Boeing Begins Integrating F-22 Fighter's Advanced Avionics

Boeing has begun integrating the highly sophisticated avionics that will operate the weapons system for the Lockheed Martin/Boeing/Pratt & Whitney F-22 Raptor. Avionics-integration engineers initiated this critical phase of F-22 development by integrating the software and hardware that runs the flight controls, power controls and the weapons-delivery systems.

"We're treating this as our first flight," said Joe Gerhardt, manager of F-22 Avionics Integration Laboratory design. "This is our first major integration effort for the F-22's avionics, and everything is progressing very successfully. Our integration tools and processes are prepared for the long haul."

The software involved in the initial integration included the cockpit controls and displays, the vehicle management system, the stores management system, the integrated vehicle subsystems controller and engine simulators.

"Most of these systems have been running together using engineering prototype software," Gerhardt said. "The difference here is that for the first time we are using the actual software that will be on board the first F-22 with a complete avionics suite."

Boeing is responsible for ensuring all the elements of the avionics fit together and perform as designed for the ultimate customers -- F-22 pilots and maintenance personnel.

This involves the integration of 1.6 million lines of flight software code representing more than 100 computer software products developed by 15 companies along with avionics hardware, weapons and avionics-test support systems.

Software designers and system integrators at the F-22 Avionics Integration Laboratory in Seattle, as well as those across the country who are networked to the lab, will integrate and test avionics functions including mission management, sensor control, sensor tasking, track fusion, fire control, integrated navigation, cockpit displays and flight-path management.

Boeing is applying lessons learned from other programs such as the 777, AWACS, and the B-2 and B-1B bombers in developing the F-22 Avionics Integration Lab. The next-generation lab features a fully paperless environment, full pilot-in-the-loop functionality and closed-loop sensor fusion testing. The F-22 Avionics Integration Lab will operate as an F-22 without wings.

"The degree of avionics integration on the F-22 is unprecedented in the fighter industry," Gerhardt said.

Conventional avionics are composed of independent systems operating on separate processors. This requires pilots to closely monitor and analyze a wide array of data that isn't always directly relevant to the mission at hand.

The integrated and highly advanced avionics on the F-22 will perform much of this "housekeeping," allowing pilots to focus on the immediate requirements of their mission.

Integration and testing of the F-22's avionics is scheduled for completion in 2002.

Boeing is teamed with Lockheed Martin to design and build the F-22 as a replacement for the F-15 air superiority fighter.

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