America's Greatest Projects - Project Gemini

An Online Continuing Education Course for Engineers

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Introduction

The National Aeronautics and Space Administration (NASA) was formed under the Eisenhower Administration in the summer of 1958 following the successful launch of Sputniks 1 & 2 by the Soviet Union. Its formation was an effort by the United States to coordinate the space programs that were fragmented among the various Department of Defense (DOD) segments of the U. S. military. All three of the major military organizations were in the process of generating and conducting their own satellite launches and space programs. But the formation of NASA was not as basic and simplistic as it may seem today. NASA was viewed as an unnecessary albatross by the majority of military officials, especially those who had their own agendas. NASA needed a leader who commanded authority and respect, had great administrative and leadership skills, and understood the nuances of working with the U. S. Congress to meet the financial requirements of such a historic undertaking. Dr. T. Keith Glennan was appointed by President Dwight D. Eisenhower to be the very first NASA administrator in August 1958, shortly after the Soviet Union had launched Sputniks I and II.

Dr. T. Keith Glennan

Dr. Glennan, an electrical engineering graduate from Yale University, had served in an administrative capacity for the United States Navy during World War II. After the war Dr. Glennan went into corporate America, although he continued to serve on various national committees, and was highly regarded in Washington, DC circles. In 1952 he became president of Case Institute of Technology in Cleveland, Ohio, and was instrumental in expanding their enrollment and their prestige to a national level. He was selected as the first NASA Administrator in August of 1958, and he coordinated the necessary protocol to bring the many-faceted U. S. Space Program under one authority.

Within a short time after NASA's formal organization, Glennan incorporated other organizations involved in U. S. space exploration projects from other federal agencies into NASA to ensure that a viable scientific program of space exploration could be reasonably conducted over the long-term. He brought in part of the Naval Research Laboratory to NASA and created for its use the Goddard Space Flight Center in Greenbelt, Maryland, which currently employs nearly ten thousand personnel, most of whom are civil servants and contractors. He also incorporated several disparate satellite programs, two lunar probes, and the research effort to develop a 4.4 million ton thrust, single-chamber rocket engine through the U. S. Air Force and the DOD. In December 1958

Glennan also acquired control of the Jet Propulsion Laboratory (JPL), a contractor facility operated by the California Institute of Technology. In 1960, Glennan obtained the transfer to NASA of the Army Ballistic Missile Agency, located at Huntsville, Alabama, and renamed it the Marshall Space Flight Center.

By mid-1960, Glennan had secured for NASA primacy in the U.S. federal government for the execution of all space activities except reconnaissance satellites, ballistic missiles, and a few other space-related projects, most of which were still in the study stage, that the DOD controlled. Glennan presided over an organization that had absorbed the earlier National Advisory Committee for Aeronautics (NACA) intact, including its 8,000 employees and an annual budget of over $100 million. At the same time three major research laboratories (Langley Aeronautical, Ames Aeronautical, and Lewis Flight Propulsion), as well as two small test facilities, were consigned to NASA and made up the core of the new administration. During his brief two and a half years as the NASA administrator, Dr. Glennan managed to craft very nearly the organization as we know it today, to screen and select the base astronaut core, to pull even with the Soviet Union in the Space Race, and to choose the key engineering personnel who would move the program forward to a successful conclusion.

Project Mercury was officially approved on October 7, 1958 and publicly announced on December 17of that year. Originally called Project Astronaut, President Dwight David Eisenhower felt that gave too much attention to the pilot, and not enough to the vast numbers of personnel who would be developing the necessary technology. Instead, the name Mercury was chosen from Greek mythology, which had already lent names to rockets like the Greek Atlas and the Roman Jupiter for ICBM's (Intercontinental Ballistic Missiles).

Hugh L. Dryden

The acquisition of NACA brought with it Hugh L. Dryden, the last Director of NACA, as Glennan's Deputy Administrator. Dryden, a native of Pocomoke City, Maryland, excelled in mathematics as a student, graduated high school at the age of 14, and was awarded the Peabody Prize for excellence in mathematics. He earned a scholarship and was admitted to Johns Hopkins University, graduating with honors after only three years. His study of aerodynamic principles enabled him to receive his doctorate in physics and mathematics in 1919 at the age of 21, also from John Hopkins.

Dryden joined the National Bureau of Standards, and was appointed the director of the Aerodynamics Division, a newly created section. He performed studies of airfoils near the speed of sound. He also performed pioneering aerodynamics research on the problems of airflow and turbulence. Dryden was appointed the bureau's Chief of the Mechanics and Sound Division, and in 1939 he became a member of NACA. His work contributed to the design of the wings for the P-51 Mustang as well as other aircraft designed during World War II.

During World War II, Dryden served in an advisory capacity to the U. S. Army Air Force, leading the development of a radar-homing guided bomb program that was successfully employed in combat in April, 1945, and credited with sinking a Japanese Destroyer. After the war, Dryden became the Director of Aeronautical Research for NACA in 1946. While at the NACA he supervised the development of supersonic aircraft, established programs various jet aircraft, and studied the problem of atmospheric reentry. Dryden held the position of Director of NACA, NASA's actual predecessor, from 1947 until October 1958. In addition, he served on numerous government advisory committees, including the Scientific Advisory Committee to the President. From 1941 until 1956 he was also the editor of the first airplane publication of its type, the Journal of the Institute of the Aeronautical Sciences.

Walter C. Williams

Williams was a graduate of Louisiana State University with a Bachelor of Science degree in Aeronautical Engineering. After graduation he joined the staff at Langley Research Center in DC, and at the end of World War II he joined NACA (The National Advisory for Aeronautics) as a Project Engineer. During this period at NACA he authored numerous technical papers on aircraft flight research, and he was considered one of the highest-ranking experts on "High-Speed Airplane Stability and Control Characteristics."

Following the formation of NASA, which absorbed NACA into its organization in October 1958, Williams left the High-Speed Flight Station and was assigned responsibility for overall launch operations in Project Mercury at Cape Canaveral. He directed the Worldwide Tracking Network and recovery operations for manned space flight missions. As Operations Director in Mercury Control Center at Cape Canaveral, Florida, Williams utilized the combined know-how of approximately 20 scientists and engineers on the site. Each of these men was responsible for a specific facet of space flight and reported directly to Williams during flight operations, which enabled him to assess the flight and make necessary decisions. As Flight Operations Director, Williams was responsible for America's earliest manned space flights, including suborbital and orbital flights. He held the position of Chief Engineer at NASA Headquarters until 1982.

Objectives of the Mercury Program

Working with Glennan and Dryden, at the creation of the agency on October 1, 1958, was a group of engineers responsible for Project Mercury who were officially named NASA's Space Task Group. The Group was initially stationed at the Langley Research Center in Hampton, Virginia, but became so large that they were eventually moved into a much larger complex on land donated by the Humble Oil Refining Company in Clear Lake, Texas, in September of 1963. The complex

was later named the Johnson Space Flight Center in honor of former president Lyndon B. Johnson by an act of Congress in 1973. The STG had three main goals for the Mercury program:

A. Orbit a manned spacecraft around Earth,
B. Investigate the astronaut's ability to function in space,
C. Recover both the astronaut and the spacecraft safely.

Existing technology and off-the-shelf equipment were to be used wherever practical, system design was simplified, and an existing launch vehicle named Atlas was being prepared for employment. The actual spacecraft requirements included:

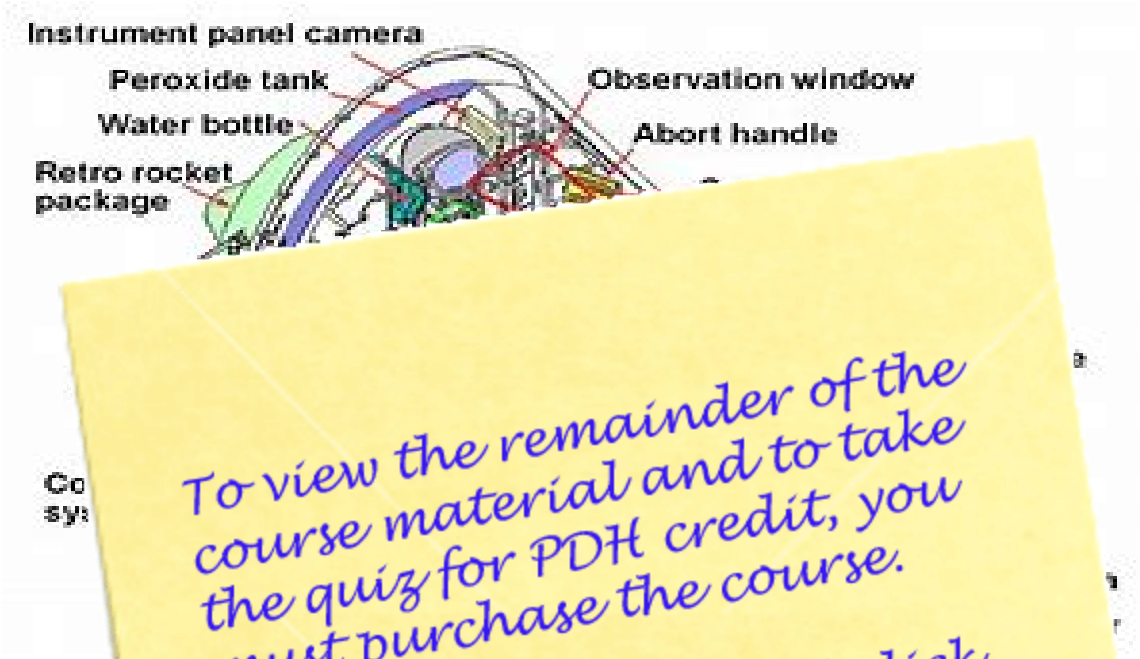
1. a launch escape system to separate the spacecraft and its occupant from the launch vehicle in case of impending failure;
2. attitude control for orientation of the spacecraft in orbit;
3. a retrorocket system to slow the spacecraft down and to bring it out of orbit;
4. a drag braking, high temperature-resistant blunt body for atmospheric reentry;
5. an extensive communications network for the spacecraft to land on water.

Since the U.S. space program, in general, and Project Mercury, in particular, was considered to be a civilian project, President Eisenhower initially refused to give the project top national priority to avoid giving the program an overly military flavor, however, the highest priority rating was granted in May 1959, a little more than a year and a half after Sputniks 1 and 2 were launched.

The Mercury spacecraft's principal designer was Maxime Faget, a native of British Honduras, who received his mechanical engineering degree from the City College of San Francisco. After serving three years in the U. S. Navy, he began his career for NACA at the Langley Research Center. Following the incorporation of NACA into NASA in 1958, Faget became one of the principal engineers that made up the Space Task Group. His experience in the design of high-speed jet aircraft cockpits placed him in a prime position to design the Mercury spacecraft. The module was initially just 10.8 feet long and 6.0 feet wide; however, with the launch escape system added, the overall length grew to just under 26 feet. With only about 100 cubic feet of habitable volume, the capsule was just large enough for a single crew member. Inside the module there were 120 controls, including 55 electrical switches, 30 fuses and 35 mechanical levers. The outer skin of the spacecraft was made of Rene 41, a nearly 50 percent nickel alloy produced by General Electric, that was able to withstand very high temperatures.

The spacecraft had a convex base, which carried a **heat shield** consisting of an aluminum honeycomb covered with multiple layers of Fiberglas. Strapped to it was a **retropack** consisting of three rockets deployed to brake the spacecraft during reentry. Between these were three minor rockets for separating the spacecraft from the launch vehicle at orbital insertion. The straps that held the package could be severed when it was no longer needed. Next to the heat shield was the **pressurized crew compartment.** Inside, an astronaut was strapped to a form-fitting seat with instruments in front of him and with his back to the heat shield. Underneath the seat was the environmental control system which included oxygen and heat, a CO_2 scrubber, and (on orbital

flights) the collection of urine. The **recovery compartment** at the narrow end of the spacecraft contained three parachutes: a drogue to stabilize free fall and two main chutes, a primary and reserve.



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For the next quarter of 1958 and the first quarter of 1961, NASA dedicated itself ward as the premier space technology center in the world. Meanwhile the U. S. Congress had budgeted more than one hundred million dollars to fund NASA and its affiliated agencies. Calm regarding the space program seemed to have prevailed nationally under the Eisenhower administration in Washington following the surprise launchings of Sputniks 1 and 2 in 1957. The United States had managed to launch its own satellites, thanks in large part to the