



MSC Exchange Forms Scholarship Program

College-age children of MSC employees may be eligible for financial assistance under a college scholarship program recently established by the MSC Exchange Council. Paying up to \$600 per academic year for four years, the fund awards will be made on the basis of financial need and high school scholastic standing.

Scholarship winners may pursue any course of study leading to a recognized bachelor's degree at any accredited college in the country. Applicants must be children of NASA employees who have been at MSC for at least two years as of January 1 and whose base income does not exceed \$8000 per year.

Students graduating from public, private or parochial high schools in January or June 1967 are eligible to apply provided they have a high school grade average of 3.5 on the 5.0 scale, or 2.5 on the 4.0 scale, and a Scholastic Aptitude Test score of 1000. Students who have taken the American College Test must have scored 22 or higher.

Students now in college are also eligible for scholarships.

Where base family income exceeds \$8000 per year and it is felt there are extenuating circumstances, scholarships may also be applied for.

Scholarship application forms are available from Mary Beeman in the Educational Programs Office in Building 1, Ext 4343. Completed forms in sealed envelopes must be returned to Mrs. Beeman/AP4 no later than February 15, 1967.

The MSC Scholarship Committee, made up of senior staff members, will evaluate students' applications and scholastic records for selecting scholarship winners. All information will be kept confidential and will be reviewed only by the committee.

The winner of the scholarship (or winners, if more than one scholarship is awarded) will be notified by mail no later than April 15, 1967.

Spanish Courses Start January 16

An organizational meeting for the second EAA-sponsored Conversational Spanish Series will be held January 9 at 5 pm in Building 1. The courses will be open to MSC and contractor employees and their families.

Current plans are for two 15-student classes each Monday at 5 and 7 pm to begin January 16 in Room 181, Building 1.

Instructor Nick Reyes at HU 8-1600 Ext 147 can be contacted for additional information.

Rules Relaxed In Summer Hire Of Offspring

For the past three summer employment periods, the sons and daughters of Federal employees (both military and civilian) have been prohibited from obtaining summer jobs in agencies where their parents are employed. The Civil Service Commission has announced a relaxation of this restriction for the summer of 1967. Under the new policy, an agency may employ sons and daughters of its own employees during the summer months, but only if they are appointed on the basis of a competitive Civil Service examination and if no other applicant with the same or a higher rating is available for appointment.

Insofar as MSC is concerned, the new policy will pertain only to positions at grades GS-1 through GS-4 filled through the Office and Science Assistant Examination No. 401. This examination covers such positions as typists, stenographers, clerks, engineering aids, and similar jobs. Summer jobs at MSC which are not filled through a Civil Service examination, i.e., positions at GS-5 and above, Wage Board positions, and positions established under Youth Opportunity programs, may not be filled by sons and daughters of NASA employees.

Persons who are interested in applying for the Office and Science Assistant examination should file now by mailing Application Card Form 5000-AB to the U.S. Civil Service Commission, Washington, D.C. 20415. (This form may be obtained from your Personnel Management (Continued on page 2)



VIBRATION JUNCTION—A non-flight test model of the Saturn V three-stage launch vehicle is readied for dynamic tests in bending and vibration modes in the Marshall Space Flight Center's enclosed dynamic test stand. The 364-foot vehicle rests on four hydraulic pads which permit motion in six degrees of freedom. The S-1C first stage was tested prior to erection of the S-11 and S-1VB second and third stages and mating of the Apollo spacecraft modules.

Flight Crews Selected For 2nd, 3rd Apollos

Crews for the second and third manned Apollo missions were named at MSC December 22.

Prime flight crew for Apollo Saturn 205/208, the second manned mission, is James A. McDivitt, commander; David R. Scott, command module pilot; and Russell Schweickart, lunar module pilot. Backup crew is Thomas P. Stafford, commander; John W. Young, CM pilot; and Eugene A. Cernan, LM pilot.

Prime crew for the A/S-503 mission, the third manned Apollo flight and the first manned flight using the Saturn V launch vehicle, is: Frank Borman, commander; Michael Collins, CM pilot; and William A. Anders, LM pilot. Backup crew is Charles Conrad, Jr., commander; Richard F. Gordon, Jr., CM pilot; and C. C. Williams, Jr., LM pilot.

Both missions are scheduled to be launched during 1967, but depend on the success of other Apollo missions including A/S-204, the first manned Apollo flight scheduled for the first quarter of the year.

A/S-205/208 is planned as a rendezvous and docking mission and will be the first manned operation of the Apollo Lunar Module which is the two-man spacecraft designed to land on the moon.

The mission plan calls for the manned command and service module to be launched into earth orbit by one uprated Saturn I launch vehicle. About 24 hours later an unmanned lunar module will be launched by another uprated Saturn I. The crew in the command module will rendezvous and dock with the lunar module.

The commander and the lunar

module pilot will transfer via a tunnel through the nose of the command module to the lunar module. After conducting a series of checks and maneuvers with the lunar module, they will return to the command module for reentry and landing.

A/S-503 will launch the entire Apollo spacecraft — command and service modules and lunar module — into earth orbit.

Gilruth, Faget Reach Antarctic

Dr. Robert R. Gilruth, Director of the Manned Spacecraft Center and Dr. Maxime A. Faget, Director for Engineering and Development are in the Antarctic until January 12 observing U.S. scientists and Navy personnel who are surveying the mountain ranges of this super-cold continent.

Dr. Gilruth and Dr. Faget joined Dr. Wernher von Braun, Director of the Marshall Space Flight Center and Dr. Ernst Stuhlinger, research chief at Marshall during a 10-day expedition to study Antarctica's environmental conditions and observe investigations in progress under the United States Antarctic Research Program.

The NASA group is expected to see how logistics problems are faced in the extreme cold and examine on the scene the Navy-designed modular vans which have been assembled into self-contained mobile base at Plateau Station, Antarctica.

Dr. Gilruth and Dr. Faget arrived at McMurdo Sound, Antarctic Monday, January 3 and will begin their return to the U.S. on January 12. They are scheduled to return to Houston on January 15.

Santa's New Vehicle



REINDEER OUT TO PASTURE—The Christmas decoration on the door of the Current Operations Section of Landing and Recovery Division in Building 30 perhaps typified the imaginative touches added to the Center's austere interiors during the holiday season.



NEXT FIRING IS FOR REAL—Five J-2 engines of the first flight stage S-II vehicle generate a vapor cloud in the test stand's water-cooled flame deflector during the December 30 static firing at Mississippi Test Facility. The stage will be shipped to NASA Kennedy Space Center to become the second stage of the first Saturn V, now scheduled for launch in the second quarter of 1967.

Saturn S-II Flight Stage Completes Second MTF Captive-Firing Test

The first flight model of the second stage for the Apollo/Saturn V space vehicle underwent its second, and possibly final, preflight captive firing test December 30 at the NASA Mississippi Test Facility in Hancock County.

NASA Buys 3rd Apollo Simulator

NASA has awarded a \$9.5 million contract to the Link Group, General Precision Inc., Binghamton, N.Y., to build and install an Apollo Mission Simulator at Cape Kennedy, Fla. This will be the third Apollo simulator built by Link.

Simulators provide flight training for crews assigned to a specific mission. Nearly every detail of the flight except weightlessness can be simulated, giving flight crews extensive useful training before they leave the ground, especially in handling emergencies.

The two simulators obtained from General Precision earlier were scheduled for installation at MSC and the John F. Kennedy Space Center, Fla. Each is capable of complete simulation with the Command and Service Module as well as the Lunar Module. The two were ordered under subcontract to the prime contractors for the modules, North American Aviation Inc. and the Grumman Aircraft and Engineering Corp.

The third simulator, ordered by NASA, an Apollo Command Module only, will be installed to provide adequate training time for Apollo crews during the active flight phase of the program.

Under terms of the NASA incentive contract General Precision will complete the installation by the fall of 1967. The company also has a contract to supply modification kits for the simulators.

NASA and North American Aviation test engineers are making preliminary analysis of all test data recorded during the firing of the S-II-1's rocket engines.

Preliminary indications are that the firing was successful.

The test, which began at 3:34 p.m., lasted 6 minutes (the approximate time the stage is expected to perform in flight). Conducting the test was the Space and Information Systems Division of North American Aviation, Inc., prime contractor to NASA's George C. Marshall Space Flight Center for development and manufacture of the stage.

The nation's largest hydrogen-powered rocket completed its initial acceptance test on December 1 at MTF in a static firing lasting 384 seconds. A minimum of two successful full-duration ground tests is required by the space agency before issuance of a flightworthiness certificate. The S-II-1, upon acceptance, will be refurbished and shipped to the NASA Kennedy Space Center in Florida to become part of the first Saturn V launch vehicle, now scheduled for flight in the first half of 1967.

The stage is 82 feet long and 33 feet in diameter and is powered by five Rocketdyne J-2

engines which develop a total of one million pounds of thrust at altitude, equivalent to more than 21,000,000 horsepower. During testing, the stage was held captive in a concrete and steel test stand 200 feet high.

Measurements of the stage's performance during the second test were recorded by some 550 data channels, each carrying multiple signals indicating events such as temperatures, pressures, flow rates, vibrations and thrust. The processed data will permit detailed evaluation of the stage's operation and predicted performance in flight.

Summer Hires

(Continued from page 1)

Specialist, college placement offices, most post offices, Interagency Boards of Examiners, or from the Recruiting and Staffing Branch. extension 7391.) A written test lasting approximately 2 hours is required, and it will be administered at examining points throughout the country. *The final date for filing the Application Card Form is January 9, 1967, for the test to be given on February 4, 1967.*



CHRISTMAS JEANS—Boys in the Teen Liberators Boys Town examine the blue jeans and cash presented to them by employees of the Instrumentation and Electronic Systems Division. At right are Rev. Freddie Gage, Teen Liberators founder, and Joe Fowler of IESD.

IESD Employees Raise \$500 For Gift to Teen Liberators

More than \$500 in cash, clothing and food were given to the Teen Liberators Boys Town in League City Christmas by MSC and contractor employees in the Instrumentation and Electronics Systems Division.

A pair of blue jeans was provided for each of 33 boys in the home, as well as other pieces of clothing, groceries and cash. IESD each Christmas selects an organization to help. They provided some \$400 worth of athletic equipment to Boys Harbor in LaPorte at Christmas 1965.

Teen Liberators Boys Town was founded by Rev. Freddie Gage as a haven for young boys from broken homes or who have been referred to Teen Liberators by courts, probation officers, judges and police officers.

Spacecraft 012 Altitude Tests Finished at KSC

Apollo spacecraft 012, scheduled for the first manned Apollo mission (A/S 204) has successfully completed altitude chamber tests at Kennedy Space Center. Leaks in the command module Environmental Control Unit (ECU) during earlier chamber runs had delayed the tests until the ECU could be replaced.

The spacecraft was moved from the altitude chamber to a work area in the Manned Spacecraft Operations Building at KSC where the service propulsion system engine expansion nozzle will be installed.

NASA Sponsors Systems Design Faculty Program

NASA will sponsor three special 10-week programs during the summer of 1967 for young engineering faculty members in the field of systems engineering design. These 10-week summer programs will be undertaken as cooperative efforts between NASA research centers and adjacent universities.

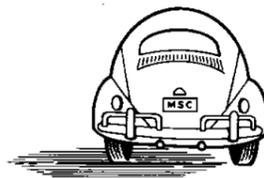
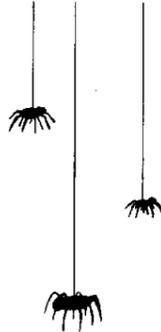
The principal objective of the program is to allow the participants to develop competence which will enable them to organize multi-disciplinary design engineering courses at their home institutions. Faculty members from various engineering disciplines will work together as a team to design a complex space system.

In addition to introducing the participants to the challenges of the space program, the activity is expected to foster the application of systems engineering theory to actual engineering problems, develop communication between engineers in different specialties, and stimulate innovation.

Participating universities and cooperating NASA centers are: Stanford University and Ames Research Center; Auburn University, University of Alabama and Marshall Space Flight Center, and University of Houston, Rice University and Manned Spacecraft Center.

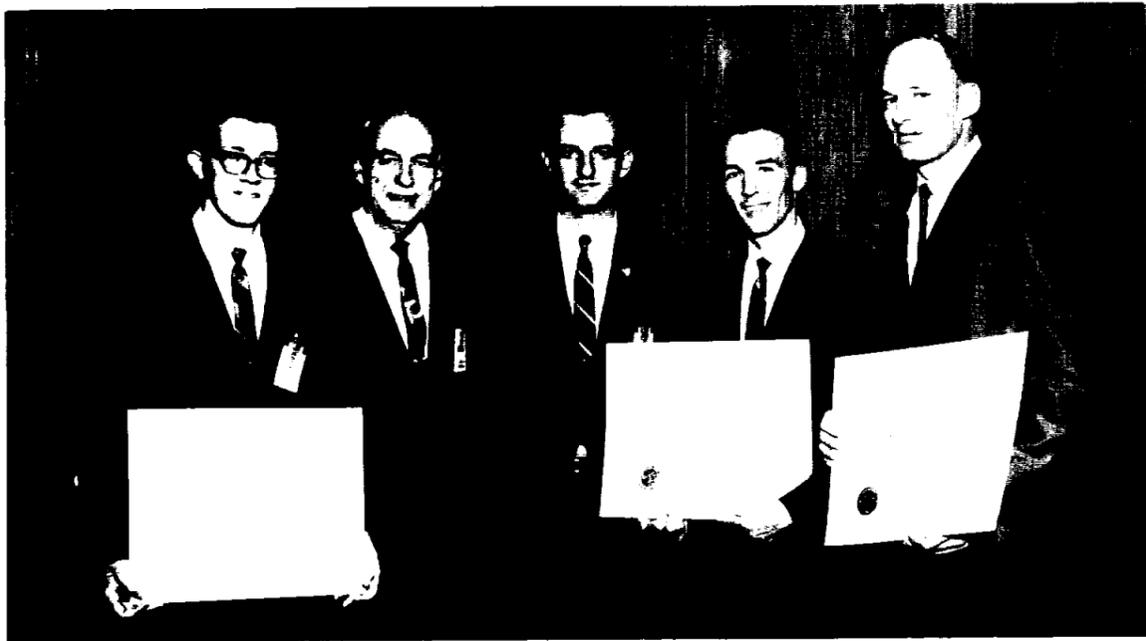
About 70 faculty members will be participating in these three programs. This is the second year that NASA has sponsored such activity.

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COMMENDATIONS—MSC Director Dr. Robert R. Gilruth presented Certificates of Commendation to two MSC employees for their part in the December 14 rescue a test subject from a vacuum chamber following an oxygen fitting failure. Left to right are Clifford W. Hess, test conductor; Dr. Gilruth; Jim LeBlanc, test subject who was rescued; Herbert G. Sherwin, Brown and Root-Northrop employee who was commended for emergency actions in the Space Environment Simulation Laboratory earlier in 1966; and Henry A. Rotter, airlock observer who went to LeBlanc's aid when chamber pressure reached 27,000 feet.

Two MSC Employees Commended For Rescue in Chamber Emergency

Two MSC employees December 22 were awarded certificates of commendation for their role in saving the life of a suit technician who collapsed when his oxygen line let go during a high altitude test in a vacuum at the Manned Spacecraft Center.

MSC Director Dr. Robert R. Gilruth presented the awards to Henry A. Rotter and Clifford W. Hess, members of the Systems Test Branch, Crew Systems Division.

In presenting the awards, Dr. Gilruth said, "It's one thing to do it in drill and in practice and another to do it efficiently and with calm skill under pressure. It's really a wonderful thing; I feel greatly honored in presenting these awards."

Hess and Rotter were cited for their efficient and effective action on December 14 during an altitude chamber test of the Apollo space suit system.

Sellout Crowd Attends Opening Of Moonglow 66

Moonglow 66 last night opened to a capacity crowd of 800 in the MSC auditorium.

MSC Jim Gorman opened the show by introducing the Astroettes in their dance rendition of "Hello Dolly," accompanied by the Sam Rayburn high school stage band directed by Fred Baetge.

Moonglow 66 producer Juanita Bower said that a great deal of the credit for the success of the show should be given to Hugh Woodsmall for technical direction and to Bill Taylor of AV Corporation for audio and lighting.

There are still tickets available for performances tonight and tomorrow night from EAA representatives and from Moonglow 66 cast members. Left-over tickets, if any, will be sold at the door. Curtain goes up at 8 pm.

Hess, of Columbia, Pennsylvania, was serving as test conductor outside the chamber, and Rotter was inside the airlock adjacent to the chamber serving as an observer.

The award to Rotter states "Despite personal hazards, Mr. Rotter's quick and effective action during the subsequent rescue prevented injury to the subject." Rotter, a Texas A&M graduate, is from La Grange, Texas.

Hess's award commends him for responding "in a highly efficient manner in directing a successful rescue operation which prevented injury to the test subject."

Jim Le Blanc, the suit technician who was inside the eight-foot altitude chamber, lost consciousness when his Apollo suit lost pressure when an oxygen line let go. The chamber was at approximately 150,000 feet at the time of the accident, and Hess ordered immediate repressurization to bring it back to sea level.

Dr. Maxime A. Faget, Director of Engineering and Development, said that without the quick action of Hess, Rotter and the other technicians Le Blanc could have suffered serious injury. "It was an extremely time-critical operation," Faget said.

A loss of suit pressure at altitudes above 50,000 feet can result in internal injury and possible death within a few minutes, MSC physicians explained.

The test was nearing its conclusion when the accident occurred. As Richard S. Johnston, Chief of Crew Systems Division, explained, a coupling linking the oxygen lines from outside the chamber into Le Blanc's suit, came loose causing an instantaneous loss of suit pressure.

The suit pressure dropped from 3.8 psi (pounds per square

inch) to .1 psi within a 10-second period. As soon as Hess noticed the drop, he ordered immediate repressurization of the chamber.

Rotter, stationed in a pressurized air lock adjacent to the chamber, was observing Le Blanc's actions. Rotter heard word of the pressure drop over the intercom and immediately prepared to enter the chamber.

Repressurization began ten seconds after the failure, and 17 seconds after repressurization began, when the altitude in the chamber was at 27,000 feet, Rotter entered from the airlock to assist Le Blanc.

First indication of trouble came to Le Blanc when he noticed "steam blowing off from my left side." This steam was created as the oxygen leaked out the loose fitting.

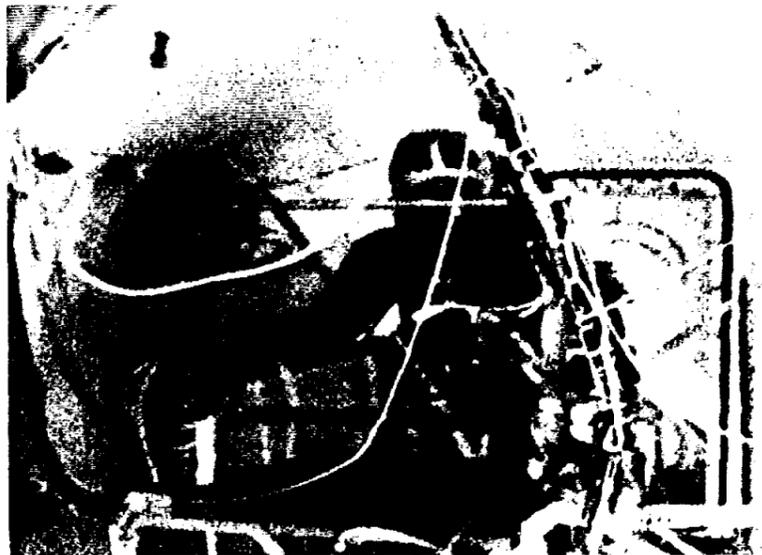
"I noticed the suit began to lose pressure, and I looked at the gauge (on his left wrist) and saw it was 2.5 (psi). My vision got fuzzy, and I stumbled backwards," he stated.

"The next thing I can remember I looked up and there he (Rotter) was. He looked awfully good to me," Le Blanc said.

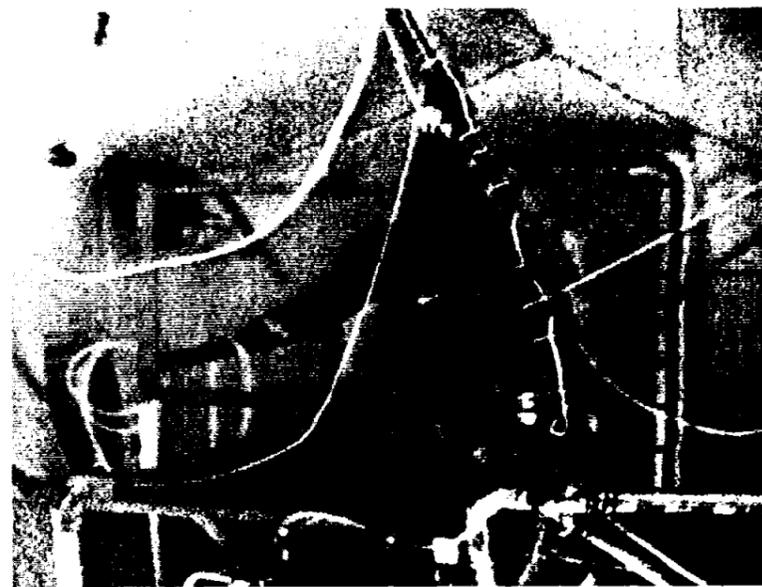
When Rotter leaped through the hatch door, he began cutting the straps off the PLSS (Portable Life Support System) pack to facilitate moving Le Blanc out of the chamber. He also loosened the gloves on the suit to permit oxygen to get to the unconscious Le Blanc.

Video-tape films dramatically capture each second of the incident from the moment the hose broke loose, as Le Blanc fell over backwards, and Rotter jumping in to aid the stricken technician.

The split-second timing—85 seconds from the time the suit pressure loss was noticed until doctors were inside the chamber checking on Le Blanc—with which Hess, Rotter and the other technicians reacted is part of their job, Crew Systems Chief Johnston said.



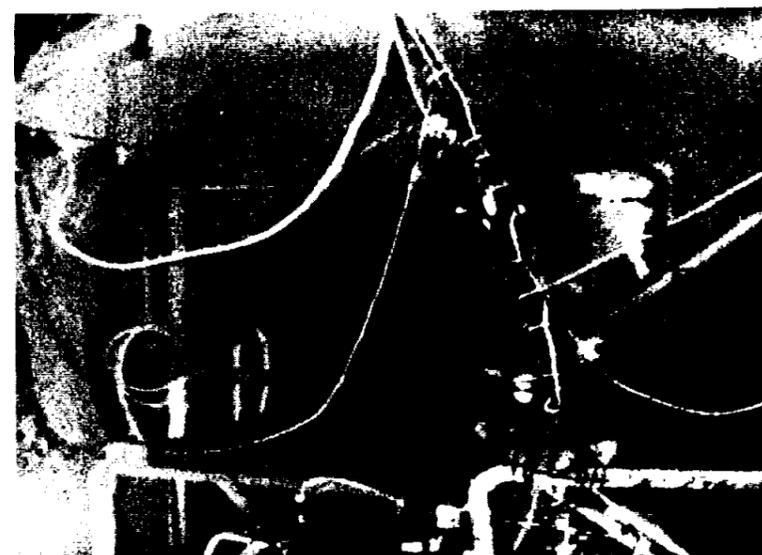
Blowups from a 16mm kinescope of videotape recorded during the test show the sequence of Jim Le Blanc's predicament. Here, Le Blanc is in a pressurized Apollo suit with the chamber pumped down to 150,000 feet equivalent altitude.



The oxygen coupling to Le Blanc's suit disconnects and he loses consciousness, falling backward from his work station.



Henry Rotter enters from the man-lock as soon as the emergency repressurization reaches 27,000 feet and releases Le Blanc's suit glove clamp rings to allow oxygen to enter the suit and revive him.



Now conscious, Le Blanc is helped from the chamber by Bill Schneider, Rotter and Dr. Fred Humbert. Schneider and Dr. Humbert entered the chamber as soon as it had reached sea-level pressure.

THREE-PHASE FAMILIARIZATION—

Flight Controllers Have to Learn Complicated Apollo Cockpit Layout

By Milton Reim

Knowing where over 500 controls and indicators are located in the cockpit of an Apollo spacecraft and being able to interpret their function and interrelationship, helps if you are to be a flight controller on one of the upcoming Apollo missions.

But, how do you familiarize all the flight control people required for each mission? A couple of small rooms and offices jammed with equipment and staffed by what is known as the Cockpit Familiarization Group, headed up by Ed Middleton, have the situation well in hand.

They are part of the Flight Control Qualification Section of the Flight Control Division's Simulation Branch and their function is to provide the tools that make it possible for the flight controller to have an intimate knowledge of the Command Module interior arrangement to insure his recognition of the capabilities and limitations of the spacecraft crew during a mission.

The group is an expanded version of a similar program that was used to familiarize flight controllers with the Gemini cockpit layout. In addition to the Apollo Command Module familiarization equipment which is now being used by flight controllers for the first manned mission, this group is also in the process of designing and assembling a unit which will be used to familiarize flight controllers with the cockpit layout of the Lunar Module.

Familiarizing flight controllers with the Apollo cockpit layout is a continuing process because the configuration of the panels and other interior equipment changes from mission to mission. Each flight controller is required to participate in a series of familiarization exercises prior to each flight.

The training is divided into three phases of from one to two hours each. The first phase orients the flight controllers as to the location of controls and indicators in the cockpit by using a step-by-step audio recording which is piped to the flight controllers through headsets. They in turn can stop the audio portion of the training and ask questions of the instructor. To facilitate location of individual items in the cockpit, a video display pinpointing the item being discussed is presented on a television monitor in the window directly above the main display console.

To facilitate access to the command module, the center couch has been removed and only two flight controllers take part in each session.

The second phase of the training orients the flight controllers with respect to "groups" of controls and indicators that pertain to the various sub-systems of the spacecraft such as power and stabilization, and the changes in position and/or function of these components for various missions. Again the audio and video aids are used to guide the flight controllers.

Phase three of the familiarization training is mission oriented and deals with crew prelaunch check lists, the liftoff phase, in-flight procedures such as fuel cell purges, engine burns, electrical power systems control and communications, on through the reentry portion of the mission.

In addition to the flight directors and flight controllers manning the Mission Control Center-Houston, the remote site flight controllers must also take the familiarization training.

The Apollo Command Module metal and fiberglass shell for the trainer was obtained from North American Aviation. Design of the cockpit panels, instrumenta-



TEACHER'S DESK—Ed Middleton, head of the Cockpit Familiarization Group, mans the instructor's console from which switch positioning and other command module crew actions can be monitored. Sam Wenneker focuses the television camera on a schematic of the command module instrument panel which is fed to the rendezvous window monitors.

tion and operator's console was performed by the Cockpit Familiarization Group. Equipment for the crew station and consoles was built by the Technical Services Division. The Instrument Construction Section of Technical Services designed and built a solid-state sequencer system for the trainer which allows a program to be set up for sequencing the lights and switches on the main display console in the crew station and they also modified an existing audio system for the trainer. The sequencer, which is the heart of the trainer, was primarily designed by Jim Clarke, Bob Pace and John Ivers of the Technical Services Division.

The television equipment was installed by the Television Services Group from the Photographic Technology Laboratory.

All displays within the command module are not instru-

mented and some are only dummied into the main display console. It was not necessary to familiarize flight controllers with the function of every control and indicator.

Within the crew compartment and on the main display panel of the familiarization unit there are over 200 switches, each with two to three positions; nearly 100 indicators, meters, gauges, and lights which require interpretation; about 200 circuit breakers on panels; and around the walls of the crew compartments various valves and levers. The flight controller must be able to locate and know the function and interrelationship of these and their functioning in relation to the spacecraft systems.

Since the Apollo Cockpit Familiarization Unit became operational on August 1, 1966, over 200 training sessions have been conducted by the training group through December 1.

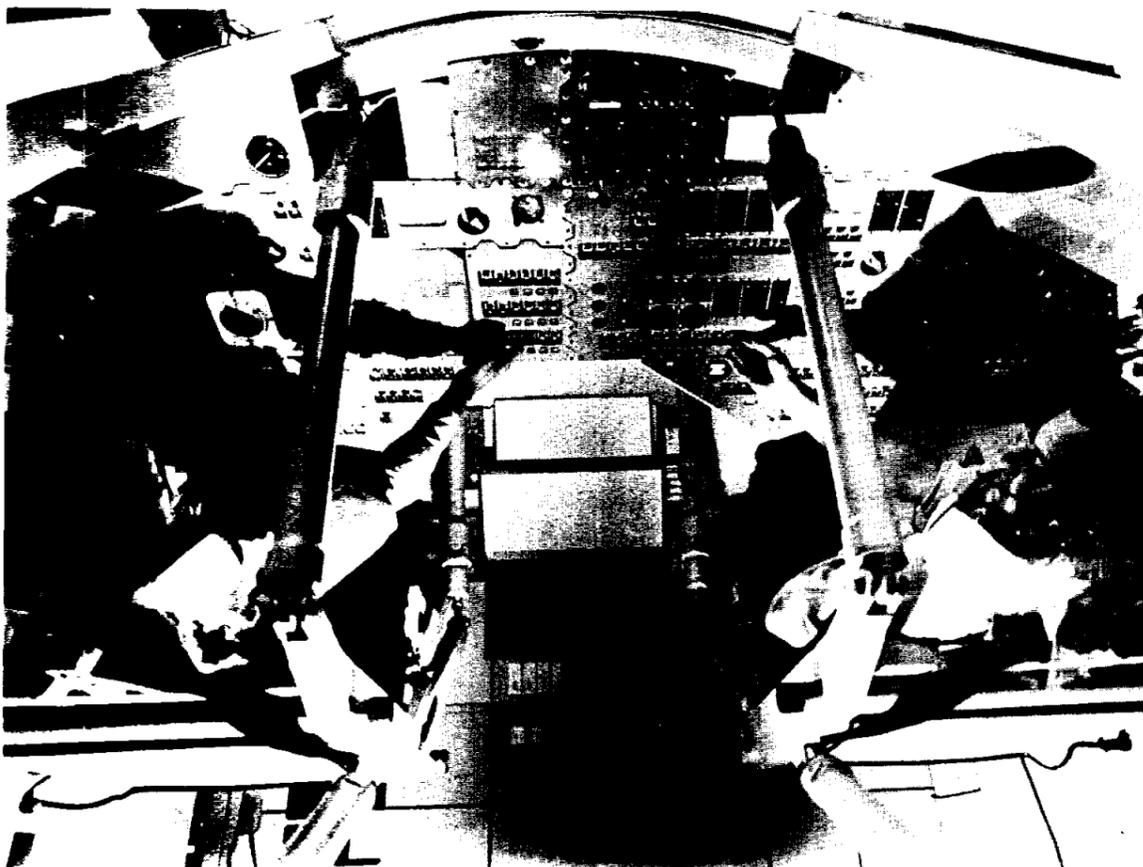
In addition to Middleton, who is engineering and training coordinator, three Philco and two International Telephone and Telegraph (ITT) employees make up the group.

Sam Wenneker is the engineer for the Command Module. Pete Price is the engineer for the Lunar Module, and Mike McGahey is the training engineer. Bill Cornelius is a design specialist for the group and Mike Grey is a draftsman. The first three are Philco employees and the latter two are with ITT.

While Middleton is concerned with the overall training program, Wenneker is mainly concerned with the cockpit configuration for a particular mission and also assists with the operation of the console during training periods.

Price also assists with the training but is mainly concerned with work on the Lunar Module familiarization unit which is scheduled to be in operation in the early part of 1967. McGahey assists with the training and console operation.

Cornelius and Grey do the detailed design and drafting work on plans for the cockpit layout and also do wiring diagrams for the installation. Technical Services builds the actual hardware for the units utilizing the plans supplied by the group.



CLASS IN SESSION—Sam Wenneker, left, and Bill Cornelius make a practice run in the command module familiarization trainer. The center couch was omitted from the trainer for ease of student entry.



COZY CLASSROOM—It doesn't look much like an Apollo command module from the outside; the cockpit interior accurately depicts for flight controllers the instrument panel and work station layouts. Television monitors are mounted in the rendezvous windows above each student's head to carry the video portion of the instructor's lecture. The audio portion is fed through individual headsets.

Apollo Guidance Tests Link Labs Mile Apart

By Bob Gordon

Test facilities, linked together by miles of underground cable, recently completed an around-the-clock six-day test at MSC of the Apollo stabilization and control system and the service module's reaction control system engines.

The service module RCS engines were fired approximately 3,000 times during the test conducted jointly by the Propulsion and Power Division and the Guidance and Control Division. The tests were to evaluate the electrical compatibility of the stabilization and control system and the reaction control engines, demonstrate the closed-loop capability of the two systems, and to gain experience for support on manned Apollo flights.

The stabilization and control system (SCS) provides control and monitoring of the spacecraft attitude and may be operated automatically or manually. The service module reaction control system (RCS) consisting of 16 100-pound thrust engines arranged in quads of four provides thrust required for three-axis stabilization and control during earth orbit and lunar trajectory.

Underground lines linked engineers in the Thermochemical Test Area who supervised the engine firings in the Auxiliary Propulsion Test Facility's 20-foot diameter subsystem test chamber with the Guidance and Control personnel, one mile away in Building 16.

Test components, in addition to the flight qualified stabilization control system hardware and the RCS engines, consisted of the three-axis (yaw, pitch and roll) flight table and analog computers. All systems were in a closed-loop setup.

Paul Horsman, chief of the Guidance and Control's Electro-

Mechanical Section, described the test. Guidance and Control programmed the firings of the RCS through the stabilization control system from Building 16, the resulting impulses of the RCS engines were measured in the 20-foot chamber and relayed back instantaneously to the analog computer which then computed the resulting vehicle dynamics and relayed the spacecraft angular position to the three-axis flight table on which the SCS gyros were mounted.

Horsman explained the gyros would then sense the attitude rate and transmit this information to the stabilization systems which if required would then initiate corrective measures via the underground cable to the RCS engines in the Thermochemical area.

Throughout the series, G&C engineers had the capability of changing the flight simulator causing the stabilization system to initiate new RCS firings. For example, Horsman explained, the three-axis flight simulator was placed in a motion causing the stabilization system to initiate RCS burns to damp out this movement.

This was accomplished by programmed commands through the analog computer or by manual operation of the hand controller on the test consoles in Building 16.

James P. Crabb of Propulsion and Power's Auxiliary Propulsion Test Section said this was the first time these two systems have been linked together in such a test. Crabb said two quads of the RCS system were mounted in the test chamber at Building 353. An altitude of 130,000 feet was maintained in the chamber throughout the test series.

The RCS 100-pound thrust engines used in the test were



BEHIND THICK WALLS—Don Lotspeich of BR-N, left, and Bill Taliaferro of Thermochemical Test Branch monitor Apollo service module RCS thruster quad firings at the control panel in the Auxiliary Propulsion Test Facility. Closed-circuit television monitors show the thrusters in the 20-foot diameter subsystem test vacuum chamber. The control room is separated from the test chamber by foot-thick reinforced concrete walls.

flight qualified. Special aluminum nozzles replaced the qualified nozzles of disilicide-coated molybdenum. This was done to assure proper measurement of the engine impulses during firing.

Engineers in the Auxiliary Propulsion Test Section monitored the RCS engine firings on the closed-circuit TV in 353.

Test firings were conducted in 20-minute runs. Approximately 20 separate firings were made during each run. Crabb said each engine was fired approximately 500 times during the test.

Viewing the firings on the TV monitors in the control room in 353, one might miss a firing with the blink of an eye. A blip of light accompanied by a dull pop, similar to the crack of a .22 rifle, marked the sights and sounds of the firings. Crabb explained the firings were milliseconds in length with 500 milliseconds the longest impulse during the test.



ON THE TUBE—John Hammond, BR-N, remotely adjusts the television camera viewing the RCS quad thrusters in the chamber.



HEART OF THE MATTER—The Apollo inertial platform of the spacecraft's stabilization and control system is mounted in the Guidance and Control Laboratory's three-axis servo-controlled simulator in Building 16. Computer-programmed attitude changes by the platform remotely initiated RCS thruster quad firings in the Auxiliary Propulsion Test Facility a mile away.



AND IT COMES OUT HERE—Output of the Apollo inertial platform and RCS thruster quad link-up is recorded on continuous graphs in the Guidance and Control Laboratory. Foreground, left to right, are Norm Robertson, Control System Development Branch, Bill Munro, Lockheed Electronics and Frank Elam, Control System Development Branch. Standing rear are Nolan Lerche and Ron Brennan, both of Lockheed Electronics.

DON'T \$RUN \$WILD \$\$\$

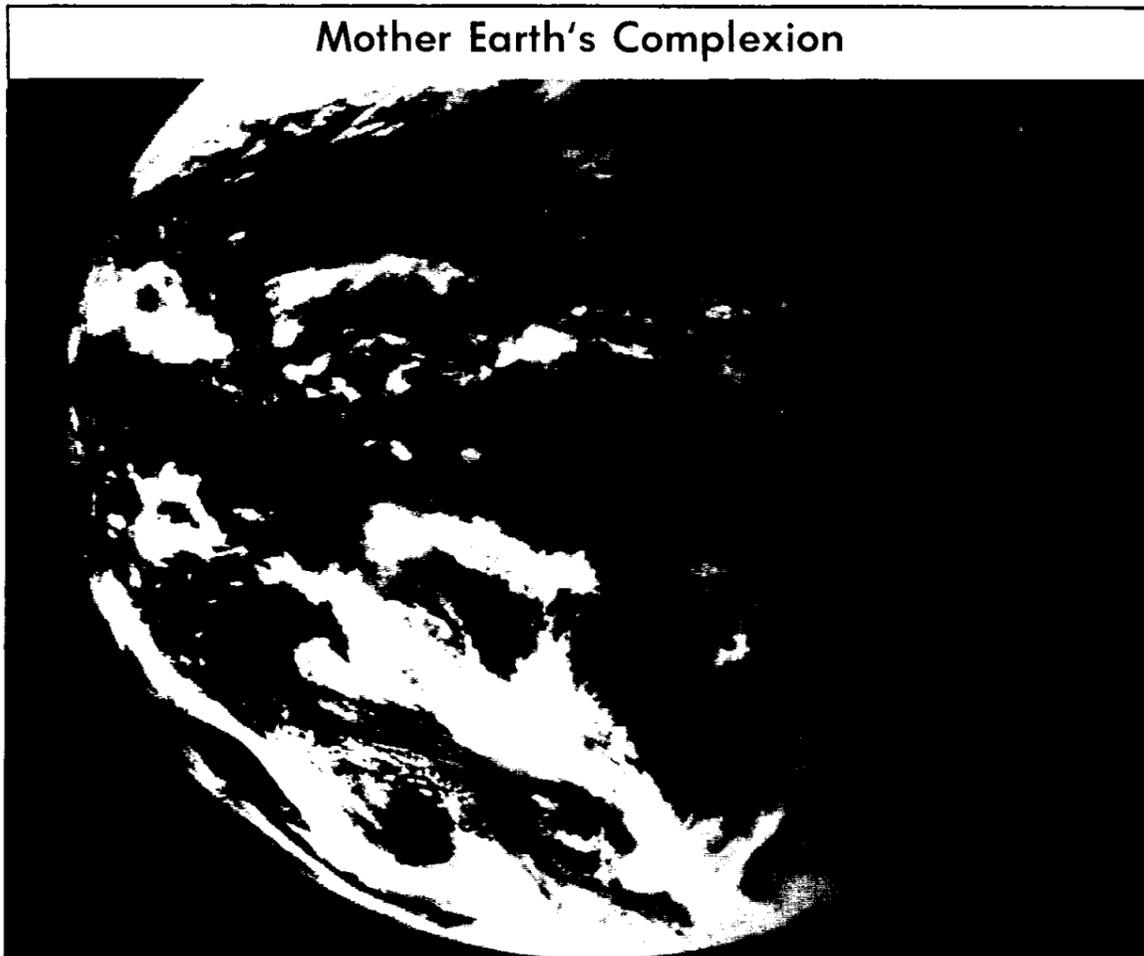


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The *Roundup* is an official publication of the National Aeronautics and Space Administration Manned Spacecraft Center, Houston, Texas, and is published every other Friday by the Public Affairs Office for MSC employees.

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Mother Earth's Complexion

OUR PLANET—NASA's Applications Technology Satellite (ATS-1) made this portrait of Mother Earth from 22,300 miles out at 4:44 pm CST December 13. It was a cloudy day all over. The ATS series satellites investigate spacecraft communications, meteorology, control technology and orbital environment.

**Badge Can Help
In Cashing Checks
— But No Photos**

"Is it permissible to use your NASA Identification Badge as personal identification in order to cash a check?"

This question was recently asked of Security Branch by an MSC employee. Since this practice is apparently quite common, Security would like all employees to know the correct policy.

Employees are advised that it is permissible to use the badge as identification to cash a personal check with one qualification. The business establishment must not be allowed to photograph the badge. This is not a local regulation but Federal Law. Chapter 33, Section 701, Title 18, U. S. Code Annotated prohibits the "execution of any engraving, photograph, print or impression in the likeness of any badge, identification card or other insignia except as authorized by law."

MSC Credit Union Holds Annual Meet

The MSC Federal Credit Union January 26 will hold its fifth annual meeting in the Cafeteria at 7:30 pm.

Even if the law did not require an annual meeting of the Credit Union at which the board and committees and the membership gather to discuss Credit Union operations, such a meeting would still be held. For the democratic basis upon which the Credit Union is formed makes it imperative for the membership to have a say in what actions the elected officers take, and, moreover, to be able to vote on issues.

At the annual meeting, the Credit Union directors will

Space News Of Five Years Ago

January 8, 1962 — Special hand tools for use in zero-gravity conditions were tested by personnel of the Manned Spacecraft and Marshall Space Flight Centers. Experiments were conducted in simulated space environment to try out non-torque hand tools drawn from a number of industrial sources.

January 10, 1962 — NASA announced that the Advanced Saturn launch vehicle, to be used for manned flights around the moon and for manned lunar landings with rendezvous technique, would have five-engined first and second stages. The first stage (S-IB) would be powered by five F-1 engines (total of 7.5 million pounds thrust) and the second stage (S-II) would be powered with five J-2 engines (total of one million pounds thrust). A third stage (S-IVB) with a single J-2 engine would be used on escape missions.

January 11, 1962 — In his State of the Union message to the Congress, President Kennedy said: "With the approval of

this Congress, we have undertaken in the past year a great new effort in outer space. Our aim is not simply to be the first on the moon, any more than Charles Lindbergh's real aim was to be first to Paris. His aim was to develop the techniques and authority of this country and other countries in the field of the air and the atmosphere.

"And our objective in making this effort, which we hope will place one of our citizens on the moon, is to develop in a new frontier of science, commerce and cooperation, the position of the United States and the free world. This nation belongs among the first to explore it. And among the first, if not the first, we shall be."

January 15, 1962 — Organization and staffing of the Manned Spacecraft Center's Mercury Project Office was completed. Major organizational division of this staff element included Office of Project Manager, Project Engineering Office, Project Engineering Field Office (duty station at Cape Canaveral), Engineering Operations Office and Engineering Data and Measurement Office. Kenneth Kleinknecht was appointed manager of Project Mercury.

January 16, 1962 — Spacecraft 16 was delivered to Cape Canaveral for the third manned (Schirra) orbital flight, Mercury-Atlas 8.

January 19, 1962 — Dr. John P. Meehan of the University of Southern California reported that Enos, 37-pound chimpanzee who orbited the earth in MA-5 on November 29, 1961, developed temporary hypertension during flight due to frustration and confusion caused by equipment malfunction.

Unnamed Soviet scientist, called "chief designer of Soviet spaceships," reported by Tass as saying that USSR planned to establish an "industrial undertaking" on the moon.

report to the membership the accomplishments of the past year in line with the premise that a credit union is a self-help financial organization owned and operated by its members for its members.

Mark your calendar now to attend the MSC Federal Credit Union's annual meeting January 26.

**Spectral Society
Elects Townsend
Houston Prexy**

The Houston Chapter of the Society for Applied Spectroscopy December 7 held an organizational meeting in Houston to elect officers. Elected president was James E. Townsend of the Geology and Geochemistry section of Space Science Division.

Other officers elected were: Mike Foster, Spectrochemical Research, vice president; Miss Ruby Keeler, Shell Development Company, secretary; Miss B. J. Jahanke, Baroid, treasurer.

The Society covers the art and science of absorption, emission, infrared, Raman, mass, NMR, X-ray and other related forms of spectral investigation for the determination of composition and structure of matter.

Monthly chapter meetings will be held to foster an exchange of information in these fields with emphasis on applications, and will include technical papers and notes from the membership along with panel discussions and guest speakers. The next meeting will be on January 19 at a place as yet to be selected.

Membership dues are \$10 annually and include subscription to *Applied Spectroscopy*, the national SAS journal. Townsend may be reached at 2781 for further chapter information.

Co-Op of Month



CREATIVE CO-OP — Jim Goins, physics/math major at the University of Florida, works in the Flight Data Systems Branch of IESD in the development and fabrication of advanced microcircuit components, and has successfully fabricated thin-film transistors which ultimately will improve spacecraft electronic systems reliability.

ROUNDUP

EMPLOYEE NEWS

Sustained Superior Performances



Fred Peters
Project Engineering
RASPO-Downey



Ed Van Riper
Program Control
RASPO-Downey

EAFB Golf Course Has Package Deal

The Ellington AFB Golf Course is offering a package deal in which a six-months membership can be bought for a five-month dues price. Monthly dues for MSC federal employees is \$4 single and \$6.50 family. Weekday green fees are \$1; \$2 on weekends and holidays.

Pro teacher at the nine-hole course is Jim "Red" Owens, and the pro shop stocks golf equipment. The course offers new-

comers a free round of golf, and Owens will give one free lesson on any particular problem a golfer may be experiencing.

Robert R. Regelbrugge of Mission Planning and Analysis Division is the MSC representative on the Ellington AFB Council and has copies of letters which entitle new members to the free round when presented to the pro. Regelbrugge may be reached at 5276.

1966-67 MSC/EAFB Basketball League

Standings as of December 22

AMERICAN DIVISION		NATIONAL DIVISION	
TEAM	WON LOST	TEAM	WON LOST
MPAD-RAB	1 0	LRD	1 0
IBM (Blue)	1 0	IBM (Gold)	1 0
747th.	1 0	USCG	1 0
ANG	1 0	Grumman	1 0
P&PD	0 0	Philco	1 0
FSD	0 0	Univac	1 0
FCD	0 0	Link	0 0
CSD	0 0	G&CD	0 1
NAA	0 0	MI	0 1
ISD	0 1	MPAD-Hawks	0 1
CAD	0 1	FCSD	0 1
ASPO	0 1	IESD/LEC	0 1
TRW	0 1	MPAD-Red Roaches	0 1

Mexico A Went-Went



TRAVELING MONEY—John O'Loughlin of Mission Planning and Analysis last year, alas, made a vacation trip to Mexico—then won the MSC Credit Union's recent "Mexico A Go-Go" drawing. He didn't turn down his winnings, though—he'll go somewhere else. Making the presentation are Credit Union treasurer Clyde Waters, left, and assistant treasurer Billie Sue Witt.

Sea Scout Ship Seeks Crewmen

Adult crewmen are needed for the Sea Scout Ship (hull number 915) which serves youngsters in the Clear Lake area. To serve as a committeeman for the Ship one does not have to be a Joshua Slocum or have 15 years experience in scouting—just a desire to work with boys in this area of maritime scouting will do.

The Ship, which musters all hands each Wednesday evening at the end of Barbuda Lane in Nassau Bay, is open to all Clear Lake-area boys 14 to 18 years of age.

To sign on the Ship's roster, contact Ed Campagna at 5516, H. P. Douglas at HU 8-0080 Ext 70, or Kevin McCabe at 3547.

Elected President



JAYCEES HEAD—Fred W. Warner of the Mechanical Systems Branch of the MSC White Sands Test Facility Propulsion Engineering Office, is installed as president of the Las Cruces, New Mexico Jaycees by outgoing president E. R. Hill. Warner earlier had held the offices of newsletter editor, external director and internal vice president and also rewrote Las Cruces chapter bylaws.

Roundup Swap-Shop

(Deadline for classified ads is the Friday preceding Roundup publication date. Ads received after the deadline will be run in the next following issue. Send ads in writing to Roundup Editor, AP3. Ads will not be repeated unless requested. Use name and home telephone number.)

FOR SALE—REAL ESTATE

4-bdr 2-bath in Fairmont Park, 2-car garage, central heat/air, sale or rent. J. T. Markley, Dickinson 534-5493.

4-bdr 2-bath in Clear Lake City, 3 min from MSC, 2180 sq ft, carpeted and draped. Equity plus assume 5 3/4% loan. Kent Grimsley, HU 8-1610.

Seven acres in League City near Space-land Airpark; good investment, all or part. \$2350/acre. J. R. Baker, HU 8-0095.

FOR SALE—AUTOS

1965 Mustang, twilight turquoise, 6-cyl standard shift, bucket seats, radio, heater, whitewalls and spinners. Good condition \$1550 Mary Nordin, OV 2-2060.

1965 VW delux sedan, air, FM-AM radio, 19,000 miles, xclnt condition. \$1450. Ed Kuykendall, NB 591-4096.

1964 Pontiac station wagon, assume \$1900 Credit Union balance. Luther Palmer, 877-1269.

Sun-roof VW, late '63, mint condition, air, many extras, engine rebuilt 100 miles ago. J. L. Day, RI 7-8994.

1962 maroon Corvair delux Monza, four on floor, air, heater, radio, belts, new tires. \$879. Pinkney P. McGathy, HU 6-5048.

1965 6-cyl Mustang hardtop, air, radio, standard factory equipment, new whitewalls, tinted glass. \$1650. Barney Roberts, HU 7-0963.

1966 Pontiac Catalina 9-pass station wagon, pwr brakes/steering/tailgate, factory air, chrome luggage rack, low mileage, less than four months old, perfect condition. \$3295. Kent Grimsley, HU 8-1610.

1962 Chevy II Nova, radio and heater, standard shift, xclnt condition. \$650. D. M. Blackman, HU 8-0672.

1964 Ford Fairlane 500 V-8, factory air, radio, heater, vinyl interior, original owner, xclnt condition. \$995. Pat B. McLaughlan, MI 9-6296.

1961 VW sedan, xclnt condition, one owner, 48,000 miles, \$600. Jim Peacock, League City 932-4458.

1961 Falcon Futura 4-door V-8, autoshift, air, radio, belts, tinted windshield, washers, whitewalls. \$950. Jim Cooper, 877-1836.

1966 Pontiac Bonneville, air and music, like new \$3200. Gus Grissom, 877-2662.

FOR SALE—MISCELLANEOUS

1966 Allstate Mo-Ped, 125 mpg, 35 mph, xclnt condition. \$75. Frank Greene, NB 591-2305.

Two girl's 24-in AMF Roadmaster bikes, chrome fenders, baskets, new tires, both in good condition. \$20 each. Barbara Carpenter, 2016 Leroy Drive, Pasadena, GR 3-2622.

Magic Chef gas range. Filter assembly for above-ground swimming pool—will throw in 12x30-ft pool if wanted. Roy Collins, HU 4-8647.

Craig TR-490 miniature cartridge tape recorder with six cartridges, like new. Originally \$95; asking \$65. Ray Dewey, GL 3-3697.

Admiral 19-in TV-radio-phon in large console, good condition, ideal for rumpus or playroom. \$25. R. Dean, HU 6-3997.

Rolleiflex, f/3.5 Zeiss Planar, case and shade. Mamiyaflex C with 80mm f/2.8 and 135mm f/4.5 lenses and camera accessories, both like new. Will trade one for comparable 35mm camera or sell. P. H. Kloetzer, 877-3365.

Used bedroom set, needs some repair: double bed, full chest, dresser w/mirror, two mattresses and boxsprings. Best offer over \$40 for whole lot. Stephen Jacobs, PR 4-9924.

New set stainless steel cookware, \$20. New set Melmac dishes for eight, \$18. New cordless electric clock, \$18. Four-foot diameter living room table, \$10. Rollaway bed w/mattress, \$35. Almost new Columbia bike w/speedometer and horn, \$30. Dining room set of large china closet, six chairs, table w/mat and table cover, \$125. Five-piece turquoise sectional living room suit w/two endtables and lamps, \$125. 22-cu ft upright Carrier deepfreeze, cost \$750—sell for \$100. Large Leonard super-delux refrigerator, \$50. Four-chair breakfast room set, \$30. Nine-piece redwood porch furniture, \$125. Large living room chair, \$25. Kenmore range w/broiler, oven, \$100. Bedroom suit, springs and mattress, \$75. Kenmore washing machine, \$75 in new parts recently, \$75. 21-in self-propelled Ambassador mower, \$30. Carl Busch, RE 3-8296.

Executive mahogany desk and chair, four office chairs, one file cabinet. \$375. Pinkney McGathy, HU 6-5048.

2 1/2-year old female Bassett hound, lemon and white, AKC registered, xclnt with children. \$50 or best offer. Gary McCollum, HU 7-2047.

Hi-Standard Supermatic tournament .22-cal automatic pistol, walnut thumb-rest stock, 6-in barrel, 500 rounds ammo, xclnt condition, \$50. Jim Townsend, 591-2545.

Pair shoe-type girl's rollerskates, white with toe stops, size 5, xclnt condition. \$8.50. MI 5-8448.

Miranda-Dr 35mm single-lens reflex camera, 50mm f/1.9 auto-diaphragm lens, 135mm f/3.5 preset lens. \$85. Charles Krpec, MI 5-6089.

1966 Honda 160, rack and shield, xclnt condition. \$425. J. Joerns, 932-3790.

Cameras: 2 1/4x3 1/4 Busch Pressman, f/4.5 Schneider Xenar lens in Compur shutter, cut-film holders, filmpack adapter, flashgun, fiber case—\$40. 2 1/4x2 1/4 Zeiss Ikonflex I, f/3.5 Zeiss Novar in Compur shutter, ever-ready case—\$25. Terry White, 932-4472.

1966 Yamaha Big Bear Scrambler motorcycle, xclnt condition, like new. J. R. Jordan, 583-1231 Baytown.

WANTED

Carpool or will pay from South Loop 3703 Link Valley, Houston to Bldg. 2 8:30-5. Karen Gerson, MO 5-2598.

Join carpool from 11027 Sageleaf, Sage-mont to Bldg 4 7:30-4. Gary McCollum, HU 7-2047.

Car pool or will pay from 2607 Cedar Drive, La Marque to Bldg 419, 7:30 a.m. to 4 p.m., Evelyn Villeneuve WE 5-3878.

Radio Modelers Seek Members

The MSC Radio Control Club has launched its 1967 membership drive to bring in other radio-control model enthusiasts from among MSC and contractor employees. Club membership now stands at 20 who meet regularly to fly and to discuss their hobby.

Short winter daylight hours have ended after-work flying sessions, but club members turn out to fly their "birds" Sundays on the antenna test range west of Building 14. The club welcomes spectators to the flying sessions but asks that all cars be kept on the Building 14 parking lot and not on the range.

Provisos for club membership include valid FCC licenses to operate citizen-band or amateur radio frequency radio-control equipment, and membership in the Academy of Model Aeronautics. AMA membership provides group liability insurance coverage.

The club has written field rules designed to promote safety and minimize confusion at the flying site.

Club contacts for further information are Bill McCarty at 4546 and Tim Brown at 5558. The next club meeting, at which members will bring in their airplanes and radio equipment for a "show-and-tell" type program, will be Tuesday, January 10 at 5 pm in Room 279, Building 4.

BOWLING

MIMOSA MEN'S LEAGUE

Standings as of December 22

TEAM	WON	LOST
Whirlwinds	36	24
Chizzlers	35 1/2	24 1/2
Road Runners	35	25
Technics	32	28
Fabricators	32	28
Alley Oops	31 1/2	28 1/2
Strikers	30 1/2	29 1/2
Real Timers	30	30
Foul Five	30	30
Weightless Wonders	25	35
Agitators	23	37
Hustlers	19 1/2	40 1/2

High Game: Bill Holton 271, Dan Kennedy and Rod Loe 265.

High Team Game: Chizzlers 1093 and 1086.



LABOR SPECIALISTS—MSC Director of Administration Wesley L. Hjernevik welcomes a group representing management, organized labor and government to a day-long program at MSC. The group discussed labor-management relations at the MSC White Sands Test Facility, New Mexico.

E&D Employees Recognized for Apollo Testing

Twenty-five MSC employees and one NASA contractor recently received special recognition for their roles in Apollo test programs in the Space Environment Simulation Laboratory and Vibration and Acoustic Test Facility.

Dr. Maxime A. Faget, Director of Engineering and Development, presented the awards to personnel of the Structures and Mechanics Division, Instrumentation and Electronic Systems Division and to an employee of General Electric.

Structural Dynamics Branch personnel receiving Sustained Superior Performance awards for their work in the Vibration and Acoustic Test Facility (LM Test Article-3) were: Wade D. Dorland, Robert J. Wren, Donald K. McCutchen, Billy B. Nelson, William W. Boyd, Robert P. Bolte and Stephen Huzar and Louis Holguin of General Instrumentation Branch of Instrumentation and Electronic Systems Division. George E. Griffith received a Quality Salary Increase for his work in the LTA-3 test series.

Dr. Faget presented a letter of commendation to Dan Earl Newbrough of General Electric for his work on LTA-3.

SSP's were presented to the following SMD people for work on Apollo S/C 008 test series in the Space Environment Simulation Laboratory: Robert D. Filbert, Albert L. Branscomb, James P. Vincent, Billy D. Etherton, James S. Moore, Peter B. Campbell, David G. Billingsley, Marion M. Lusk, and Edwin Kanyuck. Richard J. Piotrowski and James H. Chappee received Quality Salary Increases for their work on S/C 008.

Dr. Faget also presented SSP's to Robert L. Johnson, William L. Castner, Samuel V. Glorioso, Robert E. Johnson and Leslie G. St. Leger, members of the Structures and Materials Branch of SMD.

WSTF Labor Group Has Session at MSC

Labor-management relations at MSC's White Sands Test Facility was the topic of a day-long meeting at MSC in early December at which representatives of contractor firms, organized labor and government toured MSC facilities and discussed labor relations at the New Mexico facility.

The White Sands group meets monthly with MSC Labor Relations Officer Bailey R. Chaney to review potential labor problems and the manning of test facilities at White Sands. Lost time caused by labor disruptions is at a minimum at the facility.

MSC Director of Administration Wesley L. Hjernevik welcomed the group to MSC and Astronaut Office Chief Alan B. Shepard, Jr. spoke to the group on flight crew training. Films of the Gemini XII mission and of White Sands Test Facility activities, a luncheon in the cafeteria and a tour of MSC rounded out the program.

Attendees were: John W. Torkelsen, Grumman Aircraft Engineering Corp.; E. R. Gillespie, North American Aviation, Inc.; Douglas S. Estes, The Zia Company; Commissioner Fred J. Ferguson, Federal Mediation and Conciliation Service, Albuquerque, N.M., and Commissioner Willis H. Ray, FMCS, Houston.

Cal C. Andrews, business manager, International Brotherhood of Electrical Workers, Albuquerque; Luther Sizemore, executive secretary, United Brotherhood of Carpenters and Joiners of America, Albuquerque; James Price, president, Building and Construction Trades Council, AFL-CIO, Albuquerque; Floyd W. Sanders, business manager, United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry, Albuquerque, and Ernie B. Hall, business representative, UAJAPFPI, Las Cruces, N.M.

Fred W. Davis, assistant regional director, National Labor Relations Board, Albuquerque; Lawrence Porterfield, NLRB, El Paso, Texas; and Clifford W. Potter, regional director, NLRB, Houston.

M. A. Graham, secretary, Houston Building and Construction Trades Council; Joe Shrode, president, HBCTC; Don Horn, secretary-treasurer, Harris County AFL-CIO council, and Robert J. Ball, Jr., legal counsel, White Sands Test Facility.

ROUNDUP

SECOND FRONT PAGE

Lunar Orbiter Makes 6-Degree Plane Change

The Langley Research Center, Hampton, Va., directing the flight of NASA's successful Lunar Orbiter II, in early December commanded the spacecraft to change the inclination of its elliptical orbit around the Moon.

The new orbit is tilted 17.5 degrees to the Moon's equator in contrast to the 11.8 degree orbit of the satellite since November 10.

Purpose of the change is to gather extended tracking data to expand available knowledge of the lunar gravitational field (selenodesy) and to gain experience in flight operations at higher inclinations for future Orbiter mission planning. The maneuver is believed to be the first plane change accomplished by any spacecraft circling the Moon.

The event occurred at 2:36 pm CST, December 8, with the firing of the spacecraft's velocity control engine for a 62-second burn. The engine was operated for the fourth time in Lunar Orbiter II flight.

Engine burn occurred shortly after the spacecraft had passed its apolune or high point. The engine thrust of 100 pounds was exerted long enough to tilt the orbital plane to the new inclination. At the end of engine operation, engineers predicted the

spacecraft would have more than enough fuel to permit it to be deliberately crashed as was Lunar Orbiter I, should that action be needed.

Before the maneuver began, the spacecraft's orbit had the following characteristics: perilune, or low point, 24.18 miles; apolune or high point, 1,154.5 miles; inclination 11.8 degrees; period, 3 hours 28 minutes 30 seconds.

Expected values following the maneuver: perilune, 26.5 miles; apolune, 1168.7 miles; inclination, 17.5 degrees; period, 3 hours 30 minutes.

Eighteen or more hours of tracking were required to determine precisely the elements of the new orbit.

On December 6, Orbiter II failed to respond to commands turning on its high-power transmitter, cutting short its photograph readout. The command was sent from the Woomera, Australia, tracking station. NASA engineers believe the failure occurred in the high-power transmission system of the spacecraft.

All other subsystems in the satellite continue in good order, returning data on operating conditions, radiation environment, meteoroids, and lunar gravity.

Astronomer's Orbit



QUESTION SESSION—Dr. Allan R. Sandage of California Institute of Technology's Mt. Wilson and Mt. Palomar observatories and featured speaker at the December 28-29 Gulf Coast Science Foundation Holiday Lecture Series, elaborates for youngsters one of the points of his lecture. Dr. Sandage's topic was "The Current Revolution in Astronomy." At left is Lyle Jenkins of Apollo Spacecraft Program Office; at right, Dr. Armand Yramategui, director of Houston's Burke Baker Planetarium. The lecture series, sponsored jointly by the Gulf Coast Science Foundation and the American Association for the Advancement of Science, was held at Rice University's Hamman Hall.