BREAKING DEFENSE

SPOTLIGHT:

Multi-domain operations need the "right" solutions. Here are a few.



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Multi-domain operations need the "right" solutions. Here are a few.

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In attempting to answer its "Collatz Conjecture" problem, the Defense Department has identified five lines of effort related to creating true jointness and effective operations in a multi-domain environment.



AeroVironment's Crysalis is an integrated hardware and software-based ground control system that provides command and control of compatible AeroVironment unmanned aircraft systems and their payloads.

Because they're concepts of operation and not programs, multi-domain operations (MDO) and Joint All Domain Command and Control (JADC2) have been viewed as all things to all people and expected to solve all problems. Viewed that way, they're more akin to the Collatz Conjecture — a supposedly simple math problem that nobody can solve — than to a normal DoD procurement program.

For instance, JADC2 and MDO are expected to: connect all five warfighting domains and bring down silos; connect sensors to shooters in an improved OODA loop for precision fires; operate at machine speed with artificial intelligence; and permit command and control in disrupted and denied environments. In essence, they will be the panacea that will help the US and its allies keep their edge in a Great Power competition against China and Russia.

The enormity of the challenge is inherent in the questions that the US Army asked itself in its 2021 Chief of Staff Paper #1 entitled, Army Multi-Domain Transformation.

"In competition and crisis, how does the Joint Force maintain freedom of action, and impose its will against peer adversaries in all domains to deter conflict while re-establishing a position of strategic advantage? In conflict, how does the Joint Force fight operational campaigns across all domains to defeat state adversaries by winning first battles and avoiding global and strategic escalation?"

ON THE COVER: AeroVironment was recently awarded a $20.3 million contract from US Special Operations Command for the Switchblade 600 loitering munition.



Air Force 56th Helicopter Maintenance Unit refuels an HH-60G Pave Hawk assigned to the 56th Rescue Squadron in Romania, March 8, 2022. Assigned to the 31st Fighter Wing, Aviano Air Base, Italy, the unit provides search and rescue capability for the NATO alliance while also conducting joint training missions with the Romanian air force. (DoD photo)

In attempting to answer those questions and with a desire to focus both the military services and industry on what matters most, the Defense Department has identified five lines of effort related to creating true jointness and effective operations in a multi-domain environment.

The lines of effort focus on: (1) the data enterprise, specifically a "data fabric" for the services to share data in a cloud environment; (2) the human enterprise; (3) the technical enterprise; (4) integration of nuclear C2 and communications; and (5) modernization of mission-partner information sharing.

Focusing on the "right" solutions for MDO

With those five lines of effort laid down, the question now becomes: "what are the right solutions and technologies needed to achieve each one to enable multi-domain operations?"

To begin, most everyone would agree that MDO requires DoD leadership to have its eyes on the war of the future, not the war of the past. A glimpse of the evolving threat was witnessed in 2020 in the war between Armenia and Azerbaijan where lethal, armed drones sold to Azerbaijan by Turkey, Israel, and China quickly destroyed Armenia's armored tanks and vehicles in the early stages of the war. At the time this article was published, Ukraine's Turkish-made Bakar Bayraktar TB2 drones similarly had some tactical success against invading Russian forces.

Those two examples are insight into what some of the tactics that state-run, near-peer adversaries like China or Russia will employ in the future battle. The big difference will be, though, that the Great Power competitors will be able to operate in multiple domains — not just the air domain.

"The right solutions have to be, first and foremost, multi-domain because our adversaries have multi-domain capabilities," said Wahid Nawabi, chairman, president, and chief executive officer of AeroVironment (AV). "You cannot just defeat one domain, as was the case against Armenian ground forces.

"China and Russia have air, ground, space, cyber, and maritime capabilities that are just as sophisticated in some cases as the US has. That means we need multi-domain systems with much higher levels of autonomy and the ability to operate in both GPS-denied environments and in contested airspace."

Secondly, the right solutions also have to be intelligent, meaning that these systems have to work together as a team — both manned and unmanned, and unmanned-unmanned. Such multi-domain systems also need to work cohesively in communications- and GPS-denied environments. These are expected to be essential elements of success for the U.S. military and its allies.

An example of intelligent teaming is AeroVironment's aerial integration with General Dynamics Land Systems' Optionally Manned Fighting Vehicle (OMFV) for the U.S. Army's Future Command armored vehicle requirement.



Gen. (ret.) Scott Wallace, former commander, US Army Training and Doctrine Command.

Another example is AV's teaming with Kratos to equip its UTAP-22 Mako drone with AV's Switchblade loitering munition as part of the Air Force's Skyborg program. The US Air Force has a requirement to reach hundreds of kilometers into enemy territory and disable the adversary's air defense systems or ground forces using loitering munitions like Switchblade.



Wahid Nawabi, chairman, president, and chief executive officer of AeroVironment.

"The DoD is looking for interoperable systems that can talk to each other. They're looking for systems that operate in a contested battle space with segregated or no communications," said Nawabi. "They're looking for systems that can pass information between each other, such as a Puma UAS identifying a target and automatically passing that information without a human involved to a Switchblade to engage and eliminate the target. Multi-domain intelligence, interoperability, GPS-denied operation, and low cost are what the US military is looking for."

Command and control of multi-domain operations

The right solution is also one that focuses not only on the targeting aspect of JADC2 — the OODA (observe, orient, decide, act) loop, the kill chain, and sensors to precision fires — but also the command and control (C2) aspect.

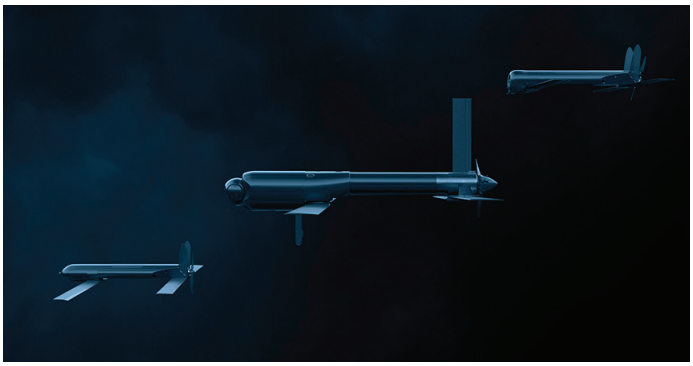
"In competition and conflict, joint operations will experience continuous disruption of command and control from the electromagnetic spectrum (EMS), space, and cyber domains," states the Army's MDO report.
"Lack of effective joint C2 will isolate distributed units and risk defeat in crisis and conflict."

In his 2020 paper entitled, Multi-Domain Operations in Context, published by the Association of the United States Army (AUSA) in 2020, William "Scott" Wallace, a retired four-star officer and former commander of US Army Training and Doctrine Command, identified why MDO and JADC2 are far from "pre-ordained" and must evolve from a sensor-to-shooter targeting philosophy to a command-and-control philosophy.

"Putting myself intellectually in the role of the commander, how does a commander influence execution of operations in a JADC2 environment where you have sensor data being moved all over the battlefield that you really can't influence because it happens a lot quicker than you can think?" Wallace asked. "And how does a commander exercise mission-command-type direction to his forces in an environment that is moving that quickly?

"The JADC2 acronym includes the words 'command and control', but the sensor-to-shooter targeting element is what we have been focusing on, as well as the command and control of sensors and shooters. The command and control of organizations and formations within a theater context in my judgment is lacking.

"It may be that I'm culturally biased because I'm a former soldier," he said. "But the mission-command aspect of Joint All-Domain Command and Control is something that I just haven't seen a lot of and I think is absent, perhaps, from some of our thinking. Maybe it will evolve once we have a solution to this ubiquitous network requirement, which I believe is part of JADC2, but there's very little discussion that I have seen about the mission-command aspects that are necessary, in my judgment, for theater-level operational and tactical command."`



AeroVironment's family of loitering munitions (image courtesy of AeroVironment).

The reason that C2 in an MDO environment is vital is because it is instrumental in enacting the DoD's Joint Warfighting Concept and one of its main precepts: gaining and maintaining decision dominance.

According to the Army's MDO plan: "the expanded battlefield, coupled with the requirement to conduct cross-domain strike in depth, necessitates a transformation of how command control is executed at every echelon—what the Army calls decision dominance. (This) is a desired state in which commanders sense, understand, decide, act, and assess faster and more effectively than their adversaries. Decision dominance is enabled by convergence, the ability to see, sense, communicate, shoot, and move at speed and scale, connecting all sensors with the best shooter and the right C2 node."

The role of unmanned systems in MDO

The future of warfare and the Defense Department's latest CONOPS will, in part, be written by unmanned systems operating at the tactical edge, either individually or as part of a swarm, with interoperability for both manned-unmanned and unmanned-unmanned teaming operations. It's a requirement for MDO and also what's known as "distributed operations" — dispersed and networked ships, vehicles, and ISR platforms operating independently and with access to the tools of decision dominance.



Two Air Force F-35 Lightning II aircraft assigned to the 48th Fighter Wing, Royal Air Force Lakenheath, England, arrive at Siauliai Air Base, Lithuania, Feb. 27, 2022, in support of NATO's collective defense. (DoD photo)

"Conflicts of the future will be with sophisticated adversaries and highly dependent on unmanned systems," said Nawabi. "Future conflicts are going to be heavily unmanned. Unlike prior conflicts where humans were on the front lines, future conflicts with near-peer adversaries will rely on massive amounts of unmanned assets for battlefield engagement. Those systems have to be multi-domain, interoperable, and intelligent."

That's especially true for warfare in an anti-access and area denial (A2/AD) environment. During the Afghanistan and Iraq wars, the US operated unmanned systems with full impunity. That won't be the case against China and Russia and other adversaries like North Korea and Iran with advanced A2/AD capabilities.

"First, if you assume that you've got an A2/AD problem, and if you don't want to throw manned systems at the problem, then unmanned systems make an eminent amount of sense," said Wallace.

"The other thing relative to unmanned systems is the use of lethal and non-lethal means in order to attack an enemy's capabilities and gain some advantage. It's important to understand that lethality is simply the destructive power of the munition. It's the terminal result of a chain of events. It's a process that includes gathering information, positioning of the lethal means, and making decisions about their use. To the extent that you can put that entire process into an unmanned system is something that gives you incredible advantage."

Take, for example, a loitering munition. In the hands of a trained operator, the loitering munition can gather information and be positioned at the proper place on the battlefield. The operator can make decisions about whether it's the appropriate target or not, and then make decisions about attacking or not attacking that particular target.

That can be done all in one package rather than needing an organization that does information gathering, an organization that maneuvers, and an organization that does the actual lethal or non-lethal strike, according to Wallace. It collapses the OODA loop into one very small package, which makes it much more flexible and capable and reduces dependence upon higher-level communications to execute the mission.

The same is true for unmanned ground systems, he added, which could be used at scale to begin to eliminate an enemy's A2/AD capabilities and to allow maneuver forces and air forces to jointly attack the enemy's formations and begin to reduce their capability to execute and therefore gain an upper hand.

Said Wallace, "I can imagine sometime in the not too distant future, a munition that is circling overhead that has embedded in it some kind of artificial intelligence associated with target recognition. That munition is not programmed to go after tanks and trucks, but can discriminate against an air defense system or, for that matter, a command post."