Space News NASA ROUNDUP!

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19 Million Dollar Construction Contract Signed

White Sands Site To Include Staff From This Center

Approximately 100 MSC employees will be located at the Center's White Sands, New Mexico facility under MSC Resident Manager Wesley E. Messing, the Apollo Project Office said recently.

The White Sands facility is primarily for use by contractors in the Apollo program, and several hundred contractor employees will be working there.

NASA will have about 10 square miles on the far side of the Organ Mountains from the White Sands Missile Range operated be the Department of Defense, under an agreement worked out between NASA and DOD. The Army will have cognizance for safety controls, and NASA will have perimeter control.

Messings' office will have supervisory authority and some contractual authority. He will serve as a focal point of contact for MSC activities and provide coordination needed for the conduct of MSC test programs at White Sands, reporting directly to Apollo Project Office Manager Charles W. Frick.

Assistant Manager for the White Sands facility will be Robert W. Cantwell.

The installation will be divided into three areas; a

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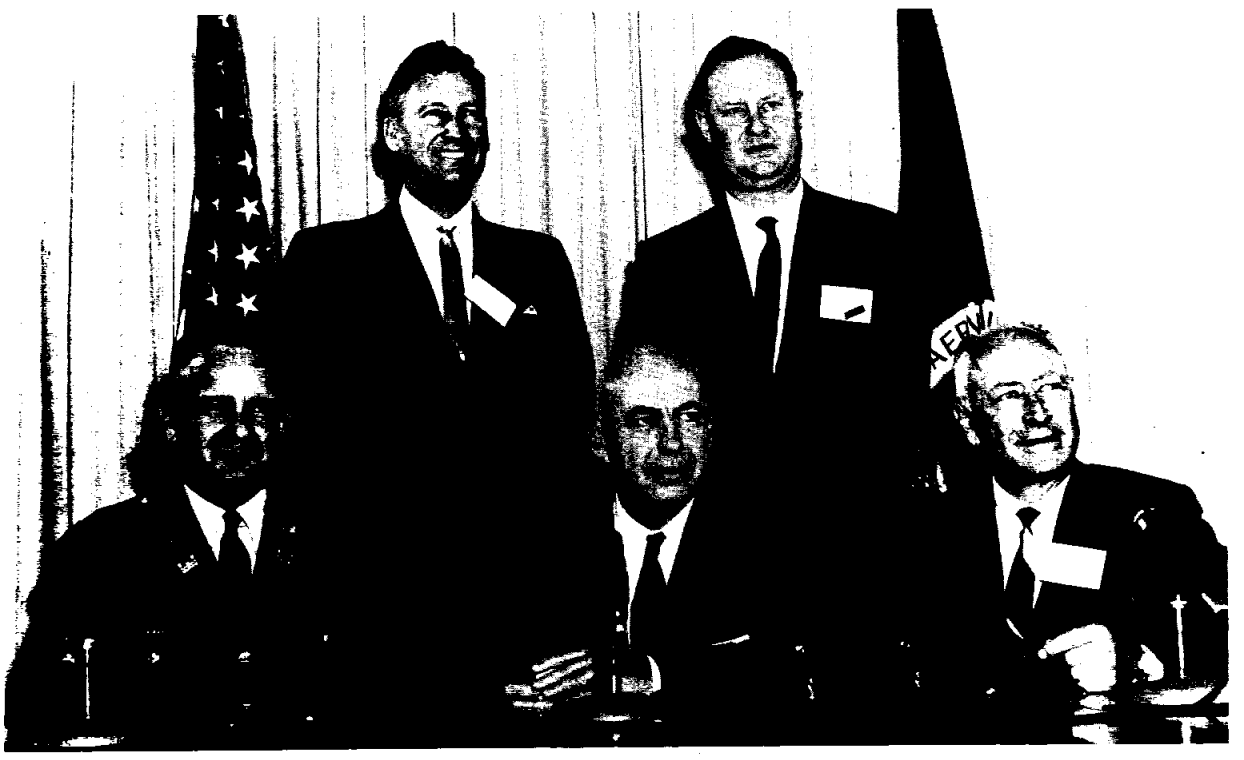


PRESENT AT THE SIGNING of the contract for Phase Three of the Clear Lake construction work were (standing) B. L. Perkins (left) vice president of Morrison-Knudson Construction Company, Inc.; A. V. Otjen (right) vice president of Paul Hardeman, Inc.;and (front row, left to right) Col. F. P. Koish, Ft. Worth District, U. S. Army Corps of Engineers; MSC Director Robert R. Gilruth; and Charles H. Leavell, president of C. H. Leavell and Company.

Budget Includes Basic Work Plus Seven Alternates

A $19 million contract for the construction of the major portion of buildings at the MSC's permanent Clear Lake site was officially signed in ceremonies at Farnsworth and Chambers Building December 3.

C. H. Leavell and Company of El Paso, Morrison-Knudson Company, Inc. of Boise, Idaho, and Paul Hardeman, Inc. of Stanton, Calif. will build 11 office and lab buildings in a joint venture.

The group was joint low bidder among seven firms which submitted bids opened November 7. Their base bid was $18,144,934.75 with an alternate bid of $18,700,879.12 for the basic construction plus a warehouse and shop building. At the time NASA had available some $18.9 million in available funds for the contract.

Col. Francis P. Koish, Fort Worth district engineer of the U. S. Army Corps of Engineers, who will supervise the work, said that additional funds had since been made available so that a contract for the basic work plus seven alternates could be awarded.

Included among the alternates were support buildings, a garage building, support office space, and certain added construction features in the basic buildings.

Work will begin shortly, Col. Koish said. Construction time according to the contract is to be 450 calendar days. MSC is scheduled to begin moving out of temporary facilities into the permanent site at the beginning of 1964, with most of the move to be completed in the first six months of the year.

Basic buildings included in the contract are the nine-story project management building, housing administrative and project engineering offices.

Other buildings include a cafeteria, the flight operations and astronaut training building, the crew systems laboratory, the technical services office and shop buildings, a systems evaluation laboratory, and SEDD lab and office building, a spacecraft research lab and office building and the data acquisition building.

Faget, Meyer, 7 Others To Share In Awards For Mercury Inventions

The Inventions and Contributions Board of the National Aeronautics and Space Administration will present cash awards totaling $8,800 to nine Manned Spacecraft Center personnel for four inventions in the Project Mercury program, it was announced Friday.

A special presentation ceremony is being arranged in the Office of NASA Deputy Administrator Hugh L. Dryden on Thursday, December 20. Awards for two inventions at Langley Research Center will also be presented at that time.

A representative will accept the awards for MSC, and will subsequently present them to the individual recipients in Houston.

The largest single award, for $2,500, will go to Maxime A. Faget, Assistant Director for Research and Development, for his work on the Mercury survival couch.

A $1,000 award will be presented to Andre J. Meyer, Jr. now chief of the Office of Project Administration in the Gemini program. It is for the vehicle parachute and equipment jettison system for the Mercury spacecraft.

Faget and Meyer will split another $1,500 for their joint invention of the emergency ejection device used in Project Mercury.

Faget, Meyer and seven others will share equally in a $4,200 award for the invention of the Mercury spacecraft itself. They are Jack C. Heberlig, assistant for manned spacecraft technology in Faget's office; William M. Bland, Jr., deputy manager of Mercury Project Office; Robert G. Chilton, head of the Flight Dynamics Branch of Spacecraft Technology Division; Willard S. Blanchard; Alan B. Kehlet, now with North American Aviation; Jerome B. Hammack, chief of Launch Vehicle Launch Systems Integration in Gemini Project Office; and Caldwell C. Johnson, Jr., chief of the Command and Service Module Office in Apollo.

MSC Authors Will Furnish Papers In AIAA Publication

Nineteen personnel from the Manned Spacecraft Center will present papers in the first issue of the joint American Rocket Society-Institute of Aerospace Sciences publication, "Aeronautics and Astronautics."

The two organizations are in the process of merging to form the American Institute of Aeronautics and Astronautics.

MSC Director Robert R. Gilruth will be guest editor of the first issue of the joint magazine, and Manned Spacecraft Center personnel have taken on the responsibility of providing most of the written material for the issue to be published in February.

Dr. Gilruth will write a guest editoral on the progress of manned space flight, particularly during the past year.

Special Assistant Paul E. Purser and Assistant Director for Engineering and Development Maxime A. Faget will be co-authors of "Engineering and Scientific Goals of the Early Phases of Manned Space Flight," a general rundown of the MSC programs, their objectives, and the steps the Center is taking to achieve them.

An article on Project Mercury will be written by W. M. Bland, deputy manager of the Mercury Project Office, and Dr. Charles A. Berry, chief of the Aerospace Medical Operations Office.

A paper on the Project Gemini design philosophy will be co-authored by James A. Chamberlin, manager of Gemini Project Office, and Andre J. Meyer, chief of the

(Continued on Page 3)

Credit Union Assets Top $100,000 Mark In Less Than Year

Assets for the MSC Credit Union went "over the goal post" this week to top the $100,000 mark by $496, an unusual record for a credit union which has been in operation less than 10 months.

The Credit Union recently received a $5,000 loan from another Federal Credit Union in El Paso, making a total of $29,000 borrowed from other credit unions to date, the maximum it is able to borrow at present.

A total of about $98,000 is outstanding in 182 loans.

Membership has reached a high of 452.

A dividend of between three and four per cent will be declared for depositors the 31st of this month.

Since available cash for loans is extremely low, depositors are urged to support the Credit Union with savings.

High Intensity Heat Invention Wins Cash Incentive Award

The Inventions and Contributions Board of the National Aeronautics and Space Administration has awarded $112.50 to George E. Griffith of Systems Evaluation and Development Division, Test Facilities Branch.

The award was made for Griffith's part in an invention entitled "High Intensity Heat and Light Unit," under the Government Employees Incentive Awards Act.

Awards of the same amount were also made to three other contirbutors to the invention, Eldon E. Kordes, now at Edwards test laboratory in California, Donald H. Trussell, presently with Avco Corporation and Deene J. Weidman, of Langley Research Center.

The patented device consists of a high-intensity radiative-type heat source to be used in supersonic wind tunnels which do not possess the capability of providing aerodynamic heating. Such heating occurs in supersonic flight within the earth's atmosphere and is a function of altitude or air density and velocity.

Although many tunnels can duplicate the desired density, velocity and aerodynamic forces, few can also duplicate the associated aerodynamic heating. This device simulates test specimen surface heating but does so by radiative rather than convenctive means.

The first full-scale heater was used by the Boeing Airplane Company in 1959 in the Langley Unitary Plan Wind Tunnel, in a series of tests on Dyna-Soar panels. It consisted of 96 quartz-tube lamps arranged in three banks for three-phase electrical operation; a grooved aluminum reflector backed by a water jacket; and special lamb end connectors for minimizing lamp vibration and for easy lamp replacement.

For these tests the heater was mounted in one wall of the test section and the test panels were located in the airstream opposite the heater. During the tests the degree of heating was controlled as desired by the project test engineer.

The addition of the heating device, which produced surface temperatrues in excess of 700 degrees F., allowed the panels to be subjected to the aerothermodastic environment associated with flight in the moderately low Mach number range.

Movies

(Continued from Page 8)

Congressional Report" and "Second Congressional Report," half-hour color films.

The Seventh, Eighth, Ninth, Tenth and Twelfth Quarterly Report films cover succeeding developments in Project Mercury up to September of this year.

"Prelude to Orbit" covers the development of the Atlas launch vehicle; "Network to Space" shows the formulation and operation of the Mercury tracking station network. "Research and Development," primarily a technical film, traces the histroy of the development of flight into space.

"Reach for Space" is a film record of all launchings in the Mercury program in which a production spacecraft was used.

"Manned Spacecraft Center" shows the team effort in managing the country's first manned space program.

"Project Gemini Mission Concept" introduces, explains and develops the objectives of Project Gemini.

Persons interested in using any of these films are invited to call Audio-Visual Services, extension 3491. A film list, including the length, type and subject matter of each film is available.

Y. W. C. A. Offers Classes, Events To New Residents

The Houston Y.W.C.A. is sponsoring a number of Christmas events in its branches and centers. There will be a Posada, the Latin American ritual simulating the seeking of lodging just before the birth of Christ, at the Downtown Branch December 19 beginning at 7 p.m.

A number of classes in languages, arts and crafts, bridge, sports, knitting and sewing will begin in January. Of special interest are classes in Parliamentary procedure, vocational guidance for mature women, international cooking, and fun in music, art and drama for children.

Those interested in joining any of these classes are asked to telephone the branch or center nearest them.

White Sands

(Continued from Page 1)

central office area for NASA, North American Aviation Co., and Grumman Aircraft Engineering Corp. plus a guard station, fire station and service area (NAA and Grumman are building spacecraft assembly and test buildings there); a test area for NAA, including fuel tankage and an integrated systems test stand, for use in testing the Apollo service module only; and a Grumman test area for static tests on lunar descent engines.

Systems qualifications test utilizing Little Joe II, similar to Little Joe tests conducted at Wallops Island, Va., for the Mercury program, will be conducted at the Army's launch facility at White Sands. Their purpose will be to qualify all hardware essential to man's safety. Abort system tests are scheduled to be in next summer, with Little Joe II tests to come in early 1964.

Static tests at the NASA test stands probably will begin in the second quarter of 1964.

Centrifuge

(Continued from Page 8)

will be of heavy structural steel, and the facility will be powered by a direct current electric motor.

Preliminary design studies were made by Ford, Bacon and Davis, Inc. of New York. The U. S. Corps of Engineers is negotiating with the firm to do the detailed design. Including design, development and construction the facility and the round concrete and steel building which will house it are budgeted at $10.63 million.

MSC Photographers Specialize In Skilled Scientific Work

Say the word "photographer" and most people think of a man who covers news events or the studio where they had their portrait made last year.

But the art of scientific photography in an organization devoted to research and development is something else again.

In addition to a basic knowledge of photographic techniques, it calls for a thorough aquaintance with the latest cameras, specialized procedures involving super-fast films and multiple lighting arrangements, a knowledge of the procedures used in engineering tests, and sometimes—insofar as MSC is concerned—a pilot's rating as well.

The General Photographic Branch of MSC's Photo Services Division, headed by Eugene Edmonds, is "up to its ears" in this kind of highly refined photography.

The branch is responsible for all photographic requirements in Houston and at the locations where the Center's contractors are at work. In addition to supporting the Audio-Visual section of Public Affairs in still and motion picture documentary work, it takes care of engineering and research requirements for still photography and scientific motion picture photography for all research programs, operational tests,engineering projects and the like.

The branch's nine still and motion picture photographers are an active lot. Since MSC monitors photo work done on the Center's projects at Edwards AFB, Calif. China Lake, El Centro, and McDonnell Aircraft in St. Louis and provides support where necessary, they must often travel.

A glance at the schedule for the next several weeks, for instance, shows one group getting ready for pictures of the next spacecraft drop test in Trinity Bay, another man en route to Langley AFB for scientific motion pictures of tests going on there, another scheduled for Providence, Rhode Island, a fourth going to Johnsville, Penna. and the Navy's acceleration test facility there, and another on his way to California.

"We have experience in taking stills and movies of such tests as high arc-jets, plasma jets, wind tunnel work, high speed rocket sled runs, static rocket firings, spacecraft drop tests, and flying photography from jet chase planes," commented Edmonds, who worked for Langley Research Center before joining MSC. "We can do shadow-graph as well —photos of supersonic shock waves generated in wind tunnels and other devices."

"An engineer called me the other day wanting to know where he could get some information on a Fastex camera to be used in an altitude chamber. He was amazed when I told him we had one of our own, and offered to send one of our boys up there to work with him on what kind of lighting arrangements he would need. But this is the kind of thing we handle all the time."

Another highly exotic field the photo branch is involved in is consulation on photo instrumentation for future spacecraft and future missions—for instance, designing a hand camera to be used on the moon.

In addition to 16 and 35 mm motion pictures, with or without sound, at regular speeds, branch photographers can handle metric data cameras which take anything from a single frame per second to 8,000 frames per second, with pulse correlated shutters to snap pictures at any given interval and devices to start and stop the camera remotely.

For instance, the Fastex camera mentioned previously employs a rotating prism. coupled with a unit to step up the voltage, it can record the results of a high-speed test operation at up to 8,000 frames per second. This performance is highly useful in recording split-second results of an explosion or a static test firing. The Millekin camera provides pictures of excellent quality and better resolution at the somewhat slower speed of up to 400 frames per second, using a regular film transport mechanism. It can be run from either an AC or DC Current.

Color films now available make it possible to take color movies under extremely poor lighting conditions at high speeds. Advanced black and white films which can handle super high-speed photography and yet can be processed in at normal temperature and time have also been developed. Such aids are necessary in scientific photography and require skilled handling.

Branch photographers spend quite a bit of time off the ground, as well. They take all types of aerial photographs from helicopters, light planes and high performance jets. They do still and motion picture photography under water.

And when not taking pictures, they are likely to be designing and mounting cameras and lights for test pictures under all kinds of conditions, or consulting with engineers on the same subject.

BILL LANDERS of the general photography branch of Photo Services uses a telephoto lense almost bigger than the camera to take movies of parasail drop tests at Ellington AFB.

A $6 MILLION CONTRACT for the Little Joe II solid sub-orbital vehicle went to General Dynamics/ Convair of San Diego, Calif. November 28. Shown with the contract are J. H. Famme, president of General Dynamics/Convair (seated); and (left to right) J. Harris, contracts manager for the Little Joe II at Convair; C. D. Sword, Apollo procurement chief; and J. Hurt, Little Joe project manager at Convair. This is the first major hardware contract definitized for the Apollo test program. Little Joe will be used for testing the Apollo command and service module payload in high sub-orbital trajectories.

MSC, G/D Computers 'Talk' To Each Other Long Distance

A computer-to-computer program to report progress of an important segment of the Apollo moon project is now in operation between General Dynamics/Convair in San Diego, Calif. and MSC in Houston.

The new automatic data transmission system may be making MSC the fastest and most accurately informed customer in the world. And it's as simple as making a long-distance phone call.

In a five-minute computer chat over the phone, GD/Convair is transmitting to NASA a complete two-week progress report about the Little Joe II launch vehicle program.

In comparison with the best previous method of transmittal, which was by teletype, the computer-to-computer system saves a minimum of four hours. The possibility of errors is virtually eliminated, because the data must no longer be converted and copied from one from to another.

GD/Convair is the first NASA Apollo program contractor to put the highspeed automatic data transmission system in operation. Little Joe II will be used to launch the Apollo spacecraft on unmanned, suborbital test flights, the first of which is scheduled for mid-1963.

All pertinent information about each phase of Little Joe II design, fabrication and assembly is contained on 300 IBM data cards.

The problem was to get the updated information for each two-week period to NASA without converting and copying it from the keypunch format. NASA requires prompt and accurate notification of each key event in the Little Joe II program so that it can forecast problem areas and take immediate preventive or corrective action.

The problem was solved by running the cards through an IBM transceiver which reads the information electronically into a special Data-Phone.

The data is transmitted directly over telephone lines and duplicate cards are reproduced in Houston.

Gombos Oscillator Chosen For Use In Gemini Craft

A new, lightweight miniature oscillator developed by Gombos Microwave Inc., Clifton, N. J., a publicly-owned manufacturer of electronic subsystems and components, has been chosen for use on equipment being built by the Defense Systems Department, General Electric Company, at its Utica, N. Y., plant for the Gemini space project.

The new Gombos oscillator is a product weighing only 4½ ounces and measuring 1.50 x 2.69 x 1.625 inches. Its stability at high frequencies, notable for a unit of such small size, makes the Gombos development desirable for space exploration equipment where maximum performanc in miniaturized equipment is essential.

Gombos' new Model 151C "C" Band Triode Oscillator is now in full production and is available for use in a wide variety of missile, aircraft and other electronic systems and sub-systems.

Representatives of industry and other non-NASA employees who may be authorized to receive classified information are responsible for protecting NASA classified material in the same manner as NASA employees.

Two Apollo Test Mockups Are Delivered To Northrop

Two full-size test modules of the Apollo spacecraft were recently delivered to the Northrop Corporation's Ventura Division, which is producing the earth landing system for the spacecraft.

The 13-foot diameter steel modules were delivered by truck with a guard convoy from North American Aviation's Space and Information Systems Division in Downey, Calif. To Van Nuys, Calif.

Northrop will equip the two boiler plate modules with earth landing systems in preparation for drop tests from an airplane. These tests are scheduled to be held in the Salton Sea early next year.

Northrop Ventura designed and produced the system which lowered all Project Mercury Astronauts and will be used in the coming one-day mission. It holds a contract to design and develop a landing system for Project Gemini, and is also designing and testing recovery systems or other advanced space and planetary exploration vehicles.

Hughes Aircraft Will Build Amplifiers For Space Communications

The Microwave Tube Division of Hughes Aircraft Company has been selected by the Collins Radio Company to furnish the traveling-wave type amplifier for deep space communications aboard the Apollo spacecraft.

North American Aviation holds the principal contract for the command and service modules of Apollo, with Collins as a subcontractor. Collins has a portion of the systems communications system contracts.

The deep space system aboard Apollo will be designed to operate up to 240,000 miles out in space.

Papers

(Continued from Page 1)

Gemini Office of Project Administration.

"Facilities for Manned Spacecraft Development" will be handled as a three-part article. J. N. Kotanchik, assistant chief of Systems Evaluation and Development Division, and H. K. Strass of the Test Facilities Branch will concentrate on research and development; H. T. Johnson will write the simulation and training part of the article; and operations will be handled by John D. Hodge and Tecwyn Roberts of Flight Operations.

"Ground and Flight Crew Operations" will be written by D. Day, S. A. Sjoberg and Don Corcoran.

An article on the role of space stations in manned spacecraft development will be broken into three papers: one on space station missions by E. H. Olling; one on configuration study by O. E. Maynard and R. A. Berglund, and another on space transportation by C. W. Matthews, chief of Spacecraft Technology Division, from which all the authors are drawn.

A paper on the pilot satety program for the Mercury-Atlas launch vehicle will be written by Ben A. Hohmann, systems engineering director of the Mercury-Atlas launch vehicle program with Aerosapce Corporation. He is the only author not employed by MSC.

Scientists know more about the surface of the moon than they know about the botton of the ocean.

Office Procedures Course Being Held At Cape Canaveral

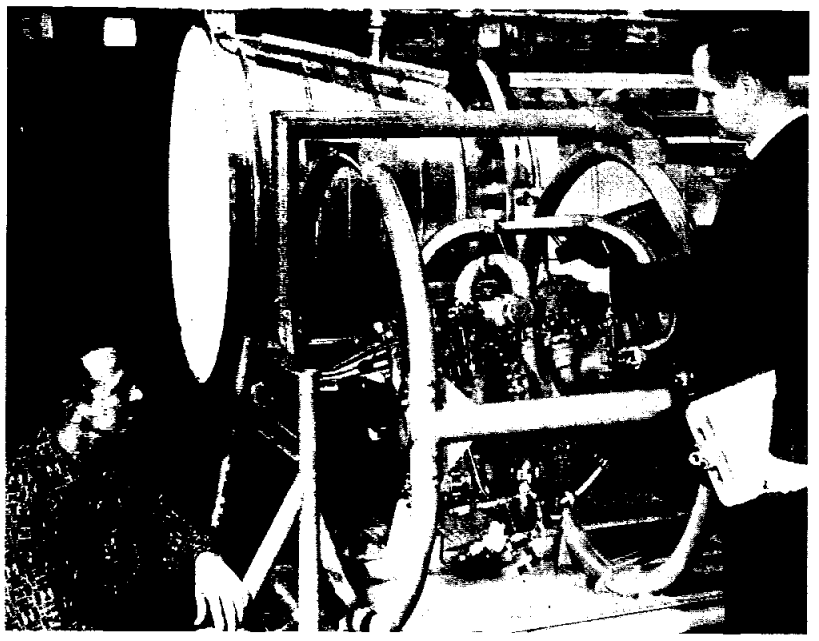
A course in correspondence and office practices is being held for about 25 MSC secretarial personnel at Cape Canaveral Tuesday and today.

Instructor for the course is Doris Kresge, chief of the Steno Services Branch of Personnel here in Houston. Assisting her are Sylvie Kelarek of the Office of the Assistant Director for Administration and Jim DeMuth of Financial Management's Accounting Branch.

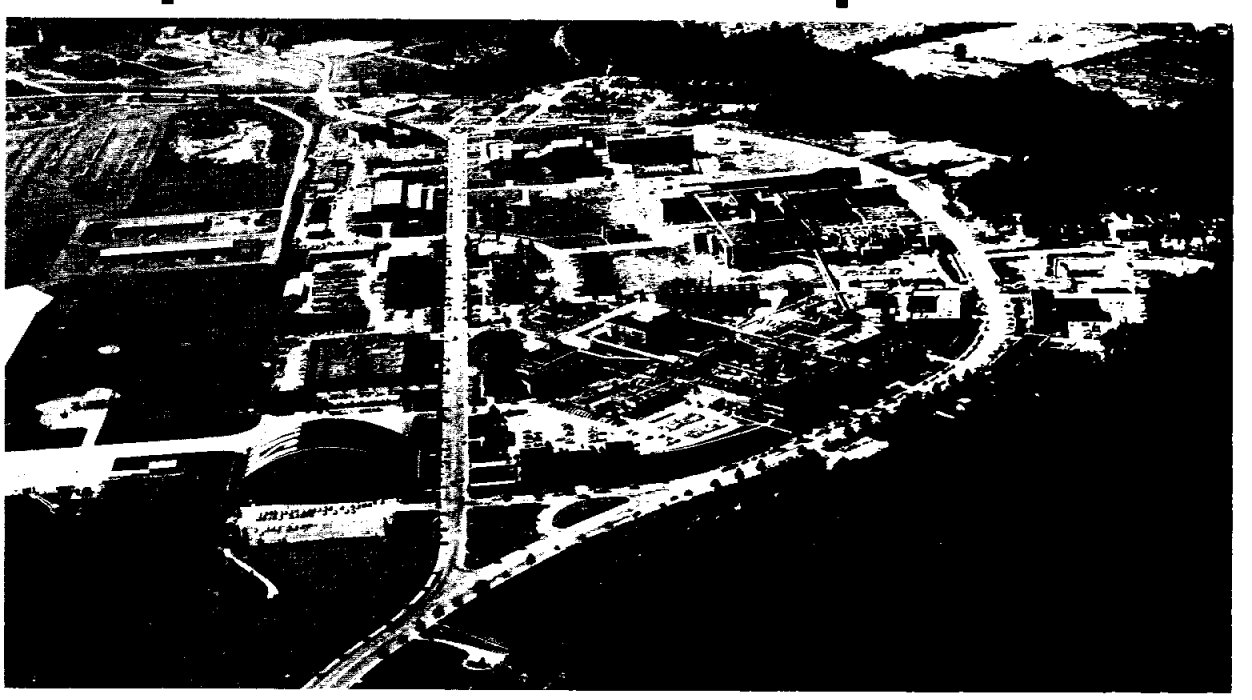
The course is the same one taught in Houston at East End State Bank Building in November and again December 5. It will be offered again at MSC in Houston January 4.

SIX YOUNG COLLEGE GRADUATES in the Management Internship program at MSC have entered the second phase of their year-long internship with specialized assignments. Here Phil Whitbeck (far right), deputy assistant director for administration discusses assignments in various MSC offices with (left to right) Paul Liebhardt, Earle Young, Ray Hasset, James Richards, Jerry Ann Penno and Mark Johnston. Liebhardt and Johnston are in Procurement, Young and Richards in Financial Management, Hasset in Public Affairs and Jerry Ann Penno in Center Management.

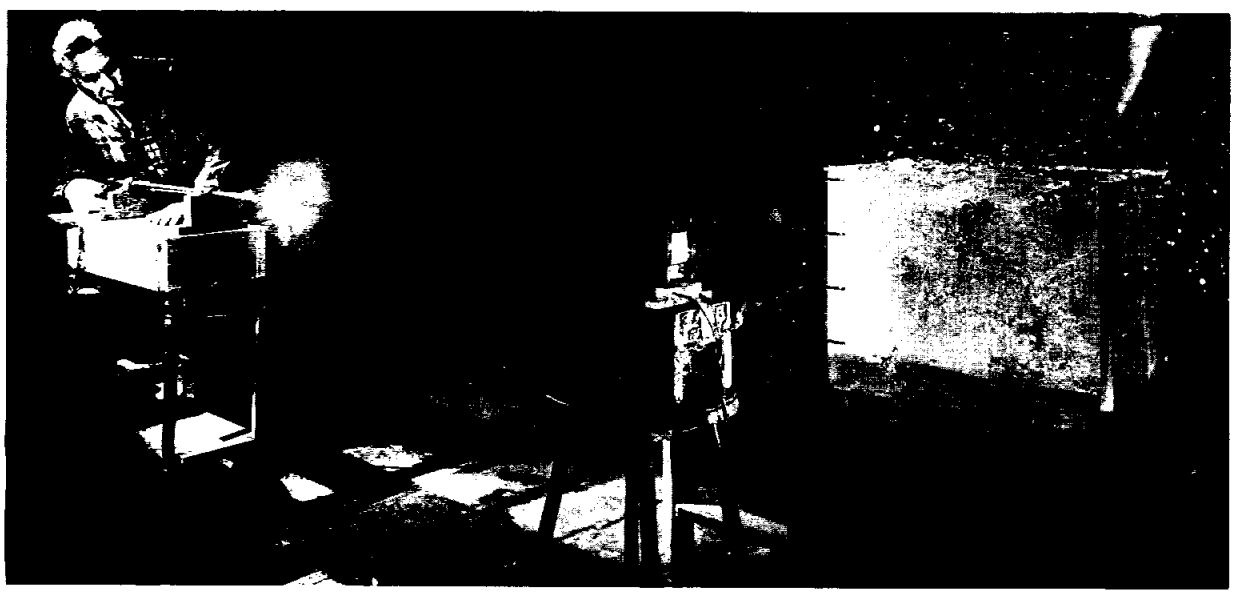
Lewis Research Center Specializes In Propulsion Prob



LEWIS SCIENTISTS inspect the recently developed Centaur rocket engine. Lewis was assigned program responsibility for the Centaur and M-1 projects in September. Centaur will be used to place satellites in high earth orbits, launch interplanetary probes and to soft-land instruments on the moon.



LEWIS RESEARCH CENTER in Cleveland, Ohio is the advanced propulsion research and development facility of NASA. Nearly 4,000 scientists, engineers and skilled support personnel are employed at this 350-acre site near Hopkins Airport.



IMPACT STUDIES to simulate damage to liquid filled tanks by high velocity minute particles in space are among the many projects underway at Lewis.

When Americans reach the moon – and eventually the planets beyond—much of the research and development in space technology will have evolved from work by scientists at NASA's Lewis Research Center in Cleveland, Ohio.

Designated as NASA's principal propulsion facility, the $165 million Lewis laboratory has a staff of more than 4,000 employees—including some 1300 scientists and engineers – currently involved in research and development of the many problems embraced by space technology.

Designed and built in 1941-42 under the National Advisory Committee for Aeronautics, NASA's predecessor, Lewis has emerged over the past two decades as the nation's most experienced facility for studies concerning aeronautics, nuclear, electric and chemical power sources, as well as advanced ideas involving thermal and solar energy conversion systems.

Located on a 350-acre site adjacent to Cleveland's Hopkins Airport, Lewis also operates a nuclear research reactor and rocket test site at the Plum Brook station located in nearby Sandusky, Ohio. Recently, the Atomic Energy Commission granted the NASA authority to operate the reactor at full power to study shielding, materials, and component problems of nuclear propulsion systems.

Director of the center is Dr. Abe Silverstein, a native of Terre Haute, Indiana who began his scientific career with the NACA in 1929, at Langley Research Center. His first tour of duty at Lewis began in 1943, where he pioneered in research on large scale ram-jet engines, and was responsible for conception, design and construction of this nation's first supersonic propulsion wind tunnels.

At the main Lewis laboratory in Cleveland unique tools of research are employed to study flight propulsion problems from the chemistry of fuels through the operation of full-scale engines. These studies are conducted under simulated conditions of high-speed and high-altitude flight and space environment. Research facilities include advanced rocket test units; laboratories for electric propulsion, space environment, and materials and structures research; central data and recording systems; apparatus for research into nuclear energy problems; and other specialized equipment.

Once the capability of earth orbital flight has been achieved, the next goals become the moon and the nearby planets. Analyses have shown that chemical propulsion will best meet the requirements of boost through the atmosphere and the various lunar missions. For more ambitious planetary missions, however, advanced nuclear and electric systems for spacecraft propulsion starting from earth orbit must be considered. In these more exotic schemes, man is buying efficiency, or more pounds of thrust per pound of propellant per second.

This is called "specific impulse," and it is not unlike getting better fuel economy in our cars, or more miles per gallon. For example, we can compare the potential specific impulse of the various propulsion systems somewhat as follows: 450 seconds for the high-energy chemical systems, 900 seconds with a nuclear rocket, and 5 to 10,000 seconds with an ion engine. The ion engine is characteristically a constant-low-thrust device with thrust measured in fractions of a pound. Consequently, this system is limited to space operations and necessitates very long unattended operating lifetimes (measured in years), and large amounts of on-board electrical power.

The nuclear rocket is presently limited to space applications because of associated radiation hazards during operation within the atmosphere.

To meet the demands of high system reliability, large ground-based space-environment facilities are being used to simulate actual operating conditions as closely as possible. These consist of large vacuum chambers with walls cooled with cryogenic fluids down to temperatures in the order of 400°F below zero. In some cases, high-intensity-arc light beams are used to simulate solar thermal radiations. In such facilities detailed performance and reliability evaluations are made of the various propulsion and power systems. At Lewis, several chambers are already in being—more are planned for the future.

At the Plum Brook facility, Lewis scientists and engineers study the shielding, materials and component problems of nuclear propulsion systems in the nuclear reactor facility, and conduct large scale rocket experiments in a number of rocket test areas.

Plum Brook's $15 million research reactor is capable of producing 60,000 kilowatts thermal at full power, with a flux density of 10 to the 14th power neutrons per square centimeter. (That's more than a million times a million neutrons shooting through a single square centimeter every second.)

Studies in the reactor center around future plans for a rocket vehicle propelled by a nuclear engine.

This is Project Rover, a joint NASA-AEC program involving radiation damage of materials, propellant system dynamics and engine control components for NERVA (Nuclear Engine for Rocket Vehicle Applications).

The propellant probably will present the same problems in a nuclear rocket that it does in a chemical rocket—plus one more. Radiation from the reactor must be kept from the stored fuel. Thus, shielding materials are a vital part of the reactor's research program.

Another project is concerned with the behavior of lubricants when exposed to radiation and widely varying temperatures for an extended period of time. Experimental facilities in the reactor include "beam" and "through" holes to furnish varied energy intensities to test materials.

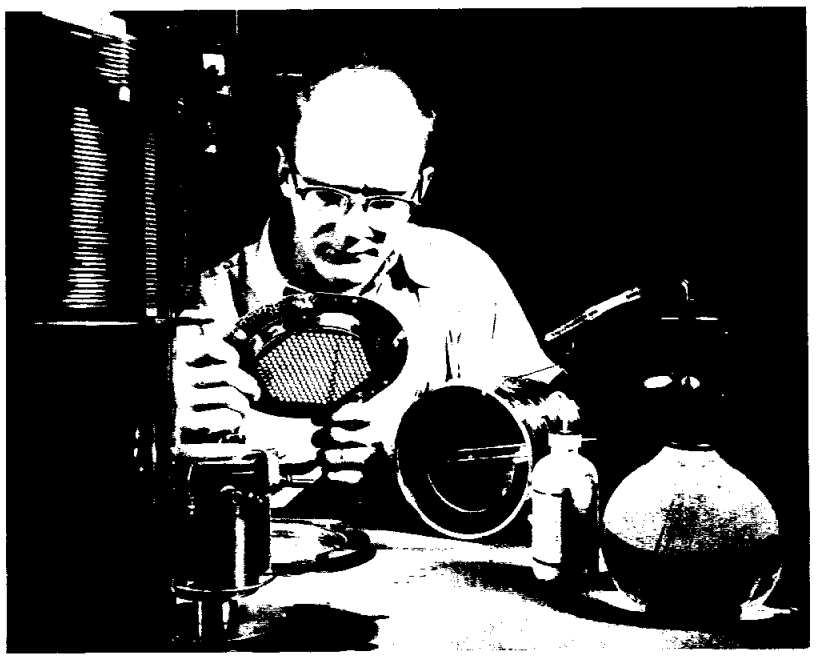
The rocket facilities—where live, rocket engine tests are conducted—were designed to study both the operation of complete rocket engine components and new high-energy or "exotic" fuels. Exotic propellants such as liquid hydrogen and liquid fluorine produce considerably more thrust than conventional chemical fuels. But they cause considerably more problems too. New structural materials must be found to build engines and rocket nozzles that can withstand combustion temperatures around 6,000 degrees F.

Dr. Abe Silverstein
Director
Lewis Research Center

Even the storage of these exotic fuels is a problem. In its liquid state, hydrogen must be kept at temperatures as low as 420 degrees below zero. New fuel tanks must be designed to shield the liquid from the intense heat of the rocket engines behind it. Tank studies on this problem form another segment of Plum Brook's work. Still another problem involves research into new types of

ems, Including Those Of Future's Nuclear Engines

AERIAL VIEW OF THE CENTRAL PORTION of the Lewis-operated Plum Brook facility near Sandusky, Ohio shows the Plum Brook Research Reactor (within the domed structure at center). Adjacent support buildings include office and laboratory at front and "hot" laboratory at right. At rear are the pump house and service equipment buildings, while the fan house and waste water retention tank areas are at extreme right next to the stack.



A TECHNICIAN CHECKS components of an ion engine at Lewis Research Center. Sometime next year Lewis engineers will launch test craft containing two electric or ion engines on sub-orbital ballistic flights from NASA Wallops Island Station, Va.

turbo pumps for use in advanced engines.

Although currently involved in advanced studies related to space programs, Lewis Research Center has contributed greatly to the advancement of aeronautics during the past 20 years. Significant contributions since 1941 include solution of the B-29 engine overheating problem; development of a thermal ice-prevention system for aircraft; and design of a water inerting system preventing fire following an air-

Alan D. Johnson
Director
Plum Brook Test Station

craft crash.

The Center also was responsible for early work in the areas of jet noise suppression, thrust reversal devices for jet aircraft, turbojet afterburners, supersonic inlets, and transonic compressors.

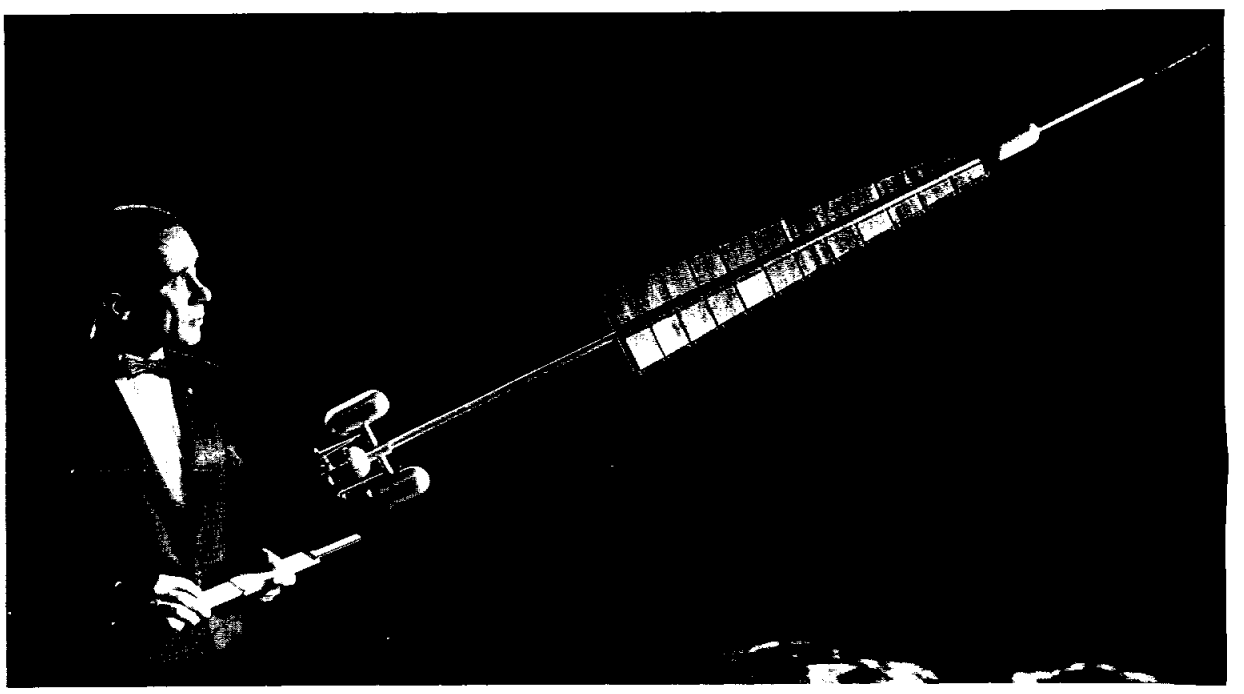
Project Mercury, managed by MSC, has also drawn heavily from research efforts at Lewis, whose scientists provided basic information on solid fuel rockets and the design of the rocket escape system for the capsule. In addition, Lewis engineers constructed and operated a "multi-axis test facility" to aid in training the astronauts in techniques for controlling the capsule during periods of tumbling.

Valuable research leading to the design of the 1,500,000-pound thrust Saturn rocket also was conducted at Lewis using the Center's 8- by 6-foot supersonic wind tunnel. At the same time, other Lewis scientists concerned themselves with studies involving the development of high-energy fuels for the upper stages of Saturn and Centaur and work on propulsion systems and materials for interplanetary space travel.

Research and development is now underway on the many problems associated with Project Apollo. Lewis Research Center is involved in such related investigations as the studies of zero gravity affects on propellant handling, meteoroid protection for tank structures, materials at cryogenic temperatures, propulsion system control and interaction effects, thrust chambers, nozzles, and auxiliary power systems.

In September of this year Lewis was assigned program responsibility for the Centaur and M-1 projects. The NASA Centaur space vehicle is being developed as the nation's first high-energy rocket system. It will be used to place satellites in high earth orbits, to launch interplanetary probes and to soft-land instruments on the moon. The M-1 engine, developing 1.2 million pounds of thrust, is planned for future space missions in the Nova vehicle.

Sometime next year, Lewis engineers will launch test craft containing two electric or ion engines on sub-orbital ballistic flights from the NASA Wallops Island Station in Virginia. This program is designated SERT—space electric rocket test.



THIS IS THE ELECTRIC space vehicle model for a projected eight man expedition to Mars in the planetary exploration which will follow successful landing on the moon. Exploration of Mars and Venus, once a science-fiction dream, is now closer than we think, say Lewis scientists.

Herein, the performance of electric engines or beam neutralization effects will be determined to correlate results with ground facility tests.

Lewis scientists are also working on solar energy conversion methods, taking energy from the sun's radiation and converting it to electricity. Using nature as an energy source, we can minimize the need to lift heavy system components off the earth.

Much of the research at Lewis during the past 20 years has contributed to other scientific areas. For example, fluid system engineers there succeeded in helping heart specialists at the famed Cleveland Clinic design a mechanical heart which someday may function as a working substitute for an actual human heart. Many other applications have aided American industry as well as mankind in general.

In preparation for the gigantic effort on the Apollo program and other projects at the Plum Brook facility, the Lewis scientific structure was recently reorganized to embrace both research and developmental responsibilities. This will develop a strong, active link between basic research areas (heat transfer, fluid mechanics, propellant chemistry, combustion, materials, etc.) and the actual design of flight systems and vehicle applications. This new managerial structure gives Lewis the capability to achieve a true space technology program.

To keep pace with the rapidly expanding space age, Lewis has—and is—experienced a vast expansion program, with the completion of new laboratories for studies of energy conversion, electric propulsion and materials and structures. A $40 million construction program at the Plum Brook reactor during fiscal year 1963 is expected to include facilities for research in space and lunar propulsion, nuclear rocket dynamics and hydrogen heat transfer. A $4.7 million development engineering building is planned at the main Lewis laboratory.

A large portion of the new budget will be used to build a Space Propulsion Facility. The "space tank" is designed to be 126 feet high with ground dimensions of 506 and 326 feet. Within the aluminum tank an environment comparable to that in outer space will be simulated to test lightweight chemical and nuclear rocket engines—their ignition, control and re-start capabilities will be of particular interest. The environment of the tank can be kept at liquid hydrogen temperatures (−423°F.) and 10^{-8} millimeters of mercury pressure for up to two weeks. (That's a pressure comparable to that at an altitude of 190 miles.) In addition, the tank can operate for 90 days at less rigorous space conditions for tests on long duration performance rocket engines and their components. This allows "cold soak" work—or, checking out the rocket component after long term exposure to extreme environments. In the cold of space, it is possible for a bearing to "weld" into the touching metal. Plum Brook's space tank is a way of being sure that the final components of a spacecraft will not cold weld once they are in space.

Another new facility on schedule is the hot hydrogen heat transfer facility. This will heat hydrogen gas to temperatures around 4500°F. before passing it through a rocket test nozzle.

Editor's Note: This is the sixth in a series of feature articles about the activities of other NASA installations. The information concerning Lewis Research Center, its facilities and its program was supplied by the Lewis Office of Public Information.

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On The Lighter Side

Tom-Tom Talk on Moon?

Lip reading, Indian sign language or even the jungle drum tom-tom code, may have to be man's emergency languages when he gets to the moon.

Advanced research experts at Aerojet-General Corporation say there will be no normal conversation on the moon. With no "atmosphere" like the earth's, there will be nothing in the completely clear void to convey sound waves.

As a result, radio will be the only answer, and if that konks out—no more communication, unless they use lip reading, sign language or written messages.

And because it is smaller than the earth, the "horizon" on the moon will be three miles away. Beyond that horizon, even the radio will not work.

The Aerojet researchers cite the frightening prospect of a man wandering three miles away and getting hurt.

Without an earth-like atmosphere, his shouts for help couldn't be heard, a balloon could not rise to signal his distress, neither could smoke signals.

That's where the tom-tom signal system might work. Using the surface of the moon itself as a drum, he could "beat" it by firing a series of pistol shots into it as a prearranged SOS distress signal.

Then seismograph equipment, like that used to record eqrthquakes, could pick up the SOS and rescuers could be sent. And just as they couldn't hear him cry help, neither could they hear him say thanks in the atmosphere-less void.

But, on the other hand, when he finally got back to his moon home, he wouldn't have to listen to his wife's scolding either, which is a notable example of a silver lining in a place without even a cloud to go with it.

—Cartoon by Pete Bentovoja, Los Angeles Examiner.
Copy by Don Bailer. Reprinted courtesy of Aerojet-General.

EDITORIAL EXCERPTS

Santa Monica Evening Outlook
November 9, 1962

HUGHES COMPLETES 'HOVERING' SATELLITE

Hughes Aircraft Co. today reported the final assembly, at its Culver City plant, of "Syncom," man's first high altitude synchronous communications satellite.

The completed spacecraft, first of three flight models, is undergoing final checkout before delivery to National Aeronautics and Space Administration at Cape Canaveral where it will be launched early in 1963, Dr. Allen E. Puckett, Hughes vice president and Aerospace Group executive, said.

The satellite, built under a multimillion-dollar contract from NASA's Goddard Space Flight Center, will mark man's first attempt to launch a communications satellite into a circular orbit 22,300 miles above the earth—and keep it there.

At that altitude the spacecraft's speed matches the speed of the earth's rotation and it will appear to hover in the sky, Puckett said. Therefore, Syncom can provide uninterrupted service 24 hours a day.

While the first Syncoms will be for experimental use only and of limited communications capacity, Hughes has already started building subsystems and an engineering structural model of a more advanced version that will have capacity for 1,200 two-way telephone channels or four television channels.

WELCOME ABOARD

Manned Spacecraft Center acquired 54 new employees between November 18 and November 30, 1962.

Gemini Project Office: Louise B. Knage, Mildred A. Field, and Charles K. Williams.

Apollo Project Office; James B. Winn, Juanita D. Pierce, Norma J. Walker, Luara A. Brooks, and Carl B. Peterson.

Spacecraft Technology Division: Ben W. Holder, Richard B. Davidson, Dennis A. Sevakis, Dennis M. Olsen, and William F. McInturf.

Crew Systems Division: Margaret Jackson, Frank P. Stelmack, W. Carter Alexander, and Frank Collier.

Systems Eval. And Devel. Division: Darrell A. Vandiver, Lonnie W. Jenkins, Bernard Brasfield, Donald C. Cole (Cape Canaveral), and John Grimand.

Preflight Operations Division: Marlin L. Bopp. Thomas M. Crutcher, and Ronald C. Butterworth.

Flight Operations Division: James S. Arthur, and Mary G. Ragsdale.

Flight Crew Operations Division: John D. Sargent, Alyce M. Dillinger, and John G. Waters.

AMR Operations Office (Cape Canaveral) Malcolm V. Britt.

Ground Systems Project Office: Paul H. Vavra.

Computation and Data Reduction Division: Billy G. Whatley, and Oscar F. Griffin.

Instrumentation and Electronic Systems Division: L. C. Pack, and Robert G. Smith.

Security Division: Judith A. McCallum.

Procurement and Contracts Division: Audrey V. Lemons.

Administrative Services Division: Juanita T. Crow and Deborah G. McCartney.

Facilities Division: Carl A. Romero, and Clyde E. Brooks.

Photographic Services Division: Tom F. Brahm, and Ronald J. Howard.

Technical Services Division: Hershel C. Larue, Gail L. Blalock, and Coy D. Martin, Clyde W. Evans, and John E. Fisher.

Technical Info. Division; William D. Chandler, and Elizabeth T. Hinkle.

Logistics Division: Flossie D. Leggett.

Legal Office: Harvey S. Hertz.

MSC PERSONALITY

Procurement's Dave W. Lang Says He Has Interesting Job

Dallas-born Dave W. Lang, chief of MSC's Procurement and Contracts Division, may have majored in business administration and law in college, but he has actually spent most of his life "in and around airplanes."

"It began," he said, "when I used to earn spending money in the summer selling tickets for airplane rides at Louisville's Bowman Field. This spacecraft business seems to be a logical follow-on."

Lang's part in "this spacecraft business" is a big one. As chief of his division and procurement officer for MSC, he has a hand in buying everything from typewriters to the lunar excursion module.

Procurement and Contracts nogotiates, awards and administers contracts for MSC including procurement for the Mercury, Gemini and Apollo spacecraft development programs. In addition the division handles purchases for supporting equipment such as those office supplies not carried as GSA stock items. (Typewriters, for instance.)

Lang calls it "a terrifically interesting job, in which we deal every day with most of the major aerospace contractors in America. In this business we are right in the forefront of science and advanced technology."

Appointed to his present position when he joined Space Task Group August 20, 1961, Lang was already deep in the Apollo program, in which he had participated as an Air Force consultant to STG since the previous June.

Born in Dallas January 11, 1921, Lang attended grammar and high schools in Memphis, Tenn., Louisville, Ky. and Columbus, Ohio. He graduated from Ohio State University in Columbus in 1949 with a B.S. in business administration after his college education was

Dave W. Lang

interrupted by a three-year stint in the Air Force.

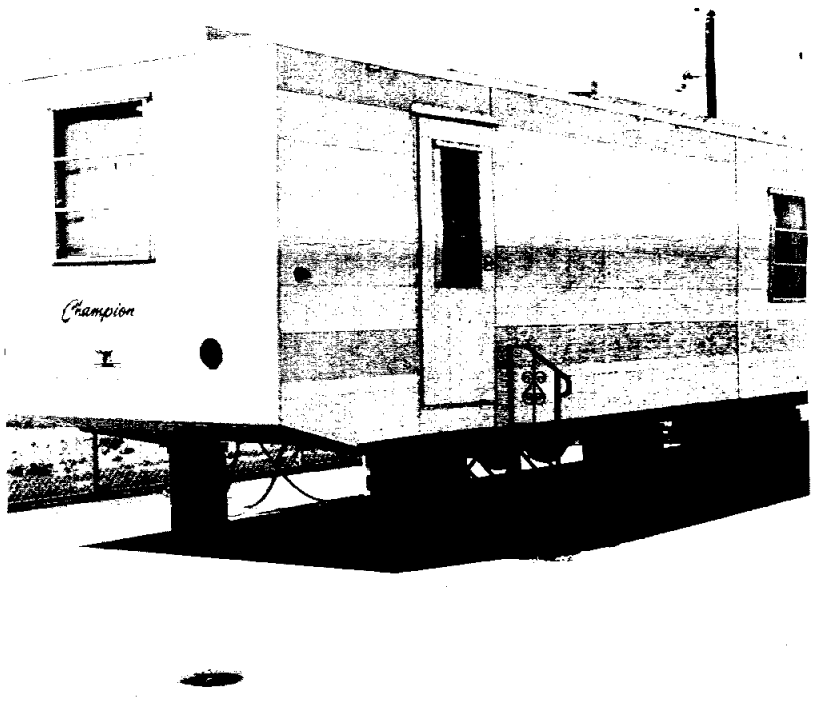
He was already on contract and procurement work, having had a year of experience with an industrial heating-airconditioning firm; *six months with* Ohio Manufacturer's Sales, Inc., purchasing agents for small firms in the same field; and a year as district representative with Century Engineering Corporation, manufacturers of oil-fired heating equipment. Upon graduation he continued with Standard Brands, Inc., food manufacturers whom he had joined in 1948.

In 1951 he was recalled to active duty with the Air Force and became a supervisory contract specialist at Wright Patterson AFB, Ohio, upon discharge in 1953. He remained in this location through several promotions until he was named procurement and production officer on the B-70 Weapon System Project Office May 11, 1958. He received a Meritorious Civilian Service Award for his work on the B-70 program as deputy chief of the office during the following year.

Lang became deputy director of materiel for Wright Patterson AFB, then deputy director of strategic systems for the Aeronautical Systems Center at Wright-Patterson before joining STG in August of 1961.

Lang is married to the former Norma Lee Slupe of Columbus, Ohio, and the couple has three children, Lana, 19, Andy, 13 and Laura, 10. The Langs recently built a house in Timber Cove and according to the head of the family have "gone completely Texan" by buying a horse. Lang's hobbies are fishing and hunting.

CREW QUARTERS for the Project Mercury astronauts and astronaut trainees at Cape Canaveral were recently redecorated. Top photos and picture at left show views of the study, relaxation and sleeping quarters in the upper story of Hangar S. At right is an exterior view of the house trailer which serves as kitchen and eating quarters for the astronauts. For a couple of weeks before a Mercury launch, a dietician will use the trailer kitchen for preparing special food for the pilot and back-up pilot as they complete final preflight training and preparation. The modern kitchen of the mobile "home away from home" is shown at left, the dining area at right.



FLIGHT ACCELERATION FACILITY chief William T. Lauten, Jr. demonstrates a simple model of the $10 million project which will be built at the Clear Lake site beginning in late summer of 1963. It is expected to be in operation by early 1965. Probably the most powerful such facility in the free world, it will be able to take a 3,000 pound payload up to 30 g's.

Planned Flight Acceleration Facility To Be World's Most Powerful

A massive flight acceleration facility, able to swing a 3,000 pound payload on the end of a 50-foot arm at a maximum speed of 42 rpms, will be built at MSC's permanent site at Clear Lake beginning next summer.

The facility will have two functions. It will be used to train Apollo flight crews, primarily to acclimate them to the gravitational forces they will experience on launch and re-entry. In this connection the 12-foot gondola on the end of the arm will be able to accommodate three men, their acceleration couches and their equipment, including a mock-up of the Apollo control panel. The gondola will have about 512 cubic feet of working space, or roughly that of a room 8 by 8 by 8 feet.

Interior pressure will be reduced to one-third atmosphere to simulate that of a spacecraft interior when necessary.

The facility will also be used for biomedical studies on the effects of various gravitational forces on human subjects and supporting systems.

The second major function of the facility will be to check out various entire spacecraft systems intended for use in Apollo missions. At maximum speed, the facility will generate a force of 30 g's which could be employed for as long as three minutes. Twenty g's could be generated for sustained periods—a half-hour or more. Such speeds would be employed only for systems and equipment tests.

"Forty-two revolutions per minute doesn't sound fast," commented Flight Acceleration Facility Chief and Project Officer William T. Lauten, Jr. "But at that speed, the gondola will be traveling at 150 miles per hour."

"In training exercises, we would not expect to subject a pilot to more than 10 or 12 g's for an extended period of time—as much as two or three minutes," Lauten added.

Mercury pilots experience a force of slightly more than seven g's on lift-off and have experienced between 11 and 12 g's during re-entry. Human subjects have gone to as high as 25 g's on the largest acceleration facility now in operation, operated by the Navy at Johnsville, Pennsylvania, but only for a period of a few seconds. The Johnsville facility also has a 50-foot arm, but it does not have the power to swing the payload which the new facility will have.

MSC's facility will have gondola which can turn on two axes at the end of the arm. This capability will allow three gravitational forces—the normal downward pull of the earth, the centrifigal force created as the gondola swings around its circle, and the backward pull of inertia—to be combined into a single "eyeballs in" force from front to back of human subjects, the direction in which they can take the largest g loads.

Respiration rates, body temperature, EKG rate, blood pressure etc. will be monitored during tests by medical personnel to insure the well-being of human subjects inside. A pre-programmed safety computer will prevent the operator or subject from exceeding safe limits.

Under certain conditions, the flight crew trainees would have the capability of manipulating the gondola as they would a spacecraft during launch and re-entry, Lauten said.

Forces on the gondola will be absorbed by a structural ring which is attached to the gimbal system. Two hemispherical shells to permit low pressure operation and to act as wind screens will be constructed of aluminum honeycomb material between two layers of fiberglass cloth. These will be attached to the structural ring. The supporting arm

(Continued on Page 2)

Space News ROUNDUP!

SECOND FRONT PAGE

Movies In Sound and Color Available To Club Groups

Need something different for the next program of your civic club, church group, or professional organization? Want something educational, interesting and as up-to-date as the space age?

Audio-Visual Services, a branch of the Public Affairs Office of MSC, has sone 27 motion picture films available, most of them 16 mm in color, with or without a sound track, and ranging in length from an hour to 11 minutes. Most of them are done in a style easily comprehensible to the layman; a few are highly technical.

The films are available on loan for the asking to be shown to groups of five or more persons, without charge. All that is necessary is several days notice, since the films are loaned on a first-come first-serve basis.

In addition to nearly a dozen films on specific flights or launches in the Mercury program, there are general films on the research and development that led to manned space flight; the Mercury tracking network; the development of the Atlas Launch vehicle; the work and purpose of Manned Spacecraft Center, a summary of all the launches in the Mercury program; the research, development, manufacture and testing of the Mercury spacecraft; astronaut selection and training, and one film on Project Gemini. They are all in color and most have soundtracks, often with musical backgrounds.

In addition, there are three technical films entitled "Apollo Reentry Simulation," "Aerodynamic Aspects of Project Mercury" and "Power Supply, Instrumentation and Communications of the Mercury Spacecraft."

Included among films on specific flights is one on MR-1, the story of the first Redstone boosted Mercury launching from initial prelaunch preparation through the successful recovery of the spacecraft. A film on MR-2 shows the story of the launch of Ham, America's first space chimp. Both run about 14 minutes in length.

Two films on Astronaut Alan B. Shepard's flight and "Freedom 7," (28 minutes) and an uncut onboard film taken during Shepard's flight with recorded radio communications added as a sound track (21 minutes.)

Concerning Astronaut John Glenn's first manned orbital flight there are three films, "The Voyage of Friendship 7" (29 minutes), "Friendship 7" (57 minutes), and "MA-6 Manned Orbital Flight" (17 minutes). The first two have a music background and all are in color.

There is a half-hour film of Astronaut M. Scott Carpenter's flight entitled "Aurora 7," and two films of Astronaut Walter M. Schirra's mission will shortly be available entitled "Sigma 7" and "The Flight of Sigma 7."

Documented film reports of all work completed in the Project Mercury operation up to July, 1959 are covered in "First

(Continued on Page 2)

WANT TO TRY IT? Astronaut M. Scott Carpenter (right) and Glenn A. Schumacher of Crew Systems inspect the first model of a contemplated training device for astronauts being developed by the Survival Section of Crew Systems Division. The section designed and constructed the yet-unnamed gadget in consultation with Carpenter as an exercising device with potential to train users to respond to a constantly changing center of gravity. A number of hand and foot-holds will be placed around the interior of the several rings. The idea is to take a spread-eagled stance in the center and ride the device as it rolls and turns in the water. The outer frame is of wood, for rigidity, and the inner rings are air inflated so that the device floats.