

Boeing Defense, Space & Security  
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## X-51A Waverider

### Description and Purpose:

The X-51A Waverider program is a collaborative effort of the U.S. Air Force Research Laboratory, the Defense Advanced Research Projects Agency (DARPA), Pratt & Whitney Rocketdyne and Boeing to demonstrate hypersonic flight capability. The X-51A will demonstrate a scalable, robust endothermic hydrocarbon-fueled scramjet propulsion system in flight, high temperature materials, airframe/engine integration and other key technologies within the hypersonic Mach 4.5 to 6.5 range.

Pratt & Whitney Rocketdyne is the propulsion system provider. Vehicle integration is performed by Boeing Advanced Network & Space Systems, headquartered in Huntington Beach, Calif.

### Customer(s):

The X-51A Waverider is an unmanned, autonomous supersonic combustion, ramjet-powered hypersonic flight test demonstrator for the U.S. Air Force.

### General Characteristics:

**Length:** Full stack 25 feet; Cruiser 14 feet; Interstage 5 feet; Solid rocket booster 6 feet

**Power Plant:** JP-7 fueled/cooled SJY61 supersonic combustion ramjet

**Weight:** Approx. 4,000 pounds

**Fuel Capacity:** Approx. 270 pounds JP-7 ( kilograms)

**Speed:** 3,600+ miles per hour (@ Mach 6)

**Range:** 400+ nautical miles

**Ceiling:** 70,000 + feet

### Background:

During its first flight test in May 2010, after being released from a B-52, the solid rocket U.S. Army Tactical Missile booster ignited and took the X-51A Waverider to approximately Mach 4.5, at which point the scramjet engine took over and accelerated the vehicle to a flight speed of approximately Mach 5.0 for approximately 140 seconds. It then observed a decrease in thrust and acceleration for another 30 seconds before the test was terminated . The test was the longest of its kind, beating the previous record of 10 seconds set by the X-41.

The second flight test vehicle flew in June 2011, but soon after being dropped from a Boeing B-52 Stratofortress off the coast of California, the vehicle encountered a problem while nearing speeds of approximately Mach 5, forcing the planned flight test to end prematurely. The hypersonic vehicle attempted to restart several times and continued to orient itself to optimize engine start conditions before flying into the ocean as originally planned. However, the team was able to collect a significant amount of data from the test.

Two additional test flights are planned for the X-51A demonstration program in the future.

The X-51A Waverider is setting the foundation for several hypersonic applications, including access to space, reconnaissance-strike, global reach and commercial transportation.

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