X-35B Completes Hover Pit Testing

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Lockheed Martin's Joint Strike Fighter (JSF) X-35B demonstrator aircraft has successfully completed hover-pit testing of its short takeoff/vertical landing (STOVL) propulsion system with all major test goals accomplished on schedule.

The tests confirmed that the X-35B's unique shaft-driven lift fan propulsion system produces abundant vertical lift, lower exhaust temperatures and a more acceptable ground environment than traditional direct-lift systems, while eliminating hot-gas reingestion problems typical in conventional STOVL designs.

"STOVL temperature and velocity measurements were even better than predicted, and we achieved sustained, full operational thrust," said Harry Blot, deputy program manager for the Lockheed Martin JSF and a former Harrier pilot. "This not only positions the X-35B for STOVL flight this summer, but also means that no further engine development is needed to meet JSF STOVL requirements. The Pratt & Whitney engine and Rolls-Royce fan performed beautifully."

Hover pit tests were conducted with a special landing gear that allowed load cells to measure STOVL lift forces and moments directly, while keeping the airplane from lifting into hover at higher power settings. Over a two- week period, the Lockheed Martin team conducted more than 100 test series with all control functions fully under pilot command.

"Everything worked as advertised. It was totally reliable," Blot said.

X-35B lead STOVL pilot Simon Hargreaves of BAE SYSTEMS performed full rehearsals of vertical-flight missions, including conversions from conventional takeoff and landing (CTOL) mode to STOVL modes. Measurements showed no thermal distress from either hot-gas reingestion or any flow-field effects on the aircraft surfaces. Instrumentation also recorded favorable thermal conditions at ground level near the airplane.

The test series included 26 lift-fan clutch engagements from CTOL to STOVL mode at high engine RPM. The X-35B repeatedly operated at maximum STOVL thrust levels for periods of up to 90 seconds. Individual test series were regularly run with a full aircraft fuel load for as much as an hour.

"All 26 conversions worked exactly as expected," Hargreaves said. "Noise level and vibration in the cockpit were virtually unchanged at idle compared to CTOL levels. The propulsion system responded predictably to pilot inputs, and thrust and thrust-vector commands were crisp. Noise and vibration at full power with the thrust vector at the hover setting were comfortable."

Tests were conducted with the hover pit in several configurations, including open-grate conditions to represent out-of-ground-effect flight, and with the pit fully plated over to represent ground-effect conditions during vertical landings or takeoffs.

"This series of STOVL testing captured the full level of system integration for the X-35B's integrated flight propulsion control system," said Scott Winship, X-35B STOVL product team lead for Lockheed Martin. "We performed conversions across the full range of operation, including tests of conversion aborts at any point during the sequence, to confirm our control methods are robust. We even tested the X-35B in full CTOL afterburner to show that this system retains the full up-and-away performance of a world-class fighter."

By demonstrating JSF commonality and performance now, the Lockheed Martin team is working to lower technical risk and cost later in the program.

Lockheed Martin , in partnership with Northrop Grummanand BAE SYSTEMS, is competing to build the JSF for the United States and United Kingdom. Government selection of a single contractor is set for fall 2001.

For information on JSF and Lockheed Martin Aeronautics Company, visit:http://www.lmaeronautics.com/

For information on Lockheed Martin Corporation, visit:http://www.lockheedmartin.com/

For government information on the Joint Strike Fighter program, visithttp://www.jast.mil/

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