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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington, D. C. 20546
202-755-8370

FOR RELEASE:

November 5, 1973

PRESS KIT

PROJECT: SKYLAB 4
Third 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 third manned visit to Skylab and briefly describes features of the mission.

NEWS
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AC 202/755-8370

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November 5, 1973

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RELEASE NO: 73-229

SKYLAB PUTS OUT WELCOME MAT FOR COMET

Space Station Skylab's final tenants will move into their orbiting home 270 miles above the Earth on or about November 10 to complete a harvest of scientific information about our home planet and our life giving star, the Sun. Two earlier threesomes of tenants occupied the space station for 28 and 59 days before "leaving the key under the mat" for the final crew that will live aboard Skylab for up to two months.

Earth resources, solar astronomy, medical and other experiments will fill the waking hours of the Skylab crewmen, with the opportunity to view the comet Kohoutek as an added bonus in December or January.

Flying above the distorting layers of Earth atmosphere, Skylab's solar telescopes and astronomical cameras are expected to provide valuable data about the make-up of comets as well as continuing the surveillance of the flares, prominences and other dynamic events taking place on the face of the Sun.

The manned spacecraft's crew can provide fast reaction times in monitoring and recording the sudden emergence and rapid development of unpredicted events on the Sun or the Kohoutek comet. Unmanned satellites, losing valuable time in ground-based data analysis and in radio relay of information, cannot react as quickly.

For the final Skylab manned mission three categories of experiments -- solar physics, Earth resources and medical -- will follow patterns set during the first two missions, with additional tasks in gathering scientific data. The Apollo Telescope Mount (ATM) has been assigned comet Kohoutek observations in addition to its other chores. Although 30 Earth resources surveys,are planned, options are open for up to 10 additional surveys. Medical investigations have been broadened to increase the knowledge of how the human body adapts to long periods of space flight.

Other corollary scientific and technological experiments -- including ten student experiments selected by the National Science Teachers Association in a nationwide competition among high school students -- will round out Skylab's final services as an orbiting scientific station.

A scientific highlight for the next Skylab crew will be the passage near the Earth-Sun region of the comet Kohoutek in December and January. The mission period will cover the comet's perihelion (closest approach to Sun) on December 28, allowing observations both before Kohoutek passes behind the Sun as well as the post-perihelion changes as the comet swings around and retreats into deep space.

Comet observations will be made with solar and astronomical instruments and cameras, including two mounted outside on the ATM truss for operation by the astronauts during an EVA. Skylab's vantage point above the atmosphere offers a unique opportunity to observe the changing composition of a comet in the ultraviolet spectrum. Little is known about the structure of comets, other that the popular theory that they are like giant snowballs hurtling through the solar system. Skylab consumables will be closely husbanded to keep open an option to extend the final mission to about 70 days, depending upon crew health and the condition of space station systems. An extension of the mission would provide an opportunity for northern hemisphere winter Earth resources surveys of ice and snow distribution and the start of the growing season.

Crewmen are Gerald P. Carr, commander; Dr. Edward G. Gibson, science pilot; and William R. Pogue, pilot. Carr is a U.S. Marine Corps lieutenant colonel, Gibson a civilian scientist-astronaut, and Pogue a U.S. Air Force lieutenant colonel. None has flown in space.

This liftoff, designated Skylab 4, is scheduled for 11:41 a.m. EST November 10 atop a Saturn 1B from NASA Kennedy Space Center's 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 crew will begin "turning on" Skylab in preparation for two months or more of working and living in space.

Undocking for a 56-day mission would be January 6 with a two-impulse service propulsion retrofire sequence bringing command module splashdown in the north-central Pacific, about 509 km (310 statute miles) north-north-west of Honolulu, Hawaii. Splashdown would be at 5:44 p.m. EST on January 6. If the mission is extended to 69 days, splashdown would be on January 19 at about 4 p.m. EST in the central Pacific.

Like any new home, the experimental space station had several defects -- anomalies -- which had to be corrected before Skylab became habitable for the planned long missions. At launch, an aluminum micrometeoroid shield ripped off, taking with it one of the main solar cell arrays for generating electrical power and jamming the other to prevent its unfolding. Loss of the shield caused temperatures inside the space station to rise to an uncomfortably high level.

The first crew to visit Skylab, Charles Conrad, Joseph Kerwin and Paul Weitz, carried along a parasol-like device which they erected to help bring the temperatures down. The jammed solar cell array was freed during an EVA and the first manned visit turned out to be successful, not only from the standpoint of gathering scientific data, but also in demonstrating that men can take on difficult repair and construction jobs in space.

The second Skylab crew was not without its share of repair work around the space station. Alan Bean, Owen Garriott and Jack Lousma erected a second sunshield to supplement the first one. They installed a "six-pack" of gyros in the Skylab attitude control system to replace balky gyros that had become undependable.

Two repair chores are planned for the final Skylab crew. They include replacing the fluid in a primary coolant loop that was leaking during the second Skylab manned mission; and inspection of the antenna on the S193 Microwave Radiometer/Scatterometer Altimeter in the Earth Resources Experiment Package (EREP).

OBJECTIVES OF THE SKYLAB PROGRAM

The Skylab Program was established for four purposes: (a) to determine man's ability to live and work in space for extended periods; (b) to extend the science of solar astronomy beyond the limits of Earth-based observations; (c) to develop improved techniques for surveying Earth resources from space; and (d) 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, is providing a laboratory with features not available 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 is pursuing the following objectives:

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 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.

OBJECTIVES OF THE THIRD MANNED SKYLAB MISSION

The third Skylab manned mission officially began September 25 when the second CSM and its crew separated from the space station just prior to reentry. The unmanned portion of this SL-4 mission will continue until the third crew is launched. After docking, the 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 objectives of the third Skylab manned mission are as follows:

1. Perform unmanned Saturn Workshop operations

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

    b. Obtain solar astronomy data by unmanned ATM observations.

2. Reactivate and Man Skylab in Earth orbit

    a. Operate the cluster (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 space station.

    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 Skylab mission of greater duration 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 observations from Earth orbit.

   c. Obtain data of the comet Kohoutek beyond the limits of Earth-based observations.

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

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 unique opportunities such as solar flares and hurricanes observed during the first and second mission.

Skylab medical experiments are designed to measure man's ability to live and work in space for extended periods, 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 remote-sensing technology 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 third manned mission has 30 EREP passes scheduled with possible options for up to 10 more, including passes over the United States, South America, Europe, Africa, Australia/New Zealand, Malaysia and Japan. An extension to a 70-day mission duration would allow coverage of snow and ice distribution in the northern hemisphere and the start of the growing season in the United States.

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. Additionally, ATM instruments will be used in observations of the comet Kohoutek between December 14 and January 2 and other non-solar events such as the planet Mercury's transit and a solar eclipse.

A wide range of experiments falls into the corollary category, ranging from stellar astronomy and materials processing in zero-g to further evaluation of astronaut maneuvering devices for future extravehicular operations. Several instruments in the corollary category will also be used in observations of the comet Kohoutek, as will a new experiment, S201, a modified version of an instrument taken to the Moon on Apollo 16.

Ten experiments selected by the National Science Teachers Association through a national secondary school competition in the Skylab Student Project are assigned to the third manned mission.

Experiments assigned to the third manned 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
M112	
M113	
M114	Hematology and Immunology
M115	
M131	Human Vestibular Function
M133	Sleep Monitoring
M151	Time and Motion Study
M171	Metabolic Activity
M172	Body Mass Measurement
	(These are two ground-based medical experiments - M078 and M111 - involving pre- and post-flight data.)

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

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
S082A	Coronal Extreme Ultraviolet Spectroheliograph
S082B	Chromospheric Extreme Ultraviolet Spectrograph (Two hydrogen-alpha telescopes are used to point the ATM instruments and to provide TV and photographs of the solar disk.)

The corollary experiments:

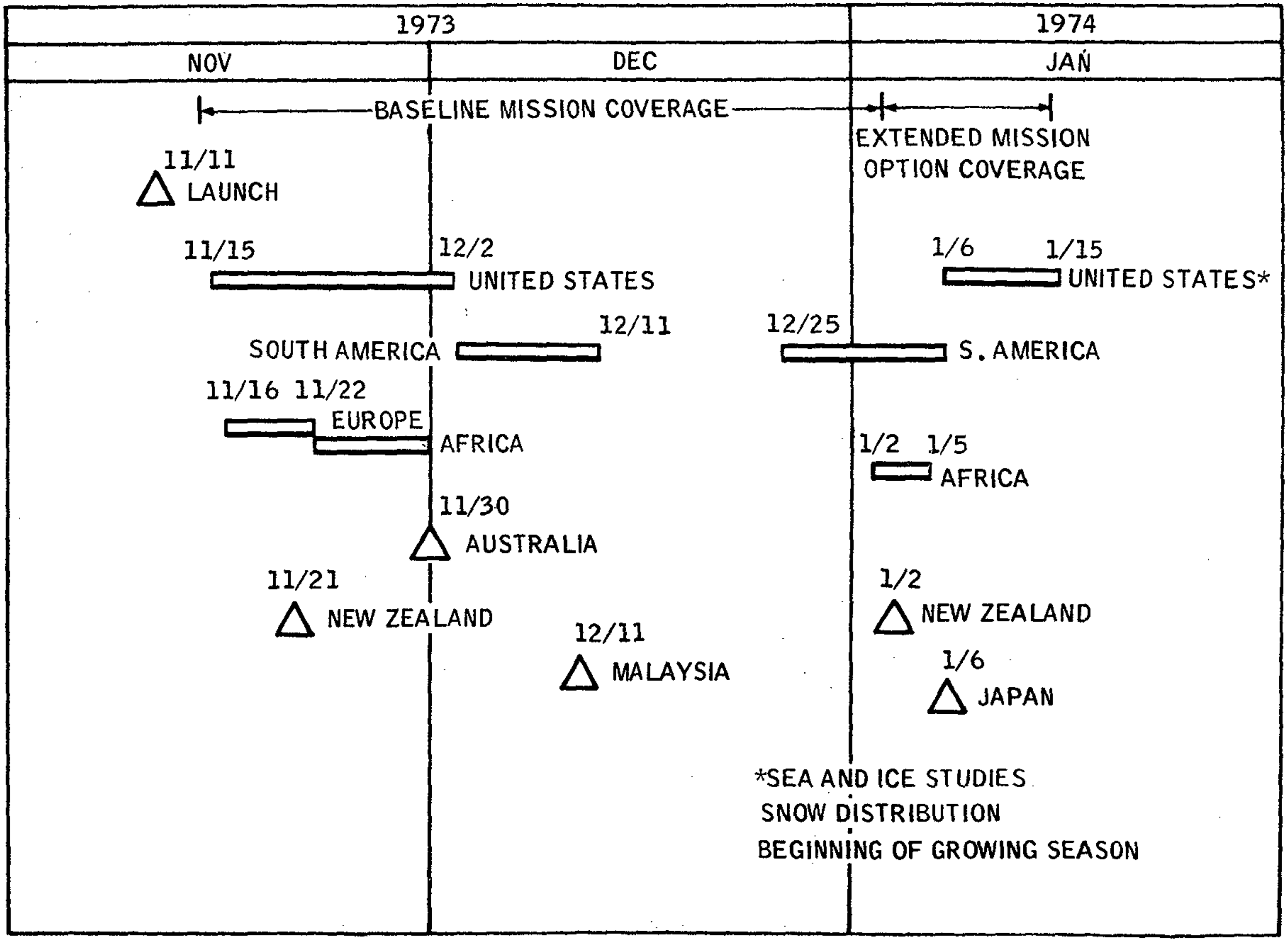
D024	Thermal Control Coatings
M479	Zero Gravity Flammability
M487	Habitability/Crew Quarters
M509	Astronaut Maneuvering Equipment
M516	Crew Activities/Maintenance Study
M556 thru M566	Multipurpose Electric Furnace Experiments
S009	Nuclear Emulsion Experiment
S019	UV Stellar Astronomy
S020	X-Ray/Ultraviolet Solar Photography
S063	UV Airglow Horizon Photography
S149	Particle Collection
S183	UV Panorama
S201B	Far UV Electronographic Camera
S228	Trans-Uranic Cosmic Rays
S230	Magnetospheric Particle Composition
S233	Hand-held Photography of Comet Kohoutek
T002	Manual Navigation Sightings
T003	Inflight Aerosol Analysis
T020	Foot-Controlled Maneuvering Unit
T025	Coronograph Contamination Measurements
T053	Earth Laser Beacon

The student investigations:

ED12	Volcanic Study
ED22	Objects within Mercury's Orbit
ED24	X-Ray Stellar Classes
ED25	X-Rays from Jupiter
ED31	Bacteria and Spores
ED41	Motor Sensory Performance
ED61/62	Plant Growth/Plant Phototropism
ED63	Cytoplasmic Streaming
ED72	Capillary Study
ED76	Neutron Analysis

(Details of most 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.)

SKYLAB 4 EREP PASSES



COMET KOHOUTEK AND SKYLAB

An unanticipated major astronomical event has caused revisions in planning for the third and final Skylab manned mission, the SL-4 mission. The passage of the comet Kohoutek was detected early enough in its trajectory to permit scientists to plan ahead for the most promising means to explore its secrets. This will be an extraordinary, opportunity for cometary astronomers, intent on training the best instruments of 1973 on this exciting intruder. The special capability of Skylab rates top priority. Its crew and its instruments are, by good fortune, ready and able to respond, to obtain maximum knowledge about the comet.

Passing inside the Earth's orbit in late November, Kohoutek will travel through the inner solar system during a unique period in the space program, when Skylab and Mariner Venus-Mercury will be in operation and a new NASA C141 Airborne Infrared Observatory is ready for flight.

Surprisingly little hard information is available on the physical nature of comets, despite recorded observations dating back to 467 B.C. Recent work indicates that the clues scientists need exist in the ultraviolet, infrared, and microwave regions of the cometary spectrum.

Comets are generally regarded as samples of primordial material from which the planets formed billions of years ago. Unlike Moon rocks and most meteorites which have experienced melting, the interiors of comet nuclei are believed to have remained in an icy state since their creation.

A great variety of striking phenomena occur in comets. A few comets actually have disappeared during relatively brief gaps in the observations. One comet split into two comets. A secondary tail apparently formed on another in response to the passage of an interplanetary shock wave. The appearance of a fine spiral pattern in the head of Comet Bennett has been attributed to rotation of the unresolved nucleus. Earlier this year, a flare occurred in a faint comet, increasing its brightness by a factor of almost 10,000 in six days.

The most permanent feature of a comet, the nucleus, is believed to be a sort of dirty ice ball, consisting of frozen gases ("ices") and dust particles. In response to solar radiation as the comet leaves the cold of deep space, the ices sublime and their vapors form an atmosphere, or coma, with a diameter that may reach 100,000 kilometers (60,000 statute miles).

The estimated diameters of cometary nuclei range upward to only a few tens of kilometers or miles. According to one estimate, the nucleus of the Halley Comet loses about 3 meters (10 feet) of surface material each time it passes the Sun. Kohoutek is probably similar in mass to Halley, but going much closer to the Sun, should shed much more.

Separation and ionization due to solar photons and solar wind particles are among the processes which act on gases in the coma, producing "daughter products" - the atoms, radicals, molecules and ions that have been detected spectroscopically in comets. Many astronomers believe that direct detection of the ices and their vapors - the so-called "parent molecules" has not been established. The gases observed thus far are all or mostly daughter products which are unlikely to exist in a solid state under the conditions prevailing in cometary nuclei.

Dust particles liberated from the comet nucleus are impelled in the direction away from the Sun by the pressure of solar radiation. Ions produced in the coma are similarly affected by the charged particles in the solar wind. Thus are formed the dust and plasma tails, which can extend up to 100 million kilometers (60 million miles).

-more-

The dust tails typically look smooth, gently curved and yellow, while the plasma tail is straight, characterized by filaments and an often turbulent appearance and is blue.

If comets condensed from the solar nebula in the region where Jupiter formed, as many astronomers believe, then the parent molecules may be expected to include water, methane and ammonia. On the other hand, if the cometary ices represent aggregated interstellar material, then many more complex substances, including formaldehyde and the other organic molecules that radio astronomers have found in galactic clouds and regions of presumed star formation, should be present.

Hydrogen was first detected in comets a few years ago, thanks to ultraviolet observations with the OAO-2 and OGO-5 satellites. These data showed that the hydrogen atoms occupied an enormous cloud, typically larger than the Sun, surrounding the visible coma.

The origin of comets is unknown. There may be a number of sources. At any rate, comets are occasionally perturbed into the inner solar system where we see them briefly as the long-period comets. Others have been captured in small orbits. These short-period comets include the famous Halley which returns in 1986. Halley was last seen in 1910.

Kohoutek is at least, a long-period comet (10,000 to 80,000 years perhaps) and recent trajectory information raises the possibility that this is the first time that the comet has ever approached the Sun.

Because Kohoutek may be in a relatively undisturbed state, the possibility of obtaining especially valuable scientific information seems clear. To respond to this challenge, NASA has organized "Operation Kohoutek" to obtain physical data on the comet by every suitable means. Dr. Stephen P. Maran of the NASA Goddard Space Flight Center in Maryland is manager of Operation Kohoutek.

The overall objective of Operation Kohoutek is to make a comprehensive investigation of the nature and evolution of the coma and tails as the comet approaches, passes and recedes from the Sun. Among the detailed goals are:

1. To identify the parent molecules of the gases ("daughter products") observed in comets;

2. To determine the processes that break down the parent molecules and that form the daughter products and excite their radiation spectra;

3. To determine the physical nature and causes of transient events in the comet and their relation to solar activity and phenomena of the interplanetary plasma;

4. To measure the solar wind velocity in the inner solar system;

5. To search for helium, deuterium, molecular hydrogen and other substances that have not yet been found in comets.

Why all the fuss about Kohoutek? From early observations and calculations it appears that Kohoutek is larger than average and will become extremely bright. This will facilitate measurements at very high spectral, spatial and time resolutions, providing maximum scientific data return.

Thanks to Kohoutek's quite small perihelion distance from the Sun, observations of its interactions with the solar wind should reveal new facts about the charged particle environment well within the orbit of Mercury.

As a new or long-period comet in a highly eccentric orbit, Kohoutek may differ substantially from comets such as Encke and Halley that remain within the planetary system, bounded by the orbits of the outer planets. The short-period comets spend a greater fraction of their lives under the influence of solar particles and radiation, and are subject to planetary perturbations. On the other hand, Kohoutek in its present tour of near-solar space should develop a great coma and tails, thanks to the large amount of matter that will be liberated from the frozen nucleus.

Often, the discovery of a major comet comes only a few months before it reaches perihelion, (the closest approach to the Sun) but Kohoutek was found almost 10 months in advance. This early warning permits systematic planning and adequate preparation for a wide variety of coordinated experiments.

On the other hand, the time involved is far too short to permit development of new spacecraft. Thus the response to the challenge of Kohoutek must make use of existing systems, or ones already well on the way to completion when Kohoutek was found. These are listed in Table 1. Prime among them is Skylab.

Skylab is unique among the spacecraft that will observe Kohoutek, thanks to its capabilities for

- long-term viewing
- near-perihelion viewing
- astronaut response
- payload optimization.

The array of astronomical and solar experiments on Skylab (Table 2) will permit the flight crew to monitor Kohoutek in the UV and visible light ranges regardless of its angular separation from the Sun. This is a critical consideration, because Kohoutek's Sun angle will not exceed 45° until January 18th. The unmanned spacecraft are generally constrained to observing at either very large or very small sun angles.

Table 3 indicates the tentative schedule for Kohoutek observations. This is subject to significant up-dating as the individual project offices and experimenters complete and refine their operational plans.

Of particular importance are the ATM instruments on Skylab. They can observe Kohoutek at perihelion when the comet is brightest and receives the most solar energy. At that time, ground-based observations are of very limited scope, due to scattered sunlight in the atmosphere.

White light imagery (S052 experiment) will be performed on ATM at frame rates up to four per minute, much faster than possible with OSO-7, and with higher spatial resolution. Simultaneous mapping of the coma in four UV wavelengths can be accomplished (S055), and high dispersion spectroscopy (S082) may detect the existence of helium and deuterium for the first time in a comet.

The ATM X-ray experiments are not listed in Table 2, since the prospects for detectable cometary radiation in this wavelength range seem poor. However, a major solar flare could induce fluorescence in Kohoutek, leading to a positive result with the S054 instrument.

For a few days just before and just after perihelion, the ATM capabilities will be somewhat reduced due to the larger Sun angles of the comet. During these intervals, however, Kohoutek is too close to the Sun to be observed through the workshop's anti-solar airlock. These are the times for the astronauts to conduct EVA operations. The instruments operated during EVA would be the T025 coronagraph and the new S201B far ultraviolet camera. The T025 observation requires pointing the instrument fairly accurately toward the Sun. For the S201B photography, the Skylab must be maneuvered so that the camera is shadowed by the ATM solar array.

At the airlock, the instruments, including S201B, will operate well before and well after perihelion. An articulating mirror system will be mounted on the airlock and a roll of the spacecraft of up to 90° will be made. Implementation of about 24 of these rather major Skylab maneuvers during the mission are being considered. Ordinarily, no more than one would be performed per day.

Comets are known for their unpredictability - for sudden flarings and shape changes. Such transient events are expected to occur in Kohoutek during the Skylab 4 mission and the astronaut crew will react by bringing appropriate instruments into play and increasing the camera frame rates for brief intervals, or taking other special measures.

Only on Skylab, among existing spacecraft, can mission planners change out or modify the instruments to take advantage of an unexpected phenomenon such as the appearance of Kohoutek. Although the stowage list for the Skylab 4 command module is still under review, officials expect to add a new instrument to the orbiting complement. This is the S201B far ultraviolet camera of Dr. T. L. Page and Dr. G. Carruthers (Naval Research Laboratory), which is needed to photograph the hydrogen cloud that will surround the head of the comet. Filters to isolate cometary emissions, a UV-transmitting lens, and extra film to support the desired high frame rates near perihelion are among the other new items expected to be sent up to Skylab.

In addition to the ATM instruments, the following Skylab experiments will be used in the comet study: S019, Ultraviolet Stellar Astronomy; S063, Ultraviolet Air-glow Camera; S183, Ultraviolet Panorama Camera; and T025, Multi-filter Coronagraph. The S019 instrument will obtain ultraviolet spectra that will be studied to determine the composition of the comet nucleus and the effects of the solar wind. The S063 camera will obtain ultraviolet and visible color photographs which can help determine the distribution of selected constituents in the coma and tail. The S183 photometric data will help determine the distribution, lifetime and the effect of hydroxyl in the coma. The T025 coronagraph's ultraviolet and visible light photographs should yield information on the particulate production and distribution in the coma and tail.

Some Comet Kohoutek Facts

The orbit of Kohoutek is inclined at 14° to the ecliptic (the plane of the Earth's orbit around the Sun).

Perihelion--the comet's closest approach to the Sun -- will occur Dec. 28 at 21 million km (13 million miles), or 30 solar radii.

Naked-eye visibility should begin in early November prior to sunrise. Eye-balling will switch to after sunset when the comet passes perihelion Dec. 28. Best viewing may come in evening twilight shortly after New Year's Day. Then full Moon will interfere until last third of January. At perihelion, tail will appear short because Earth view will be almost directly along its tail.

Discoverer: Dr. Lubos Kohoutek; discovered photographically March 7, 1973 at Hamburg Observatory in West Germany with the 32-inch Schmidt telescope.

Brightness: Preliminary estimates of Kohoutek's brightness range from visual magnitude -2 to -10. For comparison, the Moon's brightness is -12.7

Designation: Comets bear the names of their discoverers. This is Comet Kohoutek 1973f; the "f" denoting that this is the sixth comet discovered this year. The fifth was Comet Kohoutek 1973e, discovered about a week earlier by the same Dr. Kohoutek.

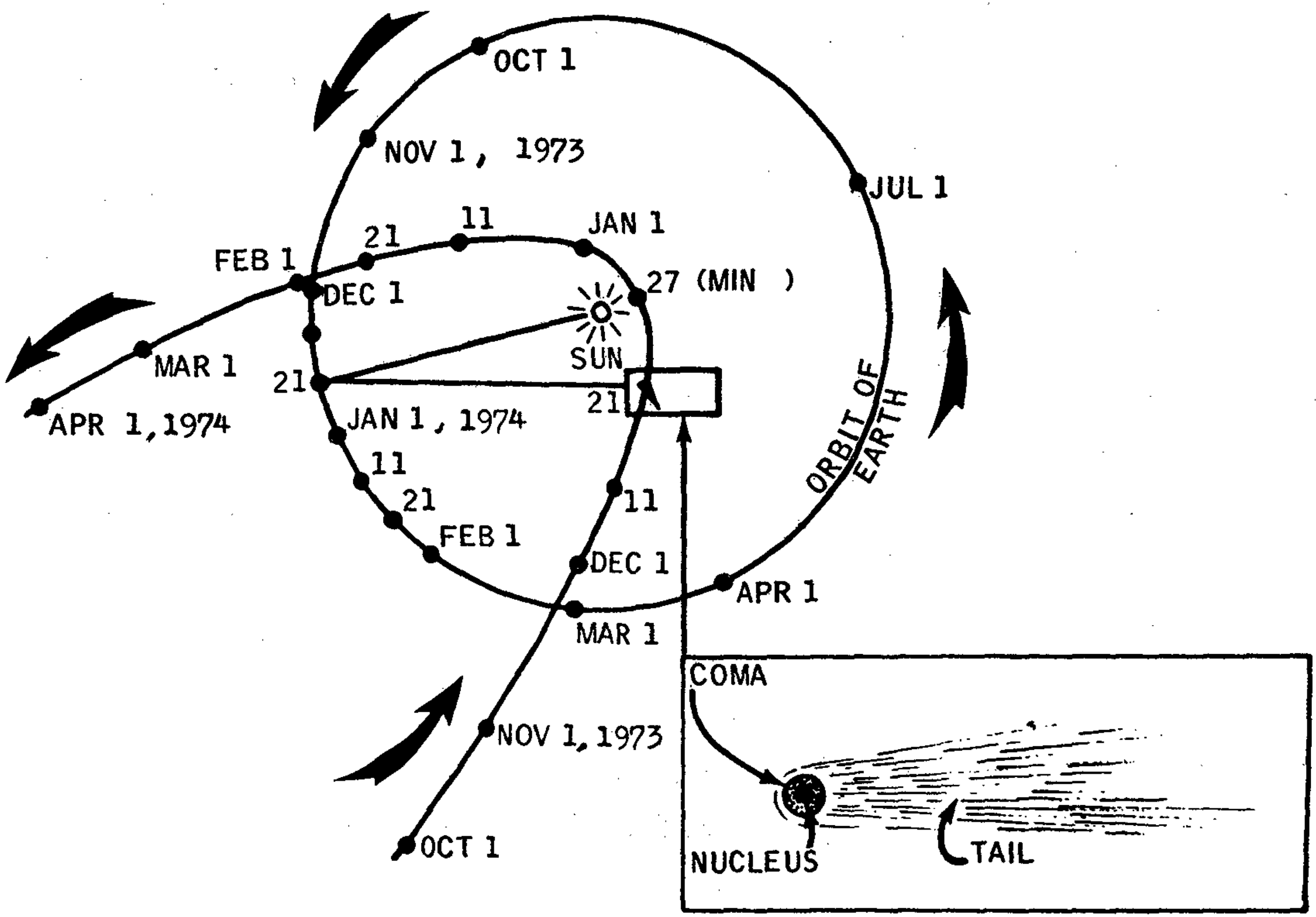
Observation Systems in Operation Kohoutek

Skylab
Mariner Venus-Mercury
Pioneer Spacecraft
Copernicus (OAO-3)
OSO-7
Sounding Rockets
Airborne Infrared Observatory and Lear-Jet
Far Infrared Balloon Program
Ground-Based Observations

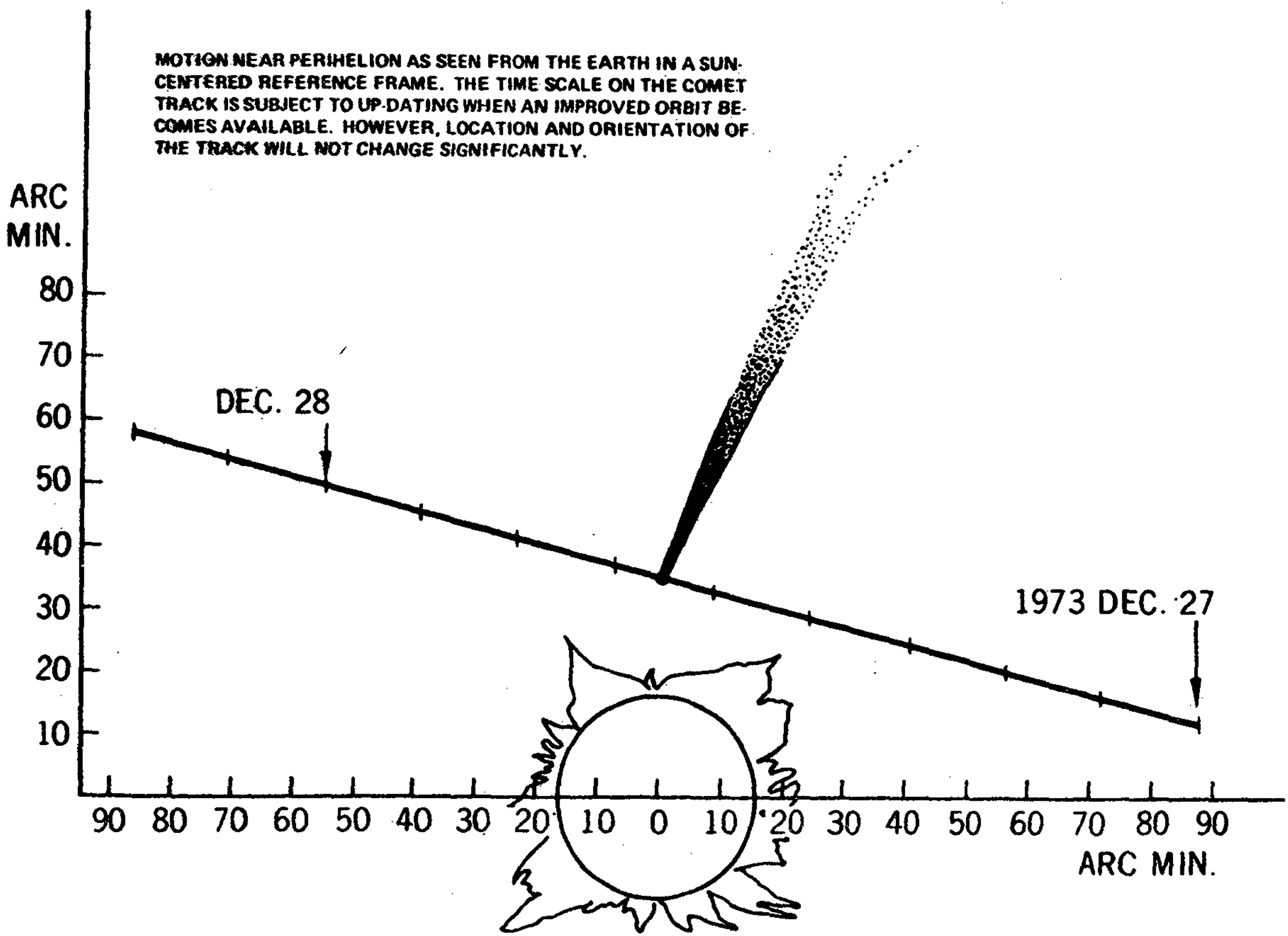
Skylab Experiments for Kohoutek Observations

Name	Description	Principal Investigator	Operation
S052	White Light Coronagraph	R. M. MacQueen High Altitude Observatory	ATM
S055	UV Spectroheliograph	E. M. Reeves Harvard College Observatory	ATM
S082	High Resolution UV Spectrographs	R. Tousey Naval Research Laboratory	ATM
T025	Multi-filter Coronagraph	J. M. Greenberg Dudley Observatory	EVA
S019	UV Objective Prism Spectrograph	K. G. Henize University of Texas and NASA-JSC	Airlock
S063	UV Airglow Camera	D. M. Packer Naval Research Laboratory	Airlock, Windows
S183	UV Panorama Camera	G. Courtes Space Astronomy Laboratory (Marseilles, France)	Airlock
S201B	Far UV Electronographic Camera	T. L. Page Naval Research Laboratory	Airlock, EVA

ORBIT OF COMET KOHOUTEK (1973f), 1973-1974



COMET KOHOUTEK(1973f)



Preliminary Phasing of Kohoutek Operations

Pre-Perihelion	
Late September/October	- Resume ground-based observations
	- Recover comet
	- Improve orbital definition
November	- Launch MVM
	- Launch Skylab 4
	- Begin Lear-Jet flights
	- Begin Skylab airlock observations
	- Launch far infrared balloon
December	- Increased priority for airlock observations
	- Comet tail passes Scorpius B-stars
	- Possible STP 72-1 observations
Near-Perihelion	
December 24	- Halt airlock observations
December 26-30	- Intensive ATM Observations
	- EVA for T025, S201B observations
	- OSO-7 observations
	- High dispersion spectroscopy with ground-based solar telescopes
Post-Perihelion	
January	- Resume airlock observations
	- Pioneer 8 measurements
	- Launch sounding rockets
	- Skylab 4 splashdown
	- Begin MVM observations
	- Prime time for Copernicus observations and ground-based photography
	- Begin C141 flights

Late Post-Perihelion

Spring	- Possible reflight of far infrared balloon

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SKYLAB 3 ACCOMPLISHMENTS (July 28 - Sept. 25, 1973)

The second Skylab manned mission not only set a new manned space flight duration record of 59 days and 11 hours but it also accomplished much more scientific experimentation than originally planned.

In two of its main discipline areas--solar observation and Earth resources observation- the Skylab 3 crew was successful in conducting half again as much observation as originally planned.

Bean, Garriott and Lousma, observed the Sun through Apollo Telescope Mount instruments from above the Earth atmosphere 305 hours as compared with the pre-launch plan of 200 hours. Additionally the Sun cooperated with Skylab in presenting an unusual number of active solar events during what was expected to be a quiet period.

In the Earth resources area, the crew was able to conduct 39 passes over selected areas of the Earth to gather data in such areas as forestry, hydrology, oceanography, cartography, geology. Original plans had been to conduct 26 of these passes.

Skylab 3 also exceeded pre-launch plans in the areas of biomedicine, technical and materials processing experiments.

During its 59 days and 11 hours in space, Skylab 3 travelled more than 24 million miles. The mission brought the total United States man-hours in space to 17,831, about the equivalent of nine years work by a man working 40 hours a week.

The crew, after an early experience with motion sickness, adapted well to the weightless environment and was eager for more work assignments as the mission progressed. In fact, during the last portion of the mission, the crew was able to do much more work per day than originally expected. From the 10th to the 15th day of the mission, the crew was able to devote about 19 man-hours a day to scientific experiments. From the 15th day to about the 20th day the rate increased from 27 to 33 man-hours per day in experiment work.

REAL-TIME FLIGHT PLANNING

Time was when pre-mission space flight plans were followed "by the numbers" with few changes except those caused by systems malfunctions. Skylab flight planning, however, is almost 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, forcasts 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.

The Skylab flight planning cycle begins at midnight Houston time (CST) with a team of flight planners in Mission Control Center drafting a "summary flight plan" for the following crew work day that will start 24 hours after the planning team ends its work shift. This first team is relieved by the so-called "execution" team (day team) of flight controllers concerned only with the existing detailed flight plan for the immediate day. 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, spacecraft systems status and optimum crew time usage. 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.

DAILY CREW ACTIVITY

The normal Skylab crew workday starts at 6 a.m. and runs until 10 p.m. CST

Breakfast is at 7 a.m., lunch at noon and dinner at 6 p.m. CST --- 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.

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 may be set aside for R&R rest and relaxation.

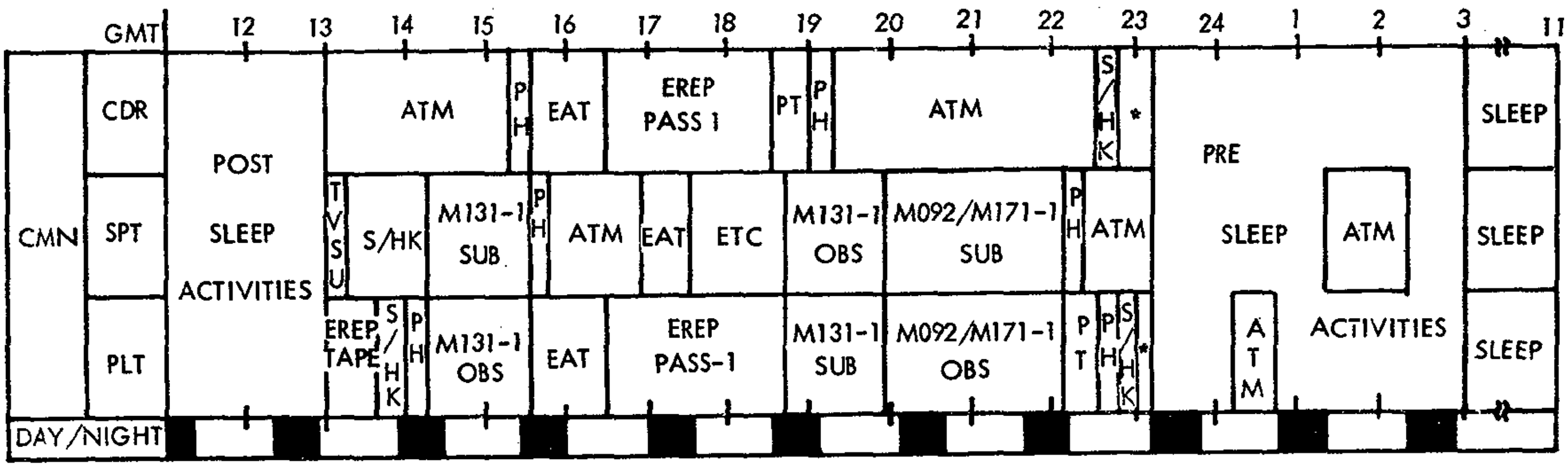
Mission Control Center flight planners fill the remaining eight hours of the crew work day with experiment operations.

Some modifications to flight planning philosophy have been made as a result of experience in the two previous Skylab missions. A marked improvement in crew proficiency was noted after the second week of flight in both crews. Flight plan scheduling has been changed to take advantage of the time gained as crewmen adapt to space station operations.

For example, meal periods have been shortened from one hour to 45 minutes, and the pre- and post-sleep periods have also been shortened. Housekeeping chores, such as trash disposal, filter changing and cleanup which was scheduled in the daily flight plan on the first two missions, will be on the daily "shopping list" for crew option to fit into any slack time.

These changes in flight planning methods have increased the normal experiment day from 22.5 to 28 manhours and are expected to yield more than 200 additional experiment manhours over a 56-day mission.

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

MISSION PROFILE: Launch, Docking and Deorbit

Skylab 4, the third manned visit to space station Skylab, will be launched at 11:41 a.m. EST November 10 from the NASA Kennedy Space Center's Launch Complex 39 Pad B, for a fifth-orbit rendezvous with the space station. The experimental station, designated Skylab 1, was launched into an initial 431x432.9 km (233 by 234 nm) orbit inclined 50 degrees to the equator which is expected to be 427.3 by 432.9 km (231x234 nm) at Skylab 4 rendezvous.

The standard five-step rendezvous maneuver sequence will be followed to bring the astronauts and the Command/Service Module 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 after launch.

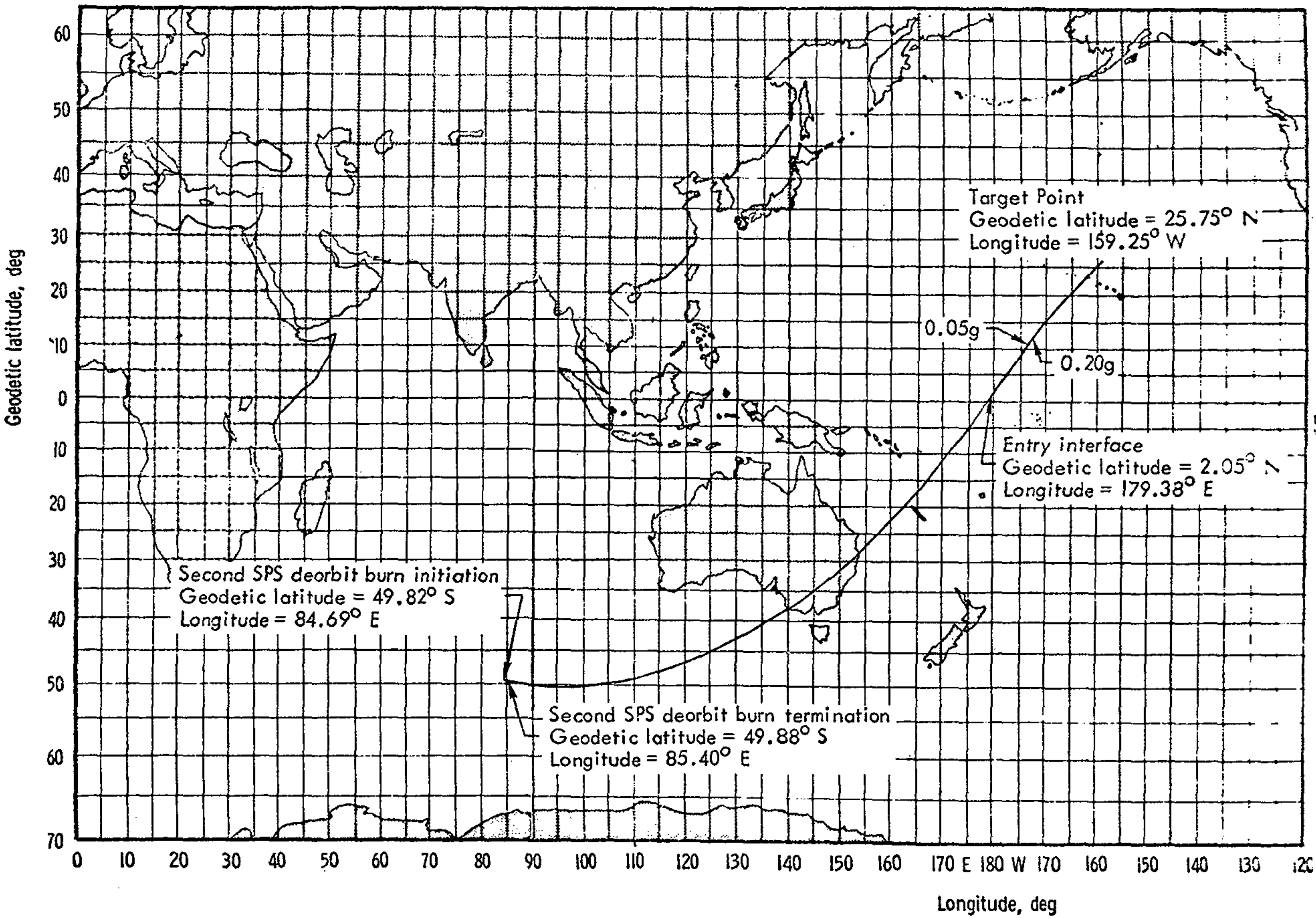
After verifying that all docking latches are secured, the final Skylab crew will begin activation of the space station but will sleep aboard the Command Module the first night.

As in the frist two manned missions, timekeeping will be on a ground-elapsed-time (GET) basis until 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 operations period, the crew will return to the CSM, undock and perform two deorbit burns---the first of which will lower CSM perigee to 168.3 km (91 nm) and the second burn will lower perigee to an atmospheric entry flight path. Splashdown will be in the north central Pacific 509 km (310 statute miles) north-northwest of Honolulu, Hawaii. Splashdown coordinates are 25°45'N x 159°15'W. Command Module touchdown, will be at 5:44 p.m. EST January 6, 1974.

(Note: If the mission is extended after the press kit deadline, the JSC Skylab News Center will issue reentry and landing timelines.)

SL-4 ENTRY GROUND TRACE FOR AN SPS DEORBIT MANEUVER



COUNTDOWN

After the July 28 launch of the second crew to man Skylab, the mobile launcher was brought back to the Vehicle Assembly Building at NASA's Kennedy Space Center in Florida. The stages of the next Saturn IB launch vehicle and a boilerplate Command/Service Module (CSM) were erected on the mobile launcher on July 31 and August 1.

Starting August 2, the impact of problems with two of the four control engine quadrants in the docked service module's attitude control system and the possibility of a rescue mission resulted in accelerated processing of the SL-4 launch vehicle and CSM for a possible rescue mission.

Integrated testing of the launch vehicle stages was conducted while the CSM underwent thorough testing - including simulated flights - in the altitude chamber of the Manned Spacecraft Operations Building at KSC.

On August 11, the CSM was moved to the VAB and erected atop the Saturn IB. The vehicles were moved to Complex 39's Pad B on August 14 for pad integration and final tests. A Flight Readiness Test in preparation for the potential rescue mission was conducted September 4-5 and launch preparations went into a "hold" September 11 at a point seven hours prior to the scheduled loading of hypergolic propellants for the Saturn IB's second stage auxiliary propulsion system and for the CSM.

The Skylab 3 mission ended successfully September 25 without the need for a rescue mission and the SL-4 space vehicle was returned to a routine flow on September 25 heading toward a planned launch date of November 11.

As in the previous Skylab launch, SL-4 launch preparations differ from earlier 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 countdown will include launch vehicle cryogenic fueling and final countdown activities without astronaut participation.

Following the simulated T-0, the count will go into an operational hold until T-42 hours, 30 minutes, prior to launch. The final recycled count will then proceed to launch. There will be no "dry" test with crew participation in the early portion of the count as was done on earlier missions.

Key events in the final count, beginning at T-42 hours, 30 minutes, include:

T-36 hours	Begin 8 1/2-hour service module cryogenic fueling and pressurization.
T-27 hours	Start CSM mechanical buildup and closeout; to be completed at T-15 hours, 30 minutes.
T-25 hours, 30 minutes	Install launch vehicle batteries.
T-19 hours	Launch vehicle power transfer test.
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-58 minutes	LV power transfer test
T-57 minutes	Clear closeout crew from pad area
T-45 minutes	Retract Swing Arm 9 to park position
T-44 minutes	Launch Escape System armed
T-42 minutes	Final launch vehicle range safety checks (to T-35 minutes)
T-35 minutes	Last target update of the Launch Vehicle Digital Computer for Skylab rendezvous

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T-15 minutes	Hold for liftoff adjustment - maximum 3 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

SKYLAB RESCUE VEHICLE

Preparations for placement of the Skylab Rescue Vehicle, CSM-119, on Pad B at Launch Complex 39 will begin immediately after launch of SL-4. Based upon a November 10 launch, the mobile launcher will be returned to the VAB on November 11 for refurbishment. The erection of the Saturn IB launch vehicle is scheduled for mid-November and the rescue spacecraft - which already has undergone altitude testing - is to be erected atop the two Saturn IB stages and Instrument Unit at the end of November.

The rescue CSM and its Saturn IB are scheduled for transfer from the VAB to the launch pad in early December for pad integration and final tests. Current scheduling calls for SL-R (the designation of the rescue mission) to be in a launch readiness configuration by the end of December.

The countdowns for SL-4 and SL-R are identical from the T-minus 26 hour, 30 minute mark. The SL-4 launch countdown was restructured to match the rescue countdown. Following rescue countdown procedures during an actual launch will enhance confidence and provide a rehearsal for the KSC launch team in the event a rescue mission should become necessary.

The Skylab Rescue Vehicle will remain on Complex 39's Pad B until completion of the SL-4 mission.

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