Flying to the **edge of space**

The North American X-15 first flew 50 years ago this month

By Erik Simonsen

Fifty years ago on June 8, 1959, a sleek black aircraft was released from a NASA NB-52B flying at 37,550 feet (11,445 meters), marking the first flight of the remarkable North American Aviation X-15 rocket plane. With NAA test pilot/engineer Scott Crossfield in the cockpit, the unpowered test flight initiated an exhilarating 10-year journey that achieved hypersonic speeds and explored the upper edge of the Earth's atmosphere.

Conceptualization of Project 1226 dates back to June 24, 1952, when the National Advisory Committee on Aeronautics (NACA), which became NASA in 1958, recommended research flights with capabilities far beyond the Bell X-2's top speed of Mach 3.1 (3.1 times the speed of sound). A joint NACA, U.S. Air Force and U.S. Navy meeting on July 9, 1954, firmed up requirements and established a goal of Mach 6.6 and an altitude of 250,000 feet (76,200 meters) for Project 1226, which was later designated X-15.

With the concurrent Mercury manned spaceflight program, the United States was on a fast track into space but lacked critical data needed to achieve that goal. The X-15 program would be called upon to assist by focusing on aerodynamic heating, re-entry conditions, acceleration and deceleration forces, and reactions of crew to weightlessness.

After a contractor competition, with Douglas Aircraft a very close second qualifier, NAA was notified in September 1955 that it would build three rocket-powered X-15 aircraft. On Oct. 15, 1958, in a high-profile ceremony attended by then–Vice President Richard Nixon, the first X-15 (or NA-240) was unveiled at NAA's Los Angeles Division in Inglewood, Calif.

With the specified Thiokol 57,850-pound- (257-kilonewton-) thrust XRL99 engine behind schedule, two temporary 8,000-pound- (36-kilonewton-) thrust Reaction Motors XLR11 engines were installed, and on Sept. 17, 1959, the first powered flight took place. Despite a small hydrogen peroxide fire in the engine section, Crossfield easily reached Mach 2.1 and an altitude of 52,341 feet (15,954 meters). Capable of burning 18,000 pounds (8,165 kilograms) of liquid oxygen and anhydrous ammonia in a mere 85 seconds, the single XLR99 engine was installed for flight No. 34, which on Nov. 15, 1960, took U.S. Air Force test pilot Robert White to Mach 4.4 and 77,450 feet (23,607 meters).

Spectacular is probably the best descriptor for the X-15 program: NASA pilot Joe Walker reached a record altitude of 354,200 feet (67 miles, or 108 kilometers) on Aug. 22, 1963—a mission that earned Walker the coveted astronaut wings. With the X-15A-2 covered with an ablative coating to protect the aircraft's skin from extreme heating, Air Force Capt. William "Pete" Knight strapped in on Oct. 3, 1967. In addition, two large external propellant tanks were attached to the lower fuselage to allow the engine to burn for a total of 140.7 seconds. The extended burn time paid off, as radar data confirmed that the X-15A-2 had accelerated to 6,629 feet (2,021 meters) per second, or Mach 6.7, and reached an altitude of 102,100 feet (31,120 meters). Knight had traveled twice as fast as a bullet fired from an M-16 automatic rifle, and the unofficial speed record stood until the Space Shuttle first re-entered the atmosphere at Mach 22 in April 1981.

In all, eight X-15 pilots received their astronaut's wings for exceeding an altitude of 50 miles (80 kilometers) above Earth. Later, two of the pilots became NASA astronauts—Neil Armstrong on the Gemini and Apollo programs, and Capt. Joe Engle,

PHOTO: (ABOVE) After launch from the NASA NB-52B, Air Force Capt. William "Pete" Knight initiates ignition for his record Mach 6.7 (6.7 times the speed of sound) flight on Oct. 3, 1967. The aircraft's special white coating was designed to slowly burn off, or ablate, as it protected the X-15A-2's skin from high heats generated during the flight. NASA

U.S. Air Force, who commanded the Space Shuttle *Columbia* on its second flight (STS-2) in November 1981, and *Discovery* in September 1985 (STS-51I). Capt. Engle, at age 32, was the youngest to qualify for astronaut wings. He flew 16 X-15 missions, for which three of the flights achieved astronaut status. Engle, who retired as a major general (U.S. Air National Guard) and is currently an aerospace consultant, recently commented on the X-15 program.

"The X-15 provided the Space Shuttle Design Team with invaluable information on hypersonic flight, in particular, how to re-enter the earth's atmosphere with a winged vehicle, and how to precisely land a low L/D [lift-to-drag] unpowered vehicle."

The success of the X-15 program would not have been possible without untiring dedication as well as personal sacrifice. There are many visionaries and heroes associated with this program. At the forefront was the NAA design team of Harrison Storms, Charlie Felz and Crossfield.

Crossfield, U.S. Air Force Maj. Robert White, NASA pilot Joseph Walker and U.S. Navy Cmdr. Forrest Peterson were presented the prestigious 1961 Collier Trophy at a White House ceremony by then-President John F. Kennedy for "invaluable technological contributions to the advancement of flight, and for great skill and courage as test pilots for the X-15."

With NASA pilot Bill Dana at the controls, the last X-15 flight (No. 199) took place on Oct. 24, 1968.

By far surpassing its design specifications, the X-15 represents a pinnacle of aeronautical achievement. Its contributions extended to all manned spaceflight programs including, Mercury, Gemini, Apollo and the Space Shuttle. Through the ensuing decades, Boeing's hypersonic/spaceflight vehicle activities have continued with the X-20 Dyna-Soar, the Space Shuttle, the X-30 National Aerospace Plane and the X-43 Hyper-X. Today, Phantom Works continues research in that exclusive flight regime in the form of the HyFly and X-51A WaveRider programs. ■

erik.simonsen@boeing.com

X-15 contributions to aerospace

- First application of hypersonic wind tunnel theory on a flight vehicle
- First reusable super alloy structure for the hypersonic flight regime
- First restartable, throttle-controlled and man-rated rocket engine
- Demonstrated pilot's ability to control a rocket-boosted vehicle in exoatmospheric flight
- Demonstrated pilot functions during weightlessness
- First spaceflight stellar navigation system
- Use of horizon all-spectrum scanner (an extreme altitude reference)
- First application of the MH-96 adaptive control system that automatically transitioned from conventional flight controls to the reaction control system for high-altitude flight, and back again for descent
- First demonstration of piloted, dead-stick (unpowered) landing techniques starting at high altitudes and more than 200 miles (322 kilometers) from the landing site
- Development of wedge-tail vertical stabilizer for hypersonic stability control
- Development of advanced pressure suits

X-15—tale of the tape

General characteristics

- Crew: One
- Length: 50 feet 9 inches (15.47 meters)
- Wingspan: 22 feet 4 inches (6.81 meters)
- Height: 13 feet 6 inches (4.11 meters)
- Empty weight: 14,600 pounds (6,622 kilograms)
- Loaded weight: 34,000 pounds (15,422 kilograms)
- Powerplant: 1× Thiokol XLR-99 liquid-fuel rocket engine developing 57,850 pounds (257.3 kilonewtons) of thrust

Performance

- Maximum speed: Mach 6.7
- Range: 280 miles (451 kilometers)
- Service ceiling: 67 miles (108 kilometers)
- Rate of climb: 60,000 feet per minute (18,288 meters per minute)
- Thrust-to-weight ratio: 2.07

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