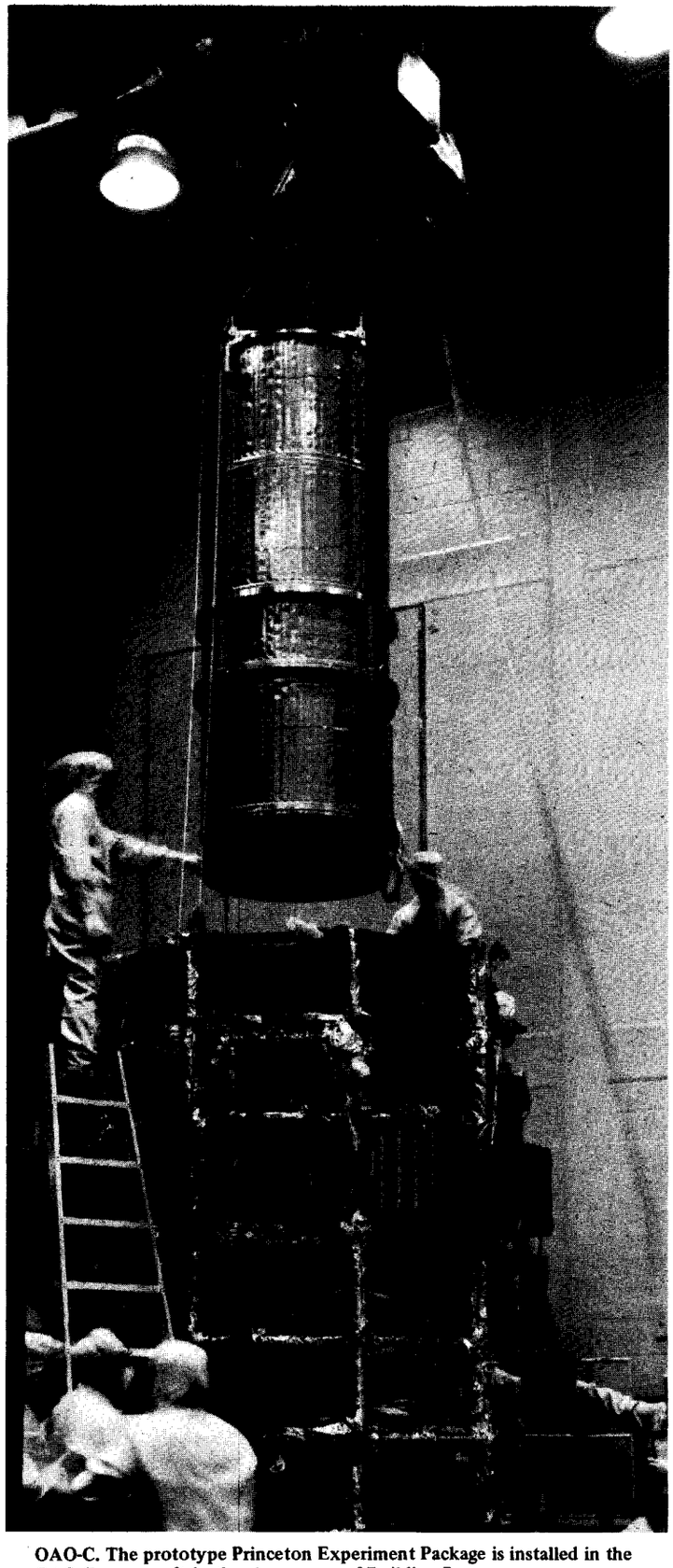
GODDARD NEWS July 12, 1971 Vol. 19, No. 4



OAO-C. The prototype Princeton Experiment Package is installed in the OAO-C spacecraft in the clean room of Building 7.

'In House' Effort Readies OAO-C

A concentrated "in house" effort is underway here with government and contractor teams to prepare the OAO-C spacecraft for launch in 1972. OAO-C, the last and heaviest of the Orbiting Astronomical Observatories, is the third OAO spacecraft to be integrated and tested at Goddard. Earlier spacecraft were OAO A-2 that was tested here by a Goddard crew, and OAO-B that was tested here by the Grumman Aerospace Corporation (GAC) crew.

OAO A-2 was placed into orbit on December 7, 1968, and has been operating satisfactorily for over 30 months. The only operating satellite in the OAO series, it is one of Goddard's most successful spacecraft. Under the direction of OAO Project Manager Joseph Purcell and Project Scientist Dr. James Kupperian, OAO A-2 made possible many scientific breakthroughs including: The discovery of a huge hydrogen cloud a million miles in diameter around the comet Tago-Sato-Kosaka; the discovery that the hottest stars in the universe are even hotter than suspected; and evidence that normal galaxies are unexpectedly bright in the ultraviolet.

OAO-B did not achieve orbit in November of 1970 when the shroud of the Atlas/Centaur launch vehicle failed to open properly. Subsequently the Goddard/Grumman team began work on the OAO-C spacecraft that had been at the Center since April of 1970.

OAO-C, weighing in at around 4900 pounds, will carry two experiments which are also undergoing testing at Goddard. A large telescope designed by Princeton University will operate in the ultraviolet region of the spectrum. A set of smaller telescopes designed by the University College of London will gather stellar data in the x-ray region. (See Pages 6 and 7)

PAET: A Successful Mission

All went well with an Ames Research Center project designed to test a high-speed probe technique for determining the structure and composition of unknown planetary atmospheres.

The Planetary Atmosphere Experiments Test (PAET), an atmospheric probe carrying a Goddard-built mass spectrometer as part of its payload, was launched aboard a Scout rocket from Wallops Island, Virginia, on June 20, 1971. It reentered the Earth's atmosphere at 15,000 miles an hour and impacted about 15 minutes later in the Atlantic Ocean about 600 miles downrange and about 100 miles northeast of Bermuda.

Primary data gathering points for the mission were Goddard's MSFN station at Bermuda and the Apollo Tracking Ship USNS Vanguard. Additional support was provided by the Wallops Island telemetry ship Range Recoverer, and two Advanced Range Instrumentation Aircraft (ARIA).

James E. Murphy, Network Support Manager for the mission, says, "Based on information passed on to me, a quick look reveals that all results were excellent." He went on to say that the PAET (See Page 2)

For news of Apollo 15, see Pages 3 and 4.

GODDARD'S PAET EXPERIMENTERS check preliminary data from the Mass Spectrometer flown on the mission. From left are James L. Shannon, Dan N. Harpold, Jimmy D. Cooley, Nelson W. Spencer and Dr. Hasso B. Niemann.

PAET. . . .From Page 1

trajectory was so accurate that the Vanguard was almost, but not quite, able to recover the capsule. Recovery was a secondary objective and not necessary for PAET success.

The Planetary Atmosphere Experiments Test is one step in providing the technical base necessary for advanced planetary exploration to Mars, Venus, and eventually the outer planets. These missions will require measurements of atmospheric properties. Instruments aboard the PAET capsule were subjected to deceleration forces peaking at about 80 Gs (80 times the force of gravity) similar to conditions that will be encountered on a planetary entry mission.

Experiments aboard the PAET spacecraft gathered data on the Earth's atmosphere structure and composition. Objectives of the atmosphere structure experiment were to determine the pressure, temperature and density changes with altitude and the mean molecular weight of the encountered gas. Accelerometers, pressure sensors, and temperature sensors are included in the instrument package.

Principal investigators for these Ames built experiments are S. C. Sommer, Atmosphere Structure Experiment; and E. E. Whiting, Radiometric Composition Experiment.

Mass Spectrometer

Of special interest to Goddard is a Mass Spectrometer Experiment designed here by principal investigators Dr. Hasso B. Niemann and Nelson W. Spencer of the Laboratory for Planetary Atmospheres. This instrument analyzed gas samples that were drawn into the PAET capsule during atmospheric entry to determine the gas species present in the atmosphere at various altitudes. The system employed an adaptive scan technique which enabled measurements of only those gasses attaining a predetermined concentration level.

"It is too early to say just what our results are," says Dr. Niemann, "but from early examination of the data, everything looks good."

WALLOPS ISLAND, VIRGINIA. The Planetary Atmosphere Experiments Test (PAET) payload section is checked before launch by Robert H. Reynolds and Alfred Boissevain of the Ames Research Center. The capsule was successfully launched on June 20, 1971.

Goddard Mourns...

Virgil McIe, 35, died June 15, 1971, and **Joan Marie McIe**, 27, died June 13. Mr. McIe, of TID's Photographic Section, has been called a "good all-around photographer who was equally adept at taking portraits or technical pictures of Goddard equipment and experiments." His news photographs often appeared in the Goddard News. His wife, the former Joan Bethke, was once a secretary and reporter for the Public Affairs Office. Her column "Goddard Ramblings" was a regular feature in this paper during 1966. The couple met at Goddard and were married in December of 1968.

Virgil McIe

Many Reqests for ERTS Data

NASA has received more than 600 proposals from potential domestic and international users of data expected to be obtained from the Earth Resources Technology Satellites (ERTS) and the Earth Resources Experiment Package (EREP) to be carried on Skylab.

This is the greatest number of proposals for experiments ever received by NASA in response to an announcement of opportunity for analysis of space-derived data.

Government, universities, and industry, foreign and domestic, are interested in a wide range of applications of the data including agriculture, forestry, geography, demography, cartography, geology, hydrology, oceanography, meteorology, environmental quality, ecology and the techniques required to convert sensor data into the desired information.

For example, an experimenter might want to have a certain set of sensors or cameras look at a precise area of a state at certain days and times for estimating crop or timber inventories. A test of such a use would be worthwhile scientifically and, if the sensors were not committed at the same times or days on other investigations, it would be technically feasible.

NASA and the cooperating user agencies, the United States Departments of Agriculture, Interior, Commerce, and Navy and the Corps of Engineers, want a balanced program of research to demonstrate the utility and economy of remote sensing in natural resources and environmental studies.

NASA asked potential users in early February to submit their ideas on how they would propose to conduct experiments to determine the utility of ERTS or EREP data.

Nine proposal evaluation panels in as many disciplines are now meeting near NASA's Goddard Space Flight Center, Greenbelt, Md., to study the proposals from more than 550 domestic and 80 international sources. The panels are composed of more than 100 scientists who are experts in the various disciplines involved.

ERTS-A will be launched by NASA next spring and ERTS-B in 1973. The first Skylab carrying the EREP will be launched in 1973.

APOLLO 15 ASTRONAUTS (from left) James Irwin, Lunar Module Pilot; David Scott, Commander; and Alfred Worden, Command Module Pilot; are shown with the Lunar Rover and the Apollo 15 sub-satellite. The battery-powered Lunar Rover is equipped with a television camera which will be used when the vehicle is parked. It can be controlled from the ground while Scott and Irwin explore the Moon. The sub-satellite will be ejected from the Service Module early in the mission and remain in lunar orbit after the astronauts return to Earth. It will contain particle detectors and a magnetometer, thus providing data to correlate with the surface magnetometer and particle detectors and an S-Band transponder.

Apollo 15 Preview

Apollo 15, slated for launch on July 26, will be the first of three lunar landing missions to use an improved lunar module (LM) that will be capable of delivering to the lunar surface twice as much equipment and scientific payload as in any previous Apollo missions. An improved life support system will double the time the astonauts can work on the moon.

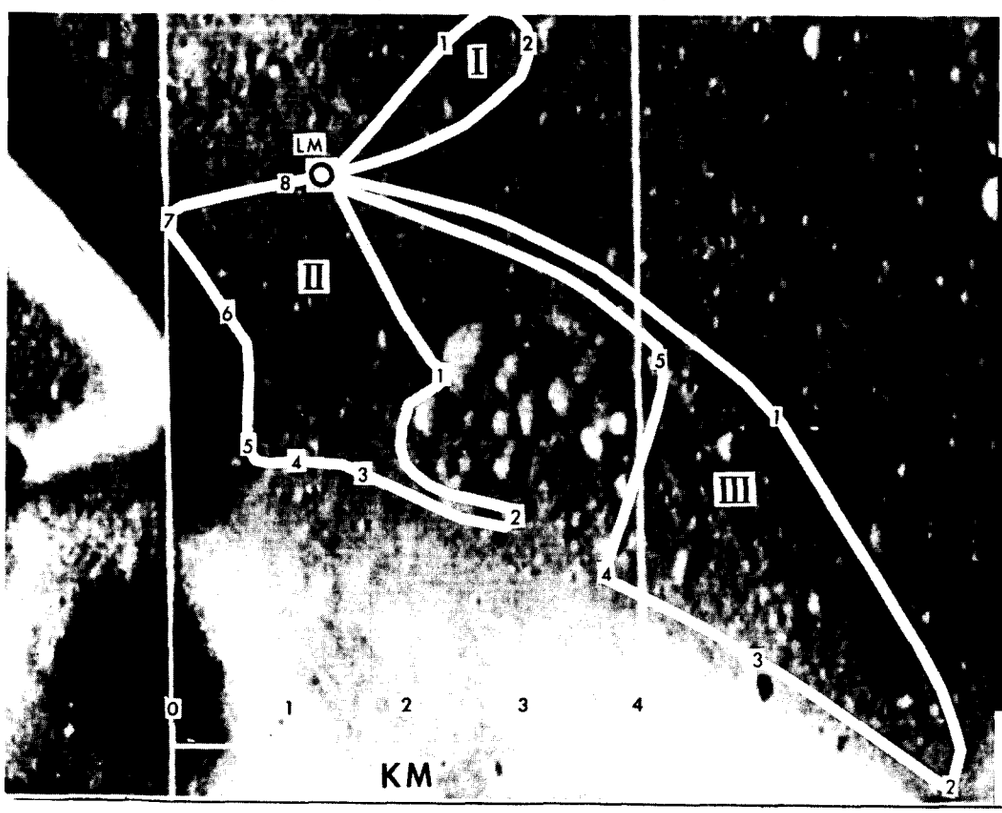
If all goes well, Apollo 15's flight to the rugged Hadley-Appenine region of the Moon will feature the first use of a lunar roving vehicle (LRV) and a new portable color TV camera that can be controlled from the ground to show the astronauts at work during the longest periods of lunar exploration yet to be attempted. When the astronauts leave the Moon, they will leave the camera in place on the LRV several hundred feet from the LM to permit viewers to witness the blastoff for the first time. Later, ground controllers hope to use the camera daily to view such events as an eclipse of the Earth by the Moon on August 6.

Crewmen for this mission are Spacecraft Commander David R. Scott and Lunar Module Pilot James B. Irwin, who will land on the Moon and stay for nearly 67 hours; and Command Module Pilot Alfred M. Worden, Jr.

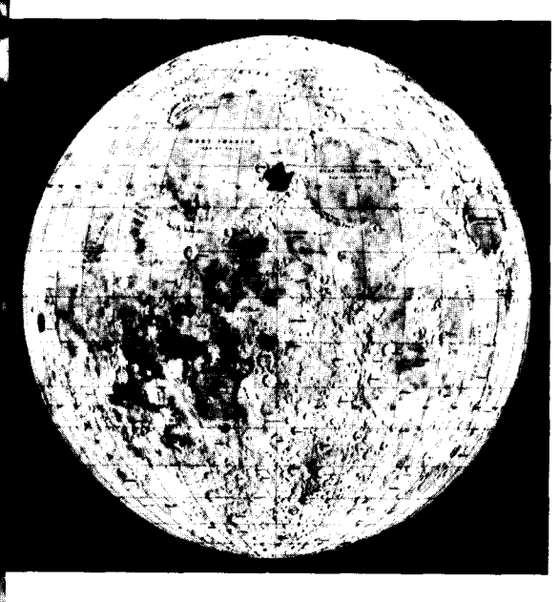
The Apollo 15 mission will include five separate periods of extravehicular activity (EVA). First will be shortly after the lunar landing when Commander Scott stands up on the lunar module engine cover with his head and shoulders out the tip hatch to photograph and describe the landing site. Astronaut Irwin will join Scott for three lunar surface expeditions to the base of the

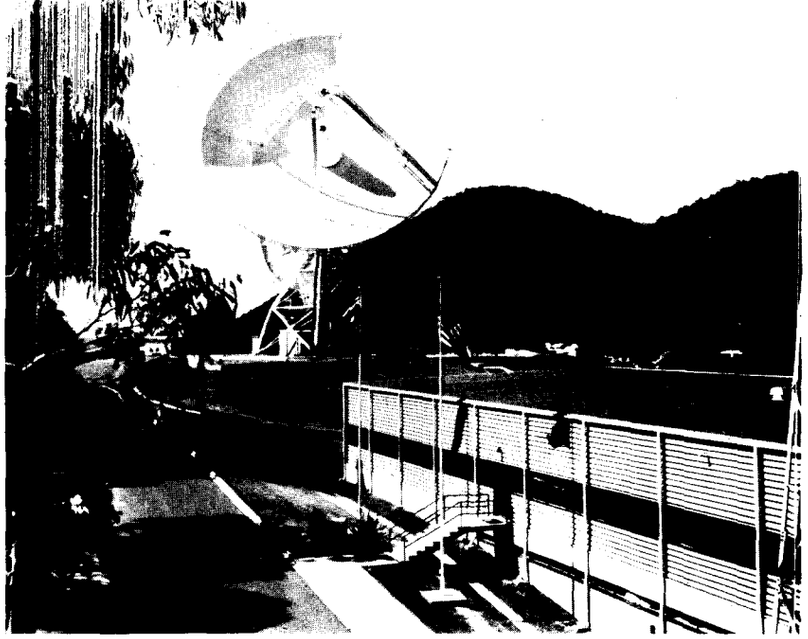
(See Page 4)

LANDING SITE. A Lunar Orbiter Photograph shows the Hadley Appennine North Site, a candidate touchdown point for the Apollo 15 mission. The area is named for the nearby Apennine Mountains and the Meandering Hadley Rille (right), a trench half-a-mile wide, 600 feet deep, and 60 miles long. The white overlay indicates the extent of the three traverses proposed with the Apollo 15 Lunar Roving Vehicle. One statute mile equals 1,609 kilometers (KM). The Hadley-Apennine South Site is located approximately 14½ miles southwest of Hadley North.



ARROW marks the Hadley-Rille near which Apollo 15 will land. The proposed Apollo 15 landing site is about three degrees east of the center of the Moon as viewed from Earth and 25 degrees north of the lunar equator on the edge of the Sea of Rains.





TRACKING STATIONS at Honeysuckle Creek Australia (above); Goldstone, California; and Madrid, Spain, will be the "electronic lifelines" for Apollo 15.

APOLLO. . . .From Page 3

13,000-foot-high Apennine Mountains, to the edge of the mile-wide 1,200-foot-deep Hadley Rille, and to the north of the landing site which has fresh-looking mare and volcanic-like surface features. Alfred Worden will make the fifth EVA on the return to Earth when he leaves the command module to retrieve film magazines from the scientific instrument module.

Experiments conducted on the Moon's surface during Apollo 15 will include a heat flow experiment to measure heat emanating from beneath the lunar surface; a passive seismometer to measure meteoroid impacts and moonquakes; a tri-axis magnetometer to measure the magnetic field; a solar wind spectrometer to determine the nature of the solar wind's interactions with the Moon; a suprathermal ion detector to provide information on the energy and mass of positive ions close to the lunar surface; a cold cathode ionization gauge to measure the density of neutral particles in the lunar atmosphere; a lunar dust detector; and a laser reflector larger than those left by Apollos 11 and 14 for precise measurements of the distance between the Moon and Earth.

Tracking and communications support for the mission will be provided by Goddard's Manned Space Flight and NASA Communications networks (MSFN and NASCOM). Key MSFN stations at Goldstone, California; Honeysuckle Creek, Australia; and Madrid, Spain, will serve triple duty as the "electronic lifelines" for the astronauts, TV links and data acquisition and command transmission points for some of the Apollo experiments. Additional mission and TV coverage will come through the 210-foot antenna at the Deep Space Network at Goldstone and a radio astronomy antenna of the same size at Parkes, Australia. Linking the entire system with the Mission Control in Houston will be the switching centers of the NASCOM.

Splashdown for Apollo 15 is set for August 7 in the Pacific at 4:46 p.m. Unlike previous Apollo missions, there will be no post mission quarrantine. Studies of the effects of past Apollo flights and quarrantines have demonstrated that there is no hazard to man, animal or plants from lunar materials.

The prime recovery ship for Apollo 15 is the helicopter landing platform USS Okinawa.

Apollo 15 command module call sign is "Endeavour," and the lunar module is "Falcon." As in all earlier lunar landing missions, the crew will plant an American Flag on the lunar surface near the landing point. A plaque with the date of the Apollo 15 landing and signatures of the crew will be affixed to the LM fromt landing gear.

Apollo 15 backup crewmen are USN Capt. Richard F. Gordon, Jr., commander; Mr. Vance Brand, command module pilot; and Dr. Harrison H. Schmitt, lunar module pilot.

Goddard Apollo 15 Investigators

Goddard people are prime investigators or co-investigators for three of the four experiments which make up an integrated geo-chemical experiment carried as part of the eight experiments in the Scientific Instrument Module (SIM) bay aboard the Service Module. They are:

Dr. Isidore Adler, Principal Investigator; Dr. Jacob Trombka, Co-investigator; and Richard Schmadebeck, Goddard Project Engineer for the X-Ray Flourescence Spectrometer.

Dr. Jacob Trombka, Co-investigator with Principal Investigator Dr. James Arnold of the University of California at San Diego for the Gamma-Ray Spectrometer.

Dr. Jacob Trombka, Co-investigator with PrincipalInvestigator Dr. Paul Gorenstein of American Science and Engineering, Inc. for the Alpha-Particle Spectrometer.

Another Goddard man, Lawrence Dunkleman, is Principal Investigator for the Gegenschein from Lunar Orbit experiment, a Command Service Module experiment not carried in the SIM bay.

Apollo Mission Events

Event	Time from Liftoff (Hr/Min)	Date
Launch		9:34 am July 26
Earth Orbit Insertion	00:12	9:46 am
Trans Lunar Injection	2:50	12:24 pm
Lunar Orbit Insertion	78:31	4:05 pm July 29
Descent Orbit Insertion	82:40	8:14 pm
Spacecraft Separation	100:14	1:48 pm July 30
Lunar Landing	104:42	6:15 pm
Lunar Exploration I	119:50	9:24 am July 31
Lunar Exploration 2	141:10	6:44 am Aug. 1
Lunar Exploration 3	161:50	3:24 am Aug. 2
Lunar Liftoff	171:38	1:12 pm
Spacecraft Docking	173:30	3:04 pm
Trans Earth Injection	223:44	5:18 pm Aug. 4
Trans Earth EVA	242:00	11:34 am Aug. 5
Pacific Ocean Splashdown (26° N. Lat./158° Long.)	295:12	4:46 pm Aug. 7

Tentative Apollo 15 TV Schedule*

Day	Date	EDT	Duration	Activity
Mon	July 26	12:59am	25 min.	Transposition and docking
Tues	July 27	7:20pm	45 min.	IVA to LM
Fri	July 30	10:22am	14 min.	Landing Site out window
Sat	July 31	9:34am	6 hr. 40 min.	EVA 1
Sun	Aug. 1	7:09am	6 hr. 25 min.	EVA 2
Mon	Aug. 2	3:49am	5 hr. 45 min.	EVA 3
Mon	Aug. 2	1:04am	30 min.	LM liftoff
Mon	Aug. 2	2:37pm	6 min.	Rendezvous
Mon	Aug. 2	3:00pm	5 min.	Docking
Thur	Aug. 5	11:44am	30 min.	Trans-Earth EVA
Fri	Aug. 6	4:00pm	30 min.	Trans-Earth Coast

***Based on nominal liftoff at 9:34 a.m. EDT Monday, July 26, 1971**

DATA TOPICS

MARINER DATA. From Left, Donald Yoemans, Robert Niemeyer, James Ryan, Principal Investigator of the MM 71/USB T&C Experiment; and James Jackson look at Unified S-Band tracking data from the Mariner '71 spacecraft.

Mariner Mars'71 Tracking and Calibration Experiment

By James W. Ryan
of the
Network Computation and Analysis Division

The goal of the Mariner-Mars 1971 Unified S-Band Network Tracking and Calibration Experiment is to determine improved geodetic coordinates for the USB Network sites, and to gain experience using the network to track spacecraft in deep space.

To date, the Goddard Unified S-Band Tracking Network has provided prime tracking support to eight Apollo missions and two TETR satellites, plus limited support to numerous scientific satellites. In every case, the quality of tracking data provided by the USB Network exceeded that which was required for mission success by a comfortable margin. In fact, the precision landings achieved in Apollo's 12 and 14 were largely made possibly by extremely high quality of high speed doppler data provided by the USB Network. One of the principal reasons for this record of success is the continuing inherent accuracy program in the USB Network, the goal of which is to define and, as far as practical, eliminate all sources of error effecting USB data. This program began in 1968 with the Apollo Ground Operational Support System (GOSS) Navigation Qualification Program, which used the Lunar Orbiter satellites as targets of opportunity to qualify the USB Network as the prime navigation tool for the Apollo Program. Some of the later results of this inherent accuracy program included the introduction into the network of the Loran-C Epoch Time Generation System and the Apollo Time Correlation Test. A recent result is the implementation into the network of the Time Increment Resolver, which has decreased the noise of high speed doppler data by a factor of twenty and the noise of low speed doppler data by a factor of ten. It was in the context of this inherent accuracy program that the Mariner Mars 1971 Unified S-Band Tracking and Calibration Experiment was conceived.

The values of the geodetic coordinates of the sites in the USB Network are the results of diverse programs which have been carried out over a number of years. Some of the values are the results of ground surveying across the United States and Australia, while others are the results of the Navy Tranet satellite program. Still other values have been derived from very precise analysis of the tracking data generated during the Gemini and Apollo flights. Due to this effort the USB Network site locations are now known to an accuracy of 30 meters in latitude, longitude and geocentric radius. The error could be a little larger for some of the isolated island sites. The Jet Propulsion Laboratory using S-Band doppler tracking of the Mariner spacecraft claims an accuracy of less than 5 meters for longitude and distance off the Earth's spin axis for the sites of the Deep Space Network.

It is the principal goal of the Mariner Mars 1971 USB Tracking and Calibration Experiment to use the Mariner Mars 1971 spacecraft as a target of opportunity for obtaining geodetically oriented tracking data. It is hoped that this experiment will at one time define accurately the relative geodetic parameters among the sites of the USB Network and also tie the entire USB Network closely to the Deep Space Network which is already known very accurately in an absolute sense.

The Tracking and Calibration Experiment has three phases; a launch phase, a cruise phase, and Mars orbit phase. In the now completed launch phase, ten of the twelve USB Network sites tracked the Mariner spacecraft continuously for ten days following launch. In this interval more than 700 hours of three-way doppler tracking data was recorded; or to state it more meaningfully, the data from this launch phase tracking exercise alone is more valuable for geodetic purposes than the tracking data from all Apollo missions combined. In the cruise phase of the experiment there are three tracking periods of five days each. In each of these periods, all sites except for the wings are to participate. The first cruise phase occurred from June 27 until July 2, 1971. The second and third periods are scheduled to occur this coming October. There are two experiment periods tentatively scheduled for December after the spacecraft has gone into orbit about Mars.

If all goes as planned within the next year, the distance off the Earth's spin axis and longitude of the sites in the Unified S-Band Network will be known with an error of less than five meters. This should suffice for all the missions in the foreseeable future.

Canadian-U.S. Agreement Using ERTS

Canada and the United States have agreed to a joint program for use of satellites and aircraft in surveys of the natural environment. The satellites will be launched by NASA.

Objective of the program is the advancement of remote sensing technology for the monitoring of air, water, land, forest and crop conditions, and the mapping of ice movements and ocean currents in Canadian and American waters. Mapping of geologic, hydrologic, vegetation and soil phenomena will also be carried out.

Under the agreement, the Canadian Department of Energy, Mines and Resources (EMR) will receive data directly from NASA's Earth Resources Technology Satellites (ERTS) scheduled for launching in 1972 and 1973. The Canadian ground readout station will be located in Prince Albert, Saskatchewan, and the data handling facility in Ottawa, Ontario. Canadian and U.S. test areas will be designated and "ground truth" and aircraft data relating to these areas will be acquired and exchanged as mutually agreed.

A joint working group will serve as the mechanism for carrying out the program. There will be no exchange of funds between EMR and NASA.

The agreement, signed by Canadian Ambassador Mercel Cadieux and Director Herman Pollack, Bureau of International Scientific and Technological Affairs, Department of State on May 14, designates the EMR and NASA as the implementing agencies.

ERTS data acquired by NASA and EMR will be made available as soon as practicable to the international community.

From Page 1. . .

OAO-C Buildup

Currently the OAO buildup efforts are being concentrated on the Early Thermal Vacuum Test (ETV). The spacecraft's 48 bays, forward and aft ends, and the sun baffles will be covered with heated skins for this test. Over 600 thermocouples are installed. Each bay has its own thermal design, and the thermal insulation for each bay as well as the instrumentation assembly on each of the equipment heat sinks requires a major buildup effort.

The early Thermal Vacuum Test is used primarily to qualify the spacecraft thermal design, but will also be used to check all equipment including the prototype experiments. Following ETV, the flight experiments will be installed and integrated. Any spacecraft changes will be incorporated and the spacecraft will undergo functional testing and final bay closeout in preparation for the acceptance test program. The acceptance tests consist of a shorter thermal vacuum test, a fine guidance test to demonstrate the 0.1 arc second pointing accuracy, and an "all up" vibration test with balance booms, solar arrays, and sun baffles installed. If all goes well, OAO-C will be shipped to Florida for eventual launch aboard an Atlas/Centaur from Cape Kennedy in the first half of 1972.

The OAO program features not only the largest and heaviest Goddard spacecraft, but also the biggest "in house" effort. The total number of Goddard, university, Grumman and other contractor personnel supporting the program in Building 7 alone comes to about 173 people.

Key men responsible for the spacecraft integration and test effort are: Robert Schlechter, OAO Integration and Test Manager; Gerald Hempfling, Assistant ITT Manager; Robert Weaver, Engineering Staff Supervisor; Philip Tischler, Field Operations and Test Manager for Grumman and Earl Light, Grumman Field Base Manager. Project Experiment Systems Engineers for the PEP and UCL in-house programs are Richard White and Martin Eiband. They are assisted by Joseph Stecher, T&E Experiment Support Manager. Don Hortenbach of Princeton University and Dr. Peter Sanford of University College of London are the university representatives at Goddard.

KEY OAO PERSONNEL review spacecraft buildup. Progress must be good! From left are: T. Stinis, GAC Subsystem Eng. Supr., R. Schlechter, GSFC I&T Manager; J. Purcell, Project Manager; E. Light, GAC Field Base Manager; R. Weaver, GSFC I&T Eng. Staff Supr.; and T. O'Meara, GAC Tech. Assistant to OAO Field Manager. G. Hempfling, Asst. I&T Manager is not shown.

GRUMMAN Test and Mission Support Personnel responsible for the XDS 930 Ground Station are from left Charles G. Cavey, Jr., Sebastian Parisi, John A. Aymar, Alfio Nicotra, Harvey A. Rabinowitz, Jay C. Petersen, Patricia A. Lozinski, Pat H. Sullivan, Richard J. Pasquini, Joseph B. Germain, Heinz Albert, Ronald L. Johns and William Wilde.

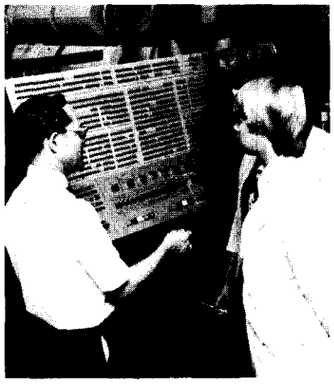
OAO is our most complex and commensurate engineering team. involved in the integration and tes on the floor of Building 7 to show are (first row, front) J. Low, J Toretta, D. Bishop, W. Anderson, and D. Margolies. Second row: T. D. Wink, J. Piccone, and J. Gilbert Engineering personnel involved in Sargent, Observatory Systems M Manager; Jerry Kull, Stabilization Power Systems Design Branch; C Branch; Stan Ollendorf, Thermopi E. Observatory Support Manager. Th Laurita, P. Tischler, R. Schlechter, F M. Falk, M. Clark, P. Drapala, L. O'Hara, C. Christensen, R. Sava, W Matos, and K. Bauman.

REPRESENTATIVES OF THE various organizations contributing to the Princeton Experiment Package (PEP) program in Building 7 are shown here. The test console, two of which have been built by T&E, will facilitate greatly the operation of the experiment in both the ground test program and orbital operations. Front row: D. Belluche, of Sylvania; D. Hershfeld, D. York, D. Horenbach, of Princeton University (P.U.); R. Schleifer, Perkin Elmer; and J. Drake, P.U. In back are: P. Gross, R. White, R. Morgan and L. Medico, Perkin Elmer.

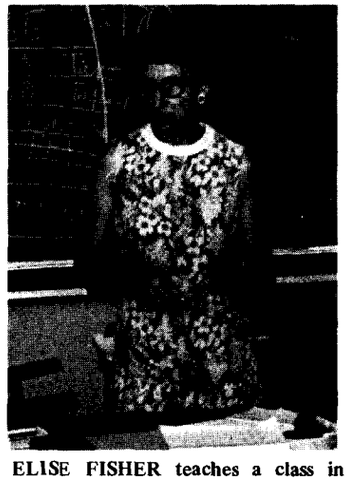
PARTICIPANTS in the Summer Institute in Computer Applications are (from left, seated) Darlene Solquitt, Janet Allen, Sharon Jones, Jacqueline Garnett, Program Director Dr. Peggy Bannister, Cherrill Bradshaw, Nellie Howard, Paula Spears, and Regina Miller. Standing are Celeste Dixon, Randy King, James Dorsey, John Worthy, Henry Edmunds, Roland Wilson, Roy Gibbs, Raymond Whitley, and Gwendolyn Trent.

DR. PEGGY BANNISTER (left), of Bowie State College, acts as both director of the Institute and student counselor. Here she discusses the program with returnee students (from left, back) Jacqueline Garnett, Henry Edmunds, Celeste Dixon, Roy Gibbs and Darlene Colquitt. At the typewriter is Brenda James, a sophomore from Bowie State who is acting as secretary for the Institute.

Summer Computer Institute Begins Second Year



NEW STUDENTS observe actual operations at the instrument panel of the IBM 360 as part of their training in computer concepts under the instruction of supervisor Girard Griffith.



ELISE FISHER teaches a class in Fortran IV computer concepts to the new students in the Institute.

SECOND YEAR STUDENTS Jacqueline Garnett and Darlene Colquitt use CRBE on the computer terminals in order to solve problems directly related to their project assignments under the supervision of project leaders Dennis Giblin (left) and Oliver Clark.

The Summer Institute in Computer Applications began its second season on June 14, 1971, and will continue until August 20. Sponsored jointly by Goddard and Bowie State College, the program is designed to give selected students from predominately black colleges a chance to learn basic computer fundamentals and try their hands at on-the-job projects in computer programming and applications. The unique range of computer resources needed on Center to carry out Goddard's many programs gives the students a close-up look at computer applications ranging from managerial information retrieval, through the determination of orbital parameters for manned and unmanned spacecraft, to the analysis of data from scientific satellites.

Beginning last year with 12 undergraduate students, the program has expanded this summer to include 18 students, five of them returnees. Each student is a sophomore or above with a 3.0 cumulative grade average, and each student receives $100 per week to cover expenses. This year they come from Bowie State College, Cheyney State College, Delaware State College, D.C. Teachers College, Federal City College, Howard University, Coppin State College, Lincoln University, Morgan State College, the University of Maryland-Eastern Shore, and Washington Technical Institute.

The institute is divided into two sections—one for first year students and one for returnees. The first section, taught by Elise Fisher of the Theoretical Studies Branch, covers computer utilization concepts, Fortran programming and basic job control language. Advanced students are taking two "programmed-instruction" courses which allow them to study on their own with guidance from their instructors only when needed. William Wildes of the Theoretical Studies Branch, is instructor for the course in advanced Fortran, and Dennis Giblin and Sue Burrowbridge, both of Space and Earth Sciences Computing Center, are instructors for the second advanced course in assembly language. Both sections include seminars and tours of Goddard and other computer centers. In each case, three weeks are devoted to course work, six weeks to work on individual projects of benefit to both the students and Goddard, and a final week is set aside for writing papers on the projects. Students completing the program receive four college credit hours.

The Summer Institute in Computer Applications was initially organized by Hans Bremer, Dr. Albert Fleig, Melba Mouton and Evmenios Damon and is now run for Goddard by Bowie State College under the direction of Dr. Peggy Bannister. Goddard people acting as advisors for the students are: Pete Bracken, Susan Burrowbridge, Wrandle Barth, Oliver Clard, Herb Durbeck, Dennis Giblin, Hank Haugen, John Morton, Bruce Bromberg, Dave McGlew, Robert Nelson, Karl Peters, Lloyd Purves, Allan Silver, Walt Truszkowski, Larry Sapper, and James Andary.

F. FIGLER (right) and J. Conlon of Grumman test a spacecraft circuit with a break out box.

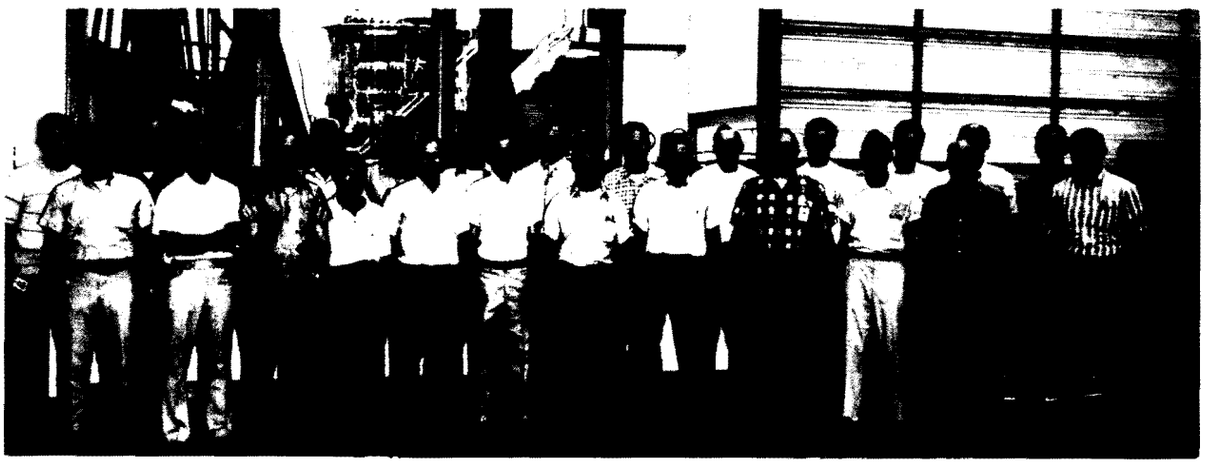
GODDARD AND GRUMMAN Engineers check out the On Board Processor (OBP), a ground programmed computer which will be flown on OAO-C. Shown are R. Sava, J. Piccone, G. Daelesman, L. Kearney, J. Kull, W. Stewart and T. Taylor.

GODDARD AND GRUMMAN Quality Engineers and Inspectors assigned to the OAO program in Building 7 are (from left, front) M. Wypler, J. McCormack, N. Giovannetti, J. Schwarze, and A. Martines. In back are: A. Bellisimo, N. Sawchuck, W. Kappus, M. Falk, T. Gunshinan, J. Rothenburg and J. Kearney.

largest spacecraft and requires a
Goddard and Grumman personnel
of spacecraft C are shown grouped
se dimensions of this effort. Shown
anner, L. Martin, J. Stivaletti, E.
. Daelemans, J. Ritchie, R. Weaver
ook, R. Fiscum, C. Shult, T. Stinis,
Other key Goddard and Grumman
he program and not shown are: J.
anager; Bill White, Experiment
t Control Branch; John Fairbanks,
rles Hoffman, Flight Data Storage
sics Branch; and Bill Meyer, Tano
ird row: C. Jackson, R. Karcher, L.
. Figler, T. Blixt. Fourth row (rear)
Nevala, B. Rudow, L. Beasley, S.
. Tittley, L. Olshan, J. Medler, D.

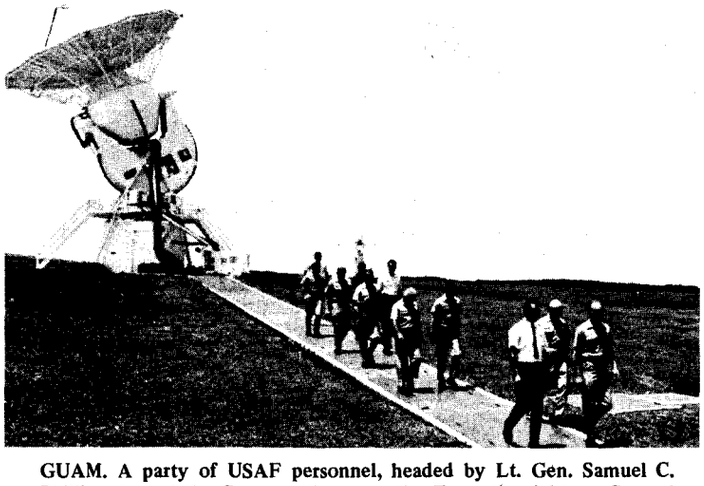
THE TEST AND EVALUATION DIVISION plays a large tole in the OAO experiment qualification and acceptance test program. One of their contributions is the University College of London (UCL) experiment test console (hardware and software provided by T&E). Shown here are (from left, front) J. Ives, F. Hawkins, both of UCL; and T. O'Neill. In back are: J. Muller, M. Boniface of UCL, M. Falk, J. Stecher and R. Burda. Missing is Martin Eiband, GSFC Project Experiment Coordinator, who was roughing it in England.

OAO SUPERVISORS, Quality Engineers and Technicians enjoying a brief respite from the restrictive operating environment of the clean room. From left are: J. Baumann, J. Conlon, H. Shultis, C. Moubray, W. Taylor, S. Meade, W. Hoffman, T. Diaz, T. Long, L. Despang, E. Mountain, and F. Kuklman. Second row (rear): P. Francis, S. Rechardt, G. Croft, C. Bayle, L. Featherstone, R. Bournschein, R. Demme, W. Kappus, M. Wypler, M. Clark, A. Englehart, V. Farinola, C. Diekman and M. Maurico.



GODDARD AROUND THE WORLD

BERMUDA. Bronze plaques appearing on the entrance to the dependents schools at the Bermuda Naval Air Station were designed and procured through personnel at the Bermuda Tracking Station. NASA Station Director Daniel S. Hunter presented the two plaques at the dedication ceremonies of the Roger B. Chaffee school. The school was named after Navy Lieutenant Commander Chaffee in keeping with Navy tradition of naming its schools after Naval heroes.Chaffee was one of three astronauts who died in a spacecraft fire atop a Saturn launch vehicle during simulated countdown of the first manned Apollo mission in January of 1967. Choice of Chaffee's name is particularly appropriate, said Hunter, "because the base is also the site of the NASA tracking station." Here Mr. Hunter (center) presents a plaque commemorating Mr. and Mrs. Daniel L. Chaffee's visit to Bermuda for the dedication of the school in their son's name. Wylie McMillan (left), assistant station director, and William May (right), assistant M&O supervisor, look on as Chaffee admires the handcrafted plaques.



GUAM. A party of USAF personnel, headed by Lt. Gen. Samuel C. Phillips, toured the Guam station recently. From the right are General Phillips, now Commander of the Air Force Space and Missile System Organization (SAMSO); Col. Glen Dunlap, Commander of the 43rd Strategic Wing SAC; Richard Hynson, Guam USB Supervisor; Capt. Wormington, Col. Grottle, and Capt. Rye, all of SAMSO; Brig. Gen. Evelle Younger, Atty. Gen. of California; Charles Force, Guam Station Director; Col. Gandy, Vice Commander of SAMTEC; Tom White, Guam M&) Supervisor; and Lt. Ronn Hamrah, SAMSO.

CORPUS CHRISTI, TEXAS. Station Director Lynn F. Woodward says this picture shows a routine day for the security guards at the Network Tracking Station at Corpus Christi. Two rattlesnakes were killed in the vicinity of the Acquisition Aid Complex in one day. Holding the snakes is Chief Guard Roger Lozano, who is 5'6" tall. The bigger of the two snakes had 12 rattles.

Steve Yednock Has Personal Interest in Apollo 15

Stephen Yednock, a teletype operator in the Networks Communications Center in the Basement of Building 14, has a personal interest in the success of the Apollo 15 mission. While in the U.S. Air Force, Steve was assigned to the Apollo Range Instrumented Aircraft (ARIA) Control Center at Patrick Air Force Base in Florida and took part in the Apollo 12, 13, and 14 missions.

While at Patrick AFB, Steve often came in contact with the Apollo astronauts. After they had finished their training flights, they would stop by to have a cup of coffee and "shoot the breeze" with the man on duty. Steve says he met nearly all the astronauts during this period and that they are really a "great bunch of guys."

Mr. Yednock was discharged from the Air Force in April of 1971 and one month later started to work in the Control Center Section as a teletype operator in Goddard's Manned Space Flight Program.

THEN. Stepehn Yednock in his ARIA days with the Air Force poses with David R. Scott, commander of the up-coming Apollo 15 mission.

NOW. Mr. Yednock prepares a message for teletype transmission from Goddard's Networks Communications Center.

Plans Underway for TDR Satellites

A pre-proposal conference for a study of a Tracking and Data Relay Satellite System (TDRESS) was held here June 23, 1971. Purpose of the study is to provide NASA with design and cost information on Tracking and Data Relay satellites and the interfacing elements of an overall system.

NASA engineers believe current technology in communications satellites has evolved to a point where it is practical to consider using a TDRS System as an integral part of the tracking and data acquisition networks. The TDRSS as envisioned would provide extended coverage and service to satellites in near Earth orbit, or up to 3,100 miles (5,000 km) altitude.

NASA intends to award two separate and concurrent contracts for definition studies of the TDRSS. Major elements of the system include: spacecraft, user telecommunications system, ground station, and Network scheduling and operations control center.

The overall TDRS System will include two geo-synchronous satellites, either spin or three-axis stabilized, positioned approximately 130 degrees apart, both being viewable from a common point in the United States.

The study is to be conducted in two phases. The initial study phase will provide preliminary design and cost factors for the satellites, spacecraft tracking, telemetry and command system, telecommunications service system and associated ground station to service a reference set of user spacecraft. Part II of the study is to detail necessary changes required to provide increased telecommunications service to higher data rate users.

Study management is the responsibility of Goddard, under the direction of NASA's Office of Tracking and Data Acquisition. George Q. Clark is Chief of the TDRSS Study Office here at Goddard.

First NASA/Morgan State Research Program Begins at Goddard

The first NASA/Morgan State Summer Research program began here at Goddard on June 14. During this eight-week period, the following participants are devoting full time to the investigation of current Center problems: Dr. Gladys Bradley, Mrs. Patricia E. R. Low and Charles F. Roberson of Morgan State College: Mrs. Valerie N. Bush of Delaware State College; Johnney Gills, Jr. and Joe L. Padgett of Howard University; Dr. Adnan M. Haider of the University of Maryland-Eastern Shore; and Mark J. Rockman of Bowie State. The Director of the Program, Dr. ohn W. King, is Professor of Biology at Morgan State College.

The program is designed to acquaint its participants with the educational opportunities available at Goddard and to strengthen the scientific and technological competence of universities in areas of interest to NASA. It also stimulates participation in NASA research by the faculties of Negro colleges and universities.

USING VINTI'S POTENTIAL, Charles F. Robinson, Assistant professor of Physical Science at Morgan State College, investigates solutions of Laplace's Equation.

DR. ISADORA POSEY, Associate professor of Chemistry at Federal City College, makes chromatographic separation of organic contaminants generated in spacecraft-related experiments.

VALERIE N. BUSH, Instructor of Biology at Delaware State College, detests and counts bacteria with the aid of a photomultiplier microphotometer.

MICCO Builds Goddard Consoles

NEW CONSOLES for the Operations Control Center are being integrated and tested for Goddard by MICCO Industries, a company created to give training and steady employment to minority groups unemployed and underemployed people in the Shaw community of Washington, D.C. Here one of the consoles is inspected by (from left) Dr. Michael J. Vaccaro, Director of Administration and Management at Goddard; D.C. Congressman Walter Fauntroy, Donald Yancey, President of MICCO Industries; and William Borton, of Fairchild Industries. MICCO Industries specializes in electronic fabrication, integration and testing, and since it began its first Goddard contract in May of 1970, has handled jobs of increasing complexity for the Center. The company was first established in February of 1968 by Fairchild and the Inner-City Community Organization (MICCO) of Washington, D.C., but is now run entirely by MICCO.

Lewis Research Center Celebrates 30th Anniversary

To help celebrate its 30th anniversary, the Lewis Research Center invited former employees now working at Headquarters, other NASA installations and retirees back to the laboratory.

A week-end-long celebration is planned to commemorate the occasion. On Friday, July 16, special ceremonies for employees, retirees and other dignitaries will be held in the hangar starting at 4:00 p.m. The annual employees picnic will follow the hangar ceremonies and continue the anniversary theme. On Saturday and Sunday, July 17 and 18, fifteen to 20,000 people are expected to attend open house being held for the general public.

A large number of special exhibits will be set up at the hangar for the various events. Reciprocating engines and turbojet engines representing the early work of the laboratory are being loaned to Lewis by the National Air and Space Museum of the Smithsonian Institution. In addition, the Apollo 8, Gemini 7 and Mercury MR-2 spacecraft will be on display.

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