

## WSTF Test Will Man-Rate Apollo Launch Escape System

The last in a series of Apollo launch escape systems tests will be held sometime in mid-December at the White Sands Test Facility, N.M. Airframe 002, a production spacecraft, instead of a ballasted boilerplate as in earlier flights at White Sands, will be flown.

Systems not needed for this test are omitted from the spacecraft. Completion of the test

## MSC Procurement Totals \$1.4 Billion For Fiscal 1965

Fiscal year 1965 procurements at the Manned Spacecraft Center totalled approximately \$1,487.4 million, or three per cent higher than during fiscal year 1964, according to Dave Lang, chief of the procurement and contracts division.

Lang said approximately 86 per cent was placed with business firms, 1.4 per cent with educational and other nonprofit institutions and 12.5 per cent with, or through, other Government agencies.

MSC's dollars awarded to business through competitive procedures increased from 69 per cent of the total business in FY 1964 to 78 per cent in FY 1965. An additional 13 per cent represented awards on follow-on contracts placed with companies that had previously been selected on a competitive basis. In these instances, selection of another source would have resulted in additional cost to the Government by reason of duplicate preparation and investment.

Small business firms received about two per cent of the total dollar value awarded to business. Excluding the 10 largest awards which were for major systems and hardware requiring resources not generally within the capability of small business on a prime contract bases, small business received about 15 per cent of the remaining business dollar.

Nearly 73 per cent of the awards to business in excess of \$25,000 resulted in cost-plus-fixed-fee contracts, a reflection of the fact that MSC's procurements are primarily for research and development.

Of the total dollars awarded during fiscal year 1965, \$1,290 million or 87 per cent was negotiated. Over 95 per cent of the negotiated amount represented R&D efforts.

Business firms in 45 states and educational and other non-profit institutions in 26 states participated in MSC procurement during FY 1965. California, New York, Missouri, Wisconsin,

successfully will fully qualify the Apollo launch escape system for manned missions.

Mission objectives include demonstration of the spacecraft and launch escape subsystem in a tumbling mode, verify airframe structural integrity under extreme conditions, demonstration of canard damping of tumbling, and qualification of the boost-protective cover structure.

The mission profile as planned calls for a launch northward from WSTF Complex 36 atop a Little Joe II launch vehicle. Two Algol and five Recruit solid propellant rocket motors comprise the so-called first stage. At 37 seconds after liftoff, at an altitude of 13,900 feet, two second-stage Algols boost the test vehicle to 58,000 feet and an abort signal will fire the launch escape system 78 seconds after liftoff.

Three seconds before launch escape system ignition, a programmed Little Joe II pitch-up maneuver will induce dynamic conditions to cause the Command Module to tumble after separation.

The command module and escape system will coast up to about 70,000 feet before beginning a tumbling descent. Canards deploying from the upper end of the escape system will then stabilize the command module base-heatshield forward. At 21,000 feet, the tower jettison rocket motor will ignite to carry away the escape system and the

(Continued on page 2)

## MSC People Witness Airliner Hijack Attempt

Cuba, instead of Cape Kennedy, very nearly became the destination of Assistant Director for Flight Operations Chris Kraft and Public Affairs Officer Paul Haney November 17 when a teen-age two-gun hijacker attempted to take over a jet flight en route to the Cape. And if one of the hijacker's pistols had not jammed or misfired, Kraft might now be dead or at least nursing a .22-caliber bullet wound in the head.

When the boy first made it known that he was armed, he pointed a .22-caliber automatic directly at Kraft's face, but the pistol misfired. He was unable to get into the crew cabin, and before being overpowered, he fired several shots into the cabin floor with the .22 and with a .38-caliber revolver.

The young gunman had ideas of taking over the aircraft and diverting it to Havana as a means of drawing public attention to the plight of anti-Castro cubans still on the island.

He plans fell through when Edward C. Haake, manager of the Houston office of Radiation, Inc., disarmed and overpowered the boy through a ruse of showing him a collection of American gold coins. Kraft and Haney helped Haake subdue the boy. Gemini Program Office Manager Charles W. Mathews and Center Medical Programs Chief Dr. Charles A. Berry were also aboard the aircraft.

The boy faces federal charges of intimidating the crew of an aircraft in flight.



COCKPIT CHECK—Gemini VII command pilot Frank Borman discusses the status of the Gemini spacecraft in which he and James Lovell will live for 14 days, with J. F. Yardley, center, McDonnell Project Gemini Technical Director, and R. D. Hill, McDonnell Base Manager.

## Gemini VII Fuel Cells Replaced; Still Plan December 4 Launch

The Gemini spacecraft that will carry crewmen Frank Borman and Jim Lovell on a two-week earth-orbital mission was mechanically mated Monday with its launch vehicle following activation of two replaced fuel cell sections.

The cells originally installed in the Gemini VII spacecraft were thought to have been damaged when one of the cryogenic reactant tanks was inadvertently overpressurized.

Preparations at Launch Complex 19 and flight controller simulations in Mission Control Center-Houston are proceeding smoothly toward supporting the

scheduled December 4 launch date. Spacecraft simulated flight is scheduled for tomorrow.

The Gemini VII/VI mission, as now planned, calls for Gemini VII to be launched a week from tomorrow with the primary objective of 14 days of space flight. Gemini VI spacecraft and its launch vehicle will then be re-erected on Pad 19 as soon as launch damage can be repaired.

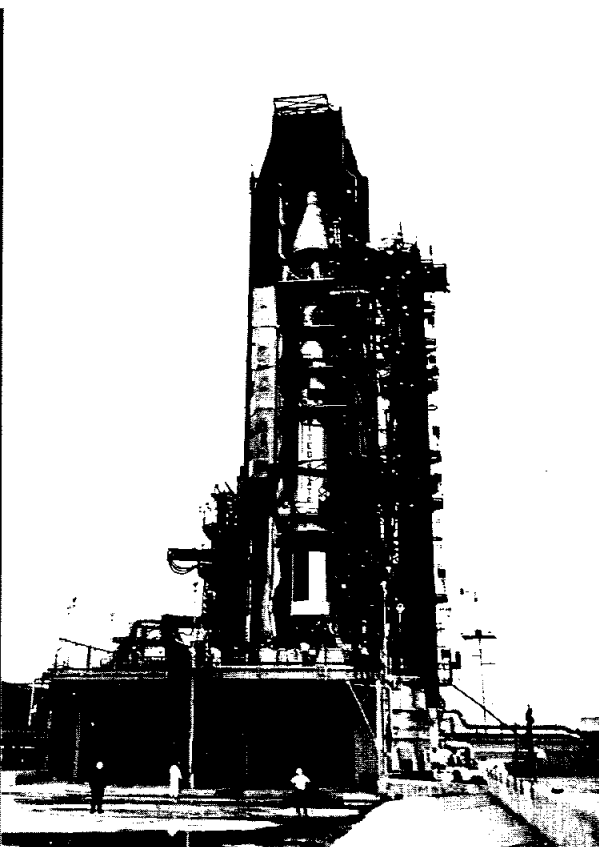
Gemini VII will play the role of a rendezvous vehicle when it becomes apparent that Gemini VI will be launched within the 14 day period of the mission. Gemini VII's orbit will be circularized to 161 nm. circular.

Crewmen Wally Shirra and Tom Stafford, in the two-day Gemini VI mission will rendezvous with Borman and Lovell in the same manner, except for docking, that they would have kept their appointment with the Agena that failed to orbit October 25.

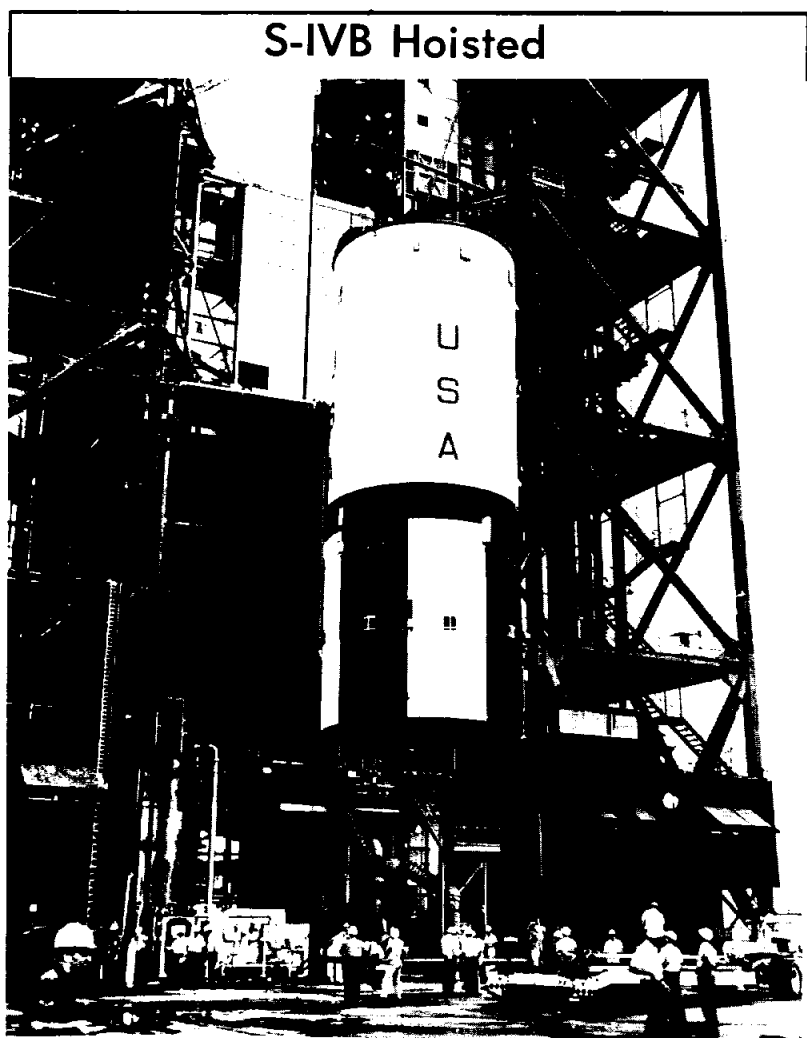
In later Gemini spacecraft developments, Spacecraft VII is in preparation at McDonnell in St. Louis for altitude chamber tests scheduled for early December. Gemini Launch Vehicle VIII awaits shipment to Kennedy Space Center from Martin-Baltimore, but neither the spacecraft or the launch vehicle are needed at the Cape before the first of the year.

Ground and altitude test programs for the Agena rendezvous vehicle for the Gemini VIII mission are being prepared at this time.

At press time, an agreement had been reached with the striking machinists union which would allow work to continue on McDonnell-built Gemini spacecraft at Kennedy Space Center.



NIGHT AND DAY—Floodlights on Launch Complex 19 illuminate the erecting of the second stage of Gemini Launch Vehicle 7, left. At right, Gemini Spacecraft 7 is shown after being hoisted to the top of the erector prior to the mating operations.



**S-IVB Hoisted**

**TOP OF THE STACK**—The S-IVB stage for the first Saturn IB mission, Apollo 201, is hoisted to the top of Launch Complex 34 at Kennedy Space Center. The S-IVB's single J-2 liquid-hydrogen liquid-oxygen engine develops 200,000 pounds of thrust.

**1965 Procurement**

*(Continued from page 1)*

Texas, Massachusetts, Florida, Maryland, Washington, D. C., and Connecticut received the largest cumulative awards.

Lang said there was continued emphasis on incentive contracting with the conversion of two major contracts from cost-plus-fixed-fee. The Gemini spacecraft contract with McDonnell Aircraft Corporation was converted to a CPIF with FY 1965 awards totaling \$166.8 million.

Also converted was the contract for the guidance computer subsystem for the Apollo Command & Service Module with AC Electronics. The FY 1965 award totaled \$64.5 million.

Eleven CPIF and three fixed price incentive contracts were in effect for a combined total of \$250.9 million or approximately 19 per cent of the business awards in FY 1965 in excess of \$25,000.

The ten largest contracts with business in terms of aggregate value of awards fiscal year 1965 are as follows:

North American Aviation, Inc., Downey, Calif. Design, develop and test three-man earth-to-moon-and-return Apollo spacecraft. FY 1965 obligations \$581.6 million; cumulative obligations \$1,452.0 million.

Grumman Aircraft Engineering Corporation, Bethpage, New York. Lunar Excursion Module development. FY 1965 obligation \$242.6 million; cumulative obligations \$392.1 million.

McDonnell Aircraft Corporation, St. Louis, Mo. Design and develop Gemini Spacecraft. FY 1965 obligations \$166.8 million; cumulative obligations \$657.6 million.

General Motors Corp., AC Electronics Division, Milwau-

kee. Guidance computer subsystem for Apollo Command Module. FY 1965 obligations \$64.5 million; cumulative obligations \$112.4 million.

Philco Corporation, Palo Alto, Calif. Implementation of the Mission Control Center. FY 1965 obligations \$21.2 million; cumulative obligations \$63.7 million.

International Business Machines, Corp., Bethesda, Maryland. Real Time Computer Complex. FY 1965 obligations \$14.0 million; cumulative obligations \$36.1 million.

TRW Systems Group, Redondo Beach, Calif. Mission control program. FY 1965 obligations, \$6.4 million (new contract).

General Dynamics Corp., San Diego, Calif. Solid suborbital vehicle. FY 1965 obligations \$5.7 million; cumulative obligations \$18.0 million.

United Aircraft Corp., Hamilton Standard Division, Windsor Locks, Conn. Development of Apollo prototype space suits and portable life support systems. FY 1965 obligations \$5.2 million (new contract).

boost-protective cover. Four-tenths of a second later, the apex heat shield will be jettisoned uncovering the egress hatch, parachutes and other upper-deck equipment.

Reefed dual drogue parachutes deploy two seconds after tower jettison. The drogues disreef after eight seconds. Reefed main parachutes deploy at 8,000 feet following drogue jettison,

**Application Satellite Tracking-TM Station To Be In Australia**

A tracking and telemetry station to support Application Technology Satellites will be established by NASA at Toowoomba in eastern Australia near the city of Brisbane.

Plans for the new station were jointly announced by James E. Webb, NASA Administrator, and Allen Fairhall, Australian Minister for Supply. NASA and the Department of Supply are the cooperating agencies for the government of the United States and the Commonwealth of Australia.

The station to be established at Cooby Creek, 16 miles north of Toowoomba in the Darling Downs, Queensland, and 80 miles west of Brisbane, will support a NASA satellite program known as ATS (Applications Technology Satellites). Multiple experimental and scientific payloads aboard these spacecraft will serve for satellite communications and television transmission, meteorological studies including pictures of the Earth's cloud cover, navigational studies and other studies of radio propagation and gravity gradient.

Satellites in the ATS series will be placed in orbit at two levels: at medium altitude, and at the synchronous altitude of 22,300 miles where the spacecraft, circling the Earth at the speed of Earth rotation, seems to hover over one spot.

Equipment for the station will include a 40-foot diameter parabolic "dish" type antenna which will be able to transmit commands to the satellite and receive telemetry from it. There will also be several trailers in which specialized electronic equipment will be housed. All electronic equipment will be provided by NASA.

Staff at the new station will number between 60 and 70 and will consist of scientists, engineers, technicians and supporting personnel. A contract will be let to private industry for operation and maintenance of the station under a Department of Supply station director.

In addition, there will be a number of American scientists and engineers associated with design and development of instrumentation at the station and aboard the satellite. Australian counterparts who will work with this team will be drawn from the Department of Supply and other organizations in Australia interested in such fields as communications, meteorology and navigation.

**Launch Escape System**

*(Continued from page 1)*

and are disreefed eight seconds later.

Landing will be approximately 22 miles from the launch point after some 440 seconds of flight.

Previous White Sands qualification flight tests of Apollo hardware are as follows:

Nov. 7, 1963—Boilerplate 6 pad abort propelled only by launch escape system.



**INGENUITY PAYS OFF**—Maxwell W. Lippitt and Joe L. Day, Crew Systems Division, receive a \$1000 cash Invention Award for inventing a biomedical recording electrode from NASA Deputy Associate Administrator Earl D. Hilburn, right.

**SERVICE, ACHIEVEMENT HONORED—  
Invention Wins \$1000 Cash  
At Annual Awards Ceremony**

Inventiveness, service and achievement were recognized November 18 when the Seventh Annual Awards Ceremony was held in the Building 1 Auditorium. Thirteen MSC employees received awards for 30 years of Federal service, Invention Awards, Superior Achievement Awards and MSC Certificates of Commendation.

Following an invocation by the Rev. Robert A. Engstrom, pastor of the Clear Lake City House of Prayer Lutheran Church, Master of Ceremonies Paul E. Purser welcomed the awardees to the ceremony. Center Director Dr. Robert R. Gilruth presented 30-year Service Awards to W. Kemble Johnson, James M. Towey, James L. Gibson and Kenneth J. Vogel.

Dr. Gilruth introduced the feature speaker Earl D. Hilburn, NASA Deputy Associate Administrator, who, after his address to the group presented a \$1000 cash Invention Award jointly to Joe L. Day and Maxwell W. Lippitt, Jr. of Crew Systems Division for their invention of an electrode for biological recording.

Deputy Center Director George M. Low presented Superior Achievement Awards to James M. Bayne, Jack A. Kinzler and Fred T. Pearce, Jr. The Air Force Commendation Medal, first Oak Leaf Cluster, was presented Col. Rufus T. Hessberg, formerly Assistant Chief for Medical Support, Crew Systems Division, and who recently returned to active Air Force duty.

MSC Certificates of Commendation were presented by Dr. Gilruth to James A. Chamberlin, Paul E. Purser and Aleck C. Bond.

The Awards Ceremony ended with benediction by the Reverend Engstrom.



JOHNSON

TOWEY



GIBSON

VOGEL



BAYNE

KINZLER



PEARCE

HESSBERG



CHAMBERLIN

PURSER



BOND

May 13, 1964—Successful high-Q test of Boilerplate 12.

Dec. 8, 1964—High-Q abort of Boilerplate 23 (31,000 feet).

May 19, 1965—Successful Boilerplate 22 powered-flight abort, although high-altitude objectives were not met because of break-up of launch vehicle.

June 29, 1965—Pad abort of Boilerplate 23A using improved subsystems.

## THE MAN FROM S.P.A.N.

# Observatory Back In The Trees Keeps Eye On Sun For Flares

There's a new dome in Houston, but it hasn't been built for sporting events or entertainment.

Housed under a silvery dome at the northeast corner of MSC is the SPAN, Solar Particle Albert Network, the first in a series of three telescopes to study radiation coming from the sun.

The Houston station will be joined early next year by monitoring points at Grand Canary Island in the Atlantic and Canarvon, Australia to keep a constant watch on the sun's fiery surface for flares and spots.

The network will be used to develop a warning system for radiation events on the sun which could endanger astronauts on a lunar mission. If a dangerous flare were observed, it would be several hours before the radiation would reach the vicinity of the moon, which would enable the astronauts to return to the safety of the command module if they were on the surface of the moon.



IT'S DONE WITH MIRRORS—Ken Cashion adjusts the upper mirror system of the heliostat atop one leg of the tower. The tower leg serves as a vertical optical tunnel for the white light sun image on its way to the spectrograph below.

The Houston facility is mounted on a 75 ft. tower in a grove of moss-hung oaks. The combination of altitude and trees keeps the effects of heat shimmer at a minimum.

There are two monitoring telescopes at the MSC station. One is a hydrogen alpha solar patrol instrument fitted with special filters which can provide an optical image of the sun's surface. The lens is four inches in diameter and has three magnifications from 20 to 80 power. A 35mm camera is mounted in the telescope to allow scientists to take time-lapse photography of the development of a solar flare.

The instrument is also equipped with an occulting cone. This device creates an artificial eclipse of the sun for the observer, blocking out the sun's disc to enable him to see the corona or halo on the sun's rim. An alternate lens also has a raster or grid to enable observers at different stations to correlate their findings.

Directly under the telescope, a small darkroom has been installed which can be used to hand process film strips from the telescope camera. In this way, engineers can check on the fine focus of the telescope.

The Houston site has a second mirror and objective lens system which carries an 8-inch diameter white light image of the sun to a spectrograph to analyze individual colors or spectra.

The spectrograph can make sure measurements as the temperatures of the sun in active regions and the force of the solar magnetic field.

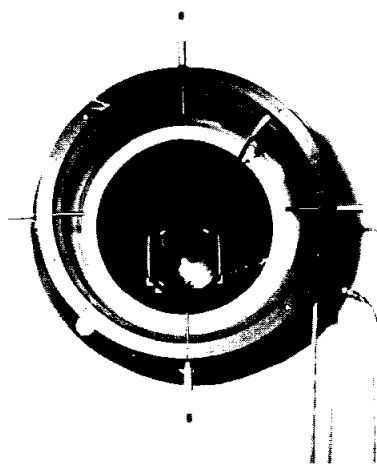
The total cost of the facility is \$171,000. The solar telescope, was assembled by Razdow Inc.,

Newark, N. J. The building and tower was constructed by Evans Construction Co., Houston, Texas. The heliostat was built by Geotech Inc., of Dallas, Texas. The spectrograph and instrumentation was furnished by Jarrell Ash Co. of Waltham, Mass.

Peter Higgins, Radiation and Fields Branch of Advanced Spacecraft Technology Division, is project engineer for the facility.



SUN WATCH — The dome of the Solar Particle Albert Network rises through the moss-draped oaks at the northeast corner of the MSC site. The spectrograph and the lower end of the heliostat and office space are housed in the building at the base of the tower.



AND IT COMES OUT HERE—The lower 45-degree precision mirror of the heliostat bounces the sun image into the spectrograph for color analysis.

## Apollo Suit, PLSS, Negotiations Begun With Two Firms

The National Aeronautics and Space Administration will negotiate with International Latex Co., Dover, Delaware, and Hamilton Standard Division of United Aircraft Corp., Windsor Locks, Conn., for development and production of Project Apollo pressure suits and a portable life support system for operations in space and on the lunar surface.

Subject to negotiations, International Latex will produce the pressure suit, which consists of a liquid-cooled undergarment, constant-wear garment, pressure garment assembly and thermomicro-meteoroid protective overgarment. Cost of the work is estimated at \$10 million.

Under a separate contract to be negotiated, Hamilton Standard will produce the life support system. It will be a back pack weighing about 65 pounds which will contain an oxygen system, thermo control system and communications equipment. This system will be used for extravehicular activities during earth orbital flights and on the lunar surface. Estimated cost is approximately \$20 million.

Present plans call for the pressure suit to be worn during the later phase of the Apollo/Saturn 1B earth orbital mission series and during Apollo/Saturn 5 missions, including lunar landings. Astronauts will use Gemini pressure suits on the initial Saturn 1B missions.

Crew Systems Division will manage the work and be responsible for integration of the pressure suit and life support system.

The companies have been engaged in research and development work on suits and life support equipment for NASA since 1963.

### Space News Of Five Years Ago

Dec. 1, 1960—A 16½-foot recovery whip antenna replaced the balloon borne system on the Mercury spacecraft.

Dec. 3, 1960—Redstone launch vehicle No. 3 was shipped to Cape Canaveral for the Mercury-Redstone 1A (MR-1A) mission.

Dec. 4, 1960—American Bar Association's "Report to NASA on the Law of Outer Space" was released, which contained collation of legal opinion on the broad spectrum of space activities.

Dec. 9, 1960—Spacecraft No. 7 was delivered to Cape Canaveral for the Mercury-Redstone 3 manned ballistic mission (MR-3).

X-15 made first flight with ball-shaped "hot nose," reaching 50,000 feet and 1,254 mph, NASA's Neil Armstrong making his second familiarization flight.

### ONE SCOOP, OR TWO?—

## Ice Cream Flavored Tablets Considered For Space Food

Crewmen on future space missions may become space gourmets through the efforts of Crew Systems Division food technologists and the U.S. Army Natick Laboratories in Massachusetts.

Compressed ice cream is high on the list of items under evaluation. Tablets are prepared like other dehydrated foods now carried on space flights. The ice cream is first frozen and the water content is drawn off. Then, the mixture is made into a powder and compressed into tablets.

Comments on its flavor by an MSC panel have been quite favorable—the majority compare the taste to that of malted milk tablets. The ice-cream flavored tablets come in chocolate and vanilla.

Barbecued meats are also being evaluated for future menus. They include beef and pork barbecue bites, and veal with barbe-

cue sauce. The first two are bite-sized, and the third is rehydrated with water.

Space food experts say that if the new foods prove feasible for space flight, they could appear as entrees sometime during the Apollo program.



NO-DRIP ICE CREAM—Mary Lou Ferrill of Space Medicine Branch, demonstrates the cone-less, dripless compressed ice cream tablet.

## Gemini VIII EVA Equipment Enters Chamber Qualification

Extravehicular equipment for Gemini VIII was tested in the 20-foot vacuum chamber in Crew Systems Division this week.

The Extravehicular Life Support System, which finished its thermal qualification last week, was combined with the Extravehicular Support Pack (ESP), a 92-pound backpack in which the astronaut will carry his oxygen and maneuvering gas supply.

The first test of the combined system evaluated the capability of the oxygen bottle in the pack to supply the extravehicular astronaut with air at a high rate of flow. The switch-over to the emergency oxygen supply in the ELSS occurs automatically after the ESP bottle is exhausted. The test subject also fire the space

gun 40 bursts of five-second duration with a 15-second interval between them.

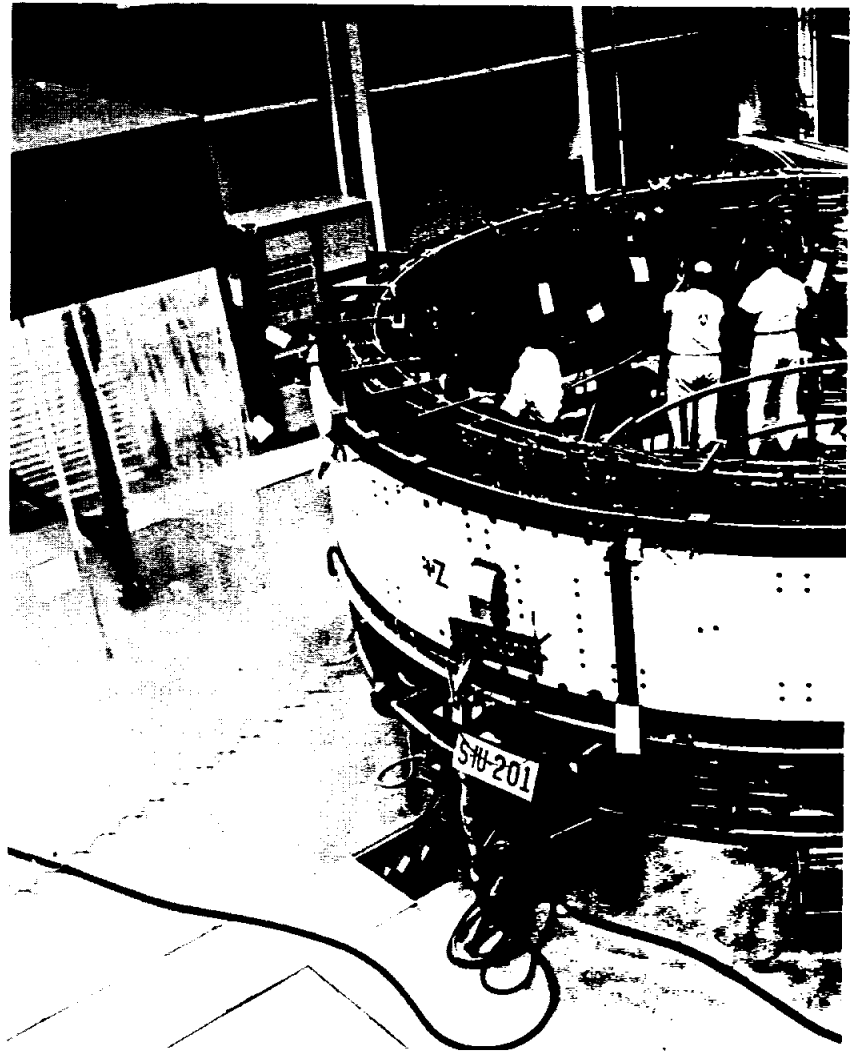
The second test was a propellant blowdown qualification in which the space gun was fired in 30-second bursts to exhaust the freon supply. The subject used the left tank air supply at medium flow during this test. Brown and Root-Northrop technicians and MSC engineers served as test subjects.

A vacuum equal to 150,000 feet altitude existed in the chamber, and the walls of the thermal box were cooled to a minus 300 degrees Fahrenheit to simulate the conditions of orbital night for both tests.

Test conductor was Kenneth Snyder, Systems Test Branch of Crew Systems Division.



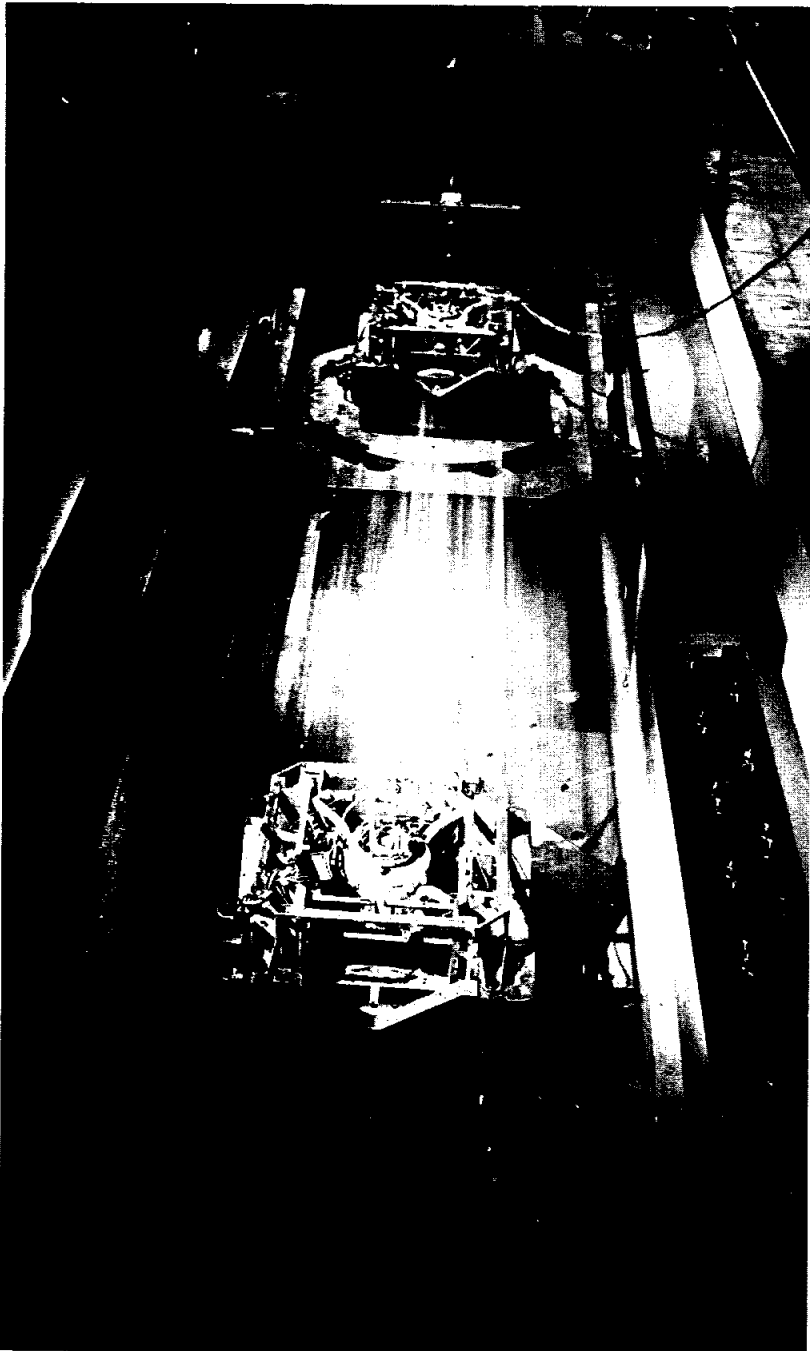
ASSEMBLY AREA—Saturn IB launch vehicle instrument units are shown in various stages of assembly at IBM's Space Systems Center in Huntsville, Ala. At the far end of the bay is the unit for the first Saturn IB, the Apollo 201 mission. IBM has a \$175 million contract with Marshall Space Flight Center for building and testing 27 instrument units—12 for Saturn IB and 15 for Saturn V.



## INSTRUMENT 'SLICE', RTCC—

# IBM Supporting Apollo In Fli

BIG JOLT—A computer for a Saturn instrument unit undergoes an acceleration test below, in IBM's Owego, N.Y. facility with a force equivalent to a one-half ton object striking a steel wall at 30 mph.



**E**ARLY IN THE PLANNING for Project Mercury, the need was realized for a system that could plot the spacecraft and predict flight parameters, and display flight control information in the form required for split-second decisions by flight controllers.

Under contract to NASA, IBM Federal Systems Division analyzed the Project Mercury mission requirements, derived the orbital mathematics and then developed the launch monitor subsystems and computer control system. This system was installed at the Goddard Space Flight Center in Greenbelt, Maryland, and flawlessly supported all the Mercury flights—and, in fact, the early Gemini flights (this Goddard system has been redesigned by IBM to support the NASA scientific flights, OAO, OGO, etc.).

Today, manned flight control has been transferred to the Manned Spacecraft Center, Houston. The Real Time Computer Complex (RTCC) is one of the most advanced information handling, computing and control systems in the world. It is designed specifically for ground support of Gemini and Apollo/Saturn.

Presently composed of five powerful IBM 7094 Model II computers, the systems will be converted to System/360 Model 75's next year.

RTCC receives many kinds of data from tracking stations around the world, processes them and sends them for display in the nearby mission operation control rooms. Using these computers, Mission Control-Houston can run a completely simulated mission to train

astronauts and ground crews at the same time that an actual mission is taking place.

To meet NASA's multi-mission requirements, IBM has designed RTCC to handle 15 times more data flow in and out of the system, compute 100 times as much data in the same amount of time, and present 275 times as much display information as the system that supported Project Mercury flights. A major difference: the five new IBM 2361 memories can hold a total of 2,621,440 words of data and program steps in storage.

### SATURN HARDWARE

IBM's Instrument Unit mission is concerned with the launch vehicle. The IU is Saturn's nerve center. During its nearly six hours of life it will: handle the navigation, guidance and flight control, command and sequence vehicle functions, put the vehicle into an earth orbit, and on Saturn V manned flights, put itself, the S-IVB stage, and the spacecraft into a lunar transfer trajectory.

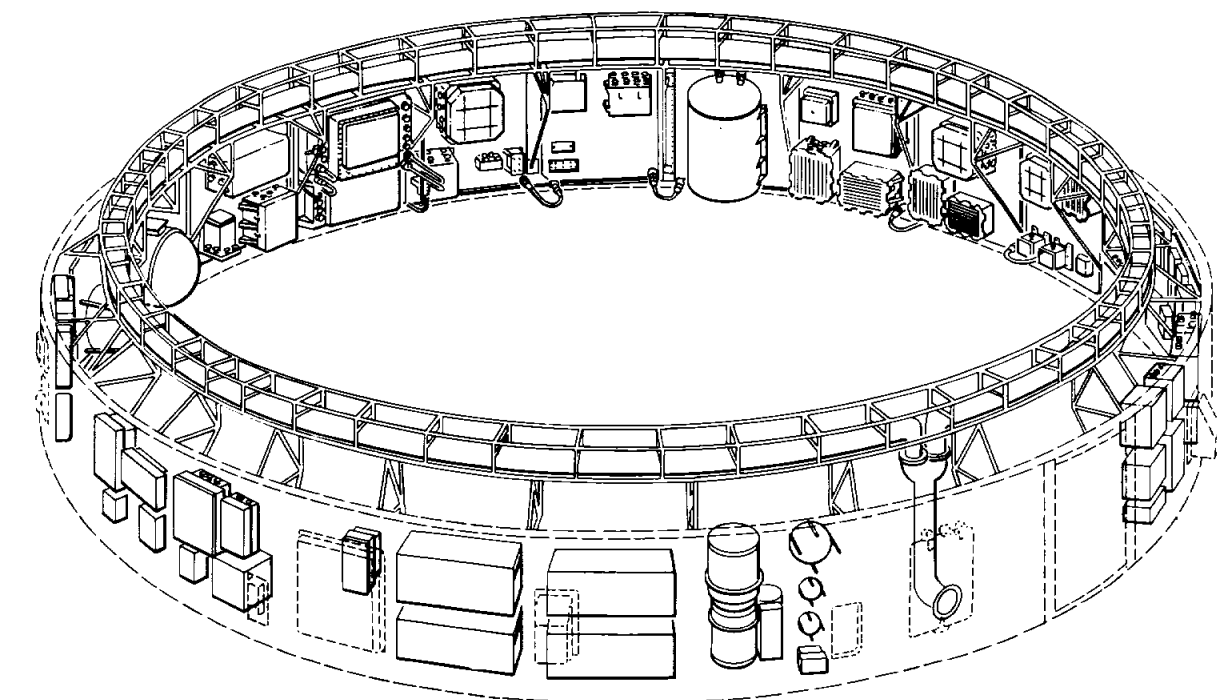
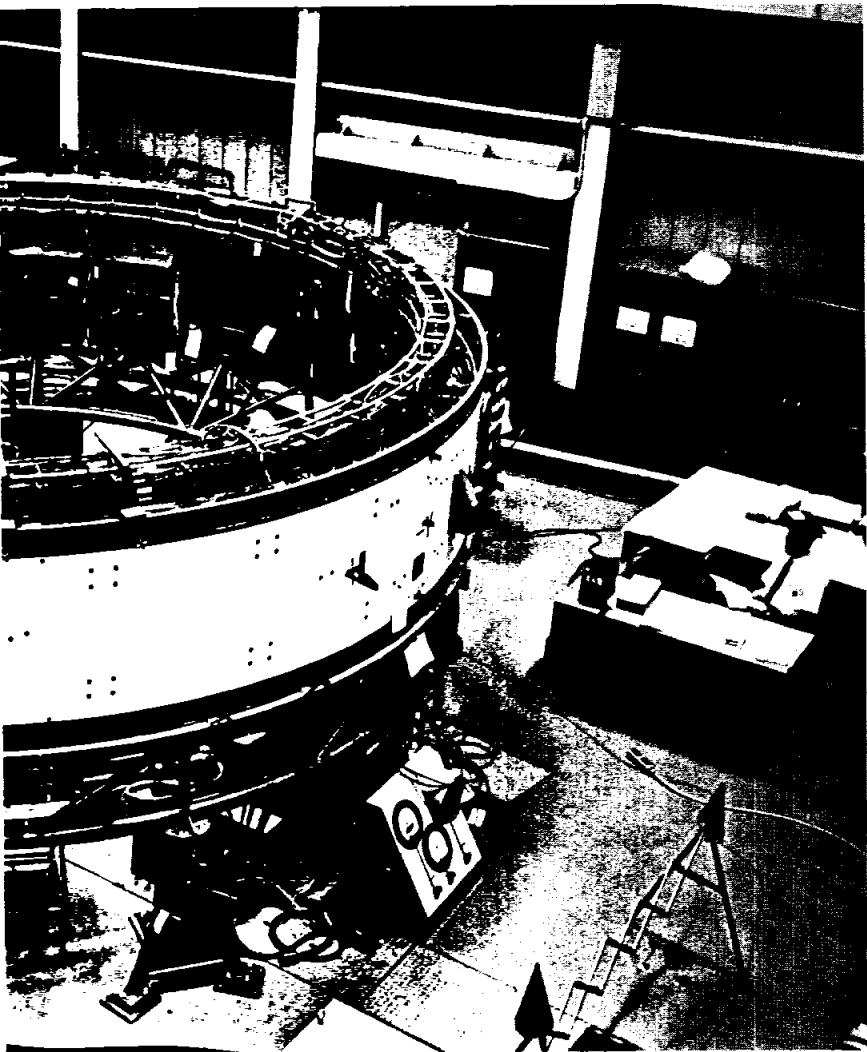
In addition, the IU will stabilize the S-IVB propulsion stage and the lunar excursion module during turnaround of the command module and the service module. After this, the IU and the S-IVB separate from the payload.

The IU is made up of six subsystems: Structure, environmental control, guidance, flight control, instrumentation, and electrical.

### STRUCTURE

The structure, on which all other systems are mounted or work through, is no thicker than a bar of soap. A systems base, the structure is also the vehicle link between the S-IVB and the payload.

This system consists of aluminum honeycomb core sandwiches between three arched segments of aluminum



**ALMOST COMPLETE**—Instrument Unit for Apollo 201 left, is shown in final checkout prior to delivery to Kennedy Space Center. The 22-foot diameter "slice" issues steering commands, stage separation and engine ignition commands, and monitors vehicle performance.

**UNIT'S UNITS**—More than 60 components go into the instrument unit's six subsystems, as shown by this isometric drawing.

## Flight Hardware, Ground Control

skin sheeting. A cross-section of this honeycomb would reveal thousands of tiny hexagonal cells. This particular design is capable of withstanding a compressive weight ratio of 2,000 pounds for each pound of its own weight.

### ENVIRONMENTAL CONTROL

This system maintains the proper temperature for IU equipment and the S-IVB stage both on the ground and in space. Coolant, which is made up of 60 percent methanol and 40 percent water—much like antifreeze—is pumped through thermal conditioning (cold) plates. Because of their shape and the heat they generate, the LVDC, LVDA and the ST-124-M inertial guidance platform are integrally cooled.

### GUIDANCE AND FLIGHT CONTROL SYSTEMS

Primary portions of these systems are the launch vehicle digital computer (LVDC), the launch vehicle data adapter (LVDA), the guidance platform and an analog flight control computer.

The LVDC and the LVDA, its link to other IU systems and the ground, are unique in their design and mission.

One of the most reliable computers ever developed for a space program, the LVDC is about the size of an ordinary suitcase. It holds information that has been stored in its memory before launch, and contains electronic circuits that perform guidance and checkout calculations at speeds measuring in millionths of a second.

Before liftoff, ground monitors use the on-board guidance and flight control systems to run simulated missions. Then, starting at liftoff, the computer navigates the six-million pound vehicle toward orbit. During ascent, the flight control

computer receives speed and attitude input from the data adapter and processes these data into steering commands. The computer also issues commands to drop off the first and second stages when they have burned out.

Once in orbit, the computer shuts off the S-IVB engine and checks it out. If all tests are okay, it restarts the engine at the exact moment that will put the Apollo spacecraft into a lunar transfer trajectory. Once in this trajectory, the IU and S-IVB separate from the payload.

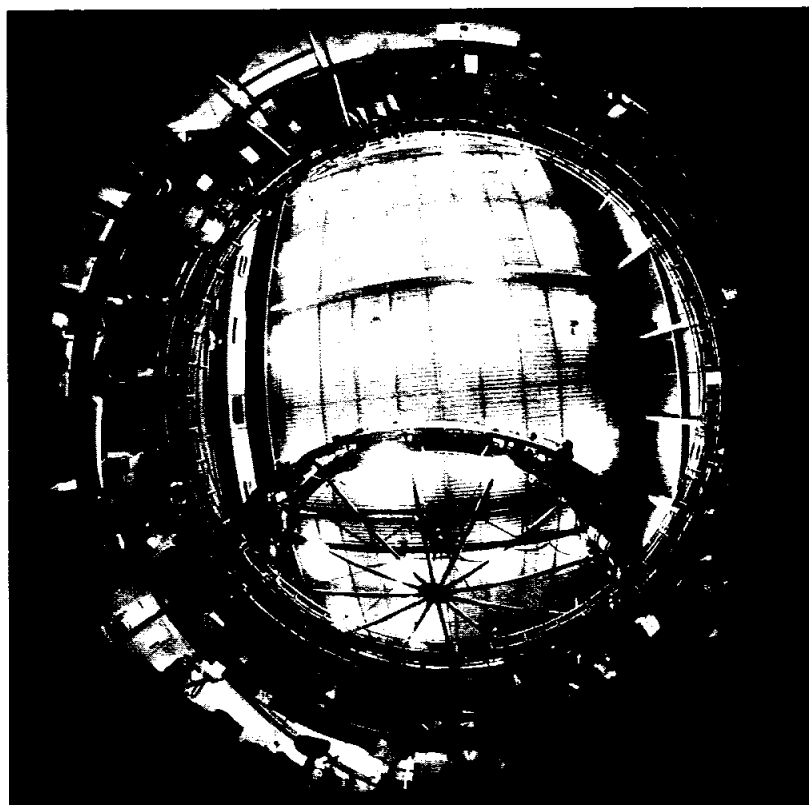
### INSTRUMENTATION

Temperatures, pressures, vibration as well as control signals from the ST-124-M platform, computer and other equipment are measured by this system. Data gathered are relayed to ground stations to evaluate flight performance and provide information for flight control decisions. Radio frequency systems are used for ground tracking and remote command purposes.

### ELECTRICAL

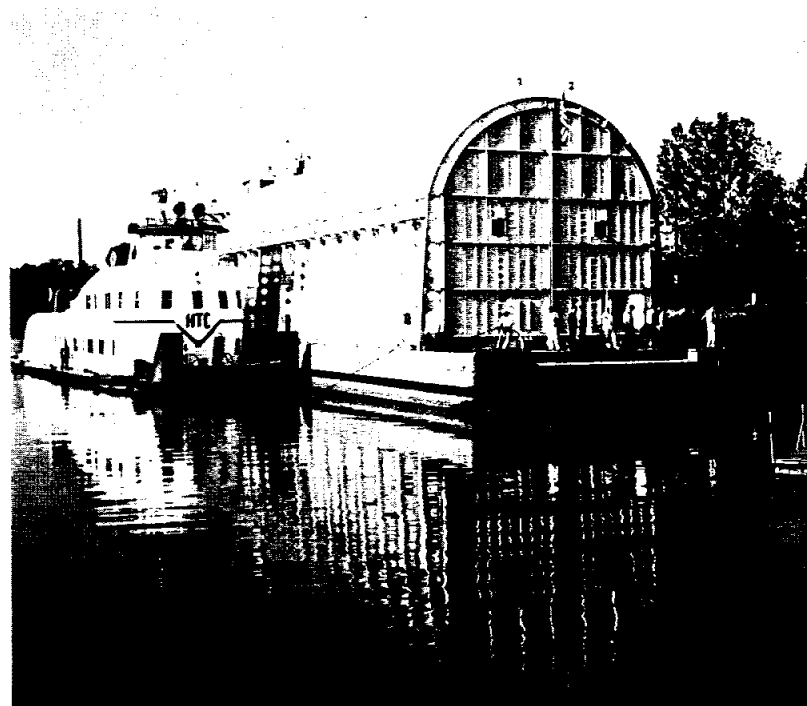
This system generates and distributes the power required to operate components during flight and sequencing of certain functions during checkout, count-down and flight. This system also has an emergency detection system to sense malfunctions or any unsafe conditions.

After the IU is assembled and tested at IBM's Huntsville facility, it is shipped to the Kennedy Space Center. At KSC, IBM has an active role in inspection, mating and launch operations concerning the IU. In addition, this role calls for planning, activating and verifying ground support facilities, installation of this equipment as well as the electrical support equipment, and all tests relating to the IU.



**UP AND OVER**—Instrument unit for Apollo 201 is hoisted up and over the unit for Apollo 202 on its way to Kennedy Space Center in this fish-eye lens photo.

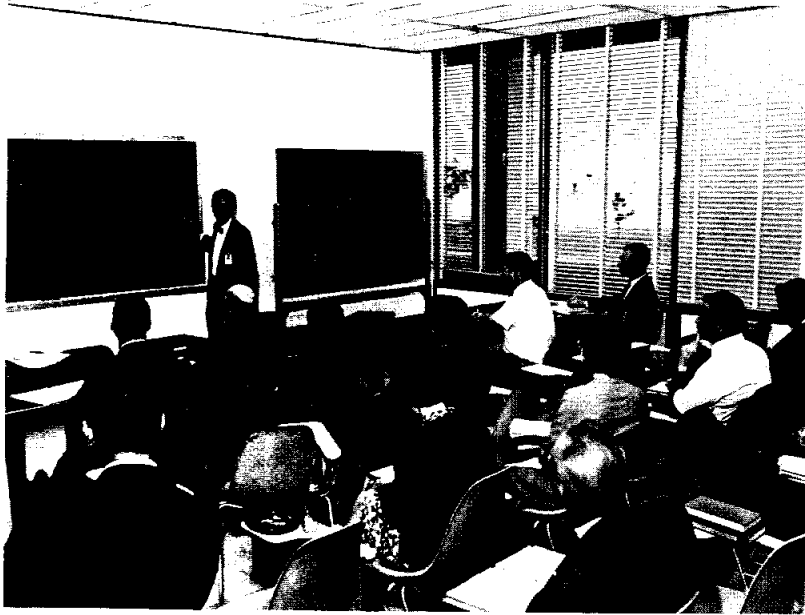
**CAST OFF FORE AND AFT**—Apollo 201 instrument unit leaves Redstone Arsenal dock aboard the NASA Barge Palaemon, below, en route to Kennedy Space Center October 9. The unit has been mated with the S-IVB stage of the Apollo 201 launch vehicle.



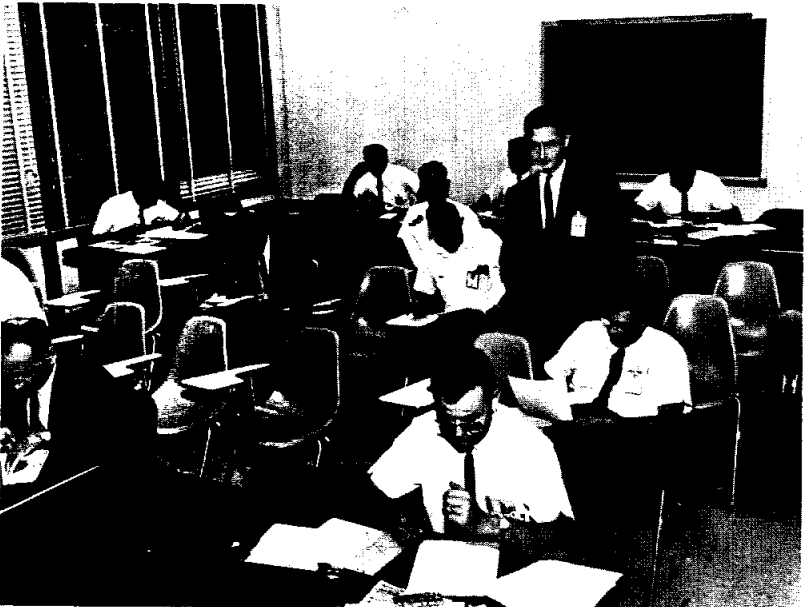
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### Schools Days at MSC



POLITICAL SCIENCE—Dr. Werner F. Grunbaum conducts a political science class each Monday and Wednesday evening at MSC in Building 15.



ELECTRICAL ENGINEERING—University of Houston professor Dr. S. R. Parker teaches a class in electrical engineering each Tuesday and Thursday, also in Building 15.

## U of H Branch To Be Established Next-door to MSC

A branch facility of the University of Houston will be built on 50 acres of land northwest of MSC. The \$1 million tract of land was a gift to the University by Humble Oil and Refining Co.

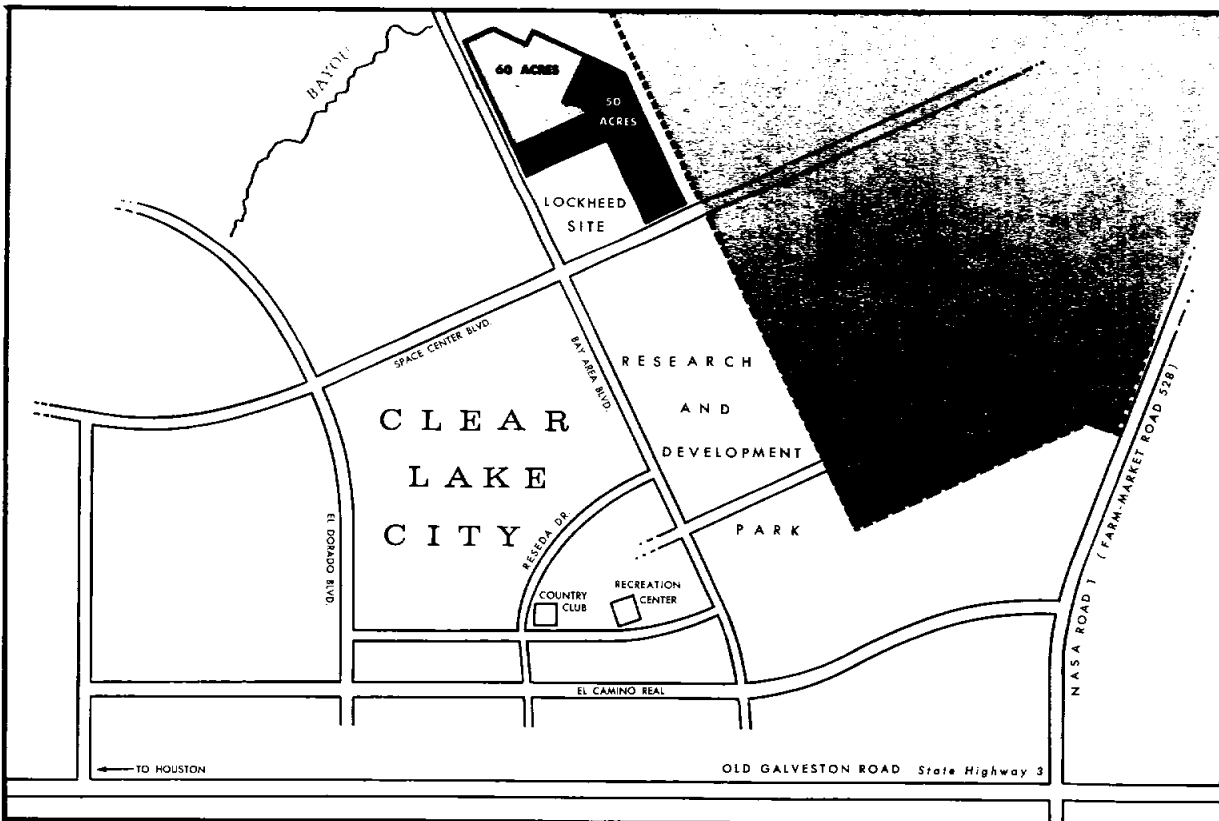
An additional reserve of 60 adjoining acres is being held by Humble as a future gift if the University demonstrates that it needs the land within five years.

Humble president Dr. Charles F. Jones announced the gift at a news conference held at the University. In accepting the gift, University President Dr. Philip Hoffman expressed "gratitude for Humble's generous offer and its recognition of the potential importance and significance of the proposed facility. He said that although the University's acceptance is contingent upon approval by the Texas Legislature and by the Coordinating Board, Texas College and University System. The State Legislature does not meet again until 1967.

Acting on behalf of MSC Director Dr. Robert Gilruth, who was in Arizona, Special Assistant to the Director Paul E. Purser said that the planned University branch would help meet the educational needs of the growing technical and scientific community in the MSC area.

Purser also explained that the University has been cooperating with MSC in providing courses at MSC, and that in the 1964-65 school year there were more than 500 graduate and undergraduate enrollments in University of Houston courses. Purser expects the figure to exceed 600 this year.

The tract lies in the research and development park section of the master plan for the development of Clear Lake City, and adjoins a 50-acre tract purchased by Lockheed Aircraft Corporation.



SITE OF UNIVERSITY OF HOUSTON BRANCH—The solid black area on the map shows the 50-acre site given by Humble Oil and Refining to the University of Houston for a branch facility. The 60-acre adjacent tract, shaded grey, may be given to the University at some future date if growth demands.

## 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.)

The Galveston correspondent for the Houston Telegraph in 1862 and 1863 signed his dispatches "Sioux." It would be interesting to know his (or her!) real name and something about his personality and background, but we know nothing beyond what we read in and deduce from the lively dispatches that he filed from the embattled island.

In a Sioux report datelined, "Galveston, Dec. 26, 1862—Via Virginia Point," the Telegraph's correspondent wrote:

"The Yankees have barricaded Kuhn's Wharf, with many improvements over the wharf rats, and have reestablished the U. S. lines at Perry's Foundry. So I still live in Dixie's Land. When the Yankees landed they raised a large flag over the wharf. I gave three cheers for the flag, then gave three groans for President Davis . . ."

Sioux's assignment was somewhat tougher than those of NASA and media news personnel covering a Gemini mission today. He spoke often of skulking through alleys and dark streets with Union patrols at his heels of his taunting the Northern officers for calling themselves champions of "liberty of the press."

He referred to the occupation force as "the Puritans," because it was three companies of the 42nd Massachusetts Volunteers, chaplained by a Universalist parson. He baited the Union troops in his dispatches by reporting a poster that he himself probably had nailed to the wall of the Market House:

ATTENTION YANKEES:  
FREE LAND!

*Deeds and titles to Texas Plantations for immigrants from Massachusetts may be had on the Mainland by applying to any office under military jurisdiction. Size of each Plantation: 4 by 6 feet.*

Sioux even managed to take a wartime census of the Texas metropolis (Galveston's normal population was about 10,000), most of whose citizens had fled to then much smaller Houston. He found only 3000 remaining in the island city, "mostly immigrants, traitors and Lincolnites." He even broke down the "immigrant" count by nations of origin.

Or was this a military census that Sioux took at the behest of the Confederate Trans-Mississippi command in Houston?

Anyway, he wrote heartbreakingly of the deserted homesteads, and said the sounds he missed most were the music of church bells and the laughter of children.

After describing the New Englanders' regimental flag bearing the seal of the state of Massachusetts, with an Indian armed

with a bow standing beneath a single star—the Telegraph reporter said the Indian represented the "savage Yankees"; the star the Lone Star of Texas, which he predicted was rising.

And Sioux informed publicly on Galveston gals who fraternized with the enemy. Bitterly he denounced them with this quotation:

"Where are the noble martyrs of the Second Texas, who left Houston a few months ago? On the field of Shiloh many fill unknown tombs. Old Mississippi is dotted with their graves . . ."

One is tempted to theorize that Sioux was more than a mere newsmonger; that perhaps he was even a Confederate intelligence agent. Day after day his dispatches contained detailed military information. He gave the name, size, armament and movements of every United States vessel in Galveston harbor. Daily he counted and reported the patrol details that ranged the streets of the city. He timed these dispatches to the half-hour, sometimes filing six or eight a day, getting them somehow to the Confederate post at Eagle Grove or the military telegraph station at Virginia Point, for transmittal to Houston—where Gen. John B. Magruder, the district commander, had his headquarters on Rusk Avenue.

### SPACE QUOTES

SPACE HAS PROFOUND IMPACT ON ALL HUMAN AFFAIRS. Deputy Administrator Hugh L. Dryden, Address before Governor's Conference on Oceanography and Astronautics, Kauai, Hawaii, October 1, 1965.

"Already the events of the last seven years have had a profound impact on all human affairs throughout the world. Repercussions have been felt in science, industry, education, government, law, ethics, and religion. No area of human activity or thought has escaped. The toys of our children, the ambitions of our young men and women, the fortunes of industrialists, the daily tasks of diplomats, the careers of military officers, the pronouncements of high church officials—all have reflected the all-pervading influence of the beginning steps in space exploration. The impact can only be compared with those great developments of past history like the Copernican theory which placed the sun, rather than the earth, at the center of our solar system; the work of Sir Isaac Newton in relating the fall of an apple to the motion of the moon around the earth through the universal law of gravitation; to the industrial revolution; or other great landmarks in the history of mankind."

# Space News ROUNDUP!

MANNED SPACECRAFT CENTER, HOUSTON, TEXAS

## EMPLOYEE NEWS

### Simple Device Such As Stepladder Can Spoil Whole Day—Or Longer

It was a stepladder, just a plain garden-variety wooden stepladder that is found in most garages for work around the house. But as the man climbed the ladder to string Christmas lights across the eaves of his house, the fourth rung gave way.

He got off light—a sprained ankle, a skinned shin, and a slight bit of embarrassment as he looked over his shoulder to see of any of the neighbors had been watching.

It could have been worse, like a broken leg or a broken neck.

Stepladder are not all that expensive to replace. A few minutes spent now and then checking wooden ladders for rot, corroded fittings and cracked rungs will pay off. Metal ladders should also be checked for corrosion.

As simple and as taken-for-granted as a ladder is, there are still things to look for and do to insure dependability.

- Never paint a wooden ladder. Use transparent preservatives such as linseed oil, varnish or shellac—these do not hide defects.
- Make sure that wooden lad-

ders are free of knots, pitch pockets, cracks, cross-grain, compression failures and shakes.

- See that wooden steps and rungs are rabbeted into the side rails and that they are reinforced by bolts or rivets.
- Check metal fittings to see that they operate freely without excess play.
- A ladder's spread when opened should be 6 to 10 inches for each foot in height. Example: A six-foot ladder should spread 36 to 60 inches at the floor.

Possible failure is not limited to wooden ladders, for even the seemingly foolproof aluminum ladders now on the market can be hazardous if not properly maintained. While metal will not rot like wood, extended exposure to weather or chemicals, overloading and dropping them can lead to failure. Moreover, a metal ladder provides a potential ground when working with electrical circuits.

So much for maintenance. Here are some operational-type pointers for using a ladder properly and safely:

- Give a ladder a "walk-around" check before using, like a pilot does his airplane before climbing into the cockpit.
- Keep ladders indoors out of the weather when not in use.
- Always face the ladder when climbing up or down.
- Use both hands for grasping the ladder while climbing; tie tools, wire and other items to your belt, or place them on the ladder shelf before climbing.
- Carry ladders on the shoulder, base forward and pointed toward the ground.
- Discard any painted wooden ladder; there is no way of knowing when it might let you down—hard!

### Art Club Winter Exhibit Planned Dec. 18-Jan. 3

A winter art exhibit, sponsored by the EAA Art Club, will be held in the Auditorium December 18 through January 3.

The Art Committee is anticipating an even larger exhibit than the one held last April, and all MSC and contractor employees are urged to enter original pieces of art in various media.

Eugene Brock at Ext. 4788 has entry blanks and rules concerning preparation of entries.

### MSC Christmas Dance Tickets Sold By EAA

Social activities always dominate the after-five scene during this season each year. Plan now to attend the gala semi-formal Christmas Dance held annually at the Sylvan Beach Pavillion, La Porte.

Rex Bauerlein, Chairman of the Dance Committee, has appointed Evon Collins as co-chairman, also in charge of publicity; Sarah Lopez is designing the decorations; and, Bea Herrera will head the ticket sales.

Tickets are limited to 700 and will be available at \$2.50 per person, including set-ups.

### Model Airplane Club To Meet December 1

The fourth monthly meeting of the MSC Radio Control Model Airplane Club will be held in Room 278, Building 4, at 5 PM on Wednesday, December 1.

All NASA and MSC-Contractor employees are invited to attend. The program will be conducted by Mr. Dave Hoffman who will illustrate the latest foam-plastic and fiberglass techniques of airplane construction with an "Early Bird" model kit.

There will also be several important items of Club business considered at this meeting. One of these will be the adoption of official operation rules for the flying site. Yearly membership and insurance fees for the Academy of Model Aeronautics will also be due for the 1966 season. For further details, call Bill McCarty—Ext. 5411, Bill Mallary—Ext. 2297, or Tim Brown—Ext. 4374.

### Bridge Winners Named

Winners at the November 2 game were NORTH-SOUTH: L. E. Mercier and T. K. Sulmeisters, first; Bob Hodgson and Lee Pearson, second. EAST-WEST: Bill Hamby and Floyd Bennett, first; Emer St. Leger Henry Rotter, second.

At the November 9 game, Betty and John Herrmann tied for first NORTH-SOUTH with Larry and Marilyn Gallagher; EAST-WEST winners were Floyd Goostree and Arthur Carlson, first; John Gordon and Ray Lynch, second.



**WINNING TEAM**—Members of the Instrumentation and Electronics Systems Division football team show off the trophy they won as top team in the MSC/Ellington AFB Flag Football League. The IESD team won seven games and lost one during the season. Team members, left to right, are: James F. Axley, coach; William F. Ritz, Jerry Pels, Art Campos, Gary Johnson, Jack Boykin, and Robert J. Swint. Other team members were on travel or otherwise unavailable when this photo was made.

### MSC/EAFB Flag Football League

TEAM	Final Standing			
	WON	LOST	PCT	PF PA
1) IESD	7	1	.875	127 43
2) 2103 Communications Squadron	6	2	.750	114 57
3) General Electric	6	2	.750	88 25
4) Lockheed Electronics	6	2	.750	83 50
5) Guidance & Control	5	3	.625	91 39
6) Structures & Mechanics	2	6	.250	44 114
7) ISD	2	6	.250	35 100
8) 747th. AC&W Squadron	2	6	.250	23 69
9) ASPO	0	8	.000	10 119

Game Scores from 4 November thru 9 November  
 Guidance & Control 21, ISD 0  
 747th AC&W Squadron 2, ASPO 0 (Forfeit)  
 IESD 13, 747th AC&W Squadron 0  
 Guidance & Control 2, ASPO 0 (Forfeit)  
 General Electric 13, 2103 Communications Squadron 0  
 Structures & Mechanics 6, 747th AC&W Squadron 0  
 IESD 19, Guidance & Control 15  
 Lockheed Electronics 2, ASPO 0 (Forfeit)

### Judo Club Take Third At Regional Matches

The MSC Judo Club won third place and earned one team trophy and five individual trophies at the Regional Matches held November 6 at the State

Fair of Texas grounds in Dallas. Jim Giles captained the team.

The Club meets each Tuesday from 5 to 7 p.m. at the Clear Lake Community Center, and each Thursday from 7 to 9 p.m. at the Webster Community Center.

MSC and contractor employees are invited to participate in the Club. Call Don Bray at Ext. 2801 for details.

### MSC Aero Club Meets

At the November 9 monthly meeting of the MSC Aero Club a film describing customs procedures and facilities to private pilots in the Bahamas was shown. Other items discussed include local airport facilities open to club members, dues for the coming year, and a new decal that will be issued with 1966 memberships.

The Aero Club's next meeting will be on December 14 at 5 p.m. in the Building 1 Auditorium. Don Bray at Ext. 2801 has additional information about Aero Club membership.

### MSC BOWLING ROUNDUP

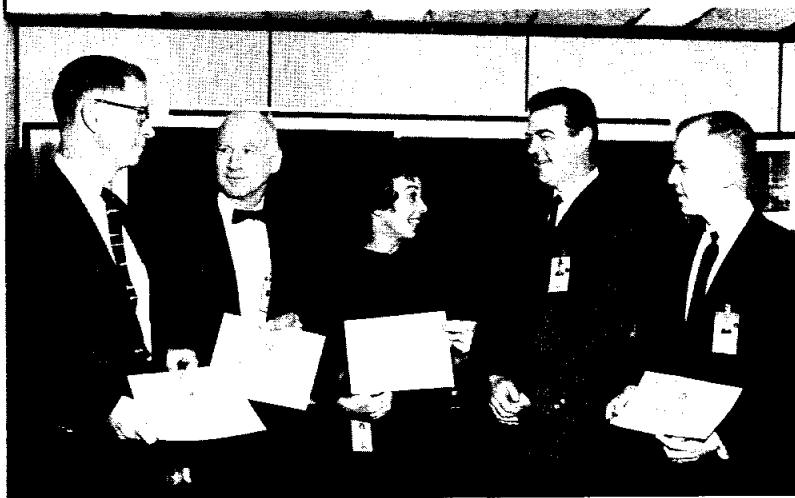
MSC COUPLES LEAGUE		
Standings as of November 16		
TEAM	WON	LOST
Bowlernauts	30	14
Idgits	29	15
Intimidators	16	18
Spastics	25½	18½
Almosts	25	19
Four Friends	24½	19½
Eight Balls	22	22
Sociables	20	24
Aces	18	26
LBD	18	26
Fireballs	16	28
Fabulous Four	10	34

MIMOSA MEN'S LEAGUE		
Standings as of November		
TEAM	WON	LOST
Whirlwinds	29	7
Chizzlers	23	13
Alley Oops	22	13
Fabricators	19	17
Road Runners	18	18
Goobers	17	19
Green Giants	17	19
Technics	16	20
Foul Five	12	24
Agitators	7	30

High Game Women: Betty Durkee 222, Shirley Yeater 209.  
 High Game Men: Joe Garino 237, Gene Petersen 237.  
 High Series Women: Shirley Yeater 571, Betty Durkee 542.  
 High Series Men: Joe Garino 629, Dan Kennedy 626.

High Game: B. Graham 273, G. Amason 266.  
 High Series: G. Amason 701, B. Harris 701.  
 High Team Game: Alley Oops 1105, Road Runners 1103.  
 High Team Series: Chizzlers 3138, Alley Oops 3085.

### Total 90 Years Service



**SERVICE AWARDS**—Gemini Program Office Manager Charles W. Mathews, second from right, presented service awards to four Program Office employees recently. Left to right are: Wilbur F. Gray, resident NASA manager at McDonnell Aircraft Corp., St. Louis, 25 years; George F. MacDougall, Jr. deputy manager, office of program control, 25 years; Emily Ertl, office of Test Operations, 20 years; Mathews; and Reginald M. Machell, office of Spacecraft Management, 20 years.



**CENTURY PLANT**—Americans in the year 2065 A.D. will dig up the time capsule buried at the site of the future Hampton, Va., Aerospace Museum and Park and find relics of the nation's first manned spaceflight program. During the "Christopher Kraft Day" celebrations in Hampton November 10, Kraft placed into the time capsule a wind-tunnel model of the Mercury spacecraft and a copy of "Project Mercury; A Chronology," by the MSC Historical Services Branch. Kraft is shown with Hampton city manager C. E. Johnson and city workmen prior to burial of the capsule.

## Kraft Returns To Home Town For Hampton 'Chris Kraft Day'

It was old home week in Hampton, Va., November 10 as that city and its school system celebrated "Christopher C. Kraft Day." Kraft, assistant director for flight operations, is a native of Phoebus, Va., which is now part of Hampton.

The "local-boy-makes-good" celebration included a speech by Kraft to students and faculty of Hampton High School, from which Kraft graduated in 1941, placing a Mercury wind-tunnel model in a 100-year time capsule planted at the site of a proposed Aerospace Museum; planting a tree in a parkway in front of the Museum site; attending a Phoebus Civic Association banquet; being guest of honor at a joint luncheon sponsored by the City of Hampton and Hampton Roads Junior

Chambers of Commerce, and receiving a framed painting of the Christopher C. Kraft Elementary School now under construction in the Northampton section of Hampton.

Other MSC people taking part in Christopher C. Kraft Day were Sigurd Sjoberg, Kraft's deputy; Chris Critzos, engineering assistant to Kraft; Jerome Hammack and Kenneth Kleinknecht of the Gemini Program Office; Robert F. Thompson, chief of Landing and Recovery Division; Aleck C. Bond, Engineering and Development Directorate; Harold I. Johnson, Flight Crew Support Division; John P. Mayer, chief of Mission Planning and Analysis Division, and Howard Gibbons, chief of the News Services Branch, Public Affairs Office.

### AFTER 21 YEARS—

## A 'Chute, a Slap, a Shove; A Drop Toward the Enemy

The crippled B-17 sank closer to the German landscape that cold day in November, 1944. Flak had set fire to the engines and fragments from the bursts had ripped through the fuselage. The bombardier turned from his position in the clear plastic nose of the stricken airplane to aid the navigator, who lay on the floor bleeding from flak and chunks of the airplane's equipment.

After attempting to stop the navigator's bleeding, the bombardier snapped a chest-pack parachute to the semi-conscious navigator's chute harness, rolled him toward an open escape hatch, and before shoving him through the hatch, clasped the wounded man's fingers on the parachute D-ring. With a sharp slap in the face to awaken him, the bombardier let the navigator slide though the hatch before he himself buckled on another chute and bailed out. Captured

by *Wehrmacht* troops, the bombardier later helped carry the wounded navigator to a German hospital. Both men spent the rest of the war in prisoner-of-war camps.

The bombardier, then Lt. Douglas K. McKnight, now Lt. Col. McKnight and chief of personnel services of the 72 Bomb Wing, Ramey AFB, Puerto Rico, recently was awarded a belated Silver Star for assisting the wounded navigator bail out of the flaming Flying Fortress.

A letter recommending Colonel McKnight for the Silver Star had been found in McKnight's master personnel file which was dated October 1945 and initiated by the navigator McKnight helped to bail out—Lt. Mathew Radnofsky, now of the Systems Development Branch of Crew Systems Division.

## Apollo Pallet Design Contractors Picked

The National Aeronautics and Space Administration today selected four companies to perform four-month design studies on an experiments pallet to fly aboard Project Apollo missions. They are Lockheed Missiles and Space Division, of Sunnyvale, Calif.; McDonnell Corporation of St. Louis, Mo.; Martin Company of Denver, Colo.; and Northrop Space Laboratories of Hawthorne, Calif.

The firms, under separate and concurrent fixed price contracts valued at approximately \$375,000, will design and develop detailed specifications and produce mockups of a pallet to be placed in the Apollo spacecraft service modules.

The pallet will house scientific, technological and engineering experiments to be carried on Apollo missions of up to two weeks duration beginning in 1968.

After review and evaluation of the design studies, NASA plans to select one of the firms to develop the experiments pallet flight hardware under a cost-plus-incentive-fee contract.

### MARINES LEND HAND—

## Apollo Surf Recovery Tests Check Equipment, Techniques

An Apollo surf recovery exercise was conducted successfully in the Gulf of Mexico near the Galveston south jetty November 16 with the NASA Motor Vessel Retriever and a US Marine Corps LVTR1A1 (landing vehicle track recovery) taking part in the simulated recovery exercise.

The exercise was to evaluate the LVTR1A1 as a recovery vehicle for retrieving the Apollo spacecraft and crew in the event of an abort landing at Cape Kennedy in areas near the launch site that are not accessible to other sea rescue craft.

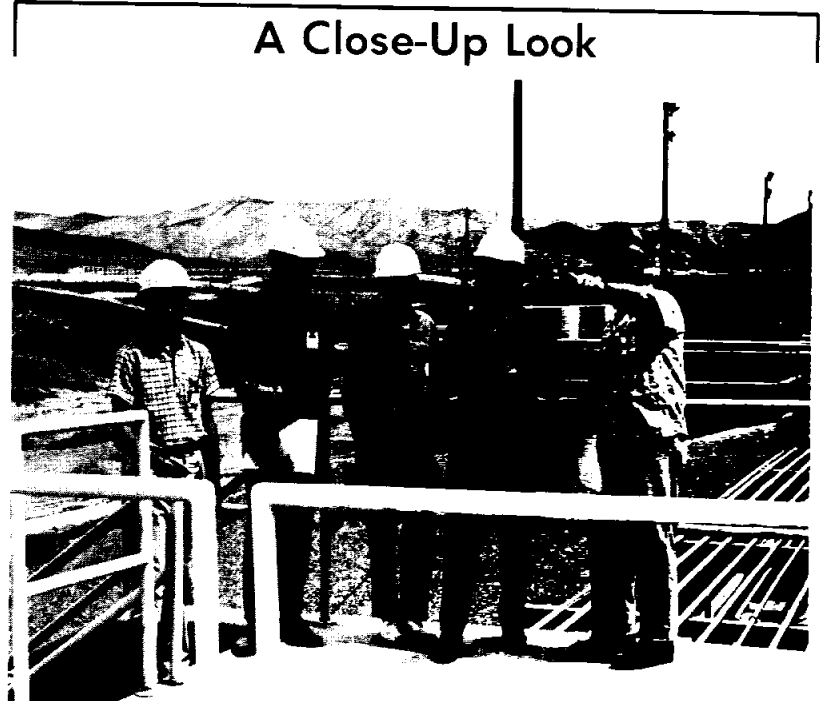
A reef covering an area off the Cape near the launch site prohibits the regular LCU (landing craft utility) rescue vehicle from approaching the area because the water is too shallow. A vehicle that can operate in shallow or deep water was required and the LVTR1A1 met the requirements.

In the evaluation test on November 16, the Retriever placed an Apollo spacecraft in the water about one mile off the Galveston beach. Then the LVTR1A1 put forth from the beach and retrieved the spacecraft with a special crane mounted on the vehicle and returned to the beach. Abroad the recovery vehicle in addition to the Marine crew were Harold Neher, test conductor from Landing and Recovery Division, (LRD) and Charlie Vernon from Technical Services Division. In charge of the operation on the Retriever was Weldon B. (Gus) McCown, LRD.

This evaluation test was the final test in a series to qualify the vehicle for surf recovery

## Space News ROUNDUP!

### SECOND FRONT PAGE



**EXPLORERS TOUR WSTF**—Four members of NASA-sponsored Explorer Post 335 get a close-up look at the static test stands for the Apollo lunar excursion module at White Sands Test Facility. Explaining the installation to the Las Cruces, N.M., Scouts is John Dickinson (right) of Grumman Aircraft Engineering Corp., prime contractor on LEM. The Explorers, whose post is sponsored by WSTF, are Bruce Lunsford, Bob Holland, Gene Jameson and Paul Galos.

## Supply Service Center Created At Ellington

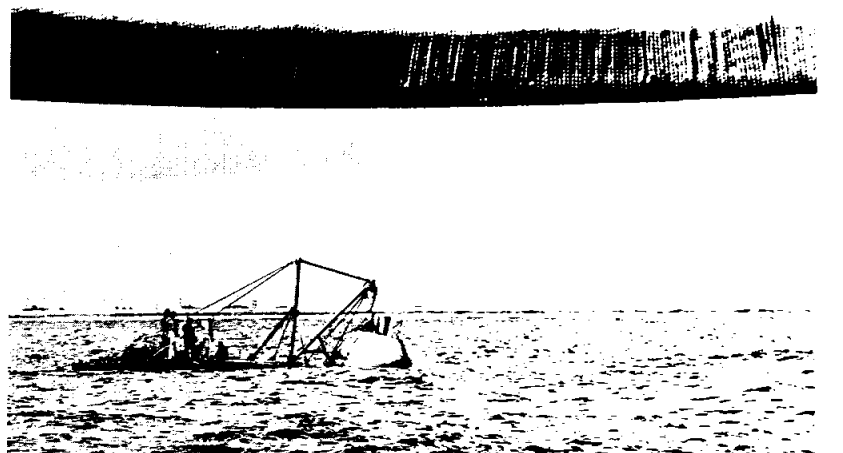
An MSC Supply Service Center at Ellington AFB was established November 15 to service those organizations housed at Ellington.

Located in Building 364, the Center has immediate over-the-counter issue of office supplies, blank forms, expendable repair parts, electronic components and other supplies.

The Center also prepares purchase orders for items not available through normal requisitioning, and accepts and disposes of excess supplies in MSC offices at Ellington.

It is expected that the Center will expedite paperwork in serving these offices.

Offices in a pinch for supplies may telephone their orders to the Center at Extension 7649 for rapid delivery.



**SURFCASTING**—A Marine Reserve tracked recovery vehicle hoists an Apollo boilerplate spacecraft from the shallow Gulf waters adjacent to the Galveston South Jetty during surf recovery tests of the vehicle and a special crane developed by the Operational Evaluation and Test Branch. In the foreground is part of the Apollo stand-off ring aboard the NASA Motor Vessel Retriever.