Space News ROUNDUP!

VOL. 4 NO. 6 MANNED SPACECRAFT CENTER, HOUSTON, TEXAS JANUARY 6, 1965

MSC-Florida Operations Transferred To KSC

About 500 employees of the Manned Spacecraft Center's Florida Operations were transferred to the Kennedy Space Center effective January 1, under a realignment announced Dec. 24, 1964 by NASA Headquarters. G. Merritt Preston, manager, MSC-Florida Operations, becomes deputy director of Launch Operations under the realignment.

Elements of the manned space flight organization were realigned to meet the requirements imposed by concurrent Gemini and Apollo launch schedules.

Dr. George E. Mueller, associate administrator for Manned Space Flight, said the key organizational changes that became effective January 1, are:

1. Creation of a new position, mission operations director, Office of Manned Space Flight (NASA Headquarters, Washington), to which E. E. Christensen has been appointed. This position replaces the position of deputy associate administrator for Manned Space Flight Operations, which has been vacant since Dr. Walter C. Williams resigned April 24, 1964, to join the Aerospace Corporation.

2. Creation of two mission director positions. The mission directors, reporting to the mission operations director, will work from Washington, and will have overall responsibility for the mission to which they are assigned.

3. Creation of an Operations Support Requirements Office (OSRO) in the Office of Mission Operations. Program requirements for support of manned space flight operations will be reviewed, coordinated, and transmitted through this office to other NASA offices and centers, and to the Department of Defense and other government agencies. Porter Brown, now head of the Manned Spacecraft Center's Operations Support, Plans and Programs Office at the Kennedy Space Center, will become director of OSRO.

The Operations Support Requirements Office will provide a single channel and point of contact for support requirements submissions; however, the details which must be worked out within the agency and the Department of Defense on a day-to-day basis during implementation of support of manned launches will continue to be handled at the operating levels.

4. Transfer of the Manned Spacecraft Center's Florida Operations to the Kennedy Space Center and establishment of the position of Director Launch Operations. The transfer of the MSC group will place the responsibility for assembly, checkout, and launch of the total Apollo space vehicle with a single organization.

Dr. Kurt H. Debus is the director of NASA's Kennedy Space Center and Albert F. Siepert is the Center deputy director. Under the revised organization, Dr. Debus will also act as the director, launch operations, and G. Merritt Preston, who has supervised the

G. MERRITT PRESTON

MSC Florida Operations, will become the deputy director, Launch Operations.

Within the launch operations area, three operating elements will be headed by assistant center directors: Launch Vehicle Operations by Dr. Hans F. Gruene: Spacecraft Operations by John J. Williams and Information Systems by Karl Sendler.

In addition, the new positions of director, Plans, Programs and Resources and assistant director for Support Operations filled by Lt. Col. Rocco A. Petrone and Lt. Col. Raymond L. Clark, respectively, relate to the former positions of assistant director for Program Management and assistant director for Technical Support Operations. The post of assistant director for Administration was filled by George E. Van Staden, effective January 4.

As a final realignment the Launch Support Equipment Engineering Division and the Facilities Engineering and Construction Division will report to the new position of assistant director for Engineering and Development. Col. Aldo H. Bagnulo will act in this position, in addition to his heading the Facilities Engineering and Construction Division.

"The realignment provides for the efficient carrying out of launches in the upcoming manned space flight missions," Dr. Mueller said, "organizational responsibilities and relationships between the NASA Centers and Offices directing, managing, and supporting the manned flight effort are simplified and strengthened."

In Cross-Country Flight—

Apollo Spacecraft Adapter Delivered By Helicopters

A team of Army helicopters delivered the first dummy Apollo spacecraft adapter to the Kennedy Space Center at Merritt Island, Fla. on December 29, in a cross-country flight from Tulsa, Okla.

The conical-shaped unit structurally simulates the adapter section that will house the Apollo lunar excursion module (LEM) on its trip to the moon. Upon arrival, it was transferred by crane to a special flatbed trailer and moved to the Pyrotechnic Installation facility in the Merritt Island industrial area.

The 4,700 pound, 28-foot tall unit made the cross-country trip from Tulsa, Okla. to Merritt Island in just over 36 hours, slung under an Army CH47A helicopter. A second helicopter provided inflight visual checks, served as a backup carrier, and supplied landing directions for the primary carrier. Three refueling stops were scheduled enroute.

Because of the size of the adapter unit—22 feet in diameter at the base—transportation by road, water, rail or even the modified "pregnant guppy" airplane used to deliver spacecraft modules to the Cape, proved impractical. NASA studies showed the helicopter method to be more practical and more economical.

This adapter mock-up will not

(Continued on page 7)

Moon Blink Net To Locate Color On Lunar Surface

A moonwatch network has been organized by NASA to assist with development and operation of the "Moon Blink," an instrument designed to verify and locate color on the lunar surface.

When alerted by one of the stations, the watchers at scattered distant points will train their telescopes on the Moon to verify a sighting. Professional and amateur astronomers at some 35 stations are working with NASA to give volunteer assistance to the Moon Blink program. They are linked by long-distance telephone.

The instrument is being developed by NASA's Office of Advanced Research and Technology under contract with Trident Engineering Associates, Annapolis, Md. It consists essentially of rotating color disks which appear to blink when red color

(Continued on page 7)

AFSC Commander Visits Center

GENERAL VISITS MSC—Gen. Bernard A. Schriever, commanding general of the U.S. Air Force Systems Command, a recent visitor to the Center, is shown as he gets "checked out" in the Gemini Docking Simulator in Building 260.

Gemini Spacecraft-3 Delivered To Cape

The Gemini spacecraft in which Astronauts Virgil I. Grissom and John W. Young will make the nation's first two-man flight this spring arrived at the Kennedy Space Center Monday.

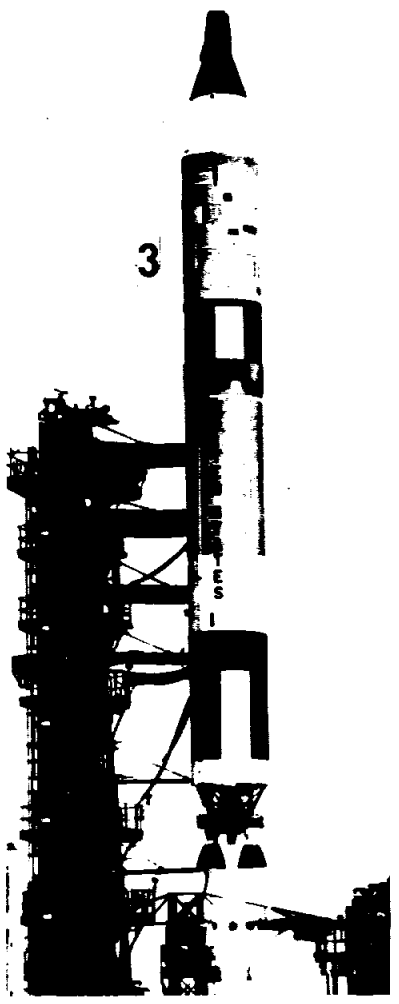
The spacecraft was moved from McDonnell Aircraft Corp., St. Louis, to the Kennedy Space Center for final flight preparation. Delivered to the Cape Kennedy skid strip by a C-124 aircraft, the spacecraft, designated GT-3, was moved by a special transporter to the pyrotechnic installation building on Merritt Island.

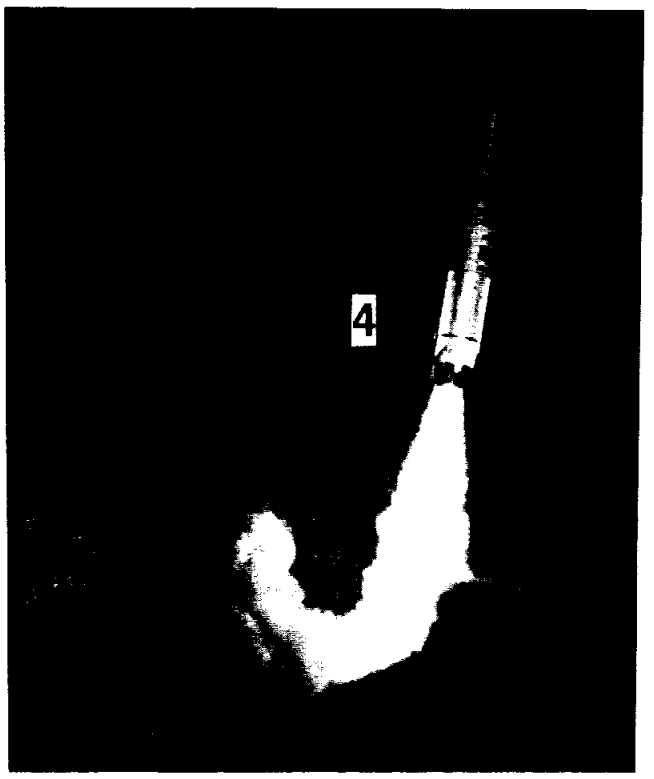
Three orbits are planned for the first manned Gemini flight. Recovery will take place near Grand Turk Island in the Bahamas. The manned flight will follow GT-2, an unmanned Gemini spacecraft which will be launched on a ballistic flight down the Eastern test range this month.

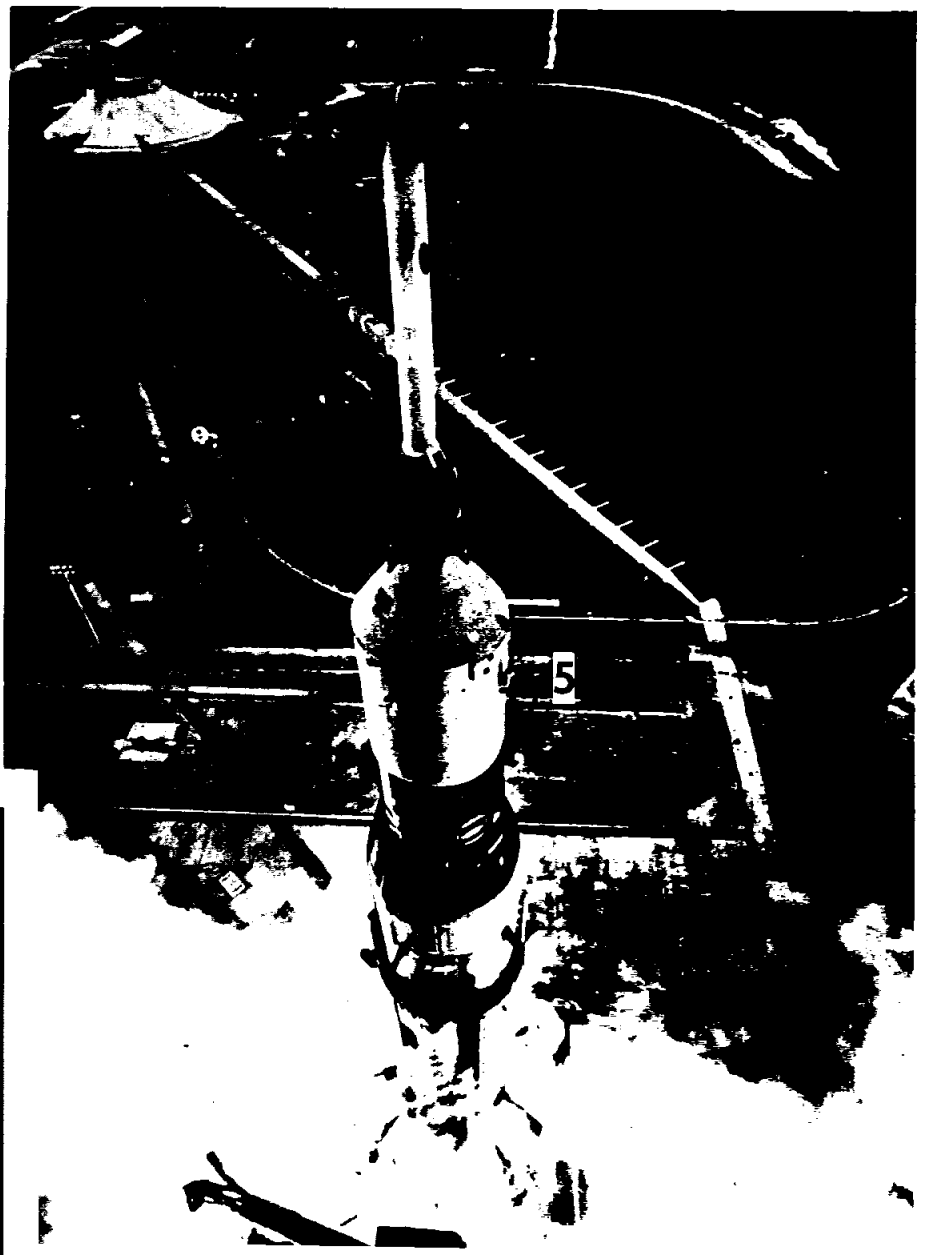
The GT-3 spacecraft will be launched from Cape Kennedy's Complex 19 and inserted into an elliptical orbit ranging in height from 87 to 161 nautical miles. Twenty seconds after the Gemini launch vehicle's second stage cut off, the astronauts will initiate aft firing thrusters which will separate the spacecraft from its booster.

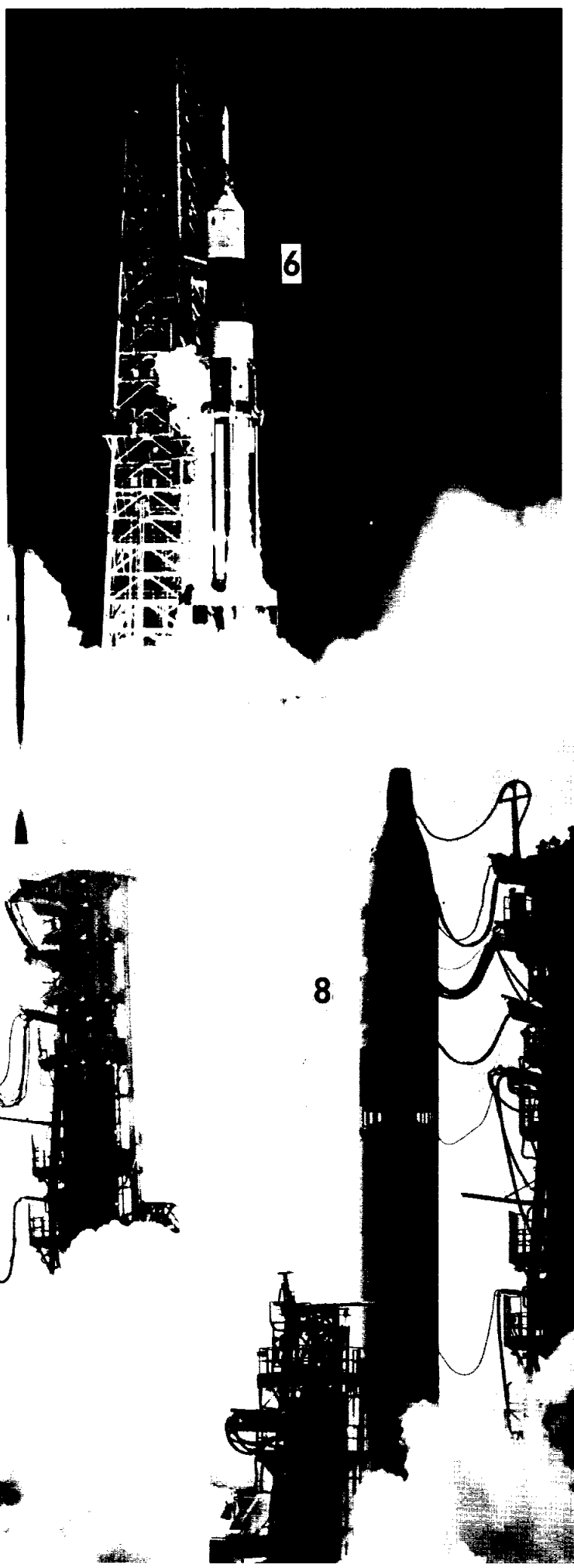
Objectives of the mission are to evaluate spacecraft systems, astronaut procedures, and the world-wide tracking network with respect to the spacecraft. In addition to managing spacecraft systems throughout the flight the astronauts will evaluate the numerous systems and equipment. They will also conduct three experiments.

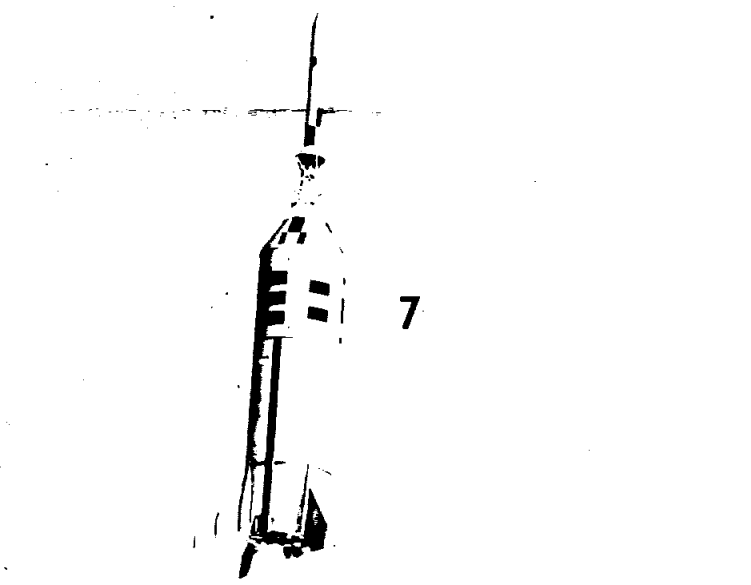
(Continued on page 7)











1964 Launch Highlights

Man-rating of the Gemini and Apollo spacecraft and their launch vehicles was one of the bigger efforts conducted in the manned space program in 1964.

Starting in the lower left corner and going clockwise they were:

1. GLV test firing, January 21.
2. SA-5 launch, January 29.
3. GT-1 launch, April 8.
4. LJ-II/BP-12 launch, May 13.
5. SA-6 launch, May 28.
6. SA-7 launch, September 22.
7. LJ-II/BP-23 launch, December 8.
8. GT-2 attempted launch, December 9.

'1964 A Year Of Filling The Pipeline With Hardware'

For NASA and the Manned Spacecraft Center, 1964 was a year of steady progress in the manned space flight program. It was a year filled with much activity in the research and developments field, in building Apollo and Gemini hardware, and in testing and evaluating this hardware.

Speaking for MSC management, Paul E. Purser, special assistant to the director said, "Looking back now, 1964 was a year of filling the pipeline with hardware. We are looking forward in 1965 to a year of manned flights with Gemini, and to further advances in developing and improving Apollo hardware for accomplishing our lunar mission within this decade."

The following is a chronological summary of the major events of 1964 as reported in the pages of the *SPACE NEWS ROUNDUP*.

JAN. 8, 1964—Approximately 2100 MSC employees were scheduled to move from locations in Houston and Ellington AFB to the Clear Lake Site from February 20 through April 6, with the remaining groups of about 500 persons to be moved by July 1.

—The first fuel cells to provide onboard power and water for the Apollo spacecraft were delivered to North American by Pratt and Whitney Aircraft.

JAN. 22, 1964—George M. Low, deputy associate administrator for Manned Space Flight at NASA Hq. was named deputy director of the Manned Spacecraft Center to replace James C. Elms who resigned to return to private industry.

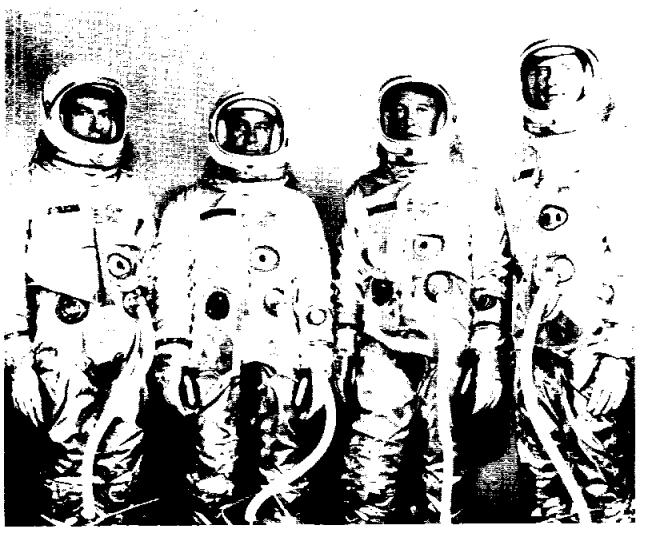
—John H. Glenn Jr., one of the original seven Mercury astronauts and the first American to orbit the earth, resigned from his assignment with the NASA Manned Spacecraft Center, effective at noon on January 16.

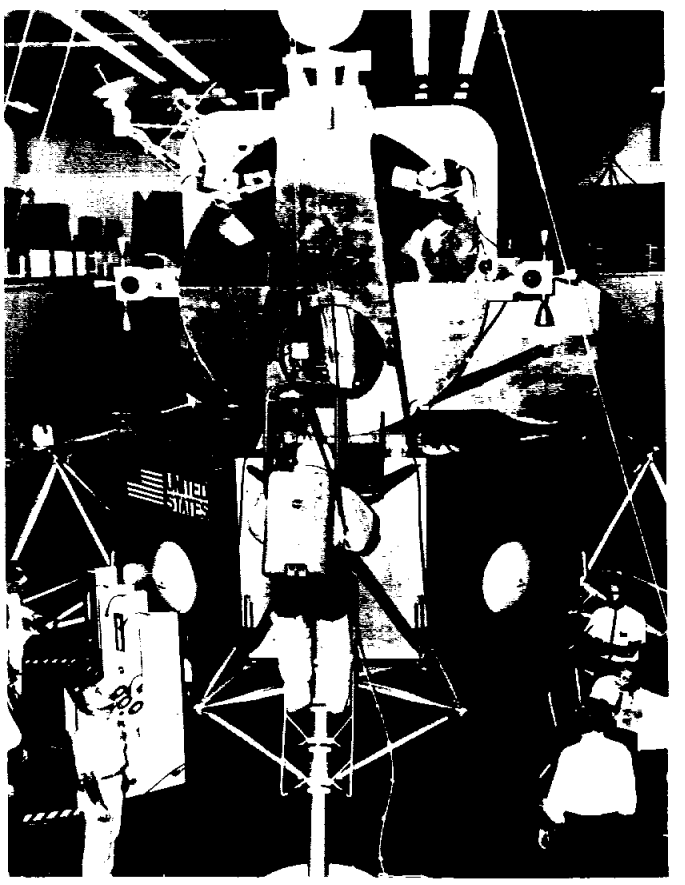
FEB. 5, 1964—Both stages of the first Gemini-Titan II launch vehicle were static-fired on Gemini Launch Complex 19 at Cape Kennedy, Fla., on January 21.

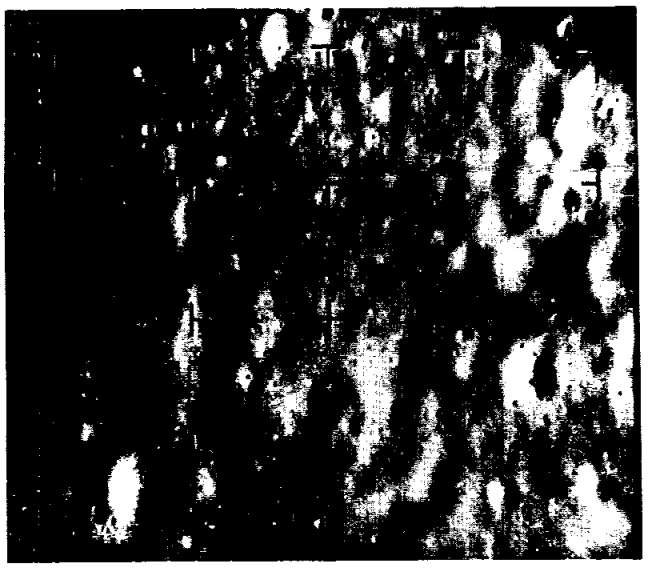
—President Lyndon B. Johnson, on January 21 requested Congress to appropriate $5.3-billion for the National Aeronautics and Space Administration for fiscal year 1965, and also recommended a supplemental appropriation of $141-million

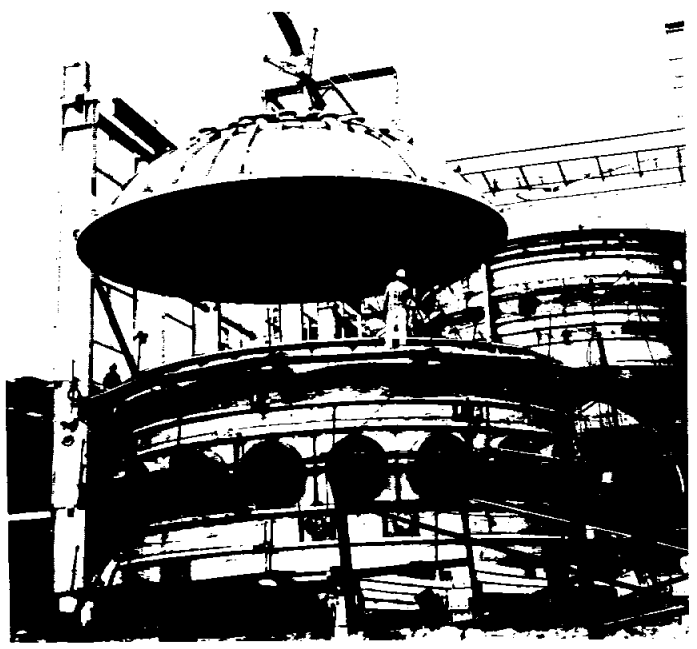
(Continued on Page 8)

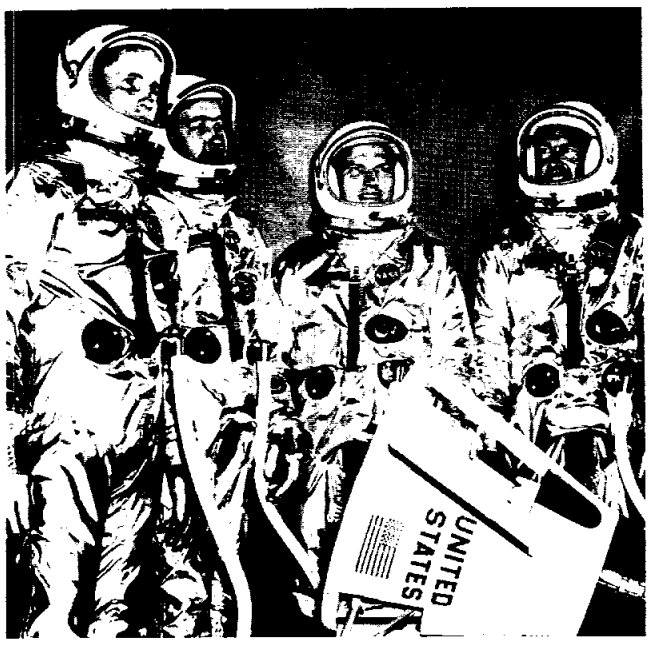
Scenes Representative Of MSC Activities In 1964





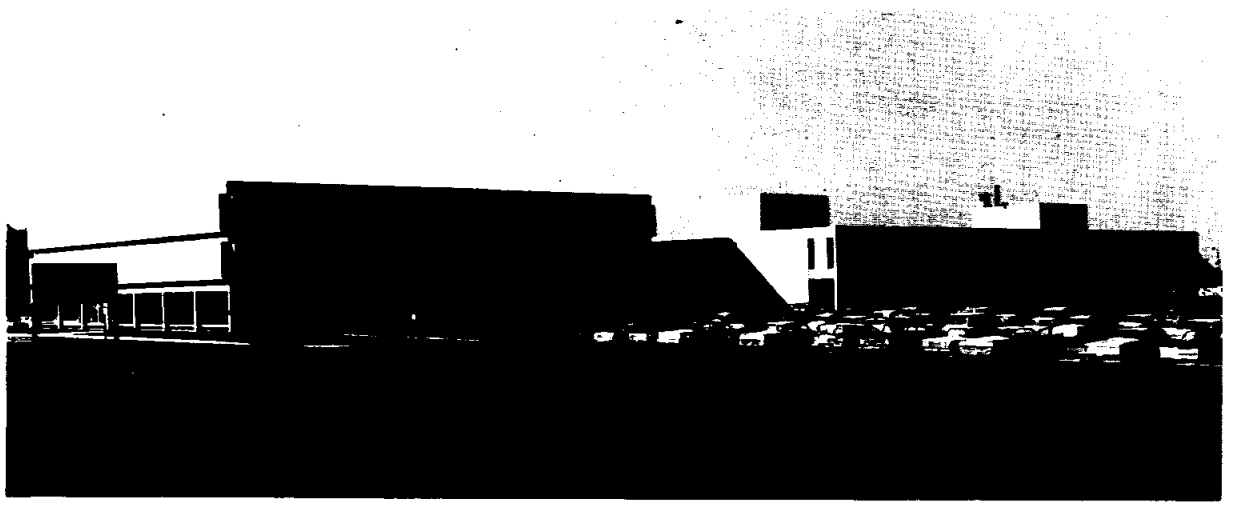




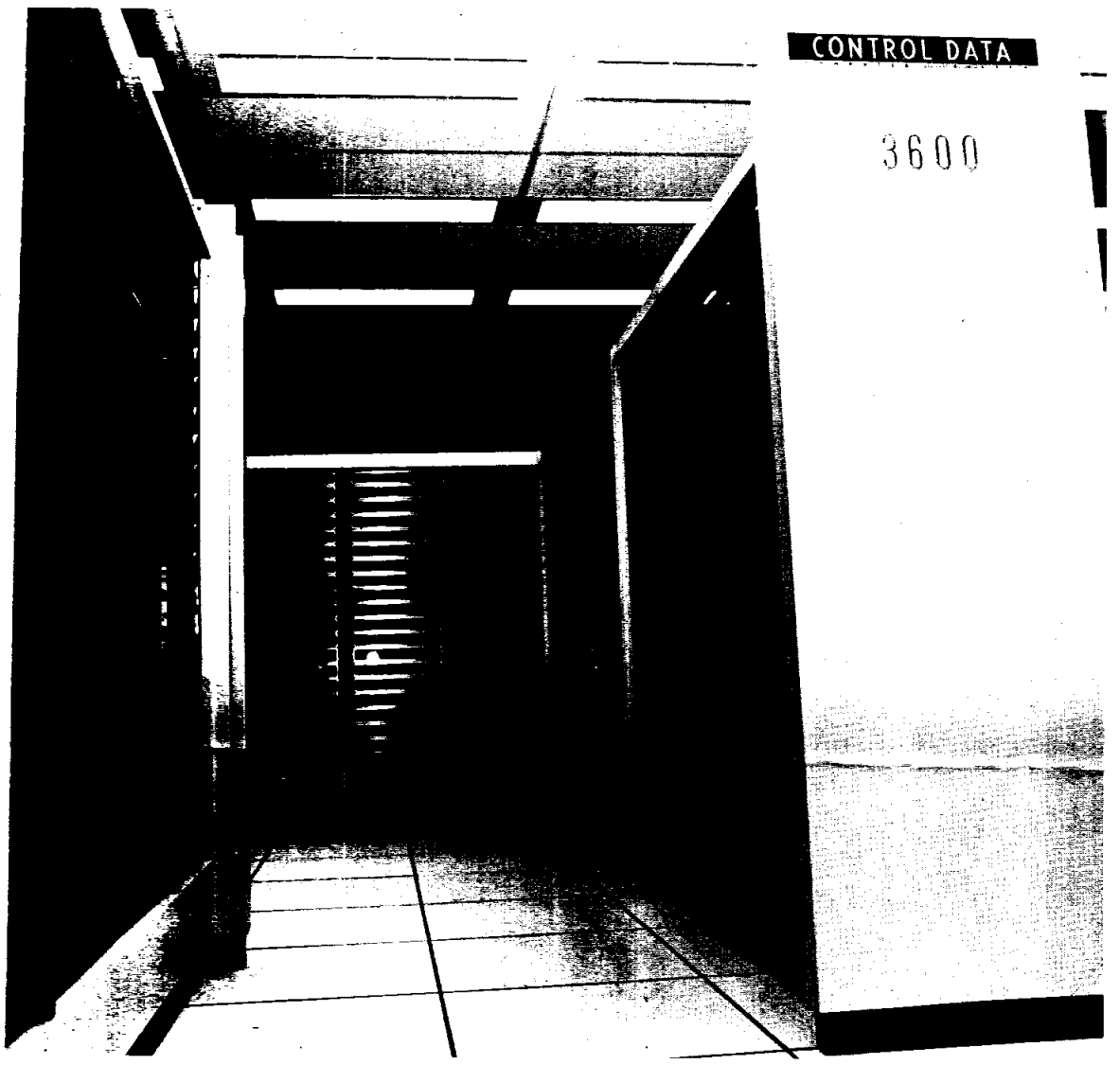


REPRESENTATIVE ACTIVITIES—During 1964 a myriad parade of events took place at the Manned Spacecraft Center and other locations throughout the country involving MSC people or their representatives. The above photos sketchily depict some of these events that occurred during the year 1964. Starting in the upper left and moving clockwise: Astronaut training in the field occupied a sizeable amount of time. Depicted is a group on a geology trip to the Grand Canyon, other trips were made to Panama for jungle survival, to Nevada for desert survival and to other locations for various types of geology and other training. In April, John W. Young and Virgil I. Grissom were named the prime crew for the first manned Gemini mission, GT-3, with Walter M. Schirra Jr., and Thomas P. Stafford as the backup crew. In October, an inspection and review of the LEM was conducted at the contractor's plant. This was just one of the many inspections and reviews of Gemini and Apollo hardware at the various contractor plants around the country. Another big item during the year 1964 was the move from temporary sites in Houston to the Clear Lake Site. The major move which began early in February was completed the latter part of June. In July, the crews for the GT-4 mission were chosen. James A. McDivitt and Edward H. White II were named as the prime crew, with Frank Borman and James A. Lovell Jr. as the backup crew. In March, the cap for Chamber B of the Space Environmental Simulation Laboratory was lowered into place. This was just one of the many construction events that took place throughout the year at the Center. During the latter part of the year the Gemini Mission Simulator became operational along with the Translation and Docking Trainer and other training and simulation devices. Noted progress was made also in the Flight Acceleration Facility before the year ended. The major goal of all this activity, to make a round trip to the moon, is depicted by a photograph (center) of the lunar surface that was taken by the Ranger 7 spacecraft on July 31, three miles above the moon just 2.3 seconds before impact.

Control Data Computer



CONTROL DATA HEADQUARTERS—Corporate headquarters of Control Data Corporation is located in Minneapolis, Minn.



COMPUTER ELEMENTS—Elements of the Control Data 3600 computer are shown in the MSC Data Reduction Complex in Building 12.

APOLLO SUPPORT COMPUTER COMPLEX—A portion of the acceptance checkout equipment computer complex installed by Control Data at the GE Apollo Support Division, Daytona Beach, Fla. is shown here. An identical system will be installed soon at the MSC Environmental Test Chamber and at the Merritt Island Launch area.

The Data Reduction Complex of the Computation and Analysis Division here at the Manned Spacecraft Center is actively supporting the Gemini and Apollo programs with one of the most powerful digital computer systems in the world today, furnishing MSC scientists and engineers with vital pre-flight and post-flight analyses.

This is one of the larger installations of the Control Data Corporation, Minneapolis, Minn., computer systems manufacturer. In addition to the installation here at MSC, Control Data has two other large installations—Missile Impact Prediction and Tracking System at Cape Kennedy, Fla., and Acceptance Checkout Network for Apollo and Gemini programs, plus more than 30 other areas where Control Data equipment is being used on NASA projects.

Heart of the Data Reduction Complex here is a Control Data 3600 computer supported by three other Control Data computers, two 3200's and a 160-A. A large quantity of associated or peripheral equipment includes magnetic tape drives and drums, card readers and punches, high-speed printers and other data processing equipment. The system is so flexible that all of the computers share most of the same peripheral equipment.

Some idea of the magnitude of Data Reduction Complex can be gained by the fact that the 3600 computer has 65,536 words of magnetic core storage while each of the 3200's has 16,384 words of storage. Speed frequently being of importance, the four-computer system is capable of more than 1,000,000 computations per second from data received from 14 separate channels.

A typical operation may require from three to five reductions and refinements of a huge mass of data. Because the computers are "on-line" satellites, they are capable of communicating with each other. Data collected at the Cape Kennedy launch site may be recorded on magnetic tape and processed by the 3600 computer. In one mode of operation, telemetry data received from flights is processed on one of the 3200's through a complex system of telemetry equipment and reduced and formated for processing on the 3600. The 160-A computer is in control of the assignment of all peripheral equipment used during the processing without any manual intervention.

Besides utilizing its power and speed in data reduction and refinement, the Data Reduction Complex serves a secondary function of allowing other NASA/MSC divisions to solve their problems. As an example, The Guidance and Control Division—located in another building—communicates with the computers by a Bell Telephone 301 B Data-Set at a rate of 40,800 bits per second, as compared to the usual rate of 2,000 bits per second for such systems. This high-speed transmission is handled by a Control Data 8529 Data-Set Adapter at the central data reduction site. Ultimately, many participating sectors of MSC will be linked by such a system. A Control Data 3200 computer system now is being

WILLIAM C. NORRIS
president of Control Data Corp.

installed as a remote telemetry data reduction station at the White Sands Missile Range, which may be coupled to the 3600 at Houston via Data-Set.

Another feature of the Control Data computer system at the Data Reduction Complex is the modular design or configuration of the system. It can be readily expanded to meet future needs.

Lockheed Missiles & Space Co. is the Data Reduction Complex prime contractor, and is supplying the manpower and programming for the operation of the complex.

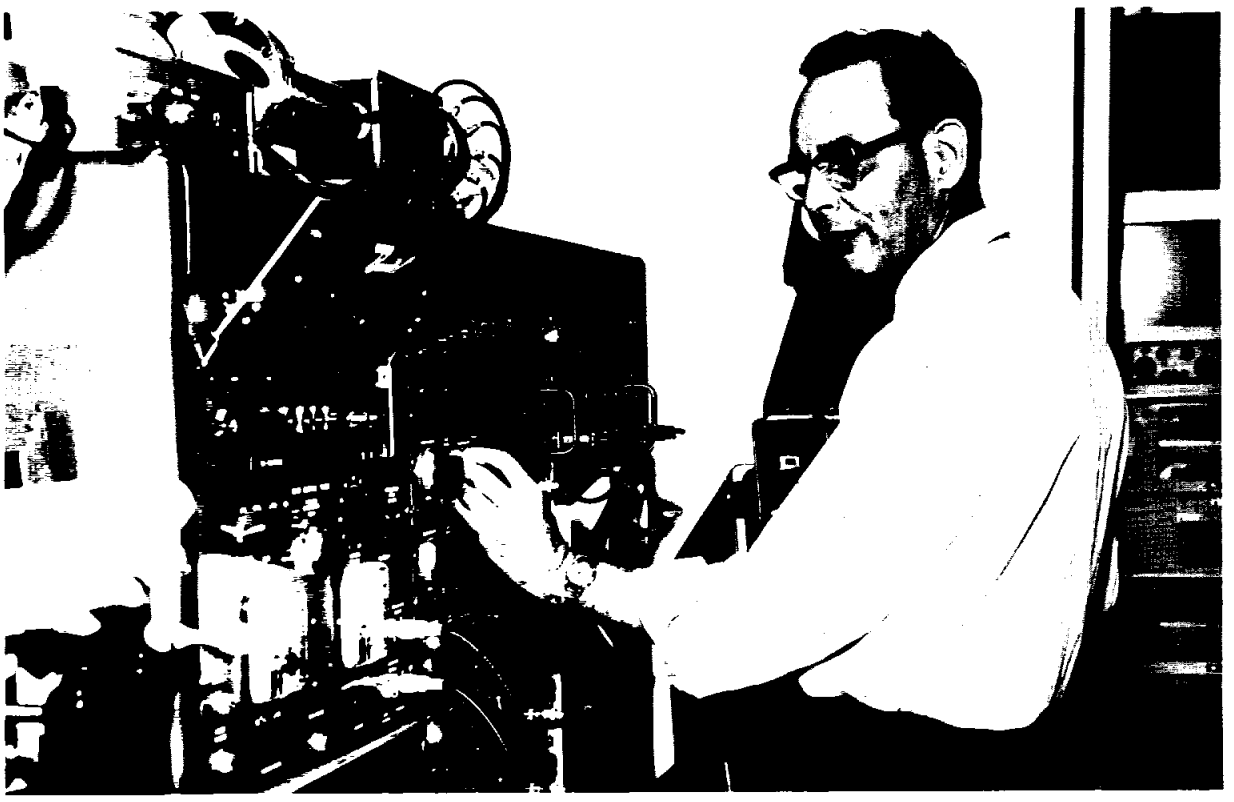
At Cape Kennedy, another huge Control Data computer system has been accepted by the USAF for missile impact prediction and tracking on the Eastern Test Range. This real-time (instant information) system supplies the range safety officer with a constant flow of information as to the missile's track and other flight data, from launch to burnout. On the basis of this information, the range safety officer can make, within a matter of seconds, continuous go-or-destruct decisions vital to both range safety and the millions of dollars invested in the missile. The system also aids materially in the recovery of missiles down the 9,000-mile length of the Eastern Test Range because of the accuracy of impact predictions.

The main-springs of this powerful system are two Control Data 3600 computers and a 160-A satellite computer. The computer selects the best possible source of down-range elec-

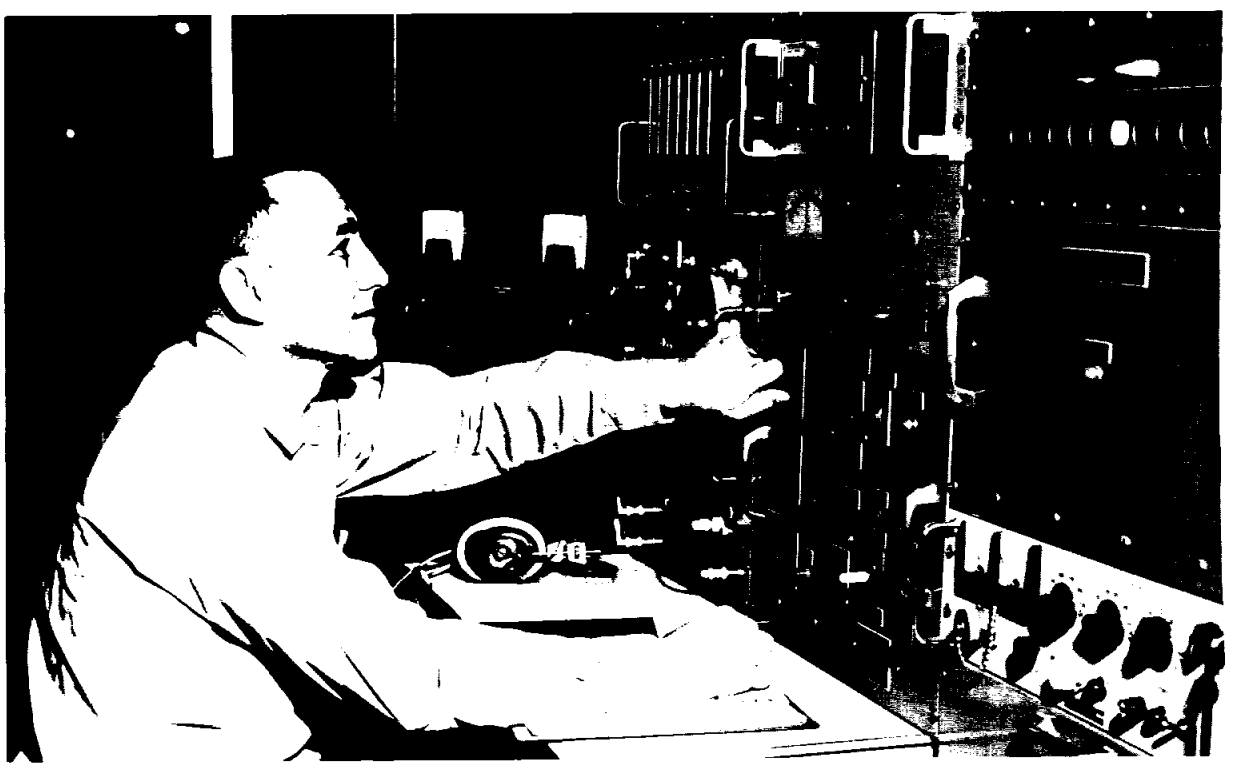
EDITOR'S NOTE: This is the thirty-eighth in a series of articles designed to acquaint MSC personnel with the Center's industrial family, the contractors who make MSC spacecraft, their launch vehicles and associated equipment. The material on these two pages was furnished by the Control Data Corporation.

MSC at work...

BILL McCOMBS, instrumentation operations assistant, Thermochemical Test Branch, Power and Propulsion Division, is shown calibrating a pressure transducer in the MSC Thermochemical Laboratory in Building 350.



DICK BOYER, chemist in the Thermochemical Test Branch, Power and Propulsion Division, operates a mass spectrophotometer in the material lab in the Thermochemical Laboratory, Building 350.



LESTER WYNN, instrumentation operations assistant, Pyrotechnics Test Section, Thermochemical Test Branch, Power and Propulsion Division, operates a universal initiator test set used for testing electro explosive initiators.

Test Your Security I. Q.

1. The NASA-MSC BADGE may not be defaced in any manner including attaching of awards, pins or novelties of any type. A. True: B. False.

2. A make up period for all MSC employees who have not been photographed for the new NASA-MSC BADGE will be held in the west side of the auditorium, building 1, from January 11-15. A. True: B. False.

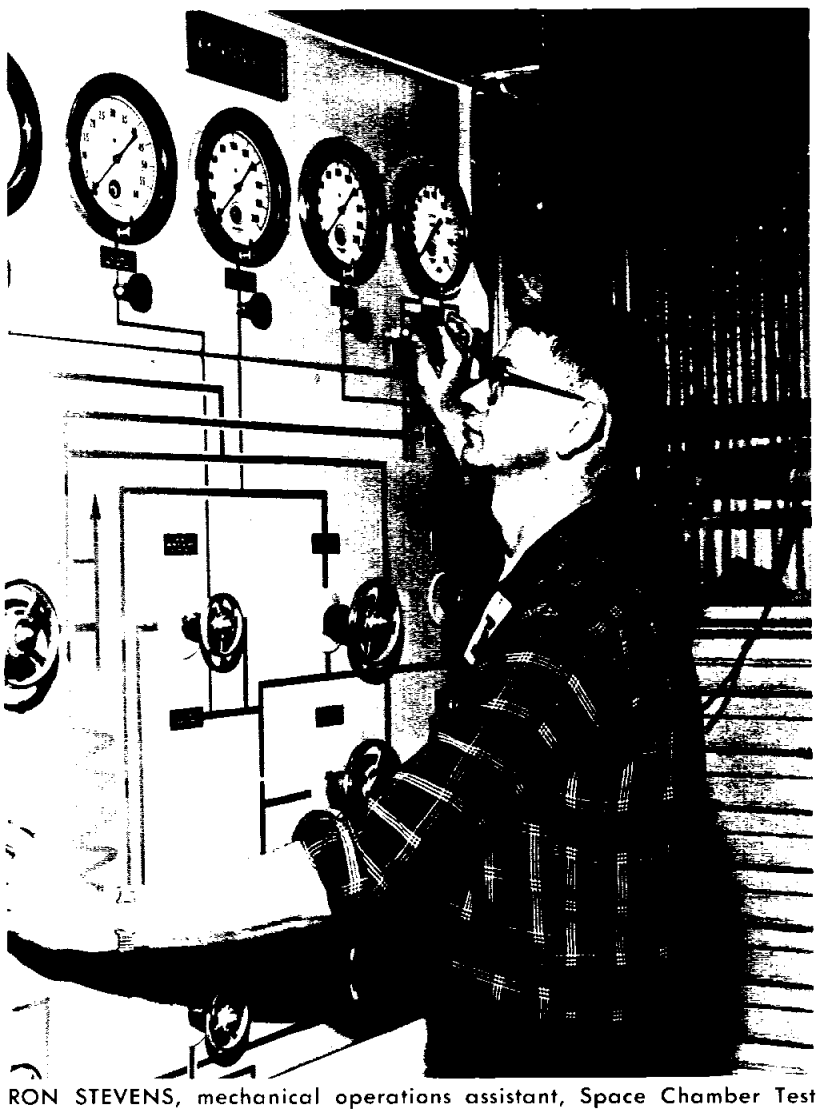
3. All NASA-MSC employees are required to display the new BADGE and new type DECAL by: A. January 15, 1965: B. February 1, 1965: C. January 25, 1965.

4. The new type DECAL is to be attached to the outer left side of the windshield. A. True: B. False.

5. While on travel status, the new NASA ID BADGE should be: A. utilized as an ID card by removing the clip: B. attached to the clothing at all times: C. left at home since it is only good at NASA-MSC.

Answers on page 5-A.

A. SUZANNE CARPENTER does some routine typing as part of her secretarial duties in the Gemini Support Crew Provisions Office, Crew Systems Division.



RON STEVENS, mechanical operations assistant, Space Chamber Test Section, Thermochemical Test Branch, Propulsion and Power Division, checks out a liquid nitrogen recirculation unit.

Aero Club Sets Meeting Date; New Members Invited

The Aero Club here at the Manned Spacecraft Center will start this month holding regular meetings the last Monday in each month, with the next meeting scheduled for 5 p.m., January 25, in the ground floor theatre of Building 30.

Many favorable comments were made by members that took the 12-week audio-visual private pilot ground school course that just ended recently.

The Federal Aviation Agency has agreed to give the private pilot examination here at MSC in the evening if those desiring to take the test can get together at a specific time and date.

Plans by the Aero Club call for repeating the 12-week pilot course if enough people express an interest. The cost is $10 and those interested may contact any Aero Club Officer.

Time and days that the class will meet will be determined by those taking the course.

Dues for membership in the Aero Club are one dollar per quarter as set by the constitution. Members that have not paid their dues for the last quarter of 1964, are requested to do so or their names will not be included on the new roster that is now being compiled.

New members that join the Aero Club in the last month of a quarter are automatically paid up for the following quarter. Dues from old or new members may be sent to Bill Kuydendall, EB2.

Dick Sutton, Ext. 4302, has requested information for the club's records on members that have soloed, obtained student permits, FAA licenses, or new ratings since joining the club.

For information on the Aero Club, contact: Bill Kuykendall, Jack Joerns, Howard Kyle, C. Ed Middleton, or Fred Kelly.

Rod & Gun Club To Elect Officers, Ratify Constitution

The MSC Rod and Gun Club will hold a stated business meeting at 7 p.m., January 21, at the Southwestern Savings association in Nassau Bay.

Purpose of this meeting is to approve the club's constitution and by-laws, elect officers for the new year and to discuss future plans. All members are urged to attend this meeting.

The MSC Rod and Gun Club membership is open to all MSC personnel. Associate membership is open to contractor personnel associated with MSC. If you are not a member of this club and enjoy hunting and fishing sports, contact David Bell, Ext. 4771, for a membership blank.

With a current membership of over 100 members, the MSC Rod and Gun Club shows potential for a good year in 1965.

Card, Stamp Money Given To Needy By Crew Systems

The Crew Systems Division employees bid each other Merry Christmas and Happy New Year by making the season more enjoyable for the needy.

Money which would have been spent on cards and stamps was contributed toward a fund for this cause. A total of $130 was turned over to the Seabrook Volunteer Fire Department and added to the Fire Department's fund of approximately $100. This fund was used to provide food, clothing, and Christmas gifts to needy families in the Seabrook area.

March Of Dimes Poster Girl Visits MSC

POSTER GIRL—Four year old Michaeline Lea "Mickey" Heinicke, the March of Dimes National poster girl began a nation-wide tour in Houston on December 28. One stop on her tour was the Manned Spacecraft Center. Here, Mickey, the daughter of Mr. and Mrs. Paul Heinicke of Denver, Colo., is shown seated in the Gemini Mission Simulator as Terry White, from the MSC Public Affairs Office, talks to her over the GMS intercommunication system. Mickey wears braces because of a spine defect.

Mariner IV Passes 60-Million Mile Mark On Its 228-Day Journey To Planet Mars

The Mariner IV spacecraft has passed the 60-million-mile mark in its 325-million-mile flight to the planet Mars.

Project officials of the National Aeronautics and Space Administration and at the Jet Propulsion Laboratory in Pasadena reported that the spacecraft is operating normally and has been locked on the star Canopus since commanded from the ground to do so December 17.

In its first 29 days of flight Mariner IV made nearly 10 million scientific and engineering measurements in space outside the Earth's orbit.

The spacecraft had been transmitting thirty-three and one-third bits of information per second since launch from Cape Kennedy November 28. On Jan. 3, 1965 the bit rate was switched automatically to eight and one-third per second because of the increasing distance between the Earth and the spacecraft.

At 9 p.m. EST, December 27, the straight line distance between Earth and Mariner IV was 5,011,636 miles. This is about one-twelfth the distance the spacecraft actually has travelled in its arcing interplanetary orbit. It was moving at a velocity of 7,186 miles per hour relative to the Earth and 72,025 miles an hour relative to the Sun.

Actual distance travelled was 61,003,977 miles as of 9 a.m. EST January 2.

The Earth and Mariner IV are moving, in their respective orbits, in essentially the same direction around the Sun. Later in the mission, the Earth will begin to pull away from Mariner, rapidly increasing the Earth-Mariner transmitting distance.

Next July 14, when Mariner has travelled some 325 million miles to fly by Mars, the transmission distance will be about 140 million miles.

MSC BOWLING ROUNDUP

MSC COUPLES LEAGUE
Standings as of Dec. 15

TEAM	WON	LOST
Wha' Hoppen?	44	16
Hi-Ho's	38	22
Pin Splitters	31	29
Crickets	30	30
Alley Cats	30	30
Ez-Go	28½	31½
Bowlernauts	27½	32½
Sandbaggers	27½	32½
Goofballs	25½	34½
Thinkers	23	37
BLTZF	21	39

High Game Women: J. Foster 228, K. Gentile 224.

High Game Men: L. Townsend 236, J. Garino 235.

High Series Women: J. Foster 556, S. Garino 506.

High Series Men: J. Garino 642, B. Jones 628.

MIMOSA MEN'S LEAGUE
Standings as of Dec. 17

TEAM	WON	LOST
Pseudonauts	36	24
Fabricators	36	24
Whirlwinds	34	26
Green Giants	33	27
Roadrunners	31	29
Alley Oops	28	32
Turkeys ***	27	29
Spastics	27	33
Sizzlers	25	35
Technics***	19	37

***Games postponed

High Game: Hecht 244, Schwartz 242, Amason 233.

High Series: Lee 643, Morgan 629, Sandars 586.

High Team Game: Fabricators 990, Green Giants 928, Spastics 908.

High Team Series: Fabricators 2641, Pseudonauts 2631, Whirlwinds 2620.

Times Set For Badge Photos

Employees at Ellington AFB who have not been photographed for their new NASA-ID Badge may have their photos taken this Friday at Building 314, Ellington AFB.

A make-up period for all MSC employees who have not been photographed will be held in the auditorium, Building 1, from January 11 thru 15.

The NASA-MSC ID-Badge will not be defaced in any manner including attaching of awards, pins, or novelties.

Duplicate Bridge Club New Directors Told; Winners Announced

The board of directors of the Duplicate Bridge Club for 1965 are: James Raney, Wayne Brewer, Art Manson, Gil Conforti, James O'Neill, Evelyn Huvar, Muncy McKinney, and Leona Kempainen.

Mr. and Mrs. R. B. Sheridan came in first North-South at the December 22 duplicate bridge game, and Max Cone and John Stanfield were second.

Mr. and Mrs. William Stewart came in first East-West and there was a tie for second place between Emer St. Leger and Rita O'Boyle, and Ray Lynch and Paul Swanzy.

Members are reminded that club membership dues were due January 1.

ANSWERS TO SECURITY QUIZ

1. A. True; 2. A. True; 3. B. February 1, 1965; 4. A. True; 5. A. utilized as an ID card by removing the clip.

Radio Hams Set Dinner Meeting

A dinner meeting has been arranged for the third assembly of the MSC amateur radio activity.

The meeting will be held in the MSC cafeteria executive dining room at 5:30 p.m., Monday, January 18.

George Gibson of IESD will discuss "Some Rambling on High-Frequency CW DX."

A first reading of the proposed constitution will be presented to the members.

In a previous meeting, the voting body elected Don Wiseman as interim chairman for a six-month term.

All those interested in amateur radio, licensed and unlicensed, Government employees and contractors, are invited.

Systems Provide Support For NASA/MSC Programs

MSC's DATA REDUCTION COMPLEX—Control Data computer systems are shown in the Data Reduction Complex of the Computation and Analysis Division here at the Manned Spacecraft Center. Computer systems include the Control Data 3600, two 3200s, and a 160-A.

tronic sensors or tracking stations, computes the missile's impact point, presents the "bird's" current position at the rate of 20 points a second, and records raw data on magnetic tape. Under contract specifications, the entire series of calculations was required to be accomplished within 50 milliseconds. However, the Control Data system completes the computation cycle in only 33 milliseconds.

The Cape Kennedy system is so designed that while one of the 3600 computers is performing the prime tracking function, the other 3600 can be performing a scientific problem or administrative work. However, should any problems develop in the tracking function, the second 3600 computer immediately assumes the primary tracking function, through an automatic switching system, without loss of data to the range safety officer. Similar backup procedures are provided throughout most of the system to insure the utmost in reliability.

The system also transmits aiming information to down-range tracking stations, and is linked with Goddard Space Flight Center at Greenbelt, Md. Data to be processed is also recorded at the Data Reduction Complex in Houston.

In the ACE-S/C Program (Acceptance Checkout Equipment—Spacecraft) Control Data supplies much of the equipment for one of the most comprehensive checkout systems ever installed. These systems are being used by NASA to check the instrumentation on the Apollo spacecraft as well as the lunar excursion module. ACE-S/C systems are already being used by North American, General Electric, etc., and a similar system is soon to be installed at the NASA/MSC Environmental Test Chamber.

Heart of the ACE-S/C systems are dual Control Data 160G computers with complete sets of peripheral equipment. Each of the systems is capable of performing 750,000 instructions per second.

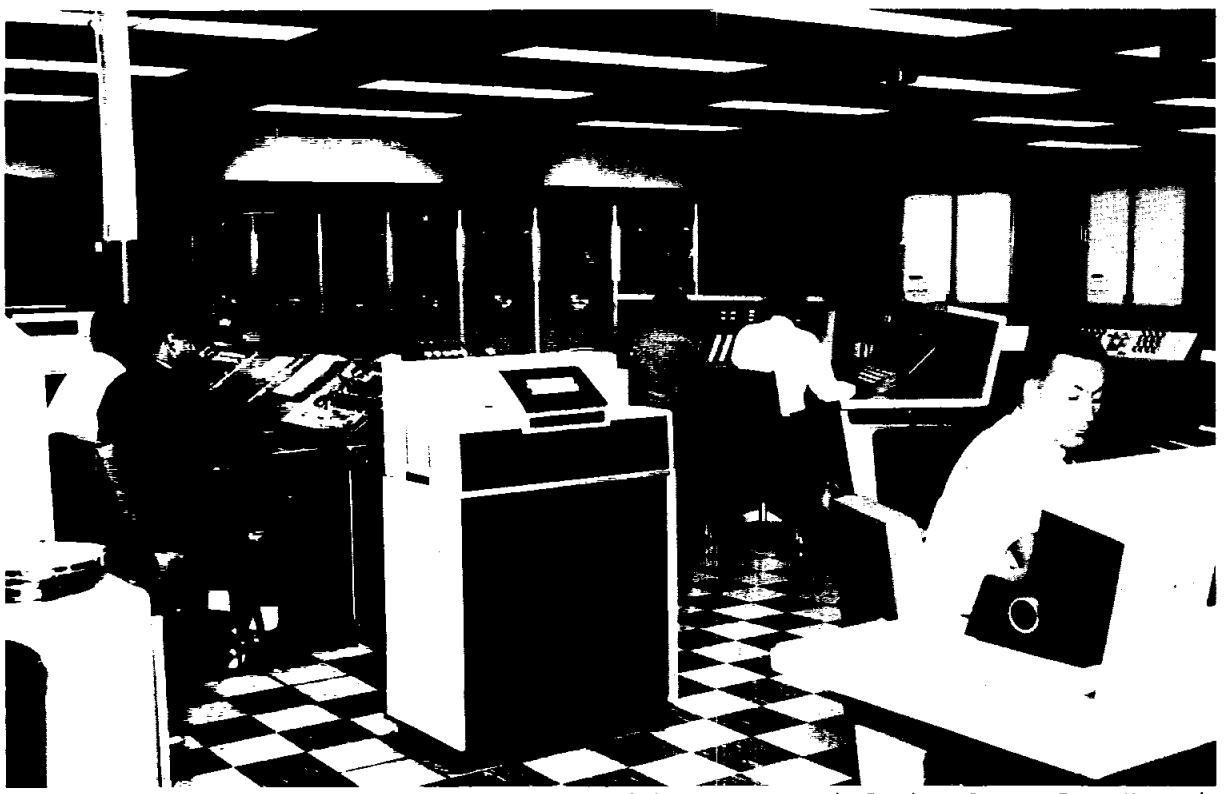
Three vital subsystems supplied by Control Data are: the Digital Test Command System (DTCS) by means of which the computers stimulate tests: the Display System on which information is shown on 20 alphanumeric cathode ray tubes for the test engineers, and the Data Entry System through which instructions from the engineers are conveyed to the computers.

Data is received directly from the spacecraft at the rate in excess of 25,000 words per second. One 160G computer receives this data, organizes it, compares it with pre-determined parameters, and presents it to the Display System for the engineers to examine. Decisions made by the engineers and instructions from them are conveyed to the other 160G computer by means of the Data Entry System. The computer then translates these instructions and transmits the appropriate signals to the Digital Command System in order to stimulate the tests and take the actions desired by the engineers.

Constant evaluation and comparison of the tests against predetermined limits by the computers give the test engineers warning if the results of stimuli to the spacecraft exceed specified parameters—a situation which could endanger the test, the spacecraft, and even safety of the astronauts and test crews. In such a situation, the computers generate a sensory alarm that signals the engineers either to correct the situation or to halt the test. The computers also automatically probe for the difficulty and display its source on the test console.

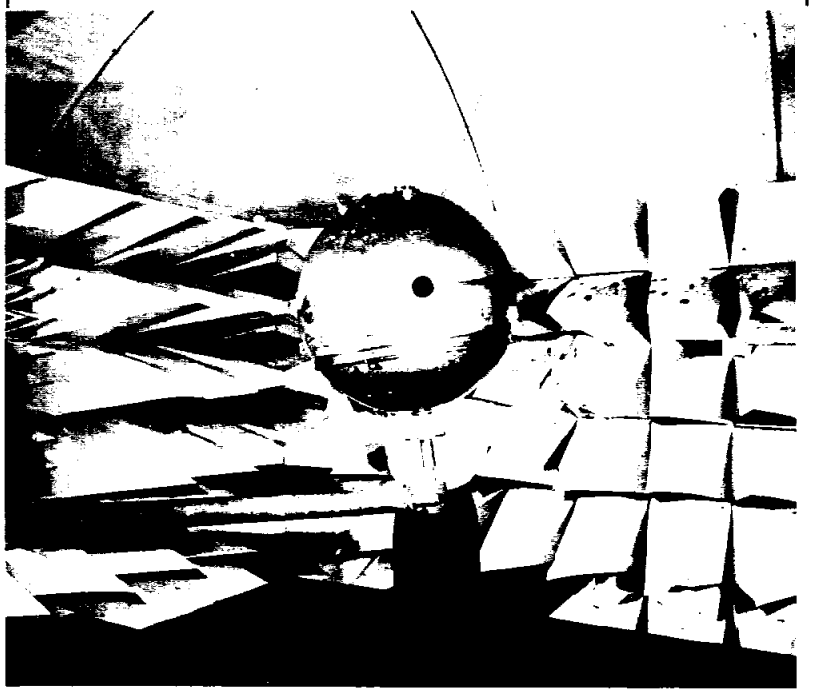
Identical ACE-S/C systems are being installed at five different sites in connection with the Apollo and lunar excursion module projects. This identical equipment and uniformity of programs insures completely compatible checkout procedures and results. Each 160G computer system is required to pass a 72-hour acceptance test, without maintenance, during which the computer system executes more than 200 billion instructions.

Some of the other areas where Control Data computer systems are being used in NASA projects include the following: NASA/Data Acquisition, College Park, Md.: NASA/Mini-Track, Greenbelt, Md.: NASA, Fairbanks, Alaska: Pacific Missile Range, Point Mugu, Calif.: Lewis Research Center, Cleveland, Ohio: NIMBUS I, II, and III, Greenbelt, Md.: Wallops Island, Va.: Space Nuclear Propulsion Center, Cleveland, Ohio: Wylie Laboratories, Huntsville, Ala.: Lockheed Missiles and Space Co., White Sands, New Mex.: Johns Hopkins University, Silver Springs, Md.: Edgerton, Germeshausen, & Grier, Inc., Jackass Flats, Nev.: North American Aviation, Inc., Downey, Calif.: Douglas Aircraft Co., Inc., Culver City, Calif.: General Electric Co., Daytona Beach, Fla.: Merritt Island Launch Area, Cape Kennedy, Fla.: Grumman Aircraft Engineering Corp., Bethpage, LI, N. Y.: Test Support Office/TIROS/ PMR, Pt. Mugu, Calif.



NERVE CENTER OF EMTR—This is the "nerve" center of the Eastern Missile Tracking Range, Cape Kennedy, with two Control Data 3600 computers in the real-time computer system. Besides tracking the missile, the system gives the range safety officer a continuous impact prediction, enabling him to make a go-or-destruct decision.

Goddard's New Anechoic Chamber

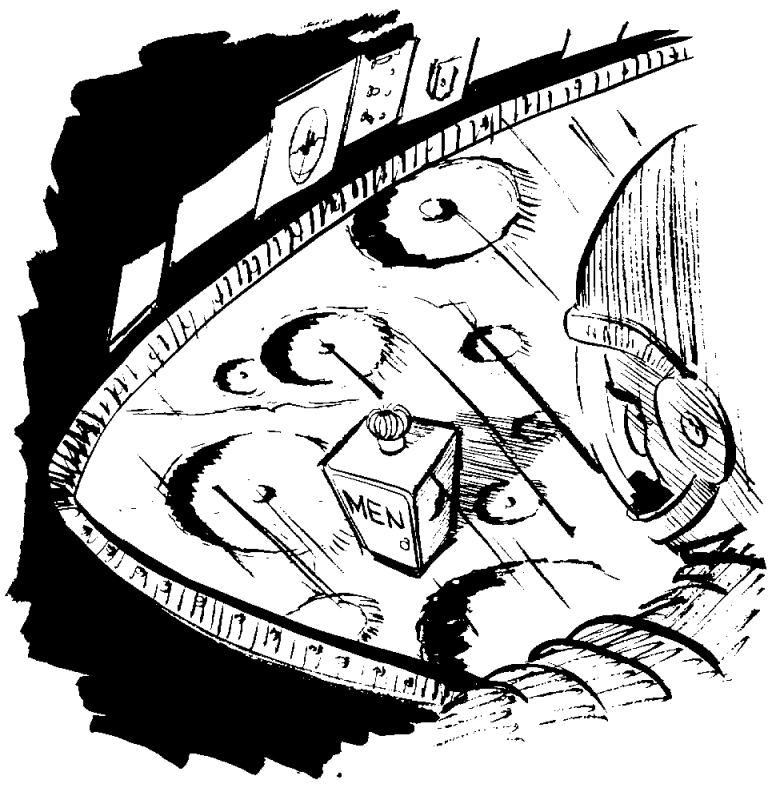


MAN IN MOON?—No, it's John Steckel, project manager of vertical test range at Goddard Space Flight Center, in new anechoic chamber. He is positioning satellite mock-up of the type used in NASA's cislunar atmospheric explorations to gather data for manned space flight. He's surrounded by 70-inch-long microwave absorbers, developed by B. F. Goodrich, that create echo-free environment such as prevails in outer space and allow antenna signals of satellite to be charted as they will be heard from deep in space.

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 . . . . . Robert R. Gilruth
Public Affairs . . . . . Paul Haney
Editor . . . . . Milton E. Reim
Staff Photographer . . . . . A. "Pat" Patnesky

On The Lighter Side



Silver Combined With Tungsten Helps Keep Rocket Nozzles Cool

Silver, the same precious metal long used to make necklaces for milady, now is lining the throats of rocket nozzles—not for beauty's sake, but to make them run cool.

It all started at Aerojet-General Corporation in Sacramento, Calif., a few years back when it was realized that many of the new high energy propellants under development for solid rockets would burn at temperatures over 6,000 degrees. That's pretty hot when compared with steels that flow like water at 3,000 degrees.

So the call went out. Nozzle throat materials were needed to withstand those high temperatures and the severe thermal stresses and erosion of the hot gases passing out the nozzle at the speed of sound.

Research came up with a high sounding composite material known as silver infiltrated tungsten.

Aerojet's scientists and engineers chose tungsten because it melts at 6,170 degrees. That was good but tungsten also had a big drawback. It was so brittle a big chunk would shatter if it were dropped. Nevertheless, the experts were able to control the grain structure of the tungsten by careful processing methods so that it contained millions of tiny uniform voids or pores.

Silver was forced into the pores to form a metallic structure that was strong, chemically stable with propellants and most important, it loved heat.

In a rocket engine's nozzle, the silver trapped in the tungsten matrix gets hot, turns to a liquid and then vaporizes. And that's the secret. As the silver boils off it takes the heat with it. As the structure heats up again, more silver vaporizes to repeat the action over and over again.

Space News Of Five Years Ago

Jan. 8-16, 1960—The First International Space Science Symposium was held at Nice, France, under the sponsorship of COSPAR. A U.S. delegation from the National Academy of Science participated.

Jan. 11, 1960—A contract was signed by NASA and Western Electric Company in the amount of $33,058,690 for construction and engineering of the Mercury tracking network.

Jan. 15, 1960—A document entitled "Overall Plan for Department of Defense Support for Project Mercury Operations" was reviewed and approved by NASA Hq. and the Space Task Group.

Jan. 19, 1960—In keeping with a concept of using certain off-the-shelf hardware items that were available for the manufacture of Project Mercury components, companies around London, England, were visited throughout 1959, resulting in the later selection of the SARAH beacon batteries.

SPACE QUOTES

GOAL IS UNITED STATES FIRST IN SPACE. Dr. Mueller, National Editorial Writers Conference, Cocoa Beach, Fla., Nov. 13, 1964.

"The overall purposes of this program, however, have been generally misunderstood. Many people seem to believe that a landing on the moon, ahead of the Soviets, is the paramount objective. This is not so. The principal goal is to make the United States first in space. The manned space flight mission milestones provide a focus for the development of the capability required for pre-eminence . . .

"In the Apollo program, construction of facilities is on schedule and 55 percent complete."

Welcome Aboard

During the last reporting period, a total of 56 persons joined the Manned Spacecraft Center. Of these, ten were assigned to MSC-Florida Operations, Merritt Island, Fla.; two to White Sands Operations, Las Cruces, N.M.; one to Downey, Calif.; and the remaining 43 in Houston.

Logistics Division: Jessie K. Collom.

Procurement and Contracts Division: Terrell C. Cone Jr.

Personnel Division: Johnnie M. Baldridge, Sharon J. Dobbs, Marina M. Evans, and William N. Henderson.

Resources Management Division: Charles S. Howard, James M. Lindsay, Helen R. May, and Carl R. Praktish.

Office of Technical and Engineering Services: William R. Leatherbury.

Photographic Division: Francis G. Williamson.

Engineering Division: Manuel Avila Jr.

Flight Crew Support Division: Michael S. Brzezinski, Vernon C. Hammersley, Chris D. Perner, Bill R. Sheegog, Jasper C. Smith, and Richard E. Thompson.

Information Systems Division: William A. Hill, and Charles L. Royston.

Instrumentation and Electronic Systems Division: William A. Campbell, Willie M. Dunaway, Thomas E. Lewis and Frank A. Rotramel.

Crew Systems Division: Frank H. Metcalf.

Guidance and Control Division: Margie O. McGregor.

Propulsion and Power Division: Zach D. Kirkland, and Ralph J. Taeuber.

Structures and Mechanics Division: Edward T. Chimenti.

Advanced Spacecraft Technology Division: Andrew W. Patteson.

Flight Control Division: Jack E. Breiby, Myles E. Franklin, Gerald D. Griffith, Herbert E. Porter, Loyce E. Roberts, John A. Wegener, and Lyle T. White.

Landing and Recovery Division: John E. Hoover, and Donald G. Morris.

Mission Planning and Analysis Division: Edward M. Henderson, and Richard E. Kincade.

MSC-Florida Operations (Merritt Island, Fla.): Jack T. Cellum, Walter L. Cope Jr., Douglas A. Delve, William H. Glusing, Joseph M. Langan, Orel D. Harr, Frank L. Norton, James E. Parker Sr., Martin B. Pearah, and William J. Paton.

Apollo Spacecraft Program Office: Ruby C. Edgerton, and Edward W. Van Riper.

White Sands Operations, (Las Cruces, N. M.): Shirley R. Glicken, and Richard O. Worthey.

MSC PERSONALITY

Apollo Division Chief Performed SST Aircraft Feasibility Tests

Early wind tunnel feasibility tests for construction of a supersonic transport (SST) were conducted at Langley Research Center under the leadership of Owen G. Morris, now chief of the Reliability and Quality Assurance Division in the Apollo Spacecraft Program Office here at the Manned Spacecraft Center.

Morris was leader of a group that investigated feasibility of a SST in wind tunnel tests from 1958 through 1961 and also took part in pioneering work that went into the program for the SST that is scheduled to be built in this country.

His group did preliminary work and investigated over a dozen potential configurations

OWEN G. MORRIS

for a SST and conducted mission analysis and economic feasibility of such a craft.

Other areas of investigation by his group included running tests to help "iron out" aerodynamic problems in the aircraft F-102, F-103, F-105, F-106, and B-58. His group also wind tunnel tested the Atlas and Titan launch vehicles and research vehicles at Langley, as well as nose cones for ICBM's.

The early Mercury tests were conducted by Morris' group in the wind tunnel at Langley.

In his present position, Morris has the primary responsibility for development and monitoring policies and procedures for assuring the reliability and quality of Apollo spacecraft systems and components.

He establishes the reliability apportionments between elements of the spacecraft and serves as the primary point of coordination and control for all manufacturing processes and quality control problems.

Morris joined NACA, predecessor of NASA, in 1948 at Langley doing design and monitoring construction of the wind tunnel there. He was in charge of designing the control system, the compressor system and test sections of the tunnel. After its completion he was responsible for initial operation and calibration of the wind tunnel.

From 1952 to 1961 he was head of a group of engineers conducting studies on aerodynamics of supersonic aircraft and missiles in a variety of technical fields that included performance, stability control, internal aerodynamics, heat transfer and boundary layer flow. It was during the latter three years of this period that his group conducted feasibility tests of a SST.

In February of 1961 he was placed in charge of the technical requirements for Project FIRE, later changed to CALORIE, which was a reentry program to determine heat transfer characteristics at lunar return velocities.

Morris joined the Space Task Group in October of 1961 as head of the Mission Engineering Branch in Apollo, and in the latter part of 1962 became assistant chief of the Systems Engineering Division.

He assumed the duties of acting chief of the Command and Service Module Division in August of 1963 and in December became assistant program officer for the Apollo command and service module.

In February of 1964 he was named assistant chief of the Test Division and one of his duties was to serve as operations director for the successful Apollo boilerplate-12 flight in May of last year at the White Sands Missile Range in New Mexico.

He participated in the original negotiations on the command and service module contract and was a member of the evaluation team for the lunar excursion module.

Morris assumed his present duties in July of 1964.

He was born in Shawnee, Okla., and attended high school in Hobart, Okla. He was graduated from the University of Oklahoma with a BS degree in mechanical engineering in 1947 and was awarded a MS degree in aeronautical engineering in 1948.

Morris is an associate fellow of AIAA, and a member of Tau Beta Pi, and Tau Omega, engineering fraternities. He has authored over a dozen technical papers.

He is married to the former Moree Glover of Tulsa, Okla., and the couple has two children, Debbie 12, and Janine 8. The family resides in Timber Cove, Seabrook, Tex.

Morris builds and flys model airplanes as a hobby and is a member of a local airplane club.

Moon Blink

(Continued from Page 1)

appears on the Moon.

A number of observers have reported reddish color spots on the Moon over a period of several years. Last October, the Moon Blink located a patch of reddish pink in the crater Alphonsus.

The instrument was being tested by Lyle Johnson, an amateur astronomer at Port Tobacco, Md. Johnson's experiments are being continued as weather and Moon position permit.

About half of the astronomers in the network are amateurs and about half professionals, according to Winifred Cameron, astronomer, Theoretical Division of NASA's Goddard Space Flight Center, Greenbelt, Md. Most of the East Coast observatories are cooperating.

As part of the development program, five of the experimental instruments have been distributed to outlying stations in Alabama, California, Kansas and Colorado. Five more may be added later. The Trident company is working under a $60,000 contract with the NASA Headquarters' Electronics and Control Research Division.

The instrument is being developed for detection of unusual coloration on all types of bodies orbiting in space. Simple and relatively inexpensive in design, it is meant for use by professional and amateur astronomers.

Scientists generally believe that red color could mean that the lunar satellite is not a "dead" object. Some claim the unusual color signifies a source of gases and possibly of energy.

Any source of energy would be significant to the NASA lunar landing program. For this reason, and in the effort to learn as much as possible about the Moon's surface, engineers of the Apollo lunar landing program are interested in the moonwatch network.

Dr. Dessler Of Rice, To Address AIAA Meeting Next Week

A meeting of the local chapter of the AIAA will be held January 15, with Dr. A. J. Dessler, head of the Space Science Department at Rice University addressing the group.

The program will begin at 7:30 p.m., preceeded by a social hour at 5:30 and a dinner at 6:30, in the Flintlock Inn on FM 528.

Dr. Dessler will speak on the progress of the Rice Space Science Department since it was estabished two years ago.

For reservations, call Goldie Marks at Ext. 2283 or Pat Todsen at MI 9-2733.

Gemini Spacecraft

(Continued from Page 1)

These experiments are designed to:

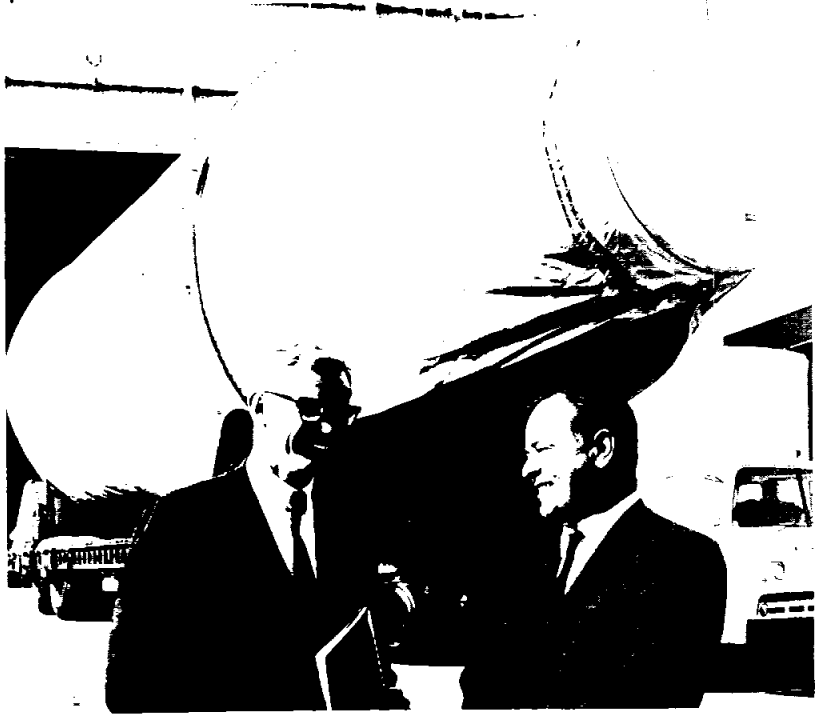
1. Evaluate effects of zero gravity on fertilization, cellular division, differentiation and growth of sea urchin eggs.

2. Measure the frequency of various types of chromosomal aberrations in human white blood cells which have been exposed to known radiation during weightlessness.

3. Determine the effect that injecting coolant into the reentry ionization sheath has on communications during this time.

Normally, voice communication is lost during reentry because radio signals of that frequency cannot penetrate the sheath which builds up around the spacecraft due to intense heat caused by friction when the spacecraft enters the earth's atmosphere.

NASA Accepts First S-IVB Rocket



ROCKET STAGE ACCEPTED—The first Saturn S-IVB rocket upper stage was accepted recently by Dr. Robert C. Seamans Jr. (left), associate administrator, NASA, at the Douglas Space Systems Center, Huntington Beach, Calif. The 23,500-pound S-IVB, 60 feet long and 22 feet in diameter, is the third stage of the Saturn vehicle which will propel the Apollo spacecraft to the moon. The cover around the S-IVB protected the vehicle during shipment to NASA's Marshall Space Flight Center, Huntsville, Ala., on its more than 6000-mile land, sea and river trip.

Astronaut Geology Field Training To Continue In Hawaiian Islands

The U.S. astronauts will continue their geology field training this month when they go to the Hawaiian Islands for a close-up look at active volcanoes.

The geology sessions will be held starting January 11 on the island of Hawaii. The astronauts will ascend the twin peaks of Mauna Loa and Mauna Kea, and also examine the Kilauea Crater. The astronauts will come to Hawaii in two groups. Each group will spend five days in geological exploration of the Island.

On Mauna Loa, the astronaut groups will be given field problems dealing with mapping and relative age of the lava flows. They will also study problem of rock sample collection.

On one of the days, the astronauts will be flown by charter plane around the Island to get an overall view of its geological features. Later in the day, they will go to the Volcano Observatory for a lecture on geophysics and a look at the seismographs which record the tremblings of the volcanic island.

The island of Hawaii is one of the world's best examples of shield volcanoes. Geologists believe some of the features on the moon may be caused by shield volcanoes. The astronauts will also study olivine basalt, a dark lava which may also be found on the maria or "seas," dark areas on the moon. They will also examine cinder cones and other volcanic features which may be similar on the lunar surface.

The Hawaiian names for the lava flows which the astronauts will study are more exotic. The blocky, rough basalt is known as a a (ah-ah) and the ropey-surfaced lava is called phoehoe (pahoyhoy).

Dr. Howard Powers, director of the Volcano Observatory, will be chief lecturer for the astronauts on this field trip. He will be assisted by Dr. Al Chidester of the U.S. Geological Survey, and Dr. Ted Foss, head of MSC's Geology and Geochemistry Section.

"We hope there may be a volcanic eruption while we are on the field trip," Dr. Foss stated, "Hawaiian eruptions are not violent, and it would give the astronauts valuable first hand information on the behavior of shield volcanoes in action."

The astronauts' day by day schedule is:

First day—Arrive at Hilo Airport and travel to Volcano House, base of operations for the field trip.

Second day—Field trip begins. Examine rim of Kilauea crater and lava flows from Kilauea south of Hilo.

Third day—Visit Kilauea Iki crater. Walk down to floor of Kilauea crater to Halemaumau (Smoking Pit) then take automobiles down Chain of Craters Road.

Fourth day—Air tour of the Big Island by chartered plane. Second part of the day will be spent at Volcano Observatory for geophysics lecture.

Fifth day—Ascend Mauna Kea, Hawaii's highest volcano. Observe cinder cones on Volcano's peak. Spend the night at Pahaka Loa State Park.

Sixth day—Ascend Mauna Loa, Hawaii's second highest volcano. Descend to Kailua on West Coast, where the trip ends.

Apollo

(Continued from Page 1)

go on a lunar mission, but will go to the launch pad frequently as part of prelaunch checks. Using this model of actual flight-ready adapters, Kennedy space Center engineers will conduct tests to determine whether the mechanical fit is adequate, if sufficient access is provided to perform service and checkout of the LEM, and to determine its compatibility with test facilities and ground handling equipment.

The adapter simulator will be tested first for weight distribution and center of gravity. It will later be brought to the Manned Spacecraft Operations building where it will be placed in the integrated systems test stand for fit checks.

Down-To-Earth "Moonplot" Ready For MSC Studies

A down-to-earth piece of lunar landscape is ready for exploration by astronauts and engineers at the Manned Spacecraft Center.

The "moonplot" is a circular area 328 feet in diameter located on the western side of the Center grounds next to the Humble Oil Company's drilling lease.

The simulated moonscape will be used by astronauts for geology training and for determining surface mobility and landing capability on the lunar surface. Engineers can make time and motion studies and evaluate requirements for conducting the lunar surface phase of the Apollo mission.

The area, slightly larger than a football field, is built mainly from blast furnace slag. It is considered an accurate reproduction of how a chunk of lunar terrain of the same area would look. Although the landscape does not represent any particular area on the moon, it does contain lunar features such as craters, ridges, and ejecta material.

The major ridge in the area is 336 feet long and 12 feet high. The largest crater is 64 feet across and 16 feet deep. The smaller crater is 40 feet in diameter and ten feet deep. In addition to the two major craters on the moonplot, there are approximately 75 smaller pits which range from four feet in diameter down to a few inches. Approximately 2,500 tons of slag was used in building the lunar surface.

A mock-up of the Lunar Excursion Module, the section of the Apollo spacecraft which will descend to the lunar surface, will be placed on MSC's lunarscape to provide a test vehicle for the engineering studies.

After landscaping, crater walls for the lunar scene were built from chicken wire and covered with Gunnite, a cementing material. Then the blocks of slag were cemented in place on the walls of the crater.

LUNAR LANDSCAPE—Decending into one of the craters in the Lunar Topographic Simulation Area at MSC is George Post, suit technician, Apollo Support Office, Crew Systems Division. In his hand he holds a Jacob's staff which is used to maintain balance on rugged terrain, for carrying tools, and other uses.

'1964 A Year Of Filling The Pipeline With Hardware'

Space News ROUNDUP!

SECOND FRONT PAGE

(Continued from Page 3)

for 1964.

—NASA launched SA-5 successfully on January 29 at Cape Kennedy in a spectacular shot which placed a 37,700 pound satellite into earth orbit.

—Fourteen new members of the Gemini and Apollo space flight pool reported to the Manned Spacecraft Center February 3, to begin their training as astronauts.

—Ranger VI, a camera laden spacecraft, launched from Cape Kennedy on January 20, completed its trip to the surface of the moon on February 2, but failed to send back pictures of the lunar surface.

FEB. 19, 1964 — The Little Joe II launch vehicle for the first full-scale test flight of the Apollo launch escape system was delivered early in February to the White Sands Missile Range in New Mexico, by General Dynamics/Convair.

—The three-phase airlift of the boilerplate Apollo for the SA-6 flight from North American Aviation in California to Cape Kennedy, was completed the middle of February.

—Nearly 280 MSC employees began vacating leased facilities in Houston on February 20, as the mass move of employees, furniture, and equipment into the Clear Lake Site got underway.

MARCH 4, 1964 — In line with President Johnson's request for increased emphasis on economy in government, Dr. Robert R. Gilruth, director, MSC, initiated a cost reduction program to save $2-million in operating costs on the FY 64 budget at the Center.

—MSC accepted the Life Systems Laboratory at the Clear Lake Site and moving day for the Crew Systems Division was scheduled for March 11.

—All visitors to the Clear Lake Site had to be identified by a visitor's badge beginning March 9.

MARCH 18, 1964 — The second week in March, an additional 225 MSC employees vacated temporary quarters in Houston and joined some 1700 other MSC employees at the Clear Lake Site.

—The appointment of Dr. Charles A. Berry, as chief of Center Medical Programs of MSC was announced by Dr. Robert R. Gilruth, MSC director.

— The Apollo boilerplate spacecraft and related equipment, to be used in the first full-scale test flight of the launch escape system, was delivered early in March to the MSC facility at White Sands Missile Range in New Mexico.

—Eighteen astronauts descended into the mile deep Grand Canyon in Arizona early in March to study geology first hand. The remainder of the group took a similar trip later in March.

APRIL 1, 1964—The first Gemini-Titan flight was scheduled for no earlier than April 7.

—Walter C. Williams resigned March 16 as deputy associate administrator for Manned Spaceflight Operations, to become vice president and general manager of manned spaceflight for the Aerospace Corp.

APRIL 15, 1964—The first phase of the nation's second manned space program began like a storybook success on April 7, as a Titan II rocket propelled a Gemini spacecraft into orbit in an almost perfect launching from Cape Kennedy.

—Virgil I. Grissom and John W. Young were named April 13 as the prime crew for the first manned Gemini spaceflight, with Walter M. Schirra Jr. and Thomas P. Stafford as the backup crew.

—The 62-ton, 38-foot diameter stainless steel door for Chamber A in the Space Environmental Simulation Laboratory was swung into place early in April to enclose the large test facility.

—The first regularly scheduled Manned Spacecraft Center Technical Symposium, scheduled for April 27, was announced by Dr. Robert R. Gilruth, director.

APRIL 29, 1964 — Apollo boilerplates 12 and 13 were on pads in New Mexico and Florida, respectively, awaiting checkouts prior to launches scheduled in May.

—Twenty-three scientific and technological experiments for flights GT-2 through GT-5 were announced.

—To alleviate traffic congestion in and around the Clear Lake Site, staggered hours of duty became effective on May 10.

MAY 13, 1964—The Apollo-Little Joe II High-Q abort mission was successfully launched on May 13 at White Sands Missile Range in New Mexico.

—A rough water egress test using a boilerplate version of the Gemini spacecraft was successfully conducted May 6 in the Gulf of Mexico.

MAY 27, 1964—Parasail landing tests using a one-third scale model of a Gemini spacecraft were successfully conducted the last part of May at Ft. Hood, Tex.

—The SA-6 launch was scheduled for May 28 to orbit the first Apollo systems.

—Open House at the Manned Spacecraft Center was scheduled to begin on June 6-7 and to be open each Sunday afternoon thereafter to the public.

JUNE 10, 1964—SA-6 placed an Apollo boilerplate spacecraft into an earth orbit that circled the earth 50 times before reentering.

—A lunar training area with craters 50 feet across was scheduled for construction at the Manned Spacecraft Center.

—The Incentive Awards Program was implemented at MSC.

—Apollo boilerplate-15 and related equipment was shipped by air to Cape Kennedy from California for the scheduled SA-7 flight.

JUNE 24, 1964—The final relocation of MSC employees began on June 24 with 737 persons vacating leased Houston facilities.

—The newest group of astronauts took part in a jungle survival course in the Panama Canal Zone.

—Over 52,000 people attended MSC's first open house.

JULY 8, 1964—Members of the Science and Technology Advisory Committee for Manned Spaceflight spent three days at the Manned Spacecraft Center the first week in July for a series of meetings with Center officials on problems relating to manned space flight.

—Specific assignments for the astronauts were announced.

—The first tracking station to be completely built for Project Gemini was dedicated June 25 at Carnarvon, Australia.

JULY 22, 1964—NASA Administrator James E. Webb was here at the Center on July 10 for a tour of the facilities and to meet with Col. John Glenn.

—Astronaut M. Scott Carpenter was recuperating in a Houston hospital from injuries received in a motorbike accident in Bermuda where he was scheduled to take part in the Navy Project Sea Lab I.

AUG. 5, 1964—Astronauts James A. McDivitt and Edward H. White II were named the prime crew for the GT-4 flight, with Frank Borman and James A. Lovell Jr. as backup pilots.

—The Ranger 7 spacecraft impacted on the moon in the Sea of Clouds (Mare Nubium) on July 31, but not before it had taken and transmitted 4316 pictures of the moon to an earth tracking station in California.

AUG. 19, 1964—The newest group of 14 astronauts completed a week long desert survival course which began August 10, near Reno, Nev.

—The first "Operational Readiness Inspection" was conducted at the Propulsion Systems Development Facility at the MSC-White Sands Operations, Las Cruces, N. M.

—The new federal pay raise was signed into law by President Johnson on August 14.

SEPT. 2, 1964—The GT-2 launch experienced two delays, a lightning strike on August 17 and Hurricane Cleo on August 27.

—Dr. Robert C. Seamans, associate administrator, NASA, said at a press conference at MSC, August 27, that any NASA follow-on manned space program would be managed from the Center here, in the same sense that Gemini and Apollo are now being managed here.

—The first Apollo spacecraft preflight acceptance testing station was declared operational the last week in July.

—Weightless flying in a jet aircraft was begun at Dayton, Ohio, for the 14 newest astronauts.

SEPT. 16, 1964 — NASA signed a $496-million extension of the Apollo contract with North American Aviation.

—Three flight directors in addition to Christopher C. Kraft were named to serve during future Gemini and Apollo missions. They were John D. Hodge, Eugene F. Kranz, and Glynn S. Lunney.

—A quota of $47,848 was set for the United Fund campaign among MSC employees here in Houston.

SEPT. 30, 1964—Gemini Spacecraft 2, scheduled for an unmanned 2,000 mile suborbital flight later in the year, was delivered to Cape Kennedy, September 21.

—Nearly 4,000 attended the MSC picnic on September 27 at Galveston County Park.

—SA-7 launching on September 18 sent an Apollo boilerplate spacecraft on a successful 59 orbit flight which ended when the craft reentered the atmosphere and disintegrated on September 22.

OCT. 14, 1964—A major test of the NASA Worldwide Tracking Network began on October 9 and was concluded on October 17.

—A full scale metal mock-up of the Lunar Excursion Module was reviewed at Bethpage, N. Y., October 8, by MSC officials.

— During September the MSC-Florida Operations group moved into the new Merritt Island facilities.

—The appointment of Martin L. Raines as manager of the MSC-White Sands Operations in New Mexico, was announced on October 3, by Dr. Robert R. Gilruth, director, MSC.

OCT. 28, 1964—NASA announced that 10 to 20 scientist-astronauts would be recruited for the Nation's future manned spaceflight missions.

—Eight days, beginning October 19, were spent in a Gemini space suit by Astronaut Russell L. Schweickart for a series of tests, evaluations, and simulations to determine the compatibility of man and biomedical recording equipment over an extended period of time.

NOV. 11, 1964—Air Force Captain Theodore C. Freeman, the first astronaut to die while in training, was killed October 31, when his T-38 jet trainer plunged to the ground near Ellington AFB.

—The NASA/AIAA sponsored Third Manned Space Flight Meeting was held in Houston, November 4-6 and was attended by about 1,000 delegates.

—The Cape Kennedy Gemini Mission Simulator became operational on November 1. The GMS here at the Manned Spacecraft Center reached operational status on December 1.

—Testing began in November on 17 Gemini suits to qualify them for operation under any possible conditions that could be encountered in the first manned flights.

—The MSC United Fund goal was exceeded when over $52,000 was raised by Center employees.

NOV. 25, 1964—The cause of the fatal crash of Astronaut Theodore C. Freeman was attributed by an inquiry board on November 16, to a collision with a snow goose. Astronaut Freeman was buried with full military honors in Arlington National Cemetery, November 4.

—A new dual-purpose employee identification badging system was instituted at MSC and other NASA centers.

—The MSC Sixth Anniversary Honor Awards Ceremony was conducted at the Center on November 19.

—A Career and Guidance Clinic was held November 17-19 here at MSC for over 300 local educators.

—A conference for over 100 Summer Session Administrators from colleges throughout the country, was held here at MSC, November 22-24, and one of the speakers on the program was Gov. John B. Connally of Texas.

DEC. 9, 1964—The GT-2 and the Little Joe II/Boilerplate-23 flights were scheduled for the second week in December.

—The Mariner 4 spacecraft began a 325-million mile flight to the vicinity of Mars on November 28.

DEC. 23, 1964—The Apollo launch escape system passed another important test on December 8 at White Sands Missile Range as it performed its necessary function under severe conditions on a flight boosted by the Little Joe II launch vehicle.

—The launch of the unmanned Gemini spacecraft, set for December 9 at Cape Kennedy, was postponed until early 1965, because of a shut down by the Titan II engines slightly more than one second after ignition.

—Nearly 1,000 persons had applied or indicated interest in the scientist-astronaut program by December 23.

— A successful 96-hour Gemini suit test at the Center was conducted in a pressure chamber with Hoyt Maples as test subject.

—A Gemini boilerplate spacecraft was gently lowered into the waters of Trinity Bay on December 11 by two developmental spacecraft landing rockets, after being dropped from a C-119 aircraft.