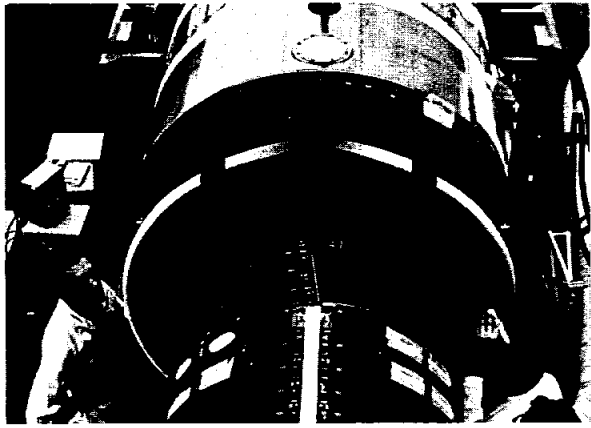




They had a date



with an Agena, but . . .

Space News **ROUNDUP!**

VOL. 5, NO. 1 MANNED SPACECRAFT CENTER, HOUSTON, TEXAS OCTOBER 29, 1965

Gemini VI Mission Scrubbed When Agena Fails To Orbit

The countdown had been perfect. From the time the flight controllers had seated themselves at their Mission Control Center consoles until the perfect no-holds lift-off of the Atlas-Agena at four seconds after 9 a.m. CST, there had been only minor hitches in the preparations for launch—nothing that meant stopping the clocks.

After Gemini VI crewmen Wally Schirra and Tom Stafford had been awakened, had breakfasted on steak and eggs with several of their fellow astronauts, suited up and ridden out to Pad 19, they had watched the Atlas-Agena launch on television in the white room from the spacecraft seats.

Atlas-Agena lift-off was at four seconds after the hour, and the Gemini VI crew and launch team went ahead with their preparations to launch the spacecraft 101 minutes later for a rendezvous with the Agena in the fourth revolution.

All went well in the Agena launch. Nominal trajectory and ground track were followed and the Agena separated from the Atlas at about 5 min. 15 sec. after lift-off. The Agena's 16,000-pound primary propulsion system was to have inserted Agena into a 161-nautical mile circular orbit after a short period of coasting flight.

Things began to turn sour at this point. First the Agena telemetry signals began to drop out, and Mel Brooks on the Agena Systems Console in Mission Control said that he could not confirm ignition of the primary propulsion system from data reaching him following a brief stabilizing burn of the secondary engines. Stations downrange in the Air Force Eastern Test Range also could not confirm engine ignition, and the radars did not lock on to C or S-Band Agena beacons. Radars at Patrick AFB and MILA skin tracked five pieces at 9 min. 30

sec. after lift-off. Antiqua radar reported sporadic hits.

Back at Pad 19, the Gemini VI countdown proceeded smoothly and Flight Director Chris Kraft at Mission Control-Houston waited for Canary Islands and Carnarvon data on the Agena to come in.

The data did not come. The Canary Islands station was unable to track the Agena at its predicted acquisition time, and Carnarvon reported "no joy, no joy" on that station's attempt to acquire and track the Agena.

At 9:54 a.m. CST, at T-42 minutes in the Gemini countdown, Chris Kraft called a hold when it became apparent that the Agena had been 8600 feet per second short of insertion into orbit. The mission was scrubbed and the Gemini VI crew reluctantly opened the spacecraft hatches and egressed.

At a Gemini VI scrub briefing for the press at Kennedy Space Center, Dr. George E. Mueller, NASA Associate Administrator for Manned Space Flight, said, "The countdown up to the time of the Agena failure was a perfect countdown and everything appeared to be going well. I particularly want to commend the crews of the companies, the Air Force and NASA groups who worked so hard to make this launch possible and to tell them how much I share their disappointment in the results. This is, as you know, the first time in a long while that we have not completely finished a mission, and we, of course, are all anxious to understand what the problems are and to determine how we can avoid this in the future."

"In the meantime," Mueller continued, "we are proceeding immediately with the Gemini VII mounting—mounting of the spacecraft—and we will go forward with the Gemini VII flight as soon as possible. I do not anticipate a delay in the Gemini VII flight because of the problems with the Agena."



AFTERMATH—The Gemini VI scrub press briefing at Kennedy Space Center is watched on television in Mission Control-Houston by MSC Director Dr. Robert Gilruth, left, Deputy MSC Director George Low, and Assistant Director for Flight Operations Christopher C. Kraft, Jr., seated.

Negotiations Begun With IBM For Computer Complex Growth

The National Aeronautics and Space Administration will negotiate a contract extension with the Federal Systems Division, International Business Machines

Corp., Rockville, Md., for continued support of the Real-Time Computer Complex at the Manned Spacecraft Center, Houston.

The extension is expected to cost about \$80 million. It will provide for converting to incentive contract clauses which are presently under discussion.

Technical Symposium Meets Tuesday, Nov. 2

The November MSC Technical Symposium will be Tuesday, November 2 starting with dinner in the Cafeteria at 4:45 p.m., and with the technical program starting at 6:15 in the Auditorium.

Speakers and topics for the Symposium are: Otto E. Crewelge, Jr., Structures and Mechanics Division, "Prediction of Apollo Service Module Response to Transonic Fluctuating Pressure"; Frank C. Littleton, Advanced Spacecraft Technology Division, "Saturn S-IVB/Apollo CSM Separation Dynamics for Tumbling Aborts"; and Donald E. Gault, Ames Research Center, "Lunar Erosion and Sedimentation Processes."

The work calls for conversion to new generation IBM Systems 360 computers and use of advanced multi-program techniques to increase capabilities required for Apollo missions.

The Real-Time Computer Complex in the Mission Control Center at Houston provides the computing capabilities required for mission monitoring, in-flight mission planning and simulation activities. In the Mission monitoring and planning functions, raw data is converted and displayed in formats easily interpreted by flight controllers.

The RTCC also generates simulated raw data required for pre-flight testing and mission simulations.



CONCENTRATION—Agena flight controllers Bruce Walton, left, and Mel Brooks closely watch their console telemetry and tracking displays for any signs of life in the Agena rendezvous vehicle.

Mathews Reviews Gemini V, Talks About Future Missions

Charles W. Mathews, Manager of the Gemini Program Office, met with reporters October 18 in the Gemini News Center to discuss some of the findings of the Gemini V mission, as well as to comment on future Gemini missions.

Mathews said that additional insulation of the Gemini fuel cell cryogenic hydrogen tank, and a technique for re-pumping the



MATHEWS

tank to coax out the last few molecules of air in the annulus between the tank inner and outer shells, should stabilize pressures and head off any recurrence of the excessive venting that was encountered on Gemini V.

The hydrogen venting caused pitch rates to build up that required Cooper and Conrad to dampen them with the attitude thrusters periodically. The thrust from the vents is now aligned through the spacecraft center of gravity to cancel out and buildup of rates.

The so-called "pogo" effect in the Gemini V launch has been narrowed down to the pre-flight loading procedure where oxidizer standpipes above the Gemini Launch Vehicle first-stage turbopumps were not loaded to the proper level to dampen the surges of propellant reaching the engines, Mathews said.

Another problem besetting Gemini V was the pressure drop in fuel cell cryogenic oxygen during the first revolution because of a faulty tank heater. Mathews said that all future fuel-cell equipped spacecraft will have cross-connections between the breathing oxygen and fuel cell oxygen tanks so that the heater of either tank can be used to pressurize the other tank. A solenoid valve provides the cross-pressurization at the pilot's option.

Although the Gemini V radar evaluation pod exercise was abandoned after the drop in fuel cell oxygen pressure, tests later in the mission with a radar transponder similar to the ones used on the pod and on the Agena target vehicle was interrogated by the onboard radar from ranges of six to seven hundred miles. The transponder was mounted on a wooden tower at Kennedy Space Center for the tests. As

the range dropped to 250 miles, the spacecraft computer began giving good solutions from radar inputs.

Referring to the Gemini V OAMS thruster problem, Mathews said, "A reasonable amount of evidence points to the fact that some of our heaters on the OAMS thrusters became inoperative although we cannot really confirm this completely. Nevertheless, we have added heaters to our subsequent spacecraft in redundant fashion to the OAMS lines. We are also going to keep these heaters going continuously, whereas on Gemini V we did not. We feel that possibly the problem was just due to an operational procedure where we had the heaters off a little too long."

Gauging of propellants remaining, an uncertain measurement in past flights, will become more exact with the Gemini VII mission. Mathews said that a "Volkswagen" type hydrazine fuel tank, supplementing the main tank, would be activated when the main tank is exhausted, thereby giving the crew an accurate mark on propellant remaining.

In closing, Mathews discussed the 90-mile undershoot in the Gemini V splash point, and attributed the error mainly to an omission in the retrofire equations of the cumulative effect of the earth's rotating slightly more than 360 degrees in a 24-hour period.

Saturn V Booster Considered For Voyager Planetary Flights

The 7.5 million-pound thrust Saturn V launch vehicle is being considered by the National Aeronautics and Space Administration for its planned Voyager program of unmanned planetary exploration beginning with Mars missions in 1971.

Saturn V is currently under development for the Apollo manned lunar landing program.

Voyager is being planned to ultimately carry heavily instrumented landing capsules to the planets to study their surface characteristics and to search for extraterrestrial life. Voyager is being undertaken in procurement phases with preliminary design and system design phases to be completed before a commitment is made to flight hardware development.

NASA has considered developing a Saturn I-B/Centaur launch vehicle combination to launch Voyager spacecraft, but with its much greater thrust the three-stage Saturn V would give considerably more flexibility to planning early Voyager missions. It would also provide the launch vehicle capability at the beginning of the Voyager program which would be required by future missions.

Under this concept, a single Saturn V vehicle would launch two spacecraft on missions to orbit Mars in 1971.

The following editorial from the September 20, 1965 issue of *Aviation Week* is reprinted in the Roundup through the courtesy of *Av Week's* editor, Robert B. Hotz.

Hotz contrasts the openness of the United States manned space flight program with the secrecy of the Soviet space program, and points out the benefits of our openness in terms of the nation's technical competence in the eyes of the world and in the eyes of the people who foot the bill for the program—the American taxpayers.

In the early days of the U.S. space program, a basic policy decision was made to conduct its operations in an atmosphere of maximum public exposure. This decision was made at a time when the U.S. was running a very poor second in space achievements. It was made against strong and bitter opposition. The decision also was made at a time when it was evident that the Soviets were planning to conduct their space technology program under as heavy a blanket of military-type secrecy as their Iron Curtain could provide.

The men who argued for an "open" U.S. space program in contrast to the Soviet secrecy did so in the belief that such a policy would, in the long run, project a far better image of technical competence and scientific purpose than the USSR could under its combination of secrecy and selective propaganda blasts.

The role the 1971 missions will play in the evolution of the landing capsule is under study, with the first capsule missions carrying scientific experiments being contemplated no sooner than 1973. The findings by Mariner IV of a more rarefied martian atmosphere than expected will be a major consideration in scheduling entry capsules on early Voyager missions for engineering development and more precise determination of the atmospheric conditions.

Engineering test flights of the spacecraft systems during 1969 are no longer planned; however, extensive ground tests are projected prior to 1971.

Under the phased procurement program, three industrial firms—The Boeing Co., General Electric Co., and TRW Systems, Inc.—have completed preliminary designs for the spacecraft system and one will be selected for system design.

Saturn V is being developed under direction of NASA's Marshall Space Flight Center, Huntsville, Ala. Its first test flight will be in 1967. Saturn V will be launched from Kennedy Space Center, Fla.

Project responsibility for Voyager has been assigned by NASA's Office of Space Science and Applications to NASA's Jet Propulsion Laboratory.

Building the Technical Image

Leadership Aura

The course of space technology has proved this U.S. policy to be far more effective than that of the Soviets. It has projected an international aura of leadership and achievement that has permitted the whole world to share in U.S. space projects, both scientifically and emotionally. It also has applied a steady and increasing pressure on the Soviets to abandon their super-secrecy.

There are many indications that the Soviets have been forced to respond to this pressure by stripping some layers of secrecy from their space efforts. This has been necessary to establish the credibility of their accomplishments. For as the world watched the U.S. space program unfold on live television and in millions of words written by foreign correspondents in many languages from Cape Kennedy, California and Washington, the contrasts of the USSR's silence on any technical details of its equipment and space flights generated a growing, brooding doubt as to the authenticity of Soviet achievements.

Now that the pace of the U.S. space program has accelerated to something approaching this nation's true technical capability, the effects of this "goldfish bowl" policy will pay off even more handsomely. One has only to look back at last summer's tremendous series of U.S. space achievements—the Gemini manned flights, the Mariner 4 reconnaissance of Mars, the Titan 3C booster test and the growing use of communications satellites—to realize how their impact has been spread around the globe by this policy.

There is little doubt that the leadership in space technology passed to the U.S. during the course of last summer. But who, outside of a small internal bloc of techno-politicians, would have realized this under a

Comsat Asked For Satellite Services To Support Apollo

The National Aeronautics and Space Administration has asked the Communications Satellite Corp., Washington, D.C., to provide communications satellite services in support of tracking and data acquisition needs for Project Apollo.

Negotiations of a definitive contract will begin soon. NASA will be acting as a representative of the National Communications System during the negotiations.

The desired services are for six highly reliable three-kilowatt telecommunications channels to be made available to three Apollo tracking ships and three remote land stations. The facilities are to be in operation by the fall of 1966.

blanket of super-secrecy? As a result of the fantastic international coverage available under U.S. policy, the emotional and scientific impact of Ed White's floating in space and the slow but sure transmission of the first photographs from Mars across 50 million mi. of space were felt everywhere. And let us not forget the sight that millions watched on television last spring of the live photo transmission from Ranger 9 as it closed on the moon, up to that final, dramatic black square denoting impact on the lunar surface.

Now President Lyndon Johnson has given this effort another big boost by sending the astronauts and their wives abroad. Again, it took some longer-range vision to overcome the perennial objections of petty bureaucratic thinking to get the astronauts their passports. President Johnson took the first step in this direction by sending Gemini 4 pilots White and McDivitt, their wives and his ebullient Vice President Hubert Humphrey to the Paris air show. This dramatic gesture rescued the U.S. image from complete disaster in the face of Soviet competition (AW&ST June 28, p. 11). Stimulated by the success of this mission, which confirmed the soundness of his judgment, President Johnson has sent the Gemini 5 twins, Cooper and Conrad, to the International Astronautical Congress in Athens (AW&ST Sept. 6, p. 21) as the first stop on a good-will tour of Africa (see p. 25) that specifically will lend encouragement to the nations and people supporting the global tracking stations for the manned space flight program.

Policy Contrast

President Johnson also has shrewdly demonstrated the contrast between U.S. and USSR policy in this regard by inviting the Soviets to witness the launch of a Gemini flight from Cape Kennedy and follow its operations from the Manned Spacecraft Center at Houston. The Soviets' refusal to accept this invitation stems from the fear that they would be required to reciprocate and invite U.S. observers to their space launch pads at Tyuratam. So far, no foreigners, even from other Iron Curtain countries, have been allowed to visit Tyuratam or Baikonur, the principal Soviet manned space flight center.

Hopefully, the increasing pressure from the technical success of the U.S. space program and its open-door public policy eventually will thaw the Soviet ice and open a larger window on their contributions to space technology.

In the meantime, the success of the U.S. policy should be duly noted. The citizens who are paying for this effort with their tax dollars may rest assured that the image of a still-young, vigorous and technically competent nation is being projected abroad through their space program.

—Robert Hotz

Stop at the poll on your way to work Tuesday, Nov. 2!

Apollo "Bubble" Type Helmet Gives More Visibility, Comfort

The familiar white space helmets are on the way out, because of the efforts of a psychologist and a mechanical engineer in Crew Systems Division.

Dr. Robert L. Jones and James O'Kane have developed a "bubble" helmet which is smaller and lighter than previous helmets, and yet is more comfortable and provides more visibility.



NEW HELMET—Dr. Robert L. Jones, Crew Systems Division psychologist and co-developer of the Apollo "bubble" helmet, models the helmet.

The helmet, which is made from a plastic material called polycarbonate, is transparent except for a small section at the back of the head. Hence the name, "bubble" helmet.

The Apollo suits which will be used for the moon landing will have this new type of helmet design.

The helmet started as a development project, but its design offered so many advantages over the other helmets that it was incorporated into the Apollo suit, and will be worn by astronauts exploring the surface of the moon.

The first consideration in designing a new helmet was the fit, or headspace inside the helmet. If the helmet did not rotate, it was necessary to find out just how much room a man

needed to move his head freely inside the helmet. The results of head motion studies revealed that a smaller and lighter helmet could be designed and the field of view of the astronaut actually increased.

A pattern for the new helmet was cut and a mould made by personnel of the Technical Services Division. The first helmet was almost round, but in later designs, the sides were flattened to give an even better shape and fit.

Other features were added to the helmet. A new design of the neckring where the helmet connects to the torso of the suit permitted donning or removing the helmet in a few seconds.

Protection pads made of a foam material were moulded to fit on the inside and outside of the back of the helmet to protect the head against buffeting, vibration and impact during launch and reentry. They are removable during flight.

Three adjustable visors on the outside of the helmet will provide protection from heat, radiation and glare. The visors move independently.

After assembly, the helmet was tested by mounting it in a drop rig and subjecting it to various g-forces caused by impact. The helmet received as many as 34 g's without damage in these tests.

Other evaluation tests included visual field measurements, carbon dioxide build-up, and ease of operation.

The features of the helmet were reviewed by members of the astronaut group and Center management, and adopted. The "bubble" helmet has taken its place as the latest development on the Apollo suit for the lunar landing.

U.S., Soviet Academy Agree On Plan For Space Cooperation

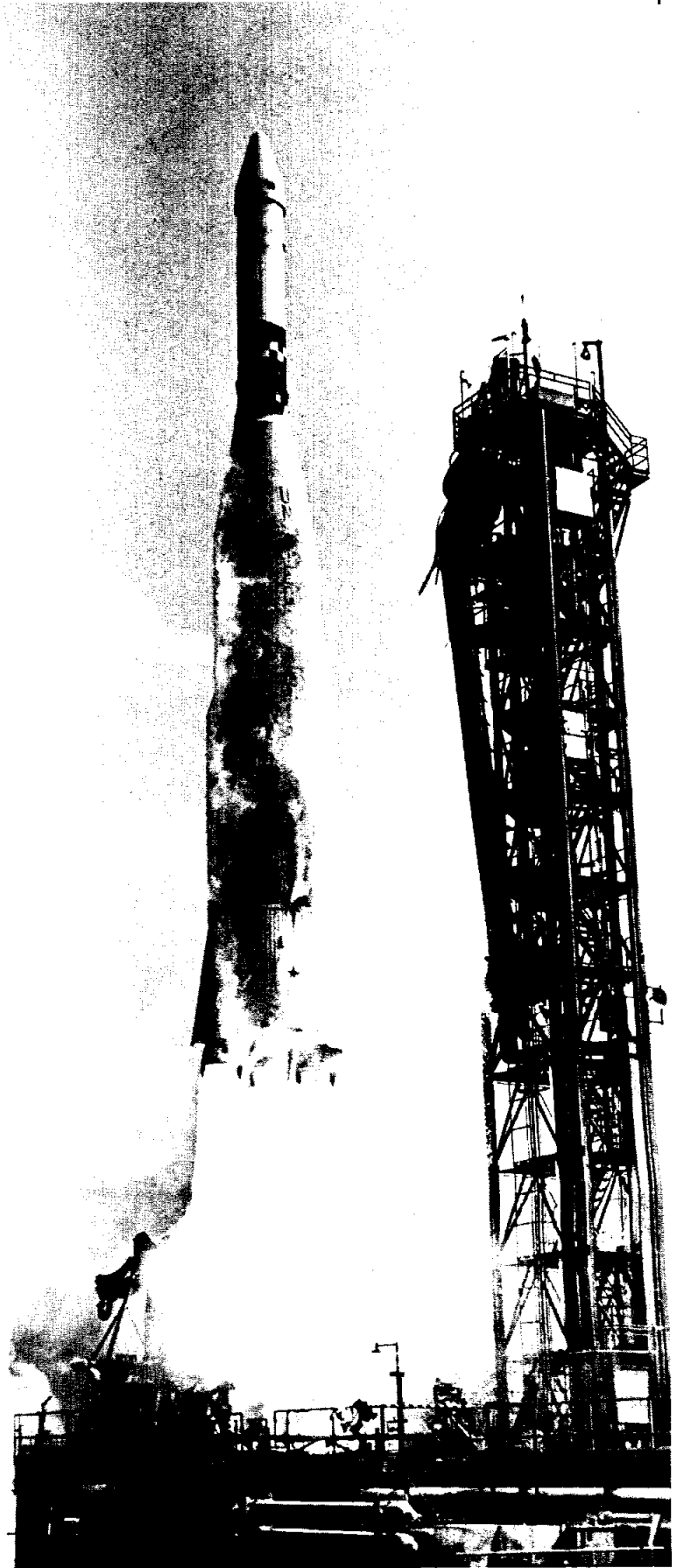
Representatives of the U.S. National Aeronautics and Space Administration and the U.S.S.R. Soviet Academy of Sciences reached two satisfactory understandings in discussions on space cooperation in New York, Oct. 8.

The first understanding reaffirms the existing agreement for the exchange of weather satellite data between Washington and Moscow. It is now understood by representatives of both sides that satellite data is expected to be available on a continuing basis from both sides within a few months. Meanwhile, the present daily and useful exchange of conventional weather data will continue.

The second step is a new agreement for the preparation and publication of a joint review of research in space biology and medicine in the two countries. This agreement provides for a joint Editorial Board and for full cooperation by both sides in the preparation of materials available in the two countries, the selection of authors, and the publication of their work, probably in two or more volumes. The agreement goes into effect automatically in the absence of objection from either side within two months. A text of the agreement will be made available only after the conclusion of the two-month waiting period.

The negotiators were Academician A. A. Blagonravov and Professor A. A. Nichiporovich for the U.S.S.R. and Dr. John W. Townsend, Deputy Director, Goddard Space Flight Center, and Arnold W. Frutkin, NASA Assistant Administrator for International Affairs for the U.S.

On The Way



LIFT-OFF—The Agena rendezvous vehicle for the Gemini VI mission lifts off perfectly from Launch Complex 14 atop an Atlas Standard Launch Vehicle at four seconds after 9 a.m. CST, October 25. Shortly after Atlas sustainer engine cut-off, a programmed burn of the Agena's primary propulsion system failed to occur to place the Agena into orbit. The Gemini VI mission was scrubbed when Canary Islands and Carnarvon reported tracking was "no joy."

Extravehicular Work Maneuvers Investigated By Crew Systems

A test series on extravehicular activity has been completed by the engineers of Space Medicine Branch of MSC's Crew Systems Division.

Test subject Jack Slight, wearing a Gemini spacesuit and strapped into a six-degree of freedom zero-gravity simulator, "walked" through space from a mockup of the Gemini spacecraft and Agena target vehicle as they were docked together on the laboratory floor at the Manned Spacecraft Center.

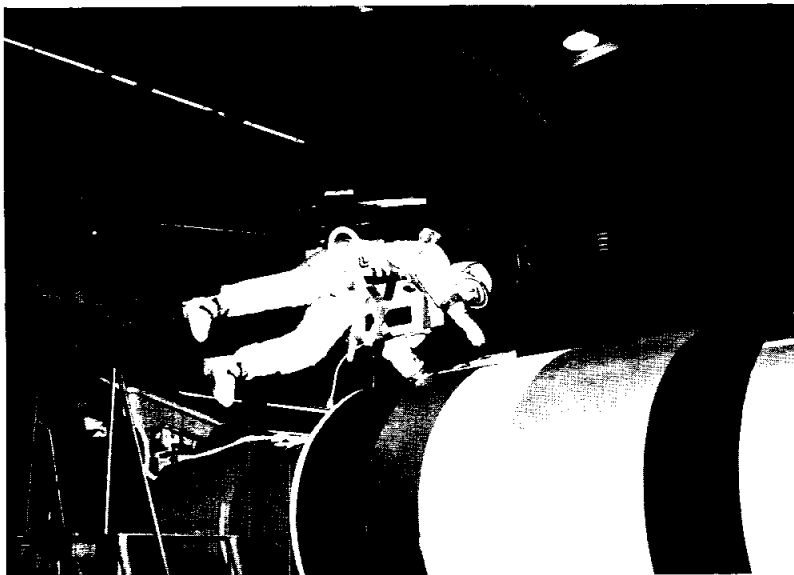
Slight opened a panel on the side of the Agena which represented a micrometeoroid collection experiment which will be flown on a later Gemini mission. In a second set of maneuvers, he retrieved the trap and carried it back to the spacecraft.

The purpose of the tests is to determine the procedures necessary for performing the task in space, to define the handholds necessary for the astronaut to perform the experiment, and design verification of the experiment.

The tests will be performed again next month in a true

weightless condition in the cabin of an Air Force KC-135 aircraft flying a trajectory which produces weightlessness for a period of 30 seconds.

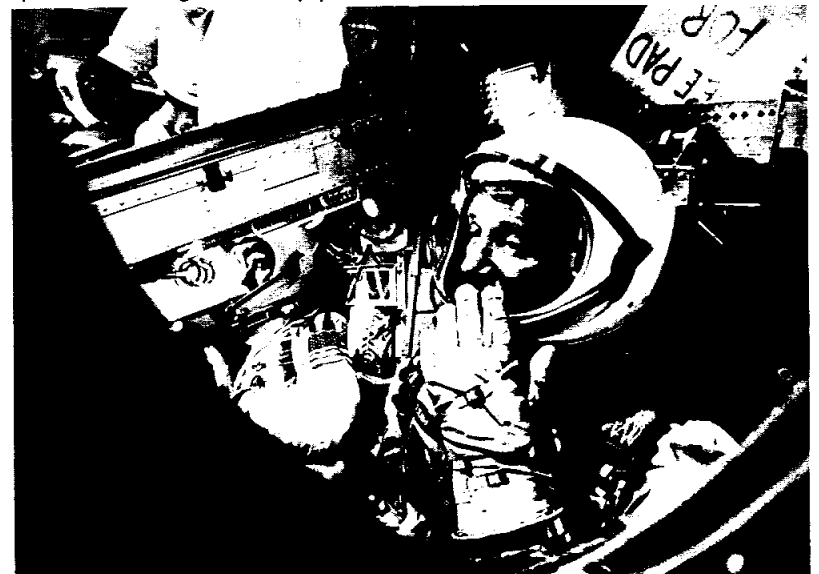
Martin DeBrovner, Space Medicine Branch, is test conductor for the series.



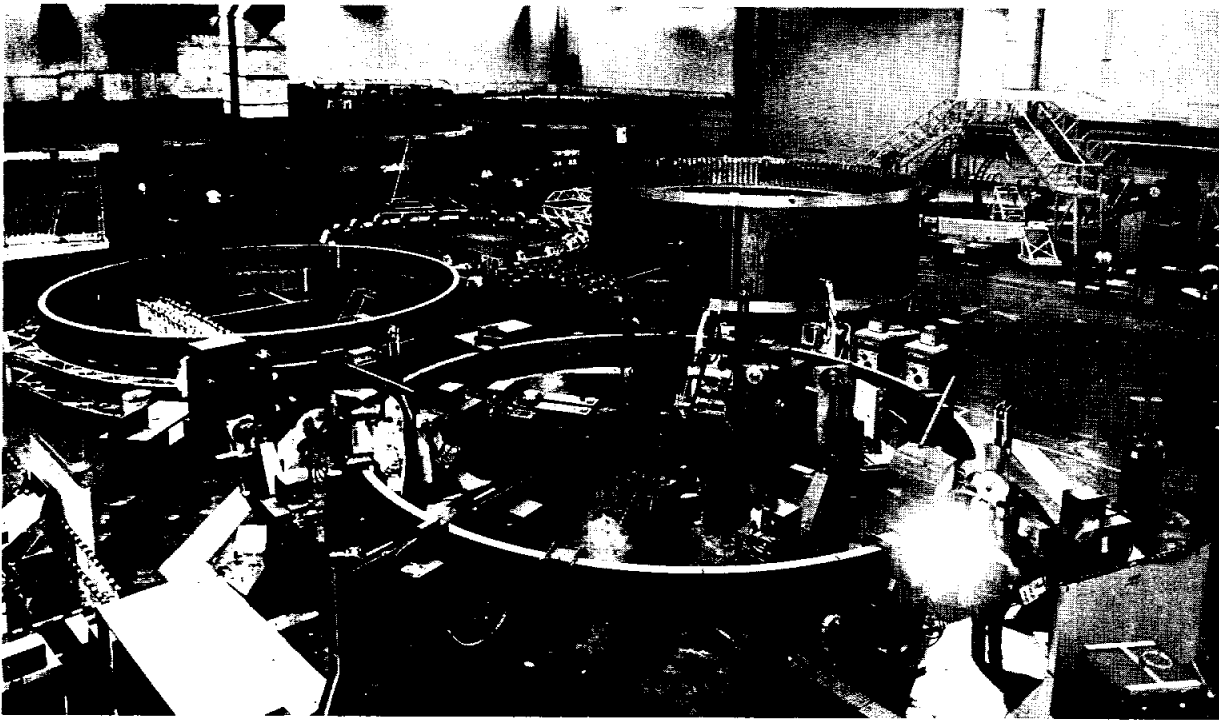
SIMULATED SPACE WALK—Crew Systems test subject Jack Slight, wearing a Gemini pressure suit and strapped into a six-degree of freedom zero-gravity simulator, performs experiments to determine maneuvers needed for useful work in space. The experiments were conducted in the simulator laboratory in Building 13.

However you vote,
get out and VOTE

November 2!



READY ON PAD 19—Astronauts Wally Schirra and Tom Stafford run pre-launch cockpit checks on the Gemini VI spacecraft. The crew reluctantly egressed after the mission was scrubbed at T-42 minutes after it was determined that their Agena rendezvous vehicle had failed to achieve orbit.



MILLING Y-RINGS—Three aluminum billets are welded together to form a ring 33 feet in diameter. A ring with a cross sectional Y-shape will be milled from this solid piece of aluminum and will be used to form an integral part of the S-IC booster's fuel and liquid oxygen tanks. The Y-ring will connect the tank ends with the tank wall.

Boeing Building S-IC Stages Where Once Plantation Stood

If the 19th-century plantation owner, Antoine Michoud, could have seen the 138-foot S-IC-D when it rumbled out of the NASA Michoud Assembly Facility in New Orleans, La., this month, he wouldn't have been able to credit his courtly, old eyes.

In Michoud's day, the area produced muskrat, cypress and water moccasins. Now it is producing the first stage of the Saturn V, the nation's largest rocket booster, and shortly, the first ground test version will issue from the plant.

Although the "D", or dynamic ground test version, is the first S-IC stage to be completed at

the Michoud complex, another first stage booster, the S-IC-T, already has successfully completed full-duration static test firings at NASA Marshall Space Flight Center. The tests, termed "highly successful," have proved the workability of the largest booster ever assembled in the United States and possibly the entire world. Boeing supplied major assemblies for the "T" while at the same time readying the Michoud plant for full production.

NASA announced December 15, 1961, that Boeing would build the S-IC. Contracts held by Boeing for construction of the first stage and for additional responsibility of systems integration support for the entire

Saturn V exceed \$800 million. Boeing is to build two test and eight flight stage S-ICs. MSFC is producing four stages, including the first two flight stages.

Each S-IC stage will spend only two and a half minutes in flight, but it will play a vital role in the mission of project Apollo. It will have to lift and propel the entire Saturn V/Apollo vehicle—over six million pounds—through the first 40 miles of its flight to the moon.

In developing a booster which could perform such a Herculean task, designers had to think big. They created a behemoth which produces 7.5 million pounds of thrust. It is 138 feet long and 33 feet in diameter with a dry weight of 143 tons. When the liquid

propellant is added, a refined kerosene and liquid oxygen, the weight soars to 2,355 tons.

Boeing planners, likewise had to think big. They have put together a team of over 12,000 employees located throughout the country to form what is now the Launch Systems Branch of the Boeing Space Division. At the Branch headquarters in New Orleans, over 6,000 employees assemble the rocket. Saturn V final stage work also is underway at the Marshall Space Flight Center; Kennedy Space Center, Fla.; Seattle, Wash.; Wichita, Kan. and at the NASA Mississippi Test Facility site.

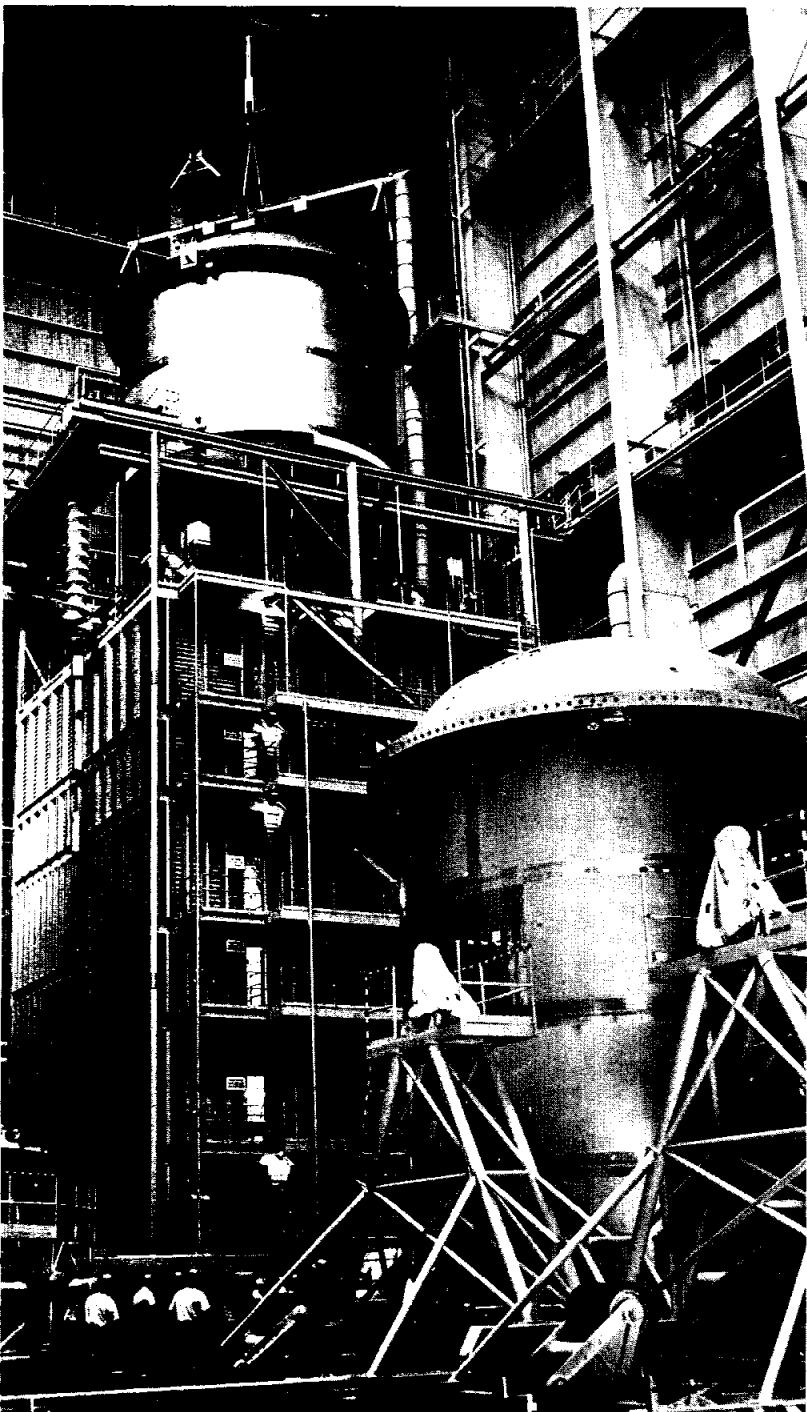
Launch Systems Branch General Manager is R. H. (Dick) Nelson, a veteran of engineering and development work on such systems as the B-17, B-47, GAPA, Bomarc and Dynasoar. C. A. (Clint) Wilkinson, another Boeing veteran who labored with Dr. von Braun's specialists to complete the initial design of the S-IC, is the manager of the Boeing Michoud and

Mississippi Test activities. Bernard Beckelman heads the Branch operations at Huntsville where about 4,000 Boeing engineers and technicians work with NASA engineering and management people on S-IC design.

Bigness also can be applied to the New Orleans rocket assembly plant. NASA's Michoud Assembly Facility has about two million square feet of manufacturing floor space. A \$50 million program for new construction and renovation of the old World War II plant was undertaken in 1962. New construction includes a 215-foot Vertical Assembly Building, Stage Test Building and Engineering and Office Building. Still under construction is a Contractor Services Building.

Subcontractor and supplier support comes from 45 states and the District of Columbia. An estimated 20,000 people in industry and government will contribute to the successful fabrication, assembly and testing of the first stage booster.

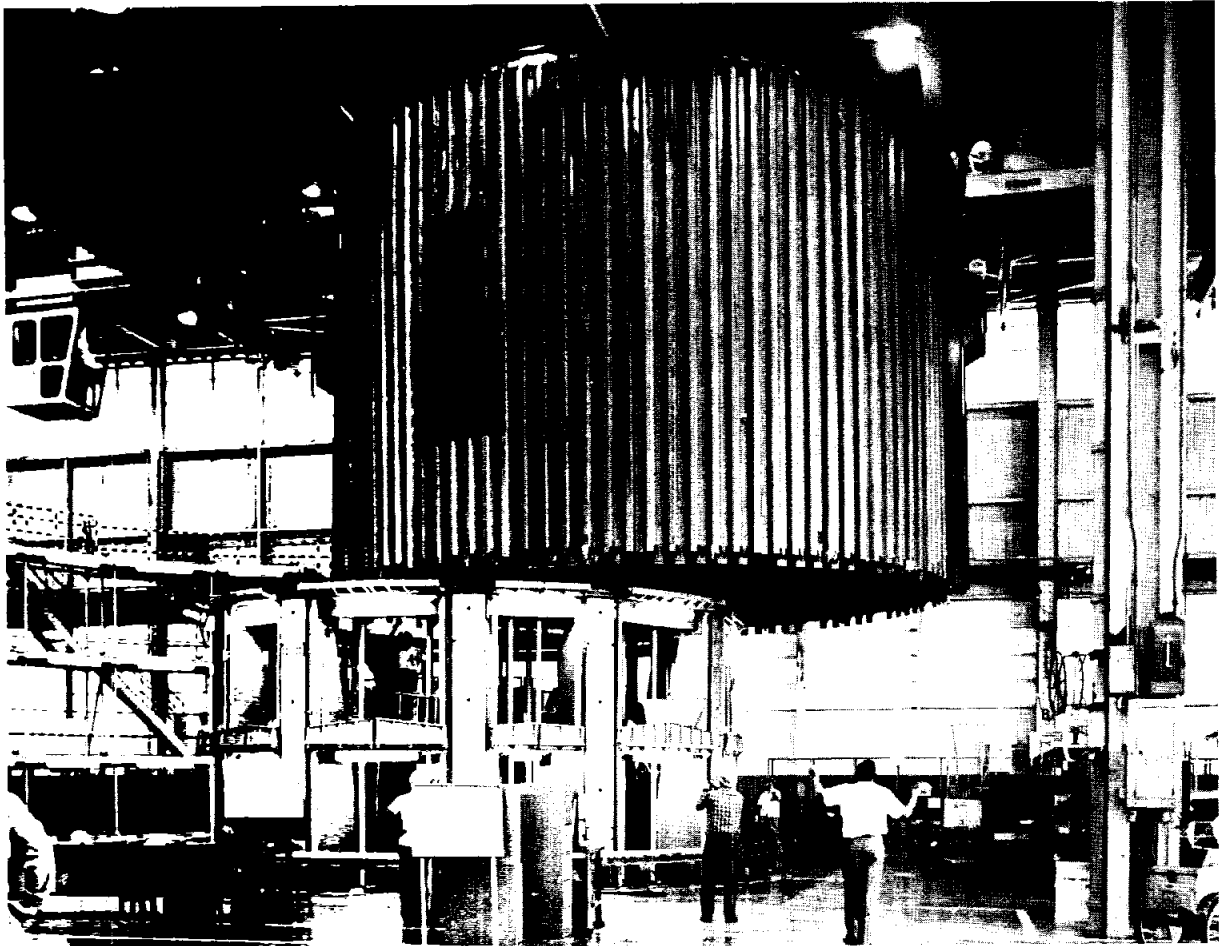
The S-IC is not a simple booster. It is among the most advanced rockets under construction in the United States today. Its engines and flight



TANK TESTS—The 200,000-gallon fuel tank for the S-IC is shown being lowered into the hydrostatic test stand at Michoud Assembly Facility, left. The tank will be pressure tested in the test stand and, after cleaning, final hardware will be installed. The S-IC 330,000-gallon liquid oxygen tank is in the foreground.

BULKHEAD WELD—The progress of an automatic TIG (tungsten inert gas) weld machine, below, is checked as it welds pie-shaped sections of aluminum together to form the bulkhead, or tank end for one of the fuel tanks for the S-IC.





OUT OF THE JIG—Overhead cranes are shown lifting an S-IC intertank from the final assembly fixtures at Michoud. The intertank is the structural link connecting the fuel tank to the liquid oxygen tank on the first stage Saturn V booster.

hardware produce 160 million horsepower. Its design and fabrication have enlarged the frontiers of technology and science beyond former limits.

S-IC parts are shipped to Michoud from subcontractors and from other Boeing locations, notably Wichita, Kan. Parts of tanks — pre-cut, milled and shaped—are welded together in an environmentally controlled "room within a room" at the plant. The pieces which are to be assembled into the ends of the tanks—the bulkheads—are trimmed in especially designed tools. After proper preparation of the welding surfaces, they are joined by welding.

The skins — ten-foot-high aluminum sections which make up the sides of the fuel tanks — are joined into rings in the same room by the same type of welding process. Other components also are assembled in the room, such as the "Y-rings," major

structural parts of the tanks. Y-rings are milled from a large circular billet of aluminum.

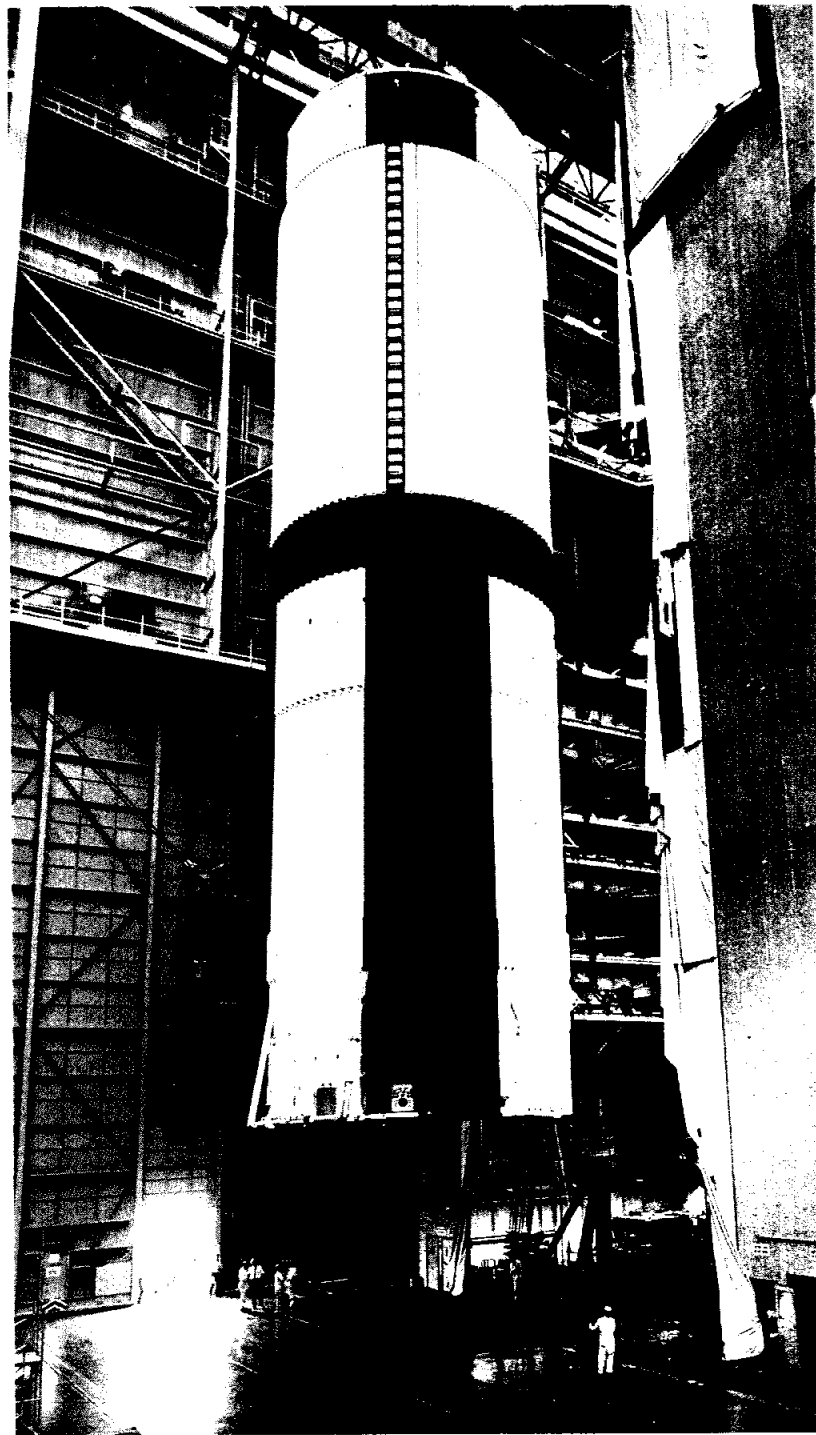
The three other major parts of each stage—the thrust structure which supports the five F-1 Rocketdyne engines, the inter-tank section, which is the structural link between the booster's fuel and liquid oxygen tanks and the forward skirt, which is used to mate the S-IC stage to the engine shroud of the second stage booster—are assembled from preformed parts in the open areas of the plant.

Final assembly takes place in the 215-foot Vertical Assembly Building. Final welding of the tanks and the stacking of the stage, one piece atop another, are accomplished here. So also is hydrostatic test, where the fuel and liquid oxygen tanks are pressure tested with water.

Significant in the assembly of the huge booster is the welding process developed especially for

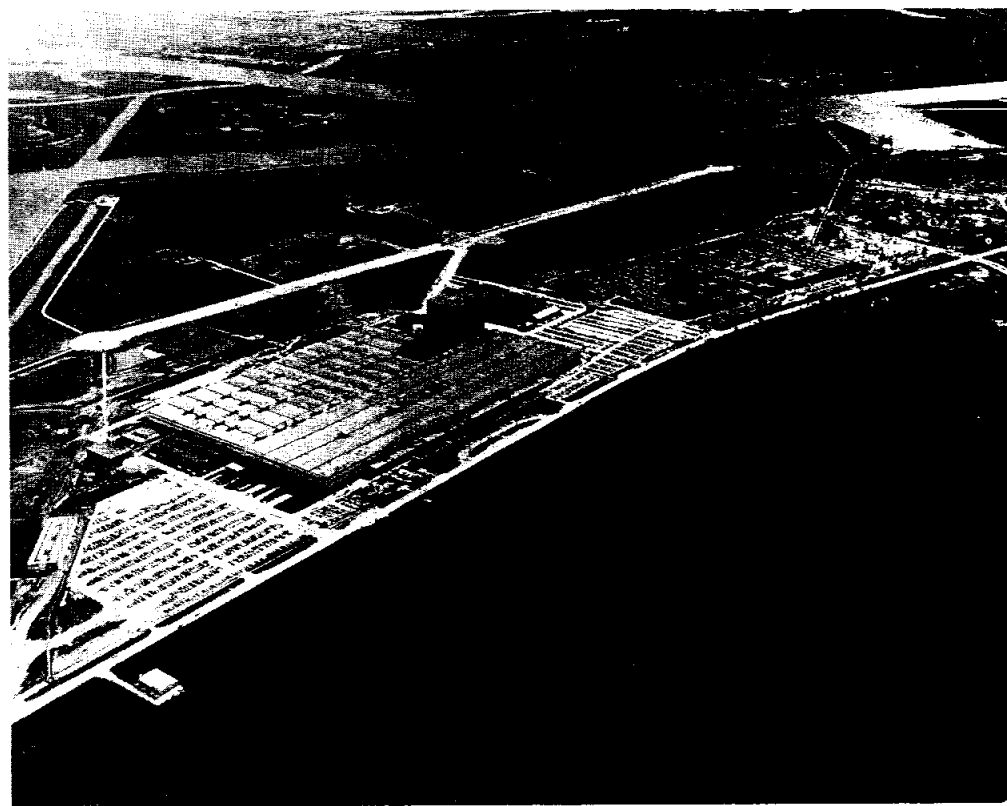
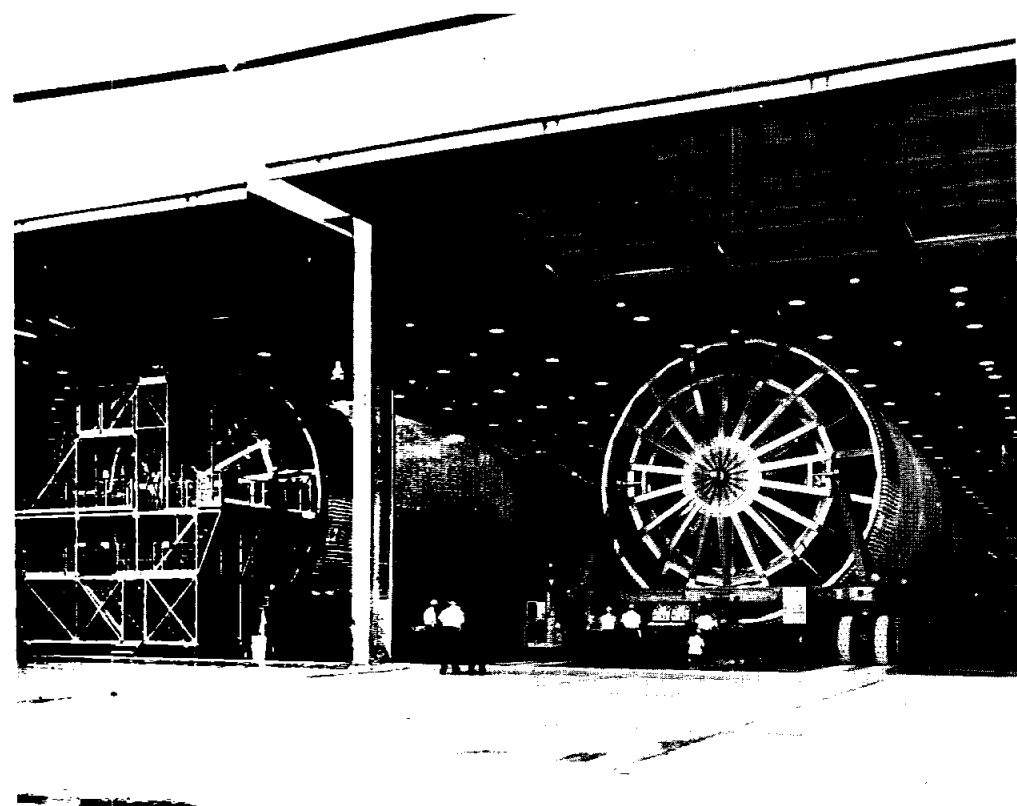
the fabrication of the 200,000-gallon fuel and 330,000-gallon liquid oxygen tanks. Thin metals, especially aluminum, have a tendency to warp or buckle during welding. A "count-down" system has been devised to guide every step of the operation which is carried out in a controlled temperature and humidity environment. An automatic TIG (tungsten inert gas) weld machine moves along a precision track to join the aluminum sections with a nearly perfect weld. Flaws are detected by X-ray and are ground out and rewelded by hand-held equipment.

Each stage will contain approximately 77 miles of wire and 44 thousand electrical connections. Its two tanks combined hold the equivalent of 59 tank cars of fuel and liquid oxygen, which, when the stage is fired, will pour through the five engines at the rate of 3,500 gallons a second.



TEST-STAGE—The first vertically assembled Saturn V booster (S-IC) towers over Boeing technicians as it is moved from the final assembly stage tower, above. This initial booster—designated the S-IC-D is a ground test stage which will be mated with the second and third stages of the Saturn V space vehicle to determine the dynamic characteristics of the 364-foot-tall rocket.

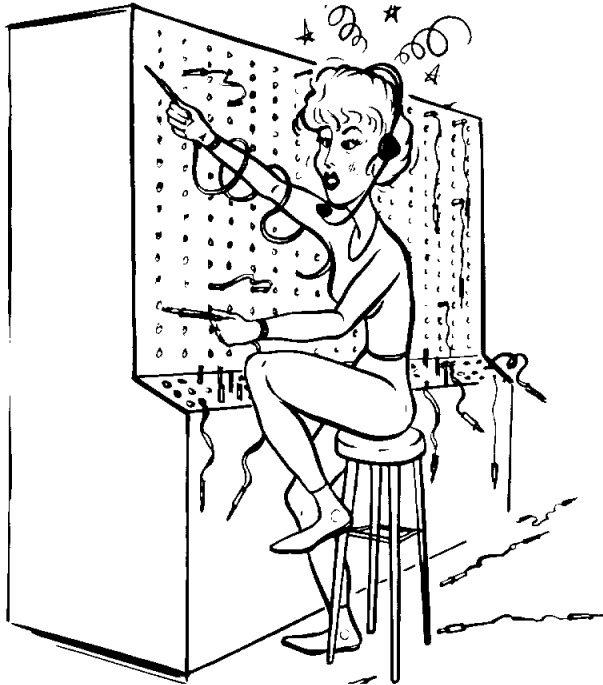
FINISHED PRODUCT—The S-IC-D, a dynamic test vehicle, is joined at Michoud Assembly Facility by the newly completed S-IC-F, a facilities check-out test vehicle (lower left). An aerial view of the NASA Michoud Assembly Facility at New Orleans, La., (below) where The Boeing Company is building the first stage booster (S-IC) for the Saturn V booster. The 215-foot vertical assembly building, in which the major stage components are joined, provides a prominent landmark. The canals in the background are used to transport booster components which are too large for highway, rail or air travel.



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On The Lighter Side



I'm glad we don't have a flight every week.

HOME HAZARDS

Not All Bombs Have Fins And Fall With A Whistle

How many bombs do you have at your house? Those handy little spray cans which dispense all sorts of things, from shaving cream to paint—those little things that can blow up if not properly handled.

Many "don'ts" have been published concerning these cans. Some of these are:

- Don't puncture the cans.
- Don't stick a pin or wire into the valve opening.
- Don't incinerate the can.
- Don't store in direct sunlight or near source of heat.
- Don't smoke while using the contents.
- Don't spray toward the face and eyes.
- Don't store in reach of small children.
- Don't keep in your automobile trunk or glove compartment.
- Don't use cans that are rusty or show signs of wear or abuse.

The fire hazards of the substances in these cans cannot be over-emphasized. Most can be set off by a glowing cigarette when it is in the vapor form, or as dispensed from the can. Hair-spray is a typical example. When in an open dish, hair spray is difficult to burn, but when sprayed from a can, it burns readily. Caution is the best way to head off a fire.

Many reasons can be given for all of these don'ts, but the most important is the pressure inside the can. Most of the cans are designed with a safety factor of two. That is, if the pressure

inside the can doubles, the metal of the can will be stretched to the breaking point and there is a good chance that the can will blow up. Heat of only 120° will raise the pressure inside the can to the danger point.

Another way of reducing the can's safety factor is to dent or otherwise abuse the can.

Tests have proven that a paint dealer's paint shaker can agitate the mixer balls in a spray can to sufficient velocities to damage the container. Sometimes only the heat of a person's hand is necessary to make a damaged can explode.

With all these "don'ts", many people probably wonder how to dispose of those little bombs. This is a problem throughout industry. Some companies which use large quantities have a special press to puncture the cans and "disarm" them.

The best way for an individual to dispose of these is to hold the can upside down and press the valve until all of the gas, usually freon or nitrogen, has been emptied into the atmosphere, and then drop them into the trash. If you have large quantities, 20 or more, cans to dispose of, it is best to notify the trashman so that these can be buried at the sanitary fill area.

The best advice for an individual to use when disposing of a spray can is to follow the manufacturer's directions, hand shake, and when empty, turn upside down and release the gas pressure before throwing into the trash.

Welcome Aboard

During the last reporting period, 37 new employees joined the Manned Spacecraft Center. Center Medical Office: Lloyd L. Shelton.

Administrative Services Division: Dorothy J. Overbeck.

Photographic Technology Laboratory: Phillip H. Levi.

Personnel Division: Charlotte S. Armstrong.

Flight Crew Support Division: Robert H. Boulware, Charles F. Davis, Thomas J. Hardy, Leslie L. Jepsen, Michael M. McCants, and Nina M. Montgomery.

Crew Systems Division: William B. Deichmann and Russell Scott.

Computation and Analysis Division: Bruce B. Johnson.

Guidance and Control Division: John M. Balfe and Henry J. G. Kaupp.

Advanced Spacecraft Technology Division: Martin A. Pomerantz and William G. Tift.

Flight Control Division: John J. Anderson, John A. Delmont, Robert F. Grasmeyer, Richard W. Kalishek, Lutrelle G. Long, Rhett F. Martin, and Bruce A. Stach.

Mission Planning and Analysis Division: Edward M. Jiongo, Robert K. Pierce, Larry K. Rude, Donald R. Sellers, and George E. Wilson.

Flight Support Division: John E. Baer, Don L. England, Robert E. Kirkbride, and Gerald F. Spiess.

Apollo Spacecraft Program Office: Felton D. Brooks, Sarah D. Palmer, Olin C. Snellgrove, and Norma L. Scott (Downey, Calif.).

Obsolete Lexicon

An entry in the 1961 edition of Webster's New Collegiate Dictionary reads thus:

space ship (spās shīp), n. An imaginary aircraft of the future for interplanetary travel outside the earth's atmosphere.

Space News Of Five Years Ago

Oct. 31, 1960—Space Task Group officials presented the status of qualification and reliability activities for Project Mercury to Dr. T. Keith Glennan, NASA Administrator.

Nov. 1, 1960—The Goddard Space Flight Center computing and communications center became operational. Goddard's mission was to serve as a communications center, and two IBM 7090 computers, operating in parallel, would compute the smoothest exact position at all times during a flight, predict future spacecraft positions, and shift the coordinates to provide acquisition information for all observation sites.

Nov. 3, 1960—Explorer VIII launched into an elliptical orbit

from AMR by four-stage Juno II, containing instrumentation for detailed measurements of the ionosphere. This was the 10th time that JPL-developed upper stage rocket clusters had successfully placed satellites or deep space probes into orbit.

Nov. 8, 1960—Little Joe 5, the first of the series with a McDonnell production spacecraft, was launched from Wallops Island to check the spacecraft in an abort simulating the most severe launch conditions. The launch was normal until 15.4 seconds after lift-off, at which time the escape rocket motor was ignited. The spacecraft did not detach from the launch vehicle until impact and was destroyed.

Out Of Texas' Past . . .

(EDITOR'S NOTE: To acquaint MSC employees with the rich historical background of the Galveston Bay area, and of Texas in general, a series of historical articles prepared by the Historical and Library Services Branch will appear in the Roundup.)

Some historians call New Orleans "mother of Texas," because that city was the jumping-off place for colonial Texas and so many volunteers in the Lone Star's war for independence were recruited in the Crescent City.

But Little Old New York also had a great deal to do with shaping the destiny of Houston and the upstart republic whose capital it was. In 1823 John Harris, of Cayuga, N. Y., came to Galveston Bay in his schooner and sailed up a stream called Buffalo Bayou because it was full of buffalo fish. At the mouth of Brays Bayou John went ashore and set up a trading post that became the town of Harrisburg (the county was named for his family too), now a part of Houston.

After three years John went back to New York state and persuaded his brothers, Dave, Bill and Sam, to join him at Harrisburg. In another three years the town was jumping. It had houses on both sides of Broadway, a sawmill and a grist mill. The Harris schooners made regular voyages to New Orleans and other United States ports.

Then in 1830 one of the biggest real-estate promotion schemes in the history of this country was hatched in New York City. Anthony Dey, a Wall Street banker, and several other New Yorkers organized the Galveston Bay and Texas Land Co. Their main assets were doubtful titles to three big land-grants that they had bought for peanuts from three unsuccessful colonizers: Joe Vehlein, a German merchant from the City of Mexico; Dave Burnet, who became the first president of Texas; and Lorenzo de Zavala, the first vice president.

The Galveston Bay outfit sold Texas land scrip far and wide at rates of 5 and 10 cents an acre! This paper conveyed no land, although it seemed to do so, but only authorized the owner to settle in Texas—which he could do legally without the scrip.

Among those who ostensibly fell for this scheme were the brothers John and Gus Allen, the sophisticated New York financial promoters for whom Allen Parkway, in Houston, is named. But unlike most other chumps, John and Gus eventually realized a handsome profit on the deal. The first thing they did when they arrived at Nacogdoches (a point of entry) in 1832 was to buy a league of Texas land for \$100.

Local wiseacres laughed: the Allens were the biggest pair of greenhorns ever to cross the Sabine.

But they didn't laugh when Gus went to Natchez and sold the league for \$5000.

Among the Allen boys' drinking companions at Brown's Tavern, in 'Doches, was a 40-year-old lawyer who, as a boy, had run away from home and become the adopted son of a Cherokee chief. After winning the well-deserved Indian nickname of Big Drunk, this lawyer had returned to public life to become a distinguished soldier and adjutant general of the Tennessee militia, had taught himself law, been elected to Congress, served as governor of Tennessee, attempted an unsuccessful marriage, got himself appointed ambassador to the United States from the so-called Cherokee Nation, taken an Indian wife, challenged the Supreme Court on the independence of the Cherokees, been tried by the House of Representatives for brawling and—most important of all—had formed a lifelong friendship with Andrew Jackson, who for some reason wanted Texas in the Union.

This lawyer's biggest client was the Galveston Bay and Texas Land Co., that had sold the founders of Houston city the worthless land scrip. He was a dynamic fellow, six feet tall, handsome and an eloquent speaker, a libertine and a heavy drinker, yet a man handy with swords, pistols and fists. And when the occasion demanded, he could be as suave as a French diplomat.

His name: Sam Houston. Soon he would become General Houston, liberator of Texas.

And what did the Allen brothers do with the \$5000 they got for the league of Texas land they sold in Natchez? Why, they bought the site of the city of Houston with it, paying exactly \$5000.

John is buried in Founders' Cemetery, on West Dallas Avenue, in Houston, a short distance from downtown land worth thousands of dollars per front inch. Gus rests in Greenwood Cemetery, in Brooklyn, not far across the East River from the foot of Wall Street.

The Duke and "Flight"



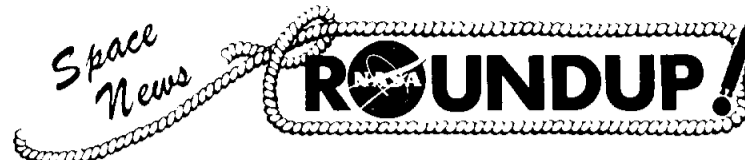
DUKE VISITS MSC—The Duke of Windsor visited MSC on October 14, and is shown here with former Briton John Hodge, Chief of Flight Control Division, in the Mission Control Center. The Duke was King Edward VIII of England briefly in 1936. He also popularized the Windsor knot for men's ties.

MSC Aero Club Seeks New Blood

Those who like to get their feet off the ground and escape from earthbound traffic and daily routine may have something in common with the MSC Aero Club. The Aero Club is seeking new members who like to fly for the fun of it.

The Club's November meeting will be held on Tuesday, November 9, in the auditorium of the Gemini News Center (Nassau Bay Bldg. 6). A 30-minute motion picture on private flying in the Bahamas will be shown which deals with entry formalities, declaration and cruising permits and airports available to private pilots.

Don Bray, Ext. 2801, has additional information about the Aero Club for would-be members.



MANNED SPACECRAFT CENTER, HOUSTON, TEXAS

EMPLOYEE NEWS

Forethought Can Make Safe Annual Sortie By Youngsters

Doorbells will ring incessantly this Sunday night as moppet spooks are again abroad on their annual cookie-and-candy binge.

"Trick or treat!" they'll yell, and enough sweet stuff to rot a million mouthsful of teeth will be dropped into yawning bags held by sticky little hands. The garb of the youngsters will be designed (they hope) to strike terror into the heart of the owner of the doorbell.

However terrorsome these Halloween get-ups may be, are they altogether safe for their wearers? Are they fireproof? Do they have high visibility to drivers? Are the jack o'lanterns battery powered instead of candle powered?

The deadly combination of an open-flame jack o'lantern and a flammable spook suit has the potential of thrusting inconsolable grief upon parents.

And while black may be a highly-preferred color for a Halloween costume, a black-dressed child against a black night in a neighborhood street likewise has the potential of making a driver wish that he had never learned to drive.

Since these are checklists for everything else, there is no reason why there should not be a checklist for getting your youngsters ready for their trick-or-treat extortion. Here goes:

- Keep curtains and other blowing objects away from candles, (if open flames you must use.)
- Make all decorations with fire-resistant materials. Buy only materials labelled fire retardant.
- Treat newly-made children's costumes with a fire-retarding solution made of three pounds of borax and two and one half pounds of boric acid in six gallons of water. Mix well, soak costumes in solution, hand wring and lay out to dry on a flat surface. This treatment *will not* work on crepe paper or on combustibles exposed to prolonged high temperatures.
- Design considerable white into costumes; it is after dark when the goblins are afoot.
- Plan the route of your family's spooks so that they will always face traffic. (That goes for you, too, Mom and Dad.)
- When driving during the witching hours, be extra cautious, for you also have to think for the youngsters: they are thinking only of the next doorbell and their next victim.

Activities Association Offers Theater Ticket Discount Plan

A plan whereby MSC employees can obtain tickets to entertainment events in Houston is now being offered by the Employee Activities Association.

Called the EAA Theater Party Plan, with memberships available to MSC people for \$1 a year, the plan offers a 10 percent discount on movie theater tickets and special attractions at the Music Hall: two concert tickets for the price of one for two concerts out of ten; dinner for two at a downtown restaurant at reduced prices on the night of an entertainment event, and advance notice for selection of choice seats prior to public announcement of events.

To reserve a membership and for the EAA Theater Party Plan, fill out the blank below and forward to Rita Sommers, BG6, Room 344, Bldg. 2.

Asks Help For Classes

Volunteers to help organize off-duty language classes at MSC are needed by Mervin Hughes, Employee Activities Association Vice President for Clubs. Call 3761 to volunteer.

Cage Teams Needed

Team entries for the MSC Ellington AFB 1965-1966 Men's Basketball League will be accepted through November 12. MSC and contractor team managers are asked to phone their entries to David Mullins, Ext. 4521.

Announce Awards Date

Earl D. Hilburn, Deputy Associate Administrator of NASA, will preside at the Annual MSC Awards Ceremony Tuesday, November 18. Further details of the ceremony will be carried in the next issue of the Roundup.

MSC BOWLING ROUNDUP

MSC COUPLES LEAGUE		
Standings as of October 19		
TEAM	WON	LOST
Idgits	18	10
Bowlernauts	18	10
Four Friends	17 1/2	10 1/2
Intimidators	17	11
Almosts	17	11
LBD	15	13
Spastics	14 1/2	13 1/2
Sociables	14	14
Eight Balls	14	14
Aces	11	17
Fireballs	6	22
Fabulous Four	6	22

High Game Women: Betty Durkee 222, Shirley Yeater 209.
 High Game Men: Ron Durkee 245, Joe Garino 237.
 High Series Women: Shirley Yeater 571, Betty Durkee 542.
 High Series Men: Joe Garino 629, Frank Morgan 607.

MIMOSA MEN'S LEAGUE		
Standings as of October 21		
TEAM	WON	LOST
Whirlwinds	19	5
Chizzlers	17	7
Technics	15	9
Alley Oops	13	11
Fabricators	12	12
Goobers	11	13
Green Giants	11	13
Foul Five	9	15
Road Runners	8	16
Agitators	5	19

High Game: B. Graham 273, G. Amason 266.
 High Series: G. Amason 701, B. Graham 690.
 High Team Game: Chizzlers 1097, Technics 1089.
 High Team Series: Chizzlers 3138, Technics 3073.

Lunarfins Sponsor Water Safety Class

A Red Cross-certified course in life saving and water safety is being sponsored by the Lunarfins, the MSC skin and scuba diving club.

Classes meet from 7 to 9 p.m. each Wednesday and Thursday night at the Tropicana Swimming Pool, 5920 Telephone Road.

Although classes began October 27, applicants will be accepted through the November 3 session. J. W. Shaffer, Lunarfins training officer at Ext. 7657, is the contact for registration and additional details.

The Lunarfins Club is also sponsoring a certified course in the use of self-contained underwater breathing apparatus (SCUBA). Classes at the Tropicana will start at 8 p.m., Tuesday November 9.

Dozen Games Left In Grid League

Remaining games in the MSC/Ellington AFB Football League are as follows:

- November 1:
 6:30 p.m.—Structures and Mechanics vs. 2103rd Communications Squadron
 8:30 p.m.—ISD vs. General Electric
- November 2:
 6:30 p.m.—Lockheed Electronics vs. 747th AC&W Squadron
 8:30 p.m.—IESD vs. Structures and Mechanics
- November 3:
 6:30 p.m.—General Electric vs. IESD
 8:30 p.m.—2103rd Communications Squadron vs. Lockheed Electronics.
- November 4:
 6:30 p.m.—Guidance and Control vs. ISD
 8:30 p.m.—747th AC&W Squadron vs. ASPO
- November 8:
 6:30 p.m.—2103rd Communications Squadron vs. General Electric
 8:30 p.m.—747th AC&W Squadron vs. Structures and Mechanics
- November 9:
 6:30 p.m.—IESD vs. Guidance and Control
 8:30 p.m.—ASPO vs. Lockheed Electronics

Flag Football Scoreboard

Standings in the MSC/Ellington AFB Flag Football League through October 14 are as follows:

Team	Won	Lost
2103rd Communications Squadron	2	0
747th AC&W Squadron	0	2
Apollo Spacecraft Program Office	0	2
Lockheed Electronics	1	0
Structures and Mechanics	1	1
General Electric	2	0
Guidance and Control	1	1
Information Systems Division	0	2
Instrumentation and Electronic Systems	1	0

Scores for games played through October 14 are:
 2103rd Communications Squadron 28, ISD 10
 Structures and Mechanics 13, ASPO 8
 General Electric 18, ASPO 0
 2103rd Communications Squadron 14, Guidance and Control 7
 Guidance and Control 10, 747th AC&W Squadron 6
 IESD 6, ISD 0
 Lockheed Electronics 18, Structures and Mechanics 0
 General Electric 13, 747th AC&W Squadron 0

Space News **ROUNDUP!**
SECOND FRONT PAGE



FOUR FOR TEXAS—Geologist Dr. Elbert A. King examines four specimens of meteorites found in Texas during 1965. He holds one of two samples found near Conroe. In the center is a seven-pound meteorite found near Del Rio, and the 30-pound meteorite at right was found in Collingworth county in the Panhandle.

Texas Meteorite Discoveries On the Upswing, Says King

Meteorite finds in Texas are increasing, according to Dr. Elbert King of the Lunar Surface Technology Branch, ASTD.

King, an expert in the composition and origin of extraterrestrial objects who works in the Geology and Geochemistry Section at MSC, says that he has received four meteorites from various areas in Texas during the current year. All the specimens were either donated or loaned to MSC for analysis.

"Normally, four or five new meteorites is the total find for the world in one year," King stated.

The largest meteorite was a 30-pound stoney variety from Collingworth County, Texas. Two meteorites of three and four pounds were found near Conroe by a lady who observed the fall in 1955. The fourth meteorite was a seven-pound iron specimen found near Del Rio and received about a month ago through the efforts of Dr. George Edwards of the Shell Research Company.

Although meteorites are comparatively rare, they are valuable mainly for scientific information they contain rather than any monetary worth. If meteorites can be examined soon after they fall, much can be learned about cosmic radiation in space.

MSC geologists are also interested in the space rocks as a key to determining the composition of lunar rocks and possibly the evolution of the solar system. Meteorites are accepted here for examination in cooperation with the U. S. National Museum. All meteorites which are received here will eventually go to the National Museum.

King stated that most meteorites are discovered since they are heavier than rocks of a comparable size and have an unusual shape due to entry heating. Meteorites are also commonly found in areas which are free from other rocks. Anyone who suspects he has discovered a meteorite should send only a small sample of the rock for analysis.



PERFECT LAUNCH—Trajectory plotters, tracking and telemetry displays of the Atlas-Agena launch are followed by flight controllers in Mission Control Center-Houston 101 minutes before Astronauts Schirra and Stafford were to have been launched in Gemini VI to intercept and rendezvous with the Agena.

Gemini ELSS In Vacuum Chamber Testing

The final thermal testing of the Extravehicular Life Support System (ELSS)—the chest pack for use in extravehicular activity—is scheduled next week in the Crew Systems Division 20-foot vacuum chamber at the Manned Spacecraft Center.

Initial manned tests were performed by MSC engineers in an environment which is equal to the vacuum at 180,000 feet. Un-

manned tests were performed on the unit in an 8-foot vacuum chamber, and were completely successful. Two individual runs were made in the thermal chamber.

A test subject from the EVA Support Office will be wearing a Gemini extravehicular suit. The chestpack will be mounted on a small table near the test subject instead of on the subject's chest.

The run will be approximately 135 minutes in duration. The two previous runs were 65 minutes and 120 minutes in duration. The metabolic heat load of working in space will be produced by having the subject exercise on a step. During the tests, an umbilical failure will be simulated to check the switchover to the emergency oxygen supply. The next step in the manned test program will be qualification of the ELSS with the back-pack and space gun.

The ELSS chest-pack weighs about 42 pounds, and contains an emergency oxygen supply for about 30 minutes. It will be able to support extravehicular astronauts for longer time periods than the Gemini IV unit. It will be connected to the spacecraft by an umbilical for oxygen until retrieval of the Environmental Support Pack (ESP) from the spacecraft adapter.

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MSC Toastmasters Install New Officers

The MSC Toastmasters Club installed October 20 a new slate of officers during a regular dinner meeting at the King's Inn.

New officers are: Dick Wieland, president; Ernie Gillam, education vice-president; Dick Crane, administrative vice-president; Maurice Tremblay, secretary; Alan Doyle, treasurer, and Tony Verrengia, sergeant-at-arms.

A charter group of Toastmasters International, the Club provides an organized group of men the opportunity to improve their abilities to speak in public, conduct meetings and develop executive abilities. The Club is affiliated with the MSC Employee Activities Association.

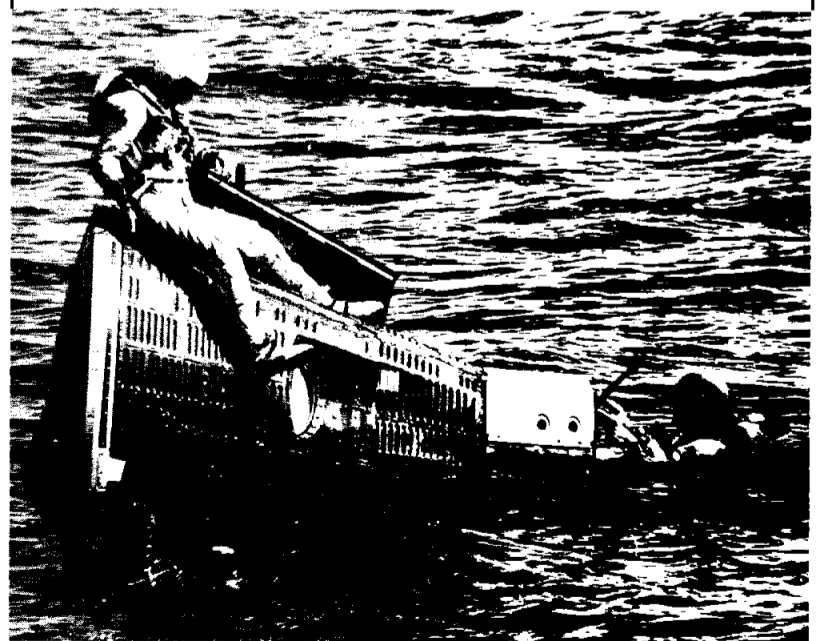
Bi-monthly meetings are held at 6 p.m. on the first and third Wednesdays at the King's Inn. Persons interested in joining the Club should contact Club Administrative Vice-President Dick Crane, at Ext. 2232, or any of the other Club officers.

Summit Meeting



OPERATIONS HUDDLE—The seriousness of the Agena situation is reflected in faces of this threesome at the Flight Director's console in Mission Control. Air Force Lt. Gen. Leighton I. Davis, National Range Division Commander and DOD Manager of Manned Space Flight Support Operations, left, huddles with Flight Directors John Hodge and Chris Kraft.

Egress Refresher



C'MON IN, THE WATER'S FINE—Gemini VII prime crew Frank Borman (in water) and James Lovell got a refresher course in water egress techniques October 15 in the Gulf of Mexico. Both astronauts were wearing training versions of the lightweight pressure suit that is in qualification testing for possible use in Gemini VII. Borman and Lovell had prior water egress training while serving as back-up Gemini IV crew. The training session was conducted by Flight Crew Support Division with the support of the NASA Motor Vessel Retriever of Landing Recovery Division, and by swimmers and riggers of Technical Services Division.