The National Advisory Committee for Aeronautics (NACA) provided advice and carried out much of the cutting-edge research in aeronautics in the United States. Modeled on the British Advisory Committee for Aeronautics, the advisory committee was created by President Woodrow Wilson in an effort to organize American aeronautical research and raise it to the level of European aviation. Its charter and $5,000 initial appropriation (low even for 1915) were appended to a naval appropriations bill and passed with little notice. The committee's mission was to "direct and conduct research and experimentation in aeronautics, with a view to their practical solution."

The NACA was involved in virtually all areas of aeronautics. Initially consisting of 12 unpaid members, in its first decade it counseled the federal government on several aviation-related issues. These included recommending the inauguration of airmail service and studying the feasibility of flying the mail at night. During World War I, the NACA recommended creating the Manufacturers' Aeronautical Association to implement cross-licensing of aeronautics patents. The NACA proposed establishing a Bureau of Aeronautics in the Commerce Department, granting funds to the Weather Bureau to promote safety in aerial navigation, licensing of pilots, aircraft inspection, and expanding airmail. It also made recommendations to President Calvin Coolidge's Morrow Board in 1925 that led to passage of the Air Commerce Act of 1926, the first federal legislation regulating civil aeronautics. It continued to provide policy recommendations on the Nation's aviation system until its incorporation in the National Aeronautics and Space Administration (NASA) in 1958.

Put into operation at Langley in 1922, the Variable Density Tunnel was the first pressurized wind tunnel in the world. It could achieve more realistic effects than any previous wind tunnel in predicting how actual aircraft would perform under flight conditions. Today it is a National Historic Landmark.

In 1925, NACA's director George Lewis launched construction of a wind tunnel large enough to accommodate a full-size fuselage with an engine. Fred Weick, the NACA's propeller expert, used this tunnel to study the relationship between engine cowlings and drag. The result was the low-drag streamlined cowling for aircraft engines, which all aircraft manufacturers adopted. This innovation would greatly reduce the drag that an exposed engine generated and would result in significant cost savings. The innovation won the NACA Collier Trophy for 1928. NACA engineers also demonstrated the advantages of mounting engines into the leading edge of a wing of multi-engine aircraft rather than suspending them below, which manufacturers also quickly adopted.

From its origins, the NACA emphasized research and development. Although the Wright brothers had flown successfully in 1903, by 1915 the United States lagged far behind European aviation capabilities, a situation many aviation advocates in the United States found galling. The United States trailed Europe in its accomplishments, its lack of organized research, and also in the amount of funds allocated to military aviation. To resolve these problems, in 1917, the NACA established the Langley Memorial Aeronautical Laboratory in Virginia. This laboratory would become the most advanced aeronautical research and experimentation facility in the world.

By 1920, the NACA had emerged as a small, loosely organized group of leading-edge scientists and engineers that provided aeronautical research services equally to all. It had an exceptionally small headquarters staff that oversaw the political situation and secured funding for research activities. Its unpaid appointed governing committee made the committee one of the most nontraditional and nonbureaucratic organizations in Washington. Moreover, its small Langley Laboratory, with only 100 employees in 1925, conducted pure research, mostly related to aerodynamics, receiving advice and support from the headquarters director of research, Dr. George W. Lewis. Researchers could develop their own research programs along lines that seemed the most productive to them, handle all test details in-house, and conduct experiments as they believed appropriate. Their "Technical Notes" and "Technical Reports" presented their interim and final research findings. Their hands believed that their independence from political pressures was partly the reason why NACA was the premier aeronautical research institution in the world during the 1920s and 1930s.

Airfoil research was also a major focus. NACA engineers tested 78 airfoil shapes in its wind tunnels and in 1933 issued Technical Report No. 460, "The Characteristics of 78 Related Airfoil Sections from Tests in the Variable-Density Wind Tunnel." The authors of this report described a four-digit scheme that defined and classified the shape of the airfoil. The testing data gave aircraft manufacturers a wide selection of airfoils from which to choose. The information in this report eventually found its way into the designs of many U.S. aircraft of the time, including a number of important World War II-era aircraft.

The Langley laboratory continued to design new wind tunnels that added to its capabilities, building about a dozen tunnels by 1958. In 1928, the first refrigerated wind tunnel for research on prevention of icing of wings and propellers began operations. In 1939 the NACA constructed a new low-lift low-speed two-dimensional wind tunnel that was exclusively dedicated to airflow testing. A transonic tunnel in the early 1950s provided data for Richard Whitcomb's research into supersonic flight.

In 1940, NACA established the Moffett Field laboratory near San Francisco as an aircraft research laboratory. It was renamed Ames Aeronautical Laboratory for Joseph F. Ames, a chairman of NACA, in 1944. Also in 1940, Congress authorized the construction of an aircraft engine research laboratory near Cleveland, Ohio. Dedicated in 1943, it became Lewis Research Center in 1948, named after George Lewis, former NACA director of aeronautical research. The NACA also established the Wallops Flight Center on the eastern shore of Virginia in 1945 as a site for research with rocket-propelled models and as a center for aerodynamic research. A temporary Langley outpost at Muroc, California, became a permanent facility known as the NASA Muroc Flight Test Unit in 1946. In 1949, it became the NASA High Speed Flight Research Station and in 1954, became independent from Langley.

This page includes images and text that describes the history and work of the National Advisory Committee for Aeronautics (NACA), including its role in research and development, and its contributions to the field of aeronautics. The text highlights key events, figures, and locations associated with the NACA's work, such as the Variable Density Tunnel, the Langley Laboratory, and the Lewis Research Center. The page also includes references to airfoil research, airflow testing, and the establishment of other research facilities.
Before the outbreak of World War II, NACA’s research had both military and civil applications. During the war, however, its activity became almost exclusively military and its ties with industry also became much stronger. In 1939, the first industry representative, George Mead, president of United Aircraft Corporation, joined the executive committee as vice-chairman. Dozens of corporate representatives would visit Langley during the war to observe and actually assist in testing.

During the war, the NACA focused more on refining and solving specific problems rather than on advancing aeronautical knowledge. A major advance, however, was the development of the laminar-flow airfoil, which solved the problem of turbulence at the wing trailing edge that had limited aircraft performance.

The NACA also contributed to the development of the swept-back wing. In January 1945, Robert T. Jones, a NACA aeronautical scientist, formulated a swept-back-wing concept to overcome shockwave effects at critical Mach numbers. He verified it in wind-tunnel experiments in March and issued a technical note in June. His findings were confirmed when German files on swept-wing research were recovered and by German aerodynamicists who came to the United States at the close of the war.

High-speed flight research after the war was often a collaboration between the NACA and the U.S. Army Air Force. The first glide flight of the AAF-NACA XS-1 rocket research airplane took place in January 1946. Breaching of the sound barrier occurred on November 14, 1947. Record flights by rocket planes by the military and the NACA proved the characteristics of high-speed aerodynamics and stresses on aircraft structures. NACA’s John Stack led the development of a supersonic wind tunnel, speeding the advent of operational supersonic aircraft. He shared the Collier Trophy in 1947 with Chuck Yeager and Lawrence Bell for research to determine the physical laws affecting supersonic flight.

At Lewis, NACA translated German documents on jet propulsion tests that became basic references in the new field of gas turbine research. Italian and German professionals came to Lewis to work with their American colleagues in these new aspects of flight research. To cope with continuing problems of how to cool turbine blades in the new turbojets, another German, Ernst Eckert, at Lewis laid the basic foundation for research into the world of heat transfer.

In December 1951, Richard T. Whitcomb verified his "area rule" in the NACA’s new transonic wind tunnel. Useful in the design of delta-wing planes flying in the transonic or supersonic range, the rule stated that, to reduce drag, the cross-sectional area of the aircraft should be consistent from the front of the plane to the back. The resulting "Coke bottle" or "wasp waist" fuselage shape was contrary to the design customary at that time that had the cross-section much greater where the wings were attached to the fuselage. Designers quickly applied the supersonic area rule to the design of new supersonic aircraft.

In 1952, the NACA was already thinking about aircraft that went very high and had to reenter the Earth’s atmosphere at a high rate of speed, producing a great deal of heat. That year, H. Julian Allen of Ames conceived the "blunt nose principle," which suggested that a blunt shape would absorb only a very small fraction of the heat generated by the reentry of a body into the Earth’s atmosphere. The principle was later significant to intercontinental ballistic missile nose cone and NASA Mercury capsule development.

The NACA was also considering flight beyond the atmosphere. In 1952, the laboratories began studying problems likely to be encountered in space. In May 1954, the NACA came out in favor of a piloted research vehicle and proposed to the Air Force the development of such a vehicle. The NACA also studied the problems of flight in the upper atmosphere and at hypersonic speeds, which would lead to the development of the rocket-propelled X-15 research airplane.

The NACA ceased to exist on October 1, 1958. It was succeeded by the National Aeronautics and Space Administration (NASA), which was formed largely in response to Soviet space achievements. NASA became the nucleus of the new agency, and all NACA activities and facilities were folded into NASA. The major focus became space research, but aeronautics would remain as the first "A" in its name.

--Judy Rumerman

Sources:


Additional References:
NACA Technical Reports and Memoranda can be found at http://ntrs.nasa.gov/search.jsp?R=551811&id=1&as=false&v=false&q=tt%3D%2522Proceedings%2Bof%2Bthe%2BF%3D%2522| Educational Organization | Standard Designation (where applicable) | Content of Standard |
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A ball of fire and flying debris mark the explosive failure of the first American attempt to launch a satellite on Vanguard, December 6, 1957.

Three members of the Explorer team celebrate the announcement that Explorer I has become the first U.S. satellite to orbit the Earth, January 31, 1958. Left to right: William Pickering of the Jet Propulsion Lab, James van Allen of the State University of Iowa, and Wernher von Braun of the Army Ballistic Missile Agency.