Open, Safe and Secure: Building The Next Generation Of Digital Avionics

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Army aviators must be decisive, ready to leverage an array of advanced capabilities to best succeed in the operating environment. Northrop Grumman's mission to deliver a digital avionics suite that is open, safe and secure ensures pilots will have the equipment necessary to continue thriving well into the future.

Built on a modular open systems architecture, Northrop Grumman is delivering a software-defined mission equipment package that allows the Army to rapidly integrate new capabilities, reduce training time for operators and realize substantial cost savings for its aircraft. Northrop Grumman's customers receive the maximum benefit with an open architecture that allows for the possibility of working with an array of developers on future upgrades, bolstering competition and increasing acquisition speed.

James Conroy, vice president for Navigation, Targeting and Survivability, calls MOSA the hallmark foundation for Northrop Grumman's aircraft survivability offerings, allowing for interoperability across the fleet to ensure critical platforms are able to work together in the future multi-domain operational environment.

"Northrop Grumman is the only provider of a verifiable MOSA architecture flying on an Army platform right now. The fact that the architecture is open, safe and secure as well as scalable really allows the Army maximum flexibility," Conroy said of the company-developed, Army-owned architecture.

Leading this effort is Northrop Grumman's critical work on the UH-60V Black Hawk program, where the company is retrofitting L-model platforms with a digital, open architecture integrated glass cockpit, including an integrated computational system, visual display system and Control Display Units.

The flexibility offered with this digital, open architecture approach allows for long-term capability growth for both the Army's current fleet and out to its next-generation Future Vertical Lift platforms offering affordable, rapid upgrades to handle changing mission sets for decades to come.

Dennis Neel, Northrop Grumman's director for Integrated Digital Systems, points to the open systems architec-

The UH-60V cockpit features Northrop Grumman's software-defined mission equipment package with a digital, open architecture integrated glass cockpit. *Photo credit: Northrop Grumman*

ture as the key to bolstering the capabilities of the future fleet as the threat environment grows in complexity.

"We look to provide the open architecture solutions that allow the platforms to continue to iterate as the threat evolves," Neel said. "All of the work that's been done on this open systems architecture is very applicable to Future Vertical Lift. This is an Army-owned architecture that they're using on the UH-60V today. That architecture has the ability not only to evolve with the UH-60V's needs but it also has the potential to move to Future Vertical Lift and evolve with those platforms."

After receiving the initial contract award in 2014 for UH-60V and then conducting first flight with the digital cockpit in 2017, Northrop Grumman is now working through low-rate initial production to include delivery of the latest software drop.

By replacing the analog gauges on the L-model Black Hawks with the software-defined digital cockpit, Northrop Grumman is able to replicate the improved interoperability and intuitive pilot-vehicle interface similar to the UH-60M. The UH-60V program builds on prior experience delivering advanced mission equipment packages for the U.S. Marine Corps AH-1Z and UH-1Y helicopters, U.S. Navy E-2D Advanced Hawkeye, and the Royal Jordanian Air Force AH-1 programs.

The UH-60V integrated mission equipment package builds in state-of-the-art video input and output, provides enhanced pilot situational awareness and allows for decreased workload on pilots and lowers the platform's overall lifecycle cost.

Neel notes the UH-60V was the ideal for meeting the Army's goal to affordably extend the Black Hawk's lifecycle while ensuring the platform is always up to today's technology standards.

"The Army had two choices to do that. You could buy all new aircraft, which is fairly expensive. Or you can take platforms which are flying and still have a lot of life in them and upgrade the cockpits up to today's standards. That's what our focus was for UH-60V," Neel said.

Building the backbone of the evolutionary UH-60V work is the Northrop Grumman-designed, Army-owned open and flexible plug & play architecture that allows for rapid capability upgrades. This allows the Army to continually iterate on the Black Hawk, ensuring the platform can grow infinitely as the threat evolves.

"In the survivability game there isn't a fixed endpoint. It's a constant, evolving situation. Adversaries' threats evolve and the survivability needs to evolve, and you need that modular open systems architecture to enable that," Conroy said. "The Army understands that the development cost is the smallest portion of the lifecycle cost for maintaining a platform, with 75 percent of the costs in operations and sustainment. So they were looking to have an open, safe and secure solution that breaks the vendor lock and they no longer have to go back to the Original Equipment Manufacturers for

any type of upgrades or sustainment activities."

Northrop Grumman has been able to demonstrate the ability to integrate a new capability on the UH-60V in a matter of weeks, when previously it would take magnitudes of time longer to account for closed proprietary architectures or more arduous hardware adjustments.

Northrop Grumman provides the Integrated Avionics Suite for the UH-60V, a modernized technology supporting rapid and timely capability enhancements and replacing the analog gauges in UH-60L helicopters. *Photo credit: U.S. Army*

The most recent software drop provided an update to allow the UH-60V to conduct the medevac mission set, including integration of a new FLIR camera to help pilots search through degraded weather environments. Previously, such an update would have required installing a new display and extra controls and requiring additional certification for the new equipment.

"With the UH-60V, what we're able to do is use all the same things that the platform already has on it. We mapped all the controls into the digital cockpit's multi-function display that they're using today. So no new hardware had to come onto the platform," Neel said. "That was something that we were able to quickly demonstrate to the Army to show what was possible for us to bring to their solution, and then was added to the latest software drop we provided them. And we were then able to quickly integrate that capability. That was very affordable and very quick for the Army to add in that capability."

With no new equipment that operators need to familiarize themselves with, as the capability is controlled via the multi-function display, the overall training time is greatly reduced. The technology is integrated and ready to be used faster than ever before.

Taking advantage of a model-based engineering approach also allows Northrop Grumman to reduce software development schedule and cost, while increasing opportunities to work closely with the customer on tailoring new capabilities to exact needs. Building in agile software development practices creates a more streamlined certification process, with an ability to automate software testing once a new tool is delivered.

"That's allowed us to evolve quickly and be able to supply new solutions rapidly to the warfighter and into the field," Neel said. "It starts with engaging our customer upfront and being able to work

collaboratively with them all the way through the testing cycle and fielding."

Powering the UH-60V's digital cockpit is an advanced multi-core process on FlightPro Gen III mission computers, ensuring the platform is ready to take on additional capabilities when needed. The boosted processing power also allows pilots to have a centralized location for analyzing the massive amount of data collected by the platform, eliminating the need for extra displays distributed across the helicopter.

"This is something that's been done in the commercial space for quite some time, but here we're looking to apply that to the defense industry in a safe manner. It's really something I believe will be a gamechanger and which is needed by the Army," Conroy said. "Bringing all the information back to a central processor that has a multi-core processor capability really enables all the data to be centrally located and then for it to be combined in a way that is easily digestible by the pilots."

The Army's Future Vertical Lift modernization effort to revolutionize around a new fleet of advanced aircraft systems presents an exciting opportunity to leverage advanced digital avionics backed by a secure, modular open systems architecture. Northrop Grumman's work on the UH-60V works as a flying prototype of what the FVL platforms, the Future Attack Reconnaissance Aircraft and Future Long Range Assault Aircraft, could accomplish in terms of rapid capability integration and long-term technology growth.

"We believe that the architecture is fully scalable and can support the future FARA and FLRAA platforms," Conroy said.

A cornerstone of developing the FVL fleet will be reducing the size, weight and power require for these platforms, while increasing survivability with next-generation sensor and weapons technologies.

"That's really going to require them to have that open systems architecture that will allow various applications to be running on a central processor. It's also going to require more integration of data so the Army can really start advancing some of those survivability capabilities. We think the current open architecture they have really will enable that as well as positioning the Army to prepare for the rapid iteration of and how the threat vector continues to evolve," Conroy said.

With burgeoning interest from international partners in integrating digital avionics on their own platforms and the Army placing open architecture as a primary focus for their FVL fleet, Northrop Grumman is prepared to set the course for future aircraft survivability systems. From the UH-60V's evolutionary digital cockpit to the groundbreaking work on modular open systems architecture, the possibilities for extending lifecycles and building out advanced mission capabilities on the aircraft of today and tomorrow are boundless.

"The Army has a really good foundation that they can then take, and there's a very natural progression, toward Future Vertical Lift," Neel said.