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The Beginnings of America's Man in Space Program

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Introduction

On October 1, 1958 - days short of the first Sputnik anniversary - the National Aeronautics and Space Administration (NASA) officially came into being. After months of study and debate in the wake of the launching of the first Soviet satellites, the United States government reached a consensus on how the country should proceed into the Space Age when President Dwight Eisenhower signed the National Aeronautics and Space Act of 1958 on July 29.

NASA was formed around the existing NACA (National Advisory Committee for Aeronautics) which had been under the direction of Hugh L. Dryden. Appointed as NASA's first administrator was T. Keith Glennan while Dryden became his deputy. While the military would continue to run space projects related to the needs of national security, all purely scientific space programs under military control would eventually be transferred to NASA. This included, much to the chagrin of officials in the Department of Defense, the United States' nascent man-in-space effort.

Early Studies

The genesis of what would become America's first manned space programs can be traced back to July 14, 1952 when the NACA executive committee passed a resolution to "devote modest effort to problems of unmanned and manned flights at altitudes from 50 miles to infinity and at speeds from Mach 10 to escape from earth's gravity." The direct result of this resolution was the X-15 program conducted jointly by NACA, the USAF, and the U.S. Navy starting in December of 1954. This advanced rocket-powered aircraft would fly to the edge of space at 80 kilometers (50 miles) and as fast as Mach 7. It would bridge the performance gap between existing X-planes and what was needed to meet NACA's ultimate goal.

The next step lead to joint NACA and USAF studies of still higher flying manned aircraft or the "Manned Glide Rocket Research System". Conducted under the aegis of the USAF's ARDC (Air Research and Development Command) starting in March 1956, this set of studies eventually lead to the "Dyna-Soar" or X-20 program. At the same time ARDC also established a parallel research project for a manned ballistic capsule known as "The Manned Ballistic Rocket Research System". Since the development of a simple ballistic capsule would require much less time than an aerospace glider, such a program could give the USAF much needed experience in this new environment in the shortest time possible. As had been done in many earlier USAF research programs, NACA was invited to participate.

Although there was a vocal minority in the NACA hierarchy who were against involvement in a purely ballistic approach to manned spaceflight, by early 1956 there had already been much research conducted at NACA laboratories on the subject. As a result of hypervelocity experiments performed during June 1952, a team of scientists and engineers under H. Julian Allen at the High-Speed Research Division of NACA's Ames Aeronautical Laboratory (now NASA Ames Research Center) discovered that a blunt body minimized heating during a hypersonic reentry into the atmosphere. The previous conventional wisdom held that a slender shape would be preferred but studies had shown that they produced more heat than any known materials could withstand. Allen and his team had now solved this thermal barrier problem with their counterintuitive blunt shape in which 90% of the heat is absorbed by the shock wave generated during reentry.

On April 28, 1953 Allen and Alfred J. Eggers Jr. of Ames co-authored a secret NACA report detailing their findings. This report, which was distributed to

missile contractors and the military that spring, heavily influenced the designs of the first generation of ICBM warheads and subsequent manned spacecraft.

Choosing the Best Approach

In early 1954 Allen, Eggers and Stanford E. Neice of Ames wrote a now classic paper on atmospheric reentry entitled "A Comparative Analysis of the Performance of Long-Range Hypervelocity Vehicles". In this paper they compared the advantages and disadvantages of three different reentry body configurations: A blunt no-lift body, a high-drag lifting body, and a low-drag gliding body. These three concepts would be the focus of manned spaceflight research in the following years.

Eggers went on to present a modified version of this paper at the annual meeting of the American Rocket Society in San Francisco in June of 1957. At the time he was convinced that a glider would be a better approach to manned spaceflight than a simple ballistic capsule. While the total heat load would be greater, a glider's heating rate would be much lower as would be the G-forces during reentry. A glider would also be maneuverable and allow the pilot to make a precision landing. Unfortunately it was soon realized that such a spacecraft would be too heavy for any military rockets then envisioned to lift into orbit.

While the proposal to use the M-1 lifting body for America's first manned spacecraf was not accepted, it did spur research into such designs as (left to right) the Ames' M2-F1, M1-LK and Langley's lenticular bodies shown in this 1962 NASA drawing. (Courtesy NASA)

Eggers then began to push for a lighter and simpler lifting-body design (originally proposed in an Ames report on hypersonic flight released in January of 1957) as a compromise between the ballistic capsule and the glider. His design, called M-1, was a triangular shaped craft about 3 meters (10 feet) wide and 2 meters (7 feet) long with a rounded underside and a flat top. Looking like a quarter of an egg, this design would minimize heating and G-forces during reentry and allow 320 kilometers (200 miles) of cross-range and 1300 kilometers (800 miles) of down-range maneuverability in a package that military rockets could handle.

The third concept using a simple ballistic capsule was championed by a team at NACA's Langley Aeronautical Laboratory (now NASA Langley Research Center) who wrote a minority view in the appendix of the January 1957 Ames report. During the mid-1950s Maxime A. Faget, Robert O. Piland, and a team of engineers at Langley's Pilotless Aircraft Research Division (PARD) had conducted a series of flight tests with models of blunt bodies under the supervision of Langley's Associate Director, Robert R. Gilruth, in an effort to extend Allen's original work. They felt that a blunt, nonlifting shape like a sphere would offer the best chances of getting a man into orbit in the shortest time.

While the M-1 design held much promise and stimulated further research into lifting bodies (which continues to this day), NACA management began to favor Langley's ballistic approach due to its simplicity. In parallel with the USAF efforts in the manned ballistic rocket project (which eventually became known as MIS or "Man-In-Space") and those of a group of 11 contractors who answered the ARDC call for proposals, Langley engineers continued to slowly develop the design and specifications for a manned ballistic space capsule during the months leading to the Space Age.

The Dawn of the Space Age

After the launch of Sputnik, the entire country was struck by a sense of panic. And with the launching of Sputnik 2 in November 1958 with its canine passenger, it was clear that the Soviet Union were taking the first steps needed to send a man into space. During this time, NACA leaders sought to determine what role their organization would play in an American manned spaceflight effort. But in addition to the NACA plans and the USAF MIS study (which quickly became MISS or "Man In Space - Soonest"), the U.S. Army and Navy also started pushing their own proposals for a manned space mission.

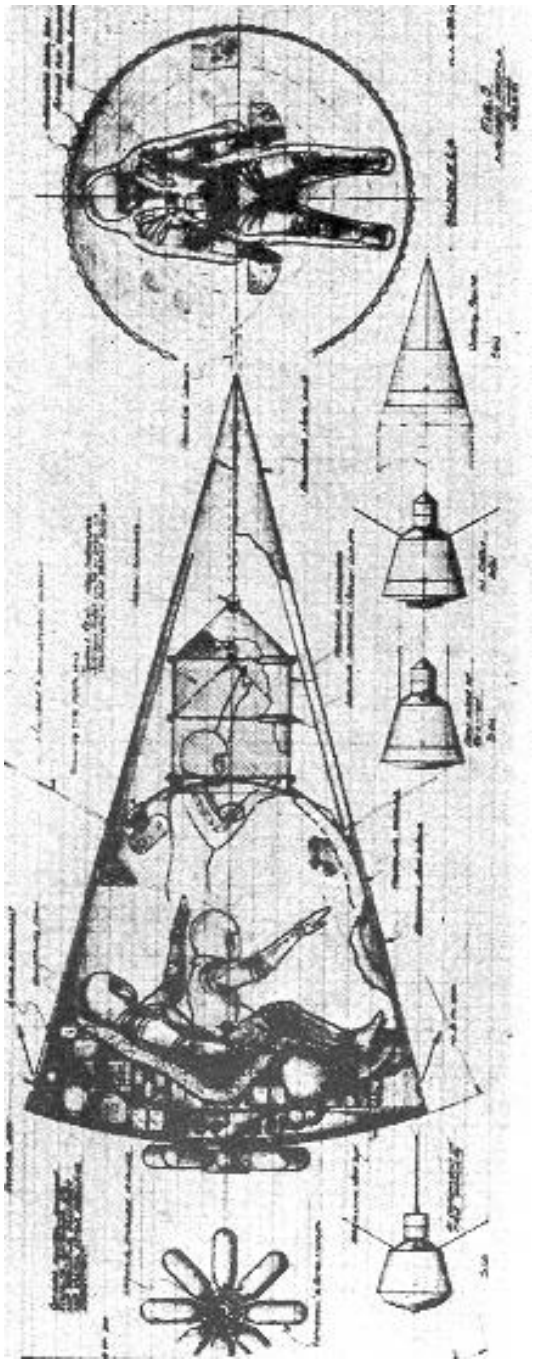
The Army proposal originated from the Wernher von Braun's team at the ABMA (Army Ballistic Missile

Agency). Initially called "Man Very High" and later known as Project Adam, their proposal called for using a modified Redstone rocket to launch a manned capsule on a short suborbital flight. The ABMA proposal was essentially an updated version of the British Interplanetary Society's V-2-based Megaroc concept. The Navy's Bureau of Aeronautics proposal, called Mer I for "Manned Earth Reconnaissance I", envisioned a cylindrical spacecraft with deployable wings launched on a two-stage rocket. As with other aspects of the nation's space program, ARPA (Advanced Research Projects Agency) was put in charge of coordinating all these efforts in the spring of 1958. From the start ARPA clearly preferred the MISS proposal but whoever finally got the project, NACA was guaranteed a leading role due to their experience in the field.

Still, as the spring of 1958 approached, it was becoming increasing clear that the nation's space program would be run not by ARPA but by a civilian agency and NACA had already quietly accepted the task. Because of this and growing differences in opinion between NACA and USAF over the best way to proceed with MISS, NACA began to quietly break out and push its own ideas among the various military and civilian study groups and panels that were set up to consider the issue. In order to bring their own ideas into the forefront, NACA sponsored the Conference on High Speed Aerodynamics from March 18 to 20, 1958 where NACA engineers presented their proposals for a manned space mission to a group of military, industrial, and contractor personnel.

During this symposium, the NACA management's eventual plan was outlined in a Langley paper by Faget, Benjamin Garland, and James J. Buglia. They proposed a 3.35 meter (11 foot) long, roughly conical shaped ballistic capsule with a 2.13 meter (7 foot) in diameter heat sink mounted on its blunt end. The pilot would be strapped into a form fitting couch to better withstand the G-forces associated with launch and reentry. Because the effects of spaceflight on the pilot were totally unknown, the simple capsule would be designed to operate automatically. Unlike the USAF which wanted to develop a new Thor-based launch vehicle for MISS, NACA wanted to use the Atlas ICBM (which had just begun test flights) to orbit their capsule.

Once in orbit, the capsule would be turned so that it traveled blunt-side first using small gas jets to control attitude. A solid retrorocket package would then be used to slow the capsule enough to perform a high drag, no-lift reentry into Earth's atmosphere at the end of the mission. By June 1958 Langley's Faget and Charles W. Mathews had already completed the first draft of the manned satellite's preliminary specifications based on this concept that NACA officials clearly preferred.



The NACA Langley team's concept for a manned capsule by the summer of 1958. (Courtesy NASA)

Project Mercury is Born

As ARPA and the USAF continued to jockey for position throughout mid-1958 in a bid to monopolize the manned space program, NACA engineers continued to refine their space capsule design and specifications. But the unofficial competition for the manned space program ended on August 18 when President Eisenhower finally decided that the soon to be created NASA would be in charge. Money ARPA had allocated for MISS would be transferred to NASA along with the funding for other scientific space projects that had been given to NASA.

To ease the program's transition, a Joint NASA-ARPA Manned Satellite Panel headed by Gilruth was established on September 17, 1958 to make final recommendations to NASA for the manned program. Their proposals were submitted to Glennan and ARPA director Roy Johnson between October 3 and 7. On October 7 NASA formally organized its manned space program and gave it the task of placing a capsule in orbit, investigating the pilot's reaction to the orbital environment,and safely recovering the pilot and capsule. By the end of October, NASA representatives had already started negotiations to procure the rockets they needed for their project.

The Space Task Group management team that ran Project Mercury – (left to right) Charles J. Donlan (Associate Director), Robert R. Gilruth (Director), Maxime A, Faget (Flight Systems Chief), and Robert O. Piland (Assistant Chief for Advance Projects). (Courtesy NASA)

By November 5, 1958 NASA's new Director of the Office of Space Flight Programs, Abe Silverstein, had organized the STG (Space Task Group) at Langley to run the manned space program. Gilruth was appointed as Director of the program with his former Technical Assistant, Charles J. Donlan, assigned as his deputy. Faget became the Flight System Chief in charge of the spacecraft's design while another former-PARD member, Piland, became Assistant Chief for Advanced Projects. With NASA's manned space program management team and an initial staff of 33 people in place, the program's pace began to accelerate.

On November 7, 1958 40 perspective bidders met at Langley for a briefing from STG engineers on their vision of the manned space capsule. About half expressed continued interest in the project and on November 14 they received a copy of the 50-page document entitled "Specifications for Manned Space Capsule". On December 11 STG received bids from 11 contractors for the manned space capsule. After STG established component assessment teams to review the bids, the long task of choosing a contractor for America's first manned space capsule began.

But as the pace of the manned program began to pick up, there was a need to give the new project a name. While several were proposed, on November 26 Glennan and Dryden choose Silverstein's suggestion which he had based on Greek mythology. On December 17, 1958 NASA officially announced it - Project Mercury.

Bibliography

David Baker, *The History of Manned Spaceflight*, Crown Publishers, 1981

William M. Bland Jr., "Project Mercury", in *The History of Rocket Technology*, Eugene M. Emme (editor), Wayne State University Press, pp. 212-240, 1963

Eugene M. Emme, *Aeronautics and Astronautics 1915-1960*, NASA, 1961

Loyd S. Swenson Jr., James M. Grimwood, and Charles C. Alexander, *This New Ocean: A History of Project Mercury*, NASA, SP-4201, 1966