NASA Facts

National Aeronautics and
Space Administration
Langley Research Center
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Langley's Role in Project Mercury

Project Mercury

Thirty-five years ago on May 5, 1961, Alan Shepard was propelled into space aboard the Mercury capsule Freedom 7. His 15-minute suborbital flight was part of Project Mercury, the United States' first man-in-space program. The objectives of the Mercury program, eight unmanned flights and six manned flights from 1961 to 1963, were quite specific: To orbit a manned spacecraft around the Earth, investigate man's ability to function in space, and to recover both man and spacecraft safely. Project Mercury included the first Earth orbital flight made by an American, John Glenn in February 1962.

The five-year program was a modest first step. Shepard's flight had been overshadowed by Russian Yuri Gagarin's orbital mission just three weeks earlier. President Kennedy and the Congress were concerned that America catch up with the Soviets. Seizing the moment created by Shepard's success, on May 25, 1961, the President made his stirring challenge to the nation — that the United States commit itself to landing a man on the moon and returning him to Earth before the end of the decade. Apollo was to be a massive undertaking — the nation's largest technological effort.

The first home of Project Mercury was Langley Research Center in Hampton, Va. More significantly, most of the leadership for Project Mercury and, later, Gemini and Apollo, were Langley engineers. Until then, the Langley lab was not known to many outside the aerospace community.

NASA Langley's Major Contributions to Project Mercury

- **Initial home of Project Mercury**
- **Trained original seven astronauts**
- **Invented Mercury space capsule design**
- **Tested Mercury space capsule**
- **Designed and monitored a tracking and ground instrumentation system**

NASA Langley Research Center photo #59-8027

Langley researchers conduct an impact study test of the Mercury capsule in the Back River in Hampton, Va.

Langley Research Center, established in 1917 as the National Advisory Committee for Aeronautics (NACA) Langley Memorial Aeronautical Laboratory, was the first U.S. civilian aeronautical research facility devoted to the advancement of the science of flight. Almost every aspect of flight was studied at Langley and, during World War II, at the request of the military, the Pilotless Aircraft Research Division (PARD) was begun.

Aiding the military's development of pilotless aircraft was how researchers at Langley first got interested in the problems of space exploration. Learning the techniques associated with building, instrumenting, launching and monitoring rockets and missiles later proved essential to the American space program and Project Mercury.

NASA Langley's Role in Project Mercury

NASA Langley made many important contributions to Project Mercury. The research center and its staff members were transformed by the Nation's rush

to make human spaceflight a reality. Once dedicated exclusively to the advancement of aeronautics, Langley engineers were reassigned, and asked to help solve problems far removed from their original training and experience. “Basic” research was supplanted by “project” work as the Langley laboratory was renamed NASA Langley Research Center. The physical plant was dramatically expanded as was the center’s staff and budget. For the first time, Langley began to work with large contractors on major research endeavors in what was an exciting time for both researchers and the Nation.

Mercury Project Management

After President Eisenhower delegated authority for the country’s manned space program to the National Aeronautics and Space Administration in 1958, the first NASA administrator, T. Keith Glennan, assigned the working level responsibility to Langley’s assistant director Robert Gilruth. Gilruth asked the small group of designer/engineers from the Pilotless Aircraft Research Division (PARD) to step up their studies of ballistic-shaped spacecraft. In November 1958, Gilruth garnered many of the forces from PARD to form the Space Task Group (STG) to manage Project Mercury, the first phase of NASA’s manned space program.

As Project Mercury matured, the STG grew. By the summer of 1959, there were 400 people assigned to finish mission definition studies and begin the advanced engineering work. One small group was sent to Florida to ready NASA’s manned launch site at the Atlantic Missile Range, while another group went to oversee the work of the prime spacecraft contractor McDonnell Aircraft Corp. in St. Louis.

While more plans for space exploration were being mapped out, NASA made arrangements to expand its facilities. Gilruth wanted Langley to be the main center but their were other contenders. The two main sites under consideration were in Massachusetts and Texas. In the end, the Manned Spacecraft Center, now the Johnson Space Center, was built in Houston. As construction was completed, Gilruth and the Space Task Group moved to Texas.

Spacecraft and Related Systems

While numerous aerodynamic, structural, materials and component tests were being conducted at NASA Langley, one team of Langley researchers were scheduling wind tunnel tests at an air force facility in Tennessee.

NASA Langley scientists and researchers had been working on a variety of rocket designs — launch, guidance, automatic control and telemetry systems were all under development before Project Mercury took shape in 1958. The Little Joe and Big Joe were two important programs.

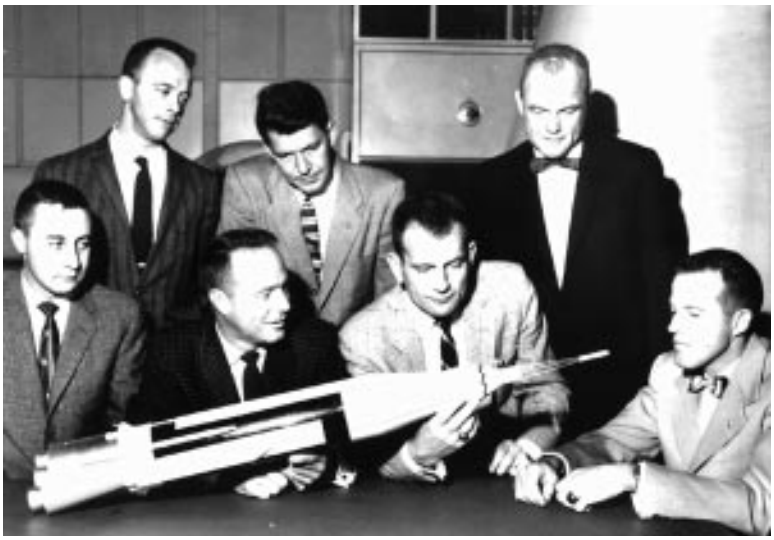
Little Joe was a solid-fuel rocket, and one of the earliest U.S. launch vehicles based on the principle of the clustered rocket engine. Langley’s Maxime Faget and Paul Purser, who conceived and designed the four-cluster, solid-propellant booster, nicknamed the project Little Joe. The first successful launch of Little Joe occurred at Wallops Island, Va. in October 1959 – – soaring 40 miles out over the Atlantic Ocean. The rocket was 50 feet tall and weighed 28,000 pounds. Little Joe’s engines produced a total of 250,000 pounds of thrust at takeoff. Little Joe was of great importance to Project Mercury, carrying instrumented payloads to various altitudes, and allowing engineers to check the operation of the Mercury capsule escape rocket and recovery systems.

Little Joe rockets were also used to send two Rhesus monkeys, Sam and Miss Sam, into space in December 1959 and January 1960. In the nose cone of one Little Joe capsule, Sam flew 55 miles into space before returning. Sam provided flight engineers with a better idea of how the Mercury astronauts would fare on their subsequent flights.

The Big Joe program involved ballistic tests of a Mercury capsule on an Atlas missile. Big Joe was a one-ton, full-scale instrumented mock-up of the proposed Mercury spacecraft, designed to test the effectiveness of the ablative heat shield and the aerodynamic characteristics of the capsule design. Big Joe was successfully launched on Sept. 9, 1959. The Big Joe project, from design to launch, was

NASA Langley Research Center photo #59-336

A full-scale model of the Mercury capsule being tested in the NASA Langley 30- by 60-Foot Full-Scale Wind Tunnel.



NASA Langley Research Center photo # 90-4371

The original seven Mercury astronauts were from left, front row: Virgil "Gus" Grissom, Scott Carpenter, Donald "Deke" Slayton and Gordon Cooper; back row: Alan Shepard, Walter Schirra and John Glenn

achieved in less than a year — the first step in providing a launch vehicle for Project Mercury. Big Joe's launch atop an Atlas D booster showed that a capsule could be launched (100 miles into the air), separate from the Atlas rocket and fall back to Earth in conditions that closely simulated orbital reentry. It also proved to be an excellent exercise for military recovery teams and confirmed that the blunt-body capsule had performed as Langley wind-tunnel tests and other laboratory studies had predicted.

Global Tracking Network

The largest, and most logistically challenging, Langley effort for Project Mercury was the Mercury tracking range project. Long-range communications were Langley's responsibility. The planning and implementation of an integrated spacecraft tracking and ground instrumentation system, developed with contract organizations, was accomplished by non-STG Langley personnel. Project managers at the Manned Spacecraft Center needed a network of linked stations capable of receiving, processing and reacting to a variety of voice, radar and telemetry data. Prior to Project Mercury, most long-distance communications were done via undersea telegraph cable or radar. The NASA Langley researchers had to build their own global communications system to help ensure Project Mercury's success.

Communication sites were plotted, surveyed and built worldwide by various companies. The result was a system that could maintain constant radio communications with the orbiting Mercury astronauts. NASA Langley supervised the site contractors and, within two years, saw an "around-the-world-for-the-first-time" communications system power up. This was the foundation of the present Mission Control Center where state-of-the-art workstations allow project managers to simultaneously track numerous spacecraft and satellites.

Mercury Astronauts Begin Training at NASA Langley

Seven astronauts were chosen from among more than 100 men tested at Wright Air Development Center in Dayton, Ohio and Lovelace Clinic in Albuquerque, New Mexico. At that time, no one really knew how to select and train astronauts. The search process was rigorous but quickly focused on military test pilots. Langley engineer Charles Donlan and test pilot Robert Champine played important roles in the screening and selection process.

The "Original Seven" were: Air Force Capts. L. Gordon Cooper Jr., Virgil I. "Gus" Grissom, and Donald K. "Deke" Slayton; Navy aviators Lt. M. Scott Carpenter, Lt. Comdr. Alan B. Shepard Jr., and Lt. Comdr. Walter M. Schirra Jr.; and Lt. Col. John H. Glenn Jr., United States Marine Corps.

The seven astronauts were sent to NASA Langley to begin their training for spaceflight. Langley engineers with knowledge in reentry physics, astronomy, and celestial mechanics and navigation

NASA Langley Research Center photo #59-4426

Molded astronaut couches line the Langley model shop wall. The names of the test subjects, all Langley employees, are written on the backs.

educated the astronauts in graduate level space sciences courses. Then each astronaut was assigned to a specific technical field to receive further training. Cooper and Slayton kept a liaison with the Army Ballistic Missile Agency (later Marshall Space Flight Center) and launch vehicle suppliers; Carpenter specialized in communications and navigation equipment; Glenn focused on cockpit layout; Grissom handled in-flight control systems; Schirra's specialty was life-support systems and pressure suits; and Shepard concentrated on tracking range and recovery systems.

The STG staff put the astronauts through several spaceflight simulation systems and techniques to familiarize them with the Mercury capsule and evaluate their effectiveness with the capsule control systems. A closed-loop analog simulator became the basis for several "spaceflights." This simulator had a simple chair with sidearm controller and rudder pedals and was later refitted with a three-axis controller and a molded couch individually made for each astronaut.

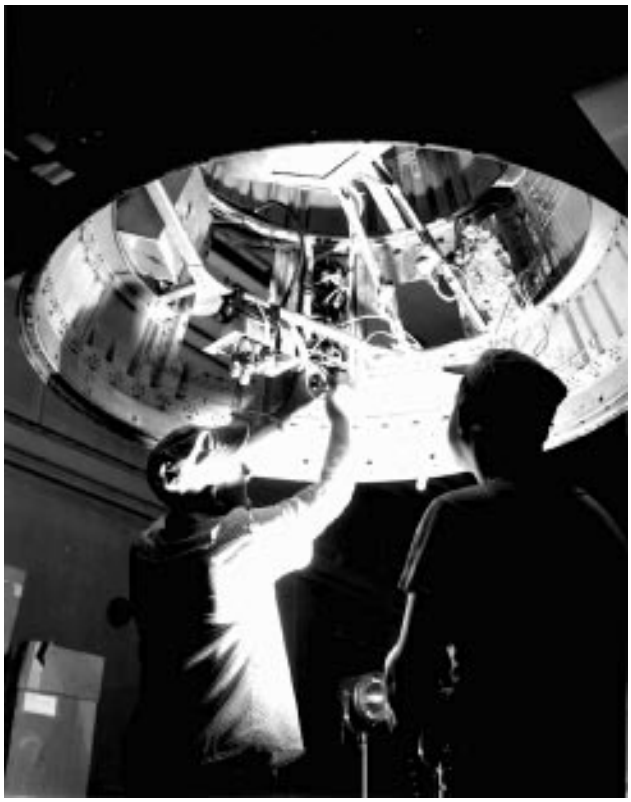
The training at Langley also included a regimen of physical exercise and scuba-diving operations designed to simulate weightlessness and the types of sensory disorientation that they might experience during reentry from space. In Langley's large hydrodynamics tank and in the Back River behind the Langley East Area, the Mercury astronauts also learned how to get out of the space capsule as it floated in the water.

Project Mercury Director Thanks NASA Langley for Its Project Work

Project Mercury ended in the summer of 1963 after four successful orbital flights. The STG completed its move to the Manned Spacecraft Center in Houston, Texas, and NASA and the nation geared up for the Gemini and Apollo programs.

Dr. Robert R. Gilruth, head of Project Mercury at Langley, wrote to NASA Langley director Floyd Thompson: "It is fitting that the Manned Spacecraft Center express its sincere appreciation to the Langley Research Center for the invaluable contributions that the Center has played in our initial manned space flight program. The Manned Spacecraft Center owes much to Langley, since . . . Langley really was its birthplace."

Specific contributions that NASA Langley made to Project Mercury included assistance in the Big Joe program; implementation of the Little Joe program; the planning and carrying out of the Mercury tracking and ground instrumentation system; numerous aerodynamic, structural materials and component evaluation and development tests; engineering, shop instrumentation and logistic support for much of the Space Task Group in-house testing; and finally, administrative support and office space from late 1958 to mid-1962 when the STG moved to Houston. Gilruth wrote, "As you can see, all elements of the Langley Center provided major assistance to Project Mercury, and we are deeply grateful for this help."



NASA Langley Research Center photo #59-5790

Two technicians assemble a Little Joe capsule. The capsules were manufactured "in-house" by Langley technicians.

Recommended Reading

To learn more about Project Mercury and NASA's other spaceflight programs, refer to:

Spaceflight Revolution: NASA Langley Research Center from Sputnik to Apollo by James R. Hansen, NASA SP-4308

This New Ocean: A History of Project Mercury by Loyd S. Swenson Jr., James M. Grimwood and Charles C. Alexander, NASA SP-4201

NASA Historical Data Book, Volume II, by Linda Neuman Ezell, NASA SP-4012

Engineer in Charge, A History of the Langley Aeronautical Laboratory, 1917-1958, James R. Hansen, NASA SP-4305

Chronology of Key Project Mercury Events

Oct. 6, 1958	Langley Research Center personnel open negotiations with the Army Ballistic Missile Agency to procure Redstone and Jupiter launch vehicles for a manned satellite project. They also discuss the procurement of Atlas vehicles with the Air Force Ballistic Missile Division.
Oct. 7, 1958	Plans for a manned satellite project are approved by NASA Administrator T. Keith Glennan.
Nov. 5, 1958	Space Task Group (STG) formed at Langley to manage the U.S. manned space program.
Nov. 24, 1958	STG orders one Atlas launch vehicle for launch of a boilerplate spacecraft model, Big Joe; nine Atlas vehicles would be required for the program and by 1962, a total of 15 were approved for purchase.
Nov. 26, 1958	The name "Mercury" is agreed upon for the first phase of the U.S. manned space project.
Dec. 29, 1958	NASA contracts for the design and construction of Little Joe I airframe; the first two are delivered May 29, 1959.
Jan. 5, 1959	Guidelines are established for choosing astronaut candidates.
Jan. 16,1959	NASA orders eight Army Redstone rockets for Mercury from the Army.
Jan. 29, 1959	The Little Joe test program drafted and then updated April 14.
Feb. 12, 1959	NASA and the Navy officials meet to discuss Mercury spacecraft recovery needs; a NASA-Navy committee formally meets on the 17th.
March 8, 1959	The first abort test of a full-scale model of the Mercury spacecraft is conducted at Wallops Island. March 11, a full-scale pad-abort test takes place.
March 31, 1959	STG officials met with Atlantic Missile Range personnel to discuss launch requirements.
April 2, 1959	NASA holds a briefing for prospective bidders on the Mercury tracking network. That day, it was announced that the selection of the seven Mercury astronauts had been made; candidates were announced on Apr. 9; training begins on Apr. 27.
Sept. 9, 1959	Big Joe I successfully launched.
Nov. 1959 to Jan. 1960	General design work on Mercury couch completed. From Nov. 8 to Dec. 5, 1959, tentative design and layout of the Mercury control center was completed.
June 20, 1960	Tests of the spacecraft environmental control system begin.
Sept. 1960	Pressure suits tested to make final adjustments; improvements and suggested changes were made through Apr. 1963 — the suit evolved with the Mercury program.
Jan. 3, 1961	The STG was declared a separate NASA field element.
Feb. 21, 1961	Mercury-Atlas 2 launch successful. Astronauts Glenn Grissom and Shepard selected to begin training for the first manned flight.
May 5, 1961	MR-3 (Mercury-Redstone), piloted by Shepard, successfully completes NASA's first manned suborbital mission.
July 21, 1961	MR-4, manned by Grissom, successfully completes second suborbital mission.
Aug. 1961	Site selection team evaluates locations for a Manned Spacecraft Center — in September, Houston was chosen as the best site.
Nov. 1, 1961	The STG redesignated as the Manned Spacecraft Center (MSC) and Gilruth is retained as director.
Nov. 29,1961	Glenn selected as pilot for the first orbital mission.
Feb. 20, 1962	MA-6, manned by Glenn, successfully completes NASA's first manned orbital mission.
May 24, 1962	MA-7, with Carpenter on board, successfully completes an orbital mission.
July 1, 1962	Relocation of the MSC group from Langley Research Center to the Houston site was completed.
Sept. 18, 1962	Slayton designated coordinator of astronaut activities at MSC.
Oct. 3, 1962	MA-8, manned by Schirra, successfully completes an orbital mission.
May 15-16, 1963	MA-9, manned by Cooper, successfully completes an orbital mission lasting more than 34 hours, concluding the Mercury flight program.
June 12, 1963	NASA Administrator James E. Webb announces that because Mercury had accomplished its goals, MA-10 would not fly.
Oct. 3-4, 1963	Project Mercury summary conference held in Houston.

For more information, please contact: NASA Langley Research Center, Office of Public Affairs,
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