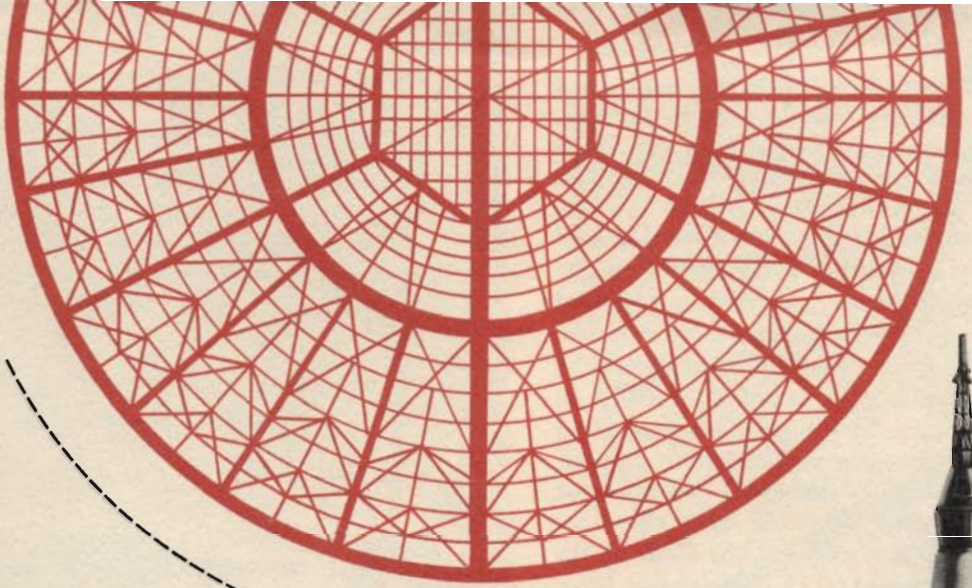


COMMUNICATIONS FOR MERCURY

Since the dawn of human life, man has turned his questioning face towards the heavens. He has looked with awe and wonder at the starry firmament and has sought to understand its endless mystery.

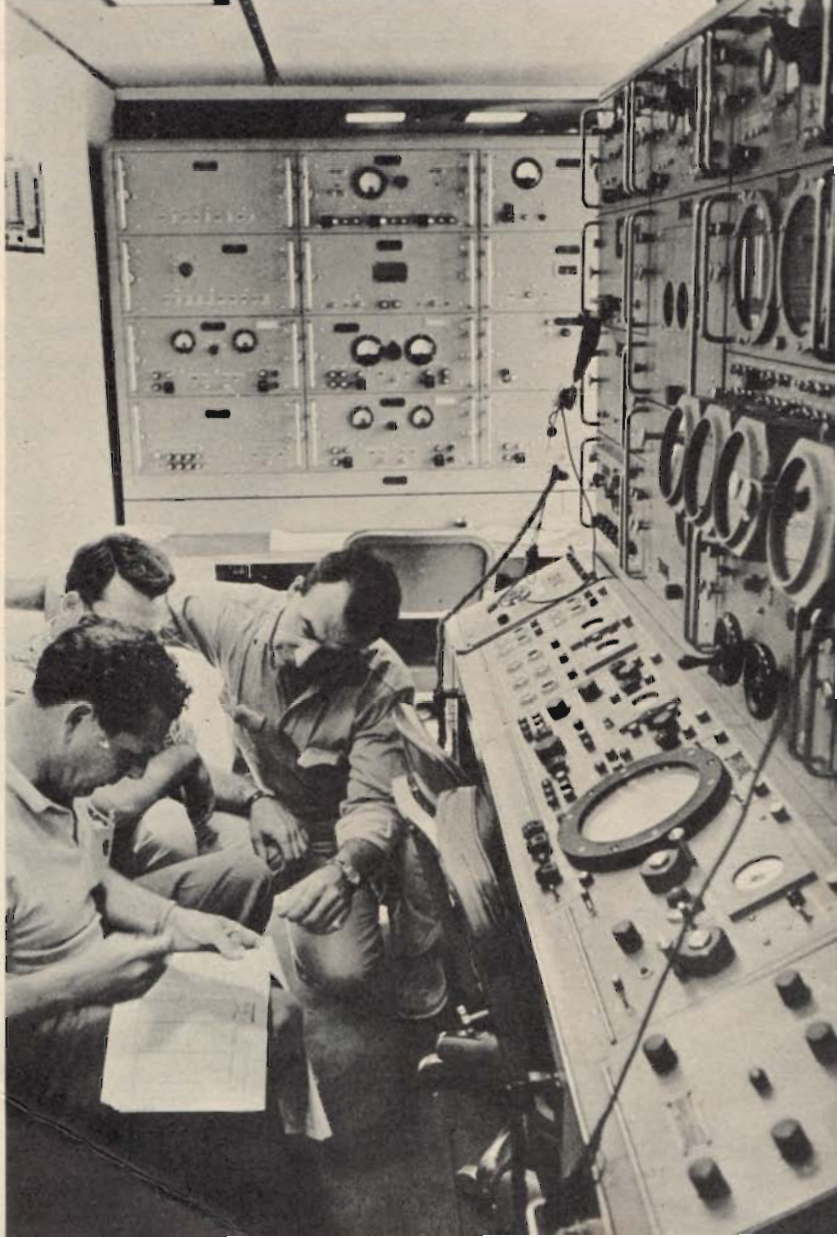
And probably for about the same length of time, men have dreamed of flying away from the earth toward the planets and stars scattered at vast distances throughout the universe.

Spurred by the desire for knowledge for its own sake and for the peaceful benefit of all mankind, we are now on the verge of penetrating this mysterious frontier of space.

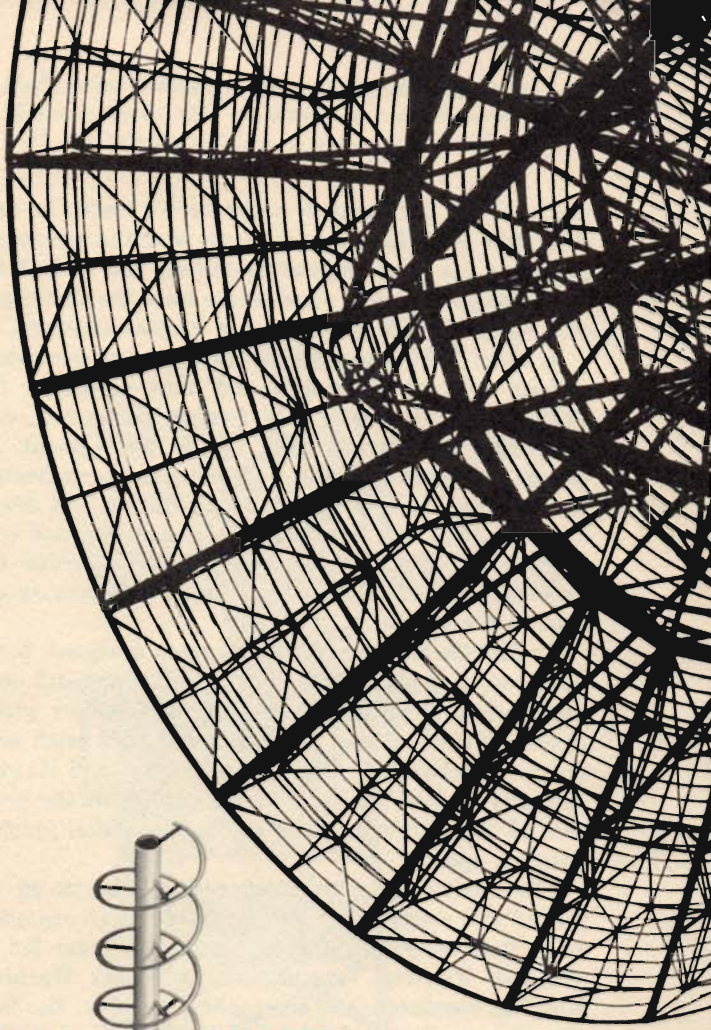
Soon a manned U. S. spacecraft will be thrust into an orbit about 125 miles above the earth, make three circuits of the globe at the approximate speed of 17,500 miles per hour, and then descend to the Earth in a selected area on the Atlantic Ocean.

The historic flights of Russia's space men proved man's capability to achieve space flight and survive. As the first phase of our own program of manned space flight, Project Mercury is the result of painstaking preparation that is unsurpassed in its concern for the safety of the astronaut and the collection of vital scientific data on his flight.

Besides again proving the wonderful ingenuity of man the flight will also demonstrate the advantages gained when many thousands of men work as a team to reach a difficult objective. The Bell System team is proud to contribute its skills, experience and leadership to the communications phase of this project.



Typical Mercury site—this one at Kauai, Hawaii.



THE TRACKING AND COMMUNICATIONS SYSTEM

In July, 1959, NASA, the National Aeronautics and Space Administration, charged Western Electric with the job of prime contractor for a tracking and communications system for Project Mercury as well as the responsibility for project management, ground communications, personnel training, and overall logistics.

Though the script was new, Western Electric's role in Project Mercury was a familiar one. The part called for down-to-earth skills in engineering and a thorough knowledge of communications systems. It also called for the experience of an organization with proved capabilities to solve the complexities of managing vast projects.

These were some of the qualities the government had found in Western Electric in the past in such communications projects as the Dew Line, SAGE, BMEWS, and the White Alice communications system in Alaska.

From the inception of Project Mercury, it was obvious that putting a man in space would be of little value without methods to gather and process the infor-

mation from the flight in progress. To track the capsule while in orbit, to communicate with the astronaut, to record his physiological reactions, and to link together distant ground sites—these were the challenges to a communications system for Project Mercury.

In July, 1961 a worldwide tracking and communications network, developed and built especially for Project Mercury under Bell System leadership, was completed and turned over to the government. In almost two years to the day, an industrial team headed by Western Electric, through cooperation and determination, had met its challenge by devising and constructing a global network which would solve the problems of communicating almost instantaneously around the world.

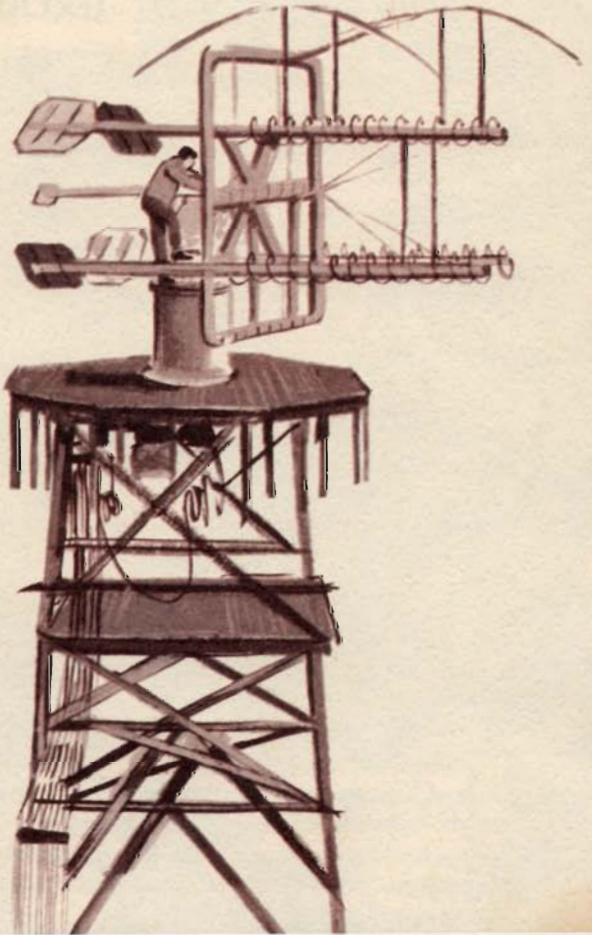
To provide such a service, the team designed, built, equipped, and connected separate tracking and communications stations at 18 sites around the globe. From Florida around the world and back with such points in between as Bermuda, Zanzibar and Hawaii, specially trained men will record and report the progress of the astronaut as he makes his orbital journey through space.

The creation of the communications network required the cooperation and skills of many organizations both here and abroad. From the team led by Western Electric, International Business Machines supplied computers and computer programs; the Bendix Corporation supplied and installed radar telemetry and ground-to-air communications equipment, and Burns & Roe, Inc. was in charge of site construction. Overall management, plus the engineering and providing of the network's system of ground communications was the special job of Western Electric. A.T.&T. and the Bell operating companies, as well as other communications companies around the world, played a big part in putting this network together. Besides acting as an engineering consultant for the network, Bell Telephone Laboratories designed the command and control equipment which will provide NASA's ground-based operations director with the necessary information for directing the space-flight.

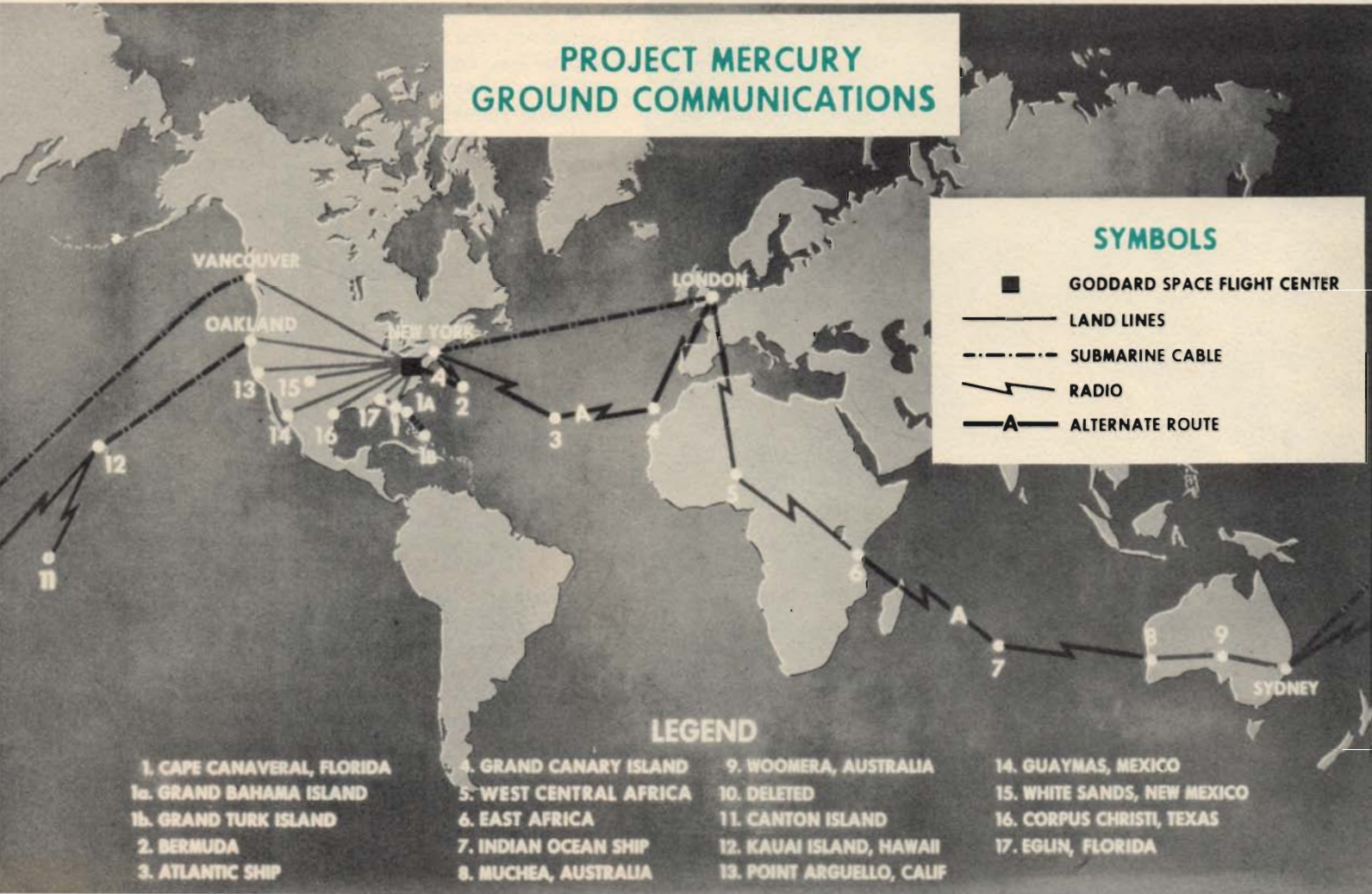
The communications network is basically a vast data handling system which functions as a receiver and transmitter of information with men and computers in between. The network, one of the largest in the world, consists of about 100,000 miles of teletypewriter circuits, 35,000 miles of telephone circuits and over 5,000 miles of high-speed data circuits. Some 20 private and public communications agencies throughout the world are providing leased land lines and overseas radio and cable facilities.

Equal to the complexity of the network were perplexities of building it. To arrange for the shipping of more than two thousand tons of materials, to translate thick instruction manuals into foreign languages, to discourage giant ants from eating into buried wire cables – these are indicative of the problems which constantly threatened to throw off the tight scheduling of the project.

Radar and telemetry equipment installed at the Mercury sites will be ready to maintain contact with the capsule. At left, a pass over Florida.



The map below presents the world wide tracking and ground instru
mentation network of Project Mercury in all its geographical scop
The Western Electric-led industrial team charged with building an
equipping the stations, completed the job on schedule.



GODDARD SPACE FLIGHT CENTER

THE GODDARD Space Flight Center at Greenbelt, Maryland is the communications and computing hub of the entire global system. Close to the nation's capital, Goddard connects the 18 tracking and communications stations around the world.

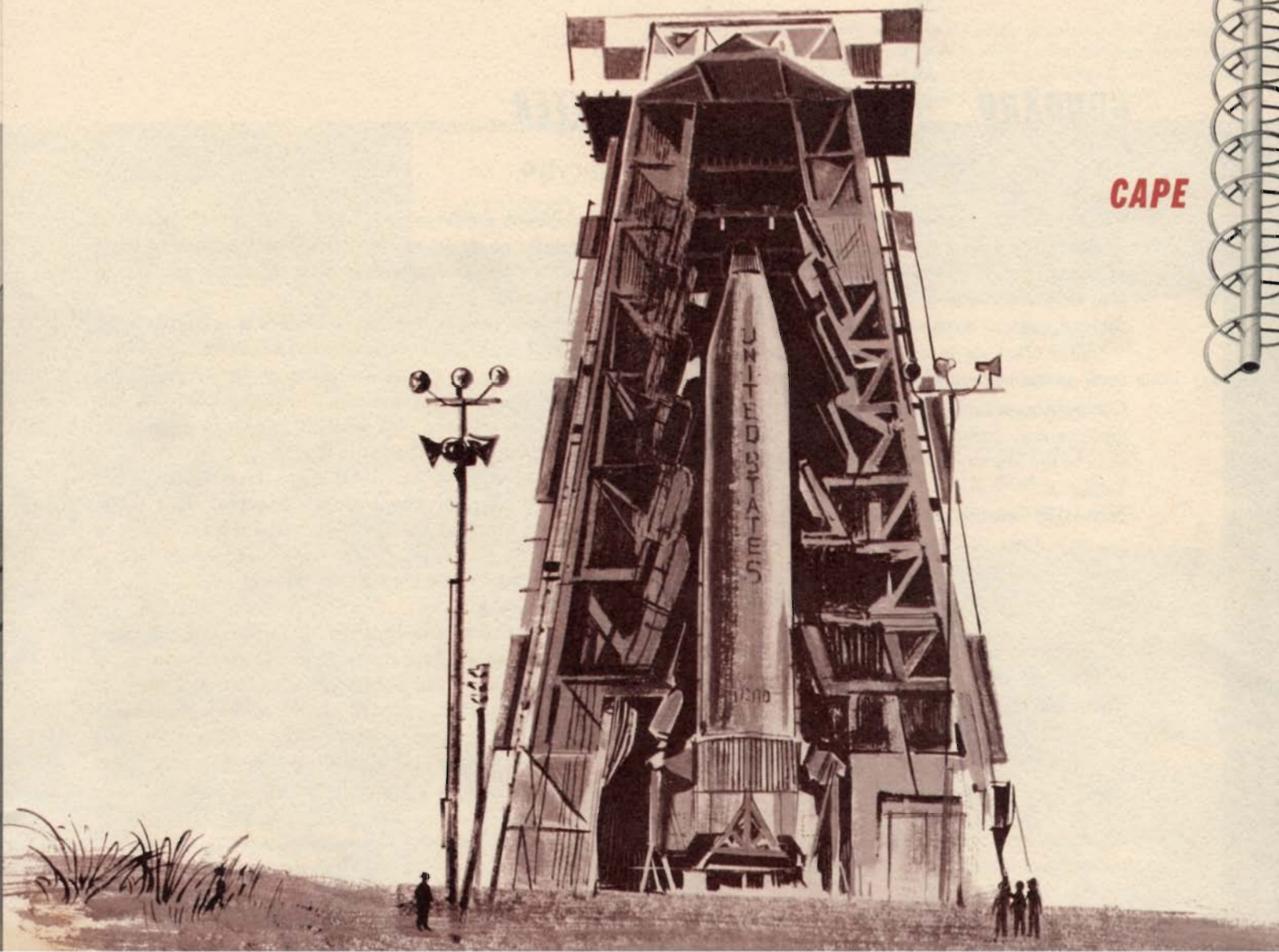
Radar tracking information pours into Goddard as soon as the rocket booster lifts an inch off the pad. Computers, capable of 200,000 calculations a minute, analyze and digest the information before relaying data to the Mercury Control Center at Cape Canaveral. Using Bell System data transmission circuits, information essential to various phases of the orbital journey flows back and forth between Goddard and Canaveral almost instantaneously. During the launch phase, for example, thousands upon thousands of facts (bits of information) picked up by Canaveral's antenna from the impulses of the spaceborne vehicle, will be relayed to Goddard, processed, and sent back to Canaveral again in seconds.

The Long Lines Department of A.T.&T. has also designed a special switchboard which will allow Goddard operating personnel to participate in round-the-world telephone conferences. Called a "SCAMA" board, it permits as many as nine telephone locations to be in conference simultaneously with Mercury officials at Canaveral.

One of Goddard's main objectives is to calculate the orbital path of the spacecraft and, from this information, to inform each station of its arrival time. These "acquisition messages" are composed by the computer and are sent without human processing by teletypewriter to the various sites.

The precise orbital predictions from Goddard are relayed continuously to Cape Canaveral. This information provides the key in determining the exact instant the spacecraft's retro-rockets should be fired to begin descent back to Earth as well as its probable impact area.

In addition to its vital function in the manned space flights, the Goddard Space Flight Center is also a key installation in the unmanned scientific satellites. In September, 1961, Goddard and the world-wide network successfully passed its first full-scale Project Mercury operational test by monitoring the robot Mercury spacecraft as it orbited the earth.


CAPE
UNITED STATES

CANAVERAL

CAPE CANAVERAL is a flat bulge of sand and palmetto bushes jutting eastward into the Atlantic Ocean from the East Coast of Florida. Several years ago it was virtually unknown outside of Florida; today it is one of the most familiar datelines in the world. A squat, one-story building houses the Project Mercury Command and Control Center. During a Mercury test, some 15 highly-trained NASA controllers in the Operations Room concentrate on a special complex of consoles and wall displays.

Their information comes from Goddard, other Cape facilities and from the network stations. All vital decisions during a Mercury launch are made at Canaveral. When the spacecraft is within range, the Center can communicate directly with the astronaut.

At a glance, controllers can check the operations of the spacecraft and the physical condition of the astronaut. An elaborate map of the world shows the location of the spacecraft and its predicted recovery area should the craft be directed to abandon its orbital path at that instant.

This operations room was designed under the supervision of Bell Telephone Laboratories, which also participated in the development of a simulator for training the ground flight controllers which faithfully simulate actual conditions encountered in the spacecraft.

All Project Mercury missions, including preparations for them, are team efforts. An estimated 5,000 persons, including engineers, scientists and technically trained people are involved in support of each flight.

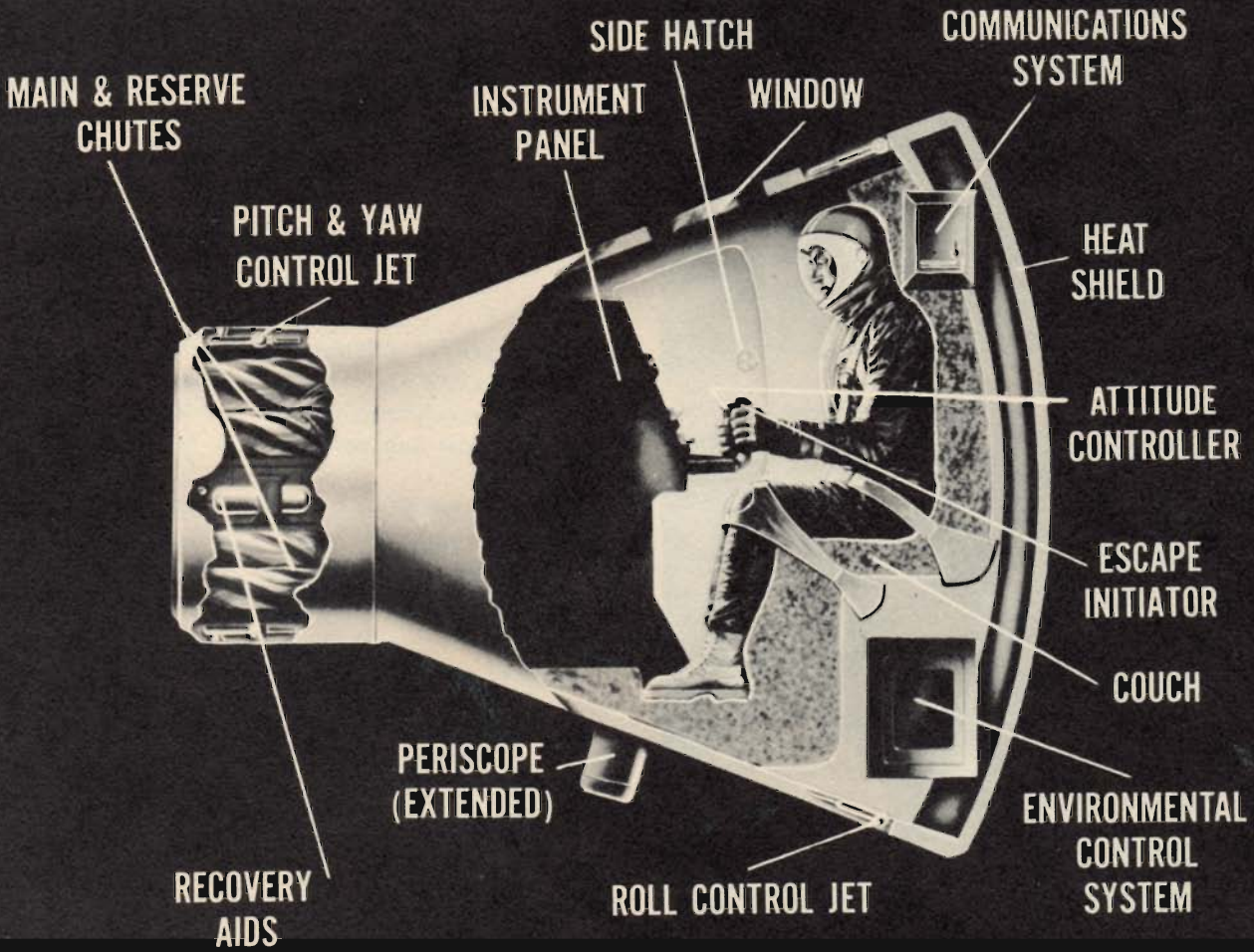
THE SPACECRAFT

THE PROJECT MERCURY craft is cone-shaped with a height of nine feet and a six foot width at the base. At launch, it weighs two tons. Within it are seven miles of electrical wire. McDonnell Aircraft Corp. is NASA's prime contractor for Mercury spacecraft production.

The spacecraft is designed to operate either by the direction of the astronaut or by ground control. Every component essential to the safety of the astronaut is backed by at least one other method of achieving the same result.

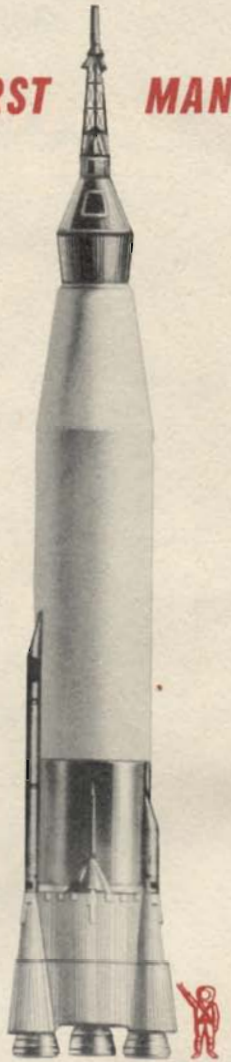
Each of the selected seven astronauts has his own body-protecting couch which fits securely into the spacecraft. Controls are handy from the couch position, as is an array of 165 instrument dials, switches and toggles.

One of these toggles actuates the emergency escape system, which (by a solid-fuel rocket in a 16-foot tower above the spacecraft) lifts the spacecraft away from the rocket booster. Boosters are "sensed" so in case of trouble they can trigger the escape system automatically. In an emergency, the rocket would pull the spacecraft away from the booster and put several hundred feet between the spacecraft and its malfunctioning booster in just one second. The tower, which mounts the rocket, then would be separated, allowing the spacecraft to begin a parachute descent. The escape system also can be triggered by command from the ground.


MAIN & RESERVE CHUTES
PITCH & YAW CONTROL JET
INSTRUMENT PANEL
SIDE HATCH
WINDOW
COMMUNICATIONS SYSTEM
HEAT SHIELD
ATTITUDE CONTROLLER
ESCAPE INITIATOR
COUCH
ENVIRONMENTAL CONTROL SYSTEM
PERISCOPE (EXTENDED)
RECOVERY AIDS
ROLL CONTROL JET

Top, left: Safely launched by Atlas rocket from Cape Canaveral, the capsule is separated from its escape assembly and booster stages by jettison rockets, and heads over into recovery position. On the third orbit, rockets will arrest its speed (left) and parachutes will be released to ease the descent.

THE FIRST MANNED



ORBITAL FLIGHT

TIME: Soon.

The global communications network is ready.

Cape Canaveral is busy.

An Atlas rocket waits on the pad.

Hours of painstaking checking by engineers and scientists of rocket and spacecraft systems will precede the countdown. Similar countdown checks also will be made at each tracking and communications station.

As dawn draws near on that historic day, the selected astronaut will leave the pilot quarters in Hanger S. He will be carrying a portable oxygen system. A white van will drive him to the launching area. He will ride in an elevator to the spacecraft atop the Atlas, and in his craft will await the moment of liftoff. Finally, that moment will arrive:

"Mainstage!"

"Liftoff!"

As the Atlas picks up speed, gravity forces will push the astronaut down in his couch. He will also experience some buffeting as the rocket attains the speed of sound. This will pass quickly.

In about two minutes and at a height of about 50 miles the two burned-out booster rockets will drop away, and the sustainer engine will carry on for another three minutes.

The craft will circle the earth in about 90 minutes. On the third orbit, the retrograde rockets will be fired about 400 miles off the Pacific coast to start the reentry. The spacecraft will then begin its descent toward a recovery area north of Puerto Rico.

When the spacecraft drops to about 21,000 feet over the ocean, a stabilizing parachute will open, followed at the 10,000-foot altitude mark by the main chute.

Shortly after the capsule splashes into the water Navy vessels and helicopters will help pluck the astronaut from his craft. Western Electric MILS (Missile Impact Locating System) will be standing by as a back up to all the other means of locating the spacecraft on impact.

TOWARD THE

PROJECT MERCURY is only the first step in America's endeavors to achieve interplanetary spaceflight. Another phase of the program, Project Apollo, will concentrate America's efforts on the manned exploration of the moon.

The downrange flights of Alan Shepard and Virgil Grissom have already dramatized our determination and ability to succeed in this venture.

The United States, believing that scientific advances can further the peaceful aspirations of all mankind, is sharing its space-gained knowledge with scientists the world over. Our explorations, by giving birth to new materials and thousands of new products, will contribute to a better standard of living.

In the near future, we may be better prepared to cope with the caprices of nature through more accurate weather forecasting. And, as we explore further, there will be other discoveries and other advances.

Scientists believe that the moon and planets hold the answers to many questions concerning the creation and development of the solar system. They also believe that to explore further to unlock these answers must be a shared undertaking which represents the peaceful ambitions of the entire world.

Man is now about to begin collecting these answers, and other answers too. The effort rises from the peaceful ambitions of the entire world. The Bell System's part in it – the first part, and a proud part – is Project Mercury.

FUTURE

SEE THE MERCURY COMMUNICATIONS SYSTEM IN ACTION

Suppose you were an astronaut, about to take off on a flight into space—what would your needs be?

With this question the motion picture "A VOICE FOR MERCURY" launches you into orbit and shows you how the Mercury tracking and communications system works.

This full color motion picture is available, free, for showing to schools, clubs and other community groups. Copies may be obtained from your nearest Western Electric location or the business office of your local Bell telephone company.

16mm., 14½ minutes.

"A VOICE FOR MERCURY"

WISCONSIN TELEPHONE COMPANY

LITHO IN U.S.A.