



## X-48 Hybrid/Blended Wing Body



NASAfacts

Boeing's sub-scale X-48B Blended Wing Body technology demonstrator rests on the cracked surface of Rogers Dry Lake at Edwards Air Force Base before beginning its flight test program. (Boeing / Robert Ferguson)

Boeing Phantom Works, NASA and the Air Force Research Laboratory have joined together to study the structural, aerodynamic and operational advantages of the Hybrid or Blended Wing Body concept, a cross between a conventional aircraft and a flying wing design. The Air Force designated the sub-scale prototype as the X-48B, based on its interest in the design's potential as a multi-role, long-range, high-capacity military transport aircraft. The follow-on upgraded modified version has been designated the X-48C.

The program's goal is to learn more about the low-speed flight control characteristics of the concept when applied to large transport or cargo aircraft. Engineers are also intrigued by the design's potential to get up to 30 percent

better fuel economy than traditional aircraft due to its unique shape, a combination of a flying wing merged with a triangular body.

The 8.5-percent scale, remotely piloted X-48 is dynamically scaled to fly much like the full-size aircraft would fly.

### X-48B

The Blended Wing Body research team successfully completed 250 hours of wind tunnel tests on X-48B Ship No. 1 at the historic full-scale wind tunnel at NASA's Langley Research Center in Hampton, Va., in May 2006. NASA's Dryden Flight Research Center at Edwards Air Force Base, Calif., is hosting the X-48 flight test activities and providing in-flight flight research expertise garnered from

years of operating a variety of cutting-edge unmanned air vehicles.

Following completion of installation of test instrumentation, the second X-48B Blended Wing-Body technology demonstrator began ground checkout at NASA Dryden in late 2006, with the first five test flights occurring in early 2007. Flight testing at NASA Dryden focused on the low-speed, low-altitude flight characteristics of the blended wing body configuration, including engine-out control, stall characteristics and handling qualities. The short flight test program was designed to demonstrate that the novel design can be flown as safely as current transports having a traditional fuselage, wings and tail configuration.

Both X-48B technology demonstration aircraft were built by Cranfield Aerospace in the United Kingdom to Boeing's specifications. The subscale prototypes have a wingspan of 20.4 feet, with prominent vertical fins and rudders at the wingtips and elevons along the trailing edges of the wings. Three small model aircraft turbojet engines, providing a maximum combined thrust of about 150 lbs, power the 523-lb. gross weight aircraft. The X-48B has an estimated top airspeed of 118 knots (138 mph), a maximum altitude of about 10,000 feet and a flight duration of about 40 minutes.

### **X-48C**

The X-48C, a modified version of the X-48B aircraft, successfully flew for the first time Aug. 7, 2012 at Edwards Air Force Base. The Boeing-designed aircraft is flying again in partnership with NASA.

The new X-48C model was modified to evaluate the low-speed stability and control of a low-noise version of a notional, future Hybrid Wing Body (HWB) aircraft design. The HWB design stems from concept studies being conducted by NASA's Environmentally Responsible Aviation project of future potential aircraft designs 20 years from now.

Primary changes to the "C" model from the "B" model were intended to transform it into an airframe noise-shielding configuration. External modifications included relocating the wingtip winglets inboard next to the engine exhaust ducts, effectively turning the winglets into twin vertical tails. The aft deck of the aircraft was

extended about two feet to the rear. Finally, the project team replaced the X-48B's three 50-pound thrust jet engines with two 89-pound thrust engines.

Because handling qualities of the X-48C are different from those of the X-48B, the project team developed flight control system software modifications, including flight control limiters to keep the airplane flying within a safe flight envelope. This will enable a stronger and safer prototype flight control system suitable for future full-scale commercial hybrid or blended wing aircraft.

The X-48C retains most dimensions of the B model, with a wingspan just longer than 20 feet, and a weight of about 500 pounds. The aircraft has an estimated top speed of about 140 mph, and a maximum altitude of 10,000 feet.



The X-48C Hybrid / Blended Wing Body technology demonstrator lifts into the skies after taking off from the bed of Rogers Dry Lake at Edwards Air Force Base on its first test flight. (NASA / Carla Thomas)



The remotely operated X-48C Blended Wing Body aircraft lifts off Rogers Dry Lake at Edwards Air Force Base, Calif., on its first test flight Aug. 7, 2012. (NASA / Carla Thomas)

National Aeronautics and Space Administration

**Dryden Flight Research Center**

P.O. Box 273

Edwards, California 93523

[www.nasa.gov](http://www.nasa.gov)