Space News ROUNDUP!

VOL. 1, NO. 13 MANNED SPACECRAFT CENTER, HOUSTON, TEXAS APRIL 18, 1962

First Construction Contract Work Underway at Clear Lake

Thiokol to Build Apollo Spacecraft Jettison Motor

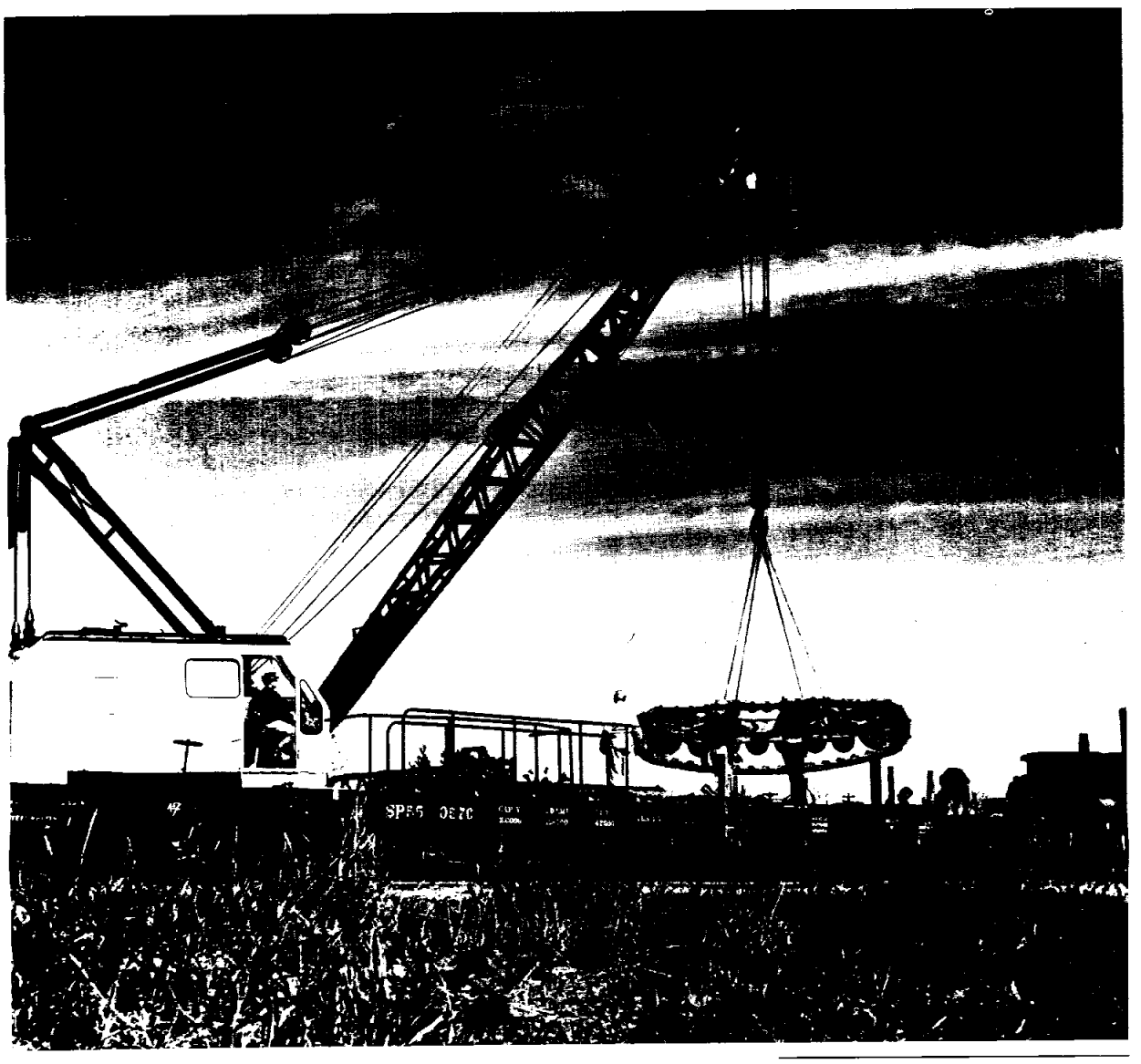
Thiokol Chemical Company's Elkton, Md., Division will design and build the solid-propellant tower jettison motor for the National Aeronautics and Space Administration's multi-man Apollo spacecraft that will be used for the first American lunar voyage.

The Maryland firm's contract is expected to exceed $1 million, according to North American Aviation's Space and Information Systems Division, principal contractor for the Apollo spacecraft to NASA's Manned Spacecraft Center.

The tower jettison motor is part of the Apollo launch escape system, which has three basic components—the tower and its jettison motor, and the launch escape motor. The overall system is designed to separate the Apollo's manned command module from the launch vehicle in the event of an emergency during the launch phase.

The launch escape motor is being built by the Lockheed Propulsion Company of Redlands, Calif.

Thiokol's Elkton Division was picked for the job following an intensive selection procedure, which included evaluation of technical design, ability to produce, probable cost, and program management.



OFF-LOADING OF HEAVY EQUIPMENT for use in the preliminary work at MSC's Clear Lake site is shown above, prior to the start of activities by Morrison-Knudson in the overall site grading and drainage phase of their contract. Below a bulldozer is shown leveling ground on the site which will be later used for material storage. Clear Lake can be seen in the background.
—Photos by Patnesky

Space Environment Simulation Chamber Contract Awarded

The Manned Spacecraft Center has announced the award of a contract for engineering studies and design criteria for the space environment simulation chambers for the Center.

The contract was awarded to Bechtel Corporation of San Francisco, Calif., for about $280,000 to cover studies and various design concepts and their costs, the preparation of reports of the studies and design layouts for the facility.

The four chambers are being considered as a part of the facility although they may not all be built depending upon availability of funds. The largest facility will be large enough to enclose a complete space vehicle as much as 105 feet high—as high as a ten-story building, and with an inner working dimension of at least 35 feet in diameter. It will be capable of simulating a vacuum equal to that existing at 80 miles high and temperatures as low and as high as those expected to be encountered on the near side of the moon's surface.

Current Plans Call For Building Bids During September

Work was started early in April on the first construction contract for Manned Spacecraft Center near Houston, according to an announcement made by Col. R. P. West, District Engineer, U. S. Army Corps of Engineers, Fort Worth District.

West awarded a $3,673,000 contract March 29 to the Morrison-Knudson Construction Company of Boise, Idaho, and Paul Hardeman, Stanton, California, for site development and basic utility installations at the Center in the Clear Lake area about 20 miles southeast of Houston.

The Corps of Engineers is supervising the design and construction of the project for NASA.

The work will include overall site grading and drainage, utility installations including an electrical power system, a complete water supply and distribution system, sanitary and storm drainage systems, basic roads, security fence and street lighting.

The next major work at the project will be for construction of 20 buildings to house some of the principal facilities at the center.

Space News Roundup Goes Lithotronic

The contract to print *Space News Roundup* locally was awarded to the Houston Lithographing Corporation last week.

In addition to the change of location for MSC's bi-weekly publication, a change of process has also been made. Houston Lithographing uses, through Lithotronic Houston, the Linofilm system of electronic photocomposition. Metal type is not used in this process.

The copy is set on a keyboard unit which perforates a tape. The tape is then processed through an electronic photographic unit. A strobe light in this unit flashes 12 times a second, photographing each letter separately, thus permitting exceptional speed and clarity.

The staff herewith offers MSC personnel their first electronic issue.

Commission on Higher Education Asked To Help Support MSC

Paul E. Purser, special assistant to the director of Manned Spacecraft Center, appeared before the Texas Commission on Higher Education April 9 and discussed the current and anticipated educational needs of the Center. He also told the Commission how much MSC is depending upon the local colleges and universities for support.

Purser said, "One of the basic reasons for locating the MSC near Houston was the availability, in the immediate area, of educational programs necessary to fill the Center's training needs."

He pointed out that since MSC officials have moved to Houston they have become convinced that the universities in the area do have the ability and potential to meet the needs.

"Our educational requirements are not only numerous but are quite varied and complex," he said. "One of our main problems is to provide our engineers, scientists, technical, and management employees with a convenient means of keeping abreast of the 'state-of-the-art' in their many fields of endeavor. Consequently, challenging graduate study courses must be available and readily accessible."

He estimated a need for 110 to 240 graduate course enrollments during 1962, and for 220 to 250 enrollments during 1963; and pointed out that these are expected to be primarily in the mechanical and electrical engineering, physics, and mathematics disciplines and will extend in scope through the Ph. D. level.

Purser said that the University of Houston, to help fill the immediate needs, has established graduate courses in physics, mechanical engineering, and mathematics during the coming summer semester for approximately 50 MSC employees.

He added that the availability of a strong graduate study curriculum in Houston would assist the Center in other vital ways, such as playing a major role in attracting better personnel to those industrial firms which establish offices in the area to support MSC. He said these firms will undoubtedly bring employees to the area who can contribute as teachers, researchers, and consultants.

Purser stressed that there is little doubt that the manpower needs of MSC will be as complex and urgent as those of any organization in the country during the next decade. It is estimated that the entire lunar landing program will utilize approximately 24,000 people and will cost from 10 to 15 billion dollars.

In closing he said, "On behalf of the director and staff of Manned Spacecraft Center, I request this commission adopt and implement policies and plans that will contribute to the high level of graduate educational programs clearly needed by the Manned Spacecraft Center. We are depending upon you to support us in this race 'for space'."

A CORRESPONDENCE AND OFFICE PRACTICES course was conducted in the conference room of the Farnsworth-Chambers Building March 27-28. A portion of the group attending is shown as they listen to an instructor explaining the proper method of answering a telephone.

Recovery Operations Defined During Washington Conference

The portion of the MA-6 Result Conference in Washington which was devoted to the recovery operations was presented by Robert F. Thompson and Enoch M. Jones of Flight Operations Division.

They define recovery operations as the support required for location and retrieval of the astronaut and spacecraft subsequent to landing.

The support provided for all Mercury flights reflects a consideration of both normal flights and various possible abort situations; and it is the latter case, that is, supporting possible abort situations having a reasonable probability of occurring, that imposes by far the greatest support requirements on recovery forces. Consequently, while a relatively large number of recovery vehicles and personnel are required to provide the desired support capability, only a few become directly involved in the recovery for any given operation.

They pointed out, too, that the recovery forces which have supported Project Mercury flight operations—the aircraft, planes, ships, helicopters, and other special vehicles—are provided by the Department of Defense, and for the most part represent operational units that devote only a relatively small part of their total workload to Mercury recovery. Recovery techniques and equipment have been developed which permit the Department of Defense to support this program with an acceptable diversion from their normal functions.

Recovery support areas were considered in two broad categories: planned recovery areas in which the probability of landing was considered sufficiently high to require the positioning of location and retrieval units assuring recovery within a specific time; and contingency recovery areas in which the probability of landing was considered sufficiently low to require only the utilization of specialized search and rescue procedures.

In all, there were 16 search planes, 12 helicopters and 21 ships assigned to the recovery forces to retrieve the Friendship 7 spacecraft and Astronaut John H. Glenn, Jr.

Cryogenic Engineering Course Is Underway With 26 Attending

A 20-hour course in Cryogenic Engineering is being conducted at the Houston Petroleum Center this week with 26 Aerospace Technologists attending. In addition, a number of technicians and supply personnel who are concerned with storage and handling of cyrogenic materials and equipment are expected to attend the safety lecture scheduled Friday.

The course is being presented by Dr. Richard H. Kropschott of the National Bureau of Standards' Cryogenic Engineering Laboratory. Guest lecturers for the course are Dr. R. B. Scott and Dr. D. B. Chelton.

The course, as planned, provides for four scheduled hours each day with the remainder of the time open for individual or class discussions and consultation.

Included for discussion in the course are thermodynamics and thermodynamic charts, cycles and equipment, thermometry, insulation, mechanical properties, storing and transporting liquids, and transfer of liquids.

Those attending the course are Larry Bell, Raymond Bradley, Robert Brock, William A. Chandler, Will Ellis, Arlie Fisher, Robert Fletcher, Bill Freedman, Walt Guy, Dale Hannaford, Eziaslav Harrin, Malcolm Jones, Harold Lambert, Gerald Launey, Arnold Levine, Joe Kosmo, Emory Meeks, William Reveley, William Scott, Gordon Spencer, Emily Stephens, H. Kurt Strass, Gene Thornhill, Hugh White, Charles Yodzis and Larry York.

Those already committed to attend the safety lecture are Arthur Chapman, Paul Folwell, Francis I. P. Glynn and Norwood Smith.

Reading Improvement Course Scheduled to Start Monday

A reading improvement course will be conducted for MSC personnel beginning next Monday. The course will be conducted from 2:30-4:30 p.m. for eight consecutive Mondays by Dr. Stanley E. Davis, Head of the Reading Clinic of the University of Houston.

The course is designed primarily for those employees who must review a substantial amount of paperwork in the course of their duties and is geared to increase both reading rate and comprehension ability.

The objectives of the course are to give the student a better understanding of his present reading status and the factors which affect reading ability, a better understanding of the reading process, and ideas which he can put into practice to improve his reading skill. The text to be used in the course will be "Faster Reading for Business" by George Spache and Paul Berg.

Jack Lister, head of the Training Branch, indicated last week that additional reading improvement courses would be conducted at a later date. Supervisors may submit names of nominees for the course to Lister.

Those scheduled to attend the initial course are James G. Winters, Jeff Davis, Charles Slaughter and Robert C. Brewbaker of Procurement; Ralph Sawyer, Alfred B. Eickmeier, Len Packham, Kermit A. Edwards and Jevas Nicklos of Systems Evaluation Development Division; R. L. Stevens and T. F. Woods of Digital Computer Group; Robert W. Fricke, Jr., Joan L. Schulze and Rita G. LaFleur of Technical Services.

Also Edward A. Armstrong, Robert L. Frost, Norman R. Schulze, G. F. MacDougall and Galloway B. Foster, Jr. of the Gemini Project Office; Lee N. McMillion, W. G. Dean, and W. D. Graves of the Apollo Project Office; Frank J. Hickey and Joe M. Pirtle of the Security Division; Richard S. Johnston and James C. Shows of Life Systems Division; and Brian LeBert-Francis of the Financial Management Office.

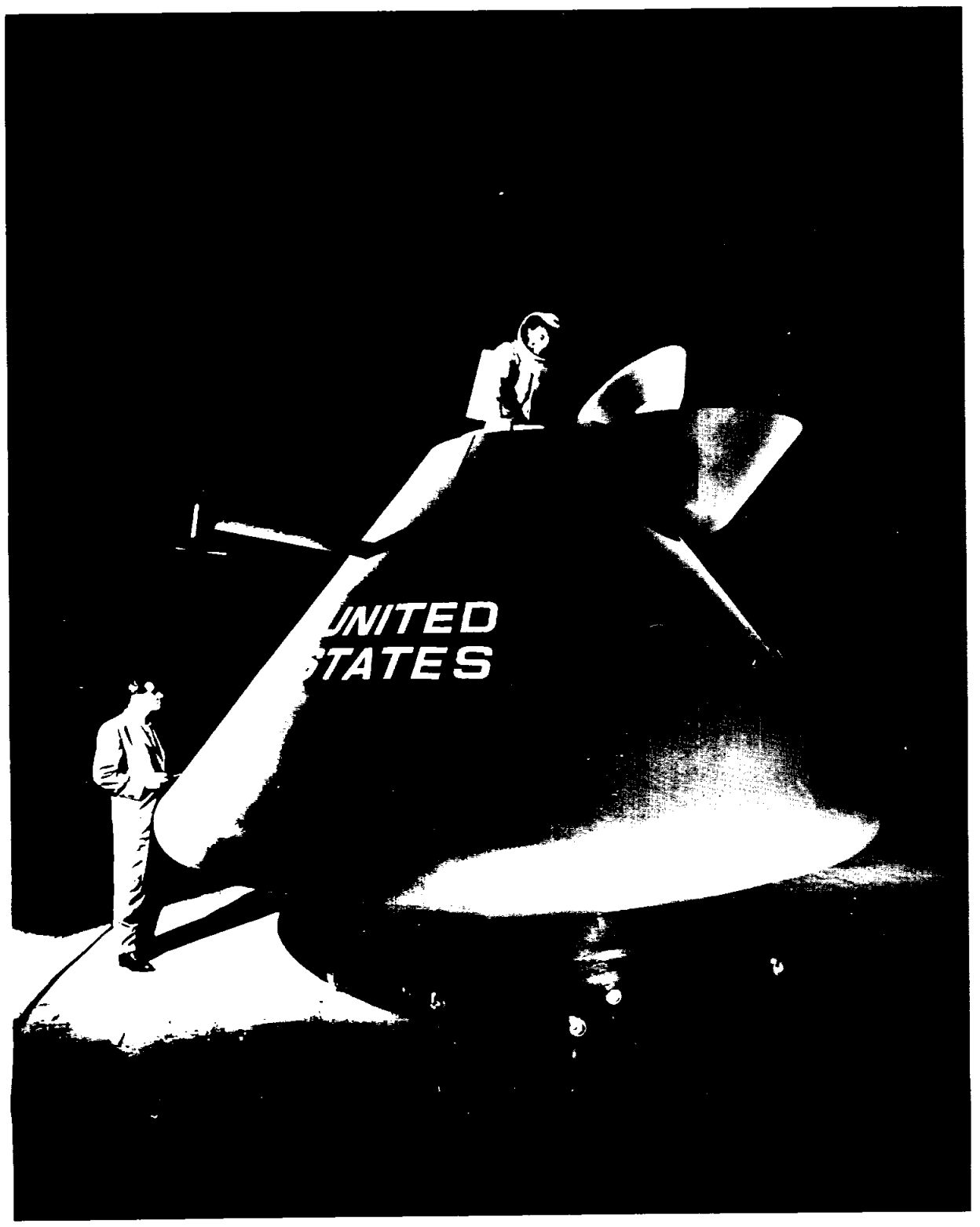
Astronauts Decline Houston Home Offer

The Houston Home Builders Association has offered seven homes to the Mercury Astronauts in Houston, Tex., the new location of NASA's Manned Spacecraft Center.

NASA has determined there is no legal bar to acceptance of the offer. As a matter of policy, however, NASA has advised the astronauts that acceptance of the houses is not considered to be in the best interest of all concerned. At the same time NASA specified that the final decision should be made by the seven men.

After considering all factors, the astronauts, in consultation with their attorney C. Leo D'Orsey, have determined to decline the offer.

They expressed their appreciation to the people of Houston for their wonderful hospitality and for this very generous offer and believe the offer was made in good faith. The astronauts feel, however, that the motives of the people who made the offer and their acceptance might be misunderstood.



NORTH AMERICAN AVIATION, prime contractor for the three-man Apollo spacecraft, exhibits the full scale preliminary model mock-up. An astronaut, shown egressing from the spacecraft through the top, will also enter the same way on the moon. The spacecraft will be approximately 13 feet in diameter at the base and 12 feet high.

Apollo Spacecraft Design Will Feature Versatility

The Project Apollo spacecraft is a three-man vehicle being designed and constructed for America's initial expedition to the lunar surface. The National Aeronautics and Space Administration has assigned the management of the Apollo program to MSC. Charles W. Frick is MSC's Apollo project manager.

The Apollo is expected to be launched by the Saturn series of launch vehicles being developed at the Marshall Space Flight Center. The two Centers are working closely together in the development of the flight hardware to assure compatability and to work out solutions of problems presented by design concepts.

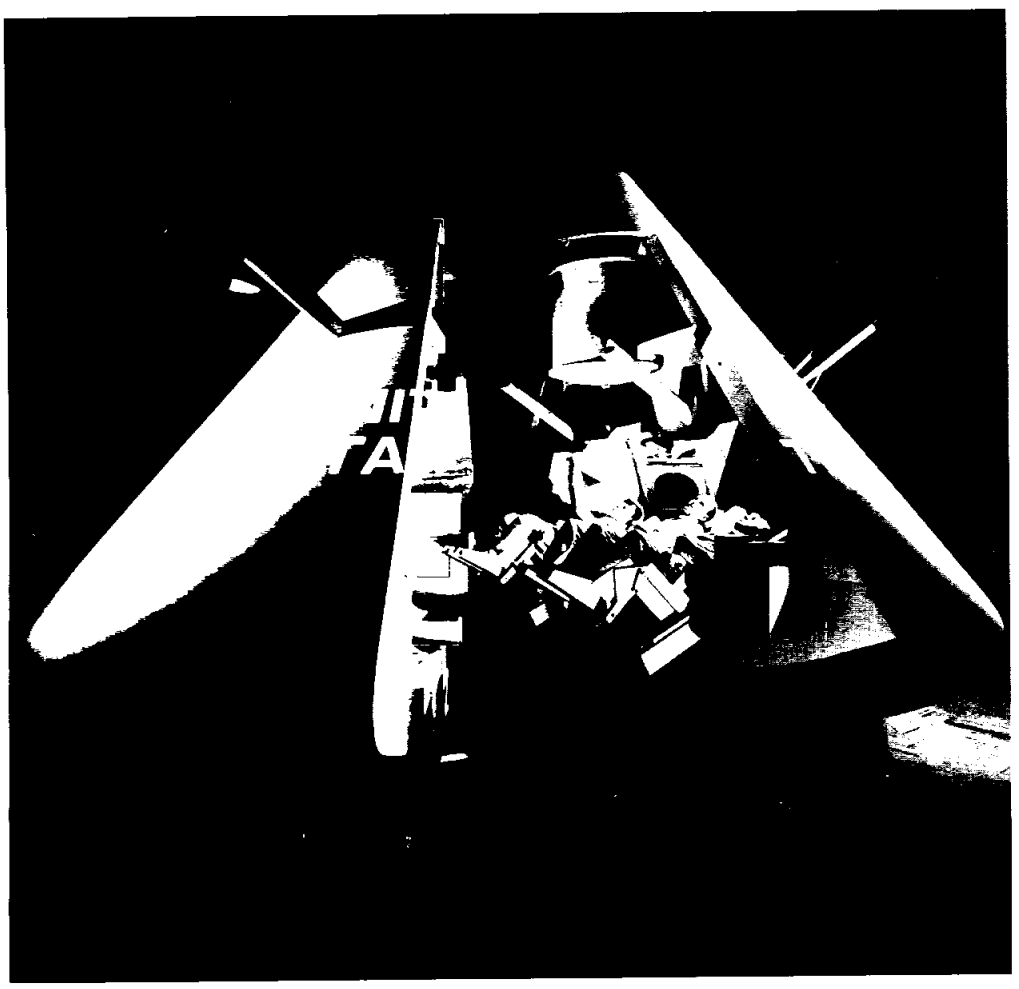
This melding of programs is already underway, and, as a result, some early Saturn flights which were originally assigned to the sole purpose of launch vehicle development are scheduled to carry development and prototype versions of the Apollo spacecraft. These flights will not only materially aid in the Apollo development program but will also provide a means for assessing the complete system and the operational problems associated with it.

It is felt that a plan of successive tests and missions, each of increased difficulty or complexity, is the best means of developing spacecraft for manned flights. This method was used in Project Mercury and is ideally suited to the Apollo spacecraft since it allows for manned flight on early missions of reduced hazard and is in keeping with the development of the launch vehicle capability.

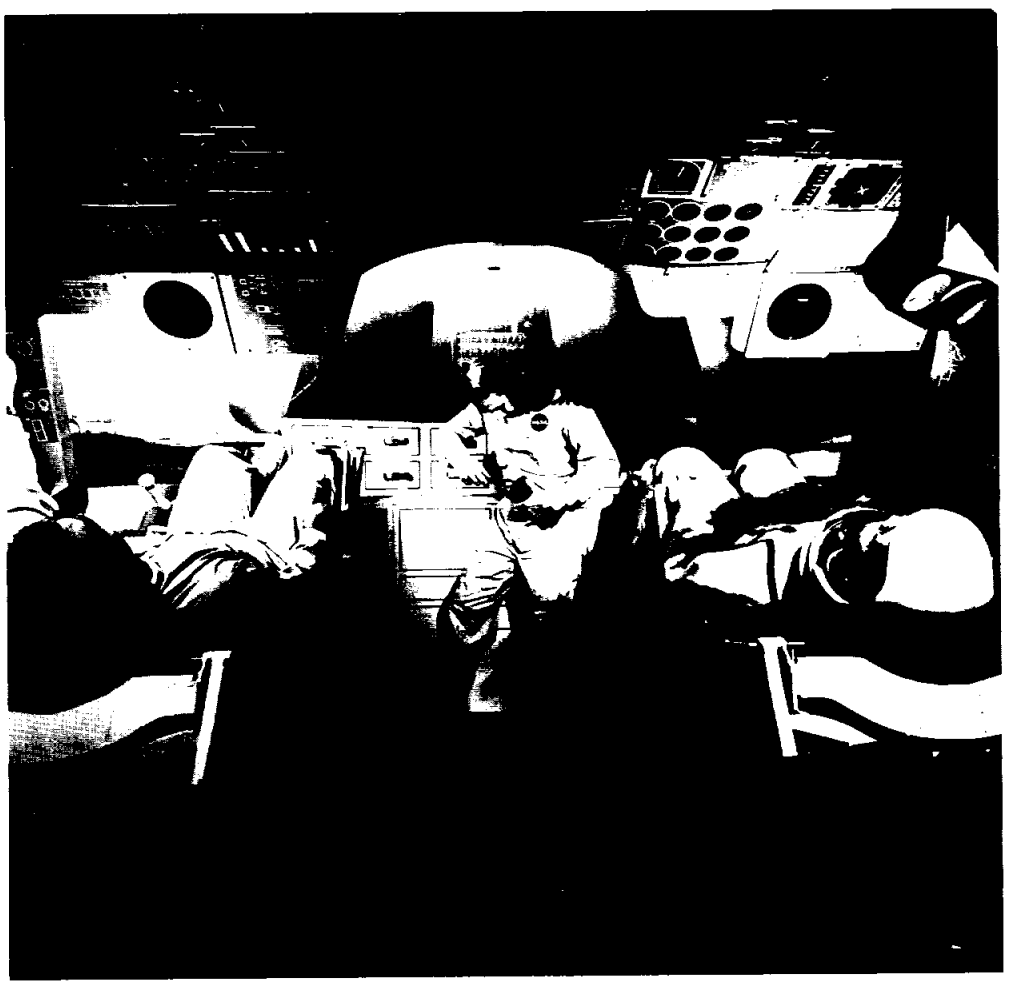
The Apollo spacecraft will be primarily designed for its lunar mission. Nevertheless, it will be well suited for other missions. It will be capable of rendezvous and, therefore, should work well in support of orbital space stations and laboratories. It will be designed to provide adequate accomodations for a 14-day mission with the three-man crew. With minor modifications, it should be able to carry double that number on flights of short duration.

The Apollo spacecraft will consist of a Command Module (a mock-up of which is shown on this page), Service Module, and Lunar Landing Module. Of these only the Command Module will return to the earth's surface at the conclusion of a mission.

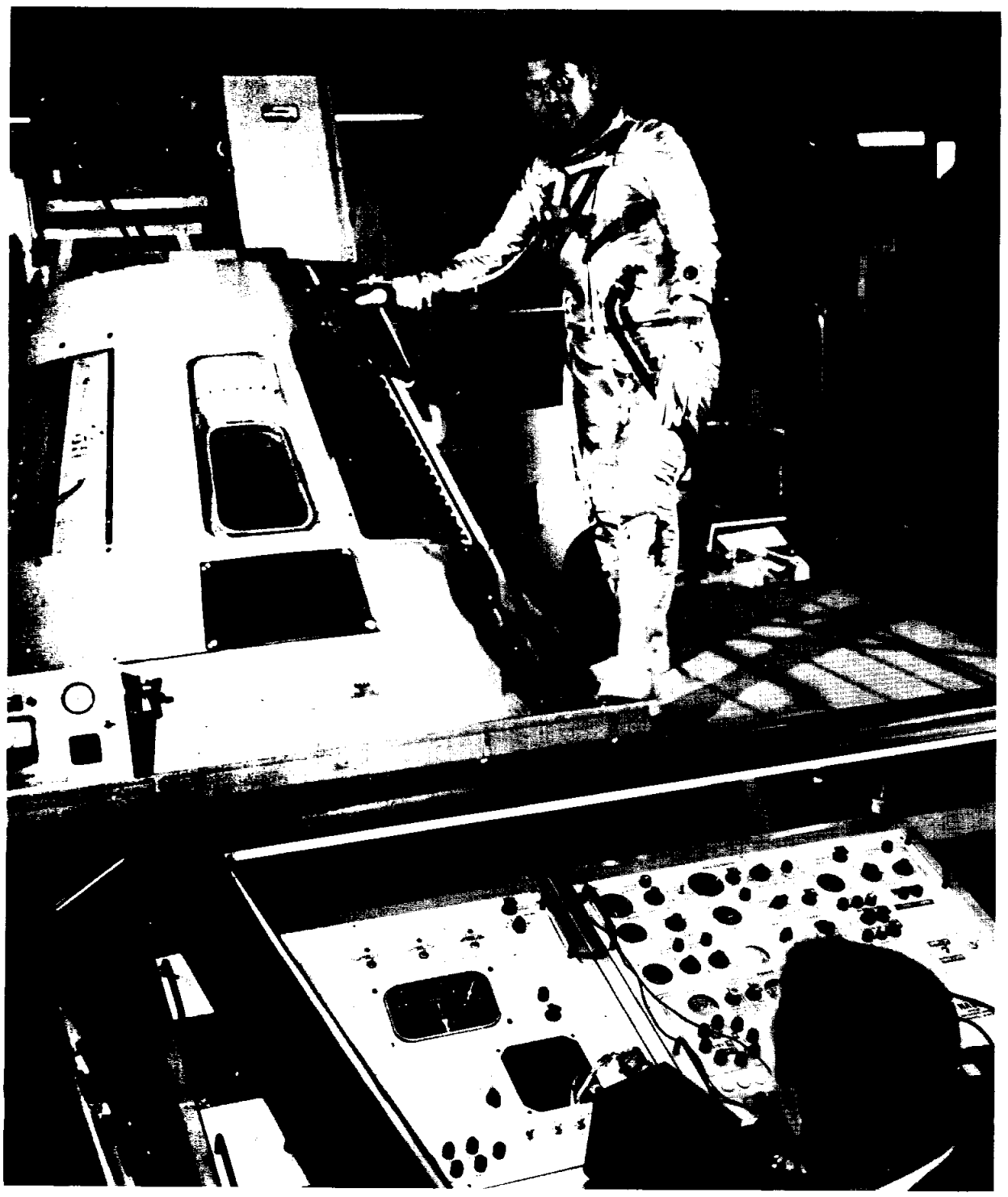
The Command Module will house the crew and be the center of command activity during the mission. Inside this module will be display panels, navigation equipment, communications systems, and the various controls available to the crew to carry out their tasks. During high activity phases of the mission the crew will be side-by-side, but, during other phases they will be able to move about the module. There will be separate areas for food preparation and sleeping, and various vital equipment will be accessible for minor adjustments, calibration and repair.



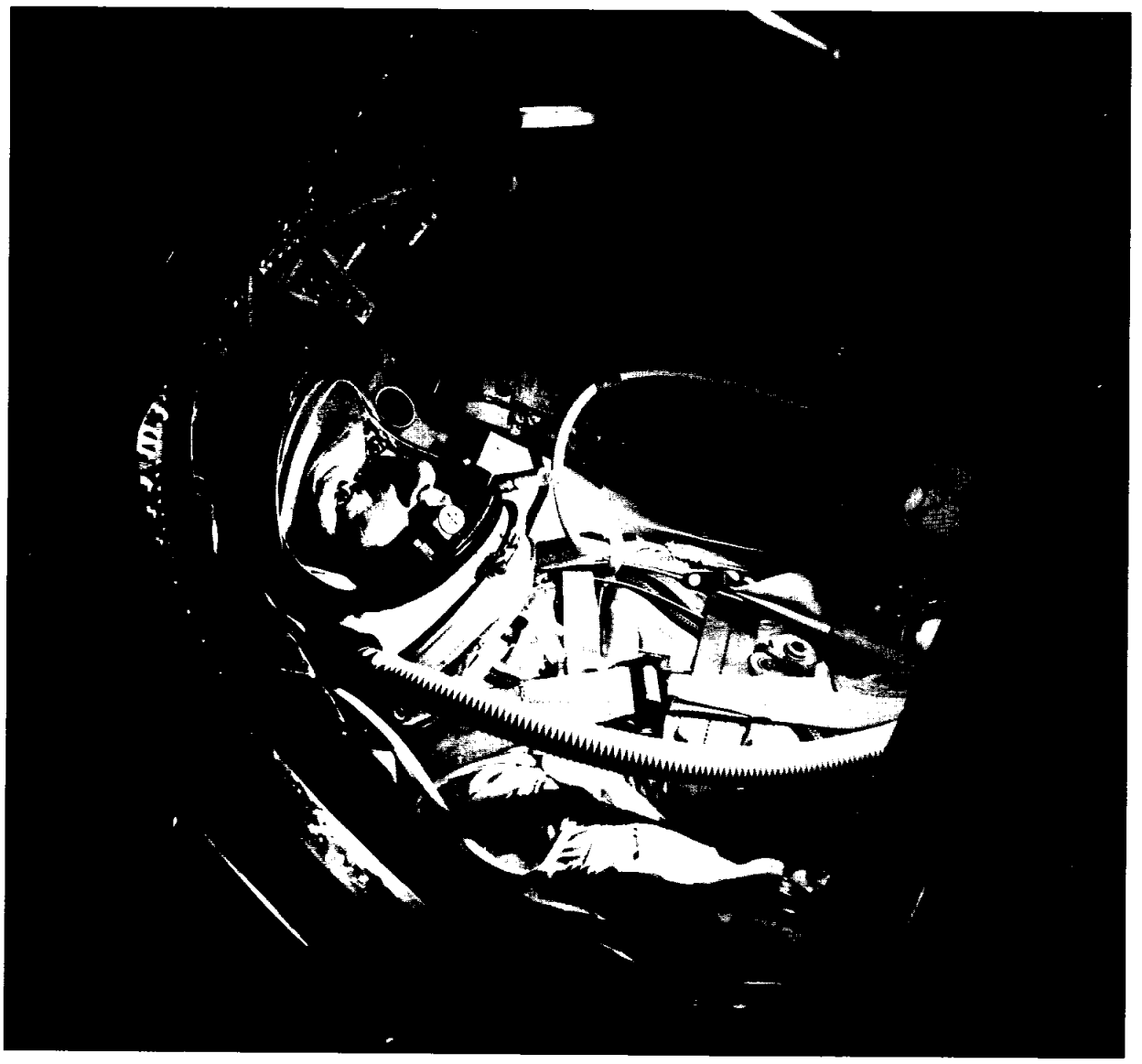
A CROSS SECTION VIEW of the mock-up command module shows how the three astronauts might be placed in their couches in a launch position. This preliminary mock-up gives an indication of how this particular problem may be handled.



AN INTERIOR VIEW of the mock-up shows two of the three-man crew in their couches while the other member works on a spacecraft part. They are wearing light, comfortable coveralls with the pressure suits stored in the module where they can be donned quickly.



SCHIRRA PREPARES TO ENTER the procedures trainer with McDonnell engineer Sherman Fusch shown at the console in the foreground.



SCHIRRA IS SHOWN in his couch in the procedures trainer, ready to start a "fast trip around the world."

CREW EQUIPMENT TECHNICIAN Al Rochford fastens the straps on Astronaut Walter M. Schirra's pressurized suit as Schirra prepares for a training session in the procedures trainer at Langley.

Procedures Trainer Exercises Of Realistic Circumstances Th

It is quiet inside the spacecraft, the windows darkened, the hatch closed. Lying on his back, encased in his pressure suit like a silver mummy, the astronaut waits. He is sealed off from everything, even the air inside this tiny cabin. The voices that come to him, the oxygen he breathes, are piped in. The words he speaks go out the same way. The switches, buttons, levers he touches are felt remotely, through a pair of heavy gloves. In his right hand is the "stick" with which he controls what part of this flight he can control. In his left is the abort lever. Through the plexiglass visor over his face he surveys a tiny kingdom made up of switches, levers, buttons, rings, dials, indicator lights—above, on both sides, behind his head.

Only his eyes move. He waits.

A light flashes. Indicator needles move. He responds. The spacecraft begins to roll, to pitch, to yaw sideways. He corrects. An automatic system fails. Something is not working right. He hits an override switch and takes over manually, then shifts quickly to another part of the panel that needs his attention. The spacecraft is re-entering the atmosphere now. All his training and experience are needed.

Less than five feet away, a technician standing on a concrete floor leans against a railing and calmly lights a cigarette.

The "spacecraft" has never left the ground. It never will.

This is the procedures trainer, complete in every detail except that it will never see the topside of an Atlas launch vehicle. Instead, it is wired to a bank of computers and to a control console. The man at the console is the situation maker. Whatever he decides should happen does happen, insofar as the astronaut inside the trainer is concerned. The pilot takes whatever action the situation calls for, and the computers pick it up and figure out what the result would be in actual flight.

"We can do everything that we could do in flight," said McDonnell Aircraft engineer Sherman Fusch of the procedures trainer. Fusch is one of the "situation makers" who sit at the console as the astronauts take hours of continuing training in the mock spacecraft—as many as four or four and a half hours in a single run, though most are shorter.

AL ROCHFORD CHECKS Astronaut M. Scott Carpenter's gloves after helping him suit up for a training mission.

ASTRONAUT M. SCOTT CARPENTER relaxes for a moment before starting a run in the procedures trainer.

ffer Astronauts y Could Face in A Variety Space Flight

"We can run re-entry problems, over and over, if the pilot feels that's what he needs. We can run through the pre-launch check and procedures; we can turn him around after he leaves the launch vehicle; we can go through the retro-sequence. Or we can go through four and a half hours of full simulation from start to finish, as Shepard did in December."

The procedures trainer is an important part of the astronaut's training, and the differences between the trainer and an actual spacecraft are kept minor. For instance, the windows on the trainer at Langley (there is another at Cape Canaveral) are smaller than the ones in the MA-6 in which Astronaut John Glenn circled the earth. There is one switch having to do with manual landing control which is missing, but will be installed shortly. Otherwise, the trainer is as like the real thing inside as a pair of Volkswagens.

"There isn't much inherent stability in one of these things, as there is in a winged aircraft," said Fusch. "During re-entry, the spacecraft rolls constantly, and it can develop a pitch or a yaw. The astronaut tries to hold the pitch and yaw rate at zero while I deliberately disturb it. I can simulate leaks and systems failures; introduce abnormal power consumption; run the temperature up; fail batteries or fuses; even decompress the cabin. Of course, the trainer cabin is not really pressurized, but we get the same effect by suddenly inflating the suit. That's what would happen if the cabin sprang a leak and depressurized quickly."

Astronauts using the trainer are fully suited as they would be in flight, and a suit technician is on hand to do the necessary tightening, adjusting, connecting and general "buttoning up." The "flight" over, the astronaut climbs from the trainer, slips into a pair of oversized galoshes to keep his flight boots clean, and carrying his own air-compressor, treks out to a car and back to the suit room to take it all off again.

In a few hours, by moving only a block or so, he has had the equivalent of several hours of space flight and countless emergencies. He will do it often before the cigarette-smoking technician and millions of other earth-bound humans fall away beneath his back and he is on his own in outer space.

CARPENTER IS PICTURED during a training exercise in the ALFA trainer at Langley.

The SPACE NEWS ROUNDUP, an official publication of the Manned Spacecraft Center, National Aeronautics and Space Administration, Houston, Texas, is published for MSC personnel by the Public Affairs Office.

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Editorial

Several articles in this issue are devoted to different phases of the report presented in Washington April 6 concerning the results of the Mercury-Atlas 6 flight on February 20.

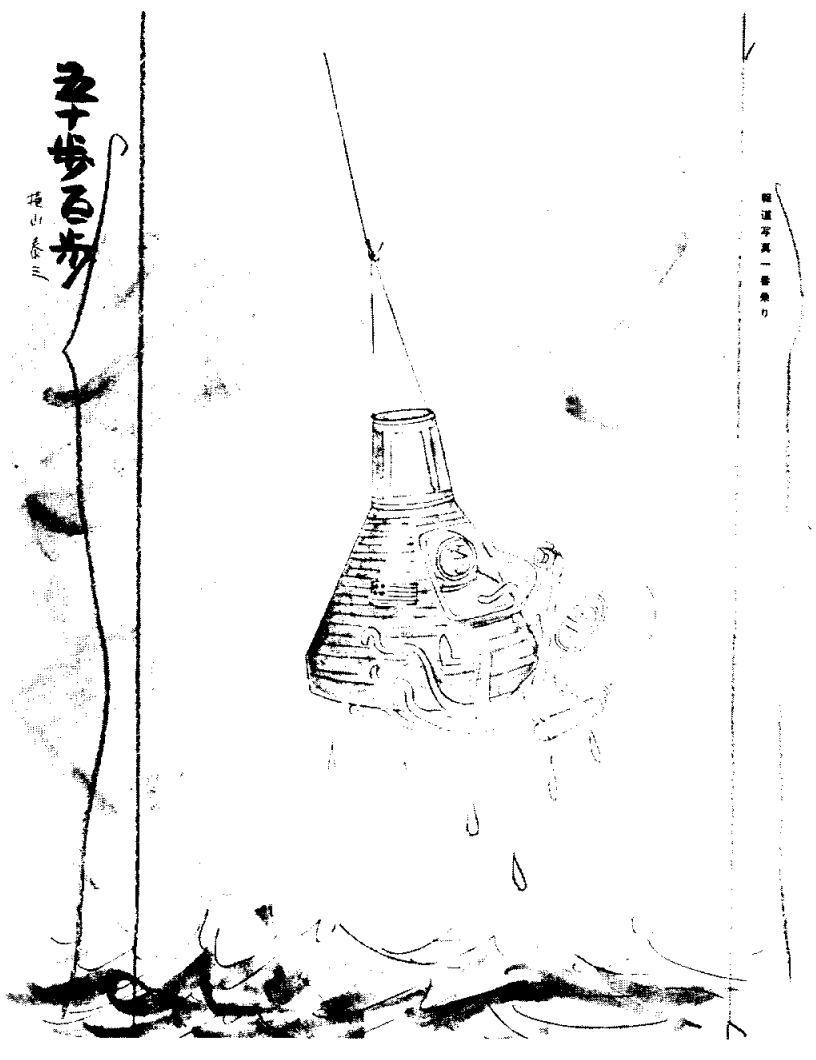
The complete report covered pre-launch activities, spacecraft description, flight operations, flight data, and post-flight analyses.

Pertinent information has been extracted from these reports in an effort to acquaint MSC personnel with the more detailed results of the historic mission. Although space does not permit the complete reproduction of this informative report, it was felt that the summaries presented would be valuable to all personnel.

In addition to those resumes of the various phases of the report covered in this issue, it is planned to cover additional phases in the next issue in order that more adequate coverage might be offered.

It is further planned to cover the activities of all future Mercury, Gemini, and Apollo missions in a similar manner.

On The Lighter Side



"A race for the first reports" —*Asahi, Japan, Picture News*

EDITORIAL EXCERPTS

By DONALD FREEMAN
The San Diego Union's
Radio-TV Editor

By far the most dramatic recording of the year, "Astronaut," the on-the-spot account of Lt. Col. John Glenn's orbital flight, has been getting a healthy workout on the air these days, nudging aside the twist and the rock 'n' roll records. And that, in itself, is an earth-rattling feat.

The record, on the Reprise label, has already gone into its second pressing. It's a striking document that catches history on the wing with great effectiveness. As you hear it you relive a day that none of us, I suspect, will ever forget.

Bill Baldwin handled the narration, Bruce Herschensohn composed the score and the script was written by Frank Kerr of the motion picture section at General Dynamics-Astronautics who was present at the launching—"My eyes were as wet as everyone else's"—and had also previously toured most of the tracking stations from Nigeria to Australia.

Kerr had been preparing the script for the NASA (National Aeronautics and Space Administration) film on Glenn's flight. The notion for a recording of it came later.

Talking with Kerr the other day, I wondered if Col. Glenn had heard the record.

He had, indeed, Kerr said, "I'm happy to say that Glenn heard it and he was pleased and impressed." Which is understandable. It's a dandy.

MSC PERSONALITY

Descendant Of Texas Ranger, J. W. Ould, Returns To Scene

The great-great-great nephew of an illustrious Texas Ranger returned to the state where his ancestor became famous recently in the person of J. Wallace Ould, Chief Counsel for the Manned Spacecraft Center.

Ould, who was for 12 years chief counsel for the Atomic Energy Commission's Oak Ridge operation, is himself a native of Lynchburg, Va. His

J. WALLACE OULD

ancestor was one "Big-Foot" Wallace, a veteran of the Mexican War and later a Texas Ranger about whom a book has been written and after whom a World War I Liberty Ship was named.

Ould became chief counsel for NASA's Manned Spacecraft Center at Langley AFB Nov. 12, 1961 and recently transferred to the Houston site. Prior to that he had been at Oak Ridge since 1947, first as legal advisor to the Division of Community Affairs and since 1949 as chief counsel.

Oak Ridge was built by the government in 1942, and by 1945 there were 75,000 people living and working there. Anxious to get out of owning and operating the city, a project which was costing eight to 10 million dollars annually, the government called in a legal staff to help with drawing up a special act for disposal of the city into private hands and for incorporation of the community. Ould's work was incorporated into Public Law 221, passed by Congress.

A graduate of Lynchburg Public Schools and VMI at Lexington in 1927, he received his law degree from the University of Virginia Law School at Charlottesville in 1930. Ould practiced law at Lynchburg from 1930 to 1942. With the advent of World War II, when all his VMI classmates were going into service, he was refused a commission because of difficulty with his eyes. "I had to get into the war somehow," he said, and so accepted a position with the War Production Board's legal staff in Washington.

In 1945, he was named assistant general counsel for the board.

In 1947, with Oak Ridge still in the organizational stages, he joined the Oak Ridge staff to deal primarily with community affairs. The job of conversion to civilian ownership, however, took time and in the meanwhile there were other things.

By 1956, when things had leveled off, the reactor program was started and it was 1959 before another settled period. The incorporation problem was pretty well solved. By last summer, Ould, a man who likes to work hard, was looking for new fields to conquer. He had been interested in space for some time, and as he says, "coming into the Space Administration was really the only thing that appealed to me. So in mid-November, I 'moved over'."

Although his favorite sport is swimming, Ould would rather talk about his addiction to working with high fidelity sound systems. Stereo does not appeal to him, so he has worked out his own wide-range monaural sound system, an idea which may be patented. Meanwhile he can talk "tweeters" and "woofers" with the best of them.

A member of the Federal and Virginia Bar Associations and the National Lawyers Club, he is married to the former Anne Bundick of Charleston, W. Va. They have a daughter, Ellen, 22, who is now in school in Washington, D.C.

Specialized Training Improves Crew Function During Flight

(Continued from page 8)

Pensacola, Fla.

The crew spent a total of 90 hours in the procedures trainer, and hours were spent practicing manual control of spacecraft attitudes. Additional practice in manual control was acquired through the air-lubricated free-attitude (ALFA) trainer at Langley AFB. Astronaut Glenn was subjected to simulated systems malfunctions of every description. Tape recordings of his voice during training were sent to all range stations to familairize controllers with his normal manner of speaking.

"Since its inception, the physical training program has been the option of the individual." Astronaut Glenn elected running, and over the past three years has built up from one to five miles a day.

A two-day period spent at Morehead Planetarium in Chapel Hill, N. C. proved invaluable in familiarization of constellations and star patterns, and study was also aided by a Farquahr celestial sphere and many star charts, astronomy books and star finders.

As a result of preflight briefings, the need for some special equipment became apparent.

In addition a knee pad, knife, scissors, survival kit, flashlight, star charts and an orbital chart book with an overlay of worldwide weather were carried.

Egress from the small end and side hatch of the spacecraft were practiced in the water using helicopters, and by other members of the team using a destroyer. At Cape Canaveral, two LARC amphibious vehicles were used to practice deep-water familiarization with the liferaft and survival equipment, resulting in many equipment and packing modifications. Pad egress was practiced using the Midas Tower and the M-113 armored vehicle.

A considerable amount of time was devoted to star recognition, briefings, physical exams, correction of the pressure suit, Morse code practice, and the study of aerial photos, world charts, Tiros satellite photos, photos from previous Mercury flights, mission rules, and the Atlas systems.

Results of Glenn's Mercury-Atlas 6 Flight Are Presented

Pilot Describes His Feelings Before and During Mission

Astronaut John Glenn's official pilot's flight report revealed three valuable conclusions which will have a direct bearing of future space efforts.

• Weightless flight was quickly adapted to, and was found pleasant and without discomfort.

• The chances of mission success are greatly enhanced by the presence of a human crew in the spacecraft.

• A human crew is vital to future space missions for the purpose of intelligent observation and actions when the spacecraft encounters expected or unexpected occurences or phenomena.

His report was mainly concerned with those items in the three mission objectives where man's observation capabilities provided information not attained by other means. Said Glenn, "It is in this type of reporting that a manned vehicle provides a great advantage over an unmanned vehicle, which is often deaf and blind to the new and unexpected." He added that his report would stress what he heard, saw, and felt during the orbital flight.

Preparation and Countdown

Speaking of the preparation and countdown period, Glenn referred to the fact that many people were worried about his mental state during the delays during the countdown as well as previous delays, and repeatedly asked whether he was afraid before the mission. He said, "Humans always have fear of an unknown situation—this is normal. The important thing is what we do about it . . . the best antidote to fear is to know all we can about a situation. It is lack of knowledge which often misleads people when they try to imagine the feelings of an astronaut about to launch. During the years of preparation for Project Mercury, the unknown areas have been shrunk, we feel, to an acceptable level."

He said that when the countdown reached zero he could feel the engine start. The spacecraft shook, not violently, but very solidly, and there was no doubt when lift-off occurred. Glenn said that when the Atlas was released there was an immediate gentle surge that let him know he was on his way.

Insertion into Orbit

Speaking of the phase during insertion into orbit, Glenn said there was no doubt when the clamp ring between the Atlas and the Mercury spacecraft fired. He said there was a loud report and he immediately felt the force of the postgrade rockets which separate the spacecraft from the launch vehicle. He added that prior to the flight he had imagined that the acceleration from these three small rockets would be insignificant and that he might fail to sense them entirely.

Immediately after the separation from the Atlas the autopilot started to turn the spacecraft around to its normal aft viewing attitude. He said, "I could see the Atlas through the window. At the time, I estimated that it was a 'couple of hundred yards away'. After the flight an analysis of the trajectory data showed that the distance between the launch venicle and the spacecraft should, at this point, be 600 feet. . . . There was a large sized luck factor in this estimate; nevertheless, the facts do give an indication that man can make an adequate judgement at least of short distances to a known object in space. This capability will be important in future missions in which man will want to achieve rendezvous, since the pilot will be counted on to perform the final closing maneuver."

Orbit

Glenn said that after the autopilot turned the spacecraft around and put it in the proper attitude in orbit he received the times for firing the retrorockets and started the check of the controls. "This is a test of the control systems aboard the spacecraft. I had practiced it many times on the ground in the Mercury procedures trainer and the test went just as it had in the trainer. I was elated by the precision with which the test progressed.

"It is quite an intricate check. With your right hand you move the control stick, operating the hydrogen peroxide thrusters to move the spacecraft in roll, pitch, and yaw. With your left hand you switch from one control system to another as the spacecraft is manually controlled to a number of precise rates and attitudes.

"This experience was the first time I had been in complete manual control, and it was very reassuring to see not only the spacecraft react as expected, but also to see that my own ability to control was as we had hoped."

Attitude Reference

A number of questions had been raised over the ability of a man to use the earth's horizon as a reference for controlling the attitude of the space vehicle.

Glenn said, concerning this, "Throughout the flight no trouble in seeing the horizon was encountered. During the day the earth is bright and the background of space is dark. The horizon is vividly marked. At night, before the moon is up, the horizon can still be seen against the background of stars. After the moon rises (during the flight the moon was full), the earth is well enough lighted so the horizon can be clearly seen."

Co-Op Program Aids Both Sides

(Continued from page 8)

"He stays abreast of current developments in the space sciences, a technology which is moving so fast that this is a tremendous advantage. He may start out checking tubes or re-copying a dog-eared blueprint, but he learns why those tubes are so important and what that blueprint applies to. As he progresses, he will wind up taking an active part in experiments and doing the job of a junior engineer.

"In the process, he has a chance to demonstrate his various abilities within the field. We try very hard to develop specialized abilities and keep them in the job best suited to them, so that square pegs go into square holes.

"The government, too, benefits in that MSC becomes a known agency around the campus, and the less advertised benefits of government service are brought to the attention of possible recruits.

"A good co-op program is a great natural resource for improving the quality of our scientific personnel."

The student's transportation to and from the school during alternate on-the-job and formal educational training is paid by the government. The Training Branch assists him in finding housing in the Houston area for his work periods.

"We are getting excellent nominations from the schools," Hughes added. "We have the cream of the crop—talented, energetic young men of good moral fibre who are making a great contribution to our work. The program is growing at the same rate that MSC is growing, and it is growing in relation to the quality of our students. The future looks good—very good."

In addition to the five students from the University of Houston pictured on page 8, the following young men are now working in the program:

From Auburn University, J. Winston Blackmon and Kenneth W. Kornegay; from Drexel Institute, Stanley L. Adams, William E. Berry, Harry George Clauss, Jr., James F. Kuder, David H. Perel, Daniel B. Potochiniak, Howard J. Strauss and Harold A. Vang; from Fenn College, David D. Cope, Frank E. Hess, Dale G. Sauers, William D. Stuart; from the University of Florida, Mario E. Guerrero, John S. Hines and Wilbur K. Martindale; from Georgia Tech, William B. Cunningham, Joseph B. Fitzsimmons, James G. Tibbetts III and Alan H. Spring; from the University of Louisville, John Beld and Omer Boyd, Jr.; and from VPI, Norman E. Robertson.

Man Can Adapt, And He Plays Important Role Notes Report

"The MA-6 flight showed that man can adapt to spacecraft activities in a space environment in much the same way he adapts to his first flight in a new airplane. It is clear that man must play an integral role. The performance of Shepard, Grissom and Glenn . . . would seem to justify the selection of mature, experienced test pilots as Mercury astronauts."

These were the salient points in a five-page report on pilot performance by Flight Crew Operations Chief J. Warren North and his staff, presented in Washington, D. C. April 6 as part of a series of reports on MA-6 and its results. Co-authors of the report were North, Harold I. Johnson, Helmut A. Kuehnel, and John J. Van Bockel.

Network communications were excellent during the flight, the report said, but it was apparent at Mercury Control Center that the pilot was actually the only person with continuous knowledge of spacecraft systems, and was therefore in the best position to exercise control of the flight. Even during the period when Astronaut John Glenn was assessing the heat-shield malfunctions which occurred, he was still able to continue detailed systems reporting, make visual observations of weather, and take photographs.

Although most of the spacecraft flight events can be identified by control panel instruments, all three of the manned flights to date have shown that the first and most reliable indication was the sight and/or sound cue which came to the pilot directly.

During Glenn's flight, the automatic attitude control jets malfunctioned. For that reason, the pilot was on manual control during most of his last two orbits. When it was decided that the retrorocket package must be retained, the automatic retrojettison switch had to be left in the "off" position after retrofire. This interrupted the sequential system and made it necessary to control manually certain events from that time through the end of the flight. This included retaining the retrorocket package, pitching to reentry attitude, retracting the periscope, actuating the 0.05g reentry relay, and extending the periscope. Rescue aids were also depolyed manually after impact, in accordance with normal procedures.

In each case, the pilot took the appropriate action and got the desired result.

In contrast to the MA-5 mission, there was little concern regarding the ability of the spacecraft to complete three orbits. In fact the third orbit gave the pilot more time to experiment with the malfunctioning control system so that he could better perform retrofire and reentry. In general, Glenn found that he could easily orient the spacecraft in pitch and roll by using the horizon as a reference.

Yaw, or drift, is more difficult to determine, but by the end of the flight Glenn was able to determine yaw quite easily both in daylight and during full moonlight by using the window reference. During the flight, he used the procedure of pitching down to minus 60 degrees to pick up terrain drift due to the orbital velocity. He found that the periscope was not as useful as the window for determining drift on the nightside. Even with a full moon, the clouds were too dim in the periscope to pick up a specific point easily and follow it for yaw heading information.

He was able to observe the separated launch vehicle clearly when it was both above and below the horizon.

Direct observation of the sun through the window was no more annoying that direct observations from the surface of the earth.

Glenn found that weightlessness was pleasant, and in several respects easier or more enjoyable than the usual one-gravity condition on earth. Zero gravity, in fact, facilitated certain tasks such as using the camera, since he could leave his equipment hanging in mid-air when he was interrupted by other activities. He had no problem in reaching for and activating controls. He could move his head rapidly in each of three planes of rotation with no sensations of nausea or vertigo.

The pilot reported he could feel only the highest angular accelerations encountered during the flight. Most of the attitude maneuvers were conducted at rates lower than those that could be felt under one gravity.

Another point made in the report is that the similarity of the actual flight to simulations in the procedures trainer was excellent. The attitudes of the spacecraft between the flight and the trainer varied 10 degrees or less, while the rates varied less than one degree per second. The time used to complete the flight maneuver was almost identical to that in the procedures trainer.

The pilot made three 180 degree yaw manuevers during the MA-6 fiight. The first was a planned maneuver in which he minimized pitch and roll errors. The other two were done for the purpose of observing and taking pictures of the sunrise, and of the particles surrounding the spacecraft. Glenn had no difficulty making the precise 180 degree turnaround, using the window, while holding pitch and roll reasonably steady.

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SECOND FRONT PAGE

Gilruth Tells IRE Of MSC Programs

MSC Director Robert R. Gilruth spoke at the opening luncheon of the three-day conference of the Southwestern Institute of Radio Engineers in Houston last Wednesday.

He told the group that a radar unexpectedly was able to track astronaut John Glenn's Friendship 7 spacecraft even during the searing heat of re-entry.

Gilruth pointed out that "as a result, the tracking problem for the re-entry of the Apollo spacecraft after its trip to the moon may not be as great as we first thought."

He said that when Glenn fired his retro-rockets to slow down his spacecraft and re-enter the earth's atmosphere a shock wave was created in the air when he came down to about 25 miles. Its heat brought temperatures on the protective heat shield up to an estimated 3,000 degrees Fahrenheit.

Gilruth said that as had been expected, all communication with Glenn by voice radio or other signals from transmitters aboard the spacecraft was temporarily cut off. He explained that the atoms and molecules of the surrounding air had been stripped of electrons and had become ionized; that is, it had acquired an electric charge. Such a mass of air is called plasma by scientists.

Radar tracking of the flight was also expected to be temporarily interrupted but it was expected that radar could follow the general path by tracking the wake of the ionized air it left, much as meteors are tracked.

However, one of the numerous tracking radars being used got through to a transponder or signal reflector on the spacecraft. "It was the C-band radar," Gilruth said, meaning a radar using a frequency centered on 5,000 megacycles a second.

Referring to the re-entry problem for the Apollo spacecraft after circumlunar or lunar landing missions, he pointed out to the Institute members present that the problem will be much greater. He said the Apollo spacecraft will return to the atmosphere at an estimated speed of 36,000 feet a second, compared to about 25,000 feet per second as in the case of the Mercury spacecraft. Recent scientific calculations indicate that the re-entry heat for the Apollo will be many times greater than for the Mercury.

As a result, it will be necessary that the Apollo re-enter the atmosphere at a much less severe angle, thereby adding several minutes to the time required to pass through the heat barrier and adding to the recovery difficulties.

Gilruth told the engineers that the electronic equipment they produce will have to be much advanced to insure the very high reliability required for the more difficult future space flights planned by MSC.

He told them that the Mercury program is proving man's capability and effectiveness in space by a series of flights consisting of space probes, three orbit missions, and at later dates a seven orbit mission and an 18 orbit mission, and explained briefly the objectives of the Gemini and Apollo programs.

Gilruth stressed the importance of man on all these flights and said that "in essence, man is a highly diversified computer capable of changing his program."

Training And Aids Prove Invaluable To Crew Readiness

"Many hours were profitably spent in specialized training activities. . . . All of these contributed greatly to crew readiness for the orbital mission," said Astronaut M. Scott Carpenter in his report of astronaut preparation.

"At this stage of the Mercury Program, each spacecraft differs somewhat from its predecessors and a considerable amount of time must be devoted to the study of those differences." Part of this is done by formal briefings by McDonnell Aircraft and NASA engineers.

In addition, many hours of individual study were devoted to notes and publications which applied specifically to spacecraft 13.

A second important activity is participation, as a spacecraft observer, in the many systems checks during preparation for flight.

During early phases of training, the flight crew received a refresher course in night vision, and spent periods in a slowly revolving room and in a human disorientation device at the Naval School of Aviation in

(Continued on page 6)

UNIVERSITY OF HOUSTON Co-op students are shown with Co-op Coordinator Mervin Hughes, right, at the Rich Building as they look at a piece of equipment with which they will become familiar at a later date. Left to right are Bill Stagg, J. T. Edge, Tom Cobb, Pete Higgins and David O'Brien.

Co-Operative Education Program Combines School And Job Training

Some 36 industrious young men are presently working for Manned Spacecraft Center as fully paid government employees. At the same time, they are earning engineering degrees in any one of nine schools scattered all over the United States. When they are through with the five-year program, they will have not only that degree but two years of solid engineering experience, more maturity and developed abilities than the average graduate, an accumulation of Civil Service benefits and a chance to go right on working with the space program. The government will have a job-trained, well-grounded, experienced employee who has already proved himself.

The program is known as Co-operative Education. Begun only last year at MSC, it is administered by the Training Branch and is expected to prove of tremendous value to both sides.

Briefly, a student engineer in the Co-op Program first completes his freshman year of college, a minimum of two semesters or two quarters. By this time he has had engineering drawing, math, maybe some calculus. Thereafter, he alternates a semester or quarter of schooling with a semester of working for MSC as a fully paid technical assistant and later on, as a junior engineer. The problems he handles may be relatively menial at first, but they relate directly to his field and as his skill and his formal education grow, his tasks also enlarge. The program is an ambitious one and the schedule is full, for the student gets a four-year degree and two years of experience into a five-year period, working year-round.

Some of the men work at Cape Canaveral; plans are presently to place 28 there, but the rest, eventually about 80, will work at the Houston site. Most of the 36 already in the program are working in Houston now.

Inquiries come into the Training Branch every day from young men who would like to get in the program. Unfortunately it isn't that easy. The student must be attending a school which has a co-op program approved by the government. His grades must be above average (co-op students average a B-plus and some are straight-A students) and he must be first recommended to MSC by the co-operative education coordinator at the school he attends. MSC is now working with nine schools: Auburn University, Auburn, Ala.; Drexel Institute of Technology, Philadelphia, Pa.; Fenn College, Cleveland, Ohio; University of Florida in Gainesville; Georgia Institute of Technology in Atlanta; University of Houston; University of Louisville, Ky.; Southern Methodist University in Dallas; and Virginia Polytechnic Institute in Blacksburg. Other schools such as Mississippi State and LSU are eligible and may come into the program later.

Of those recommended as candidates for the program, only a certain number can be taken in, according to the number of available slots. There must be a qualified supervisor to watch over the work of each student trainee.

But for the lucky few, the benefits are enormous.

"This program develops the best engineer we know how to make," said Co-op Coordinator Mervin Hughes of the Training Branch. "We take in electrical, mechanical, aeronautical, and chemical engineers, math and physics majors, and the program will soon be open to textile engineers as well. We hire them in pairs, so that while one student is going to school the other is working here, giving us a full-time employee between the two of them.

"In the end we have a career engineer who has been employing the techniques we use for the past five years. It takes very little job orientation for him to become an effective employee.

(Continued on page 7)

Four Courses Open To MSC In Summer

Four engineering and math courses are being offered for MSC employees during the summer quarter by the University of Houston Graduate School.

The summer quarter begins June 4 and applications must be in to the Training Office in the Lane-Wells Building by May 15.

The four courses being offered are Partial Differential Equations, Classical Mechanics, Atomic and Nuclear Physics, and Statistical Thermodynamics.

A larger graduate program will be held during the fall quarter. Courses for the fall quarter will be announced at a later date.