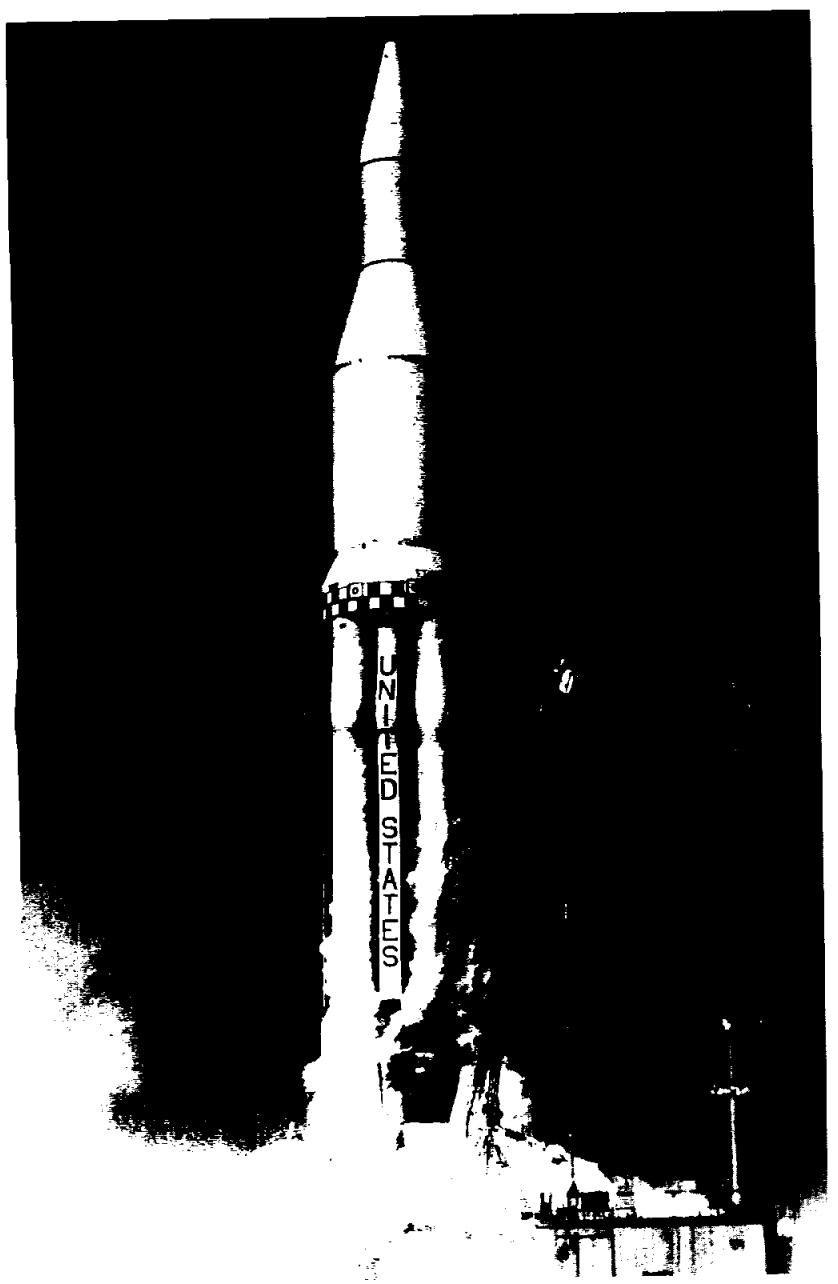
Space News
NASA ROUNDUP!
VOL. 1, NO. 14 MANNED SPACECRAFT CENTER, HOUSTON, TEXAS MAY 2, 1962

Astronaut Applications Being Accepted Till June 1

Second Saturn Flight Termed Complete Success



SATURN SA-2 lifts-off at Cape Canaveral last Wednesday.

The second Saturn C-1 (SA-2) was launched from Cape Canaveral last Wednesday at 8 A.M., and several minutes later NASA officials announced that the flight was a complete success.

This was the second of 10 Saturn C-1 research and development flights. After these tests are completed in 1964, the C-1 is expected to be ready for use in the first phase of the Apollo manned lunar landing program—that step being the placement of a three-man spacecraft in earth orbit for up to two weeks.

The 162-foot high rocket, powered by eight H-1 engines which developed a total of about 1.3 million pounds of thrust, climbed to an altitude of 135 miles in 115 seconds, then, after the engines cut down the 463-ton vehicle coasted to a height of 65 miles.

At this point, the vehicle was deliberately destroyed by an explosion which released 95 tons of water ballast which had been carried in the upper stages in a bonus experiment.

Officials said the water dispersed within two seconds to form a huge cloud eight to 10 miles in diameter and disappeared in 10 to 12 seconds. They indicate that the water formed ice flakes instead of drops as expected.

The main vehicle objectives of the SA-2 flight were:

• Determine the in-flight performance of the eight booster engines, the controlling movements of the four gimballed engines, and engine cutoff and propellant utilization.

• Verify structural integrity of the vehicle's airframe, evaluating stress at critical moments of flight and determining vibration and bending modes.

• Further prove the operation of the launch facilities for Saturn vehicles—propellant supply systems, ground support equipment, automatic checkout equipment, instrumentation, and launch pedestal with hold-down arms.

Other flight objectives included confirmation of aerodynamic characteristics, and correlation of predicted stability and performance.

Geographic Society's Hubbard Medal Presented to Astronaut John Glenn, Jr.

The National Geographic Society's Hubbard Medal was presented to Astronaut John Glenn in Washington, D. C. on April 9. The Medal is the Society's emblem of the great explorers of the 20th Century.

The presentation was made in the Armory with a crowd of 6,000 present. The heavy gold Hubbard Medal had only been given to 20 men since it was first struck. The first recipient was Admiral Robert E. Peary on January 11, 1913, for discovery of the North Pole.

One of those present for the presentation was also on hand when Admiral Peary received his medal. He was Dr. Melville Bell Grosvenor, president and editor of the National Geographic Society.

In speaking, Grosvenor said that Glenn's achievement ranked "with those of the great explorers who have gone before him . . . Columbus . . . Magellan . . . Cook . . . Sir Edmund Hillary and Admiral Byrd."

Glenn's citation read: "For extraordinary contributions to scientific knowledge of the world and beyond as a pioneer in exploring the ocean of space."

Actually there were two medals. One was only gilded bronze. It was given to Mrs. Glenn to display in the home. Dr. Grosvenor told her, "It looks exactly the same and no one will know the difference unless they try to steal it; it isn't as heavy."

Interviews, Examinations, Other Screening To Take Place In July

Approximately five to 10 additional astronauts for NASA's manned space flight program will be selected by the National Aeronautics and Space Administration next fall.

Experienced jet test pilots with engineering training will be screened to form the new group of spacecraft pilots to augment the present team of seven Project Mercury astronauts.

The new pilots will participate in support operations in Project Mercury and will join the present astronauts in piloting the two-man Gemini spacecraft. After Gemini flight some of those pilots may act as spacecraft commanders on Apollo missions.

Following is the timetable for selection.

Applications from any individual meeting the qualifications will be accepted by the Director of Manned Spacecraft Center at Houston, Tex., until June 1. The aircraft industry, military services, and other government agencies will be requested to recommend pilots best qualified for this work.

In July, pilots meeting the qualifications will be interviewed and given written examinations on their engineering and scientific knowledge.

After that screening, selected applicants will be given a thorough physical examination by a group of medical specialists. Final selection will be made this fall.

Five qualifications are established for applicants.

(1) The candidate must be an experienced jet test pilot and preferably be presently engaged in flying high performance aircraft.

(2) He must have attained experimental flight test status through the military services, the aircraft industry or NASA or must have graduated from a military test pilot school.

(3) He must have earned a degree in the physical or biological sciences or in engineering.

(4) He must be a United States citizen, under 35 years of age at the time of selection, and six feet or less in height.

(5) He must be recommended by his present organization.

The training program of the new astronauts will include work with design and development engineers, simulator flying, centrifuge training, additional scientific training, and flights in high performance aircraft.

It is planned that in the late stages of Apollo spacecraft development a third group of astronauts will be selected to join those then available as the pool from which Apollo flight crews will be chosen.

Frick, Piland Speak to IAS

Charles W. Frick, Apollo Project Manager for MSC, spoke to a sectional meeting of the Institute of Aerospace Sciences at San Diego Monday. He discussed the progress of the various phases of the Apollo program.

The same day Robert O. Piland, deputy manager of the Apollo Project office, spoke to a national meeting of the IAS at St. Louis, Mo., on the same subject.

Dr. Dryden Awarded Langley Gold Medal

Dr. Hugh L. Dryden, Deputy Administrator of the National Aeronautics and Space Administration (NASA), has been awarded the Langley Gold Medal of the Smithsonian Institution.

Presentation of the medal was made on Friday, April 27, at 7 p.m., at the annual meeting of the American Philosophical Society, in Philadelphia. The American Philosophical Society was founded in 1743 by Benjamin Franklin and is America's oldest scientific and academic society.

The Langley Medal is named for Samuel Pierpont Langley, aviation pioneer and Secretary of the Smithsonian Institution from 1887 to 1906. It has previously been awarded only

(Continued on page 2)

Astronaut Glenn Discusses Observations During MA-6 Flight

Astronaut John Glenn discussed the luminous particles, the high layer, night and dayside observations of the earth and sunrise and sunset observations in his report on MA-6 results in Washington last month.

Glenn's paper, one of 13 presented, was entitled "Description of the MA-6 Astronomical, Meteorological and Terrestrial Observations."

Of the particles, Glenn said:

"Coming out of the night on the first orbit, at the first glint of sunlight on the capsule, I was looking inside the capsule to check some instruments for probably 15 or 20 seconds. When I glanced back out the window, my initial reaction was that the capsule had tumbled and I was looking off into a star field . . . I could see nothing but luminous specks about the size of stars."

"They were about the color of a very bright firefly, a light yellowish-green color. They appeared to vary in size from pinhead to possibly three-eights of an inch. They were floating in space at approximately my speed . . . I appeared to be moving through them very slowly, at a speed of maybe three to five miles an hour. I thought at first of the lost Air Force needles but they were not anything that looked like that at all.

Glenn said he did not believe the origin of the particles was the spacecraft itself because they were not more dense nearer the spacecraft than away from it. They averaged eight to 10 feet apart, he said, and occasionally one or two would come swirling "very, very slowly" up around the spacecraft and across the window.

He saw them for about four minutes before the sun came up and the light blotted them from view, and observed them at each succeeding sunrise. Once he "blipped" the hydrogen peroxide thrusters to see if they had anything to do with the origin of the particles, but could see that they did not.

The High Layer

Turning to a phenomenon known as the high layer, Glenn said he had no trouble seeing the horizon on the night side. "Above the horizon some six to eight degrees there was a layer that I would estimate to be roughly one-and-a-half to two degrees wide. I noticed that as they (the stars) came down close to the horizon, they became relatively dim for a few seconds, then brightened up again before they went out of sight.

"As I looked more carefully, I could see a band, parallel to the horizon, that was a different color than the clouds below. It was not the same white color as moonlight on clouds . . . It was tannish or buff white in comparison to the clouds and not very bright. This band went clear across the horizon."

Glenn observed the layer on all three passes through the nightside and the intensity was reasonably constant. It did not have sharp edges and looked like a dim haze layer.

Night Observations

Going over Australia during the night, Glenn saw quite easily the lights of Perth, Australia, where residents had turned on all the lights in the city in his honor.

Using Perth as a landmark, he traced a very slight demarcation between the land and the sea, the only time he observed a coastline on the nightside.

Further inland, he said, he saw a series of about four or five towns in a row, lined up east and west. Over Woomera, the Australian tracking station for Project Mercury, clouds obscured the view. Most of the clouded areas at night looked like big sheets of stratus clouds, he said, but "you could tell there were areas of vertical development by the shadows or lighter and darker areas on the clouds."

Weather fronts could not be seen well at night, but could be defined on the dayside. With moonlight, Glenn said he was able to pick up a good drift indication by using the clouds, but not as accurately as he could during the day. ". . . you can at least tell what direction you're going at night within about 10 or 15 degrees. In the day light over the same type clouds, you could probably pick up your drift down to maybe a couple of degrees."

The horizon was dark before the moon came up, Glenn said, but could be seen silhouetted against the stars very clearly. Before moonrise, he said, "looking down is just like looking into the black hole of Calcutta."

Storms

Glenn saw a couple of large storms in the Indian Ocean, and said the play of lightning in them was clearly visible. "You can see lightning zipping around in these storms all over the place. It was flashing around and you could see a cell going and then horizontal lightning back and forth."

He noted it was difficult to see anything through the airglow filter because his eyes never had a chance to become thoroughly dark-adapted.

Clouds in different types can be seen clearly on the daylight side, the astronaut noted. Weather patterns are easily identifiable.

In daylight he could see New Orleans, Charleston, Savannah and other cities of comparable size.

"I think the best view I had of any area during the flight was the clear desert region around El Paso on the second pass. There were clouds north of Charleston and Savannah, so I could not see the Norfolk area and further north. I did not see the Dallas area that we had planned to observe because it was covered by clouds, but at El Paso I could see the colors of the desert and the irrigated areas north of El Paso. You can see the pattern of the irrigated areas much better than I had thought we would be able to . . . a very definite square pattern.

Heavy Cloud Cover

"The western part of Africa was clear, and I saw dust storms," he said, but the cities of Africa were covered by clouds. A large part of the land area was clouded over, but Glenn did see what he assumed was the Gulf Stream. "The water can be seen to have different colors," he said. The wake of a ship in Recovery Area G was also visible as a tiny "V." He could see Cape Canaveral clearly.

During sunset, the astronaut noted, he got a look at the phenomena known as "flattening of the sun," but it was not as pronounced as he thought it would be. It occurred as the last sliver of the setting sun was visible above the horizon, when it appeared to spread out as much as 10 degrees on each side, matching the bright area of the horizon.

He said he did not see the sunrise directly, but only through the periscope. "You cannot see that much through the scope. The sun comes up so small in the scope that all you see is the first shaft of light. The band of light at the horizon looks the same at sunrise as at sunset."

Dr. Hugh L. Dryden Gets Langley Medal From Smithsonian

(Continued from page 1)

nine times in the 54 years since its establishment in 1908. It was first given to the Wright brothers in 1909. The other recipients have been Glenn H. Curtiss, Gustave Eiffel, Charles A. Lindbergh, Charles M. Manly, Richard E. Byrd, Joseph S. Ames, Jerome C. Hunsaker, and Robert H. Goddard.

The basis of the award is for "specially meritorious investigations in connection with the science of aerodromics and its application to aviation," as determined by the Board of Regents of the Smithsonian Institution. The citation to Dr. Dryden is in recognition of his "important applications of experimental science to the problems of flight and for his wise and courageous administration of much of America's research and technical developments that now make possible the conquest of air and space."

The official presentation of the medal will be made on behalf of the Smithsonian Board of Regents by Dr. Jerome C. Hunsaker, professor emeritus of aeronautical engineering of the Massachusetts Institute of Technology, a Smithsonian Regent, and himself a recipient of the Langley Medal in 1955.

FLEECY CLOUDS AND BACKGROUND TREES add to the activity at the Clear Lake site as a steam shovel excavates for a future canal.

A HERD OF CATTLE, following their white leader, were pictured exhibiting a great interest in the proceedings as if wondering what was happening to tomorrow's lunch as the huge steel monster was gobbling up the turf in big chunks.

—Photos by Patnesky

Hours And Hours Of Breathing-ECS Tests Try Men As Well As Equipment

Thirty hours in a space the size of a low broom closet. Thirty hours without being able to stand upright. Thirty hours of sitting in a canvas lawn chair or lying on your back on a foam rubber mat over metal, wearing an often ill-fitting pressure suit. Thirty hours of drinking water from a thermos jug, eating "baby food" from a "toothpaste tube," listening to the radio, reading, talking, or just thinking.

Think you could stand it?

In the Lane Wells Building there's a group of engineers, and student trainees who go through this sort of thing frequently. Thirty hours is the record, but ten or 14 sound just as bad when you're familiar with the problems.

They are aerospace technologists of the Life Systems Division, involved in testing the environmental control system (ECS) of the Mercury spacecraft, and right now they are busy breathing.

This is not a facetious statement.

One of the modifications in the mill for the Mercury spacecraft is a change in the capacity of the lithium hydroxide canister which removes carbon dioxide (CO_2) from the air the astronaut breathes. Oxygen is forced into his pressure suit through a gas inlet connection at the waist, carried to the body extremities and permitted to flow freely back over the body for cooling, into his helmet for breathing and out through and exhaust. The environmental control system then reprocesses it for the next cycle. Briefly, it goes first through a debris trap, then is scrubbed of odors by passing through activated charcoal. Below the charcoal is a canister of lithium hydroxide, a crystalline solid which reacts chemically with the gas to remove carbon dioxide exhausted from the astronauts lungs. The gas is then cooled and "dried" to remove water vapor and starts the cycle all over again.

Some 4.6 pounds of lithium hydroxide will keep the carbon dioxide at a safe level for about 55 hours. This was plenty for the MA 6 and future three-orbital flights, since even counting pad checkout time, the flight and re-entry, it left a sizeable safety factor. During the contemplated one-day flight however, which includes 24 hours of flight time, the astronaut will be breathing cycled oxygen for a total of about 40 hours. A 55-hour canister just doesn't leave enough of a safety margin. The capacity of the canister is being increased to 5.6 pounds, which should give him from 65 to 70 hours of safe breathing, without changing the size of the canister.

Different people manufacture carbon dioxide at different rates, and there isn't too much data on the subject. Although ECS technicians can set up a set of simulators—a "canned man" which gives off carbon dioxide, water vapor and heat as a human body would do—there isn't enough information to set it accurately or to be sure it can really simulate human metabolism. Again, the effects of prolonged living and working in a closed breathing system are relatively unknown. Even if the graphs and indicators say the air is still safe, how can one know how a man would be feeling? Would he grow sleepy or lethargic? Would there be any long-term damage to his system? Would he sense a bad odor, or perhaps begin to imagine that he did? How serious would constant discomfort be on his ability to function?

ECS technologists already know, for instance, that one small pressure point in a suit—a tight boot, for instance—can become unbearable after 14 hours although it was hardly noticeable in the beginning. Since they do not have custom-fitted suits, as the astronauts do, (some of the would-be volunteers cannot even get into the testing suit) most of them have found out at one time or another just how bad things can be.

One of the problems is that an astronaut in space would have no gravity to worry about, but the test vessel isn't in space. After a while, the weight of the helmet, for instance, begins to press into the top of a man's head murderously. So technicians invented a home remedy, and inflated collar something like a life jacket which simply lifts up a little on the helmet. Another thing is the impossibility of lying on your back with your legs in the air, the position of the Mercury couch when the spacecraft is not in flight, for long periods. Your legs go to sleep. So technologists took the couch out and installed a modified lawn chair so the test subject can sit upright. For variation, he can unroll a thick foam-rubber mat over the couch support and lie down in the standard position. In between he can move his head enough to read books, listen to a radio, or talk to the engineer who is constantly monitoring his headset.

But it still isn't the way you'd want to spend a long vacation.

Meanwhile, in the lab outside, other technologists are running around cooking up test problems. "Last week," said technologist Dick Mayo, "we were running heat tests. There was a lot attention given to the fact that John Glenn got uncomfortably warm during the post landing phase of his flight." Technicians can duplicate temperature and humidity experienced in the recovery area, for instance, by using a device which forces hot air through channels in the walls of the spacecraft. "So far we've run tests at 130 degrees, but that's not as high as we can go." Humidity can be sucked into the system artificially, and the cabin leaks can be simulated.

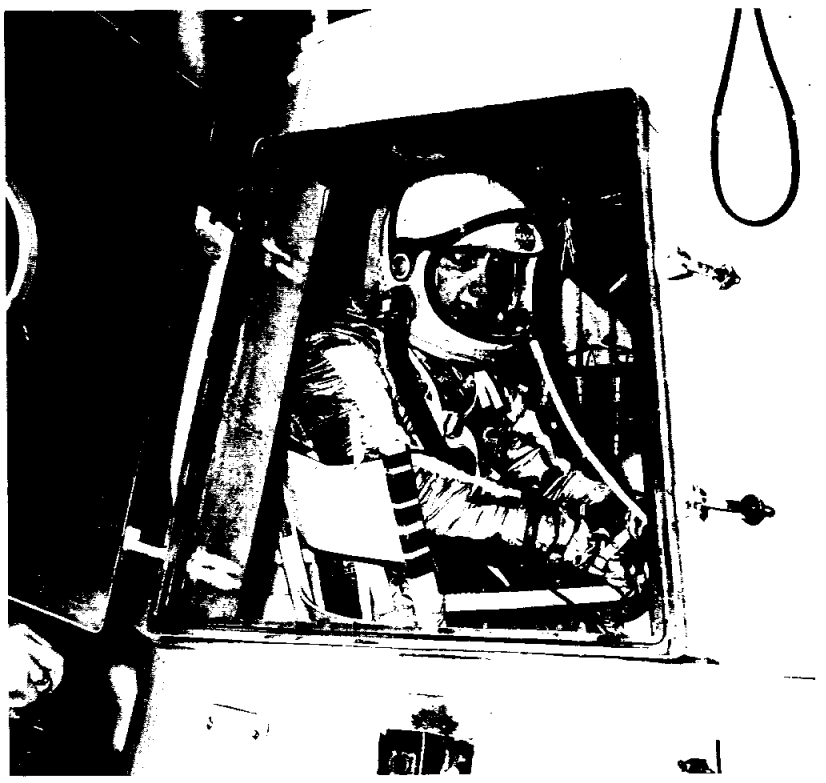
As the tests are run, mechanical measuring devices are making graphs of pressure in the suit and in the cabin; moisture, carbon dioxide and oxygen content; temperature in the suit, the cabin, and 24 different points in the system; the test subject's heartbeat, respiration, pulse rate, etc. Several different devices may be tested at one time.

Alternating light and dark when the spacecraft is in orbit has tended to build up heat in the capsule during daylight which doesn't go back down enough on the dark side. "During one-day missions the spacecraft may experience higher temperatures than it has in previous flights. We're planning a series of test runs to simulate expected conditions and perhaps recommend modifications to improve systems performance," Mayo added.

Test subjects are taken from the test crew or borrowed from the equipment branch. All have been through altitude and pressure chamber training at the Air Force Aviation School of Medicine at Brooks AFB, San Antonio.

Anybody who has a cold or sinus trouble is grounded. Add those to people who won't fit into the suit and you have a shortage of test subjects which crops up often.

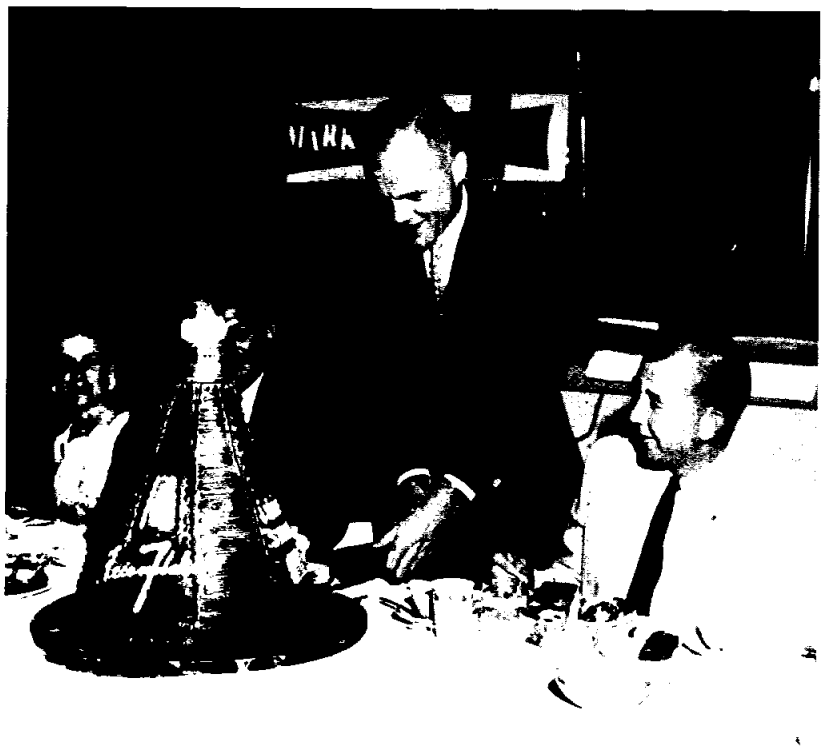
Any volunteers?



TEST SUBJECT Gil Freedman of the Material and Equipment Branch gets as comfortable as possible before the hatch is closed for a test run on the environmental control system. The lawn chair he is setting in is a concession to hours of testing necessary under earth gravity.

NORMAL OPERATING CONDITION during a test run shows the main control panel at left being monitored by technicians Bob Bernardin, Bill Berry and electronics technician Jim Brady. In the foreground are ECS technician Dick Mayo and co-op student Dave Berel.

DR. RICHARD M. DUNHAM of the Life Systems Division tries the prone position during a short test run in the ECS test chamber. A foan rubber pad has been substituted for the usual couch. In rear is thermos jug of water.



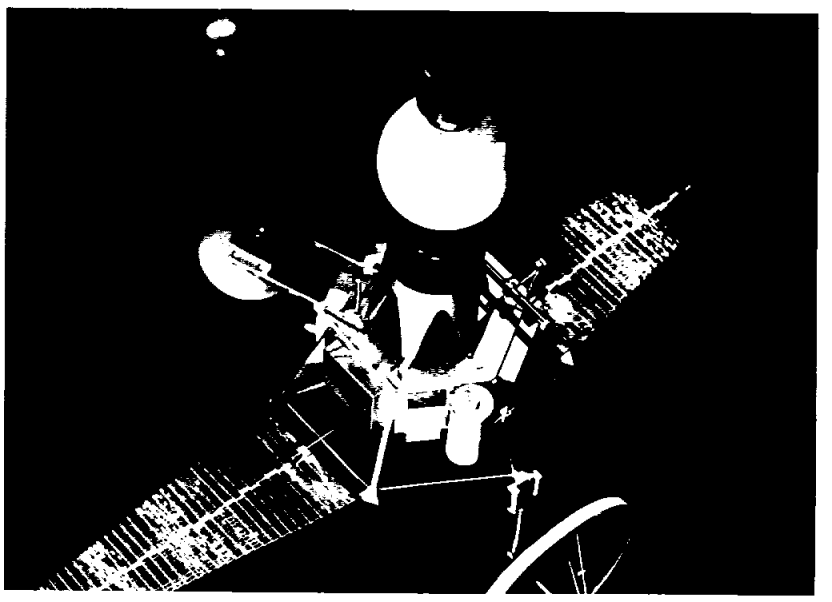
A TESTIMONIAL PARTY in honor of John Glenn and the MA-6 flight was held last week in the Armory at Cocoa Beach, Fla. At the top and center pictures Glenn is shown as he receives souvenir gifts commemorating his flight from the MA-6 Launch Team. At the bottom, Glenn is pictured cutting the "Friendship 7" cake. The party was attended by many NASA and contractor employees.

Ranger 4 Hits Dark Side of Moon Thurs.

Ranger 4, launched at Cape Canaveral last Monday afternoon, crash-landed on the back-side of the moon at 6:47 am CST last Thursday, some 64 hours and an estimated 231,486 miles after its launch. It was tracked to its moon landing by an 85-foot antennae at the Goldstone, Calif., tracking station.

Although NASA scientists were disappointed that expected moon measuring experiments were impossible because of an electronic failure, they hailed the flight as a "tremendous guidance success."

The 730-pound package of scientific instruments, launched aboard a 10-story Atlas-Agena rocket had been scheduled to take and relay television pictures of the moon's surface, landing instruments to measure temperature and moonquakes, and a variety of lesser studies.



A SCALE MODEL of the Ranger 4 spacecraft launched last Monday which crash-landed on the far side of the moon 64 hours later.

WELCOME ABOARD

The following is a list of employees who joined Manned Spacecraft Center during the months of February and March, but have not to date been listed in this column. Most of them began work at either the Houston or Cape Canaveral sites.

MERCURY PROJECT OFFICE: William J. Williams, Raymond F. Kilgallen (Atlantic Missile Range Project Office).

GEMINI PROJECT OFFICE: William H. Douglas, Ben Riena, Gregory P. McIntosh, Duncan R. Collins, William F. Smith, Carolyn A. Rancorn, Calvin C. Guild, Jessie E. McPherson, Paul L. Charvoy, James E. Powers.

APOLLO PROJECT OFFICE: Jesse F. Gore, Norman J. Mc.eod, Calvin H. Perrine, Hubert P. Davis, William F. Rector, Donald L. Wyrick, Raul L. Reyes, David W. Gilbert, Alice D. Robinson, Paul F. Weyers.

PREFLIGHT OPERATIONS: Joseph B. Fitzsimmons, Moody M. Steadham, Kenneth W. Kornegay, James G. Tibbetts, III, Lawrence A. Niss, Donald E. Phillips, Stanley A. Gross.

FLIGHT OPERATIONS: Joel Wythe Moore, Jr., Michael J. McCullough, John B. Bullock, Arthur J. Thiberville, Mary A. Mitcherling, Wanda K. Cheatham, Patsy L. McCaskill, Patricia L. Chaffery, Donna R. Sanford, Vernon L. Sturdivant.

FLIGHT CREW OPERATIONS: Richard G. Snyder, Bobby R. Uzzell, Thomas S. Clinton, Ralph Edward Drexel, 1st Lt. Joseph P. Loftus (USAF), Maj. George B. Smith (USAF), James W. Blodeaux.

SYSTEMS EVALUATION AND DEVELOPMENT: George Hondros, Richard J. Piotrowski, George B. Gibson, Horace H. Allen, William E. Milligan, Donald G. Wiseman, Robert D. White, Billy D. Kendrick, Thomas H. Buckler, David M. Wickman, Clyde R. Edmiston, Omer Bloyd, Jr., Robert C. Dyer, John T. Taylor, David M. Hickman, Edward A. Schultz, Herbert A. Schultz, George W. Brandon.

ELECTRICAL SYSTEMS: David E. O'Brien, William Charles Stagg, Reagan S. Redman.

ENERGY SYSTEMS: Jimmy D. Bradley.

LIFE SYSTEMS: Larry B. York, Robert H. Stule, John W. Yuskin, Frank A. Burgett, John W. Bold, David D. Cope, John F. Rayfield, Richard E. Bellebille, Robert J. Lamonte.

SPACECRAFT RESEARCH: Peter W. Higgins, Ernest R. Gubbins, James G. Hondros, Frank C. Littleton, Jr., William E. Hensley, Norman E. Robertson, John A. McNulty, James W. Blackmon, Frederick J. Stebbins, Robert D. Schwartz, Anita E. Gregory, Frank C. Littleton, Judith A. McCallum, Thomas Cobb, Robert W. Abel, Rex R. Bauerlein, Ernst F. Germann, Homer E. Thornhill, Dallas E. Evans.

FLIGHT DYNAMICS: J. T. Edge.

RELIABILITY AND FLIGHT SAFETY: Carl P. Spencer, Thomas J. Edwards, Lemuel S. Menear.

SPACE PHYSICS: Warren Gillespie, Jr.

TECHNICAL INFORMATION: Patricia L. Jordan, Rita G. LaFleur, Lois K. Beard, Robert W. Frick, Jr., Sandra Canon, Charles L. Coston.

ADMINISTRATIVE SERVICES: Deborah McCartney, Felix Littale, Allen Williams, Lora Simmons, James Lloyd Young, Adam Ernest Cook, J. C. Chatman, Lolita Currie, Ramiro Perez, Marilyn Joyce Shupe, Sherrie Lou Ebert, Barbara A. Metalski, Pauline A. Wells, Boyd E. Mounce, James R. Cooper, Charles A. Biggs, Tommie Lee Walton, Roscoe Bruler, Earnest Boyd, Richard Stannery.

CAPE CANAVERAL ADMINISTRATION: Robert L. Osborne, Jayne D. Bidgood, Catherine W. Archer.

STENOGRAPHIC SERVICES: Betty M. Hall, Maude Louise Haby, Laurie Anne Striegel, Linda Rae Striegel, Joyce Patterson, Margaret Anne Messing, Camille D. Lackey, Elizabeth S. Puskar, Rebecca Beerman, Mary Ellen Holeman, Ida M. March, Geneva T. Harper, O'Tulsa H. Placker, Virginia Z. Laired, Mary H. Hardeman, Karen A. Ash, Glory L. Allahverani, Doreen M. Horrocks.

PROCUREMENT AND CONTRACT: James C. Bishop, James P. Harris, Carl R. Scarlett, Milton Holyman.

PROCUREMENT AND SUPPLY: Leland R. Smith, Winlon B. Pelham.

SUPPLY: Bernard E. Broughton, Carl E. Dalin, Arthur K. Richardson.

Logistics: Sylvester Barrett, Frank D. McCrimmon, Charley F. Brown.

PERSONNEL: Edward A. Gorecki, Geraldine E. R iney, Jimmie T. Cain, Rebecca Jane Boyer.

FINANCIAL MANAGEMENT: Mary M. Siller, Brian Lebert-Francis, Donna Sue Kelley, George J. Buehler, Joseph A. Lynch, Louis H. Hendon, Gloria L. Theologian, Marian Lee Yancey.

BUDGET AND FINANCE: Joseph Hehn, Pearl C. Gibson.

BUSINESS MANAGEMENT: Blanche R. Henderson.

MANAGEMENT SERVICES: Mildred L. Wilkes.

SECURITY: Charles A. Buckel.

TRANSPORTATION: Jack D. Rainey.

FACILITIES: Billy C. Hatler.

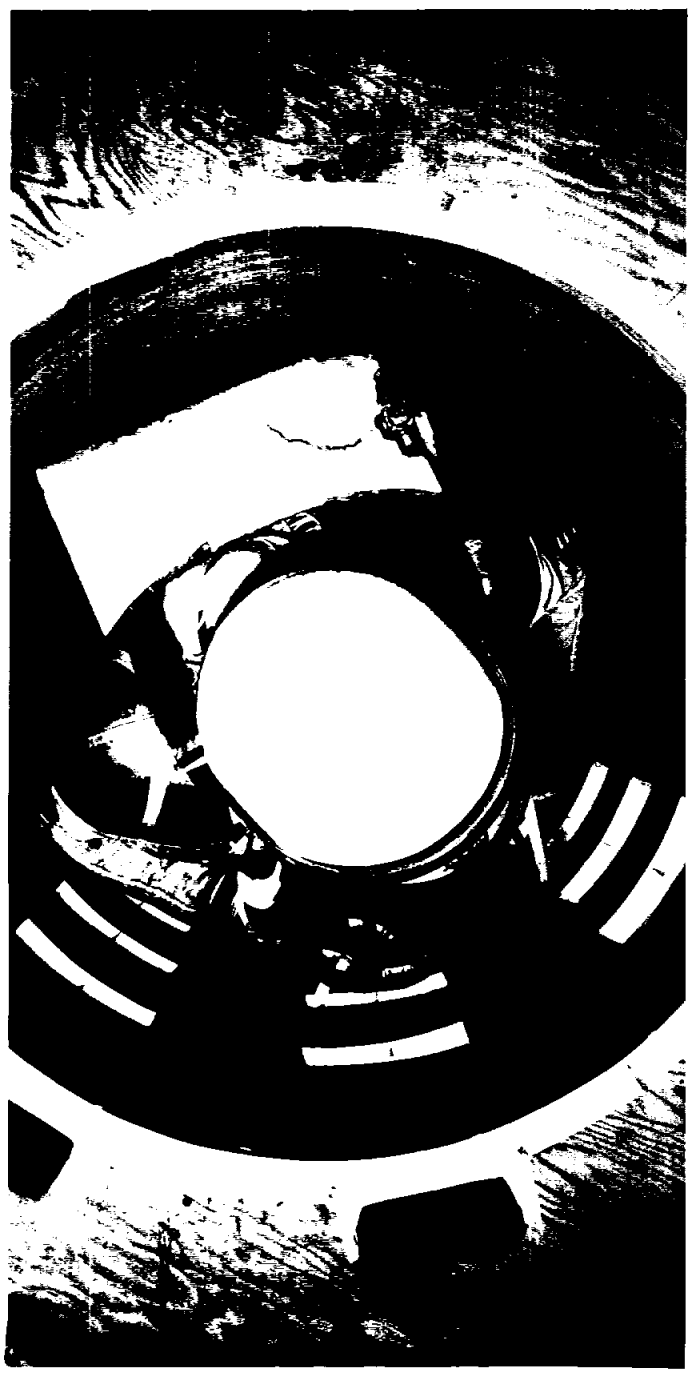
CONSTRUCTION OFFICE: William A. Milam, Harley F. Erickson.

GRAPHIC SERVICES: Gerald J. Lyons.

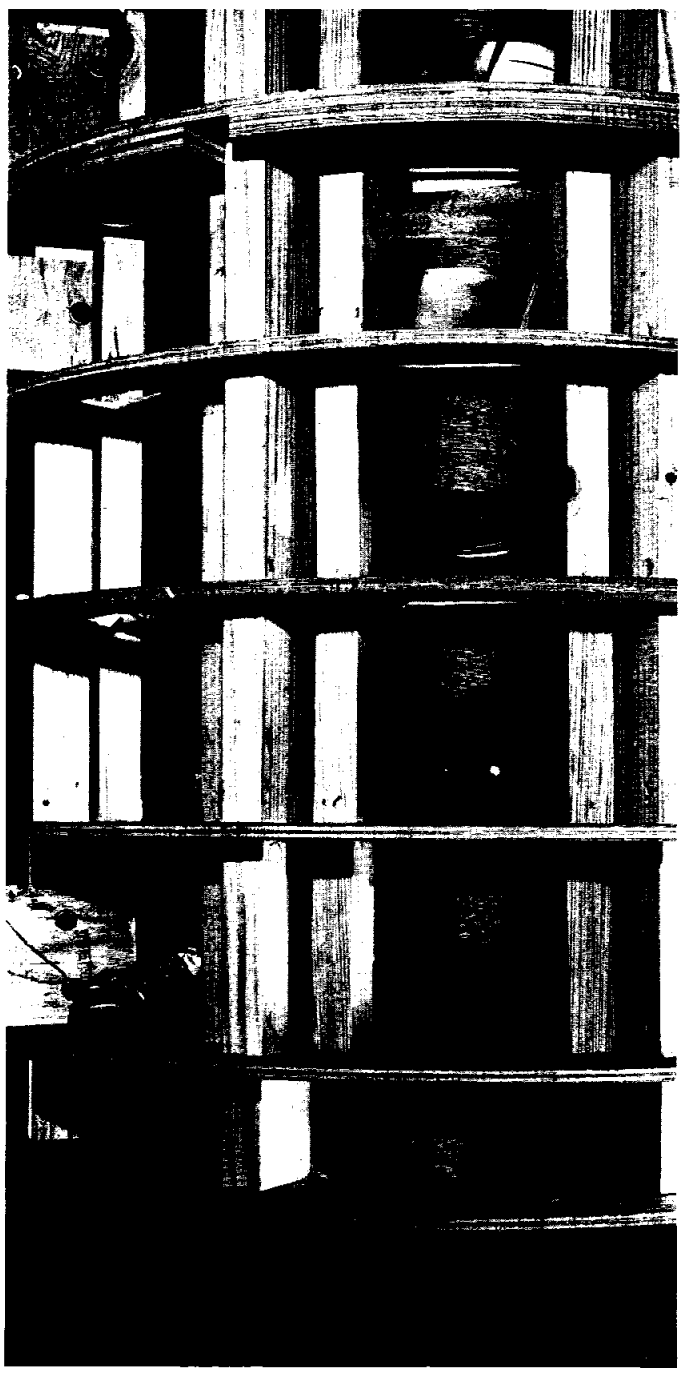
DIGITAL COMPUTER: Eugene H. Brock.

PHOTO DIVISION: John W. Holland, Jr.

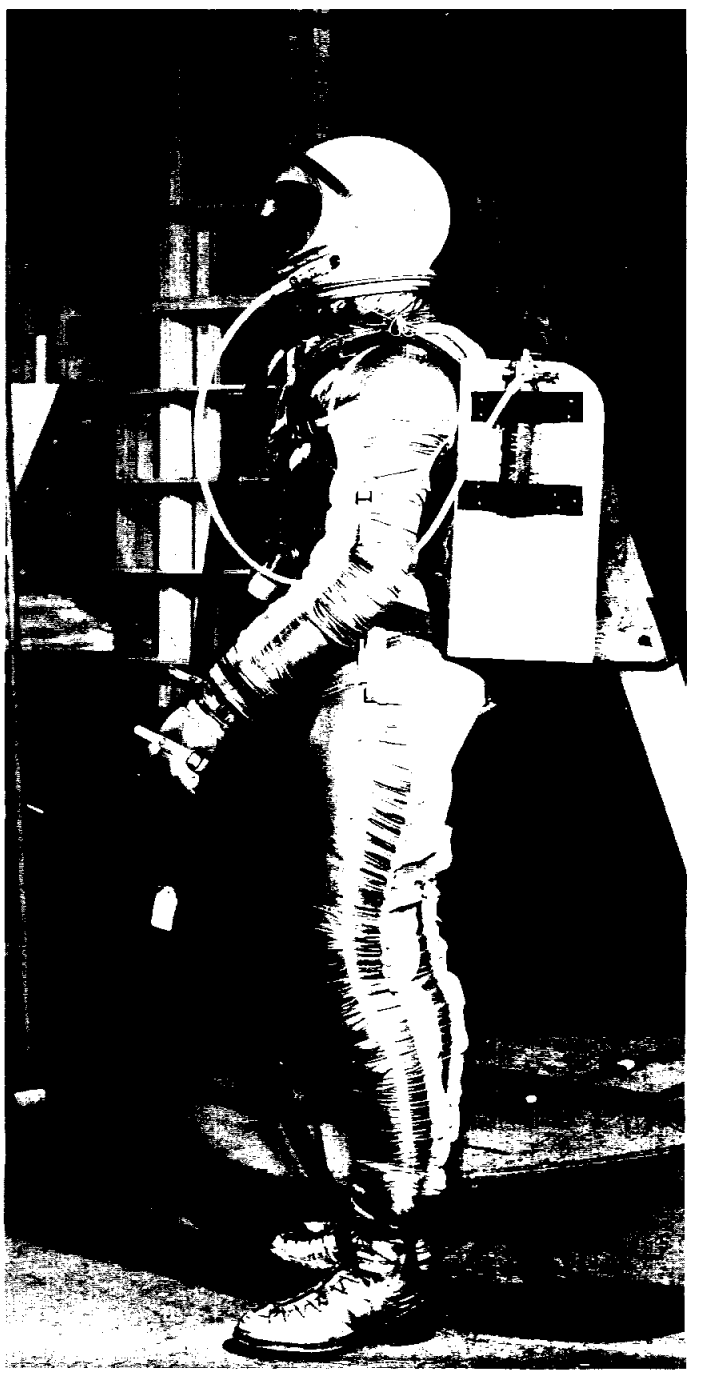
OFFICE OF CHIEF COUNSEL: Marvin J. Marnock, Marvin F. Matthews.



LIKE A STRANGE MOTH coming out of a cocoon, test subject Joe Kosmo of the Crew Equipment Branch, Life Systems Division works his way up through the Apollo air-lock mock-up with five pounds of pressure in his suit. Tightness of pack corners against sides of air-lock suggests a possible modification in the shape of the back pack, which will contain breathing apparatus for use on the moon.



FEET AND KNEES are all that can be seen through the climbing slots in the side of the mock-up. Note size of suit legs, at only two pounds of pressure.



TEST SUBJECT Joe Kosmo displays the full proportions of the pressure suit and back-pack in which he must squeeze through the 28-inch Apollo air-lock mock-up, shown in background.

STANDING ON THE FLOOR at the bottom of the mock-up, Kosmo prepares to begin the climb at two-pounds suit pressure. Slots in the air-lock sides are used as hand and foot-holds. The mock-up is 28 inches in diameter.

Getting In And Out On The Moon, Or How Big Should The Door Be?

It was only a few years ago that the idea of going to the moon was to the general public an impossible daydream. Today, however, the man who once chided his science-fiction reading son for "wasting your time with that trash" sits at the dinner table and discusses payloads, orbital velocity, second stages and lunar landings as if it had been common knowledge for years.

In the midst of second-guessing the scientists on the size of the payload and what fuel to use, there is a tendency to forget entirely the small, practical things which are going to be just as important.

For instance, how big does the door have to be? What size entrance is going to be necessary on the Apollo spacecraft to allow a fully-suited astronaut to get in and out at (a) earth gravity, and (b) roughly a sixth of that, or lunar gravity?

"Somewhere around 28 inches, and even then there are going to be problems," say Henry Friloux and his cohorts of the Life Systems Division. They should know, because they've been figuratively climbing in and out of the "Apollo air lock" for several days. In this cast it's a plywood mock-up between six and seven feet tall, which is presently resting on the floor of the lab area in the Lane Wells building.

Technologists are devising the best procedures for egressing through it, trying the climb at various pressures in the Mercury spacesuit. Since a man on the moon would have to carry his own breathing apparatus, they are wearing a back pack which should be the appropriate size, although at the moment it doesn't have anything in it.

The mock-up is 28 inches in diameter, and has been varied down to 24 inches. To simulate a lower pull of gravity, a can of water attached to a parachute harness has been used as a counterweight, to keep the astronaut from having to pull his whole weight up as he climbs.

Later models of the pressure suit have come through the air-lock with increasing facility. The first model tested, for instance would not go through a 26-inch opening without the counterbalance, and would not go through the 28-inch opening without the water can at more than two pounds pressure, since increased pressure in the suit makes a difference in size.

"Determining the size of the opening isn't the only problem. In addition to the actual suit design, there is the shape of the back-pack. Now rectangular, it tends to rub against circular air-lock walls at the corners. Redesigning its shape might help.

"What we are looking for," says Friloux, is the smallest diameter that it's possible to use, and the best procedures for getting in and out. Right now we're using slots in the walls for climbing at earth gravity but that might not be the best way. That's the kind of thing we're working on."

It is a virtual certainty that these problems, the big ones and the small ones, will one day be solved. Man can go right on dreaming of his visit to the moon. It will one day be a reality.

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 Officer . . John A. Powers
Editor . . . . . Ivan D. Ertel
Staff Writer . . . . . Anne T. Corey
Staff Photographer . . . . . Bill Taub

On The Lighter Side

A series of explosions has occurred in the Houston area recently and not the least of these was the population explosion when Mrs. Wesley L. Hjornevik and the five Hjornevik boys appeared on the scene—add one more basketball team (at least potentially) to the Texas scene.

Word of the week in the ROUNDUP office—extinctospectopolariscopeocculogyrogravoadaptometer. The meaning is simple—V-Meter.

Rex Ray has reported that there are a number of active mice in the F&C Building. His report was based on the fact that his ask trays and similar items disappeared at night and he claims that he is certain no person would be guilty of such an act, so it must be mice.

To back up Ray's argument, those mice must be getting mighty hungry. Last week, when people occupying office space in one wing of the building had their backs turned, the tile on the floors of a number of offices disappeared.

Probably the two most popular "people" at the F&C Building are the squirrels which scamper about the patio.

Anticipated reaction of a moon-man who has learned through propaganda channels that the Apollo Project is underway and the Americans are on the way.

EDITORIAL EXCERPTS

Business Week, March 14, 1962

SPACE CRESCENT TRANSFORMS GULF AREA
(Excerpts)

The U. S. civilian space program has in its first few years cost close to $3 billion. By 1970 spending could add up to more than $40 billion. And a great many of these dollars will be spent in a deep crescent that stretches from Houston, Tex. (up through Huntsville, Ala.) to Cape Canaveral, Fla.

NASA is clustering its activities in five areas, linked by inland and sheltered coastal waterways.

Key spots in the crescent are Houston, where NASA will build the $90 million Manned Spacecraft Center . . . New Orleans, where NASA is reactivating a $50 million ordnance plant in which Chrysler Corp. will produce most of the Saturn S-1 boosters an the Boeing Co. will make the advanced Saturn S-1C . . . Hancock County, Miss., where NASA will build its Mississippi Test Facility for static test-firing of Saturns . . . Huntsville, Ala., where George C. Marshall Space Flight Center (is located), and Cape Canaveral, Fla.

NASA has already brought more than 700 personnel to Houston; by next June 1, 640 NASA families will be relocated in Houston and 3,000 families by June, 1963. (Those expected by this June) will increase the local population by 6,560, create a market for $24 million worth of homes.

So far, space contractors haven't followed NASA's wake to Houston in force. But they can be expected to act on their desire to be close to the Manned Spacecraft Center.

The Center will be built at Clear Lake, 22 mi. southeast of Houston. Humble (Oil & Refining Co.) and Del Webb Corp. plan to develop 1 another 15,000 acres wrapped around the lab area in the next 15 years into a $500, million community of some 15,000 population. Land in the lab area that sold at between $1,000 and $1,500 an acre before the MSC announcement has moved to an asking price of $3,500 an acre.

As great as the Florida East Coast development has been, the boom is only beginning, it seems. Brevard County was the nation's fastest growing county during the 1950's jumping from 17,000 population in 1950 to more than 117,000 in 1960, and it could double again by 1970.

All the companies directly connected with missile testing, are, naturally, already at the Cape. These and others are talking about expanding either at the Cape or elsewhere in Florida.

The great industrial rush to Florida can be expected as giant solid-fuel boosters are developed for future assignments in space. Once the solid fuel is cast in the case, such a rocket must be handled as one piece. So they pretty much have to be manufactured close to the Cape and on a waterway deep enough to be delivered by barge.

MSC PERSONALITY

Aleck C. Bond, Georgia Tech Alumnus Heads SED Division

Aleck Constantine Bond, a working aeronautical engineer with a master's degree since 1948, is of Greek descent and used to work in his father's restaurant "In fact," says Bond, "the whole family is in the restaurant business, except me." So why did he get into aeronautical engineering?

"My college counselor asked me the same question," Bond confessed. "He said I needn't expect it to be a glamorous occupation; I'd never make more than $125 or $150 a month at it."

Bond is doing somewhat better than that as chief of MSC's Systems Evaluation and Development Division. SEDD develops the whole spectrum of spacecraft systems to meet the requirements of the Mercury, Gemini and Apollo Projects and does advance planning and research on others. When the MSC site at Clear Lake is ready, SEDD will operate the space environmental chamber to give spacecraft functional and integrity checkouts in all space and lunar environments before the first flight tests. Included are the electrical systems branch, mechanical systems branch, energy systems branch, and facilities test branch, which will operate the environmental chamber and the themrodynamic test area for structures and materials testing.

Bond has an excellent background for his present job. As a member of the NACA's Pilotless Aircraft Research Division (PARD) at Langley Field, Va. for more than 10 years, he was associated with a variety of research programs on ram jet performance, flight evaluation of special configurations, aerodynamic heating and high temperature materials. Of particular interest is the fact that Bond later spelled out specifications for the ablation heat shield used on Mercury spacecraft, a project with which he began his association while with PARD. Bond headed the Structural Dynamics Section during his last three years with NACA, and in November of 1958 transferred to the NASA Space Task Group as project enginner for the "Big Joe" flight test. "Big Joe gave us our first real measurement on the heating problem, and was used for making many design changes in the Mercury spacecraft," he commented. Bond was also project engineer on the production of the first Mercury spacecraft. In August of 1959 he was named head of the performance branch of the Flight Systems Division. He was designated assistant chief for Mercury support, Flight Systems Division, April 2, 1961 and named to his present job March 2 of this year.

The author of some two dozen technical papers for NACA and NASA, Bond made a trip to Istanbul, Turkey as a representative of MSC Director Robert Gilruth to speak before the Advisory Group for Aeronautical Research and Development (ADGARD) of NATO in October of 1960, giving a status report of the Mercury program. He was a member of the Golovan Large Launch Vehicle Planning Group for five months during the past year.

Born August 11, 1922 in Columbus, Ga., he moved to

ALECK C. BOND

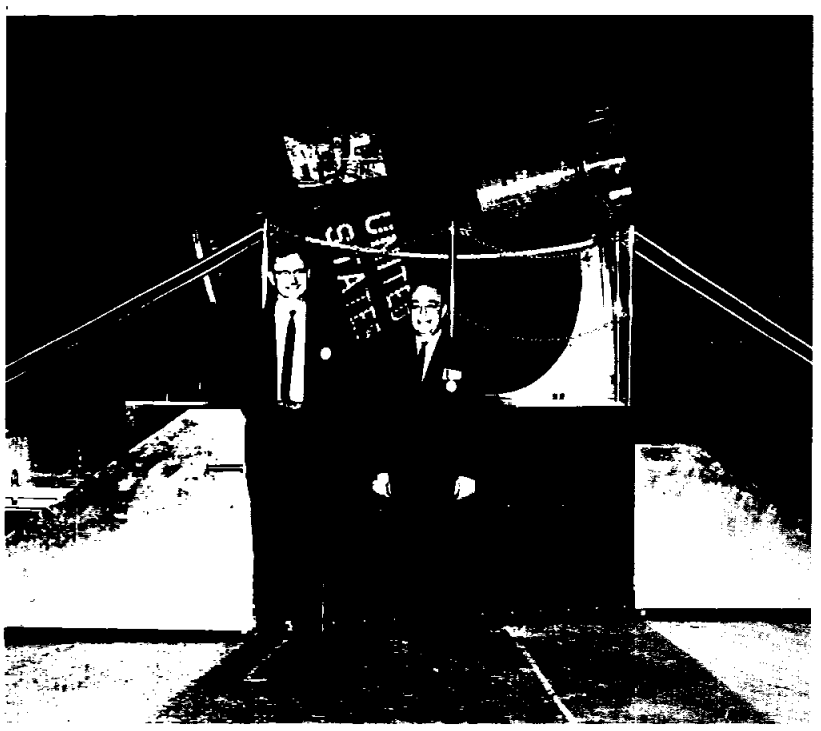
Pensacola, Fla. at the age of 6, when his father opened a restaurant there. He grew up near the Naval Air Station. It was this location, he says, which fostered his early interest in aeronautical engineering. He was graduated from Pensacola High in 1940, received his BS from Georgia Tech in 1943, and worked for Bell Aircraft Corp., Marietta, Ga. for two years before entering the Air Force.

Returning to Georgia Tech in 1947, he did seven months work as a graduate research assistant and then acquired his masters' degree in aeronautical engineering in March, 1948 before accepting his position with NACA.

Bond and his wife, Anastasia, have two daughters, Connie, 8, and Kathy, who will be 12 in July. Both, he says, have an unusual grasp of science with which he is quite pleased, and "keep the den walls plastered with pictures of Mercury rockets."

His favorite outside interest is deep sea fishing and boating, activities for which he hasn't had much time lately. He is also an avid grower of roses, although he says he leaves the fancy hybrids to other people and just grows "plain roses."

Friendship 7 Spacecraft Starts on World Tour; Schedule Is Listed



THE FRIENDSHIP 7 SPACECRAFT, as it will be displayed on the worldwide tour is shown above. Left to right, are W. H. Gray, MSC representative to McDonnell Aircraft Corporation, and Andrew Lamache of the Project Management office.

Friendship 7, the Mercury spacecraft in which Astronaut John Glenn Jr. orbited the earth three times, is circling the earth again. But this time it is making more than 20 stops along the way.

The National Aeronautics and Space Administration has loaned the spacecraft to the U. S. Information Agency which is displaying it on all continents. Friendship 7 will return to the United States in mid-August for the Century 21 exposition at Seattle, Wash., before being presented to the Smithsonian Institute in Washington, D.C., for permanent exhibit.

The Friendship 7 tour will include stops in Australia, Bermuda, Spain, Nigeria, Mexico, Great Britain, and Zanzibar—nations cooperating with the United States in the Project Mercury tracking program. The itinerary also includes two to four-day exhibitions in France, Japan, India and Brazil.

The first stop on the trip was at Hamilton, Bermuda, April 20. Glenn was unable to accompany the spacecraft on the tour because he is assisting in preparations for forthcoming Mercury flights.

Cities in which the spacecraft will be seen, in addition to Hamilton are Accra, Africa; Ankara, Turkey, Bangkok, Thailand; Belgrade, Yugoslavia; Bogota, Colombia; Buenos Aires, Argentina; Cairo, Egypt; Djakarta, Indonesia; Karachi, Pakistan; Lagos, Nigeria; London, England; Madrid, Spain; Manila, Philippines; Mexico City, Mexico; New Delhi, India; Paris, France; Rio de Janeiro, Brazil; Santiago, Chile; Sydney, Australia; Tokyo, Japan; and Zanzibar.

THE NOSE OF AN Air Force C-130 opens wide to accept its valuable cargo in St. Louis, as preparations are completed to take the future exhibit of the Smithsonian Institute to its first scheduled stop—Hamilton, Bermuda.

Collins Radio Company Reveals Apollo Telecommunications Plans

Collins Radio Company has revealed some major functions and characteristics of the telecommunication system to be used aboard the Apollo moon landing spacecraft to be built by North American Space and Information Systems Division.

Under the terms of its $40 million contract, Collins plans for the spacecraft's telecommunications system include the following:

(1) Voice transmission and reception facilities will be provided aboard the spacecraft for the astronauts to communicate with earth stations.

(2) A spacecraft intercommunication system for the astronauts to talk to each other will be within the craft.

(3) Tracking and ranging beacon equipment will be installed to keep the tracking stations on earth fully informed of the exact position of the spacecraft. The earth stations may in turn, transmit information to the crew, supplementing data provided by onboard navigation systems.

(4) Rescue voice and beacon equipment will also be included in the systems for communication during the landing phase of the mission.

(5) On-board communication "storage" facilities will be provided for those periods when direct communication with the earth will not be possible because of the location of earth-based facilities and during periods when the spacecraft is behind the moon.

For maximum communication reliability during the moon flights, the spacecraft communications systems will be designed on an "integrated modular concept."

Collins will contribute to a study to determine the location and design of ground communication equipment to be used in project Apollo regard.

PAO John Powers Is Speaker at SMU

John A. Powers, public affairs officer for MSC, spoke last Wednesday at a luncheon highlighting Businessmen's Day on Southern Methodist University's campus at Dallas.

Powers subject was "Business and the Space Age." His speech coincided with the second successful Saturn launching that morning and he referred to it during the speech.

He said, "This is a big step toward the moon. We're committed to the Apollo in the Apollo program." He also mentioned the up-coming MA-7 flight and said that astronaut M. Scott Carpenter would try some thing Glenn didn't have time for.

Webb

(Continued from page 8)

craft which last week hit the moon for the first time.

The second five are the Titan II, an ICBM developed by the Air Force and scheduled for use with the Gemini two-man spacecraft in late 1963 or early '64; the Centaur, for putting heavy payloads into deep space, including the 2,100-pound Surveryor for a "soft" landing on the moon; the Saturn C-1, to boost the three-man Apollo spacecraft into orbit around the earth for test and operational flights; the mighty Advanced Saturn, equipped with five F-1 engines in the first stage, which is scheduled to lift a specially-prepared Apollo for a flight around the moon; and finally the gigantic Nova, equipped with a cluster of eight F-1 engines in the first stage and the powerful M-1 liquid hydrogen-fueled engine in the second, standing 280 feet tall exclusive of the payload, which will have power enough to send a fully-equipped Apollo on a direct flight to land on the moon and return to earth.

Webb explained the optional method of boosting the Apollo payload into earth orbit, where it would rendezvous with another spacecraft and launch from there to the moon. He said this could cut as much as two years from the program, if the technique can be developed.

"What we require for the future are more efficient means of propulsion," he said, one of which is the nuclear rocket, the use of which is limited by the strength of materials available to withstand the high temperatures involved. NASA is working with the Atomic Energy Commission on the development of this engine, called NERVA, for Project Rover.

In closing, Webb said: "Scientists, engineers, technicians, and leaders . . . are cooperating wholeheartedly to attain our national goals. The American people themselves have responded to with enthusiasm to the great adventure that lies before us."

P. Purser Tells AOA Meeting About Manned Space Programs

Paul E. Purser, special assistand to the MSC Director, recently spoke at the American Ordnance Association meeting in Dallas, Tex., about the manned space flight programs.

He discussed the objectives of Projects Mercury, Gemini, and Apollo and described the progress of the design, development and manufacturing phases of the Mercury program. In addition he went into detail as to the differences in the concepts of the Gemini and Apollo spacecraft and objectives as compared with Mercury.

He told the group that "Manned Spacecraft Center has been established to provice a source of technical competence for manning the existing programs and for properly manning future programs." Purser told them that the accomplishment of this mission will require not only a staff of technically competent scientists, engineers, and administrators, but also a certain amount of experimental equipment and facilities.

He explained that the purpose of the facilities is two-fold: first, to provide a means of testing and evaluating contractor designs of flight components, and second, maintaining the skills and knowledge of the staff in order that they may properly supervise current projects and plan projects.

Purser discussed the major test facilities which are presently being planned for the Clear Lake site and pointed out that it is not planned to duplicate existing major facilities which exist at the other NASA or Armed Forces Research Centers, and that it is planned to continue to rely on other centers for supporting research and tests in many of the unique facilities of those centers.

Specifically, he said, those facilities being planned include a series of environmental chambers of different sizes which will be capable of approaching the conditions of space and of lunar surface. The large chamber would accept the complete space vehicle of the Apollo class and larger and all spacecraft systems, with the exception of major propulsion, would be exercised and performance evaluated. The other three chambers would be in the medium-size category and have been proposed for the attainment of certain other specific test objectives such as current and advanced environmental control systems, pressure-suit test and development, astronaut familiarization and training, and solar simulation.

Purser also went into detail about the thermo-chemical test area facilities, structural and vibration equipment, communications facilities, crew training and life systems laboratories, and the lunar landing facility.

He told the Ordnance meeting that to meet the demands of the activities he had described there would be a nucleus of diversified machine shops, fabrication areas, model-making shops, and test preparation and support groups.

It was pointed out that activities conducted near the site such as seaworthiness tests, land and water touchdown maneuvers, rescue-aids development, pickup procedures, and other advanced testing procedures unique to manned spacecraft will require day to day effort in order to meet the quick response of hardware integration schedules. Ongoing programs require many small changes which oftentimes need to be made, tested, transported thousands of miles, and integrated with existing equipment. Many models of the space vehicles need to be produced for wind-tunnel investigations, structural integrity tests, antennae pattern analysis, balance and weight effects, heat-transfer, and pressure-distribution verification.

MA-6 Flight Objectives Accomplished

"The fact that John Glenn's flight was an unqualified success is well documented . . . This flight marked a major milestone in the United States program for the manned exploration of space," reads the summary of MA-6 results.

The stated objective (in the fall of 1958) of Project Mercury was "to determine man's capabilities in a space environment." This objective has been accomplished for the missions to date. It has been determined that a trained pilot can perform tasks under a relatively high g-stress as well as under zero-g, can monitor all his systems, can manually control the flight sequence, and can adequately control the attitude of his craft.

In Project Mercury, far more has been learned than was anticipated. A knowledge of how to design, develop and manufacture a craft has been gained. It has been learned how to modify existing launch vehicles, designed for other purposes, to make them suitable for manned flight.

A knowledge of how to use an extensive network of tracking stations using real-time data transmission and computing and allowing real-time flight control has been gained. Ground rules have been established for recovery from space.

Some of the items developed for Project Mercury will find use in other fields, such as the new lightweight survival equipment which might well be used in air-rescue services, and the biomedical instruments.

Extensive training and simulation has been found to be an absolute requirement.

Most important of all, it has been learned that a well-trained pilot can perform a mission in space just as well as he can perform a mission in the earth's atmosphere.

The summary was presented by George M. Low, Director of Spacecraft and Flight Missions, Office of Manned Space Flight, NASA.

Space News ROUNDUP!

SECOND FRONT PAGE

Webb Outlines National Launch Vehicle Series To Conference

"In carrying out the national space program, uncertainty has ended and urgency has been added," NASA Administrator James E. Webb told members of the Western Space Age Industries Exposition and Conference, in San Francisco, Calif. last Tuesday.

Included in the conference were the governors of 13 western states, industrial and engineering leaders.

"It was almost 50 years from the Wright Brother's flight until we learned to build an airplane that could fly faster than sound. . . . Now, four years after the first satellites, we are able to launch spacecraft large enough to carry men in orbit about the earth."

Webb summarized the goals expressed in the National Aeronautics and Space Act of 1958, a ten-year plan laid out under the Eisenhower Administration. Then he added, "Although the Eisenhower long-range plan called for a rapid development of space by any normal standard, the manned lunar landing mission was considered to lie beyond 1970 and there was skepticism as to whether Russian accomplishments could really challenge us in space. Mr. Eisenhower's doubts as to the value of manned spaceflight were expressed in his last budget message . . . and he refused to include in his budget the funds required to build big boosters. That meant that the manned lunar landing could not, in fact, take place before about the middle of the 1970's."

This, said Webb, was the situation in early 1961 when the Soviet Union began its series of history-making demonstrations.

On March 24, President Kennedy announced that if we were to retrieve our position in space, we could no longer proceed with the Mercury one-man space ship as if that were to be the end of our program, and that we must, even in a tight budget situation, commit ourselves to build the giant boosters required for multi-manned space flight.

On May 25, Kennedy announced new goals for the nation in space and new programs to achieve them. These actions, said Webb, were to accomplish within the ten years of the 1960's about the same volume of research, development, exploration and applications as plans of the previous Administration envisioned in about 15 years.

Webb then outlined the National Launch Vehicle Program, presently consisting of 10 behicles in ascending order of size. Briefly, they are the Scout, a four-stage, solid propellant vehicle that can place a 150-pound satellite in orbit and is used for scientific satellite launchings; the Delta, our most reliable rocket, which is used to launch scientific research satellites such as the TIROS weather series; the Thor-Agena B, used extensibely by the Air Force and the launch vehicle for the advanced Nimbus weather satellite; the Atlas, used to launch Mercury spacecraft; the Atlas-Agena B, used for the unmanned Ranger lunar-landing

(Continued on page 7)

No Adverse Effects So Far, Say Flight Doctors

Preflight and postflight medical examinations have revealed "no adverse effects" of Astronaut John Glenn's orbital flight in MA-6, says an aeromedical team, but there is a chance that this flight was too short to produce detectable effects.

Two other possibilities are that they have not yet become evident, or that they were of such short duration that they disappeared before Glenn could be examined.

These were opinions expressed in the MA-6 results conference held in Washington last month.

Special studies were included, in which the pilot was timed and scored on his ability to maintain his balance while walking along successively more narrow rails. His scores were considerably higher than those obtained for a group of flight personnel.

Glenn began a low residue diet four days before the flight, retired at 9:30 the night before, and was awakened at 2:30 a.m. the morning of the 20th. Shortly after 3 a.m., his final preflight medical examination revealed a "calm, healthy, alert adult male," and all results of the examination were normal. Postflight medical examination began 39 minutes after Glenn landed when he emerged from the spacecraft aboard the destroyer *Noa*. The pilot was described as appearing hot, sweating profusely, and fatigued. "He was lucid, had no medical complaints other than being hot, and there was no other subjective evidence of dehydration."

The medical history of the space flight revealed that in spite of voluntary and rather violent head maneuvers, Glenn noted no gastrointestinal or disorientation symptoms during weightlessness. He experienced no adverse effects from isolation or confinement. He was kept active and busy during the flight. He experienced a mild condition of "stomach awareness," which in no way approximated nausea, during the 20 minutes the spacecraft was on the water prior to recovery. Cabin air temperature was 103 degrees F. at the time of the landing and the pilot had taken in only 94 cubic centimeters of water (in the applesauce puree flight food) for the rather long period of 13 hours.

The postflight exam showed everything normal except for slight skin abrasions on the knuckles of his right hand (received when the plunger of the explosive actuator for the egress hatch recoiled), an area of reddening where the blood pressure microphone had been attached, and a mild reaction to the moleskin adhesive plaster which attached the four ECG electrodes.

Further medical examinations after transfer to the carrier U.S.S. Randolph, and another at Grand Turk Island, showed everything normal.

The only changes between preflight and postflight examinations was a weight loss of about five and a third pounds, apparently due to slight dehydration.

The report was prepared by Dr. Howard A. Minners of the Life Systems Division; Dr. William K. Douglas, astronaut flight surgeon; Dr. Edward C. Knoblock of Walter Reed Army Institute of Research; Dr. Ashton Graybiel, U.S. Navy School of Medicine, Pensacola, Fla.; and Dr. Willard Hawkins, Office of the Surgeon General, Headquarters, United States Air Force, Washington, D. C.

Aerojet to Build Service Module

Aerojet-General's Space Propulsion Division at Azusa, Calif. has been selected to build the service module propulsion engine for the Apollo spacecraft, it was announced last week.

The liquid fueled rocket engine will be utilized to make midcourse corrections on the flight to and from the moon and for other power requirements of the lunar mission.

C. O. Nelson, Apollo material manager for North American Aviation's Space and Information Systems Division here—principal contractor for the spacecraft—said the work will be done at an estimated cost of $12 million. Aerojet-General is a subsidiary of the General Tire and Rubber Co.

The engine will be located in the Apollo's service module which is one of the spacecraft's three sections or "building blocks;" the other two are the command module which houses the Apollo's three-man crew, and the lunar landing module.

The Apollo spacecraft, it is planned, will put the first Americans on the moon for scientific exploration by 1970. The present NASA schedule calls for the Apollo to be launched into earth orbital flights during the 1964-65 time period and for circumlunar flights and lunar landing by the end of the decade.

INTERESTED SPECTATORS AT THE Clear Lake site last week included, left to right, Martin A. Byrnes, Jr., Center Operations Manager, and Governor and Mrs. Price Daniel. The Governor and his party dropped by the site to see the progress of the work there.