Boeing Expertise Fuels X-43A Hypersonic Research Flights

The flight of NASA's X-43A at seven times the speed of sound got a lift from Boeing [NYSE: BA] research expertise with hypersonic vehicles and spacecraft.

On Saturday, a NASA Dryden Flight Research Center B-52 aircraft flown from Edwards Air Force Base, Calif., carried the X-43A off the California coast, where it was launched just before 2 p.m. PST over the Pacific Ocean mounted on a booster rocket.

The booster took the X-43A up to its test altitude of about 95,000 ft., where the X-43A separated and flew freely for several minutes. During the free flight, the scramjet engine operated for about 10 seconds and the X-43A successfully achieved its test speed of Mach 7.

"This successful flight is an important step toward validating the use of advanced air-breathing propulsion technology for achieving more rapid global travel and routine, affordable access to space," said Bob Krieger, president of Phantom Works, Boeing's advanced R&D unit. "Applied to civil, military and space systems, this technology has the potential to open new frontiers in aerospace."

Boeing Phantom Works is teamed with prime contractor ATK GASL to develop and build the X-43A or Hyper-X for NASA. Boeing designed the vehicle, the airframe thermal protection systems and flight control and navigation systems. ATK GASL was responsible for vehicle fabrication, assembly, systems integration and testing in addition to providing the scramjet engine. The booster is a modified Pegasus rocket built by Orbital Sciences Corp.

The 12.3-foot-long X-43A is powered by a scramjet, or supersonic combustion ramjet engine. As air-breathing engines, scramjets have significantly fewer moving parts than traditional turbojet engines, and do not require oxidizer to be carried onboard for combustion like conventional rocket engines do. Scramjets allow for the design of smaller, simpler, more affordable reusable vehicles for potential space, military and civil applications.

Hypersonic flight, defined as flying at least five times the speed of sound, remains a mostly unexplored region. At those speeds, metals can melt or vaporize almost instantly, and aerodynamic control must be extremely precise. Additionally, strong shockwaves are created that can cause exceptionally high temperatures and forces on various parts of the airframe.

To meet these challenges, the X-43A employs a tile-based thermal protection system, carbon-carbon composites, and high temperature-resistant metals; a control system designed to deal with the rapid changes in forces and motions expected at Mach 7; and a special control technique to sense and prevent disruption of the supersonic airflow through the inlet, which would dramatically reduce engine thrust.

Boeing has explored the challenges of hypersonic flight since the 1950s, beginning with the X-15 to the space shuttle to the X-43A.

Phantom Works is currently teamed with Pratt & Whitney on the Scramjet Engine Demonstrator-WaveRider program for the Air Force. Additional Phantom Works projects include the FALCON Hypersonic Cruise Vehicle program for DARPA and the HyFly hypersonic missile demonstrator program for DARPA and the Navy.

"Many challenges remain to be overcome, particularly in developing efficient and high-performing engines for sustained hypersonic flight," said Tom Harsha, Boeing Phantom Works X-43A program manager. "But we'll learn important lessons from the X-43A about the technology we'll need to make hypersonic flight practical."

NASA's Langley Research Center in Hampton, Va., and Dryden Flight Research Center near Edwards, Calif., jointly conduct the Hyper-X program.

Boeing Phantom Works is the advanced research and development unit and a catalyst of innovation for The Boeing Company. It provides advanced solutions and innovative, breakthrough technologies that reduce cycle time and cost while improving the quality and performance of aerospace products and services.
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