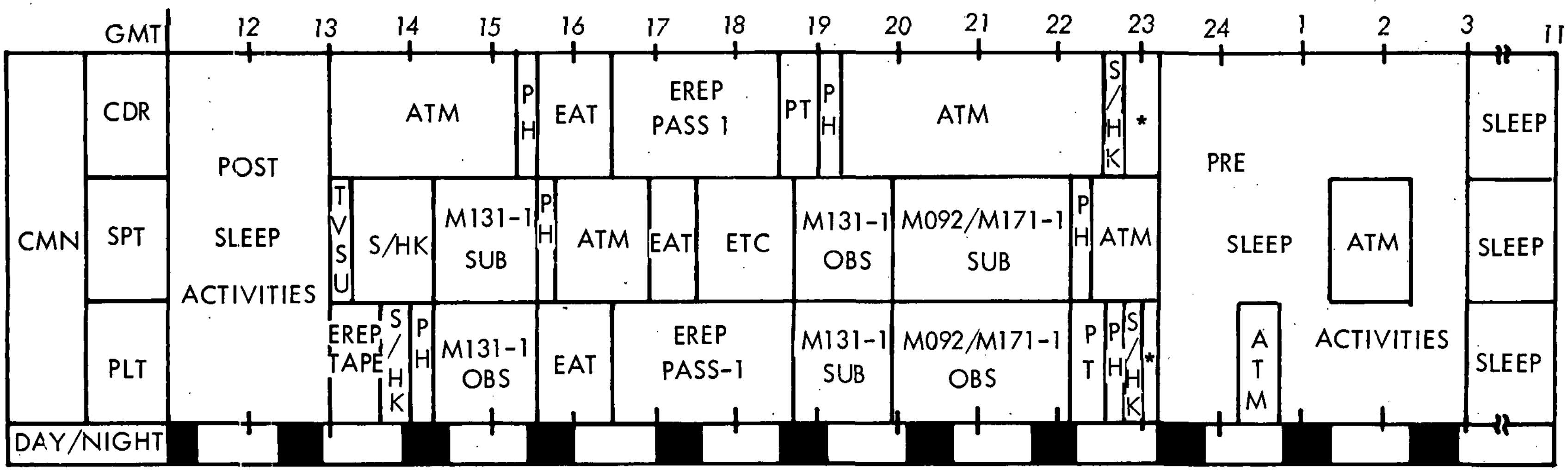
During the mission the astronauts will be operating and monitoring about 60 items of experimental equipment and performing a wide variety of tasks associated with the several hundred Skylab scientific and technical investigations.

Depending upon experiment scheduling requirements, Skylab crews have a day off about every seventh day.

About two 15-minute personal hygiene periods are scheduled each day for each crewman and one hour and 30 minutes for physical exercise. Additionally, an hour a day maybe set aside for R&R -- rest and relaxation. Another regularly scheduled activity each day is two and a half hours of systems housekeeping, such as cleaning of environmental control system filters, trash disposal and wiping down the walls of the space station.

Mission Control Center flight planners fill the remaining eight hours of the crew work day with experiment operations.

TYPICAL CREW DAY



POST SLEEP ACTIVITIES

SYSTEM CONFIGURATION
PH
URINE SAMPLING
T003 EXPERIMENT
BODY MASS MEASUREMENT
BREAKFAST
DINNER PREP
PRD READOUTS
LOAD FILM
REVIEW PADS
STATUS REPORT

S/HK - SYSTEM HOUSEKEEPING

PH - PERSONAL HYGIENE

PT - EXERCISE

TVSU - TV SETUP

* TIME AVAILABLE FOR COROLLARY EXPTS

PRE-SLEEP ACTIVITIES

EVENING MEAL
ATM (1 to 2 PASSES)
MISSION PLANNING
RECREATIONAL ACTIVITIES
CONDENSATE DUMP
TRASH AIRLOCK DUMP
FOOD RESIDUE WEIGHING
STATUS REPORT
T003 EXPERIMENT
SYSTEM CONFIGURATION FOR SLEEP
PH
BREAKFAST PREP

ML73-2330

SKYLAB STATUS: WHAT HAPPENED

The unmanned Skylab space station was launched on May 14. Approximately one minute after liftoff, at the time of highest aerodynamic pressure, the meteoroid shield around the outside of the workshop was torn off and apparently caused one of two solar panels used to generate electricity for the laboratory also to be torn away and jammed the other in a way that prevented its full deployment.

The net result was that Skylab was in good orbit, but had only about half of its power-generating capability in operation and the spacecraft was overheating. The overheating occurred because the lost meteoroid shield also provided thermal balance. It was painted in a way to reflect enough sunlight so that the laboratory would stay cool.

A principle purpose of the meteoroid shield -- a thin aluminum skin .025 inch thick -- was to protect the Skylab vehicle from the possible impacts of tiny space particles by providing enough resistance to make them splatter and lose energy before striking the inner walls of the workshop.

Without the shield the workshop will be exposed to more potential direct hits which might result in some minor air leaks by the end of the 240-day mission. The pressurization system is adequate to meet such a contingency.

The Skylab team responded quickly to the situation. The first task was to stabilize conditions. Temperatures were increasing rapidly. External skin temperatures were estimated to be as high as 325 degrees Fahrenheit. There was concern that the unrefrigerated on-board food, medicines, and film might spoil.

The flight control team tried to find an attitude or position of Skylab which would minimize the heating and at the same time cast sufficient sunlight on the remaining solar cells, those attached to the ATM, to generate the electricity required to operate the space station. Ground controllers oriented the orbiting space station from one attitude to another to control temperatures and still obtain enough sunlight for power generation.

After a great deal of calculation, analysis and some experimentation, inside temperatures were stabilized at approximately 125 degrees and power levels at about 2800 watts, which barely covered the unmanned housekeeping requirements. Although some food and medicines were assumed to have been spoiled, there remained sufficient unspoiled food on board for all three missions, and some of the medicines were replaced by the first crew to go aboard.

While the laboratory was being stabilized, it became very clear that a fix would be required. The laboratory was too hot for normal habitation and the temperature was too high to carry out the medical experiments.

The temporary pitched-up attitude of the laboratory was determined by the need to balance solar heating and power generation, and was therefore not fully appropriate for either the solar experiments (which require precise pointing at the Sun) or the Earth resources experiments (which require equally precise pointing at the Earth). The best way to fix the Skylab was to provide quickly a sunshade which would once again reflect away the proper amount of sunlight so that the laboratory would remain cool and regain its pointing flexibility.

By the third day after launch, a number of approaches to thermal control had been well enough defined to develop a firm design, development, manufacturing, test and training schedule. The aerospace industry and NASA centers has responded fast and well to the call for help. The crew launch date was then reset for Friday , May 25, a delay of 10 days.

On the day before launch, three different sunshades were selected to go along with the crew because no one really knew what the astronauts would find when they rendezvoused with Skylab. Officials didn't know if the meteoroid shield was completely and cleanly severed or whether parts of it were obstructing areas where the sunshade might be installed. By carrying several different sunshades, the crew would at least have one suitable for the situation.

One sunshade, called a SEVA sail, was a trapezoidal awning to go on ropes that would stretch from the base of the Skylab work shop to a hand rail on the apollo telescope mount. (SEVA refers to standup extravehicular activity). One of the astronauts, standing up in the hatch of the undocked command/service module, would first attach ropes and hooks to the Skylab base. The CSM would then be maneuvered toward the ATM where the converging ropes would be attached at a single point, pulled taut and the 22-by-24-foot sail would be positioned over the workshop.

A different "twin-boom" sunshade was designed to be deployed from the ATM truss assembly during an EVA. Two of the astronauts would step out of the airlock in pressure suits, affix a special bracket on the ATM structure, and attach to the bracket two long poles that they had assembled from short sections. At the end of each pole is a pulley with a rope threaded through it. With poles forming an inverted vee extending back over the workshop, a sheet of reflecting material would be hooked on the ropes and pulled, like a sail, to a position over the workshop where the meteoroid shield should have been.

Actually used by the first Skylab crew was the simpler parasol concept that did not require an EVA. After docking and entering the Skylab, the crew enxtended a folded canopy through the scientific airlock on the Sun side of the workshop. Once outside the spacecraft, the nylon and aluminized Mylar material was deployed mechnically, like a parasol, to form a 22-by-24-foot rectangular thermal shield over the workshop's exposed area. This approach offered the least difficult means of quickly bringing the heating problem under control.

The astronauts had trained with all three concepts at the Johnson Space Center and in the zero-gravity simulator at the Marshall Space Flight Center.

Prior to launch, program officials approved a stand-up EVA from the undocked command module to remove any debris that covered the scientific airlock and to attempt, if feasible, to free the jammed solar array. The decision was made to carry bolt cutters, tin snips, and a bending tool to help with the tasks.

On launch day, Pete Conrad, Joe Kerwin and Paul Weitz went through launch and rendezvous, soft docked, prepared for stand-up EVA, undocked, and tackled the salvage problem. Weitz did the stand-up EVA as Kerwin steadied his legs and Conrad maneuvered the CSM.

The scientific airlock was clear of debris but the crew found a length of 3/4-inch angle aluminum bent up and over the solar array beam. The beam, deployed about five degrees, was firmly restrained by the metal strap.

The angle aluminum strap has a series of bolts, one of which apparently was driven into the .025 aluminum of the solar wing, securely fastening it. The slope of the strap along the side of the beam was such that the tools could not get a grip to pry it away.

The next day, the astronauts followed procedures written just two days earlier and deployed the parasol. By the 11th mission day the inside temperatures had dropped to 75 degrees.

Immediately after parasol deployment the crew started operating experiments. They found that one, the S019 ultraviolet stellar astronomy experiment had a mirror tilt gear drive mechanism that was jammed. They promptly disassembled and assembled it again. It's working fine.

Then, as temperatures dropped and flight planners began to see daylight, Skylab encountered a new problem on day five.

During the first full EREP pass, the space station left solar orientation and went to "local vertical" as planned. This moves the solar arrays out of the sunlight and the batteries go to discharge. On that first pass, four battery systems which had gotten hot in the unmanned "pitch-up" attitude showed they were taking less than one-half charge, and one battery system dropped off the line completely. The loss was serious even though there are 18 such battery packs in the ATM power supply system.

However, the backup astronaut crew, plus a small sleepless group of specialists had been continuing to work on procedures to remove the strap that held the solar wing undeployed.

The procedures were radioed up on day 12, the crew practiced in space (inside the workshop) on day 13, and went EVA on day 14. Kerwin and Conrad cut the strap, broke a restraining bolt, and erected the solar wing. Within hours the solar wing was supplying electricity. Skylab was in full working order to carry out its planned 270 scientific and technical investigations.

In addition, the crew performed a number of other actions that saved certain experiments which otherwise could not have functioned. And, on their EVA they solved the problem of a malfunctioning ATM battery relay by banging on it with a hammer, a repair technique warmly endorsed by appliance owners and machinery operators everywhere.

The following summarizes the status of Skylab as it awaits the next working crew:

1. ELECTRICAL POWER SYSTEM

The Skylab power system was operating well and no failures or degradations were experienced in the latter phase of the first manned visit. The average power generating capacity after the crew left was ranging between 6700 watts and 8500 watts, depending on the Sun angles. The average cluster loads were about 4700 watts without command module loads and will increase to about 5900 watts when command module loads are added. All eight air-lock module battery regulator modules have been functioning well since the astronauts deployed solar wing no. 1. Electricity generated by the workshop wing is fed to the airlock module (AM) battery system.

Some degradations have occurred in the ATM Power System due to the thermal stresses induced early in the mission. One of the 18 ATM charger battery regulator modules (CBRM) is inoperative. Four CBRM's exposed to high temperatures had shown some degradation in battery storage capacity but have recovered most of their original capacity. One of the solar cell modules has had a 10 per cent degradation due to high temperatures and one regulator was operating below specification during the daylight passes reducing its integrated output to 80 per cent of capability. However, the total Skylab power system shows sufficient margin to accomplish the remaining two missions.

2. ENVIRONMENTAL CONTROL SYSTEMS

The workshop internal temperatures were stabilized originally at about 73 degrees Fahrenheit by the deployment of the parasol. During the unmanned operations, temperatures rose to the mid-90s due to increased time in the sunlight during each orbit. . It is planned to deploy the twin-boom sunshade early in the next mission to improve the shade coverage and to counteract the effects of any ultraviolet degradation of the parasol. In addition, a parasol of improved material will be brought up by the crew to be available if needed.

The airlock cooling system has been operating well and effectively cooling the equipment. The system has supplied sufficient cooling during EVA and is effectively controlling the cluster humidity. An earlier malfunction of the thermal control valve has been eliminated by a thermal/pressure cycling procedure and the valves in both coolant loops are now modulating properly.

The ATM passive and active cooling systems also are operating well.

In summary, the environmental control systems, except for the loss of the meteoroid shield, retains original redundancies and should satisfactorily complete the Skylab missions.

3. ATTITUDE CONTROL SYSTEM

In general, the attitude control system has functioned as planned. Gyro drift rates have required more ground management than was anticipated. The high drift has been attributed tentatively to bubbles in the gyro fluid during vacuum operation.

The high drift rates do not generally present a problem during solar inertial orientation since continuous gyro update is possible during the daylight portion of each orbit. However, during the early part of the mission, when off-nominal pointing modes were required to control the thermal environment, alternate means to verify the proper attitude were required.

The three control moment gyros (CMG) and digital computer system are operating satisfactorily. Gravity gradient dumping of angular momentum during the dark portion of the orbit has been satisfactory and has prevented momentum saturation or unnecessary usage of the thruster attitude control system (TACS).

Due to the early off nominal pointing modes, significantly more TACS propellants were used than anticipated. The amount remaining,about 44 per cent of the pre-mission total, is sufficient for nominal 3 CMG or 2 CMG operation for the last two missions. If problems develop similar to the initial SL-1 operation, TACS augmentation is possible by means of the CSM Reaction Control System during the manned phases.

4. HABITABILITY SUPPORT SYSTEMS

All elements of the Habitability Support Systems have been functioning as specified without any significant anomalies. The workshop waste management system operation has received very favorable comments from the crew. The system has functioned as planned and the crew has been pleased with the shower. Similarly, the Skylab food and operation of the systems for food preparation have satisfied the crew.

The food refrigeration system operated flawlessly throughout the first unmanned and manned phases. During Skylab deactivation, however, a malfunction in the radiator by-pass valve resulted in rising freezer temperatures. The redundant secondary refrigeration loop exhibited similar characteristics. Continuous on-off cycling of the by-pass valve in the primary system resulted in reversal of the warming trend and brought temperatures back to near normal. A trouble shooting procedure has been developed to insure proper operation of the secondary system in the event its use becomes necessary during the manned part of the next mission.

5. INSTRUMENTATION AND COMMUNICATIONS SYSTEM

Voice communication between the Skylab and Mission Control has been good during station passes and tape recorder dumps. TV quality, both in real time and through video tape recorder transmission, was excellent.

One of Skylab's two color TV cameras became inoperative but two new cameras will be resupplied on the SL-3 launch.

One of the three active airlock module tape recorders became inoperative after 843 hours of operation and was replaced by the crew. Later, this replacement recorder malfunctioned during the unmanned phase after 320 hours of operation. Four spare tape recorders were aboard Skylab originally.

As a result of these malfunctions, tape recorder operations during the second mission's unmanned phase has been reduced to three hours per day. Two new tape recoders will be brought up on SL-3 to fully restore the spares inventory.

One of the airlock's three 10-watt transmitters failed and was replaced by switching to the 2-watt transmitter without degradation of experiment or systems data transmissions. Additional transmitter failures, however, would degrade data transmission capability. Consequently, studies are underway at MSFC to determine the feasibility of transmitter replacement during the final mission.

ACCOMPLISHMENTS

The first Skylab manned mission made significant contributions to the basic purpose for which the space station program was established. All mission objectives of SL-1/2 were successfully accomplished.

Broadly summarized, the accomplishments were as follows:

1. Approximately 80% of the solar data planned has been obtained. Major scientific accomplishment was monitoring of solar flare on June 15.

2. Eleven of the fourteen Earth resources data runs planned were accomplished. (6 experiments/instruments were operated for 77 Principal Investigators)

3. All medical experiments (16) were conducted as required by the operational medical protocols. The time history of man's adaptation to the zero-g environment obtained for the first time.

4. Data was taken on all experiments scheduled for SL-2 except those that could not be accomplished due to use of the solar airlock for parasol deployment and weight or power limitations.

5. Data was obtained on five student investigations. Two student investigations are rescheduled for SL-3 (ED12 Volanic Study, ED22 Objects in Mercury's Orbit, data could not be obtained because of orbit track or location of astronomical body).

Major support form the astronauts included:

Maintenance: Experiment door pinned; coronagraph occulating disk dusted off; faulty camera replaced; and battery package relay was released.

Scientifically: Through astronaut alertness the early portion, or development, of a solar flare was observed with all ATM instruments.

EXPERIMENTS SUMMARY:

Not all of the returned pictures and other data are expected to be completely useful for the scientific investigations. For example, cloud cover and procedural problems will have reduced the usefulness of some of the EREP pictures. Similarly, equipment problems, exposure settings and other difficulties may have reduced the scientific product to be expected form some ATM and other astronomy pictures. As data from the first manned mission are analyzed procedures are being developed to provide improved efficiency for obtaining scientific observations on the second mission.

ATM ACCOMPLISHMENTS SUMMARY

MANNED VIEWING TIME		81 hrs	
SOLAR VIEWING PERIODS (passes)		76 FULL	29 PARTIAL
FILM USAGE (frames)	USED	PLANNED	
S052	4519	8025	
S054	6739	6976	
S056	4296	6000	
S082A	219	201	
S082B	1608	1608	
TOTAL	17377	22810	76%

*S052, S054 and S055 CONTINUE TO OPERATE IN UNMANNED MODE

EREP ACCOMPLISHMENTS SUMMARY

- DATA COLLECTED

MULTISPECTRAL CAMERA (S190A)	6500 FRAMES
EARTH TERRAIN CAMERA (S190B)	960 FRAMES
INFRARED SPECTROMETER (S191 Data Acq. Camera)	5400 FRAMES
SCANNER (192), INFRARED SPECTROMETER (191) & MICROWAVE SENSORS (193, 194)	41,000 FT. MAGNETIC TAPE

- DATA COLLECTED OVER
  - X 31 STATES & PUERTO RICO
  - X 6 FOREIGN COUNTRIES, MEXICO, BRAZIL, BOLIVIA, NICARAGUA, COLUMBIA, AND CANADA.
  - X GULF OF MEXICO, CARIBBEAN SEA, PACIFIC/ATLANTIC OCEANS
- DATA OBTAINED FOR 75 PRINCIPAL INVESTIGATORS, (66 U.S. and 9 FOREIGN) AND FOR SENSOR PERFORMANCE EVALUATIONS
- DATA WAS COLLECTED FOR 186 INDIVIDUAL TASKS ON SL-2

	ACHIEVED	PLANNED	
ATM			
MANNED VIEWING TIME	81 HRS	101 HRS.	81%
EXPERIMENT FILM	17,352 FRAMES	22,810 FRAMES	75%
H-ALPHA-1 FILM	13,000 FRAMES	16,000 FRAMES	
EREP			
PASSES	11 (5SHORT)	14	79%
ETC PASSES	6	10	60%
PHOTOS	7460	9000	83%
TAPE REELS	6	6	
186 TASK SITES COVERED, DATA TAKEN FOR 75 INVESTIGATIONS			
MEDICAL			
PERFORMANCES	137	147	93%
MAN HOURS	148	158	94%
ALL PLANNED URINE, BLOOD, & FECES SAMPLES TAKEN (EXCEPT FIRST 3 DAYS URINE IS UNKNOWN)			
COROLLARIES			
SCIENTIFIC AIRLOCK	32 MAN HRS.	38 MAN HRS.	84%
OTHER COROLLARIES	22 MAN HRS.	14 MAN HRS.	157%
UV ASTRONOMY PASSES	10	16	
MATERIALS SCIENCE OPERATIONS	9	10	
FOUR ASSIGNED EXPERIMENTS NOT PERFORMED - S020, T025, S015, M555			
STUDENTS			
BACTERIA & SPORES, NEUTRON ANALYSIS	4 MAN HRS.	4½ MAN HRS.	
DATA FOR ATMOSPHERIC ABSORPTION OF RADIANT HEAT, U.V. FROM QUASARS, U.V. FROM PULSARS			

SKYLAB BETWEEN VISITS

The second Skylab mission is in two parts: Unmanned and manned. The unmanned portion has been underway since, June 22 at 4:55 AM EDT when the Conrad/Kerwin/Weitz crew undocked from Skylab. The manned portion, a 56-day workout, will start when the Bean/Garriott/Lousma crew docks with the space station.

The ATM experiments which can operate in the unmanned configuration (S052, S054, and S055) are not only continuing their long range observational programs, but gathered unique data in support of numerous international ground based and rocket observations of the June 30 eclipse.

Highest priority was placed upon the eight to ten orbits bracketing the eclipse where the combined ATM and ground based observations were used to determine temporal evolution of solar features. Observations during the days before and after the eclipse permitted the study of the three-dimensional structure of various solar features and hence, increased the value of non-ATM observations during the eclipse.

Each of the ATM experiments also has more specific goals during this time.

The data obtained by the S052 White Light Coronagraph (High Altitude Observatory) provided a cross calibration with 30 collaborators on the polarization of the corona since ground-based observers must contend with an additional polarization contribution from the Earth's atmosphere.

The S054 X-Ray Spectrographic Telescope (American Science and Engineering) obtained a series of solar images with its thinnest filter (in the wavelength ranges 3.5-36 and 44-60 Angstroms) for collaboration with ground based observations and to identify transient features during the time of the eclipse.

The S055 Ultraviolet Scanning Polychromator-Spectroheliometer (Harvard College Observatory) studied specific features which occurred at the solar limb at the time of the eclipse. Additional ultraviolet spectra of these features obtained over a longer time span will specifically augment the data taken by a rocket experiment launched in Mauritania.

The data taken by S055 were sent via telemetry to the ground to be processed by the experimenter for use by the ground observers of the eclipse. Experiments S052 and S054 photographed the eclipse events. Their film will be retrieved at the end of the Skylab 3 mission in late September.

Between crew visits to the Skylab space station, ground controllers become sort of absentee landlords for the station. Experiments and systems status monitoring and off/on commanding is handled remotely through data and command telemetry links from the Mission Control Center at Houston.

The Skylab cluster remained in the solar inertial attitude after the first Skylab crew undocked for return to Earth. The space station's attitude and pointing control system kept the ATM telescopes aligned with the Sun.

Skylab internal pressure is vented down from five to about two pounds per square inch after the Skylab crews depart.

Attitude pointing and control systems and both major electrical systems in the space station remain fully "up" during unmanned periods. The telemetry and command systems also stay "live" to relay systems information to ground controllers and to accept commands for housekeeping functions and data retrieval. The environmental control system remains inactive, except for the refrigeration system and some thermal control components.

A number of passive Skylab experiments require long term exposure in space to acquire the desired scientific data. While the orbiting station has been unmanned the following experiments have been in operation:

1. S149 - particle collection - Four cassettes with polished surfaces are being exposed to collect micrometeorites and dust particles. The cassette holder is extended on a boom through a scientific airlock.

2. S228 - trans-uranic cosmic rays - An array of plastic modules comprised of 0.010 inch thick sheets will be exposed till the end of the third manned mission to attempt to determine the existence of high-Z cosmic rays. Unit is inside the workshop.

3. S230 - magnetospheric particle composition - A collection of foils (aluminum, platinum, aluminum oxide) are mounted on an exterior strut where they can be bombarded by rare gases (helium, neon, argon). Samples will be returned after each mission and the isotopic abundance of the gases collected in the foils will be compared with the abundance found on the lunar surface.

4. D024 - thermal control coatings - One set of paint and film samples (2 arrays) were returned by the first crew. A second set, with longer exposure to the space environment, will be returned by the next crew.

5. ED76 - neutron analysis - Ten detectors are measuring the ambient neutron flux at Skylab orbital altitudes. Four detectors were returned by the first crew. The remaining six will be returned on the last mission.

SKYLAB AND RELATED OBJECTS VISIBLE

NASA will continue to distribute information enabling people in most populated areas of the world to see the Skylab space station as it orbits the Earth.

Skylab is visible to the unaided eye only in clear skies during the two hours before dawn and after dusk -- when the viewer is in the Earth's shadow and the space station is in the Sunlight at its orbiting altitude of 435 kilometers (270 miles). Sunlight reflected off portions of the large spacecraft is what makes Skylab visible.

The space station under the best visual conditions, will appear approximately as bright as the brightest star in the sky. It will be moving easterly fast enough to be easily distinguishable from stars and may be visible for as long as seven minutes.

There has been some confusion on the part of Skylab watchers because of other visible objects traveling along the same track both ahead of and behind the space station.

These other objects were launched with Skylab and include four jettisoned, separate panels from the payload cover, the Saturn booster's S-II second stage, a jettisoned radiator shield and one unidentified object. Relative positions of the objects and Skylab keep changing from day to day. As in a 500-mile auto race, some of the objects go faster and overlap the slower ones.

Skylab is in a stable attitude and its brightness varies gradually as it moves across the star field. The other objects are tumbling in flight and seem to slowly blink on and off. An exception is the large S-II stage which is even brighter than Skylab. The stage is large, cylindrical and painted white. These features give it high and fairly steady visibility even though it tumbles as it orbits.

Sighting information for key cities is computed and issued every two weeks by the NASA Marshall Space Flight Center, Huntsville, Ala.

Ground areas that Skylab crosses include all of the U. S. except Alaska, a strip of Southern Canada, all of South America, China, Africa, Australia, India, most of Asia and southern portions of USSR.

The space laboratory flies over 89 per cent of the world's population and 65 per cent of the Earth's land areas as it orbits from 50 degrees north of the Equator to 50 degrees south.

Skylab is 36 meters (118 feet) long and its solar cell arrays are about 31 meters (100 feet) from tip to tip.

-end-