Boeing Demonstrates Low Cost Avionics Upgrade Technique

Boeing has demonstrated a new, low cost technology for upgrading avionics systems without altering the existing software.

The new technology, developed under the U.S. Air Force's Incremental Upgrade of Legacy Systems program, called IULS, consists of a software program that "wraps" around both the legacy avionics software and new software, allowing both to operate in an upgraded system.

"Because this approach allows operational flight programs to leverage proven software while incrementally introducing lower cost, commercial software and hardware, it will significantly reduce the cycle time and cost of upgrading avionics systems," said Dr. David Corman, head of the IULS project in the Boeing Phantom Works.

The new wrapper technique was recently demonstrated in an F-15E Eagle strike fighter equipped with an advanced display core processor based on commercial hardware, new avionics software developed using a commercial programming language, and the unmodified legacy software written in a military standard programming language.

The Overload Warning System was the legacy software function chosen to be wrapped and combined with the updated flight software for the flight test. By flying a series of maneuvers that would cause the OWS to trigger, the test pilot verified that the OWS functioned properly, just as it would in the legacy F-15E operational flight program.

In an earlier laboratory demonstration, the new technique was also used to successfully rehost the Communications Control Unit software of the C-17 from the legacy military standard processor to a commercial processor without modifying a single line of code.

"This successful series of tests demonstrate that we will be able to gradually evolve legacy avionics systems toward desired re-engineered end states, thus deferring conversion costs and risks," Corman said. "Now we're ready to apply it to a variety of upgrade programs."

The wrapper technology and tool set are currently being considered by the Air Force for application to the F-15 and C-17 programs, and has potential application to a wide variety of other aircraft.

The IULS program was awarded in 1996 to the Boeing Phantom Works and its partners, Honeywell and General Dynamics, and it is managed by the Embedded Information Systems Engineering Branch of the Air Force Research Laboratory's Information Directorate. Under an avionics affordability initiative called "Bold Stroke," Phantom Works has been developing commercially based, open systems avionics architectures since 1995.

The new open systems wrapper technology and tool set allow operational flight program developers to construct a visual model of both the legacy environment and the new environment, and to automatically generate the wrapper software that accommodates both in the new system.

"With the automated approach of the IULS, we should be able to save even more time and cost in upgrading legacy avionics systems, making this an even greater value to our customers," Corman said.

The upgraded flight software for the F-15E was generated using the commercial C++ object oriented language, while the legacy software is in Ada. The legacy C-17 CCU software was written in the JOVIAL language, prevalent in military avionics systems in the 1970's and 1980's. Both demonstrations employed commercial PowerPC/VME upgraded processors, replacing legacy MIL-STD-1750A processors.

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