At the end of World War II, the United States operated some of the most advanced aircraft in the world, such as the B-29. But the pace of change during the war had been so fast that it became clear to many top scientists and military leaders that unless the United States actively sponsored advanced aeronautics research, it could quickly fall behind. As a result, in 1945 the U.S. Army Air Forces (which became the U.S. Air Force in 1947) and the National Advisory Committee on Aeronautics, or NACA, began the first of a series of experimental aircraft projects, many of which were designed to develop technology for high-speed flight. These soon became known as X-planes. While prototype and experimental aircraft were not new, the X-planes were significant because they were solely intended to develop technology in general, not lead to operational aircraft.

The first aircraft produced by the joint team was the XS-1. The “S” stood for supersonic and was dropped early in the program. The X-1 was the first crewed vehicle to break the sound barrier. It was built by Bell Aircraft Company. Its fuselage was modeled on a 50-caliber bullet because that was the one shape that aerodynamics experts knew did not tumble at supersonic speeds. It had straight, very thin wings. It was powered by a rocket engine and dropped from the belly of a B-29 bomber. Its first flight was in January 1946. On October 14, 1947, the X-1, piloted by Captain Charles (Chuck) Yeager reached a speed of 700 miles per hour (1,127 kilometers per hour) while at 45,000 feet (13,716 meters), breaking the sound barrier. The X-1 proved that an aircraft could be controlled at speeds faster than the speed of sound, Mach 1. It led to several aerodynamic advances that were quickly incorporated into U.S. fighter aircraft designs.

The X-1 actually had a conventional tail with elevators for pitching the nose up and down. However, at high speeds, a shockwave formed on the tail surfaces near the hinge for the elevators, rendering them useless. But the X-1 also had a system for raising and lowering the entire tail, a few degrees to adjust the trim of the airplane in flight (to enable it to fly level). Yeager and the X-1 flight engineers proposed using this system instead of the elevators at high speeds to control the airplane. This work was lesson secretly incorporated into American fighter planes at the time, giving the United States a technological edge over Soviet, French, and British aircraft for several years. Today, all supersonic aircraft use all-moving tail surfaces.

The Bell X-1E soon followed these earlier aircraft with its first flight in December 1955. Although it did not achieve speeds or altitudes as high as the X-1A or X-1B, the X-1E proved that an extremely thin wing was not required for supersonic flight. This research led to the Lockheed F-104 Starfighter interceptor aircraft. (The X-1F was canceled before completion. The X-1D was destroyed before it could make its first powered flight.)

In June 1952, the Bell X-2 had its first flight. The X-2 was equipped with a pointier nose and more powerful rocket engine than its predecessors. It was designed to reach speeds in excess of Mach 3 (2,094 miles per hour). At such high speeds, the friction from air brushing against the aircraft heats its skin to high temperatures. The X-2, therefore, had to be made of advanced lightweight heat-resistant steel alloy. The X-2 reached a record altitude of 125,907 feet (38,376 meters). Research on the X-2, including new construction techniques, contributed to the development of advanced materials for high-speed aircraft such as the XB-70 bomber and the SR-71 spyplane.

The Douglas X-3, which first flew in 1952, was not as successful as its predecessors. The X-3 was a single-seat research aircraft. It was intended to fly at twice the speed of sound, or Mach 2. Four aircraft were planned. The X-1A had its first flight on July 24, 1951. It and its sister craft the X-1B established new speed records, eventually reaching a speed of Mach 2.44 (1,650 miles per hour) (2,655 kilometers per hour) and an altitude of 90,440 feet (27,566 meters).

Even the failure of an X-plane to achieve its goals was útil. The Northrop X-4, which flew from 1948 to 1953, proved that tailless aircraft were unsuitable for high-speed subsonic flight (under Mach 1). Other X-planes were developed to conduct various flight research. Some, such as the X-15, developed soon after the earlier X planes, were very successful whereas others demonstrated that certain technologies were essentially dead-ends.

Most X-planes have been developed by either the NACA or the National Aeronautics and Space Administration (NASA) in partnership with the military, usually the U.S. Air Force. Later on, the “X”
X-Planes

Flight Research Station with the Boeing B-29 launch ship behind it. The painting near the nose of the B-29 depicts a stork carrying a bundle that is symbolic of the Mothership launching her babe (X-1-2).

designation was used in different ways. In one case, the designation was used to mislead people into thinking that a secret spyplane project (the X-16) was actually an experimental aircraft. In other cases, the X designation has been applied to early prototype versions of operational aircraft. But initially, the title “X-plane” indicated that an airplane was built solely to demonstrate and improve aviation technology.

--Dwayne A. Day

Sources:


Miller, Jay The X-Planes: X-1 to X-45, Motorbooks International, 2001

Further Reading:


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This 1952 photograph shows the X-2 #2 with a collapsed nose landing gear after landing on the first glide flight at Edwards Air Force Base. The aircraft pitched at landing, slid along its main skid, and hit the ground with the right wingtip bumper skid, causing it to break off. The nose wheel had collapsed upon hitting the ground.

Phase One predecessor, the Skystreak. German wartime aeronautical research records, reviewed in 1945 by Douglas Aircraft Company personnel, pointed to many advantages gained from incorporating sweptback wing design into future research aircraft.

The Douglas D-558-2 with a F-86 following behind as a chase plane.

This U.S. Postal Service stamp, issued in 1997, commemorates the 50th anniversary of supersonic flight.