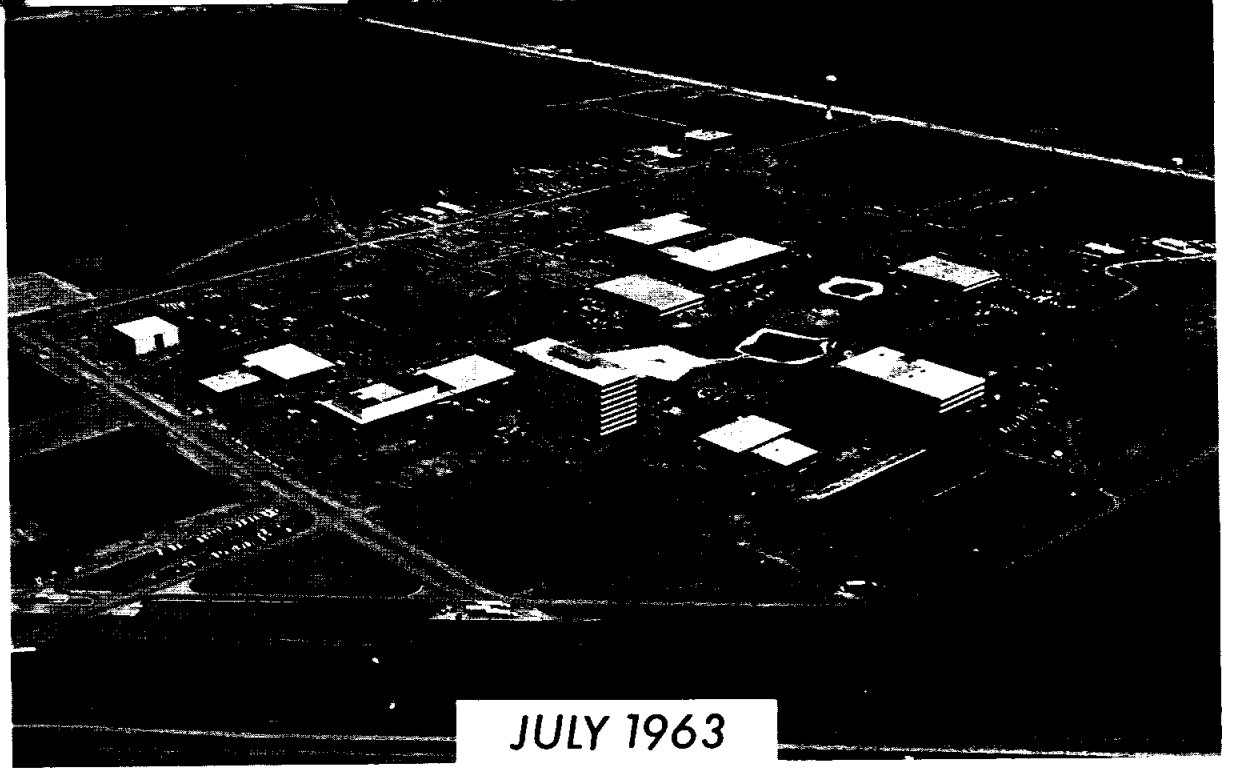
Space News ROUNDUP!

VOL. 2, NO. 20 MANNED SPACECRAFT CENTER, HOUSTON, TEXAS JULY 24, 1963

Schedule for MSC's Clear Lake Move Is Released



Plan Calls for 2,200 To Be Relocated During First Quarter of 1964

Manned Spacecraft Center is scheduled to complete its move into its new Clear Lake complex by July 1, 1964. Complete plans for the move have been laid out in a Master Move Plan which has been published.

The tentative plan calls for about 200 personnel to be in place at the Clear Lake site prior to the major move period, about 2,000 to move in during that period, and about 900 to move in following the major move period based on building availability. The major move will be made during the month of March provided buildings are completed, accepted by MSC, and all preliminary occupancy preparations within the facility have been performed.

Earl Rubenstein has been designated MSC Move Coordinator.

Other guidelines on which the move schedule was predicated were:

- The move will be effected within the shortest possible time span consistent with an orderly operation.
- The major move will begin when a majority of personnel can be relocated into completed facilities.
- Move schedules are planned so as not to interfere with operational activities or conflict with contractual lease obligations.

Tentatively scheduled to move into the new site during the major move period are the following organizations:

Personnel Division, Training Branch, Procurement Division, Financial Management Division, Photographic Division, Technical Services Division, Facilities Division, Legal Office, Telecommunications Branch, Office of Technical and Engineering Services, Security Division, Center Medical Operations, Credit Union, Control Room and Astronaut Activities.

Also the Apollo Project,

(Continued on page 6)

Gemini Suits Being Tested By Goodrich

Tests to give the astronaut maximum confidence in his space suit while he whirls around the earth for as long as 14 days, are being conducted for the Manned Spacecraft Center by the B. F. Goodrich Company.

Through extensive tests, the program is designed to achieve 99.9 percent reliability in Gemini space suits and a high level of confidence on the part of the wearers.

Four Gemini space suits, manufactured by the David Clark Co., Inc., of Worchster, Massachusetts, will be delivered to B. F. Goodrich in August to begin tests based on the "life expectancy" of moving parts on the Gemini suit, projected over a "lifetime" of 10 missions of 14 days each. The mission schedules for the reliability program were devised by the Crew Systems Division of MSC to give the suits a maximum workout.

Reliability of working parts of the suit will include opening and closing the pressure sealing zippers, required during rest periods and for comfort;

(Continued on page 6)

Little Joe Delivered At White Sands For Apollo Test

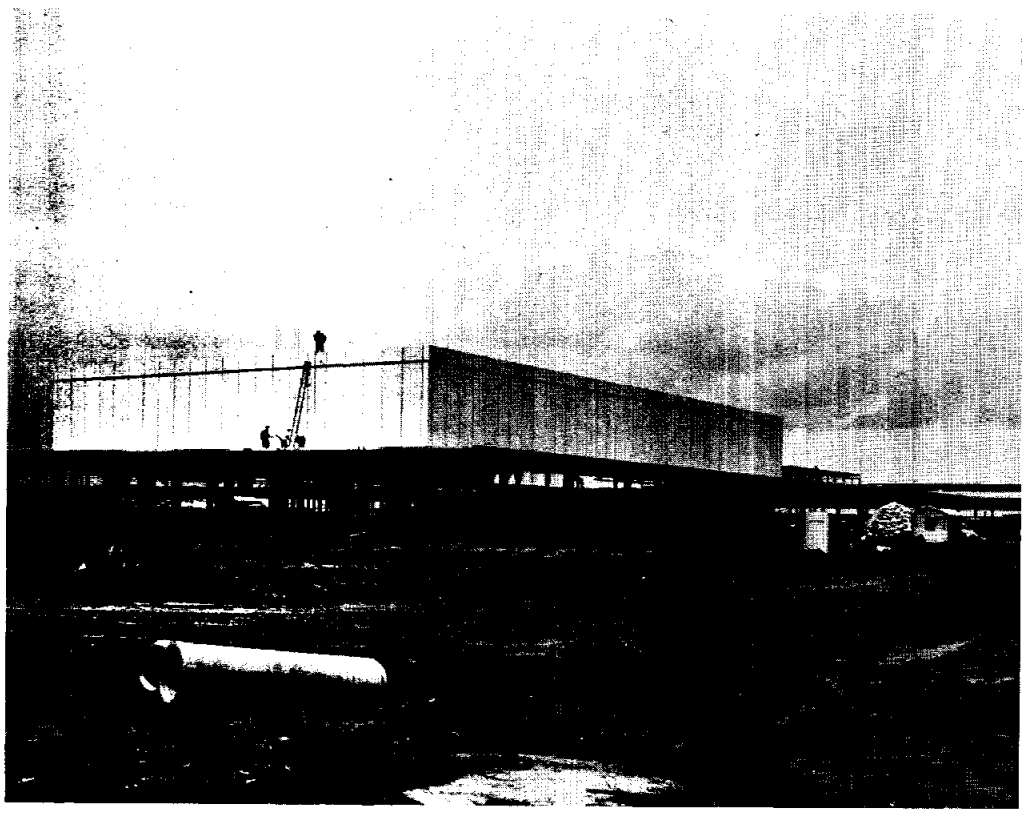
The first launch vehicle specifically produced for Apollo program spacecraft testing was trucked last week to the White Sands Missile Range in New Mexico where its initial test flight is scheduled next month.

The primary purpose of next month's test will be to check out the Little Joe II launch vehicle. The Apollo project is this country's manned lunar exploration program.

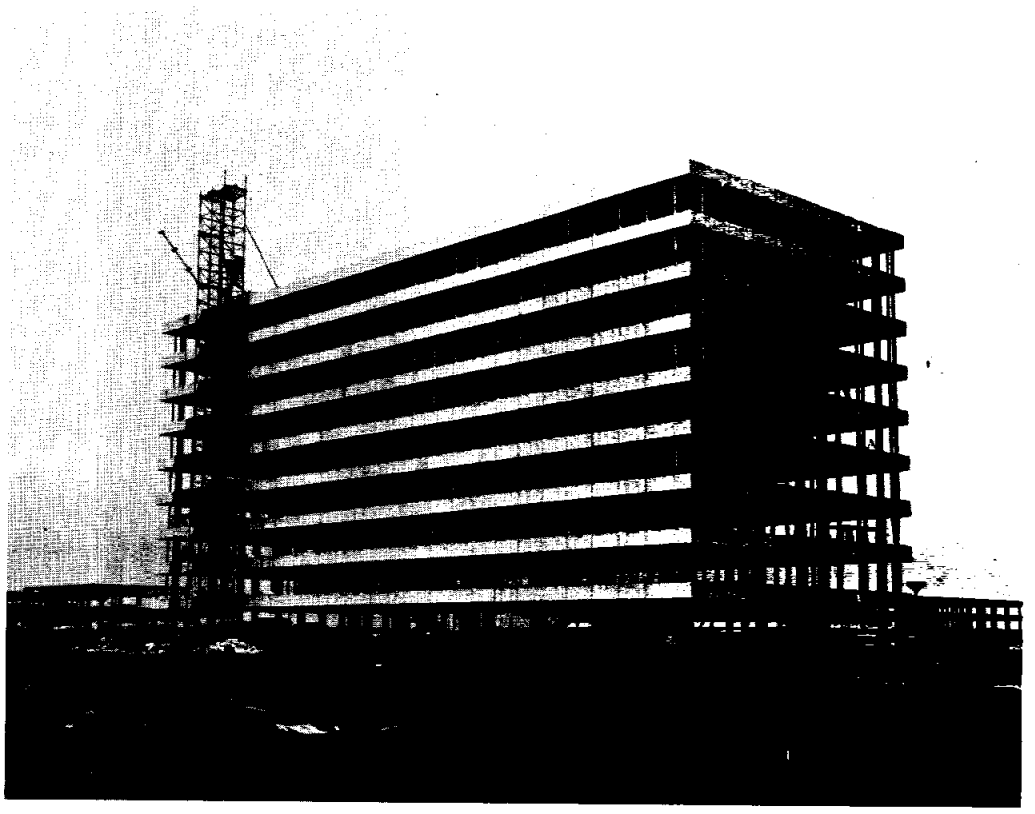
The 30-foot long, Little Joe II launch vehicle, loaded on an extendable, low-

(Continued on page 3)

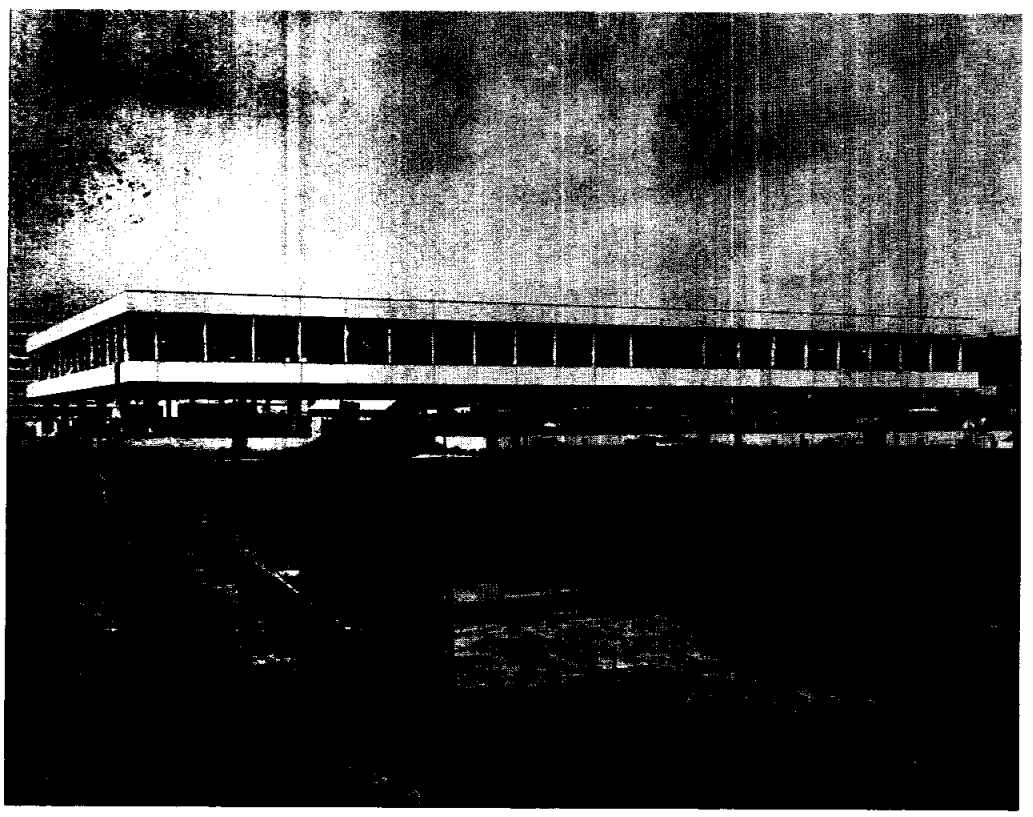
Photographs Show Building Progress at Clear Lake Site



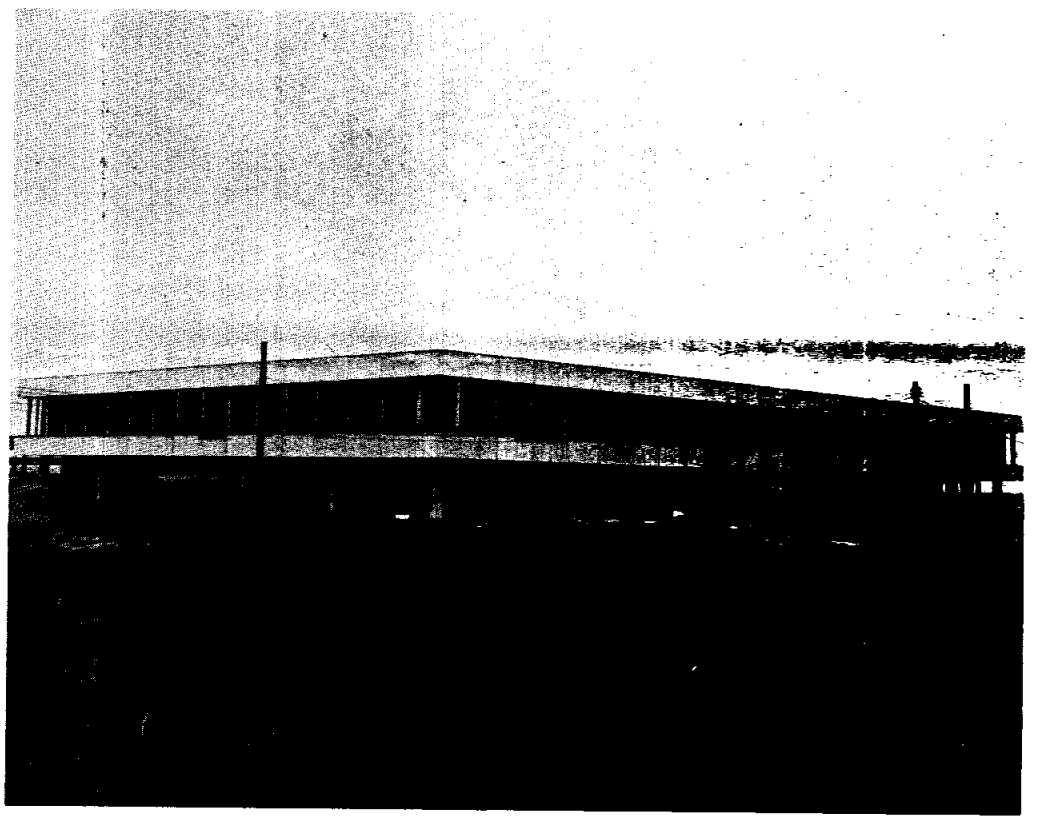
BUILDING No. 1 - Auditorium



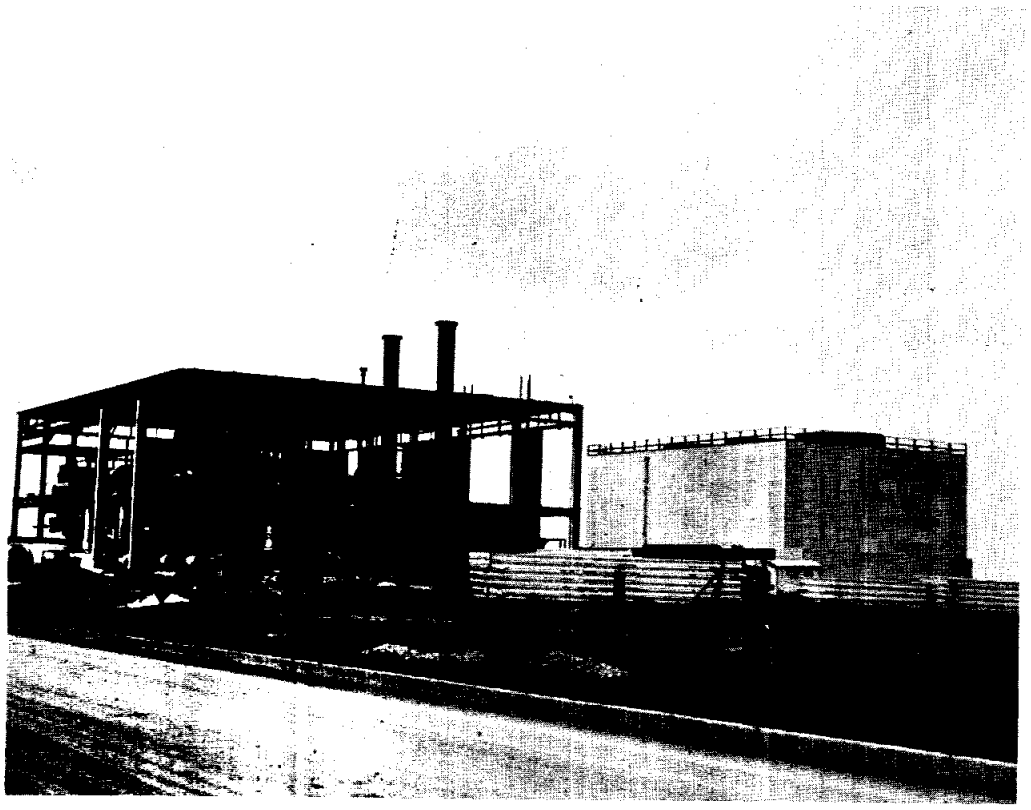
BUILDING No. 2 - Project Management



BUILDING No. 8 - Technical Services Office



BUILDING No. 12 - Central Data Office



BUILDING No. 24 - Central Heating and Cooling Plant

BUILDING No. 3 - Cafeteria

Little Joe

(Continued from page 1)

bed trailer, left the General Dynamics/Convair plant July 15. Three other trucks transported accessories and the dummy Apollo payload, which includes an adapter section, Apollo spacecraft and launch escape system.

Little Joe II is a solid-fuel launch vehicle produced by Convair for the National Aeronautics and Space Administration. The contract is managed by NASA's Manned Spacecraft Center.

Little Joe II has been designed specifically for unmanned-suborbital testing of the Apollo spacecraft. It is a relatively inexpensive launch vehicle, incorporating many proven, off-the-shelf systems and components.

The propulsion system, for example, can be tailored to meet specific mission requirements. The vehicle can accomodate as many as seven Aerojet-General algol 1-D solid-fuel motors, producing 720,000 pounds of thrust. Or it can be adapted to use combinations of algol and other off-the-shelf, solid-fuel motors to suit test mission requirements, enabling it to achieve a variety of altitudes and velocities.

Simplicity and reliability have been designed into the Little Joe II airframe which consists of a cylindrical body about 13 feet in diameter and four fins. The airframe is produced in two sections—a forebody about 19 feet long and an afterbody about 10 feet long. The four fins, each about 50 square feet, are spaced around the afterbody.

The 100,000 pound launcher, which will aim the Little Joe II launch vehicle in azimuth and elevation, has already been installed at White Sands.

The vehicle arrived at White Sands July 17 where vehicle and system test and checkout will take place. When ready for launch, the vehicle and payload will tower nine stories high.

Purpose of this flight will be to qualify the Little Joe II launch vehicle for later flights with the "boilerplate" Apollo payload and Apollo spacecraft built to production standards. The Little Joe II tests will provide engineering information for use on manned Apollo orbital flights.

CHECKS FOR $500 each were presented to Matthew Radnofsky, left, and Glenn Shewmake by MSC Director Dr. Robert R. Gilruth for their invention entitled "Lift Raft."

Life Raft Invention Worth $1,000 to MSC Employees

The Inventions and Contributions Board of the National Aeronautics and Space Administration last week awarded $1,000 to Matthew I. Radnofsky and Glenn A. Shewmake, of MSC's Crew Systems Division for the development of a life raft used in Project Mercury.

The incentive award, divided equally between the co-inventors was made by Dr. Robert R. Gilruth, Director of the Manned Spacecraft Center at a brief ceremony at the headquarters on July 12.

The life raft developed by Radnofsky and Shewmake is a departure from the tradition life raft design and fabrication in that it has three ballast containers on the underside that helps to stabilize the raft in rough seas. It has further advantages of being light in weight and capable of compact packaging to a small size when deflated.

The raft was used in Project Mercury and is under consideration for further use in the Gemini and Apollo programs as well as by the Department of Defense. It is expected that its use may be extended to overseas commercial aviation.

Retirement Benefits Greatly Liberalized Since 1920

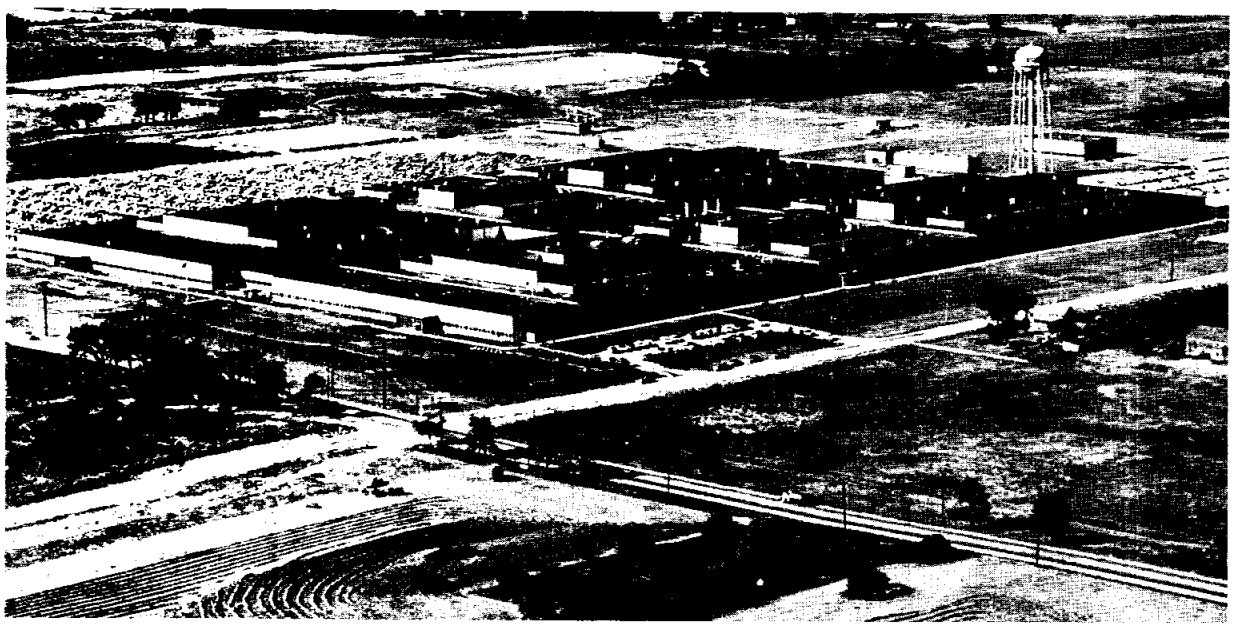
FEATURE	1920 LAW	PRESENT LAW	REMARKS
Coverage	Generally restricted to employees in the classified civil service (about 330,000 of 690,000 Federal employees).	Generally covers all employees *except* those serving on a short-term, intermittent basis, etc. (who are usually under social security), and small groups under other Federal retirement systems.	About 91 percent of Government employees, or 2.3 million persons, are covered under the present retirement law.
Contributions	Employees—2½ percent of basic salary; no Government contribution specified.	Employees—6½ percent of basic salary; employing agencies match employee contributions.	Matching agency contributions required since 1957.
Basic annuity formula	6 service classes with maximum and minimum annuity for each class. No credit for service over 30 years. Benefits related to average salary for 10 years before retirement and length of service. *Service* — *Minimum annuity* — *Maximum annuity* 15 17 years — $180 — $360 19 20 years — 216 — 432 21 23 years — 252 — 504 24 26 years — 288 — 576 27 29 years — 324 — 648 30 or more — 360 — 720	Annuity related to length of service and highest 5-year average salary under this formula: (*a*) 1½% of "High-5" salary x 5 years of service; plus (*b*) 1¾% of "High-5" x years of service between 5 and 10; plus (*c*) 2% of "High-5" x years of service over 10. Basic annuity limited to 80 percent of "High-5" salary, but total annuity may exceed the 80 percent in certain long-service cases. It is increased whenever the cost of living rises at least 3 percent since the last annuity increase.	Present law permits substituting 1% of "High-5" salary plus $25 for the percentages in any or all parts of the annuity formula. This substitution permits a higher rate of annuity in the lower salary ranges.
Disability retirement	Any age with 15 years of service if employee became totally disabled for useful service in his job.	Any age with 5 years of service if employee becomes totally disabled for useful service in his job.	Under present law, employees disabled before age 60 are guaranteed minimum disability annuity benefits.
Voluntary retirement	No Provision.	Age 62 with 5 years of service. Age 60 with 30 years of service. Age 55 with 30 years of service.	Slight reduction in annuity for early retirement (before age 60).
Mandatory retirement	Railway Mail Clerks—Age 62 Mechanics, Letter Carries and Post Office Clerks—Age 65 All others—Age 70	Employees generally—Age 70, but separation is not compulsory unless and until 15-year-service requirement also is met.	Under 1920 law, separation was automatic at prescribed age, although 15 years of service were required for annuity title.
Discontinued-service retirement	No Provision.	Any age with 25 years of service. Age 50 with 20 years of service.	Employee must be involuntarily separated without cause; annuity reduced if under age 60.
Survivor annuities	No Provision.	Automatic for qualified widows (and dependent widowers) of employees who die after 5 years' service and for dependent children. Retireing married employee automatically receives reduced annuity with survivor annuity benefit for spouse unless he elects otherwise.	Only benefit for survivors under 1920 law was refund of unexpended contributions and/or any unpaid accrued annuity.

Avien Is Selected To Develop Optical Antenna System

A $2.8 million contract to develop and produce the Optical Communications Antenna system that will track the Earth during Apollo's round trip to the Moon was announced today by North American Aviation's Space and Information Systems Division.

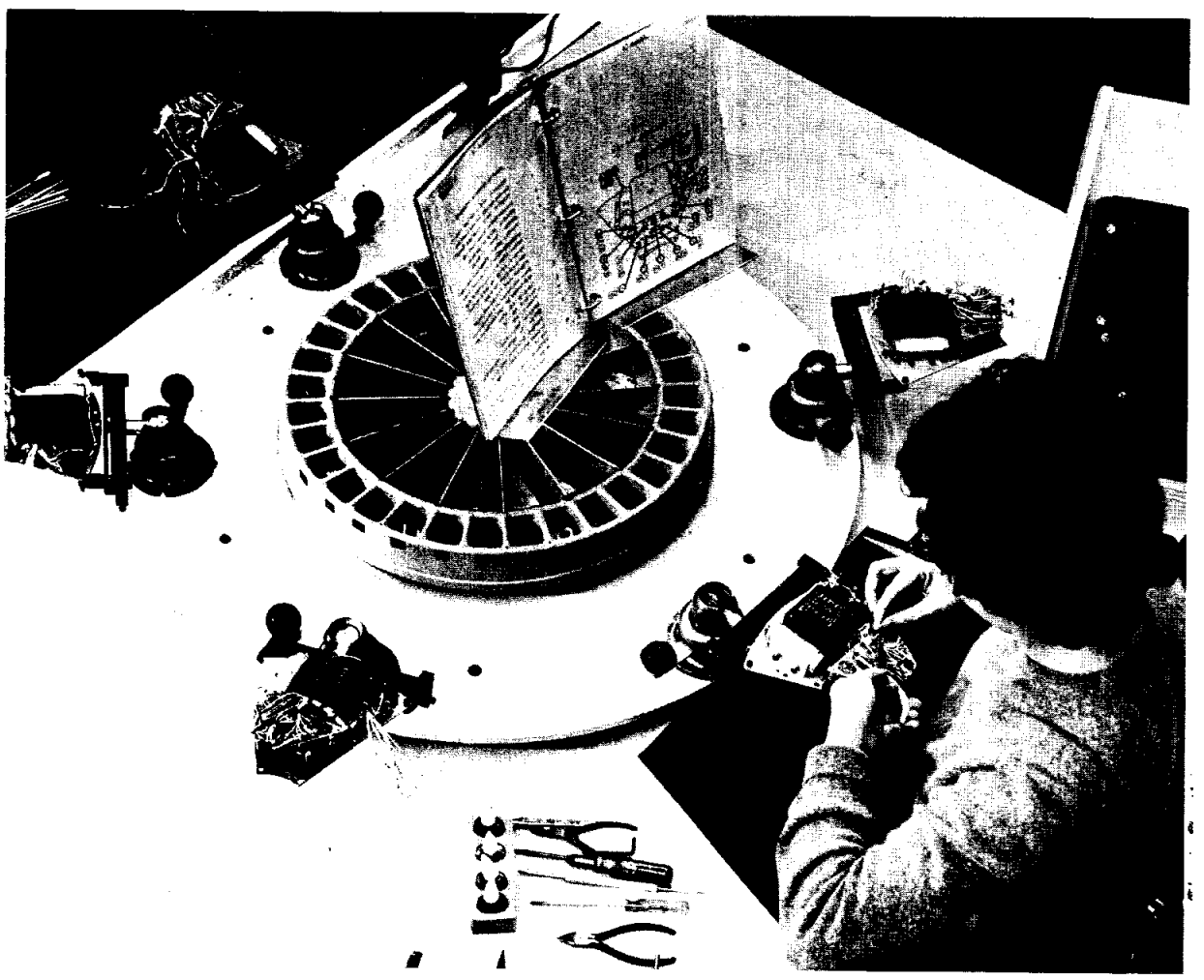
Avien, Inc., Woodside, New York, was selected to produce the antenna system as part of the primary link for voice, video, and telemetry communications.

North American's Space Division is principal contractor on the Apollo spacecraft for NASA's Manned Spacecraft Center.



AERIAL VIEW OF AC-MILWAUKEE—This 767,000 sq. ft. facility is the largest of AC Spark Plug Division's three Milwaukee plants. Here AC will manufacture inertial guidance systems for the Apollo spacecraft.

In this modern beryllium machining area, inertial components for the Apollo guidance and navigation system will be manufactured. This is a temperature-controlled area where the air is continually changed and tested.



INDUSTRIAL "LAZY SUSAN"—This turntable assembly station makes it easier for employes to follow the complicated steps of assembling the base section of a guidance system stabilization amplifier. By repeating a few assembly steps at a time, employes can assemble more units faster with a higher degree of reliability. Techniques similar to this will be used to produce equipment for use in the Apollo guidance navigation system.

WEMS — Welded Encapsulated Modules. Deft fingers check terminal connections for a WEMS unit at an inspection station at the Milwaukee plants of AC Spark Plug Division of General Motors. WEMS are electronic component units which are encapsulated for high reliability and easy servicing.

AC Spark Plug Workin

The AC Spark Plug Division of General Motors, assigned a major role in the Apollo program by the National Aeronautics and Space Administration, Manned Spacecraft Center, is proceeding on this significant mission with the same confidence and enthusiasm evident in a long series of successful accomplishments in the nation's military navigation and guidance programs.

AC will work with the Massachusetts Institute of Technology, NASA's prime contractor for guidance and control, on the design, development and manufacture of navigation and guidance systems for the Apollo spacecraft which will take a team of astronauts to the moon and back.

A leader in the inertial guidance field, AC Spark Plug currently is providing guidance systems for the Air Force Titan II Intercontinental Ballistic Missile, and inertial instruments for the Minuteman and Polaris guidance systems. The Titan III also will carry an AC system.

The General Motors division has assigned scientific talent and facilities to the program in three locations. A team of top engineering personnel is now working directly with MIT at its Instrumentation Laboratory, while the development and production work is to be done at AC's Wakefield, Mass., and Milwaukee, Wis., plants.

J. A. Anderson, vice president of General Motors and general manager of the AC Spark Plug Division, said the division had an "ideal" blend of scientific talent, aerospace engineering and manufacturing experience for the joint project with MIT.

"We recognize the importance of Apollo and will carry out our responsibilities toward the successful development and conclusion of the project," Anderson said. "This national goal in space not only enters a new realm of scientific accomplishment but has the added factor at stake in United States prestige."

Exacting requirements, broken down into five major functions, have been placed on the Apollo guidance and navigation system:

- Periodically maintain an inertial reference that can be used for measurements and computations with respect to locations in space;
- Provide a means to calculate the position and velocity of the spacecraft by either optical or inertial techniques;
- Generate attitude control and thrust commands necessary to maintain the spacecraft on a satisfactory trajectory; and
- To display pertinent data as to the status of the lunar mission.

To accomplish these requirements and functions a determination was made to include the following equipment groups:

- An inertial measurement unit (IMU) including the navigation base;

'Every Employee an Auditor Come Pay Day'

Bi-Weekly Payroll About $1 Million

"Take 3,100 employees and you'll have 3,100 auditors come pay day," is a statement the Payroll clerks of the Financial Management Division have found, without exception, to be more than true.

The Payroll Unit, located in Building 316 at Ellington Air Force Base is composed of six payroll clerks who, under the supervision of Mrs. Margaret Harrison and the assistant supervision of Lucille Blanco, are responsible for maintenance of the pay, leave and retirement records for the 3,100 MSC personnel assigned to sites in Houston, St. Louis, New Mexico, New York, Baltimore and California.

With their salary check, employees receive a Leave and Earnings statement that has been computed by the payroll clerk. This statement shows the individual's annual leave ceiling, category, leave to be used by year end or forfeited, annual leave and sick leave balance at close of the pay period and pay deductions for the period. At the present time, the bi-weekly gross payroll is approximately $1 million. From this amount, MSC employees are investing an estimated $15,000 in United States Savings Bonds.

To add complexity to the payroll clerks' duty is the fact that not all personnel are paid alike. There are five separate pay systems designed to meet each employee's individual requirement. One system is for the Excepted personnel who are paid on an annual basis; the Classification system is for the GS employees who are also paid on the annual basis; and another system encompasses the Consultants on special assignments for MSC and are paid on a daily basis. Personnel paid on an hourly scale come under the Wage Board system and a special Marine pay system has been set up for personnel assigned to the MSC ship, "Retriever."

In addition to processing the time and attendance records for a payroll, the payroll clerks process approximately 800 other changes such as promotions, periodic step increases, tax changes, leave changes and reimbursements for corrections to previous time and attendance records.

"Two things that create the most difficulty for the Payroll Unit," stated Mrs. Harrison, "are that on occasion the Time and Attendance Records are not ready for pick up at the various Houston sites by 10 A. M. on the Monday after the pay period closes and then when we get back to the payroll office we find many of the T&A's are missing, usually those of new employees. It is so important that we receive the time cards on schedule as each payroll clerk has but 24 working hours to process the payroll records of approximately 500 employees.

"After a balance tape has been made, the pay records are sent to Data Computation for keypunching and the first edit run is made. It is during this run that errors are detected and returned to the clerks for correction. On Thursday morning, the final payroll voucher is prepared."

In the afternoon, after being checked and double-checked, the payroll voucher is sent by plane to the Regional Disbursing Office in Kansas City, Missouri. There the salary checks are prepared and returned so that the following Thursday will be PAY DAY for 3,100 MSC employees.

MARGARET HARRISON
Payroll Supervisor

LUCILLE BLANCO
Payroll Control Clerk

HAZEL HOFFPAUIR
Payroll Clerk

PEARL GIBSON
Payroll Clerk

MARY ROANE
Payroll Clerk

VIVIAN WALKER
Payroll Clerk

ALICE BARKER
Payroll Clerk

NORMA VAUGHAN
Payroll Clerk

Ping Pong?

An MSC Ping Pong Club is being formed. All interested persons call Steve Jacobs at Extension 5440.

Life Support System Now Being Tested

Five men entered a space chamber at Seattle, Wash., July 16, for an engineering test of an integrated life support system. The test may run as long as 30 days.

The Boeing Company's system, the first to include all elements of life support for a 150 man day space mission, was designed and built for the Office of Advanced Research and Technology (OART) of the National Aeronautics and Space Administration (NASA).

The system is one of a series being developed by NASA for advanced space flight. With supplements, the Boeing contract is valued at $375,000.

The chamber simulates quarters on a space station or at a moon base, for the current test. Its equipment includes an environmental system producing cabin oxygen from solid, superoxide chemicals. A waste disposal system collects processes and recovers water from body waste, cabin condensation, and sink draining.

Crew members bathe in a closed circuit shower. The shower, designed for use under weightless conditions, has a separate water supply which is filtered and chemically treated for reuse.

Special diets of freeze-dried food, some of it in squeeze tubes for simulated weightless feeding, includes such items as shrimp, strawberries, and peanut butter sandwiches.

Associated with the life support equipment are specific crew tests simulating problems of space flight. A heavy work load on crew members covers navigating, scope reading, tracking, time estimating, decision making, attention span tests, and others. Psychologists outside the capsule are able to observe the test crew through one-way glass windows.

A support crew outside the space chamber will constantly analyze bacteria build-up inside the capsule. This team of Boeing scientists also will monitor toxic elements in the capsule. Influence of such elements on crew effectiveness under long term space flight conditions is not presently known.

Each member of the crew is responsible for maintaining a specific portion of the life support equipment under test.

Duplicate Bridge

MSC personnel, assigned at Cape Canaveral, who are bridge addicts may participate in Duplicate Bridge co-sponsored by the Mercury Club and the Boeing Bridge Club.

The Duplicate Bridge will be held at the Patrick Air Force Officers Club every other Monday night at 7:15 p. m., with the next scheduled date August 5.

Play will be for master points and cash prizes. If the response is great enough, play will be held every Monday. Those interested may contact Henri Kent at UL 3-4538.

Bowling Roundup

MSC COUPLE'S LEAGUE

Team	Won	Lost
Garkops	15	5
Four Nuts	13	7
Bowlernauts	13	7
Misfits	13	7
Ed's Coeds	11	9
Ridgerunners	10	10
Lame Ducks	9	11
Piddlers	9	11
Schplitz	8	12
C-Stars	7	13
No Shows	7	13
Hi Gees	5	15

Women's Hi Ind. Game: Scratch, Shirley Yeater, 191; handicap, Hedy Stewart, 240.
Women's Hi Series: Scratch, Shirley Yeater, 534; handicap, JoAnn Andersen, 655.
Men's Hi Ind. Game: Scratch, Ron Harron, 223; handicap, Tom Chambers, 250.
Men's Hi Series: Scratch, Jim Koplin, 569; handicap, Jim Koplin, 569.

A study of these attractive faces of secretaries from the Office of the Assistant Director for Engineering and Development and the Offices of three Division Chiefs, gives an indication of their friendly efficiency.

Jean Tarpley, (upper right) secretary for Jack Heberlig, John Lee, and Phil Dean in the office of the Assistant Director for Engineering and Development, is a native Texan who still lives in her hometown of Dickinson.

Two weeks after graduation from high school, Jean started to work with the Corps of Engineers at Galveston and remained there for three years. She was later employed at Ellington Air Force Base for a short period before joining MSC 15 months ago. She is married to Jack Tarpley of Dickinson. A former barrel racer of quarter horses, she is still an avid rodeo fan. Her chief hobby and avocation is raising, training and selling quarter horses.

Virginia Hughes, (upper left) secretary for Richard S. Johnston, Chief, Crew Systems Division, was born in Holton, Kansas, where she lived until after graduation from high school. She later attended Kansas University at Lawrence and Washburn University at Topeka. She was employed as a secretary for three years with the Menninger Foundation in Topeka before joining MSC two years ago at Langley, Virginia. Virginia is married to Mervin H. Hughes, an MSC employee in the Grounds Systems Project Office. The couple have three children, Sherrie, 5; Cindy, 4; and Hank, 1. In what little spare time she has, Virginia likes to relax by playing bridge.

Carolyn B. Thompson, (lower right) secretary for Aleck C. Bond, Chief, Systems Evaluation and Development Division, claims three states as her home. Born in Rockhill, South Carolina, she attended school in Hampton, Virginia, and is now a transplanted Texan. Carolyn joined the Space Task Group at Langley, Virginia, in July, 1960, and after its redesignation as the Manned Spacecraft Center, made the move with the headquarters to Houston. Carolyn is engaged to be married in August to Robert E. Bobola of the Apollo Spacecraft Systems Office. She likes to spend her spare time sewing and at rifle target practice but says that she is now going to take up cooking.

Peggy Evans, (lower left) secretary for Warren J. North, Chief, Flight Crew Operation Division, was born in Ringgold, Louisiana, and holds a B. S. degree in Spanish and Business Education from Louisiana State University, Baton Rouge. She later did graduate work at L. S. U. and at the University of the Americas in Mexico City, Mexico. Peggy came to Houston in 1961 and taught Spanish and English at Lamar High School for one year before joining MSC in August, 1962. Peggy is partial to the water sports of skiing, sailing, and swimming although she has recently taken up sky diving and has made one parachute jump.

Radio Program Features Science, Engineering News

The Lockheed Aircraft Corporation has announced a new, 5-minute, radio program of science and engineering news that was started in Houston on July 15. It may be heard at 7:50 a.m. daily, Monday through Friday, on station KPRC.

Called the "Lockheed Digest", it is of special interest to engineers, scientists, and technicians who are often hard-pressed for time to keep abreast of technological advances and specialized news in their fields. It is scheduled so that it may be heard by such specialists as they travel to work each day.

The program, previously broadcast in Los Angeles, Atlanta and Washington, D. C., now includes Houston because of its large and growing population of scientists and engineers.

Final Golf Standings

TEAM STANDINGS

Players	Won	Lost
Koplin - White	34	8
Neal - Cherry	30½	11½
Hyatt - Hanberry	23	19
Bruce - Cooper	22½	19½
Armstrong - Kline	19	23
McGathy - Garrison	18	21
Liebhardt - Bake	10	32
Hendrickson - Bone	8	31

INDIVIDUAL STANDINGS

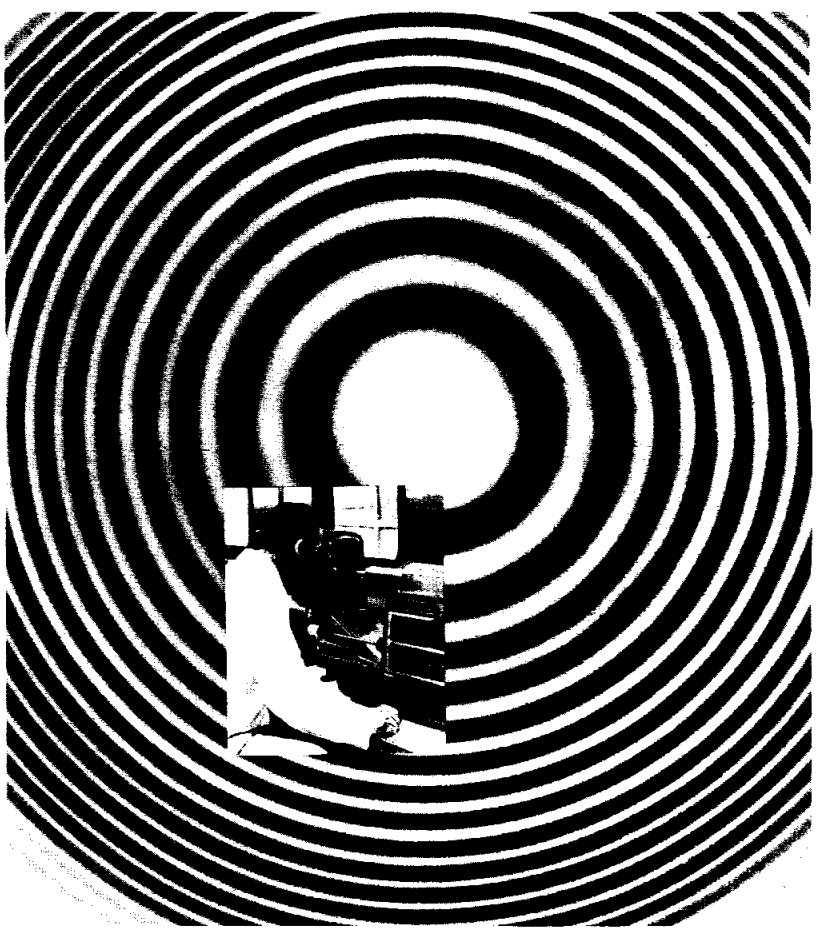
Individual (Handicap)	Total Points Won	Lost
Koplin	95	45
White	94½	45½
Hanberry	94	46

INDIVIDUAL STANDINGS

Players	Total Points Won	Lost
Neal	91	49
Cherry	89½	50½
Cooper	89½	50½
Hyatt	84	56
Bruce	76	64
Garrison	73	47
Armstrong	66	64
McGathy	64½	65½
Liebhardt	53½	86½
Bake	37	103
Hendrickson	35½	94½
Kline	33½	96½
Bone	3½	116½

Gyro instruments for the Apollo navigation and guidance system will be assembled here. This is just one of AC's super-clean areas necessary for the building of inertial navigation and guidance systems.

A TECHNICIAN in one of AC-Milwaukee's super-celan assembly rooms examines the wheel assembly of an Apollo gyro. Meticulous care to see that each part of the Apollo gyro is free from burrs or other contaminants, is taken.



THE UNUSUAL PATTERN created above is a photograph of parallel lines created by a single-color light beam. The insert shows a technician measuring light wave lengths with an interferometer in AC's Standards Measurement Laboratory.

g on Navigation, Guidance Systems

• An airborne guidance computer;

• Optical instruments such as a sextant for course correction sightings:

• A display and control panel; and

• The power and servo assembly, as well as ground support equipment.

Part of AC's job for NASA will be to assemble, integrate, and test the complete navigation and guidance system. Other companies working with AC include Raytheon which will provide the digital computer, and Kollsman Instrument Corporation, suppliers of the optical system equipment.

It is also part of AC's responsibility to devise the system test and checkout procedures and to establish the necessary test setups. This will then be followed by assembly and test of the complete Apollo system. System support in the field will also be provided to NASA.

Because of the exceptionally advanced engineering aspects of the Apollo program, the design integration of the airborne and ground support equipment is of extreme importance. Therefore, AC is responsible for design, fabrications, assembly and checkout of this ground equipment which is used, in turn, to verify the compatibility of the guidance and navigation system.

In Apollo, the inertial measurement unit will have three functions. It will measure the attitude of the spacecraft; measure the velocity of the spacecraft in a defined set of coordinates; and assist in generating steering commands.

The navigation base will hold both the IMU and the optical instruments and provide a rigid mechanical coupling between the two subsystems.

A maximum effort is underway in all phases of AC's portion of the program. Already breadboard ground support equipment is in the hands of MIT, gyros are being built for the IMU, a number of control and display units are also in Boston, and the Milwaukee plants are gearing up for production of the system.

Heading up the AC effort as Apollo Program Director is Hugh Brady. Although a relative newcomer to the AC family, he worked closely with AC engineers while at Space Technology Laboratories on Air Force Missile programs.

Two other guidance and navigation pioneers assisting Brady are Anthony Italiano, head of the AC Apollo Program Office, and Al Ostlie, Director, AC Apollo Engineering.

Both of these men bring many years of experience to the program gained from AC's work for the Air Force in avionics systems as well as ballistic missile systems.

AC Spark Plug has achieved an outstanding record for reliability in aerospace navigation and guidance.

One of its most widely-mentioned accomplishments concerned the development and production of the guidance system for the Thor Intermediate Range Ballistic Missile, a system which has yet to be equaled in its record of reliability.

AC's home office is located in Flint, Michigan where the commercial activities in automotive accessories are developed and manufactured. The Division's Milwaukee Operations, under Operations Manager Dr. B. P. Blasingame, are almost entirely devoted to government and military applications.

AC - Milwaukee was formed in 1948 when a group of engineering and management personnel came to Milwaukee to begin production of gun-bomb - rocket sights and bombing navigational computers. Two years later AC entered the inertial guidance development when it was awarded a contract for the Stellar Inertial Bombing system.

At the present time AC employs approximately 8000 people in its Milwaukee plants.

Editor's Note: This is the ninth in a series of articles designed to acquaint MSC personnel with the Center's industrial family, the contractors who make MSC spacecraft, their launch vehicles and associated equipment. The material on these two pages was furnished by the Public Relations Department, AC Spark Plug Division, General Motors.

JOSEPH A. ANDERSON
AC Spark Plug Division
General Manager and
General Motors Vice President

DR. B. PAUL BLASINGAME
Manager
AC-Milwaukee Operations

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.

Director .....Robert R. Gilruth

Public Affairs Officer ..... John A. Powers

On The Lighter Side

HAVE A NICE SPACE TRIP

Well, now, old veteran astronaut you, how do you like zipping through space on a satellite traveling 66,000 miles an hour?

Who, ME? Yes, YOU! At this very moment you are in orbit, on a space satellite called "Earth," and you are whirling around the sun in orbit at 66,000 mph. You'll travel 578 million miles this year, even if you don't leave home.

And, like those amusement park saucers that spin as you circle, you're doing that, too, at a "spin speed" of about 500 mph here in the United States.

Peoples living at the equator have a spin speed of about 1040 mph, those living at the poles practically no spin speed at all. But we're all orbiting at that 66,000 mph rate, points out Dr. Melvin L. Stehsel, of Aerojet-General Corporation's Advanced Research Division.

Messrs. Glenn, Carpenter and Shirra were only hitting about 17,500 mph in their flights—but they were orbiting around our Spaceship Earth, while we were dragging them along at our 66,000 mph clip through space.

And if the thought of this gives you any feeling like the current Broadway musical title: "Stop the World, I Want to Get Off," forget it. We don't have the retro rockets to do the job. There's no "Chicken Switch" to stop this trip.

But our spaceship is a fine one. It's completely self-supporting. It provides us food to eat, air to breathe, water to drink—and it's a "closed" system which "recycles" all of it to be used again.

Where are we going" Oh, we're on a round trip around our galaxy, the Milky Way. It'll only take some 200 million years. After that you'll probably want to think of some place different to go.

Copy by Don Bailer.
Reprinted Courtesy of Aerojet-General.

Move

(Continued from page 1)

Technical Services (Shop), Crew Systems Division, Office Services Division, Management Analysis, Program Analysis and Evaluation office, Gemini Project, Public Affairs Office, Flight Crew Operations, Director's Office, Assistant Director for Administration, Deputy Director for Mission Requirements and Flight Operations, Deputy Director for Development and Programs, Assistant Director for Engineering and Development, Assistant Director for Information and Control Systems, Office of Administrative Services, and Manager of Missions and Operations Support.

Also Reliability and Flight Safety Office, Office of Manned Space Flight Liaison Office, Langley Research Center Liaison Office, Systems Evaluation and Development Division, Travel Voucher Office and the Travel Office.

Boeing

(Continued from page 8)

is for a six-man ballistic vehicle, a modification of the Apollo.

Harlowe Longfelder, manager of Boeing's Advanced Space Systems organization, said that Boeing would draw on its experience in the X-20 Dyna-Soar, a winged spacecraft being developed for the Air Force. Longfelder indicated that Boeing had done considerable work on lifting shapes, including winged bodies.

The NASA logistics spacecraft, also called a space station ferry, would be used to rotate crews aboard an orbiting space station and to re-supply the station.

Dr. G. M. Kauf Visits MSC, Receives Medal

Maj. Gen. O. K. Neiss, U. S. Air Force Surgeon-General, visited Manned Spacecraft Center July 15 to award the Legion of Merit to a retired Air Force doctor who is now Acting Director of Space Medicine for the National Aeronautics and Space Administration.

General Neiss presented the Legion of Merit to Dr. George M. Kauf, who recently became NASA's Acting Director of Space Medicine in place of Gen. C. H. Roadman.

Dr. Kauf became Deputy Director of Space Medicine for NASA in January 1962 on assignment from the Air Force. Following his retirement from the Air Force on October 31, 1962, after 22 years of service, Dr. Kauf continued in his NASA role until he became Acting Director of Space Medicine June 1.

The award presentation was made during a visit of Dr. Kauf to MSC.

General Neiss returned to San Antonio Monday.

Suit

(Continued from page 1)

opening and closing the visor on the headpiece; removing and replacing gloves and headpiece, required during rest periods; connecting and disconnecting inlet and outlet fittings on the Environmental Control System (ECS), required during systems checks on the pad; running the suits through leakage tests, and testing them at maximum safety pressures.

In establishing proposed mission schedules for the suits, the Crew Systems Division estimated that the pressure sealing zipper, for example, would be actuated 710 times (71 times during 14 days x 10 missions). To provide for repairs in-between missions, extra pressure sealing zippers will be tested. Four pressure sealing zippers will be actuated to failure to determine a zipper "life" criterion.

The Gemini space suit reliability program will be monitored by MSC's Crew Systems Division. Cost of the program is $34,355.00.

Project Gemini, two-man spacecraft flights to begin in late 1964, is designed to develop pilot techniques in docking and rendezvousing in space. They will also be used to study the effects of long duration flights--14 days in space--on men in a weightless environment. Gemini flights will lead to this nation's most ambitious flight--the Project Apollo manned lunar landing, scheduled sometime before 1970.

STL to Study Management

NASA announced today the award of a six-month, $30,000 contract to the Space Technology Laboratories to study the most effective arrangement of management of the Manned Space Flight Program.

The study, including methods in increasing the effectiveness of the relationship of NASA technical centers to industrial contractors participating in the program, is being made in connection with NASA organizational changes necessitated by the completion of the Mercury Program and a focusing of effort on Gemini and Apollo to achieve the earliest flight dates.

In making the study and recommendations, Space Technology Laboratories will utilize the experience in the management of large ballistic missile and other space programs. The study will be under the direction of Ed B. Doll, Vice President of Space Technology Laboratories.

Doll will be assigned to Washington for the duration of the contract and will be continuously available to top NASA officials for consultation.

MSC PERSONALITY

Dick Johnston Named Crew Systems Chief

A young research chemist from West Virginia, Richard S. Johnston who has made the development of life-sustaining systems his life's work now heads the Manned Spacecraft Center's Crew Systems Division.

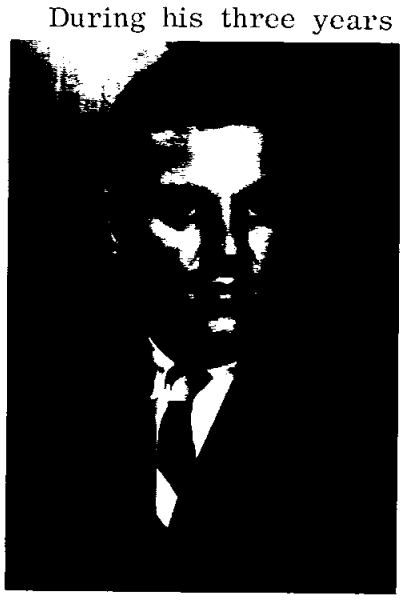
"Dick," as he is most often called by his coworkers, was appointed last week by Dr. Robert R. Gilruth, Director of MSC, as Chief of the Crew System to fill the position that was vacated earlier in the month by Dr. Stanley C. White.

Johnston was born in Keyser, West Virginia on October 1, 1926, but moved to Washington, D. C. while still a child. He attended elementary school in Washington, D. C. and was graduated from the city's McKinley Technical School in 1944. He received his BS degree in chemistry from the University of Maryland, College Park, Maryland in 1951.

Johnston's career in research chemistry actually started, however, some five years before he received his degree when he first became a summer employee and later a regular employee with the Naval Research Laboratory in Washington, D. C. His work at the Research Laboratory was with the development of chemicals which produced oxygen for breathing apparatus. He also worked with the evaluation and development of submarine air purification systems.

Johnston was transferred to the Department of the Navy's Bureau of Aeronautics in 1955 and was placed in charge of developing liquid oxygen equipment for aircraft. For this work the Department of Navy presented him with an "outstanding performance" certificate of commendation.

During his three years



RICHARD S. JOHNSTON

with the Bureau, he gained other valuable experience working on the low-level seat escape system for Navy aircraft.

Johnston joined the Space Task Group in April, 1959 and has been with Crew Systems Division since it was organized in 1961. During his early work with MSC, he contributed to the development of spacecraft life-supporting systems, including pressure suit and restraint systems.

Johnston supervised the design, layout and acquisition of equipment for the astronaut transfer van that is used at Cape Canaveral to transport the astronaut in his pressure suit from Hangar "S" to the launch pad. He also presented a medical operation plan in November, 1960 which was used throughout the Mercury space flights.

He has authored and coauthored more than 20 technical publications and has made nine technical presentations on his work.

Johnston and his wife, the former Jean Armbruster of Washington, D. C. and their two children, Suzan, 10 and Ricky, 7 live in Timber Cove near Seabrook, Texas.

In what little spare time he has, Johnston likes to play golf and enjoys relaxing with his family while fishing, crabbing and boating.

WELCOME ABOARD

New employees to join MSC between June 5 and July 15, numbered 251. All but 49 were assigned in Houston.

MSC OPERATIONS DIVISION: (Cape Canaveral): Michael D. Mitchell, William R. Wilkins, Barbara J. Wegelin, John S. Nickels, Eugene N. R. Nelson, Linda M. Crozier, Hubert G. Barbour, Jr., James J. Tadich, Harold J. Fuller, John W. Coburn, Jr., Mary G. Siepert, William M. DeGrove, Carl S. Schneider, Rodney E. Bogue, Bertram Ellis, Jr., Cameron W. Hood and Bobby E. Powell.

SPACECRAFT TECHNOLOGY DIVISION: Dennis W. Hoorn, Wendell W. Mendell, Kenneth J. Cox, Don A. Bresie, Frederic A. Wierum, Jr., Barry W. Krause, William K. Creasy, Philip R. Buchwalter, Jesse A. Vernon, Flora A. Byars, Rafael G. Gonzales, Luther W. Gurkin, III, Louis E. Livingston, David E. Claridge, Donald E. Eagles and John W. Fondon.

LOGISTICS DIVISION: Martha K. Levine, Dannie Reece, Eleanora M. Steen, John H. Quibodeaux, Wanda K. Stephens, Jesse D. Press, Iva G. Windham, Bertrand Thomasee, Samuel H. Sponseller, Leroy Phillips, Franklin B. Owens, Ada L. Noland and Robert H. Doster.

FLIGHT OPERATIONS DIVISION: Jerry L. Lowery, Gerald P. Katje, Bob E. Schutz, William R. King, Harold M. Draughon, Ronald R. Dixon, Roderick S. Bass, Vera Ehren, James E. Broadfoot, Jr., John H. Temple, Robert T. Savely, George W. Reynolds, Ernest L. Randall, Robert G. Palmer, Bobby K. Culpepper, Jeb J. Long, Arnett E. Kilpatrick, Bluford L. Brady, Jr., Carl E. Amos, Don A. Nelson, Marilyn S. Lamb and Richard C. Wadle.

PERSONNEL DIVISION: Lyle V. Kleinjan, Hilda J. Bolling, Otto S. Weilert, Robert K. Sampson, John N. Newstrom, Ray D. Laurentz, Arminta Yanez, Francis L. Teague, Imo D. Moran, Sharen M. Lummus, Sandra B. Shoeneman, Charlotte Reed, Barbara P. Ladwig, Patricia A. Reeves and Charlotte S. Smiley.

FLIGHT CREW OPERATIONS: Herbert D. Yeates, Wayne K. Williams, George Laski, Floyd T. Cleveland, Ted A. Guillory, Lawrence D. Blackshear, Stewart F. McAdoo, Jr., Lawrence K. Gaventa and Alma B. Scarborough.

WHITE SANDS MISSILE RANGE OPERATIONS: James E. Warner, Katharine M. Staggs, John J. Opre, Paul A. Bingham, Oscar Tarango, Sr., William E. Perry, Carlos E. Ramirez, John A. Mathis, Jack E. Marion, Jerald D. Bulls, George W. Book, June A. Brooks and Alta M. Wheeler.

INSTRUMENTATION AND ELECTRONIC SYSTEMS DIVISION: James M. Simpson, Michael S. Shook, Jon G. Royle, Gerald F. Pels, Curtis L. May, Glen H. McReynolds, Jr., Joseph W. Griffin, Jr., James E. McCoy, Jo C. Johnson, Charles G. Hellums and James B. Tollison, Jr.

COMPUTATION AND DATA REDUCTION: Richard Rosencranz, Jr., Charles R. Mains, Julius T. Mayhorn, Jr., James D. Francis, Billie J. Smith, James W. Gray, Hillel J. Kumin, Jay M. Goodman, Gary R. Barron, Lois C. Babcock, Delores C. Saldana, Gregory Q. Thorsen, Henry L. Bent, Thomas F. McBride, Lawrence G. McCabe, Eugene L. Davis, Jr. and James A. Banks.

APOLLO PROJECT OFFICE: Theo L. Peebles, Mary F. Weeks, Allan W. Joslyn, Robert R. Frazer (Downey, Calif.) and Alfred Cohen (Bethpage, N.Y.).

SYSTEMS EVALUATION AND DEVELOPMENT DIVISION: William A. Parkan, Robert L. Dotts, Frank A. Stafford, Richard J. Meckstroth, Joseph K. McGuire, Carol A. Brinkmann, Shelby L. Owens, Thomas M. Grubbs, Sr., Elree J. Wilkinson, Gordon Rysavy, Willis L. Clark, Richard M. Raper, Billy B. Nelson, Ruth L. Debord and William E. Woolam.

OFFICE SERVICES DIVISION: Lewis R. Braun, T. Marshall Wilkes, Jr., William L. Partridge, Jr., Sammie L. Wilkins, Phillip M. Stalling, George H. Gurganious, Clifton Carr and Carlton B. Bobbitt.

CREW SYSTEMS DIVISION: Justin S. Morrill, Jr., John N. Chatfield, Jr., James M. Waligora, Jerry C. Poradek, Francis K. Peterson, Jr., Weldon R. Cox, Ludy T. Benjamin, Jr., Russel B. Holley, Harley L. Stutesman, Jr., Michael W. Taylor and Norman Belasco.

GEMINI PROJECT OFFICE: Julie O. Massey, and Herbert L. Yarbrough (St. Louis, Mo.).

PROCUREMENT AND CONTRACTS DIVISION: L. V. Lindley, Kathlene R. Stewts, John P. Sloan, Salvatore Palazzola, Elbert H. Mason, Charles D. Heald, Parker L. Carroll, Robert G. Brown, William H. Brandenburg and Marguerite A. Gordon.

PREFLIGHT OPERATIONS DIVISION (Cape Canaveral): William S. Kendall, Jr., Harold T. Clayton, John M. Keefer, Dale E. Jansen, William H. Webb, Ollie M. Smith, George F. Page, Bert L. Grenville, Roger A. Cooner, William L. Beeker, Niven N. Ball, David E. Long, Dan S. Hixenbaugh, Leroy Selby, Jr., Jeanette M. Louis and Robert H. Huddleston.

FINANCIAL MANAGEMENT DIVISION: Hazel W. Hoffpauir, Wallace V. Drumm, Richard D. Andrews, Lolene M. Childers, Donald V. Coers, Vaughan E. Counts, Donald L. Lackey, Jr., Eugene M. Landry, J. Gordon Muir, Jr., Diana F. Perry, Jose F. Reyes, Nancy K. Robb and Larry W. Moore.

GROUND SYSTEMS PROJECT OFFICE: John R. Smith, John D. Richardson, John F. Childress, Jr., James C. Stokes, Jr., Bernard C. Embrey, Jr., Noel A. Haven, Sandra G. Savino and Samuel G. House.

PHOTOGRAPHIC SERVICES DIVISION: Ralph E. Payne, Taylor W. Moorman, Charles R. Steffler, D. Gail Blackburn and Linda R. Waters.

PROGRAM ANALYSIS AND EVALUATION DIVISION: James T. Dwyer, Jr.

FACILITIES DIVISION: Evan C. Brown, Jr., and Curtis C. Fisher, Jr.

AUDIT OFFICE: James E. Williams.

TECHNICAL SERVICES DIVISION: Walter M. Surrency, Jimmie Smith, James R. Sloan, Will E. Schram, Harry H. Holt, Robert M. Glasson, Omer B. Schoendorf, Norbert F. Philippi, Paul M. Marchal and Mitchell H. Johnson.

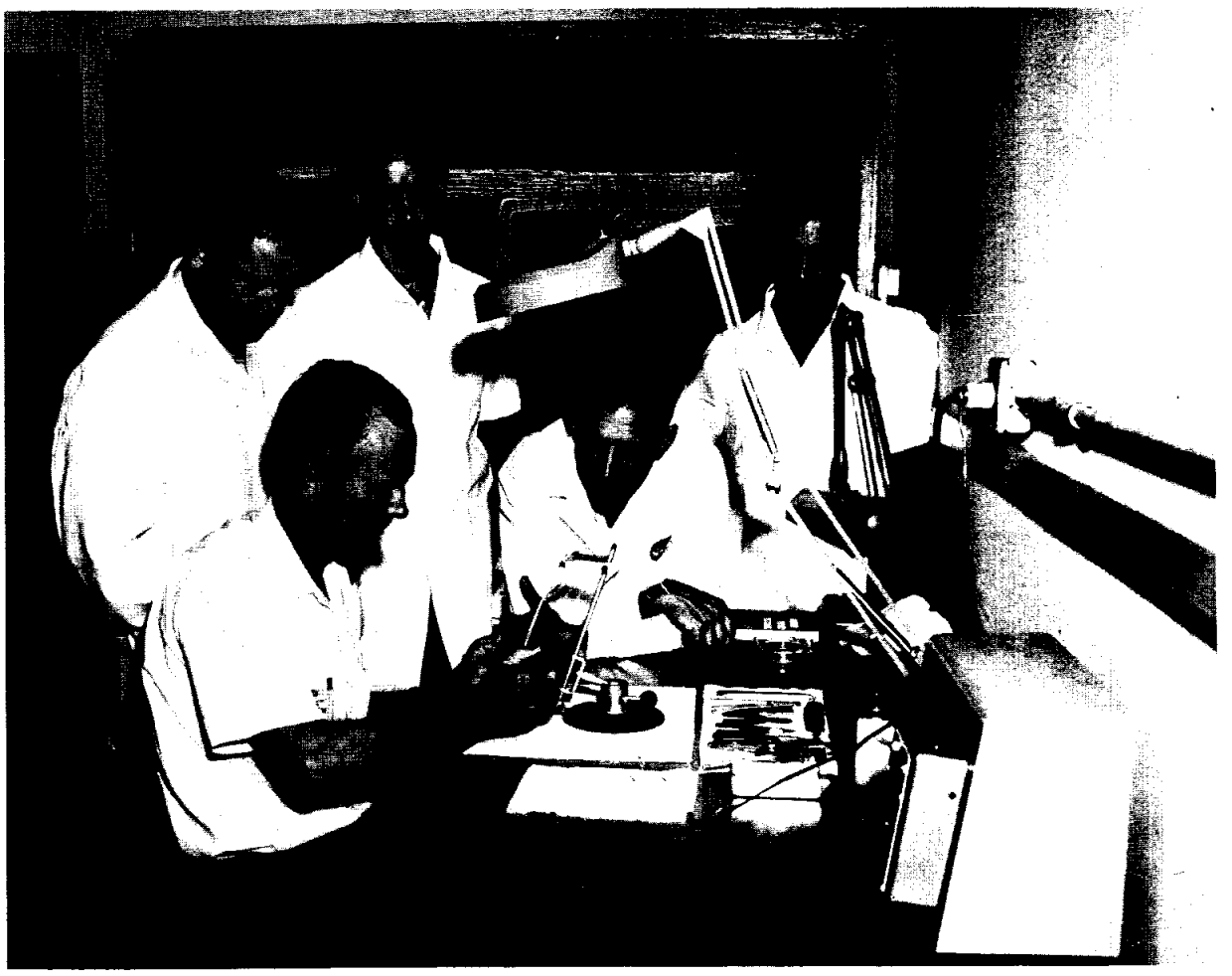
SPACE ENVIRONMENT DIVISION: James H. Sasser, John D. Rosen, Carlton R. Greer, Ellis L. Blevins and Joseph W. Snyder.

TECHNICAL INFORMATION DIVISION: James H. Parrish and Betsy C. Kopecky.

MERCURY PROJECT OFFICE: Rebecca A. Moore and Elinor M. Stockton.

PUBLIC AFFAIRS OFFICE: Jessie B. Hall.

ADMINISTRATIVE SERVICES: Holly Hague.



TRAINING SESSIONS were established by MSC June 17 to qualify and certify personnel for electrical assembly. The sessions consisted of 40 hours of instruction in high reliability soldering of flight items. Elbert Prine, who attended a similar school at Marshall Space Flight Center to qualify as an instructor, conducted the course. Prine is shown above, seated, with four personnel who attended the sessions. They are, left to right, Fred Hake, Russell Smith, Kenneth Thoma and Curtis White, all of the Electronics Branch of the Technical Services Division.

Astronaut Trip to Mars Studied

Requirements for a one-to-three-year manned expedition to Mars between 1975 and 1985 will be explored by Douglas Missile & Space Systems Division scientists under a study contract with the National Aeronautics and Space Administration.

As few as three or as many as 10 astronauts would make the 300-million-mile round trip mission to the Red Planet, according to study specifications outlined by NASA Marshall Space Flight Center's Future Projects Office.

Entitled "Manned Mars Exploration in the unfavorable (1975-1985) Time Period," the seven-month study includes definition of all systems requirements and selection of the most promising mission profiles leading to manned landings during the 10-year period.

Space scientists said the study will be unusually complex, not only because it is based on state-of-the-art 12 to 22 years hence, but also because of two cyclic factors that make 1975-1985 "unfavorable" for interplanetary flight.

One factor is the variation in the position of Mars with respect to Earth, which causes considerable variance in velocity requirements (100,000 to 150,000 miles per hour) for Earth-to-Mars round trip transfers. The other is fluctuating solar activity, creating radiation shielding problems.

NASA said previous studies have indicated that a manned Mars mission within the next 10 to 12 years, certainly a more favorable period with respect to planetary geometry and solar radiation, is difficult because required space systems may not be operational in that time.

Prime objective of the $91,901 study is the investigation of all attractive mission profiles for a manned Mars expedition, keeping to a minimum the initial mass placed in Earth orbit for interplanetary launch.

Using guidelines established by NASA, the Douglas team will determine requirements for a one-to-three-year mission duration with a stay time of from 10 to 50 days on Mars.

This is one of many "paper studies" undertaken to help NASA evaluate and plan possible future programs.

THE FIRST APOLLO components to arrive at Cape Canaveral are inspected by Manned Spacecraft Center and North American Aviation personnel. Left to right, inspecting the pitch control motor, are Sam Beddingfield, Head of MSC's Pyrotechnic and Airflight and Structures Section; Orton Duggan, Chief of the Vehicle Integration and Test Operations Branch; John Moore, NAA Test Manager; and Cecil Knowles, NAA Quality Control. The launch escape motor can be seen in the background.

Apollo Components Arrive At Canaveral

Manned Spacecraft Center recently received the first Apollo components at Cape Canaveral in preparation for Apollo program tests scheduled later this year.

The components - a launch escape motor and pitch control motor - are parts of the Apollo spacecraft launch escape system. The launch escape motor will power the spacecraft escape system in the event of a malfunction. During such an escape operation, the pitch control motor would provide lateral displacement of the command module to clear the launch vehicle.

An Apollo spacecraft, including both the command and service modules, and the remainder of the launch escape system will be delivered to the Cape later this year.

Together, these components will make up the first Apollo spacecraft to be launched from Cape Canaveral. The mission of the scheduled launch will be to check launch vehicle-spacecraft compatability.

An unmanned Apollo spacecraft is scheduled to be boosted into earth orbit in 1964 for test and evaluation of the many spacecraft systems.

Aeronca Awarded Contract for Apollo Spacecraft Skin

The Aeronca Manufacturing Corporation, Middleton, Ohio has been awarded direct responsibility for the fabrication of the 45 ceramicfoam, stainless steel honeycomb sandwich panels which comprise the external skin of each Apollo command module.

Prime contractor for the Apollo Project is the Space and Information Systems Division, North American Aviation, Los Angeles, Calif.

The aft, or re-entry end of the Apollo command module is covered with four, 2 inch thick panels. The remaining 41 panels, each 1/2 inch thick, cover the sides of the craft.

Panels are fabricated at Aeronca via multiple-load, ceramic fixture brazing. This, in itself, is a major technological breakthrough.

Since the panels must withstand extremes of heat and cold Armco is creating and supplying specifically formulated stainless steels to meet the needs of the project.

As manufactured by Aeronca, the honeycomb panels employ the "Thermantic" concept, which offers the combined advantage of high temperature resistance, light weight, thermal shock resistance, chemical stability, and high strength.

Pratt & Whitney Will Develop LEM Fuel Cells

Grumman Aircraft Engineering Corporation announced today that the Pratt and Whitney Aircraft Division of United Aircraft Corporation has been selected for negotiation on a subcontract covering the development of fuel cells for the Lunar Excursion Module.

Fuel cells will be the source of electrical power on the Lunar Excursion Module, the vehicle which will land U. S. astronauts on the Moon. LEM is a part of the Apollo Program which is under the direction of the NASA Manned Spacecraft Center, Houston, Texas.

Pratt and Whitney Aircraft is the seventh major subcontractor selected by Grumman for the LEM Program. The six others are: Radio Corporation of America's Aerospace and Communications Center, Burlington, Mass.; Rocketdyne, a division of North American, Inc., Van Nuys, Calif.; Bell Aerosystems Company, a division of Bell Aerospace Corporation, Buffalo, N.Y.; The Marquardt Corporation, Van Nuys, Calif.; Hamilton Standard Division of United Aircraft, Windsor Locks, Conn.; and Space Technology Laboratory, a division of Thompson Ramo Wooldridge, Inglewood, Calif.

Pratt and Whitney Aircraft is located in Hartford, Conn.

Space News NASA ROUNDUP!

SECOND FRONT PAGE

'Photography In Space' Is Presented At Dallas

A special hour and a half report, "Photography in Space," by three Manned Spacecraft Center Photographers was the highlight, Monday, at the opening of the 72nd International Exposition of Professional Photography at the Dallas Colesium.

The report prepared by John Brinkman, Gene Edmonds, and John Holland of MSC's Photographic Division traced the developments and techniques of space photography from Dr. Goddard's early rocket tests in 1925 through Project Mercury. It was concluded by a projection of future photographic requirements for Projects Gemini and Apollo and a discussion of anticipated problems of lunar photography.

The three career photographers have accumulated a total of more than a half century.

John R. Brinkman, Head of MSC's Photographic Division, who supervised the preparation of the report, has been in engineering photography since 1945. He started with the National Advisory Committee for Aeronautics at Langley Research Center.

Edmonds, who directs general photographic activities for the Manned Spacecraft Center, will talk on the photographic aspects during recovery operations and on modern experimental photography.

John Holland, who coordinates the activities of the photographic laboratory at MSC, is responsible for processing and preparing negatives and film footage of all material photographed by MSC cameramen. He worked with missile research photography with the Navy before joining NASA in 1962. He will speak on high speed photography and the development of an up-to-date engineering photographic laboratory.

In conjunction with the appearance of the MSC photographers, the cameras which have documented America's space achievements will be on display throughout the exposition which will continue through July 24.

In addition, Mercury Spacecraft "Aurora 7" which was flown by Astronaut Malcolm Scott Carpenter May 20, 1962 was displayed.

Among the cameras displayed at the Photography Exposition were: the 16mm Milliken pilot observer camera used during the flight of Astronaut Walter M. Schirra on October 3, 1962; 16mm Millikens used as periscope and instrument observer cameras, and the 70mm earth sky camera carried aboard the unmanned Mercury flight of September 13, 1961. A 70 mm Hasselbad and a special robot 35 mm royal camera, identical to the one carried by Astronaut Gordon Cooper to photograph the dim light phenomena are included in the Center's display.

MSC's Photographic Services Division received additional recognition last month when its operation was the feature subject for the "Industrial Photography" magazine.

Boeing Making Space Ferry Vehicle Study

National Aeronautics and Space Administration's Manned Spacecraft Center at Houston has awarded $100,000 to the Boeing Co. for a six-month study of a space ferry vehicle.

The logistics spacecraft envisioned in the study would be used to ferry men and equipment to and from an orbiting space station. The Boeing study will be limited to lifting body shapes able to make large maneuvers after re-entry into the Earth's atmosphere. The craft would carry 12 men and would land horizontally in the conventional aircraft manner.

Vernon Godsey heads up the Boeing Aero-Space Division study team on the contract. The contract covers only studies of two lifting bodies--M-2, an aerodynamic shape developed by NASA's Ames Research Center, and the HL-10, a configuration originated at NASA's Langley Research Center. Neither the M-2 nor the HL-10 are winged vehicles.

NASA-Houston has also awarded similar contracts for re-entry vehicle studies to Lockheed and North American Aviation. The Lockheed contract calls for studies of a 12-man ballistic re-entry vehicle. The North American contract

(Continued on page 6)