

## Mathews Chosen Head Of Apollo Applications

Charles W. Mathews, MSC Gemini Program Manager, has been named Director of Saturn/Apollo Applications in the NASA Office of Manned Space Flight, Washington, D. C.



Mathews replaced Maj. Gen. David M. Jones who had been Acting Director of Saturn Apollo Applications in addition to his duties as Deputy Associate Administrator for Manned Space Flight programs. General Jones

## NASA Closes Kano Station

With conclusion of the Gemini program, the United States has notified the Government of Nigeria that NASA is closing its tracking station at Kano.

Station technicians and their families will be returned to the United States or to other foreign assignments by the Bendix Field Engineering Corporation, Owings Mills, Md., NASA contractor for operation and maintenance of stations in the Manned Space Flight Network.

The station was established under a United States-Nigerian agreement of October 19, 1960, for support of Project Mercury, and has been continued for Gemini. With the reconfiguration of the tracking network for Project Apollo, third step in NASA's manned space program, the Kano station will no longer be needed.

In the message notifying the Federal Military Government of Nigeria of the termination of the tracking station, the U.S. Ambassador said, "The Government of the United States of America expresses its deep appreciation for the cooperation which Nigeria has demonstrated in making a station possible on Nigerian territory."

"The Government of the United States of America is also grateful for the cooperation which the Government of Nigeria extended to the SYNCOM experimental communications satellite project and the cooperation of the Government of Nigeria in permitting the staging at Kano of astronaut recovery aircraft."

will continue in the latter position.

Mathews will direct NASA's effort to utilize manned Apollo space vehicles to extend scientific and technical exploration of space in earth orbit and at lunar distances.

Prior to the Gemini assignment in 1963, Mathews was Chief of the Spacecraft Technology Division and Deputy Assistant Director for Engineering and Development at MSC.

Mathews joined the National Advisory Committee for Aeronautics, predecessor to NASA, in 1943 following graduation from Rensselaer Polytechnic Institute, Troy, New York, with a Bachelor of Science degree in Aeronautical Engineering.

At Langley Research Center, Hampton, Virginia, Mathews was engaged in aeronautical research and participated in early studies on reentry of orbital manned spacecraft. He served as Chairman of the group which developed detailed specifications for the Mercury spacecraft.

Mathews was awarded the NASA Distinguished Service Medal by President Johnson November 23 for his outstanding contribution to United States manned space flight as Manager of the Gemini program. Mathews is a native of Duluth, Minnesota. He is married to the former Marietta Short of Welch, West Virginia. The Mathews have two children, Douglas Craig, 15, and Elizabeth Ann, 14.

## UofH Deadline December 15

MSC employees who have not previously attended the University of Houston have until December 15 to enroll in campus or Clear Lake classes. Admission forms and other information are available from the Employee Development Section, Ext 7311.

## Newsmen Get Apollo Briefings

Newsmen covering the manned spaceflight program December 15 and 16 will have the opportunity to absorb extensive background knowledge on Apollo through a series of lectures and tours. The two-day Apollo Press Symposium will be held in the MSC auditorium and is expected to draw more than 100 newspaper, wire service, aerospace magazine and television/radio representatives from across the country.

Apollo Spacecraft Program Office manager Dr. Joseph Shea will lead off the symposium with an overall briefing on the Apollo program, including the upcoming first manned Apollo, A/S 204. Other lecturers include MSC Director of Flight Operations Christopher C. Kraft, Jr., GSFC and MSFC representatives, and comprehensive Apollo systems briefings by representatives of North American Aviation Space and Information Systems Division, prime contractor for the Apollo command and service modules.

## Last Flight for Gemini Flags



RETIRED BANNERS—MSC Security guards lower for the last time the US Flag and Gemini pennant flown during Gemini missions following Gemini XII splashdown. The flag and pennant, made by employees of the Technical Services Division, Parachute Support Section from lightweight nylon parachute material, were carried aboard Gemini III by crewmen Virgil "Gus" Grissom and John Young during the three-orbit mission March 23, 1965. The flags flew on the MSC flagstaff around the clock, from liftoff to splash, during Gemini missions IV through XII. Both the US flag and the Gemini pennant will be retired to permanent exhibit in a glass case in the Auditorium lobby.

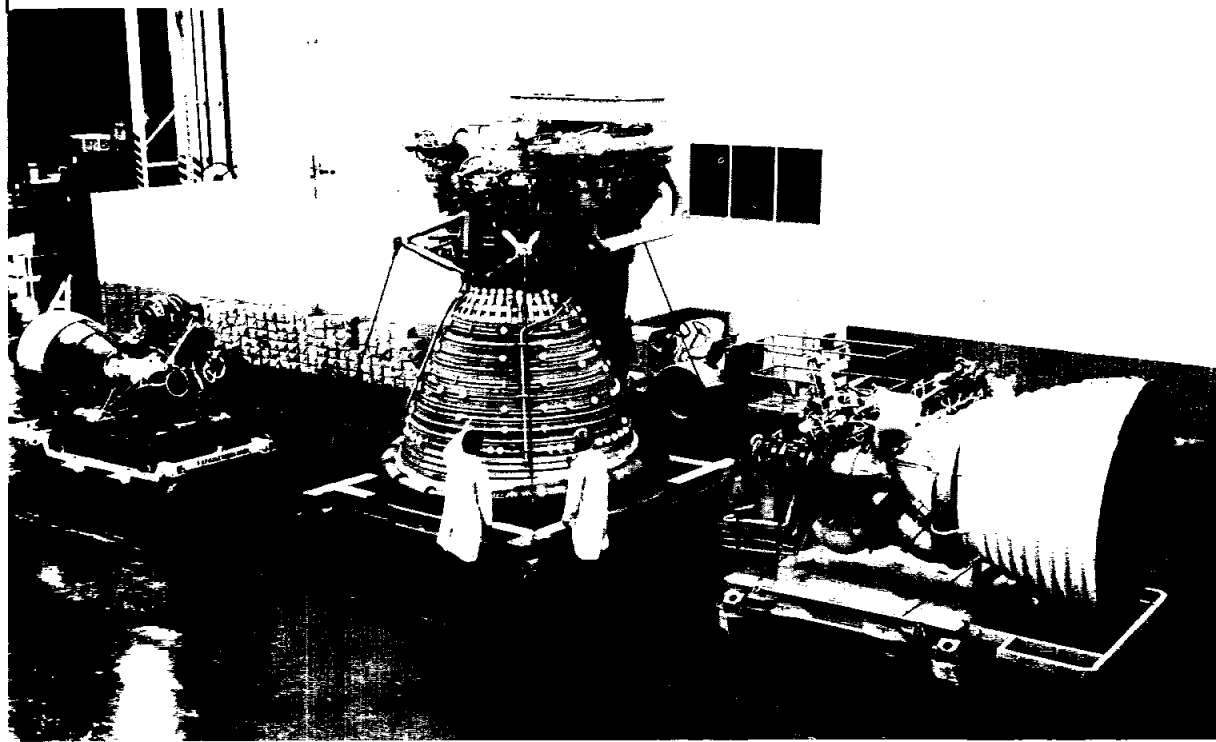
## ECU Leak Delays Apollo 204 Tests

A water-glycol leak in Apollo spacecraft 012's Environmental Control Unit (ECU) late last week during altitude chamber testing has delayed completion of the tests for an estimated two weeks.

The ECU must be replaced and revalidated before the altitude tests can be resumed in the chamber in the Manned Spacecraft Operations Building at Kennedy Space Center. The delay is not expected to have an impact on the planned launch of Apollo 204 in the first quarter of 1967.

Earlier problems in a command module water boiler type heat exchanger, used during peak heating periods to supplement the ECU space radiators, forced a change to a modified ECU. (See November 11 Roundup).

## Under Saturn's Hood



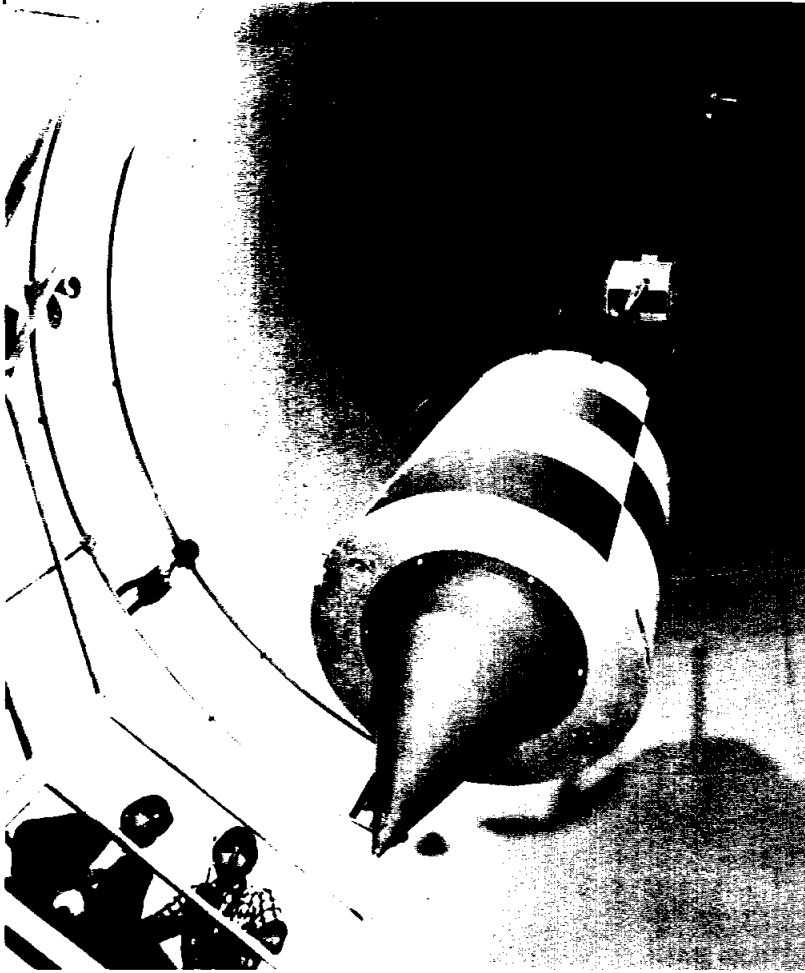
ENGINES FOR SATURN—Three different type engines for Saturn stages dress-right and cover-down on the floor at NASA Michoud Assembly Facility, New Orleans, La. At left is an H-1 kerosene/liquid oxygen engine, eight of which power the first stage of the uprated Saturn for a total thrust of 1.6 million pounds. At center is an F-1 kerosene/liquid oxygen engine for the first stage of the Saturn V launch vehicle. Five F-1s will give the stage a total of 7.5 million pounds thrust. At right is a J-2 liquid hydrogen/liquid oxygen engine of the type used to power the S-II second stage of Saturn V; the S-IVB third stage of Saturn V and uprated Saturn's second stage S-IVB. Five J-2s power the S-II stage for a total of one million pounds thrust while a single J-2 powers both versions of the S-IVB. Rocketdyne Division of North American Aviation, Inc. builds all three engines.

## Tree Ceremony, Chorus Concert, Planned Sunday

MSC employees are reminded of Sunday's community Christmas Tree lighting ceremony at the Third Street gate preceded at 5 pm by a concert of Christmas music in the Auditorium by the Bay Area Chorus. The Tree lighting ceremony is sponsored by the Clear Lake Junior Chamber of Commerce.

The Bay Area Chorus tomorrow night will give a similar concert at the LaPorte high school. Employees who cannot attend the Sunday night MSC concert are invited to attend the LaPorte concert which starts at 8 pm.

## Subtracting Gravity



**PLUMB BOB?**—No, it is a 1500-pound experiment being prepared for testing in the Zero Gravity Research Facility at the NASA Lewis Research Center. By dropping experiments down the 510-foot vacuum chamber shaft, five seconds of weightlessness can be produced. The facility can handle weights up to 6000 pounds.

## Meteoroid Detector Talks Begin

NASA has selected the Martin Co., Denver Division, to negotiate a contract to design, develop, fabricate and test several different types of detectors which could be used in future NASA flight experiments to study the meteoroid penetration hazard in space.

The contract, valued in excess of \$1 million, will be for an 18-month period and will provide NASA with basic information to

lead to the final design of a meteoroid detector with a life-time up to two years in space.

Tests of the various concepts will include flight assurance and qualification studies in ground-based research facilities.

The contract will be managed by the Langley Research Center, Hampton, Va., for the NASA Office of Advanced Research and Technology.

## The Feel of Space



**BRILLE LUNAR MODULE**—An employee of the New Orleans Lighthouse for the Blind inspects with his fingertips a scale model of the Lunar Module as a part of the Michoud Assembly Facility's program for fostering greater knowledge of manned spaceflight among blind citizens. Michoud also publishes a 14-page Braille booklet, *A Trip to the Moon in Project Apollo*, which is available free to blind readers.

# Gemini XII Crew Describes Flight Of Last Mission in Gemini Series

Gemini XII crewmen James Lovell and Edwin Aldrin described their four-day mission—last in the Gemini series—for newsmen at the November 23 press conference in the MSC Auditorium. Also taking part in the press conference were NASA Deputy Administrator Dr. Robert C. Seamans, Jr., and MSC Director Dr. Robert R. Gilruth.

The crew, after commenting that the Gemini Launch Vehicle performed perfectly, immediately began a narrative on their rendezvous with the Agena target vehicle during the third revolution.

### Radar Kaput

"We had solid radar lock-on at some 235 miles," said Lovell. "So you can imagine our confidence and elation as we tool around just waiting for the rendezvous to take place. After our coelliptic maneuver at this point we are getting set for the terminal phase initiation for the final rendezvous when Buzz noticed that the computer was not giving any change of range. I looked down at the little green light that tells us that we had a radar lock-on and it was off. We said, 'Oh no, it can't happen to us.' Then suddenly it dawned on us that sure enough the radar had failed."

Lovell and Aldrin employed backup procedures they had trained for but never expected to use to complete the rendezvous.

"The first thing on my list," said Lovell, "was acquire the target visually. I looked up there and I couldn't see a thing. Buzz took out his trusty sextant which had an eight-power scope and put it up to the window and spotted the target. I looked out again and that speck on the windshield turned out to be the Agena."

"So, we boresighted on the target and the rest of the rendezvous is more or less history. It was successful and now I am sort of glad that we had a radar failure because it gave us an opportunity to use the backup charts that all the crews have been practicing quite a bit but have not really utilized."

"I would like to stress," added Aldrin, "that this is the first and only time that the primary rendezvous has ever been accomplished by use of backup techniques."

### Three EVAs

The Gemini XII crew then began a narrative of the mission's two stand-up and one umbilical EVAs performed by pilot Aldrin.

"Since some of the early work in EVA, I think we have discovered that the training afforded by underwater simulations is going to stand us in good stead in the future," said Aldrin. "I was quite happy to find out that the dynamics, the behavior, the situation that I was confronted with in space was very well duplicated in the simulation that I had on the ground."

"I would like to stress that the work that we did and were able to accomplish in EVA was the result of a vast team effort. We made use of all the experiences of the previous crews. Our support team spent long hours preparing the mockup and we certainly spent a considerable amount of time going through EVA preparations."

### St. Elmo's Fire?

Aldrin continued by describing his first stand-up EVA.

"I am quite glad that we did schedule this stand-up EVA first. During this first period we were primarily concerned with taking pictures at night of various starfields. In the day period between the two night periods, I used this to familiarize myself with the zero-g environment. I noticed one peculiar thing during one of the night passes while I was using the shutter release cable. And I think we might want to look into this a bit and find out what caused it. While I was rubbing my fingers together I could notice in the dark a very faint glow between my fingers."

### Man on a String

"The umbilical EVA was divided essentially into three phases—a day phase, a night phase and another day phase," continued Aldrin. "The first day phase was spent in the hatch area first mounting the camera several times to compare this with how I had mounted the camera on the previous EVA. I then moved to the Agena area and made use of the tether restraint system that we had devised. This consisted of two flexible tethers that were attached to my parachute harness."

"With this restraint system I was able to completely ignore where my body was going because I knew it wasn't going very far and I was going to be able to devote my full effort to the work task that I had."

In addition to the Agena, part of Aldrin's umbilical EVA was spent in the spacecraft equipment adapter.

"Back in the adapter we had rigged up several different connectors, hose connections, and hooks and rings—just basic tasks to be done to evaluate the restraint system that we had established back there. And I'll say that there is nothing better than these foot restraints, or 'golden slippers' as they are called. The situation is very similar to just being in a one-g environment. The only difference is that the things you are working with your hands tend to move around in a way that they don't in one g."

### Lessons Learned

Aldrin summarized what had been learned about extravehicular operations from the Gemini XII mission.

"I think we learned the great value of a restraint system. To perform a task in EVA, we first must take the time to set up a restraint to the body that will substitute for the one-g that we

have down here where our feet are in contact with the ground. We have to fix the body in a position where we then could devote our entire effort to the task at hand. The second lesson that I think we learned is the value of the underwater training that we had which was extremely valuable to us in letting us go through the entire time-line of the EVA mission.

"The third lesson that I think we learned is that sincere and intense training and very close attention to equipment familiarization really pays off in this type of effort and there is just no substitute for very close training."

### Intercepting the Sun

An overspeed condition in the Agena's main engine turbopump was noticed on telemetry at Agena insertion, and the decision was made to omit the docked PPS burn to a 400-nm apogee. Rendezvous with the solar eclipse on November 12 went back into the flight plan. Maneuvers using the Agena's secondary propulsion system set up the orbital conditions for intercepting the eclipse over South America.

"Now this is a very difficult rendezvous," said Lovell, "and again I have to take my hat off to the ground personnel who computed the rendezvous and gave us the proper maneuvers to do it."

"It was my job to track the sun as we came up to the eclipse. Just as the time was approaching I could see the moon come across the rim of the sun and occult it. I thought at first that we were going to miss it because it appeared that the moon was a little bit lower than the sun and that we would never get a total eclipse. But as we approached the time of totality, suddenly the window became black and in an impulse I ripped off the filter and looked out and I could see a black disc against a sort of black sky with a brilliant ring around it of the corona of the sun. For just a few seconds I took a look at the total eclipse and I knew that we had indeed completed the rendezvous. It was quite a beautiful sight."

### Captured by Gravity

After final separation from the Agena and drawing out the Agena tether attached by Aldrin to the Gemini docking index bar during umbilical EVA, the crew of Gemini XII went about establishing gravity gradient between the two vehicles.

"We went into the night period with the docking light on, the tether shining very brilliantly. We could see the Agena now, and slowly but surely the tether tautened up, got tight, and we thought at first that we were indeed captured. But as the night wore on, the Agena slowly came up to the horizon and we were in a very, very slow spin."

"The next day we gave it another try and we again got above the Agena, maintained this posi-

(Continued on page 4)

## New Reefing Cutters Tested at White Sands

A second test drop to check out a new type parachute reefing cutter at *Roundup* press time was scheduled for Wednesday, December 7, at the White Sands Missile Range in New Mexico, by test engineers from the Landing and Recovery Division of the Manned Spacecraft Center, Houston, Texas.

A Mercury parachute was used in the test and special suspension lines containing wire, was utilized to control electrically reefing cutters. Two cutters were used in the test to disreef the parachutes. A time programmer inside the 3,000 pound full-scale Gemini boilerplate test vehicle sent the electrical impulse to activate the cutters. Electrically controlled reefing cutters of this type could synchronize disreefing of a cluster of parachutes.

The test was similar to the successful test drop performed in September of this year which demonstrated the feasibility of the system. Wednesday's test subjected the system to maximum load conditions. The first drop was made from an aircraft flying at 130 knots; Wednesday's drop was made at 160 knots, exerting a force of 75

### The Time for Action . . .

When President Lyndon B. Johnson inaugurated the Program for Improvement of Service to the Public, he said, "The task of government is to serve the public . . . it has been my deep and continuing concern to assure that each American receives from his government the fastest, most efficient and most courteous service. The time for action is now . . . I regard this as a vital undertaking."

pounds per square foot upon the parachute.

The drop was made from an altitude of 5,000 feet above the Alkali Flats in the northern part of the missile range.

## Talks Underway For Apollo 'Scope Pointing System

NASA will negotiate a contract with the Bendix Corp., Eclipse Pioneer Division, Teterboro, N. J., for development and production of a pointing control system (PCS) for the Apollo Telescope Mount.

Bendix will produce three units under contract to NASA's Marshall Space Flight Center, Huntsville, Ala. The work is expected to cost approximately \$6.9 million.

The ATM mission will be designed to allow Apollo astronauts to point the telescope to selected regions of the Sun during the period of maximum solar flare activity which begins in 1968.

The ATM mission is planned as an alternate mission to an Apollo Uprated Saturn I flight.

The PCS is one of several flight systems which will be developed for the ATM program. Design is based on a control moment gyro being developed by Bendix for NASA's Langley Research Center, Hampton, Va.

Objectives of the solar observation mission are to acquire high resolution measurements and observations of the structure and behavior of the Sun from above the Earth's atmosphere, and to test man's capabilities for conducting astronomical observations in space.

## Final Rendezvous



**PARTY TIME**—It was M equals 1500 at Galveston's Moody Center December 2 as some 1500 MSC, and industry people gathered for the Final Gemini Rendezvous. Entertainment included Bill (My name Jose Jimenez) Dana, Patti James of Galveston's Balinese Room, the Sam Rayburn High School stage band, the E. C. Holland orchestra for dancing and the MSC Astronettes. KPRC's Tim and Bob MCed the program.

## First Applications Satellite Launched

The first of a series of five Applications Technology Satellites (ATS-B) was launched December 6 from Cape Kennedy, Fla., on board an Atlas-Agena rocket.

NASA launched the spin-stabilized payload known as ATS-B into a stationary orbit at the equator 22,300 miles above the Pacific Ocean at 151 degrees West longitude. Liftoff was at 8:12 pm CST.

The spacecraft will be capable of transmitting television (black-and-white and color) and narrow band communications between stations located in North America, Asia and Australia.

The stations are located at Rosman, N.C.; Mojave, Cal.; Kashima, Japan; and Too-woomba, Australia.

There will be a number of firsts among the many experiments carried on the satellite. These include:

- VHF experiment for voice transmissions via the satellite to airplanes in flight.
- Transmission of high quality cloud cover pictures of the Earth from synchronous orbit.
- Transmission of weather data (weather maps and nephanalyses) over a long-distance system. The information will go direct

from the Environmental Science Services Administration facility at Suitland, Md., through ground stations and via the satellite to local Automatic Picture Transmission (APT) stations in the U.S., Japan and Australia.

The ATS program is designed to investigate technology common to a number of spacecraft applications. The program involves flight tests with spin-stabilized and gravity gradient stabilized spacecraft.

Experiments will be made in meteorology, communications, radiation damage and other problems of technology.

## Ion Engine Ends 341-Day Run

A milestone in the development of propulsion systems for long range space missions was achieved last month when an electric engine successfully completed 341 days of continuous operation in a space simulation chamber. This was the longest duration test of any United States space thruster system.

The 8,189-hour test of a cesium electron-bombardment engine was performed for NASA by engineers of Electro-Optical Systems, Inc., Pasadena, Cal. The test ended November 1, when the supply of cesium fuel was exhausted.

This test, conducted for NASA's Lewis Research Center, Cleveland, is part of NASA's electric engine research program. Studies show that such systems could result in increased

payloads in unmanned and manned missions.

The engine used in the test, an ion (electrostatic) thruster, is one of three types of electric rockets being investigated by NASA.

In the electron bombardment engine, high voltages are used to accelerate the propellant which has been previously ionized by electrons emitted from a cathode. The other two systems are electro-thermal thrusters, in which the propellant is heated and expanded through a nozzle, and electromagnetic or plasma accelerators which involve interaction between currents within a plasma with electric and magnetic fields.

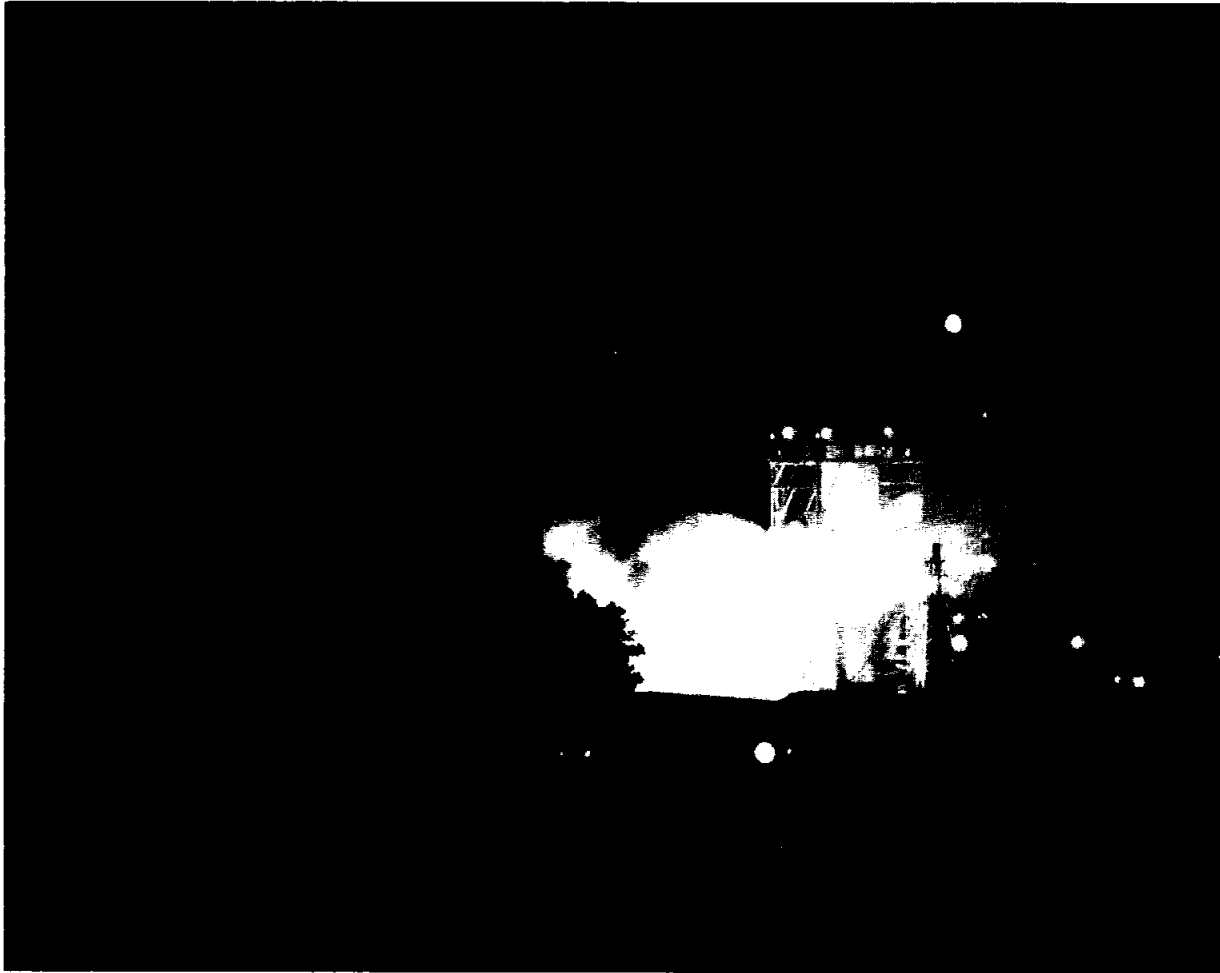
The engine in the EOS test is similar to the NASA-Lewis engine used on the first successful flight test, known as SERT I, July 20, 1964. In that flight mercury was used as a propellant instead of cesium.

The specific impulse was 5,010 seconds and the efficiency, 72.3. The test was conducted using a one-kilowatt thruster and zero-g fuel feed system operating from laboratory power supplies. Average thrust during the test was 7.05 millipounds (seven one-thousandths of a pound).

## Call Me a Taxi



**ORBITAL MECHANIC**—This conceptual space "taxi" under study by Marshall Space Flight Center looks somewhat like one of the metallic creatures in H. G. Wells *War of the Worlds*. The craft is envisioned as being a sort of maneuverable trouble-shooting vehicle for repair and maintenance, construction and rescue space tasks.



**NIGHT WORK**—Citizens living near the boundaries of the NASA Mississippi Test Facility who had not got the word no doubt sat bolt upright in bed when at 12:13 am CST December 1 the first flight article of the Saturn S-II stage ignited for a six-minute full-duration burn. The stage's five J-2 liquid hydrogen/liquid oxygen engines lit up the midnight darkness around the 200-foot high static test stand.

## Planetary Chute Test Successful At White Sands

A flight experiment to test a parachute device and techniques for possible future use in soft-landing instrumented capsules on Mars was conducted successfully November 21 by NASA at the White Sands Missile Range, N. M.

The experiment was third in a series of 15 flight tests in the Planetary Entry Parachute Program in support of the proposed NASA Voyager program to explore the planets and possibly land a capsule on the surface of Mars.

The Honest John-Nike two-stage rocket was launched at 7:45 am, CST, by the Missile and Drone Branch of Holloman Air Force Base, N. M. The parachute landed 40 minutes later.

At 120,000 feet altitude, where the Earth atmosphere compares with that of Mars, a modified ring-sail parachute was deployed in a test to study its flight characteristics.

The 30-foot-diameter parachute system was ejected after the payload separated from the second rocket stage. The parachute descended to Earth, carrying a 200-pound payload.

The payload contained instrumentation for measuring the shock of parachute opening and its oscillation characteristics. A camera recorded the parachute opening sequence.

The package, measuring five feet in length and 13½ inches in diameter, was traveling about 900 miles-per-hour when the parachute was deployed about 65 seconds after launch. The test parachute was fabricated with crescent-shaped gaps between the rings to permit air to flow through and avert excessive swinging.

## Summer Faculty Study Sponsored By NASA

During 1967, NASA will sponsor seven specialized summer programs of research and study for talented young college and university faculty members in engineering and science.

These summer programs will be conducted cooperatively between NASA research centers and adjacent universities. About 245 faculty members will not only have an opportunity to engage in vital space research at the NASA centers, but will participate in parallel seminar-type studies at the universities.

This is the fourth year such summer programs have been sponsored by NASA.

The programs are expected to update and revitalize the participants' direct knowledge of the space program, to stimulate an exchange of ideas between faculty personnel and NASA professionals, and ultimately to enrich educational and research activities at the members' parent institution.

Developed by NASA in cooperation with the American Society for Engineering Education, the programs will be undertaken for 10 weeks in the summer of 1967 and will include about 225 young faculty. Participating are:

(1) the University of Alabama, Auburn University, and the Marshall Space Flight Center, Huntsville, Ala.; (2) Case Institute of Technology and the Lewis Research Center, Cleveland; (3) the University of Houston, Texas A&M University, and MSC; (4) the University of Maryland, Catholic University, and the Goddard Space Flight Center, Greenbelt, Md.; (5) Stanford University and the Ames Research Center, Moffet

Field, Cal.; (6) Virginia Associated Research Center (University of Virginia, Virginia Polytechnic Institute, and the College of William and Mary) and the Langley Research Center, Hampton, Va.

## S-II Stage Test Fired Full Duration at MTF

Propulsion engineers are analyzing test data recorded during a six minute captive firing of the first flight model of a Saturn V second stage.

The stage (S-II-1) underwent its initial firing at the NASA Mississippi Test Facility at 12:13 am CST December 1. The firing lasted 384 seconds, the approximate time the unit is expected to perform in flight. Conducting the test was the Space and Information Systems Division of North American Aviation, Inc., prime contractor to the NASA Marshall Space Flight Center, for S-II development.

The stage is to be a part of the first Saturn V launch vehicle scheduled to be launched in the second quarter of 1967 from the NASA Kennedy Space Center, Florida. The stage is 82 feet long and 33 feet in diameter and is powered by five Rocketdyne J-2 engines, which develop a total of one million pounds of thrust at altitude. It's the country's largest hydrogen powered stage.

About 800 measurements of the vehicle's performance were recorded during the test, including propellant tank temperatures and pressures, engine temperatures, propellant flow rates and vibrations. Results must be studied carefully to determine the exact performance in every aspect of the stage's operation.

Preliminary indications are that the firing was a complete success.

North American plans to fire the stage for one additional full duration performance within the next week.

Following the second test, the stage will undergo post-static firing checks and refurbishment. The stage should depart via barge to the Kennedy Space Center the first week in January.

## Gemini XII

(Continued from page 2)

tion, and it appeared to us now that our rates had indeed dampened. We let it go for the next two revs and finally we let the Agena go, too. And there we were—two dead vehicles, captured by gravity in a vertical position going around the earth." *Water, Water, everywhere . . .*

On the fourth day of the flight the Gemini spacecraft adapter water supply petered out and the crew tapped the reentry water supply in the spacecraft cabin.

Said Lovell, "I had a dried-up package of applesauce and I put the gun in and sure enough nothing happened. I looked at it for a while and I put it in my mouth to see if any water would come out. Nothing happened. I said, 'Buzz, I think we're out of water.' Buzz said, 'Oh no, no, that's not possible.' So I pointed the gun at him and shot it and nothing came out. For four days I wasn't a bit thirsty; now all of a sudden I got a tremendous thirst and we were over the middle of the Pacific Ocean at the time."

Lovell and Aldrin narrated a motion picture of EVA, gravity gradient and reentry sequences and a few slides of terrain and weather still photos before the press conference was opened to a question-and-answer session.

## Barging Right Along



**SATURN FERRY**—Two NASA barges carrying first stages of Saturn V and uprated Saturn I pass the New Orleans skyline after leaving NASA's Michoud Assembly Facility. The *Poseidon*, on the left, carries the first flight version of Saturn V to Marshall Space Flight Center for static firing. The *Promise* returns an uprated Saturn I ground test vehicle to Marshall. The 1000-mile trip up the Mississippi, Ohio and Tennessee rivers requires about eight days.

# Pegasus Satellites Get Another Year's Work

The three Pegasus meteoroid technology satellites have served so well that NASA has decided to extend their operational lifetimes.

The unmanned satellites, largest known such spacecraft, were launched into near-Earth orbit aboard Saturn I rockets.

Pegasus I, the first, was launched February 16, 1965 by the eighth in a series of 10 successful Saturn I vehicles. Pegasus II followed on May 27 and Pegasus III on July 30. All were set to operate 18 months. And now, even before the final spacecraft has completed its first full term, they have been given a greenlight for 12 additional months.

In this second period they will continue to provide data on meteoroids, but the main purpose of this extension is to gather bonus information that will permit engineers to learn more about the durability of spacecraft systems and components over such a long period.

The three satellites will continue to transmit data on thermal measurements and radiation detection as well as meteoroids, but the emphasis will shift. Researchers will concentrate on data that will enable them to determine which materials and systems survive and continue to operate properly in an actual space environment.

This bonus information will be fed into future programs in which spacecraft will be required to operate for long periods.

Since extensive tests on Pegasus materials and systems were conducted on Earth before the three satellites were launched, researchers can use this data and that acquired from orbit to establish very accurate life and deterioration information.

Two other research angles will be pursued as secondary objectives during the next 12 months.

Researchers expect to get a better definition of meteor showers by searching for fluctuations in the count rate on a yearly basis. Also since the satellites' tumbling has slowed down, some information on the directional distribution of meteoroids may be available.

The satellites at first tumbled so fast that determining the directions from which meteoroids came was difficult.

The researchers will also be able to acquire better measurements of the Earth's heat balance and take a closer look at the fine structure of the radiation belt around Earth.

The satellites were built by Fairchild-Hiller for the Marshall Center, acting for the NASA Office of Advanced Research and Technology. Milton B. Ames, director of Space Vehicle Research and Technology, OART, exercises overall control of the project. Dr. William G. Johnson, now director of the Marshall Center's Experiments Office, was Pegasus project manager at Marshall. Dr. James B. Dozier of the MSFC Research

Projects Laboratory is in charge of data analysis. Senior electrical and electronic engineer is Harvell Williams, and senior mechanical engineer was Charles A. Faulkner.

The Marshall Center has had the three satellites under constant surveillance—24 hours a day, 365 days a year—for a total of 23,393 orbits, or a cumulative time of more than four years. The orbits range in altitude from about 310 to 450 miles.

Each of the three satellites average 16 orbits of the Earth per day. This total of 48 orbits daily has given researchers the opportunity to send more than 48 separate commands and accumulate more than 10 hours of real-time evaluation daily.

Each of the satellites has a "wing" of meteoroid detection panels reaching about 96 feet from tip to tip. The 208 panels are actually two-sided capacitors which record meteoroid penetrations from both sides.

Each capacitor is a sheet of aluminum alloy bonded to a trilaminate Mylar sheet, the back of which is coated with vapor-deposited copper. Each pair of panels is separated by a foam plastic core.

The panels expose about 2,000 square feet of meteoroid detection surface on each satellite. Thicknesses of aluminum sheets are varied, the thinnest being 1.5 mils, a second being 8 mils and the heaviest being 16 mils.

A voltage potential is maintained between the aluminum sheet and copper coating of each panel. When a particle penetrates the panel, the impact creates a plasma between the two surfaces. The plasma, before it dissipates, discharges the capacitor panel for a fraction of a second. The capacitor is then recharged almost immediately by the spacecraft's power supply. The momentary discharge is recorded as a "blip" which is translated into digital bits. The bits can then be transmitted to Earth upon command.

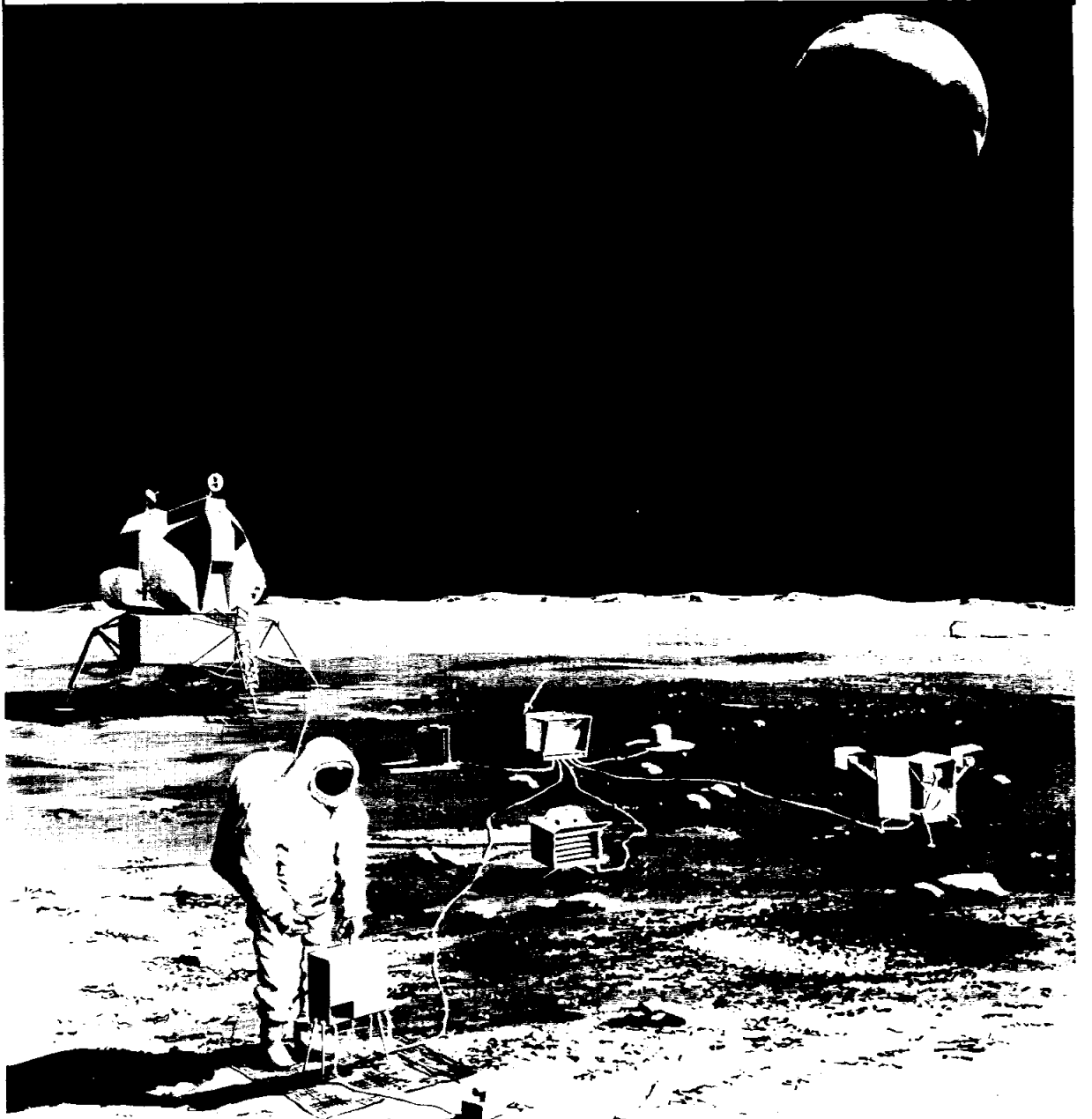
Although some detector panels became inoperative after receiving several hits, a total of 1427 events were counted in the telemetry that had been reduced by October 25. Of these counts, 312 took place in the 16 mil panels, 61 in the 8 mil panels, and 1054 in 1.5 mil panels.

It is estimated that there are 1302 holes in the 16 mil panels, 526 holes in the 8 mil panels, and 2221 holes in the 1.5 mil panels, or a grand total of 4049 holes.

The findings have eliminated many of the uncertainties in meteoroid environment and penetration estimates and provided a basis for realistically estimating the amount of meteoroid protection needed for future missions.

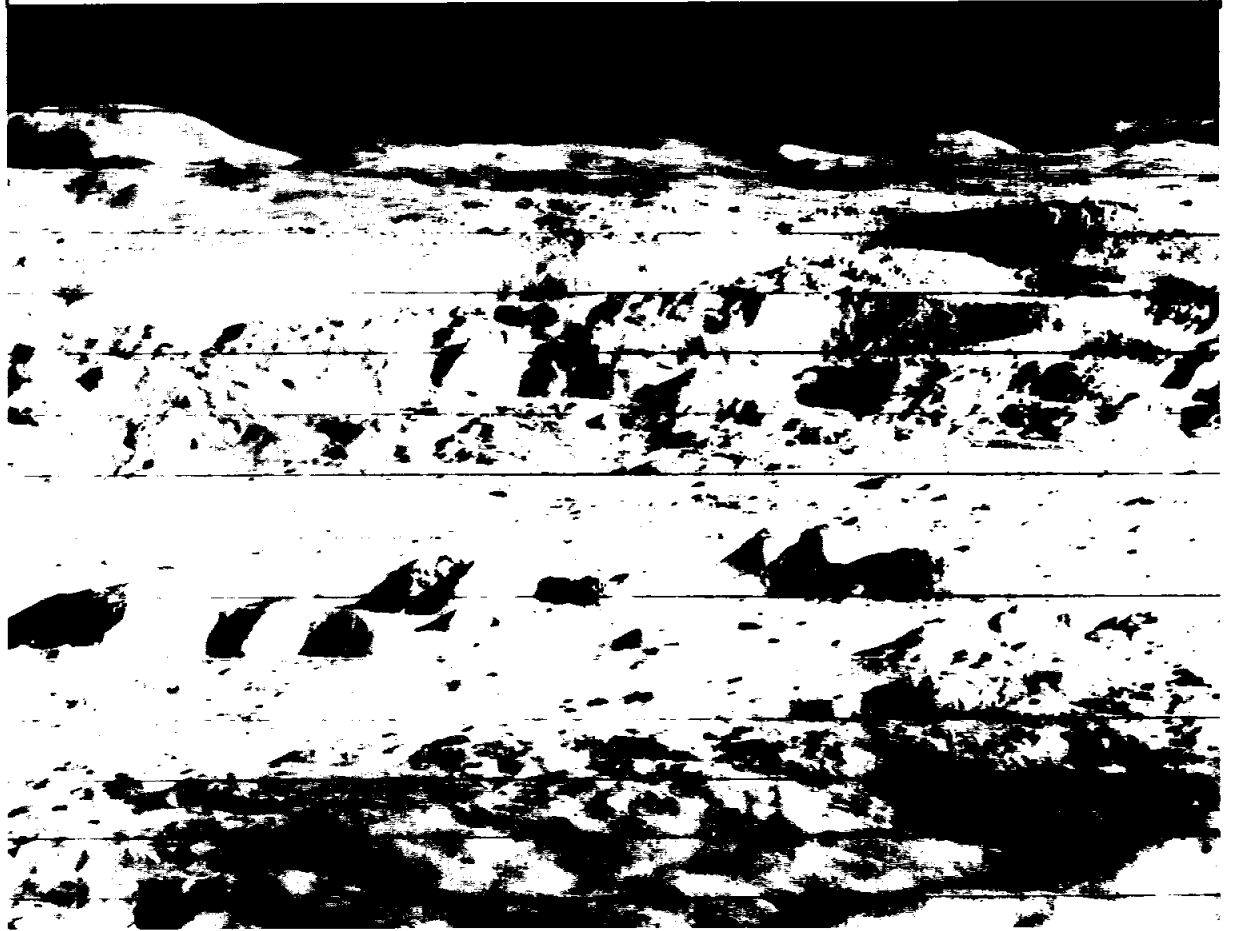
Constant surveillance of the three Pegasus satellites is maintained at MSFC's Satellite Control Center in Hangar AF at Kennedy Space Center.

## Taking the Moon's Pulse



**CALLING CARDS**—Among the devices left upon the lunar surface by Apollo crews will be the instruments being deployed in this artist's concept of the Apollo Lunar Surface Experiments Package (ALSEP). Moving out some 300 feet from the Apollo Lunar Module, the crewman deploys the suprathreshold ion detector for measuring characteristics of the lunar atmosphere and ionosphere. At left rear is the radioisotopic thermo-electric generator for providing system power. The passive seismometer at rear right measures the natural seismicity of the moon. Medium-energy solar wind particles are measured by the solar wind spectrometer at lower center, and the magnetometer at lower right measures magnitude and direction of the moon's magnetic field. ALSEP is designed to detect and transmit lunar environmental measurements to Earth for a period of one year after Apollo crews lift off the lunar surface. Bendix Systems Division, Ann Arbor, Mich., is prime ALSEP contractor.

## Copernicus Closeup



**LUNAR PROFILE**—Lunar Orbiter II's telephoto lens shot this low-angle photo across the crater Copernicus from an altitude of 28.4 miles and about 150 miles south of the crater's center. Distance from base of photo to horizon is about 150 miles, and the 3000-foot mountain on the horizon is the Gay-Lussac Promontory in the Carpathian Mountains. Cliffs on the rim of the crater are 1000 feet high and are undergoing continual downslope movement of material.





**LIFTING SPIRITS**—Youngsters at the Harris County Boys Home crowd around Santa Claus and his helper Ed White during last year's Christmas party at the Home. Behind the Santa Claus get-up is Doug Broome of Apollo C&SM Project Office. The Home gets no funds from Red Feather or United Fund agencies with which to buy athletic equipment or to provide Christmas activities; MSC employees and their families take up the slack by organizing the Christmas party each year.

## A Simple Tree, a Gift, Make a Big Difference

He could have been anyone's boy.

But he was not.

He was a ward of the Harris County Boys Home, and he had tears in his eyes after opening his present.

"I never owned a new shirt of my own before," he said.

The scene was not typical, but it is one perhaps most remembered by those from MSC who came to last year's Christmas party at the Home on NASA Road 1 between MSC and Seabrook.

The boys got more than just new shirts. They got presents and other clothes, but most of all

they had someone with whom to enjoy what they got.

MSC people made it possible.

Not many people this year or any year could please their children with a white shirt under the Christmas tree.

For the past two years, some MSC employees and their families have provided a Christmas for these children who have no Red Feather agency, no United Fund, to see to their needs. The children are placed in the Home by welfare agencies and by the courts.

Having a tree, gifts, knowing someone cares, means a lot to these boys. It lifts their spirit as well as the spirit of those who do the giving. Ask someone who was there last year.

This appeal in the *Roundup* will be the only appeal made. But there will be a tree and gifts for the youngsters at the Harris County Boys Home; Mrs. William Stoney and Mrs. William Lee are planning this year's party for December 19 at 7 pm.

But they need a little help—say, \$1 or just \$.50, or a gift. Contributions may be sent to Dorothy Swanner/PA, Room 754, Building 2.

## TB Association Makes Appeal

Corsages fashioned from tuberculosis seals will be offered December 14 in the MSC Cafeteria for donations to the Harris County Tuberculosis Association.

Volunteer workers in the one-day appeal are Barbara Cernan, Martha Chaffee, Jackie Sanborn and Joan Wade.

### OFFICIAL NOTICE

Effective 28 November 1966, Detachment 1, 1137th Special Act. Squadron, MSC, Houston, Texas, was appointed Summary Court to secure and dispose of effects belonging to Donald Lee Scott, Capt. USAF, FV2205389, whose death occurred on 28 November 1966. Any person indebted to or having claim against the estate of Donald Lee Scott should immediately contact 1st Lieut. George R. Boersig, HU 3-5595. Authority AFR 143-6.

## Hugh Dryden Fund Proposed Alternate To Card Exchange

An estimate of the dollar value of postage and Christmas cards exchanged each year by MSC employees would be hard to calculate.

After New Year's Day, the cards find their way into trash cans and that is the end of it until the following Christmas.

MSC Director Dr. Robert R. Gilruth November 16 sent out a letter to all employees urging that in lieu of exchanging Christmas cards, employees instead make contributions to the Hugh L. Dryden Memorial Fund. The fund is earmarked for construction of a memorial auditorium at the National Academy of Sciences, Washington, D.C. (See November 11 *Roundup*)

Dr. Gilruth's letter said in part, "It is suggested that instead of exchanging Christmas cards this year with other members of the staff, the cost of such cards and postage be contributed to the Hugh L. Dryden Memorial Fund. Uniform application of such a plan would be understood by all potential recipients of Christmas cards within the Center."

Dr. Hugh Dryden was Deputy NASA Administrator until his death of cancer December 2, 1965.

## Space News Of Five Years Ago

December 11, 1961—A contract was awarded by the Army Corps of Engineers to a team headed by Brown and Root, Inc., for design of a major portion of the permanent facilities to be constructed for the Manned Spacecraft Center.

The national space program portends a major technological advance for mankind. NASA Associate Administrator Dr. Robert C. Seamans, Jr. told the New Orleans Chamber of Commerce. Comparing its potential to that of the invention of the steam engine, Dr. Seamans said: "Two aspects of such major advances are characteristic. First, the practical results are largely unforeseeable, primarily because they develop on broad fronts and, frequently, in unsuspected directions. Second, the concentration of effort required does not diminish effort expended on other frontiers of knowledge, but rather spurs such activities. For example, despite fears that space technology would monopolize the scientific effort of this country, such fields of activity as oceanography, geophysics, and the physics of high-energy particles have greatly increased since the national space effort has become a serious one."

December 14, 1961—MSC Deputy Director Walter C. Williams told a University of Houston audience that the Mercury spacecraft had served and would continue to serve as a test bed for developing orbital flight techniques and hardware for more ambitious space programs.

December 15, 1961—S-1B stage of the Advanced Saturn launch vehicle would be built by the Boeing Co., NASA announced. The \$300 million contract, to run through 1966, called for the development, construction and test of 24 flight stages, plus several for ground tests. Assembly would take place at the NASA Michoud Operations Plant, New Orleans, La. The S-1B would be the first stage of the vehicle that would launch the three-man Apollo spacecraft for direct circumlunar flight or, with rendezvous, for lunar landing.

## A Suggestion Submitted Is Worth Two in Brain

A suggestion must offer a solution to a problem or propose a method for carrying out an improvement or change. Suggestions can improve safety, eliminate waste, avoid duplication, boost morale and simplify work.

Many good suggestions are moneysavers, and these are always welcome. But numerous ideas provide valuable benefits that are not susceptible to measurement in terms of dollars. An idea that produces intangible benefits is often as important as a suggestion that saves a specific amount of dollars.

An important thing to remember: regardless of how good an improvement idea is, it isn't a suggestion until it is submitted. There is always a possibility that someone else has the same idea and is thinking of suggesting it. In case of duplication, the first suggestion received is given credit for the change. Submit today on MSC Form 624.

## Exhibit Contract Awarded LTV

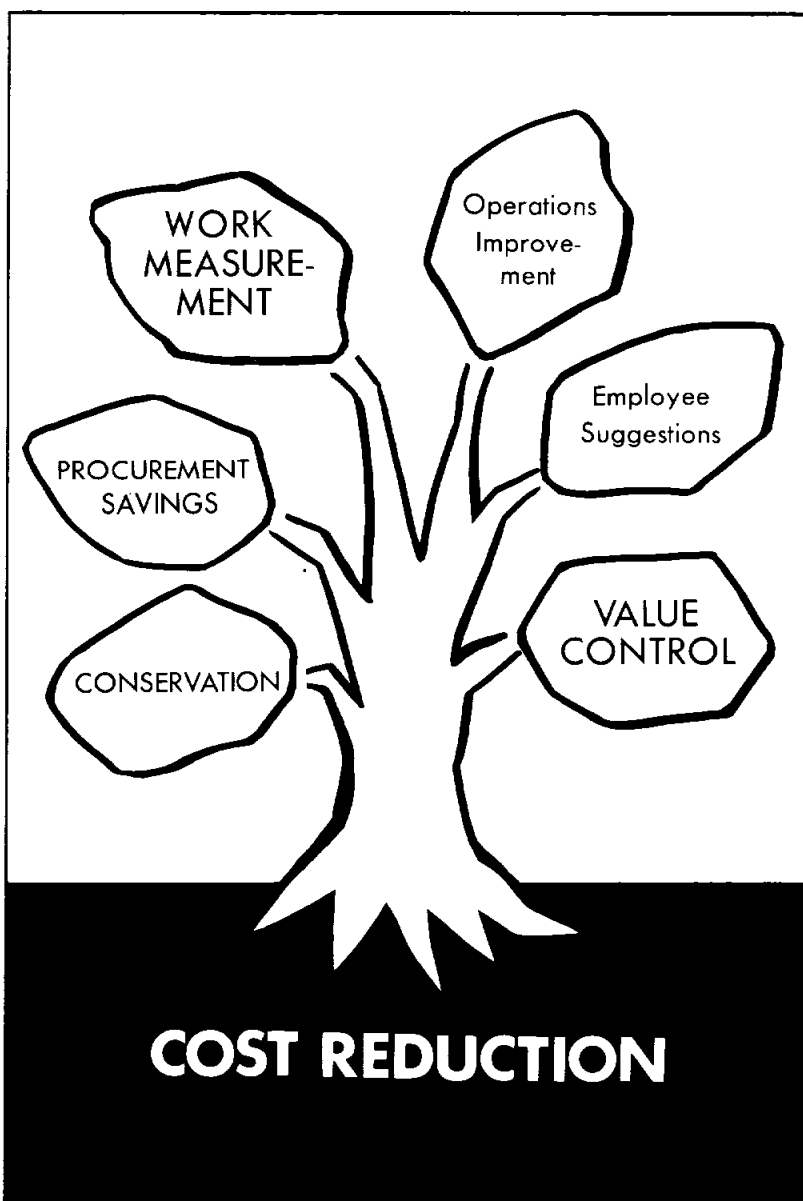
MSC Director Dr. Robert R. Gilruth, last week announced the selection of LTV Aerospace Corporation, a subsidiary of Ling-Temco-Vought, Inc., to provide exhibit management, visitor orientation, and library services in support of MSC's Public Affairs Office.

Under the contract period, from December 1, 1966, through November 30, 1967, LTV will provide briefings, escorts, and related services to visitors, manage the scheduling of NASA exhibits in an eight state area of the Southwest and Midwest and respond to routine requests for information on the space program.

The estimated cost of the contract is \$300,000 per year and a staff of 32 people will carry out the terms of the contract. Dallas-based LTV was selected from 11 companies submitting proposals.

The SPACE NEWS ROUNDUP, an official publication of the Manned Spacecraft Center, National Aeronautics and Space Administration, Houston, Texas, is published for MSC personnel by the Public Affairs Office.

Director . . . . . Dr. Robert R. Gilruth  
Public Affairs Officer . . . . . Paul Haney  
Editor . . . . . Terry White  
Staff Photographer . . . . . A. "Pat" Patnesky



# Space News ROUNDUP!

MANNED SPACECRAFT CENTER, HOUSTON, TEXAS

## EMPLOYEE NEWS

### Experimental Aircraft Group Builds and Flies Own Planes

There are a lot of people who would like to fly for the fun of it but who are thwarted by such expenses as aircraft rental, or if they own an airplane, the costs of hangar rental and overhauls.

Not all aircraft are built in factories. Some are built by aviation enthusiasts in their garages and home workshops in all-metal, wood-and-fabric or steel tube and fabric construction. Many of these amateur aircraft constructors are members of the Experimental Aircraft Association.

The Houston Chapter of EAA meets the second Thursday of each month at Houston International Airport to pool experience and advice for members building airplanes ranging from single-place to four-place light aircraft.

Many aircraft builders bypass hangar rent by designing their planes with folding wings so that they can be stored in the garage between flights, and many pilots do their own maintenance. Home-built aircraft are issued

experimental airworthiness certificates by the Federal Aviation Agency, provided they meet certain minimums of structural and aerodynamic safety.

EAA member Bob Meitzen, Ext 2631 has additional information about membership and activities of the Association.

### Superior



Donald R. Visness  
MSC White Sands  
Sustained Superior Performance Award

### 1966 MSC/EAFB Flag Football League

Standings as of December 2

American Division			National Division		
TEAM	WON	LOST	TEAM	WON	LOST
IESD	9	0	USCG	9	0
FSD	8	1	Philco/WDL	8	0
CAD	7	2	SMD	6	3
MPAD-G&P	6	3	IBM	6	3
Lockheed	6	3	TRW	4	4
Grumman	3	5	FCD	4	5
2578th	3	5	747th	3	5
P&PD Hustlers	2½	6½	NAA	3	6
ANG	2	7	SSD	2	7
Link	1½	7½	MPAD-FSB	2	7
Philco/TR	0	8	P&PD	1	8

### MSC BOWLING ROUNDUP

Monday Men's League

As of November 28

TEAM	WON	LOST
Humbugs	30	14
Rompers	26	18
The Toos	25	19
The Wheels	24	20
Alley Cats	14	30
Hi-Hopes	13	31

### Reid, Leighton Take Bridge Master Point

North-South winners of the Club Master Point on November 29 were Edith Reid and DeWard Leighton, first; Bob Wiley and Joe Snyder, second. East-West first place went to Ray Lynch and Max Cone and second to Ann Bragg and Jo Oldfield.

At the November 22 game, Alice Gowdey and Fuad Tawil were first North-South and Edith Reid and D. Leighton, second. Arthur Carlson and Andrew Jennings were first East-West; Mark Powell and Lionel Machado, second.

High Game: William Stransky

234. Curley Dartz 216.

High Team Game: Rompers

865. Humbugs and Toos 858.

High Series: B. Marlowe 588,

Cal Mitchell 581.

High Team Series: Rompers

2509. Humbugs 2457.

MIMOSA MEN'S LEAGUE

As of December 8

TEAM	WON	LOST
Whirlwinds	33	19
Road Runners	33	19
Technics	30	22
Chizzlers	28½	23½
Strikers	25	23
Fabricators	27	25
Alley Ops	26½	25½
Real Timers	24	28
Foul Five	23	29
Weightless Wonders	21	27
Agitators	20	32
Hustlers	16	32

High Game: Bill Holton 271, Dan Kennedy 265.

High Team Game: Chizzlers

1093 and 1086.

High Series: Bill Holton 728, Hal Ferrese 713.

### Moonglow 66 Gets Firm Launch Date

After several slips, scrubs and reschedulings because of conflicts with mission dates and talent commitments, Moonglow '66 has been scheduled "no earlier than" January 5, 6 and 7.

Moonglow '66 tickets at \$1 a person went on sale Tuesday in the MSC cafeteria, and are also available from Moonglow cast members and from Employee Activities Association representatives in each division. Mickey Stoneking at 3086 is coordinating ticket sales.

### Roundup Swap-Shop

(Deadline for classified ads is the Friday preceding Roundup publication date. Ads received after the deadline will be run in the next following issue. Send ads in writing to Roundup Editor, AP3. Ads will not be repeated unless requested. Use name and home

#### FOR SALE—HOUSES

El Lago Estates equity, 3-2-2, carpet, air, built-ins, Spanish, large atrium, 2 blks from elem school. Ron Harrist, 877-2802 or HU 8-3530, Ext 2484.

3-bdr 1½-bath brick, 2-car garage, large paneled den, living room, kitchen w/dining area, central air/heat, fenced yard, school bus available, other extras. Make offer for \$3100 equity; balance \$12,100, \$111/mo payments include everything. James Weaver, 932-2371 League City.

4-bdr, 1½-story brick, fenced, 2000-sq ft living area. Equity sale, 5¾% loan. D. Geier, 932-3980.

4-bdr house across from MSC, with or without furniture. Everything goes. Equity plus 5½% loan. Joe Caselli, 932-3722.

#### FOR SALE—AUTOS

'65 Falcon 4-door station wagon, auto-trans, air. \$375 down, financing available, will consider trade. Ron Harrist, 877-2802 or HU 8-3530 Ext 2484.

1965 Corvair Corsa convertible, 140-hp, 4-spd trans, Rally-pack, new tires, blue-grey w/black top. HU 4-6741 or GR 4-2547.

1966 Pontiac LeMans 2-door hardtop, bucket seats, black vinyl roof, pwr steering/brakes, autotrans, premium tires, low mileage, low price. L. Sacks, HU 8-1461 after 6 pm.

1963 Chevy Belaire 4-door, clean, one owner, autotrans, factory air, two tone. Jack Neva, HU 6-8453.

1962 Fairlane 500, 6-cyl, standard trans, radio, heater, four good tires, one owner. \$525. J. D. Weber, HU 4-1644.

1963 VW sedan, good condition, \$650. John T. Campbell, HU 8-0516, after 5.

1963 Chevy Belaire 9-Pass station wagon, top shape, 6-cyl, standard shift, good tires, battery, brakes. \$1060. R. J. Gillen, 877-1666.

1959 Austin Sedan, xcInt running condition. \$250. F. Wittler, GR 4-3416 or GR 4-3511.

1963 Olds Cutlass, xcInt condition, new Firestone w/w deluxe Champs, new battery and front brake linings. Captain Sisk, GR 3-0673 after 6.

1964 Falcon Future 4-door V-8, autotrans, air, radio, belts, tinted windshield, washers, whitewalls. \$990. Jim Cooper, 877-1836.

1962 Chevy II Nova. D. M. Blackman, HU 8-0672, 16429 El Camino Real, Apt. 4.

1966 Oldsmobile Bonneville, air and music, like new. \$3200. Gus Grissom, 877-2662.

1964 Galaxie 500, 4-door, standard shift, overdrive, air, radio, low mileage (27,500 miles), one owner, new tires, good price. C. R. Garza, WE 8-7848.

1963 Pontiac Tempest 2-door coupe, red and white, autotrans, 16902 miles, original owner. Bob Shrader, HU 4-2389.

1966 Mustang, 289 cu-in V-8, 3-spd floor shift, factory air, tinted glass, white walls, buckets, radio, heater, other extras. Will accept trade on a good used car. Coy Summers, MI 9-8838.

1966 Mustang, silver-blue, white vinyl top, air, automatic, 6-cyl, tinted glass, bucket seats, wire wheels, white walls, radio, other extras. \$2300. G. Shrum, 877-3109.

#### FOR SALE—MISCELLANEOUS

12x50 mobile home with air, less than year old, like new. Cost \$5200, will take \$4200. Moving to Colorado. HU 4-6741 after 5.

1966 Yamaha Big Bear Scrambler motorcycle, xcInt condition, like new. J. R. Jordan, 583-1231 Baytown.

### Children's Yule Party Planned December 17

The fourth annual MSC Children's Christmas Party will be held Saturday, December 17 from 2 to 4 pm. All children are requested to meet in the MSC auditorium at 2 for entertainment by a children's accordion group and a ventriloquist or magician. (In case of rain, the youngsters should gather in the cafeteria.)

Following the entertainment, Santa Claus' knee and ear will

be available at 3 pm in the cafeteria for children who have not had a chance to drop hints at home about what they would like to find under the tree Christmas morning. Refreshments and favors as well as a gift for each child will be provided.

Parents of children under five are invited; parents of older children are requested to leave their children at the party.

A maximum of 800 tickets at \$5.50 each will be sold up until noon December 16. Tickets are available from the following: Sandra Burdsal, Room 323 Bldg. 7A, Ext 5554; Diane Bell, Room 174, Bldg 16, Ext 2766; Frank D. Nolan, Room 331, Bldg. 2, Ext 5451, and Arminta Yanez Bldg. 330 EAFB, Ext 7771.

Santa Claus also needs some assistants. Call Arminta Yanez to volunteer.

### Rocket Enthusiasts Seek to Form Club

Rocket engines with thrust measuring in ounces instead of millions of pounds are the source of propulsion for an embryonic model rocket club which is just getting its activities off the ground. The group launches the scale model vehicles from the open area west of the MSC Antenna Test Range, using the same area as the MSC model airplane club.

Founders of the group hope to hold an organizational meeting some Sunday in the near future in the launch area. Gunpowder and other hazardous propellant concoctions are *verboten*, since safe solid-fuel model rocket engines are available in model shops.

General Electric Co-Op employee Frank Bittinger asks that any MSC or contractor employee (or their rocket-minded offspring) interested in forming a model rocket club contact him at 932-4511, Ext 3681.



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U.S. Savings Bonds

### Two Talks Left In Advent Series

Two inspirational talks by Houston-area pastors remain in the Advent series of services held each Wednesday morning in the MSC auditorium. Services begin at 8 am and end by 8:25 and are conducted by MSC employees who are laymen-members of Clear Lake area churches.

The final two Advent services are on December 14 and December 21.

#### FOR RENT

2-bdr studio-type bay house, central heat, 1½-bath, 2-car garage, nice yard. Max Craig, GR 1-4968.

# Space News ROUNDUP!

## SECOND FRONT PAGE

### Mariner IV Continues Work After Two Years

Mariner IV, launched two years ago November 28 on its historic Mars photo mission, has flown more than one billion miles in space and continues to operate properly, reporting its condition to Earth three times a week.

The spacecraft, now in its 741st day of flight, has been transmitting data to the Goldstone Deep Space Network Station in California across a distance of 206,201,080 miles.

At 6 pm CST November 28 Mariner IV had flown 1,025,082,830 miles since it was launched from Cape Kennedy, Fla., November 28, 1964. It completed its primary mission August 2, 1965, after transmitting to Earth 22 pictures of the Martian surface. The photos were made when it flew within 6118 miles of the planet on July 14, 1965.

By using Goldstone's new high-precision 210-ft. antenna, Mariner officials at the Jet Propulsion Laboratory, Pasadena, Cal., have been able to monitor periodically many of Mariner's subsystems and its scientific instruments.

Recent data from the spacecraft, collected by the "210" and its supersensitive radio receiver, indicated that the occurrence of an intense solar flare last September caused a slight loss in the total power capability of Mariner's solar panels. The "class three" solar storm, which raged more than a week and reached its peak on September 3-4, was detected by NASA's Pioneer VI and VII spacecraft in orbit around the Sun and by Lunar Orbiter I, then revolving the Moon.

Because the Mariner IV design allowed for a 20 per cent panel degradation by such an occurrence, the power loss caused by the flare—probably less than half that allowed for—is not expected to jeopardize the continuing performance of the spacecraft. Mariner was about 116 million miles from the Sun when the flare occurred.

Other information derived from analysis of the telemetry data indicates that Mariner's attitude control system has a nitrogen gas supply capable of keeping it stabilized for more than a year and that temperatures and voltages of all systems including the scientific instruments are as expected.

Having operated continuously for more than 17,000 hours, the spacecraft is approaching 300 per cent of its 6000-hour mission design life.

Mariner IV currently is being tracked by the 210-ft. antenna on a time-sharing basis with Pioneer VI which has been in solar orbit for nearly a year and also is beyond the range of the Deep Space Network's 85-foot antennas. If Mariner continues to function until June, 1967, communications with it may be stepped up. Mariner's orbit will bring it to within 30 million miles of Earth next September, when it is planned to attempt several engineering experiments in addition to receiving interplanetary science information.

Next year will be one of increasing solar activity. The presence of Mariner IV and Pioneers VI and VII in solar orbit, in addition to another Mariner enroute to Venus during the latter half of the year, will provide an unprecedented opportunity to take scientific advantage of this part of the 11-year solar cycle.

### Dr. Schumacher Speaks to AIAA

Dr. Eugene M. Schumacher, chief scientist at the US Geological Survey Observatory at Flagstaff, Ariz., will be the guest speaker at Monday's meeting of the Houston Section of the American Institute of Aeronautics and Astronautics.

Dr. Schumacher's talk will cover new data that have been gained from Surveyor and Lunar Orbiter spacecraft about the fine structure of the lunar surface and its broader geological features. He will stress the importance to the Apollo Program's scientific aspect of the relatively clean surfaces observed on large numbers of rock fragments scattered about in the top of the debris layer, thereby making it possible for Apollo crews to make meaningful observations on small geological features and to sample selectively.

Dr. Schumacher also will point out many new and unexpected lunar features observed in Lunar Orbiter photos, namely raised crater chains along backside rifts which closely resemble certain volcanic rifts on Earth.

The AIAA meeting will be at the Holiday Inn on NASA Road 1, and will begin with a social hour at 6 pm, dinner (\$3.25/person) at 7 and the program at 8. Reservations should be made before Monday noon through Kathy Robbins at HU 8-1400 or 591-3030 or Pat Todsén at HU 8-0900.



### A Gathering of Wings



WINGS FOR FIVE—US Air Force Chief of Staff General John P. McConnell November 29 presented USAF Astronaut wings to five Air Force officers assigned to MSC. Left to right are Frank Borman, command pilot wings; Virgil I. Grissom, command pilot wings; David R. Scott, senior pilot wings; Michael Collins, senior pilot wings, and Edwin Aldrin, senior pilot wings. The presentation was made in the Director's conference room.

HELP SUPPORT OUR MEN  
IN VIETNAM  
BUY U.S. SAVINGS BONDS

### MSFC Orders 30 F-1 Engines For Saturn Vs

The NASA Marshall Space Flight Center has ordered 30 F-1 rocket engines and varied support services from the Rocketdyne Division of North American Aviation, Inc., Canoga Park, Cal. The order completes the number of engines needed for use on the 15 scheduled Saturn V launch vehicles, plus spares.

Along with the engines, Rocketdyne will furnish ground support equipment, logistics and production support for approximately \$141 million.

The contract was negotiated on a cost-plus-incentive-fee basis, with performance, scheduling and cost serving as incentive measures for the contractor.

Delivery of the 30 engines is to begin in November, 1967, and continue through October, 1968, but the support efforts are scheduled to run through June, 1970.

The F-1 is the 1.5-million-pound-thrust engine used in the booster stage (S-1C) of the Saturn V launch vehicle which was developed under direction of Marshall. Five F-1's are clustered to give the Saturn V a 7.5-million-pound initial thrust.

With the addition of these 30 new engines, the total of F-1's purchased to date by MSFC, in Huntsville, Ala., has reached 106.

### Four Companies Picked For Advanced Studies

Four aerospace companies have been selected by NASA for the study of methods for exploring the planets and for design of advanced launch vehicles. The study contracts total \$825,000.

Lockheed Missiles and Space Co., Sunnyvale, Cal., has been awarded \$200,000 for a study of manned space missions in the vicinity of the planets Mars and Venus. Research will be concentrated on the interactions between the operational aspects of the mission and requirements for scientific explorations.

The Boeing Company, Seattle, was tapped for a \$150,000 study of a large launch vehicle concept that would be capable of carry-

ing a wide range of payloads (one to four million pounds) into Earth orbit using the building block approach. The concept is based on a liquid-hydrogen/liquid-oxygen core with provisions for large solid or liquid engine strap-ons.

Lockheed-California Co., Burbank, has been awarded \$250,000 for a study of an advanced air-breathing launch vehicle with cruise capability.

The projected vehicle would be an air-breathing, aircraft-type, first stage using liquid-hydrogen as fuel and capable of conventional horizontal take-off and landing. The second stage would consist of an expendable liquid-hydrogen/liquid-oxygen rocket able to achieve low Earth orbit with a 50,000 pound payload. The first stage is proposed for recovery by flyback to the originating base, or to an alternate base.

The fourth contract, for \$225,000, was awarded to North American Aviation, Inc., Downey, Cal., to study various classes of conceptual interplanetary spacecraft for atmospheric braking to orbit around Mars and Venus. The main fields of the study will include gas dynamics, thermodynamics and thermal protection, structures, guidance and control, and systems integration.

The four studies were awarded by NASA's Mission Analysis Division, which is responsible for the identification of research and technology required to support possible future space flight tasks.

### Firms Continue Optical Studies

The Perkin-Elmer Corp., Norwalk, Conn., and Chrysler Corp., Detroit, have been authorized about \$250,000 each to continue their studies of optical technology for NASA.

This is a nine-month extension of research by the two companies to evaluate optical experiments for possible future extended Apollo flights. The proposed experiments include control of optical telescope primary mirrors, telescope temperature control, telescope pointing, and laser propagation studies.

This work supports NASA's long range program to develop the technology required to use optical instruments such as large telescopes and lasers for deep space exploration and communications.