



NASA's First A

Aeronautics from 1958 to 2008

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At NASA's inception, a number of aeronautical research programs lent themselves readily to the space program. Among them, the X-15 high-speed research aircraft represented both the climax of the NACA's experimental aircraft program and an important reusable vehicle for exploring flight at the edge of space. Likewise, wind-tunnel testing straddled both aeronautical and space research. Some space vehicles, after all, still had to negotiate the atmosphere. To this end, NASA's aeronautics researchers explored a number of reentry technologies, including lifting-body designs and deployable airfoils, such as the Rogallo wing. Such research attests to the eagerness of many aeronautical researchers to participate in the space program and a willingness to approach spaceflight as a natural evolution of atmospheric flight. More radically, the original Centers made moves toward owning pieces of the space exploration program.

Perhaps the best measure of the diminished importance of aeronautics to NASA's leadership was the design of the American supersonic transport (SST) program. In July 1960, when the matter came before NASA Administrator T. Keith Glennan, he asked that NASA not be given charge of the program. Instead, the Federal Aviation Administration (FAA), established in 1958 and led by an eager administrator, took on the project.² NASA provided research support to the FAA, but the space program was sufficiently demanding that NASA did not want the distraction of another major development program. The decision was entirely understandable even though NASA was the most logical and, arguably, most capable agency to lead the SST program. In what would become a recurring theme, the imperatives of the space program hobbled any significant top-level focus on, or commitment to, aeronautics.

The relationship between space and aeronautics has raised a persistent question over the years: whether aeronautics would have been better off going it alone. What is often forgotten is that even though the space program overwhelmed the NACA, the NACA model was under significant pressure to change in the late 1950s. It is quite possible that in becoming NASA, the NACA received a new lease and, for just a bit longer, could operate without burdensome oversight.

NACA to NASA: Riding a Tiger

Hugh Dryden's proclaimed vision for the NACA as a space agency was far more modest than what resulted in late 1958. Dryden's plan seemed to contemplate the least expensive and least offensive way to place the NACA at the center of

2. J. D. Hunley, ed. *The Birth of NASA: the Diary of T. Keith Glennan* (Washington, DC: NASA SP-4105, 1993), pp. 188–189; Mel Horwitch, *Clipped Wings: The American SST Conflict* (Cambridge, MA: MIT Press, 1982), chap. 2.

The Rogallo Wing

The Rogallo wing is a fascinating story that almost would be a side note to NASA's history were it not for the remarkable path the technology took from a home project, to potential space race technology, to becoming the basis for an entire genre of personal aircraft. Francis Rogallo joined the Langley Laboratory in 1936 after earning a degree in aeronautical engineering from Stanford University. In the mid-1940s, Rogallo began to develop the idea of a flexible wing, something that could be made from cloth. According to his own account, the NACA was uninterested in the idea, so he pursued the idea in his spare time and with the help of his family. One of his critical innovations was that the shape of the wing could be maintained by a combination of the load and aerodynamic forces. Rogallo and his wife applied for a patent in 1948 and through the 1950s sought interest from industry. All they managed was to sell a few thousand toy kites based on the design.⁶⁶

A technology in search of an application, the flexible wing found a potential use with the launch of Sputnik. Perhaps a lightweight flexible wing could be used to bring a returning spacecraft in for a landing, unfolding atop the capsule as it dropped through the atmosphere. Interest grew at Langley, and in 1958 the Lab established a Flexible-Wing Section. Rogallo's team studied a number of different unstiffened and stiffened cloth wings. Most of the studies involved wind tunnel analysis, but the Flight Research Center tested a few of the designs. Using a conical wing stiffened with metal poles, the Paraglider Research Vehicle (Parasev) glider made hundreds of piloted flights from 1962 to 1964, towed aloft either from the ground or by another aircraft. In 1965, NASA tested another conical wing, this one stiffened by inflatable tubes and carrying a Gemini-type capsule. The military also took an interest in the early 1960s and experimented with a powered vehicle, the XV-8 for Flying Jeep (or Fleep), but NASA had by 1964 settled on recovering capsules with parachutes and ocean splashdowns, and funding for continued flexible-wing research soon came to a close.⁶⁷ The Rogallo wing, however, did not fade into obscurity like so many other ingenious designs. Popular accounts inspired outsiders to design

66. Francis M. Rogallo, "NASA Research on Flexible Wings" (International Congress of Subsonic Aeronautics, New York, NY, 3–6 April 1967); Francis M. Rogallo et al., "Preliminary Investigations of a Paraglider" (Langley Research Center, Langley Field, VA: NASA TN-D-443, August 1960); Robert Zimmerman, "How To Fly Without a Plane," *Invention & Technology* 13, no. 4 (spring 1988); Hansen, *Spaceflight Revolution*, pp. 380–387.

67. Hansen, *Spaceflight Revolution*, pp. 385–387.

their own flexible wings using the basic outlines of the Rogallo wing. These were the first modern hang gliders.⁶⁸

NASA's First Decade

Contrary to the jeremiads that predicted the death of aeronautics at the hands of the space program, aeronautics research persisted through the 1960s. The space program did steal the limelight and garnered the bulk of the Agency's funding, but it also left aeronautics largely to its own devices, a beneficiary of benign neglect. In such an environment, Center management and laboratory practice of aeronautics at Langley, Ames, and the FRC remained much as they had in the latter years of the NACA. The Lewis Laboratory, as noted, devoted itself largely to the space program after 1958. Even as Headquarters mildly attempted to increase oversight throughout the 1960s, the Centers retained the ability to initiate experiments and allocate funding. The flip side to such freedom, however, was that aeronautics research was uncoordinated and lacking top-level leadership. The one project that might have served as a rallying cry, the SST, went to the FAA and became mired in politics and impossible economics. Aeronautics in the 1960s was very much propelled by the momentum of an earlier era. By the late 1960s, however, vestiges of the NACA way were truly coming to an end. Two developments brought this about: NASA Headquarters chose to replace the heads of Langley, Ames, and the FRC with outsiders; and, with Americans on the Moon and the Apollo program drawing to a close, NASA scrutinized, for the first time since 1958, its aeronautics programs. In doing so, it began exporting to aeronautics the managerial centralization and research programming that had been characteristic of the operational space program.

68. Stéphane Malbos and Noel Whittall, eds., *And the World Could Fly: The Birth and Growth of Hang Gliding and Paragliding* (Lausanne, Switzerland: Fédération Aéronautique Internationale, 2005). NASA's 1976 issue of *Spinoff* noted that a California hang glider company was using a Rogallo wing design.