## About the Author

Dennis R. Jenkins has spent 30 years as an engineer and manager for various contractors on the Constellation, Space Shuttle, and X-33 programs. In addition, he has served in a staff capacity on the Columbia Accident Investigation Board (CAIB), the President's Commission on Implementation of U.S. Space Exploration Policy, and the Return-to-Flight Task Group, and spent a year as the Verville Fellow at the Smithsonian's National Air and Space Museum. He has authored several dozen books chronicling the history of various aerospace projects including the Space Shuttle, X-15, North American XB-70 Valkyrie, and Convair B-36. Jenkins is active in promoting the preservation of aerospace historical archives and records. He presently lives in Cape Canaveral, Florida.

## About the Cover

NASA-Dryden test pilot William H. Dana with the X-15-3 after a successful mission. *Courtesy of NASA, no. EC67-1716.* The back cover images: (left) The advanced X-15A-2 shows its new external fuel tanks. *Courtesy of NASA, no. EC65-0893,* (middle) NASA test pilot Neil A. Armstrong with the X-15-1 following a mission. *Courtesy of NASA, no. E60-6286.* (right) X-15-3 being secured by ground crew after landing. *Courtesy of NASA, no. ET62-0243.*

Neil Armstrong, amongst others, has called the X-15 "the most successful research airplane in history." That might be stretching a point, but it was certainly the most successful of the high-speed X-planes.

It had taken 44 years to go from Kitty Hawk to Air Force Captain Charles E. Yeager's first supersonic flight in the Bell X-1 on 14 October 1947. Six more years were required before NACA test pilot Scott Crossfield got to Mach 2 in the Navy-Douglas D-558-2 Skyrocket. A remarkably short three years had passed when Captain Milburn G. Apt coaxed the X-2 above Mach 3, before tumbling out of control to his death. There, progress stalled, awaiting the arrival of the three small, black North American X-15 research airplanes that would more than double the speed and altitude milestones.

The X-15 flight program began slowly, mostly because the million-horsepower XLR99 engine was not ready. This undoubtedly worked in the program's favor since it forced the engineers and pilots to gain experience with the airplane and its systems prior to pushing the envelope too far.

The first 20 months took the X-15 from Crossfield's glide flight to essentially duplicating the performance of the X-2: Mach 3.5 and 136,500 feet. Then the XLR99s arrived and things got serious. Six days after the last flight with the interim XLR11s, Major Robert M. White took X-15-2 past Mach 4, the first time a piloted aircraft had flown that fast. Mach 5 fell, also to Bob White, four months later. Mach 6, again to White, took six more months. Once it began flying with the ultimate engine, it took only 15 flights to double the maximum Mach number achieved by the X-2.

Altitude was a similar story. Captain Iven C. Kincheloe, Jr. was the first person to fly above 100,000 feet, in the X-2 on 7 September 1956. Thirteen flights with the big engine allowed Bob White to fly above 200,000 feet for the first time. Three months later, he broke 300,000 feet. Once it began flying with the ultimate engine, the X-15 took only 19 months to double the maximum altitude achieved by the X-2. Ultimately, during its 199 flights, the X-15 recorded a maximum altitude of 354,200 feet and a maximum speed of 4,520 mph (Mach 6.7). They were stunning achievements.

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# X-15

EXTENDING THE FRONTIERS OF FLIGHT

## X-15: Extending the Frontiers of Flight

X-15: Extending the Frontiers of Flight is the result of 15 years of research into the cooperative NASA-Air Force-Navy X-15 research airplane program. This history covers the program from its inception, through the preliminary conceptual studies, the airframe and engine competitions, the flight program, and the follow-on research program. Particular attention is paid to the program highlights, such as the development of a workable full pressure suit and early biomedical testing in the human centrifuge at the Naval Air Development Center Johnsville.

Despite appearances, the program was not about setting records. It is interesting to note that although the X-15 is generally considered a Mach 6 vehicle, only two of the three airplanes ever flew that fast, and then only four times. On the other hand, 108 other flights exceeded Mach 5, accumulating 1 hour, 25 minutes, and 33 seconds of hypersonic flight. It was a fast airplane. Similarly, there were only four flights above 300,000 feet (all by X-15-3), but only the initial glide flight was below 40,000 feet. However, the actual speed and altitude achieved by the program were not the ultimate test, and the fact that the basic airplane never achieved its advertised 6,600 feet per second velocity was of little consequence. What interested the researchers was the environment in which the airplane flew. They wanted to study dynamic pressures, heating rates, and total temperatures. In that regard, the X-15 performed almost flawlessly, and the data collected during the program represented the majority of the hypersonic database available when the development of Space Shuttle began in the late 1960s.

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