# Joint Integration of Unmanned Aircraft Systems (UAS)

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**UAS are a vital aspect of our military's success in full-spectrum operations, to include intelligence, surveillance, and reconnaissance (ISR); security; target acquisition/attack missions; manned/unmanned teaming; communication relay; and command and control (C2). The jointness of UAS is twofold: the UAS themselves operate jointly as an integrated system and the services work jointly to use UAS effectively in combat operations. At the Army Aviation Association of America UAS Symposium Dec. 10–11, 2009, in Arlington, VA, Army aviation senior leaders collaborated with other services' senior leaders to discuss how UAS work jointly as an integrated system and their plans for UAS integration among the services.**

The role of UAS in today's military operations is significant. Here, 1LT Steven Rose launches an RQ-11 Raven UAS near a new highway bridge project along the Euphrates River north of Taqqadum, Iraq, Oct. 9, 2009. (U.S. Army photo by SPC Michael J. MacLeod.)


## Defining Army UAS Integration

The role of UAS in today's operations is significant. "The introduction of UAS has had significant implication on how wars are fought today and how they will be fought in the future," said COL Christopher B. Carlile, Director, Army UAS Center of Excellence (COE), Fort Rucker, AL. According to Carlile, more than 325 Army UAS are deployed today, and they have flown nearly 900,000 hours in support of combat operations. In 2009, the Army Aviation Center's UAS Training Battalion, Fort Huachuca, AZ, trained more than 2,100 UAS operators and maintainers (including those in the U.S. Marines Corps (USMC) and U.S. Navy)—an 800-percent increase since 2003. "We've learned that UAS are continuing to prove themselves in key operational roles for the Army—and for the other services—on a daily basis. We employ them and we rely on them to save Soldiers' lives on the ground," said Carlile.

UAS integration involves complex capable manned and unmanned systems that are operated by trained UAS and sensor operators and integrated across the Army and joint community. Integrating unmanned aircraft and ground systems to work together requires common control and architecture. Factors contributing to UAS integration include unmanned aircraft, mission packages, the human element, the control element, display, communication architecture, and life-cycle logistics. All these are centered around the Soldier and doctrine, organization, training, materiel, and leader development, personnel and facility (DOTML-PF).

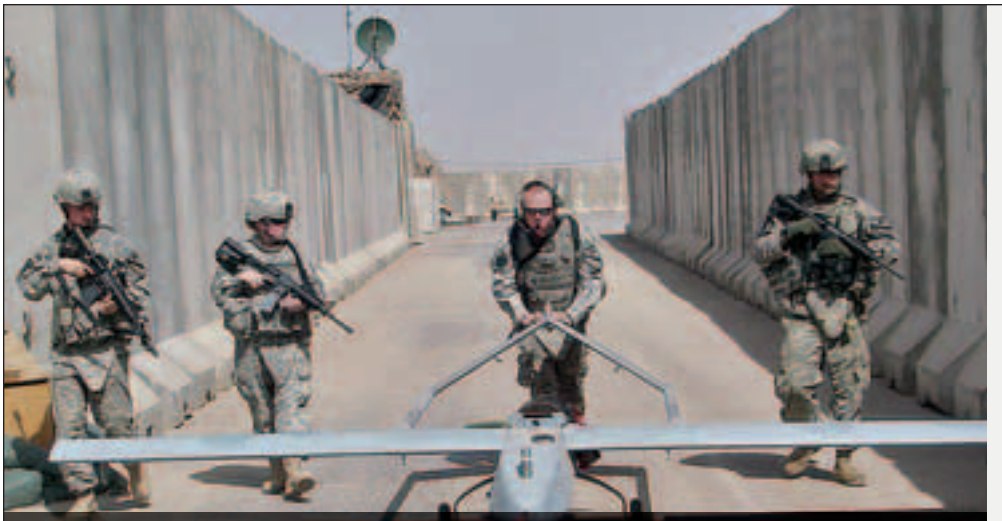
## System-of-Systems (SoS)

Army UAS function as an integrated system incorporating manned and unmanned assets. The Army UAS concept is an SoS driven by DOTML-PF, and UAS integration doctrine needs to be developed through the accompanying tactics, techniques, and procedures (TTPs). While UAS is a system approach, there are mission-specific platforms within UAS functions. These mission-specific platforms are acceptable as long as they work in an SoS environment and are interoperable within the UAS family.

Ellis W. Golson, Director, Capability Development and Integration Directorate, U.S. Army Aviation COE (USAACE), explained the importance of an SoS approach. "To have UAS, you must have the people, the aerial platform, the sensor, the network to carry the information, a device that is going to display it to whoever needs it, and the airspace," he said. "If all those aren't synchronized, it won't work. We can have the best platform or the best sensors in the world and we can't do anything with them because we don't have any way to transmit it or display it."

## Interoperability Profiles

Industry partner Lori Eckles, L3 Communications, Vice President Advanced Development Programs, advised that UAS development is accomplished through designation in one of three system categories: legacy, upgraded, and new. The development of an overarching interoperability profile is critical to ensuring the UAS platforms can work together. The profile "provides not just interoperability at the communication level, but also end-to-end sensory exploitation system," said Eckles. The SoS approach gives mission flexibility and common mission applications and allows the aircraft in the sky to disseminate real-time data to multiple users on the ground.



Soldiers assigned to the 4th Special Troops Battalion, 4th Brigade Combat Team (BCT), 1st Cavalry Division (Div.), UAS Platoon, move to a UAS launch and recovery site on Forward Operating Base (FOB) Hunter, Iraq. (U.S. Army photo by 1LT Joanne Cotton.)

Interoperability profiles for all Army UAS include:

- Universal Ground Control Station (UGCS).
- One System Remote Video Terminal (OSRVT).
- Tactical Common Data Link.
- Manned/Unmanned Teaming.

The interoperability future of UAS lies with the UGCS and OSRVT. Among other capabilities, the UGCS provides the commander with the ability to control and receive data from multiple unmanned aerial types and tactical flexibility; enables UGCS/OSRVT-linked systems; maximizes UAS operator/maintenance training and simulation; and provides payload products to the network for exploitation. Carlile advised that, "UGCS will control all types of UAS, as well as have the ability to operate eight UAS at the same time." This allows the ground commander to control the UAS using point-and-click technology through the OSVRT. The OSVRT increases the tactical commander's situational awareness of the operational environment by allowing Soldiers to mark and capture tactical information onscreen. It has multiple configurations for tactical flexibility and correlated sensor data and map with metadata.

Interoperability is also achieved through the Ground-Based Sense and Avoid System (GBSAA). A networked SoS, GBSAA is composed of system ground-based sensors, data links, procedures, logic, and interfaces. These work to detect an airborne intruder and declare a threat, if applicable, in time to allow the UAS to react and prevent air collision.

## Joint Service Interoperability

There is no doubt that making UAS joint across the services is an integral aspect of employing UAS successfully. "The joint is no longer conceptual; it's a reality, and arguably, a necessity," said COL Jeffrey N. Colt, Commander, Joint UAS COE, Creech Air Force Base (AFB), NV. He also posed the question, "As we look to joint interoperability, the bottom line is, what's the right metric and how much, and how do we measure its effects?" Across the full spectrum of operations, the services must be correlated. COL Robert J. Sova, U.S. Army Training and Doctrine Command Capability Manager for UAS, Fort Rucker, indicated the enablers that play a role in establishing joint service interoperability:

- Common operating picture (COP) forces.
- C2 for dynamic retasking within/between components.
- Local/global distribution of video/data with common links.
- Responsive sensor-to-shooter kill chain.
- Common terminology/TTPs.
- Common training for joint missions.
- Common processing, exploitation, and dissemination architecture.

Another key aspect of joint service interoperability is complex airspace management. "As much as we like to segment the airspace among the services, the reality is that it's one airspace, and we have to integrate within it and operate together," said COL Anthony W. Potts, Project Manager (PM) Aviation Systems. "We lock up so much airspace. The ability to manage it effectively is truly a combat multiplier." Part of this is adopting a conceptual SoS view where there is seamless integration between the civilian and tactical airspace.

The Joint UAS COE, headquartered at Creech AFB, represents the joint stakeholder and realizes many of the joint issues. The COE focuses on nonmaterial solutions and training and readiness. Focus areas include national airspace access, bent-down locations and airspace requirements, operator standards and joint mission qualification requirements, satisfying the see-and-avoid requirement, and solutions for working better with coalition partners. Colt advised that the development of

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appropriate joint training readiness and the integration of the COE into joint exercises and experimentation are future areas of concentration for the COE. Another initiative is the Airspace Integration Improvements Initiative being worked by PM Aviation Systems. This entails incremental improvements for collaboration and decision making among all airspace stakeholders, automated capabilities to digitally pass relevant changes to aviators in flight and UAS operators, and networking existing sensors to provide a robust COP during mission execution.

Army aviation leaders and organizations, to include the Army UAS COE in conjunction with USAACE; Maneuver COE; Military Intelligence COE; and U.S. Army Aviation and Missile Research, Development, and Engineering Center, have been working on the Army's UAS road map for the next 25 years. Nested with the Joint Communications and the Army Campaign Plan, the road map has three terms: near-term (2010–2015), mid-term (2016–2025), and far-term (2026–2035). COL Eric S. Mathewson, Director UAS Task Force, HQ U.S. Air Force (USAF), Arlington, advised that the USAF also has a road map and is working on implementing it.

The Army Aviation Center's UAS Training Battalion, Fort Huachuca, trained more than 2,100 UAS operators and maintainers in 2009. Here, SGT Richard Knuth, an unmanned aerial vehicle maintainer in Co A., Brigade Special Troops Battalion, 3rd Heavy BCT, 3rd Infantry Div. (3ID), does a pre-flight check on one of his vehicles at FOB Kalsu, Iraq, Jan. 25, 2010. (U.S. Army photo by SGT Ben Hutto, 3rd Heavy BCT, 3ID.)

SGT Donald Melvin (left), an unmanned aerial vehicle mechanic with 1st Cavalry Div. in Baghdad, Iraq, and SPC Stephen Cantrell prepare a UAS for a launch. (U.S. Army photo by SGT Travis Zielinski.)

## Future

The future of UAS looks promising, according to MG James O. Barclay III, Commanding General, USAACE, Fort Rucker, and Chief, U.S. Army Aviation Branch. "What we're reaping today is probably a miniscule amount of what I know technology can give us in the future," he said. Yet, he and other Army senior leaders cautioned against making mistakes now that will affect the UAS of tomorrow. "We need to be very careful to make sure we do it right, we get what is needed, and we get it in a manner that it can be used on the battlefield," said Barclay. The procurement of the right technology and capabilities is crucial. "We have to remain focused that we're not in the UAS business, [but rather,] focus on the procurement of capabilities," said BG William T. Crosby, Program Executive Officer Aviation. "Those capabilities are focused on the business of getting the right information to Soldiers and combatant commanders."

Mathewson advised that the military has brought unmanned systems to the forefront: "We're in a revolution in military affairs—not [of] unmanned systems, but the conscious application of automated technology and [being] able to project power without projecting vulnerability." BG Glenn M. Walters, USMC, Deputy Director for Resources and Acquisitions, Joint Staff, J8, advised that it's "mind-boggling the progress we've made in the past 2 years," and he doesn't see that trend changing. Every capability desired is being considered in unmanned form, to include airlift, resupply, ISR, strike, maintenance, etc., across all portfolios.

When asked what will happen to UAS after *Operations Enduring* and *Iraqi Freedom*, Golson admitted, "We don't know details. But we do know that we *will* have unmanned systems. The big question is: what is the right mix between manned and unmanned?" The Army and joint services are working that question today to prepare for a future where UAS continues to be a successful combat multiplier for our Soldiers.

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