Space News
ROUNDUP!

VOL. 2, NO. 18 MANNED SPACECRAFT CENTER, HOUSTON, TEXAS JUNE 26, 1963

Mercury Ends; No MA-10 Planned, Says Webb

Thirty-Seven Interns Begin New MSC Jobs During June

Faced with the challenge of sending men to the moon and returning them before the end of this decade, NASA's Manned Spacecraft Center has developed two programs to recruit talented personnel in support of its mission. Last week thirty-seven top-ranking college students and recent graduates started work in these programs.

Twenty-seven comprise the first Aerospace Summer Intern Program. Initiated by MSC, this plan gives outstanding students an opportunity to correlate experience with academic training.

The remaining ten are graduates who make up the second annual Management Intern Program. Their administrative apprenticeship lasts one year, while the summer program is for a 75-day period of employment.

The summer interns were selected from among undergraduates who have completed their junior year, and from graduate students planning to return to school for graduate work.

They have all attained a "B" average or better and have been recommended by the dean of their college. They represent schools and universities in thirteen states.

As well as working in their major field for the summer, the interns will attend seminars within the Center.

The 17 scientific and engineering summer interns have a one hour class daily in spacecraft engineering, design, and operation. This course has been developed by senior technical staff members of MSC and will constitute a special course based on experience and data gained to date from the Mercury, Gemini and Apollo projects.

There are ten summer interns in public and business administration fields. They will attend a weekly two-hour seminar comparable to graduate courses in management theory.

The summer program will benefit MSC in recruiting exceptional graduates and improve communications between colleges and NASA.

(Continued on page 3)

THE MSC "NAVY" ARRIVED at its Seabrook docking facility last week. The modified Army LCU (Landing Craft, Utility), painted "NASA blue and white," was named "Retriever" to signify its mission in recovering various spacecraft used in drop tests in Galveston and Trinity Bays and the Gulf of Mexico. Skipper Frank Gammon of the Flight Operations Division is shown as he takes command. The 115-foot craft has a modified stern resembling a destroyer's fantail to make heavy retriving operations possible and can spend five days in the open sea.

Mercury Personnel To Be Shifted To Other Two Projects

Project Mercury, which successfully reached its goal May 15 with the day-long flight of Astronaut L. Gordon Cooper, has drawn to a close. There will be no MA-10.

The announcement was made June 12 by NASA Administrator James E. Webb, who said NASA will concentrate instead on the planned Gemini launches and on Project Apollo. "There will be no further Mercury shots," Webb told the Senate Space Committee while testifying in behalf of the NASA budget request for $5.7 billion.

"We will concentrate on reorientation and realignment of NASA to move on with Gemini.

"We cannot conduct a flight in the Mercury Program with a second team, or plan for a flight operating up to two weeks and make the changes in the work on the ground, without delaying the Gemini program," he said. "It will require the first team in the manned spaceflight program to do the work we must do in the Gemini project."

At MSC in Houston, the Office of the Director pointed out that there are many factors to be weighed in connection with the decision not to fly another Mercury manned flight.

"Now that all the considerations have been reviewed and the decision made, we will divert the people and resources which would have been utilized in another Mercury flight to projects Gemini and Apollo.

"The reorientation will give us greater confidence that we will be able to meet our currently planned Gemini and Apollo flight schedules."

In Mercury Project Office quarters in the HPC Building, commentary was less serious as impromptu humorists papered the walls with signs reading "Rummage Sale; Going Out of Business." Wisecracks centered around James

(Continued on Page 7)

Flight data tables for Project Mercury are carried on pages 2, 3, 6, 7, and 8.

Holmes Resigns As Director, Manned Space Flight Office

D. Brainerd Holmes, director of NASA's Office of Manned Space Flight, resigned June 12 to return to a position in private industry.

MSC Director Robert R. Gilruth expressed surprise and regret over the resignation. "We are realigning our effort to meet our existing Gemini and Apollo flight schedules," Gilruth said, "but we will miss the perceptiveness and knowledge and drive of Brainerd Holmes in Washington."

Deputy Directors Walter C. Williams and James C. Elms joined Dr. Gilruth in tribute to Holmes and to his many contributions in the progress of the nation's manned space flight research. All three agreed that Holmes has an unusual talent for blending the technical complexity of research and development into the operational flight requirements.

Holmes joined NASA November 1, 1961. He had been an executive in the electronics division of Radio Corporation of America.

Holmes said he would remain at his post as long as he was needed to help in the transition between the Mercury and Gemini programs.

D. Brainerd Holmes

MSC Extends New Astronaut Recruiting Efforts Two Ways

Manned Spacecraft Center, making its broadest effort to see that no qualified person is overlooked in the selection of 10 to 15 new astronauts to be announced next Fall, has broadened recruiting in two ways.

One is a change in the selection criteria, the major effect of which eliminates the need for a test pilot school certificate. The other is a request for recommendations from a large number of organizations such as industrial aerospace firms, the Air National Guard, various reserve organizations, the nation's military services, the Society of Experimental Test Pilots, the FAA, the Airline Pilot's Association, and the three NASA field centers which use pilots in their work, Langley Research Center, Hampton, Va.; Edwards Flight Research Center, Edwards, Calif.; and Ames Research Center, Moffett Field, Calif.

Other qualified volunteers may applyfor consideration directly to MSC.

Among organizations contacted were the Boeing Company, Seattle, Wash.; Douglas Aircraft Company, Santa Monica, Calif.; General Dynamics Corporation, New York; Lockheed Aircraft Corporation, Burbank, Calif.; General Electric Company, New York; North-

(Continued on page 3)

One Hundred Ninety College Personnel Hired For Summer

Manned Spacecraft Center his hired 190 college students and professors for temporary positions during the summer months.

The students were selected from about about 800 applicants representing colleges throughout the country.

Most of the students are involved in scientific and engineering work, but some have business and public administration jobs.

Seventeen of the new MSC employees are assigned to other installations of NASA. Thirteen of these will go to Cape Canaveral, Florida; three to White Sands, New Mexico; and one to Downey, California.

They have started reporting for work and by June 30 they will all be on the job.

Mercury - Little Joe Missions And Test Objectives

Mission	Launch date	Objectives
LJ-6	October 4, 1959	(a) To qualify the aerodynamic and structural integrity of the booster and the mechanical performance of the launcher. (b) To check the performance of the system for transmitting a command signal from the ground station, receiving it in the booster during flight, and setting off an explosive system at the head-end of each main rocket motor in the booster.
LJ-1A	November 4, 1959	(a) To carry out a planned abort of the spacecraft from the booster at the maximum dynamic pressure anticipated during Mercury-Atlas exit flight. (b) To obtain added reliability data on the Mercury drogue and main parachute operation. (c) To study spacecraft impact behavior. (d) To gain further operational experience in recovery of a floating spacecraft, utilizing a surface vessel. (e) To obtain further experience and confidence in the operation of the booster command thrust termination system. (f) To recover escape motor and tower.
LJ-2 Primate aboard	December 4, 1959	(a) To carry out a planned escape of the spacecraft from the booster at high altitude (96,000 ft) just prior to main booster rocket motor burnout. (b) To ascertain spacecraft entry dynamics for an uncontrolled entry. (c) To check spacecraft dynamic stability on descent through the atmosphere without a drogue parachute. (d) To determine the physiological and psychological effects of acceleration and weightlessness on a small primate (rhesus monkey). (e) To obtain additional reliability data on the operation of the Mercury parachutes. (f) To obtain more data on Mercury spacecraft flotation characteristics in sea areas typical of those planned for use as recovery areas. (g) To obtain additional operational experience of spacecraft recovery by a surface vessel.
LJ-1B Primate aboard	January 21, 1960	(a) To check out the Mercury escape system concept and hardware at the maximum dynamic pressure anticipated during a Mercury-Atlas exit flight. (b) To determine the effects of simulated Atlas abort accelerations on a small primate (female rhesus monkey). (c) To obtain further reliability data on the Mercury spacecraft drogue and main chute operations. (d) To check out the operational effectiveness of spacecraft recovery by helicopter. (e) To recover the escape-system assembly (escape motor and tower) for a postflight examination in order to establish whether there had been any component malfunction or structure failure.
LJ-5A	March 18, 1961	(a) Demonstrate the structural integrity of the Mercury spacecraft and escape system during an escape initiated at the highest dynamic pressure that can be anticipated during an Atlas launch for orbital flight. (b) Demonstrate the performance of the spacecraft escape system, the sequential system, and the recovery system. (c) Determine the flight dynamic characteristics of the Mercury spacecraft in an escape maneuver. (d) Demonstrate the performance of a particular landing-bag configuration. (e) Establish the adequacy of the spacecraft recovery procedures. (f) Establish prelaunch check-out procedures for the functioning spacecraft systems. (g) Determine the effects of the flight profile on the spacecraft equipment and systems not otherwise required for the first-order test objectives.
LJ-5B	April 28, 1961	(a) Demonstrate the structural integrity of the Mercury spacecraft and escape system during an escape initiated at the highest dynamic pressure that can be anticipated during an Atlas launch for orbital flight. (b) Demonstrate the performance of the spacecraft escape system, the sequential system, landing system, and the recovery system. (c) Determine the flight dynamic characteristics of the Mercury spacecraft in an escape maneuver. (d) Establish the adequacy of the spacecraft recovery procedures. (e) Establish prelaunch check-out procedures for the functioning spacecraft systems. (f) Determine the effects of the flight profile on the spacecraft equipment and systems not otherwise required for first-order test objectives.

Mercury Beach Abort Test Objectives

Mission	Launch date	Objectives
Beach Abort (Boilerplate spacecraft)	May 9, 1960	(a) Demonstrate capability of escape system, landing system, and postlanding equipment during an off-the-pad abort. (b) Demonstrate structural integrity of escape configuration during an off-the-pad abort. (c) Provide time history data for the following parameters: (1) altitude, (2) range, (3) velocity, (4) pitch, roll and yaw angles, (5) pitch, roll and yaw rates, (6) pitch, roll and yaw accelerations, (7) impact accelerations, and (8) sequence of events. (d) Obtain operational experience for check-out, launch and recovery teams. (e) Determine the effects of off-the-pad escape and landing conditions upon the spacecraft telemetry, instrumentation and communication system. (f) Provide time history data for the following parameters: (1) indicated pressure altitude, (2) outside skin temperature, (3) inside skin temperature, (4) cabin air temperature, (5) noise level, and (6) vibration.

Mercury - Redstone Missions And Test Objectives

Mission	Launch date	Objectives
MR-1A Unmanned	December 19, 1960	(a) Qualify the spacecraft-booster combination for the Mercury-Redstone mission which includes attaining a Mach number of approximately 6.0 during powered flight, a period of weightlessness of about 5 minutes, and a deceleration of approximately 11g on reentry. (b) Qualify the posigrade rockets (c) Qualify the recovery system (d) Qualify the launch, tracking, and recovery phases of operation (e) Qualify the Automatic Stabilization and Control System, including the Reaction Control System
MR-2 Primate aboard	January 31, 1961	(a) Obtain physiological and performance data on a primate in ballistic space flight (b) Qualify the Environmental Control System and aeromedical instrumentation (c) Qualify the landing bag system (d) Partially qualify the voice communication system (e) Qualify the mechanically-actuated side hatch (f) Obtain a closed-loop evaluation of the booster automatic abort system
MR-BD Booster Development Flight	March 24, 1961	(a) Investigate corrections to booster problems as a result of the MR-2 flight. These problems were as follows: (1) Structural feedback to control system producing vane "chatter" (2) Instrument compartment vibration (3) Thrust control malfunction
MR-3 Manned	May 5, 1961	(a) Familiarize man with a brief but complete space flight experience including the lift-off, powered flight, weightless flight (for a period of approximately 5 minutes), reentry, and landing phases of the flight. (b) Evaluate man's ability to perform as a functional unit during space flight by: (1) Demonstrating manual control of spacecraft attitude before, during, and after retrofire (2) Use of voice communications during flight (c) Study man's physiological reactions during space flight (d) Recover the astronaut and spacecraft
MR-4 Manned	July 21, 1961	(a) Familiarize man with a brief but complete space flight experience including the lift-off, powered, weightless (for a period of approximately 5 minutes), atmospheric reentry, and landing phases of the flight. (b) Evaluate man's ability to perform as a functional unit during space flight by: (1) Demonstrating manual control of spacecraft during weightless periods (2) Using the spacecraft window and periscope for attitude reference and recognition of ground check points (c) Study man's physiological reactions during space flights (d) Qualify the explosively-actuated side egress hatch

Recruiting

(Continued from page 1)

rop Space Laboratories, Hawthorne, Calif.; Republic Aviation Corporation, Farmingdale, N. Y.; Ling-Temco-Vought, Dallas, Texas; McDonnell Aircraft Company, St. Louis, Mo.; Westinghouse Electric Corporation, Pittsburgh, Penna.; and Grumman Aircraft Engineering Corp., Bethpage, N. Y.

Pilots selected will join the program at MSC in October.

Interns Begin

(Continued from page 1)

The students will bring new ideas and classroom techniques to MSC; and when they return to school this fall, they will take back a first hand knowledge of MSC and its projects.

Concurrent with the appointment of the summer interns, ten Management Interns started their first week of work. They are all graduates in business administration fields nd eight have done graduate work.

For four and one-half months they will be assigned to rotational training in such departments of management as personnel, security, procurement, management analysis, and other administrative offices.

During this period the interns familiarize themselves with MSC and get an overall view of the programs. For the remaining seven and one-half months of internship, they will be assigned to a specific job.

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

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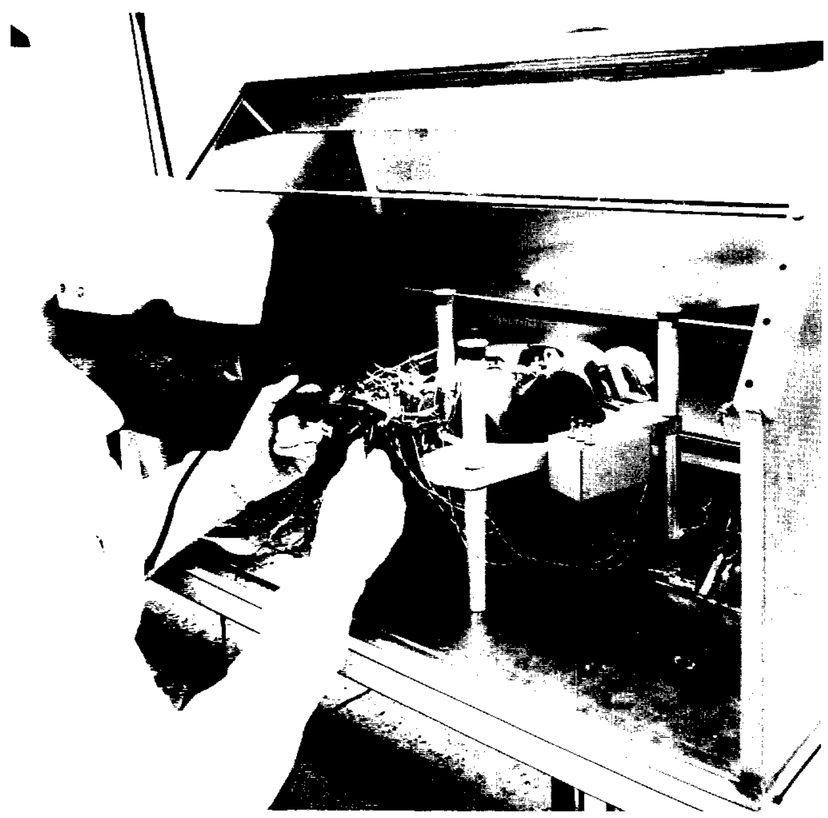
Chief, Internal Communications . Ivan D. Ertel
Editor . . . . Anne T. Corey

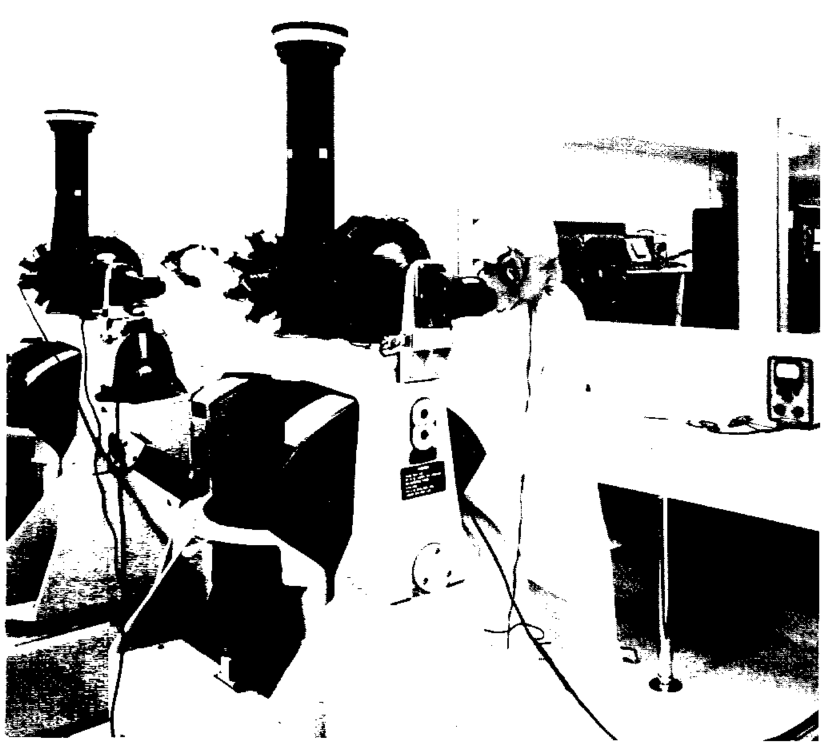
Kollsman Instrument Corporation Provides The 'Eye

EXACTING REQUIREMENTS for testing and quality assurance associated with Project Apollo are maintained by Kollsman in a number of specifically designated testing facilities.

THE KOLLSMAN SPACE DIVISION facilities are long experienced in the assembly of opto-mechanical-electronic devices and systems. Kollsman has provided equipment for flights ranging from Jimmy Doolittle's first "blind" flight to Cooper's 22-orbit mission.



NECESSARY SOLDERING operations within the clean room are performed under this hood which traps any fumes before they can escape in the clean atmosphere and extracts them.



THE TECHNICIAN in the foreground is communicating with a test engineer beyond the window via a headset. Only the product and immediately associated fixtures need be placed in the clean room. A flexible set-up of test and support equipment is set up in the next room, beyond the window.

From inner marker to outer space—this is the story of the Kollsman Instrument Corporation, a member of the National Aeronautics and Space Administration team carefully selected to develop and produce the vital guidance-navigation system for Project Apollo.

A familiar name in aviation and widely recognized as a leading designer and producer of precision instruments since the pioneer days of scientific flight—the days when the pilot's inner marker could have been a fence post—Kollsman has provided important equipment for every significant flying adventure from Jimmy Doolittle's epic first "blind" flight to astronaut Gordon Cooper's historic 22-orbit space journey in "Faith 7."

Now, as a member of the Apollo guidance-navigation team, Kollsman is putting the "eyes" in the Apollo spacecraft, for the company has responsibility for the optical subsystem designed to enable the astronauts to make visual celestial sightings vital to the guidance of their spacecraft.

Teaming with Kollsman to build the complete guidance-navigation system, and each working with the Massachusetts Institute of Technology's Instrumentation Laboratory, which has primary responsibility for the system design, are three other experienced firms. They are: AC Spark Plug Division of General Motors, producing the inertial measuring unit systems assembly; the Raytheon Company, developing the digital computer; and the Sperry Gyroscope Company, manufacturing the force-measuring accelerometers.

Kollsman, with modern research and manufacturing facilities at Elmhurst and Syosset, Long Island, New York, was selected by the Manned Spacecraft Center for its Apollo assignment in May, 1962. A month later a group of specially qualified engineers, designers and draftsmen, headed by Thornton Stearns, then chief of optical design at Kollsman, moved to the MIT Instrumentation Laboratory to work actively with other members of the guidance-navigation team. Still resident at Cambridge and with its ranks reinforced with additional technical personnel, the group has assisted in the design of three units Kollsman will supply, and has helped in the preparation of required displays and the design of associated electronics.

The optical subsystem, virtually the "eyes" of the guidance-navigation system, consists of a sextant, a scanning telescope, and a map-and-data viewer. These three devices will permit the astronauts to navigate by optical line-of-sight. Observation of stars, planets, the moon and landmarks on the earth and moon will determine directions in space. By reference to the map-and-data viewer information display, those directions will be reduced to position, altitude and velocity. From these values, corrections to the trajectory will be calculated and initiated.

The sextant and scanning telescope are contained in a single optical base which will be held rigidly with respect to an inertial measuring unit.

The scanning telescope has a wide-angle field-of-view for making observations and for orientation of the sextant. The sextant, a highly accurate instrument with a narrow field-of-view, is used for precise measurement of star angles.

Navigation information needed during the Apollo mission will be contained in film cartridges designed for easy insertion into the map-and-data viewer. Display of the data on the film will be virtually instantaneous, providing the astronauts with a readily available reference during all phases of flight.

The Apollo program at Kollsman is the responsibility of the Company's Space Division, which has its own allocation of plant space at the Syosset facility. To enable it to operate with the greatest efficiency, the Apollo program is organized as a separate unit within the Space Division. Final authority is vested in program director Arthur Ferraro, who alone reports to the division general manager, Dr. J. Robert Downing.

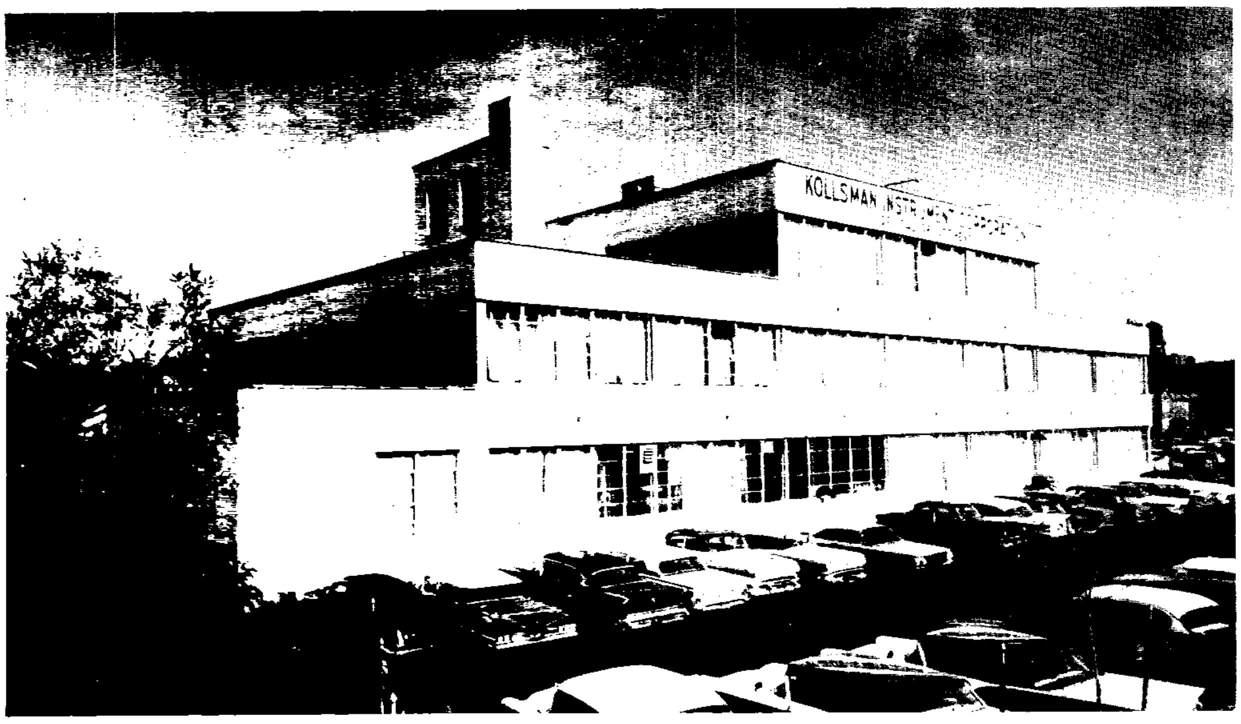
To further augment the Apollo effort, an analysis section consisting of research scientists was created. One group, working closely with the MIT analysis section, is assigned specific analytical problems which range anywhere from guidance and control analysis to abort studies. Another group concentrates upon the design of the units being built and supports its efforts by performing optical, thermal and stress analyses. These studies are backed by complete optical and environmental test facilities.

Modern Space Facilities

Kollsman's Syosset plant, which houses the Space Division, is a modern, one-story structure equipped with all the specialized facilities and equipment required for space project production. Large clean rooms meeting or surpassing the highest standards set by NASA, extensive environmental laboratories, specialized as well as standard production equipment, development laboratories, and engineering and administration office areas make up the Syosset complex. Optical grinding and finishing facilities are located in Elmhurst in a separate building designed and equipped solely for optical work.

The extremely high performance requirements established for all equipment associated with the Apollo mission have placed great emphasis upon the reliability, quality assurance and testing aspects of

For Project Apollo's Guidance-Navigation System



HOME OF KOLLSMAN'S optical devices, the optical department. Fine optics for literally thousands of periscopic sextants—forerunners of the sextants the Apollo astronauts will use—have been created here. Kollsman was a pioneer in developing such equipment.

A FEW of the high-precision optics manufactured by Kollsman—lenses, domes, prisms, reflectors and mirrors.

design and manufacturing. At the outset of the program, Kollsman created special reliability and quality assurance sections to monitor and analyse the design to insure that equipment when delivered will meet the exacting standards required for space exploration. To augment these sections, original, unique and precise opto-mechanical test equipment is being designed and manufactured to guarantee that all standards are met and maintained. This equipment includes factory, ground support, reliability and environmental test equipment.

David B. Nichinson
President
Kollsman Instrument Corp.

Consistent Growth

Kollsman's flight path from inner marker to outer space has been consistent with the growth of the aerospace industry. As manned flight became more complex, the company added optics and electronics to its precision instrumentation capabilities. In 1947 it embarked upon the course, with its development of the periscopic sextant for aircraft, which lead to its present contribution to Project Apollo. An automatic celestial navigator developed for the Navy about the same time proved to be the forerunner of a whole family of celestial navigation devices and systems produced in quantity over the past decade and a half for aerospace application. In fact, virtually every astro tracker employed in aircraft, missiles and spacecraft today has been produced at Kollsman's Syosset facility where the Apollo optical subsystem will be built.

Perhaps best known among Kollsman's celestial navigation systems and devices are the KS-50 Astro-Compass, a prime navigational system of which several thousand were produced for use aboard the B-52 jet bomber; the KS-37, first celestial navigation system for aircraft of greater than Mach 1 speed and utilized in the B-58 Hustler; the KS-85 Astro-Navigational System, first automatic photo electric sextant; the KS-120, first celestial navigation monitor for guidance in missile launching; and the KS-140 which extended the range of monitoring capability to a 24-hour span.

Kollsman's capability in optical devices was established during World War II when the company met the call for all-out production by developing set-up facilities and techniques to turn out varied optical elements. In addition to producing more than 10,000 prismatically perfect binoculars each year of the war, Kollsman delivered large quantities of drift sights for use on key bombing missions. Following the war, the company produced through 1958 alone more than 25,000 periscopic sextants, forerunners of the sextants to be used by the Apollo astronauts.

Other Space Programs

Kollsman's celestial navigation and related optical-electronics capabilities have made the company an important contributor to a number of other NASA space projects. As a prime contractor, Kollsman is responsible for the Goddard Experiment Package—one of four highly intricate experiments to be carried into space by NASA's Orbiting Astronomical Observatories. The GEP consists chiefly of a 36-inch primary mirror tracking telescope and spectrophotometer. The experiment will measure ultraviolet radiation in outer space.

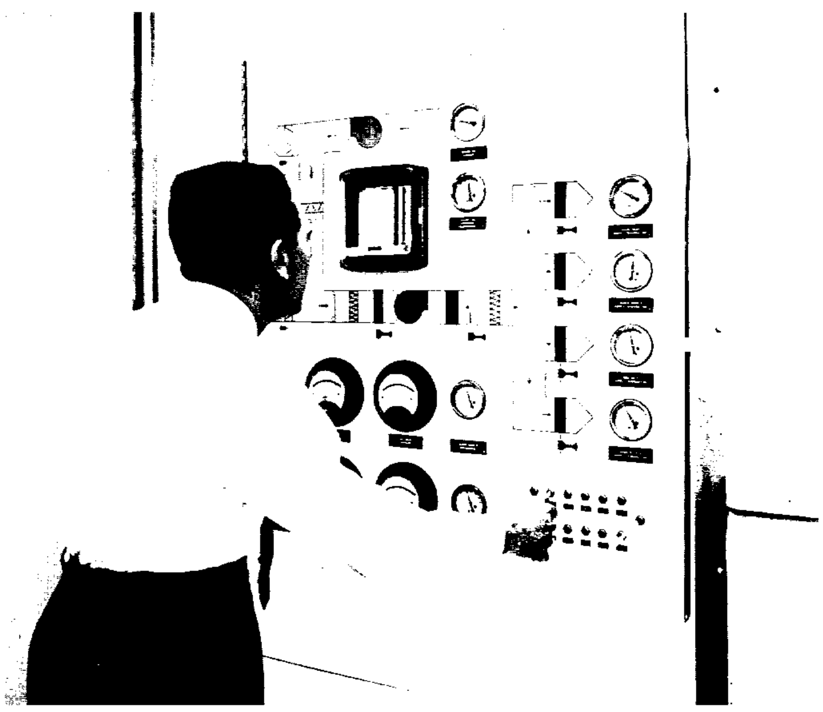
For the OAO space vehicles themselves, Kollsman developed the KS-137 astro tracker, the first space star tracker. These star trackers, six aboard each OAO, will orient the satellite in space, keeping the large telescopes in the OAO pointed at a predetermined star, sun or planet for relatively long periods of time.

Other Kollsman equipment has found its way into the nation's space program. In Project Mercury, three specially designed instruments have flown with each astronaut. These instruments, outgrowths of the early days of research in the scientific approach to manned flight, include an astronaut suit pressure indicator, a capsule altitude indicator and a cabin pressure indicator.

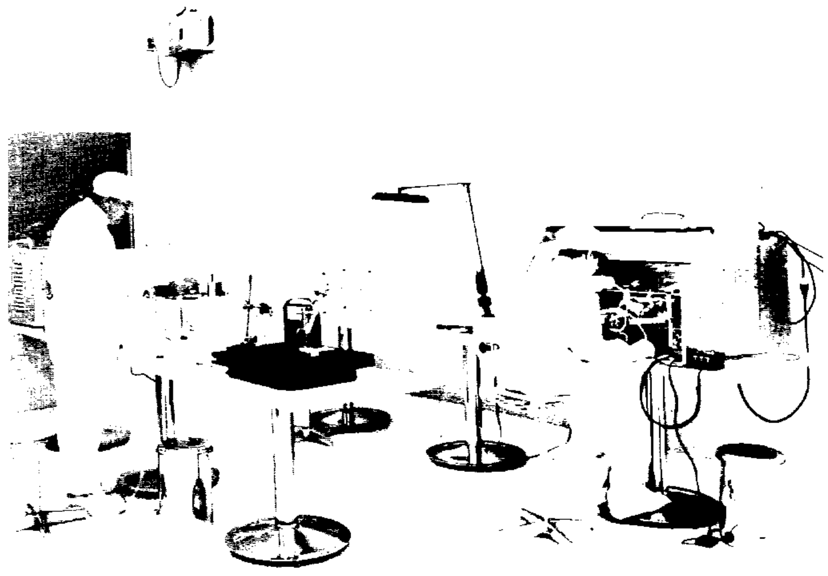
When the X-15 hurtles to the fringes of outer space and beyond, the pilot relies on Kollsman flight instruments. When the Dyna-Soar makes its first flight it will be equipped with Kollsman advance designed vertical scale angle of flight and rate of climb indicators.

This is Kollsman Instrument Corporation, a member of MSC's Apollo guidance-navigation system team . . . an industrial member of the Nation's space team.

Editor's Note: This is the seventh in a series of articles designed to acquaint MSC personnel with the Center's industrial family, the contractors and subcontractors who make MSC spacecraft, their launch vehicles and associated equipment. The material on these two pages was furnished by the Public Relations Department, Kollsman Instrument Corp.



CLEAN ROOM environmental parameters are continuously displayed on this monitoring panel. With the patching set in the lower right corner, a graph of any condition at any check point can be made. Great emphasis is placed upon control.



THE CLEAN ROOM'S specially coated walls, ceiling, and floor discourage dust adhesion. The room is maintained at constant temperature and humidity levels and is overpressured to prevent the tiniest particles of dust from seeping in.

Mercury - Atlas Missions And Test Objectives

Mission	Launch date	Objectives
Big Joe 1	September 9, 1959	(a) To recover the spacecraft. (b) To determine the performance of the ablation shield and measure afterbody heating. (c) To determine the flight dynamic characteristics of the spacecraft during reentry. (d) To establish the adequacy of the spacecraft recovery system and procedures. (e) To establish the adequacy of recovery aids in assisting the recovery of the spacecraft. (f) To conduct familiarization of NASA operating personnel with Atlas launch procedures. (g) To evaluate the loads on the spacecraft during the actual flight environment. (h) To evaluate operation of the spacecraft control system.
MA-2	February 21, 1961	(a) To determine the integrity of the spacecraft structure, ablation shield, and afterbody shingles for a reentry from a critical abort. (b) To evaluate the performance of the operating spacecraft systems during the entire flight. (c) To determine the spacecraft full-scale motions and afterbody heating rates during reentry from a critical abort. (d) To evaluate the compatibility of the spacecraft escape system with the Mercury-Atlas system. (e) To establish the adequacy of the location and recovery procedures. (f) To determine the closed-loop performance of the Abort Sensing and Implementation System. (g) To determine the ability of the Atlas booster to release the Mercury spacecraft at the position, altitude, and velocity defined by the guidance equations. (h) To evaluate the aerodynamic loading vibrational characteristics and structural integrity of the LO_2 boiloff valve, tank dome, spacecraft adapter and associated structures.
MA-4	September 13, 1961	(a) To demonstrate the integrity of the Mercury spacecraft structure, ablation shield, and afterbody shingles for a normal reentry from orbital conditions. (b) To evaluate the performance of the Mercury spacecraft systems for the entire flight. (c) To determine the spacecraft motions during a normal reentry from orbital conditions. (d) To determine the Mercury spacecraft vibration environment during flight. (e) To demonstrate the compatibility of the Mercury spacecraft escape system with the Mercury-Atlas system. (f) To determine the ability of the Atlas booster to release the Mercury spacecraft at the prescribed orbital insertion conditions. (g) To demonstrate the proper operation of the network ground command control equipment. (h) To evaluate the performance of the network equipment and the operational procedures used in establishing the launch trajectory and booster cutoff conditions and in predicting landing points. (i) To evaluate the applicable ground communications network and procedures. (j) To evaluate the performance of the network acquisition aids, the radar tracking system, and the associated operational procedures. (k) To evaluate the telemetry receiving system performance and the telemetry displays. (l) To evaluate the spacecraft recovery operations, as to the equipment and procedures used for communications and for locating and recovering the spacecraft, for a landing in the Atlantic Ocean along the Mercury Network. (m) To obtain data on the repeatability of the booster performance of all Atlas missile and ground systems. (n) To determine the magnitude of the booster sustainer/vernier residual thrust after cutoff. (o) To evaluate the performance of the Abort Sensing and Implementation System. (p) To evaluate and develop applicable Mercury Network countdown and operational procedures. (q) To evaluate the Atlas booster with regard to engine start and potential causes for combustion instability.
MA-5 Primate aboard	November 29, 1961	(a) To demonstrate the performance of the Environmental Control System by utilizing a primate during an orbital mission. (b) To demonstrate satisfactory performance of the spacecraft systems throughout a Mercury orbital mission. (c) To determine by detail measurements, the heating rate and the thermal effects throughout the Mercury spacecraft for all phases of an orbital mission. (d) To exercise the satellite clock. (e) To determine the ability of the Atlas booster to release the Mercury spacecraft at the prescribed orbital insertion condition.

		(f) To demonstrate satisfactory performance of the Mercury Network in supporting an orbital mission. (g) To demonstrate the ability of the Flight Controllers to satisfactorily monitor and control an orbital mission. (h) To demonstrate the adequacy of the recovery plans for an orbital mission; particular emphasis is required for the spacecraft occupant. (i) To evaluate the performance of the Abort Sensing and Implementation System. (j) To determine the magnitude of the booster sustainer/vernier residual thrust or impulse after cutoff. (k) To obtain data on the repeatability of the booster performance of all Atlas missile and ground systems. (l) To evaluate the Mercury Network countdown and operational procedures. (m) To evaluate the Atlas booster with regard to engine start and potential causes for combustion instability.
MA-6	February 20, 1962	(a) To evaluate the performance of a man-spacecraft system in a three-orbit mission. (b) To evaluate the effects of space flight on the astronaut. (c) To obtain the astronaut's evaluation of the operational suitability of the spacecraft and supporting systems for manned space flight.
MA-7	May 24, 1962	(a) To evaluate the performance of the man-spacecraft system in a three-pass orbital mission. (b) To evaluate the effects of orbital space flight on the astronaut. (c) To obtain the astronaut's opinions on the operational suitability of the spacecraft systems. (d) To evaluate the performance of spacecraft systems replaced or modified as a result of previous missions. (e) To exercise and evaluate further the performance of the Mercury Worldwide Network.
MA-8	October 3, 1962	(a) To evaluate the performance of the man-spacecraft system in a six-pass orbital mission. (b) To evaluate the effects of an extended orbital space flight on the astronaut and to compare this analysis with those of previous missions and astronaut-simulator programs. (c) To obtain additional astronaut evaluation of the operational suitability of the spacecraft and supporting systems for manned orbital flight. (d) To evaluate the performance of spacecraft systems replaced or modified as a result of the previous three-pass orbital missions. (e) To evaluate the performance of and exercise further the Mercury Worldwide Network and mission support forces and to establish their suitability for extended manned orbital flight.
MA-9	May 15, 1963	(a) To evaluate the effects on the astronaut of approximately one day in orbital flight. (b) To verify that man can function for an extended period in space as a primary operating system of the spacecraft. (c) To evaluate in a manned one-day mission the combined performance of the astronaut and a Mercury spacecraft specifically modified for the mission.

Mercury Ends

(Continued from page 1)

J. Shannon, assistant chief of the Engineering Operations Office, who was acting chief for one day in the absence of chief James E. Bost. "One day on the job and the whole shop folds," kidded his cohorts. Secretaries appeared with mock "crying towels."

Over all, however, there was a air of a job well done.

The flight story actually began on August 21, 1959, when the first Little Joe firing was cancelled due to a faulty wiring circuit which prematurely actuated the escape system and carried the spacecraft out over the water.

Big Joe I, however, which carried a boiler-plate spacecraft on an Atlas launch vehicle, September 9, 1959 accomplished its technical objectives so well that a second similar mission, Big Joe II, was cancelled.

On October 4, 1959, the Little Joe booster checked out well in a test conducted at Wallops Island, Virginia. No effort was made to recover the boiler-plate spacecraft.

A month later, Little Joe 1-A was flown at Wallops to execute a planned abort under high aerodynamic load conditions, and the boiler-plate spacecraft was recovered.

Another month later, on December 4, a rhesus monkey named Sam became the first Mercury "space-monkey" when he was recovered from Little Joe 2. All test objectives were met.

"Miss Sam," another rhesus, followed Sam's lead on January 21, 1960, in a Wallops Island test to evaluate the escape system of the spacecraft under high aerodynamic load, Little Joe 1-B.

A beach abort test utilizing McDonnell's first production spacecraft and its escape rocket system were flight tested in an off-the-pad test at Wallops Island May 9, 1960 to evaluate the escape rocket system. No booster was used. The test was successful.

July 29, 1960, saw the first Atlas-boosted flight with production spacecraft No. 4, which contained only a minimum number of systems and no escape tower. A structural failure in the spacecraft-booster interface caused an unsuccessful test, and the spacecraft was lost.

Meanwhile the Little Joe program continued with LJ-5 on November 8, 1960 at Wallops. Premature firing of the escape rocket prevented the spacecraft separating from the booster and it was lost.

Mercury-Redstone 1, November 21, 1960, was the first unmanned Mercury-Redstone suborbital flight. An unscheduled engine cutoff resulted in premature jettisoning of the escape rocket when the booster was only about an inch off the pad. The booster settled back with only slight damage and spacecraft No. 2 remained attached, undamaged, and suitable for use on MR 1-A.

That flight took place less than a month later on December 19, 1960 with complete success.

It opened the way for Ham, a 37-pound chimpanzee, in spacecraft No. 5, who reached a height of 157 miles January 31, 1961 on MR-2.

MA-2, February 21, 1961, checked maximum heating rates during the worst reentry conditions and evaluated the modifications resulting from the unsuccessful MA-1. All objectives were met and spacecraft No. 6 was recovered.

A repeat test of the unsuccessful Little Joe 5, called Little Joe 5-A, was held, but failed when the escape rocket fired before spacecraft No. 14's release. There was no structural damage to the spacecraft, however, and it was refurbished for Little Joe 5-B, the third test of the escape system under maximum exit dynamic pressure, which was successful April 28, 1961.

Meanwhile a Mercury-Redstone booster development test was successful on March 24, 1961. The boiler-plate spacecraft was the one which had flown previously with Miss Sam on LJ5-B. No attempt was made to recover the spacecraft, and all test objectives were met.

MA-3, on April 25, 1961 was the first attempt to orbit a Mercury spacecraft. Due to booster guidance malfunction, the booster was destroyed by the Range Safety Officer about 40 seconds after lift-off, but the spacecraft performed a successful escape manuever and was recovered and refurbished for MA-4.

On May 5, 1961, "Freedom 7" (MR-3), carrying Astronaut Alan B. Shepard, Jr. achieved an altitude of 116.5 miles and a range of 302.8 nautical miles in the first manned space mission, a complete success. The following July 21, "Liberty Bell 7," and Astronaut Virgil I. Grissom topped his altitude by almost two miles with slightly less range (MR-4).

America's first orbital flight, the unmanned Mercury-Atlas 4, successfully made one earth orbit on September 13, 1961. On November 29, a chimpanzee named Enos successfully orbited the earth twice on MA-5.

The flight opened the way for the manned orbital flights.

PRESIDENT JOHN F. KENNEDY shakes hands with some of the spectators during his May 29 visit to White Sands Missile Range, N. M., where he saw firings of the Army's Sergeant, Honest John, Little John, Hawk, Nike Hercules, Nike Zeus and the Navy's Talos missiles. Accompanying him were Vice President Lyndon Johnson and Army Secretary Cyrus Vance.

NASA Signs With AC Spark Plug For $35 Million

NASA has signed a contract totaling $35,844,550 with the AC Spark Plug Division of General Motors Corporation to fabricate, assemble and test the navigation and guidance system for the Apollo command module.

AC Spark Plug is one of three contractors participating with the Instrumentation Laboratory of the Massachusetts Institute of Technology, which has overall responsibility to NASA for design, development testing and operation support of the Apollo navigation and guidance system.

The Raytheon Company contract is for $15,029,420.

Under the contract AC Spark Plug will fabricate electro-mechanical components and will assemble and test the complete guidance and navigation subsystem.

SECOND FRONT PAGE

ITT Gets Contract For Apollo Storage Battery Charger Units

An electronic power storage battery charger designed to help insure the electrical life lines of America's first men on the moon has been ordered for NASA's Apollo spacecraft.

ITT Industrial Products, San Fernando, Calif., a division of International Telephone and Telegraph Corporation, was selected to build the battery charger units by North American Aviation's Space and Information Systems Division, principal contractor on the Apollo spacecraft. Amount of the contract is being negotiated.

The size of a box camera, the device will maintain peak readiness of the three batteries in the Apollo command module as well as the battery pack for the life support equipment that the astronauts will carry to the moon's surface.

The batteries in the command module will supply power when the main source of electricity is unavailable.

To meet the extreme reliability requirements of the Apollo program, the battery charger is being designed to operate for 40,000 hours, or more than four years, as compared to the two week duration of the Apollo mission.

Project Mercury Flight Data Summary

Flight	Launch date	Maximum altitude			Maximum range		Maximum velocity			Flight duration: lift-off to impact hr:min:sec
		Feet	Statute miles	Nautical miles	Statute miles	Nautical miles	Ft/sec earth-fixed	Ft/sec space-fixed	Mph space-fixed	
Big Joe 1	9-9-59	501,600	95.00	82.55	1,496.00	1,300.00	20,442	21,790	14,856.8	13:00
LJ-6	10-4-59	196,000	37.12	32.26	79.40	69.00	3,600	4,510	3,075.0	5:10
LJ-1A	11-4-59	47,520	9.00	7.82	11.50	10.00	2,040	2,965	2,021.6	8:11
LJ-2	12-4-59	280,000	53.03	46.08	194.40	169.00	5,720	6,550	4,465.9	11:06
LJ-1B	1-21-60	49,104	9.30	8.08	11.70	10.20	2,040	2,965	2,021.6	8:35
Beach abort	5-9-60	2,465	0.47	0.41	0.60	0.50	475	1,431	976.2	1:16
MA-1	7-29-60	42,768	8.10	7.04	5.59	4.85	1,560	2,495	1,701.1	3:18
LJ-5	11-8-60	53,328	10.10	8.78	13.60	11.80	1,690	2,618	1,785.0	2:22
MR-1A	12-19-60	690,000	130.68	113.56	234.80	204.00	6,350	7,200	4,909.1	15:45
MR-2	1-31-61	828,960	157.00	136.43	418.00	363.00	7,540	8,590	5,856.8	16:39
MA-2	2-21-61	602,140	114.04	99.10	1,431.60	1,244.00	18,100	19,400	13,227.3	17:56
LJ-5A	3-18-61	40,800	7.73	6.71	19.80	17.20	1,680	2,615	1,783.0	23:48
MR-BD	3-24-61	599,280	113.50	98.63	307.40	267.10	6,560	7,514	5,123.2	8:23
MA-3	4-25-61	23,760	4.50	3.91	0.29	0.25	1,135	1,726	1,176.8	7:19
LJ-5B	4-28-61	14,600	2.77	2.40	9.00	7.80	1,675	2,611	1,780.2	5:25
MR-3	5-5-61	615,120	116.50	101.24	302.80	263.10	6,550	7,530	5,134.1	15:22
MR-4	7-21-61	624,400	118.26	102.76	302.10	262.50	6,618	7,580	5,168.2	15:37
MA-4	9-13-61	750,300	142.10	123.49	26,047	22,630	24,389	25,705	17,526.0	1:49:20
MA-5	11-29-61	778,272	147.40	128.09	50,892	44,104	24,393	25,710	17,529.6	3:20:59
MA-6	2-20-62	856,279	162.17	140.92	75,679	65,763	24,415	25,732	17,544.1	4:55:23
MA-7	5-24-62	880,792	166.82	144.96	76,021	66,061	24,422	25,738	17,548.6	4:56:05
MA-8	10-3-62	928,429	175.84	152.80	143,983	125,118	24,435	25,751	17,557.5	9:13:11
MA-9	5-15-63	876,174	165.9	144.2	546,167	474,607	24,419	25,735	17,546.6	34:19:49

Listed range is earth track
Big Joe= MA Development Flight
MR-BD= Booster Development Flight

LJ= Little Joe
MR= Mercury Redstone
MA= Mercury Atlas