Unique Integrated System Starts F-35 Engine In Joint Test By Lockheed Martin, Pratt & Whitney

Lockheed Martin and Pratt & Whitney have successfully performed the first start of an F-35 aircraft test engine using a revolutionary integrated power package and engine-mounted starter/generator.

The aircraft's integrated power package (IPP) combines into a single system the functions traditionally performed by the auxiliary power system, emergency power system, and environmental control.

At the heart of the IPP is a small gas-turbine engine "turbomachine" that provides power to the engine-mounted starter/generator, bringing the engine to its threshold starting speed. The engine then increases to idle speed and the electrical system, which includes the engine-mounted starter/generator (ES/G) transitions from operating as a motor to operating as a generator. The IPP is also available for in-flight emergency power.

"To save weight, add reliability and improve packaging efficiency, the F-35's vehicle systems are more highly-integrated than those in previous aircraft," said Bob Elrod, executive vice president and F-35 Joint Strike Fighter program general manager. "Combining such diverse functions into a single system like this is a lofty technical challenge, but this engine start shows that cooperation among industry leaders can bring great success."

The achievement marks a major milestone in the development and integration of F-35 vehicle systems, paving the way for additional development testing in preparation for the F-35's first flight in 2006. The system was used to start a Pratt & Whitney F135 short-takeoff/vertical-landing (STOVL) engine at the company's advanced test facility in West Palm Beach, Fla. The IPP is a subsystem of the F-35 Power and Thermal Management System (PTMS).

Unlike current-generation fighters, the F-35 will rely on "more-electric" systems to operate the aircraft, including an electric starter, electrically driven flight-control surfaces, and all-electric auxiliary power and emergency power. At the foundation of this innovative architecture is the F-35 electrical system, which includes the ES/G and the IPP.

Performing engine starts with the integrated systems demonstrates the maturity of their designs and reduces risk for first flight. The JSF program has targeted the successful IPP engine start as a major milestone since the beginning of the System Development and Demonstration phase of the program in 2001.

The Lockheed Martin and Pratt & Whitney teams involved personnel from Hamilton Sundstrand, providing engine external accessories and the engine start system; Rolls-Royce, supplying the shaft-driven lift fan; and Honeywell International, provider of the integrated power package.

The F-35 is a next-generation, supersonic, multi-role stealth aircraft designed to replace the AV-8B Harrier, A-10, F-16, F/A-18 Hornet and the United Kingdom's Harrier GR.7 and Sea Harrier.

Three versions of the F-35 -- a CTOL, STOVL and carrier variant (CV) -- each derived from a common design, will ensure that the F-35 meets the performance needs of the U.S. Air Force, Marine Corps, Navy, the U.K. Royal Air Force and Royal Navy, and allied defense forces worldwide, while staying within strict affordability targets.

Headquartered in Bethesda, Md., Lockheed Martin employs about 130,000 people worldwide and is principally engaged in the research, design, development, manufacture and integration of advanced technology systems, products and services. The corporation reported 2004 sales of $35.5 billion.

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