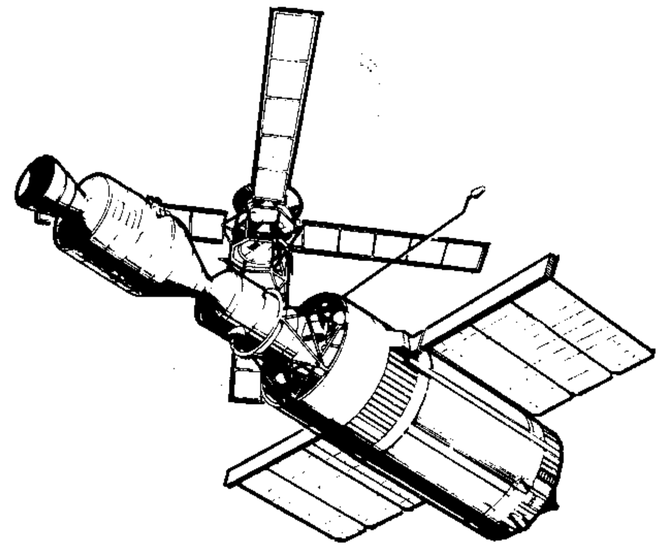
Skylab news



ST. LOUIS, MISSOURI MARCH 1971 VOL. 1 NO. 1

Skylab Hardware Taking Shape for 1973 Flight

Flight hardware for the Skylab, America's first experimental space station, is now in final assembly at several sites across the nation moving towards a launch scheduled for 1973.

Three astronauts will inhabit the National Aeronautics and Space Administration's Skylab for periods of up to 56 days, conducting solar and earth-viewing experiments and testing the ability of man to live and work in space.

A series of Skylab flight hardware critical design reviews held last summer and fall, attended by some 350 to 400 contractor and NASA personnel, approved the design configurations and authorized final assembly.

Earlier, neutral buoyancy trainers were delivered to be used by the NASA for Skylab procedures and design development testing.

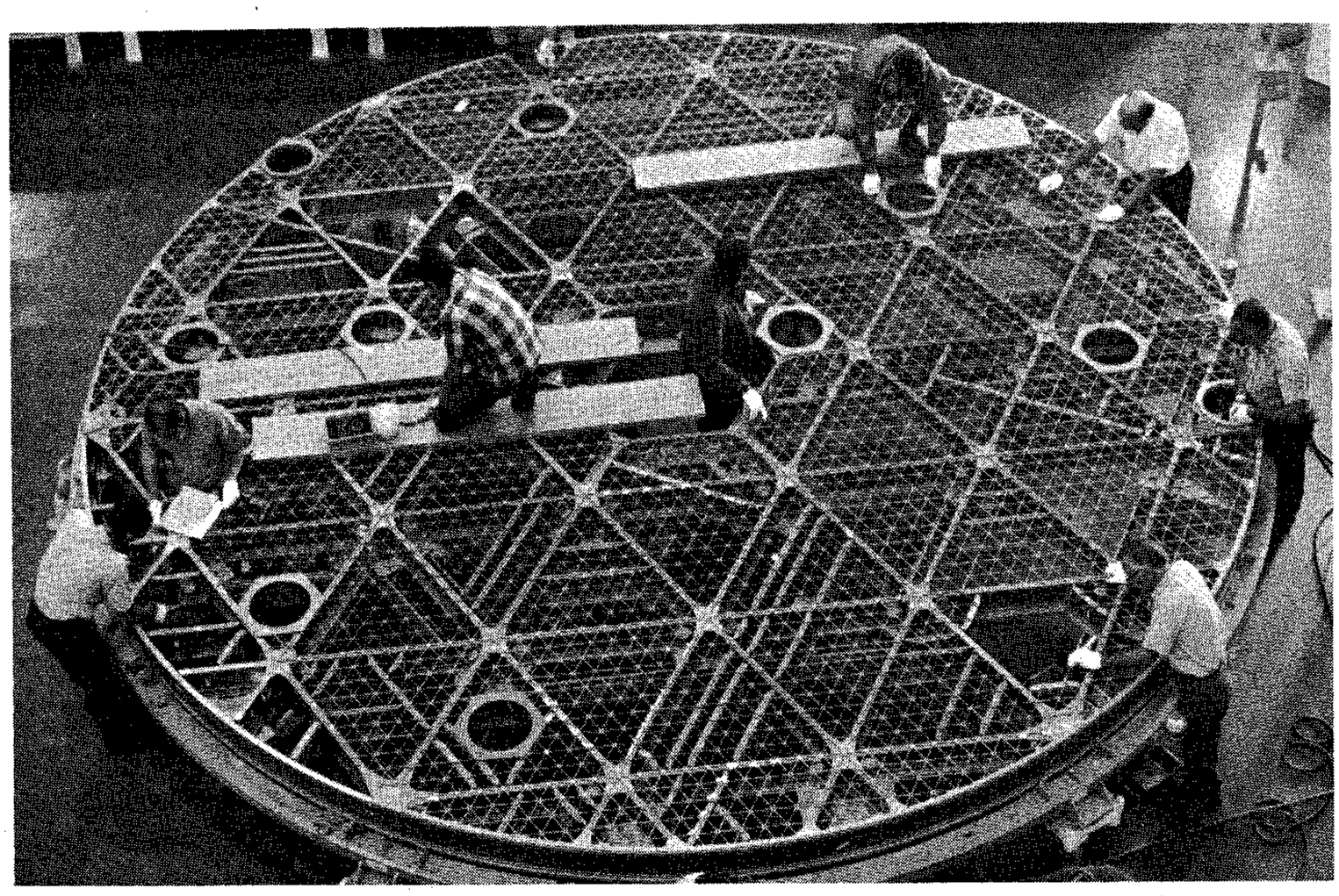
NASA's Marshall Space Flight Center (MSFC) has overall responsibility for the design and manufacture of the Skylab hardware while the Manned Spacecraft Center (MSC) is handling flight crew and mission support operations. Launch support will be by the NASA Kennedy Space Center, utilizing the facilities used by the Apollo program.

McDonnell Douglas Astronautics Company, a division of McDonnell Douglas Corporation, is building two of the major components of the Skylab, the Orbital Workshop and the Airlock Module. The Workshop provides living and working quarters for the crew while the Airlock serves as Skylab's nerve center, providing all of the cluster support for environmental control systems, electrical control and communication facilities, and an airlock for EVA access to the Apollo telescope.

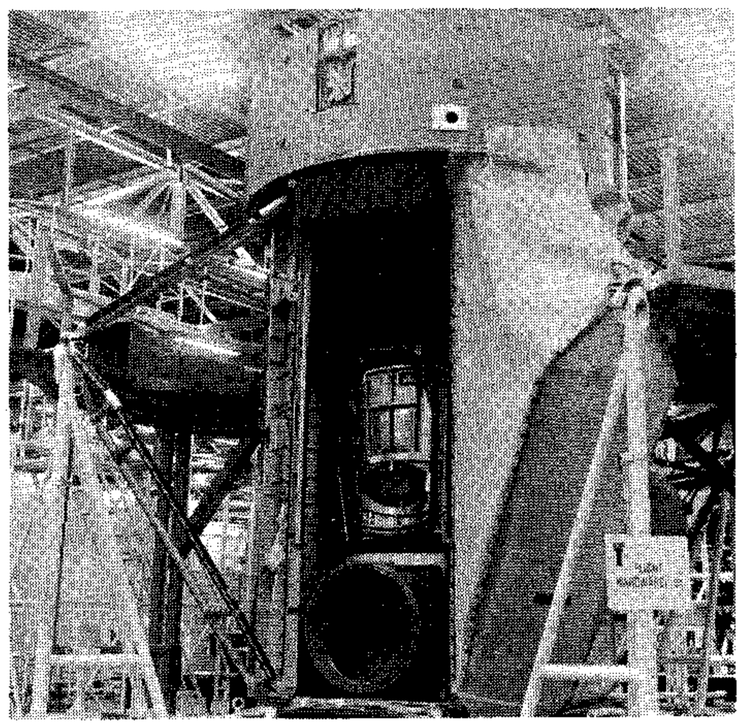
The Multiple Docking Adapter, to which the astronauts will dock their Apollo spacecraft, was constructed by Marshall Space Flight Center (MSFC) and is now at Martin-Marietta Corporation, Denver, undergoing equipment installation and final assembly and systems checkout. MSFC is also building the Apollo Telescope Mount that will be used for solar observations.

The Workshop is in the final assembly stage at MDAC's Huntington Beach (Calif.) facilities. A trainer model of the Workshop was delivered to MSC on January 5 for habitability testing and crew training.

Airlock flight hardware, under construction at the MDAC plant at St. Louis, is now in its final assembly position in the Class 100 white room. The Airlock procedural trainer will be shipped in March to MSC where it will be mated to the Workshop.



Assembling flight hardware, workers at the McDonnell Douglas Astronautics Company plant at Huntington Beach, Calif., fabricate the grid floor that separates the Skylab Workshop into two main sections.



The Airlock flight item is in final assembly at the MDAC plant in St. Louis. A round hatch for experients is visible at the bottom. The EVA hatch is at center.

Schneider and Belew Head NASA Team Directing Skylab Program

William C. Schneider, Skylab program director at NASA Headquarters, Washington, is a veteran of America's manned space flight program, having served as mission director of both Gemini and Apollo.

Day-to-day management is carried out by Leland F. Belew, manager of the Skylab Program Office at Marshall Space Flight Center, Huntsville, Alabama.

Schneider was named to his Skylab post in December 1968, immediately after having directed the Apollo 8 mission, man's first flight around the moon. He was also mission director and deputy director for missions for Apollo missions 4 through 7. As such he was responsible for all aspects of Apollo mission operations.

Prior to that he was mission director for all nine manned Gemini flights. He directed all NASA and Department of Defense personnel participating in the Gemini missions and was responsible for formulating mission and flight plans and launch schedules. As a result of his Gemini leadership he received NASA's Exceptional Service Medal.

Earlier he was Assistant Director of Spacecraft and Flight Missions with responsibility for the management of field center efforts in the development of Gemini spacecraft, Atlas-Agena target vehicles, and the Titan II Gemini Launch vehicles.

He joined NACA, NASA's predecessor, in 1949 at Langley Research Center, Hampton, Virginia as a research scientist. From 1955 to 1961 he was employed by the U.S. Navy in air-to-air missile and launch vehicle programs.

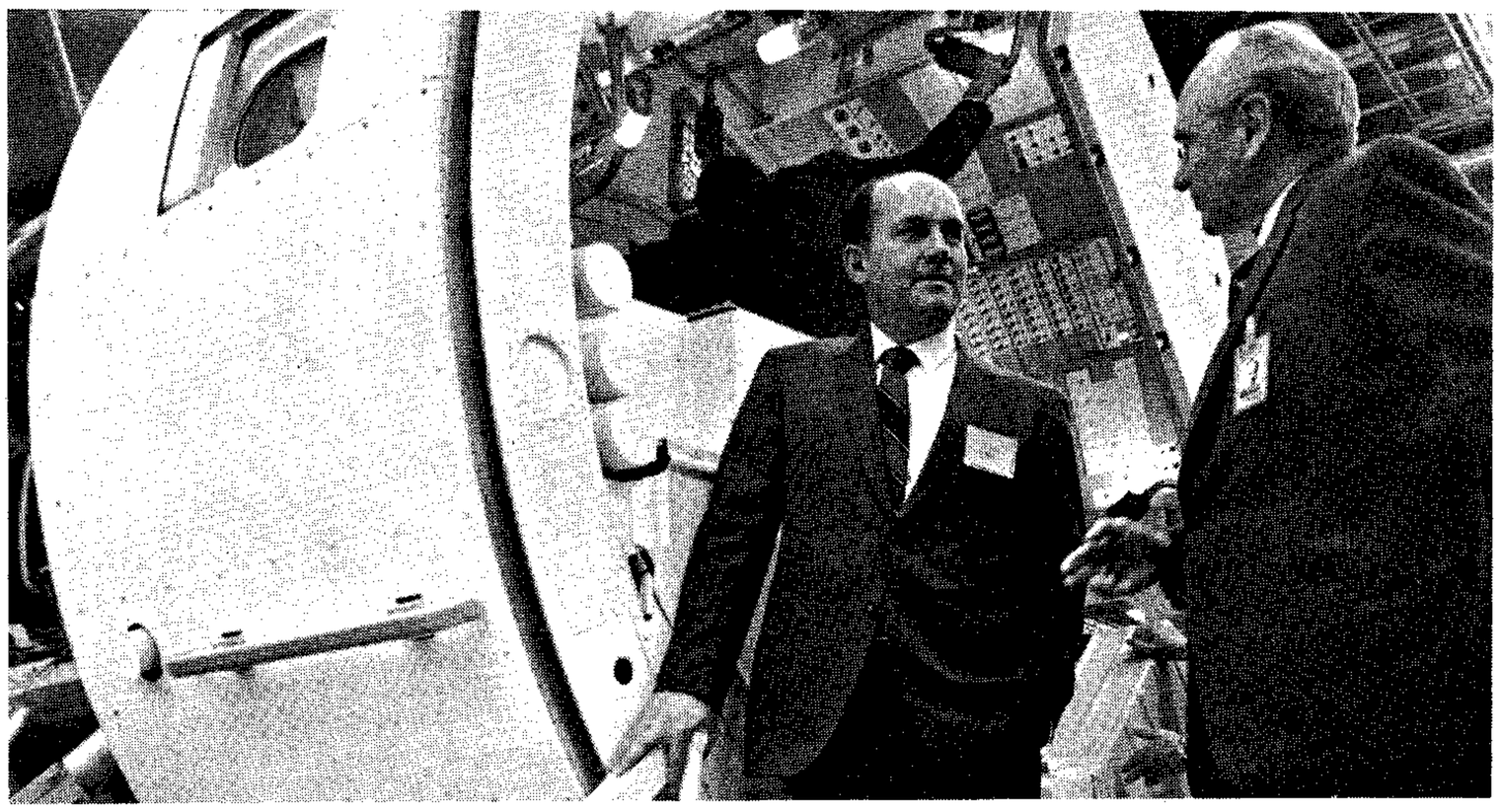
Schneider has a B.S. degree in aeronautics from Massachusetts Institute of Technology and an M.S. degree in aeronautics from the University of Virginia.

Belew was named manager of MSFC's Skylab Program Office in 1966. Previously he was manager of the Engine Program Office for Saturn Launch vehicles.

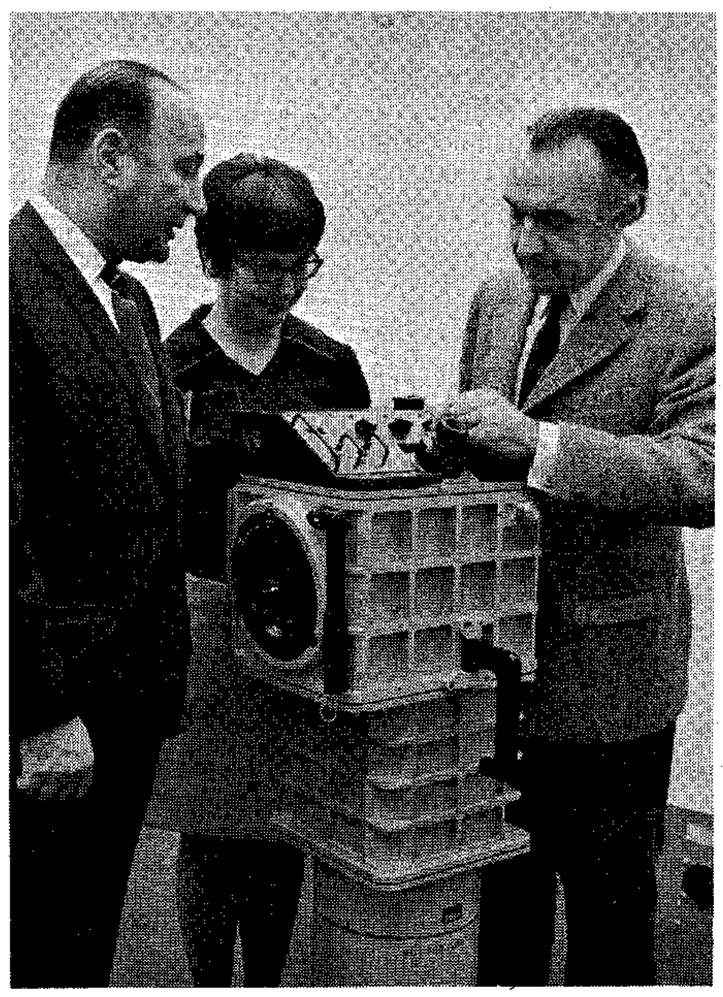
Belew worked with the Department of the Interior and the Tennessee Valley Authority before joining the Army's rocket development team at Redstone Arsenal in 1951 as a design engineer.

When MSFC was formed in 1960, he was transferred to the new agency and continued his work in the design, testing and production of rocket engines. He has performed much research and has written numerous papers in the field of liquid propulsion systems. He has a B.S. degree in mechanical engineering from the Missouri School of Mines and Metallurgy, University of Missouri.

WILLIAM C. SCHNEIDER



Leland F. Belew (left), manager of the MSFC Skylab Program Office, discusses the Airlock mockup with James S. McDonnell, president and chairman of McDonnell Douglas Corporation.



Model of French-built experiment for Skylab is explained by Dr. Georges Courtes (right), French National Research Center, to Sam Yarchin, Skylab deputy program manager, and Mary Jo Smith, NASA project coordinator.

Skylab to Carry French Experiment

A training model of the only foreign-made experiment scheduled for the first Skylab test flight has been delivered to the McDonnell Douglas Astronautics Company at Huntington Beach, California.

The French-made ultraviolet panorama is designed to gather data on massive hot stars.

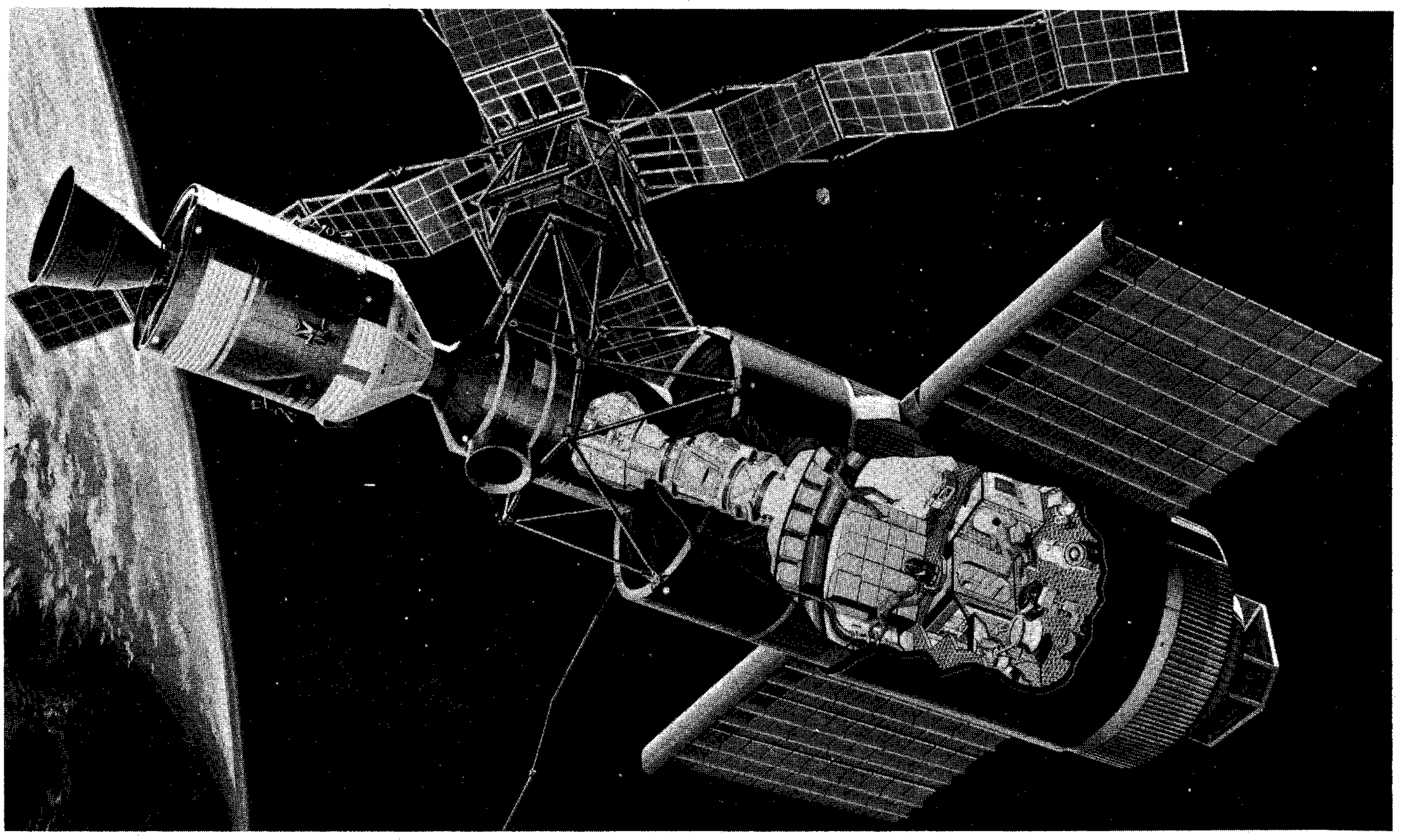
The training model, which is about 46 inches high and weighs approximately 150 pounds, will be incorporated with other Skylab training equipment. Flight model of the experiment is scheduled for delivery in May.

The experiment will obtain photometric information on very hot stars and on star clouds and galaxies.

Skylab crewmen will operate the experiment through a scientific airlock located on the dark side of the Workshop, pointing away from the sun.

Principal investigator for the research is Dr. Georges Courtes, director of the Laboratories D'Astronomie Spatiale. The French space agency is an element of the French National Research Center. Cost of developing the experiment is being borne by the French agency.

A mirror assembly developed by Northwestern University for its ultraviolet stellar astronomy experiment will provide the necessary pointing for the French experiment.



Skylab to be First U.S. Orbital Workshop

The first Skylab mission will start in 1973 with the firing of a Saturn V launch vehicle from Launch Complex 39 at NASA's Kennedy Space Center, Florida.

For this mission, the third stage of the vehicle, the S-IVB, does not contain the load of 235,500 pounds of liquid oxygen and hydrogen it carries on moon missions. Instead, its interior has been partitioned with aluminum grid to turn it into a two-story space laboratory.

An Airlock about 17 feet long is mounted atop the S-IVB. It is the nerve center for the Skylab, with electrical power and environmental control panels and communication facilities.

Mounted on the Airlock is a 17-foot long cylindrical structure called a Multiple Docking Adapter. Finally, riding ahead of the docking adapter is the Apollo Telescope Mount, designed to give scientists a look at the sun's activity undistorted by the effect of the Earth's atmosphere.

After the two-stage Saturn V has boosted the Skylab cluster into orbit about 235 miles above the earth, the telescope mount, held at two points on the top of the Airlock, pivots 90 degrees to uncover the hatch of the adapter. Solar arrays to supply electrical power are deployed from the telescope mount and from both sides of the Workshop.

The Workshop is now ready for immediate occupancy. All food, water and supplies are already on board.

Its tenants, three astronauts, arrive in the next day or two aboard an Apollo spacecraft, placed in orbit by a Saturn IB launch vehicle. They dock their spacecraft at the docking adapter, open the hatches, and move through the adapter and Airlock to the Workshop that will be their home for the next 28 days.

After checking out the Skylab's systems, the astronauts settle down to a routine of operating experiments, housekeeping and sleeping. The first crew (to be followed by two others that will each stay 56 days) is itself the subject of most of the experiments. Their body functions are monitored by a variety of experiments that encompass the most elaborate U.S. effort to date to gather biomedical data on the effects of long-term weightlessness on the human body.

Working 10-hour days, the crew eats and sleeps at about the same time as people in the eastern United States. After the evening meal the astronauts may relax with videotape movies, games and books in the relatively spacious ward room which has 100 square feet of floor space and a window through which they can view the earth. Crew quarters also include work area where food is prepared, private sleeping compartments and waste management compartment. An aluminum ceiling grid separates the quarters from the large laboratory area in the S-IVB's forward end.

Near the end of the 28-day stay, the astronauts perform one of their most exacting tasks, that of retrieving the film from the six cameras in the telescope mount.

Wearing space suits and breathing through umbilical hoses, two astronauts leave the Skylab through a hatch in the airlock. One moves to the telescope mount where he removes a magazine of exposed film. The second astronaut, staying near the airlock hatch, unwinds a spring device that extends 27 feet to his partner who attaches the film to the end of the device. The spring device is then drawn back, the film removed and the device extended again with a fresh magazine to be loaded. The procedure is repeated until all the film is retrieved and replaced.

At the end of the mission the crew prepares the workshop for an inactive period and returns to earth with experimental data. The operational lifetime of the workshop is about eight months.

Giant Shroud Passes First Simulated Ejection Test

A 56-foot-high Skylab shroud, designed and built by MDAC at Huntington Beach, has successfully completed its initial separation test in the space environment chamber at the Plum Brook Station of NASA's Lewis Research Center, Sandusky, Ohio.

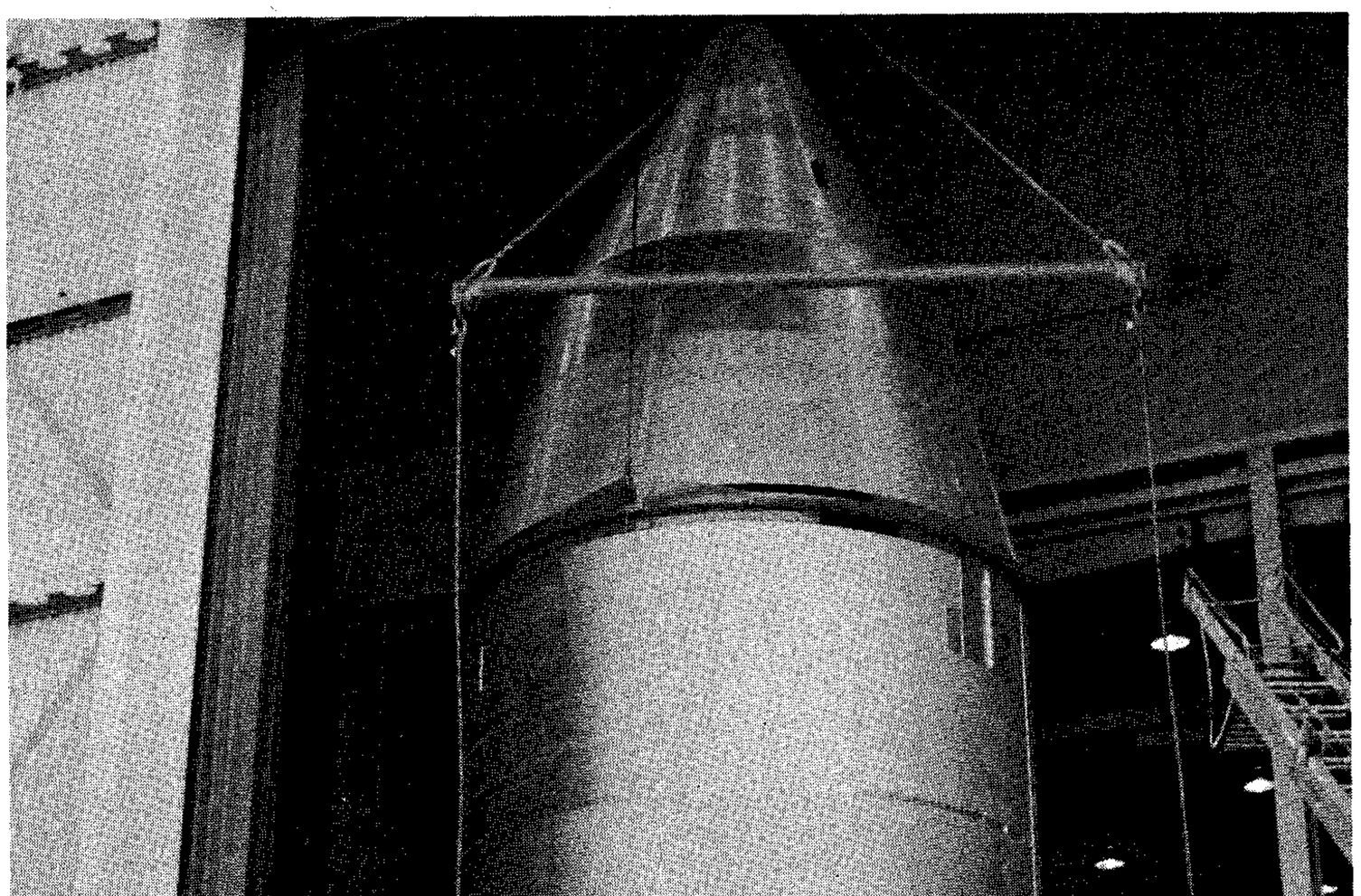
The giant aluminum fairing, largest yet manufactured in this country, was trucked from Huntington Beach in sections in October. A non-flight version, it was produced to verify that the flight shroud will separate properly from the Saturn V vehicle scheduled to orbit Skylab in late 1972.

In the NASA test, the 22-foot-wide shroud, as designed, split into its four component panels. Large, heavy nets caught the flying 6500-pound sections as they were separated and ejected by an explosive network lining the quadrant seams.

High-speed movie cameras, accelerometers and other measuring devices recorded the attitude and velocity of the panels.

The separation system is contamination-free, and it not only separates the panels but thrusts them away from one another and from the payload.

The Plum Brook chamber was selected for the test because of its size and vacuum capabilities. It is 120 feet in height and 100 feet wide and can simulate vacuum conditions equivalent to 300 miles altitude.



This payload shroud, assembled at MDAC, Huntington Beach, has undergone vacuum chamber tests at NASA Lewis research center.

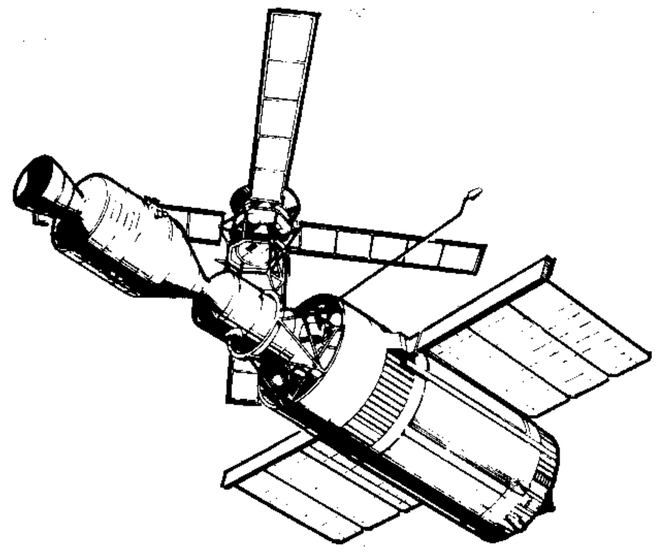
Viewed through an Airlock hatch during a visit to St. Louis facilities are, from left, Astronaut Walter Cunningham, Kenneth Smith, MSFC; Lester Calhoun, McDonnell Douglas; Astronauts Bill Lenoir and Bob Overmeyer, and Bill Haynes, Martin-Marietta.

McDonnell Douglas is promoting a manned flight awareness program among its employes and those of its Skylab subcontractors, in conjunction with the MSFC Skylab office.

Skylab posters are displayed on bulletin boards and special stickers such as the one illustrated above are used to call attention to the extra effort required to assure the success of manned spaceflights.

Response at MDC plants in St. Louis and Huntington Beach and at subcontractor plants has been excellent.

Skylab news



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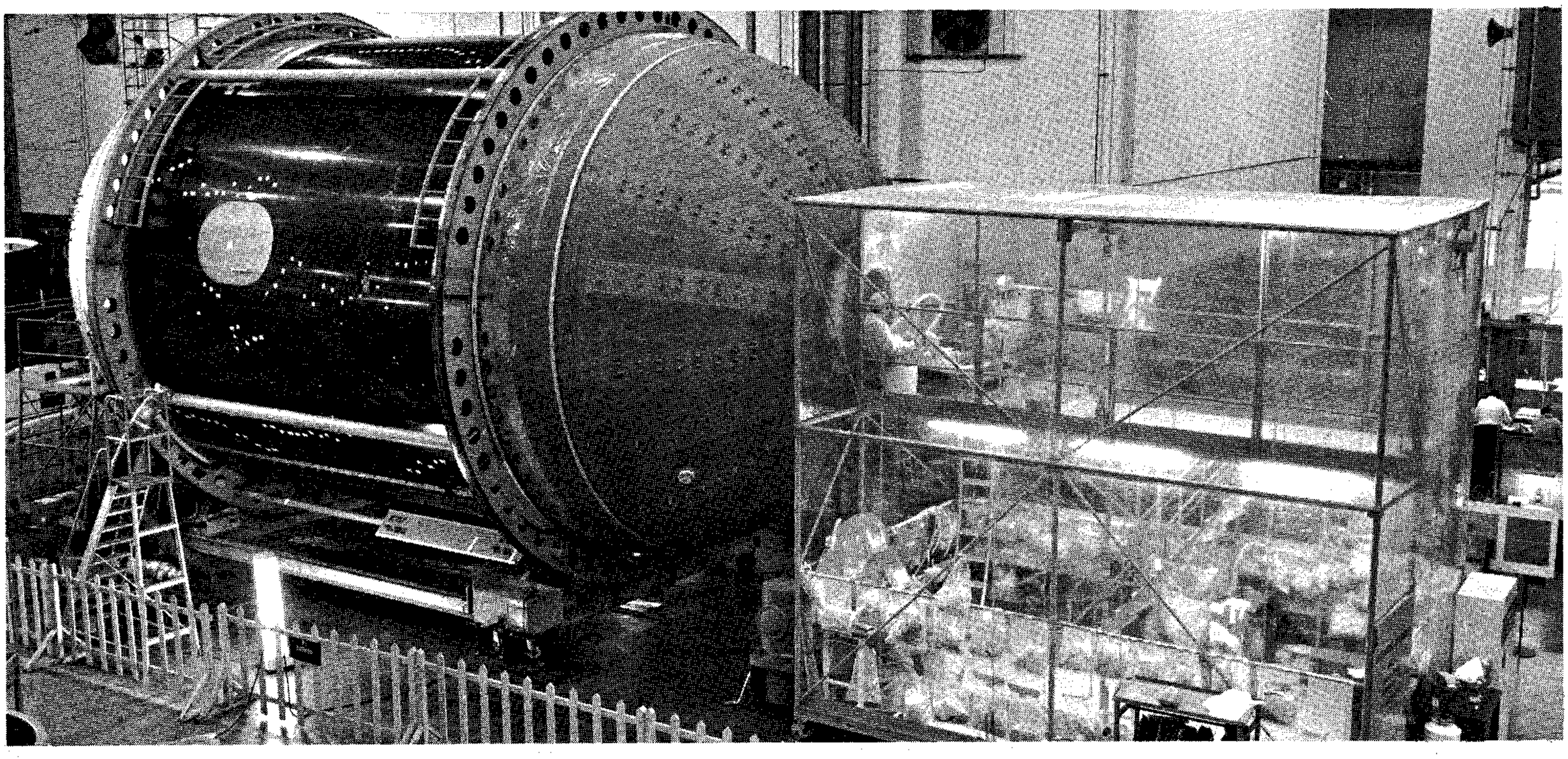


Work on the Skylab Workshop is moving ahead in a controlled environment at McDonnell Douglas Astronautics Company, Huntington Beach, California. Workers enter the cylindrical Workshop through a portable "clean room" (right) attached to one end of the Workshop.

Interior of Orbital Workshop Being Outfitted

The first major interior installations in the Skylab Orbital Workshop have been completed at the McDonnell Douglas Astronautics Company (MDAC) at Huntington Beach, California. The Workshop, with its 10,000-cubic-foot living and working area for three astronauts, is the largest element of the Skylab. It is being developed for the National Aeronautics and Space Administration's Marshall Space Flight Center.

Initial tasks in converting an S-IVB stage of a Saturn rocket to the Workshop included cutting three openings in the sides of the vehicle. One provides an 18-inch-wide observation window, and two are for 8-1/4 inch-square airlocks through which experiments will be placed in space.

In addition, the 43-inch-diameter opening in the forward bulkhead will serve as an entry for astronauts moving between the Airlock module, and the Workshop.

MDAC engineers and technicians covered the interior of the S-IVB liquid hydrogen tank with 3000 square feet of insulation and installed the metal beams and grids for the floors and ceilings.

Fred J. Sanders, program manager for the Workshop, said the next scheduled installations will include the thrust structure assembly and the floor-to-ceiling partitions which will divide the living and working area of the Workshop into an experiment section, ward room, sleep compartments and waste compartments.

Other installations will include 10 stainless steel water storage tanks, lockers and compartments for supplies and equipment for experiments.

"About 20 experiments will be installed in the Workshop by MDAC," Sanders said, "including assorted earth resources experiments and others to investigate how man will react to long-duration space missions. The final Skylab checkout will be at the Kennedy Space Center."

NASA plans call for the first three-man astronaut crew to inhabit the Skylab for up to 28 days before returning to earth. About two months later, a second trio would ride an Apollo command/service module to a rendezvous with the Workshop for a planned 56-day stay. A third trio of astronauts will follow for a second planned 56-day mission.

Telescope Mount to be Key Skylab Experiment

The Apollo Telescope Mount (ATM) is being developed to give solar scientists a look at the sun's activity undistorted by the Earth's atmosphere.

NASA is joined by the scientific community and industry in developing the highly sophisticated ATM.

Five principal investigators, all experts in astronomy and solar physics, have designed experiments for the first ATM flight. The eight instruments used in these five experiments will measure the sun in the extreme ultraviolet and X-ray portions of the electromagnetic spectrum, which cannot penetrate the Earth's atmosphere, and obtain pictures of the sun's corona in the white light portion of the spectrum.

More Advanced Labs

The first ATM is a forerunner of more advanced solar and stellar observatories which will provide increased data-gathering capability for astronomers.

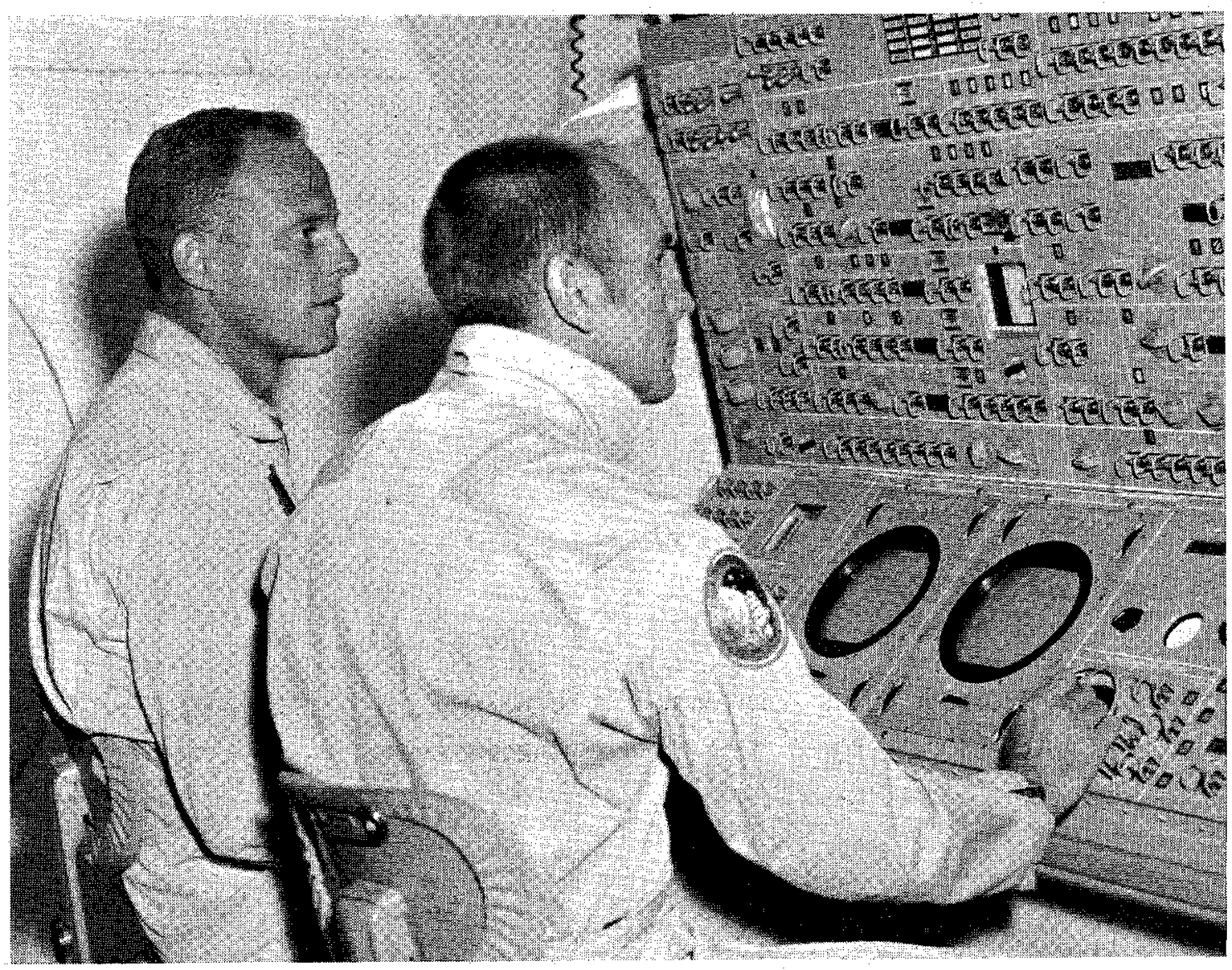
Ground-based scientists "see" the sun only in visible light and in portions of the infrared and radio frequencies of the electromagnetic spectrum. Instruments carried by unmanned spacecraft and balloons have been pioneers in spaceborne solar astronomy.

The Skylab ATM offers opportunities not available with unmanned spacecraft. An astronaut will select targets of scientific interest and point the telescopes. He will control all ATM experiment operations in acquiring the data, including retrieval of films. These operations can be augmented by radio contact with scientists on the ground who can redirect the observing program based on ground data or verbal descriptions from the astronaut crew.

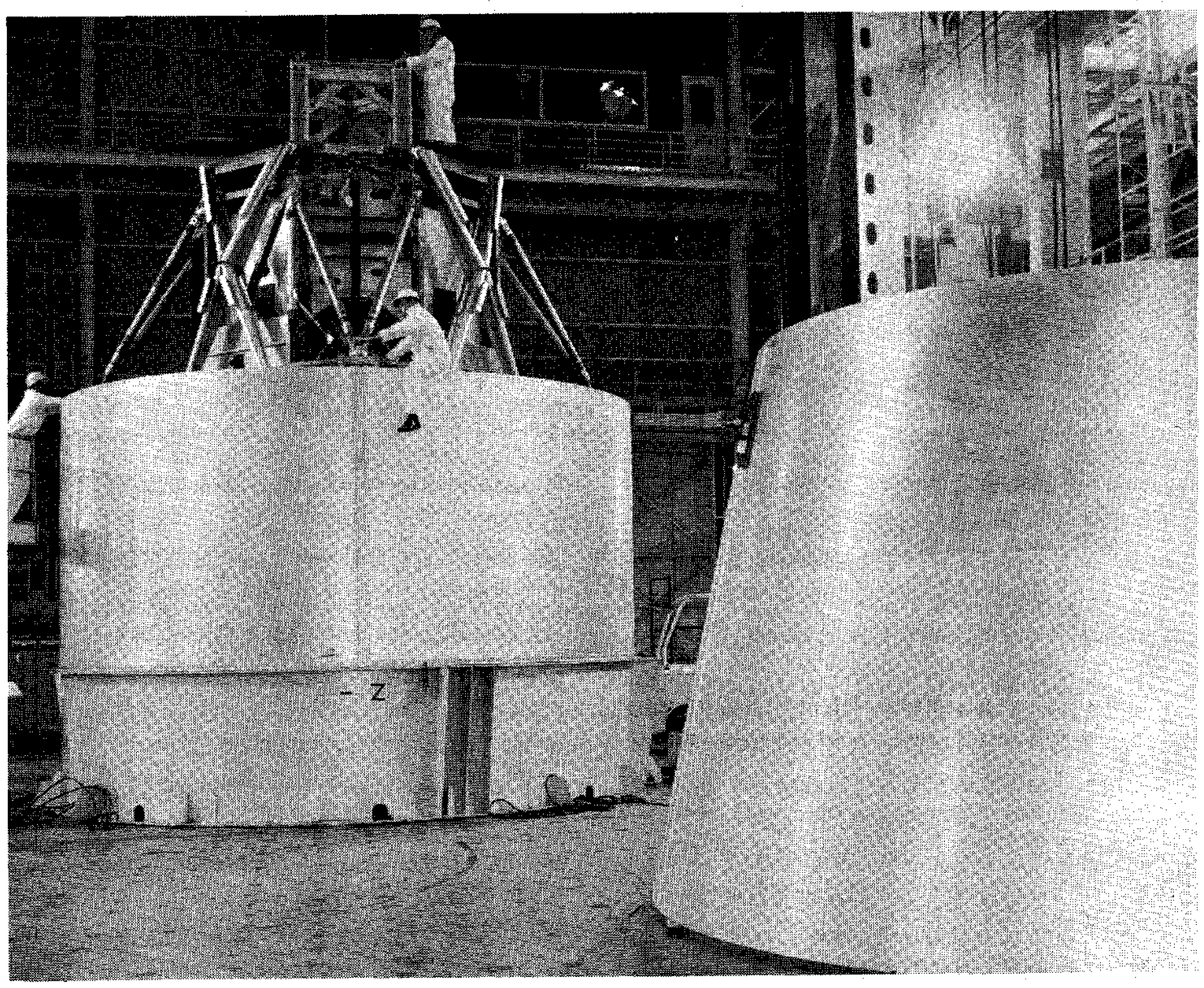
Eight major solar instruments will be used in conducting this investigation. The devices are designed to provide high spatial and spectral resolution in the ultraviolet, X-ray, white light and hydrogen-alpha (6,563 angstrom) bands of the spectrum and are particularly concerned with the active regions on the solar disk or in the corona. The telescopes are mounted in a 7-foot-diameter cylindrical structure on a special optical bench structure.

ATM Operation and Control

The ATM control and display panel, located in the multiple docking adapter, will be the primary work station. From this point the crew will control and monitor the experiments, the pointing control system, the instrumentation and communications, and the power system.



Astronauts Alan Bean (right) and Jack Lousma operate a working mockup of the control console for the Apollo Telescope Mount.



Technicians prepare an ATM and Skylab payload shroud for structural tests at the NASA-Marshall Space Flight Center.

A television system will enable astronauts at the work station to see images of the sun recorded by the telescopes. The system has five TV cameras mounted in the experiment package, two TV display monitors, and associated equipment mounted on the control console. TV data will also be transmitted to Earth.

Pepping Heads MDC Program, Assisted by Sanders, Kisselburg

Raymond A. Pepping, a veteran of manned spaceflight design, is vice president-general manager of the McDonnell Douglas Astronautics Company's Skylab program.

From offices in St. Louis he oversees the company's Skylab operations which encompass development and manufacture of the Orbital Workshop at Huntington Beach, California and the Airlock at St. Louis.

Fred J. Sanders, Workshop program manager, and Ervin T. Kisselburg, Airlock program manager, serve as his deputies in managing on-site operations.

Pepping, who has 30 years of aerospace experience, has been involved in the Skylab program since 1969 when he was named vice-president-Apollo Applications Program at the Astronautics Company in St. Louis. He was promoted to his present position last year.

His manned spaceflight experience began in 1957 when he was named manager of manned spacecraft advanced design. In 1964 he was appointed manager of the Gemini B/Manned Orbiting Laboratory program.

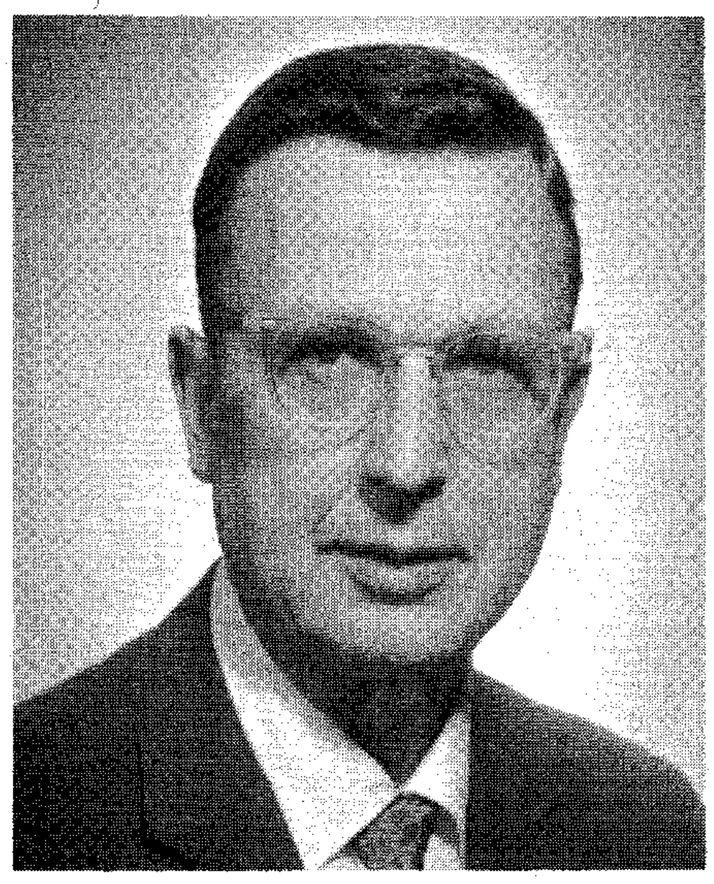
Prior to that time he had been involved in aircraft design and development since World War II during which he served in the Air Force as a project test engineer.

Joining McDonnell Douglas in 1946 as a flutter and vibration analyst, he held increasing responsible positions in the development of high-performance Navy and Air Force jet fighters.

Pepping has a masters degree in applied mechanics from Washington University, St. Louis, and served on the NASA Research Advisory Committee on Missile and Space Vehicle Aerodynamics from 1961 to 1965.

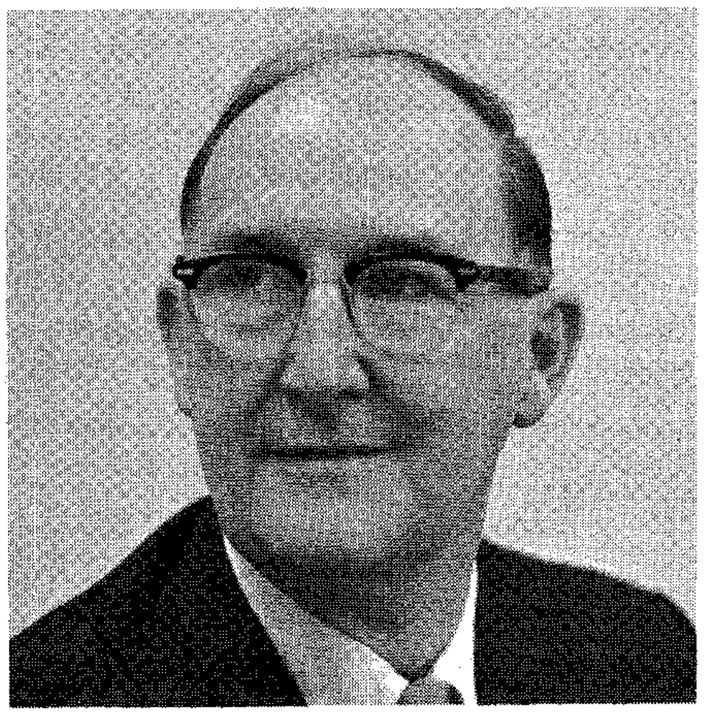
Sanders was named program director for Airlock in 1968 and assumed his present position of Workshop program manager in 1970. He was named Gemini project engineer in 1961 and served as MDC assistant base manager at Cape Kennedy until 1966. He joined MDC in 1947 as an aircraft design engineer. He has a masters degree in mechanical engineering from St. Louis University.

Kisselburg joined the Skylab project in 1970 as Airlock program manager. An MDC employe since 1945, he served as a project engineer on Gemini, a project strength engineer on Mercury, and a design engineer on high performance jet fighter aircraft. He has a bachelors degree in mechanical engineering from Oklahoma A & M.



RAYMOND A. PEPPING

FRED J. SANDERS



ERVIN T. KISSELBURG

Skylab Mission Sequence Given

The Skylab mission will begin in 1973 with the launch of the unmanned Saturn V vehicle and payload from Launch Complex 39A at the NASA-Kennedy Space Center, Fla. This vehicle will consist of the S-IC booster and S-II second stage. Payload elements are the Workshop, Apollo Telescope Mount, Airlock and Multiple Docking Adapter.

The first launch, Skylab 1, will place the cluster in a 235-nautical mile near-circular orbit, with the nominal orbit inclination of 50 degrees.

The payload shroud is jettisoned soon after insertion into orbit when the vehicle is pitched to a retrograde attitude.

The ATM is deployed while the vehicle is being stabilized to its normal solar inertial attitude. Then the ATM solar arrays, Workshop solar arrays and Workshop meteoroid shield are deployed.

During this initial period, the interior of the Workshop will be pressurized to five pounds per square inch (psi) with an oxygen-nitrogen mixture, making it ready to accept docking of the Apollo spacecraft and entry of the flight crew.

A second launch, Skylab 2, will take place 24 hours later. The manned-modified Apollo spacecraft will be launched by a Saturn IB vehicle, which will place the spacecraft into an intermediate 81-by 120-nautical mile orbit. The crew will use spacecraft service propulsion system to attain the required 235 nautical mile orbit and then dock to a port of the MDA.

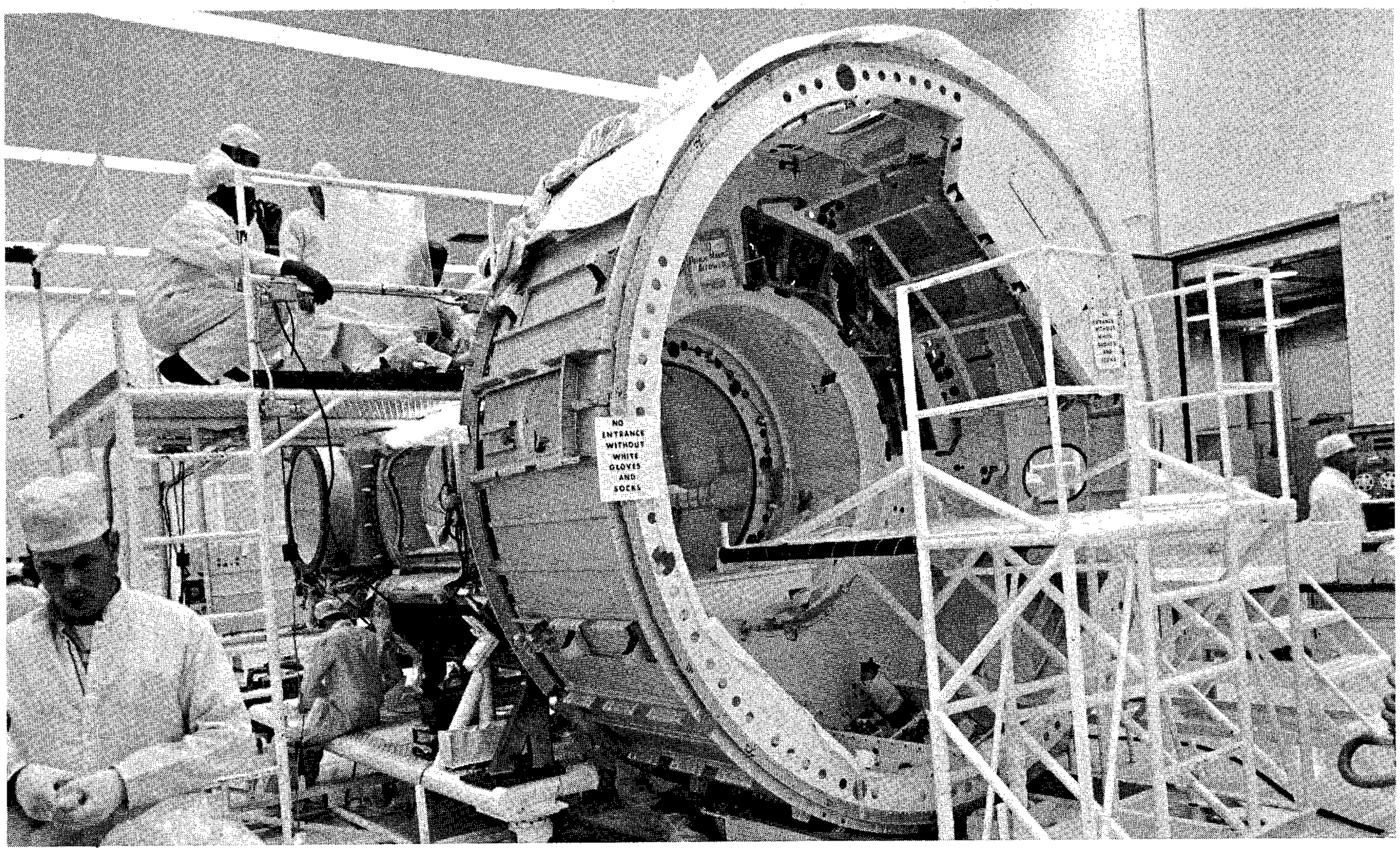
The crew will enter and complete the activation of the Workshop, which will be their home and work area for the next 28 days. The experiment program will then begin. Emphasis will be on the medical experiments and evaluation of the habitability of the Workshop. ATM experiments also will be conducted.

On the 26th day, the crew will exit the Airlock, retrieve exposed ATM film, and reload the cameras. Near the end of the 28-day mission, the crew will prepare the Workshop for orbital storage, a dormant period scheduled to last two months until the next crew visits the Skylab.

The command/service module separates, reenters and makes an ocean landing. Recovery is by normal Apollo procedures.

Some 60 days later, Skylab 3 is launched for a 56-day manned mission.

Skylab 4 will follow in approximately 30 days.



Assembly of Airlock flight hardware is carried on in a "clean room" at the McDonnell Douglas Astronautics Company plant at St. Louis. The section in the foreground attaches to the Multiple Docking Adapter.

Airlock Serves as Nerve Center of Skylab

The Airlock Module, one of the main Skylab components, is the connecting link between the Workshop and the multiple docking adapter to which the astronauts will dock their Apollo spacecraft.

The Airlock, the nerve center for the Skylab cluster, is the focal point for all extra-vehicular activity during Skylab missions. It also provides storage, distribution and conditioning of environmental gases, electrical power control and distribution, real- and delayed-time instrumentation, data management, intercommunication system, ground network to cluster command system, and experiment installation provisions.

Mounted at the forward end of the Workshop and rigidly attached to the MDA, the Airlock is 16 feet, 8 inches long, and consists of structural transition section, tunnel assembly, and truss support assemblies.

Transition Section

A structural transition section connects the Airlock to the MDA. Made of aluminum, it ranges from 10 feet in diameter at the MDA connecting end to a 5-foot, 5-inch diameter at the Airlock tunnel assembly end. Most Skylab controls and displays are located in this area. The section has four viewing ports, located at 90-degree intervals. Each port has an external, moveable cover, operated from inside the STS, as protection from meteoroids and to help stop heat loss from the Airlock.

The tunnel assembly is an aluminum cylinder 5 feet, 5 inches in diameter and 12 feet, 9 inches long. It is divided into three compartments by two hatches. The center compartment, which includes the exit hatch for all Skylab extra-vehicular activities, is large enough to hold two crewmen in pressure suits and portable life support systems. The forward compartment includes a cabin relief valve and provisions to support stowage containers, tape recorders and other equipment. The aft compartment contains part of the gaseous distribution system for the Workshop.

Four truss support assemblies, made of aluminum tubes, are located at 90-degree angles around the Airlock to attach it to the fixed Airlock shroud. In addition to supporting the Airlock, the trusses support battery modules and gaseous nitrogen tanks.

Airlock Shroud

The fixed airlock shroud supports the Airlock, ATM, MDA and payload enclosure during launch. The shroud remains attached to the Workshop after the payload enclosure is jettisoned and provides structural support for gaseous oxygen tanks and the ATM support structure.

The radiator assembly supports the Workshop cooling system and is a meteoroid shield for the Airlock and MDA.

The Marshall Space Flight Center has management responsibility for the Airlock module, which is being built by the McDonnell Douglas Astronautics Co. at St. Louis. The Airlock will be mated and undergo altitude testing with the Multiple Docking Adapter in St. Louis, before being joined to the Workshop at the Kennedy Space Center, Fla.