

Boeing Defense, Space & Security
P.O. Box 516
St. Louis, MO 63166
www.boeing.com

A160T Hummingbird

Description and Purpose:

The A160 Turbine (A160T) Hummingbird is a rotorcraft Unmanned Air System (UAS) that enables significant improvements in endurance and range over conventional technology. The A160T's unique optimum speed rotor (OSR) system allows the blade RPM to be tailored to flight conditions to significantly improve engine efficiency. The A160T has demonstrated intelligence, surveillance, and reconnaissance (ISR), cargo resupply and high-endurance capabilities and is in production.



With its vertical takeoff and landing (VTOL) capability, the A160T is runway independent and can operate at sea, in an austere land environment and in complex urban terrain. Its missions will include ISR, direct attack; communications relay; precision re-supply; and remote delivery of unmanned ground vehicles and unmanned ground sensors.

The A160T is able to reach higher altitudes, hover for longer periods of time, go greater distances and operate much more quietly than current helicopters. In May 2008, the A160T flew for 18.7 hours setting a world record for endurance in its weight class for UAVs.

Customers:

Boeing has built the A160T for customers including the Defense Advanced Research Projects Agency, the U.S. Army Aviation Applied Technology Directorate and Naval Air Systems Command.

General Characteristics:

Length:	35 ft
Rotor Diameter:	36 ft
Maximum GTOW	6500 lbs
Max Payload	2500 lbs

Maximum Cruise Ceiling	30,000 ft (current engine certified to 20,000 ft.)
Max Cruise Speed	165 knots
Demonstrated Air Speed	142 knots
Endurance	20+hours at 15,000 ft
Range	2,250+ nautical miles
Hover Altitude:	20,000 feet
Longest Flight	18.7 hours

Background:

The A160T Hummingbird UAS looks like a helicopter, but is unlike any other helicopter. It can reach higher altitudes, hover for longer periods of time, go greater distances and operate much more quietly than current helicopters. It features a unique OSR technology that enables the Hummingbird to adjust the RPM of the rotor blades to maximize efficiency and performance at different altitudes and cruise speeds.

The A160 joined Boeing's line of UAS vehicles in May 2004 with the acquisition of Frontier Systems Inc., in Irvine, Calif. The aircraft's unique characteristics address current and emerging requirements of the U.S. armed forces, the U.S. Department of Homeland Security, and international military and security organizations. The A160T began flight testing in June 2007. It completed endurance tests of three-, five-, eight-, 12- hours (all using a fraction of the A160T's maximum fuel capacity while carrying a variety of payloads) and the record setting 18.7-hour flight. The A160T also successfully completed a 142 knot speed test (while in low gear on the two-speed gearbox) and a 20,000-foot Hover-Out of-Ground-Effect (HOGE) flight. The A160T also has made 30+ successful flights with the FORESTER foliage penetrating radar (shown in the above photo).

The Hummingbird is designed to fly 2,250 nautical miles, with endurance in excess of 20 hours carrying a payload of more than 300 pounds. Since 2002, the A160 has flown more than 100 times, surpassing 350 flight hours.

The autonomously-flown A160T is 35 feet long with a 36-foot rotor diameter. It will fly at an estimated top speed of 165 knots at a ceiling of 30,000 feet (pending engine certification for that altitude), which is several thousand feet higher than conventional helicopters can fly today. Future missions for the A160T include reconnaissance, surveillance, target acquisition, communications relay and precision re-supply. The A160T's ability to stay aloft at high altitudes with heavy payloads for extended periods has caught the attention of the U.S. Army, the U.S. Navy and U.S. Marine Corps.

In March 2010, the A160T successfully completed an autonomous cargo demonstration for the Marines. Boeing showed that the A160T can deliver at least 2,500 pounds of

cargo from one simulated forward-operating base to another in fewer than five hours. The simulated mission carried 1,250 pounds over two 150-nautical-mile round trips, with the A160T operating autonomously on a preprogrammed mission.

Boeing is currently producing the A160T at its center of excellence for rotorcraft manufacturing in Mesa, Ariz. A new production line began operation in March 2010.

The A160T's predecessor, the gasoline-powered A160, flew for the first time in January 2002 at a former U.S. Air Force base near Victorville, Calif., where flight-testing of the Hummingbird continues. Earlier A160s were powered by four-cylinder and six-cylinder automobile engines. The A160 test team originally worked with a three-bladed rotor system. Currently, Hummingbirds have four rotor blades for improved performance.

During flight, an operator can vary the RPM of the A160T's rotors (speed them up or slow them down) to improve overall efficiency at different flight conditions. This is a departure from conventional rotor systems, which tend to have a fixed rotor RPM that is set for a worst-case flight condition (e.g., takeoff at maximum weight) and is suboptimal under all other flight conditions.

A helicopter can run more efficiently if it can operate across a wide range of RPMs as the A160T does. By varying the RPM of its rotors to account for differences in weight, altitude and cruise speed, peak efficiency of its rotor system can be achieved throughout various flight regimes.

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Contacts:

Marc Sklar
Boeing Military Aircraft
480-773-5266
marc.a.sklar@boeing.com

Carole Thompson
Boeing Military Aircraft
480-891-2119
carole.j.thompson@boeing.com

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