

US Army Brings EMSO to the Air Defense Fight

Electromagnetic Spectrum Operations (EMSO) have a growing role within the US Army's Air and Missile Defense (AMD) mission. On the one hand, the use of EMSO capabilities is clearly well underway on the countermeasures side. In addition to the deployment of highly-powerful and sensitive GaN-based arrays in air defense radars and active jamming systems, the Army is very active in the development of new Directed Energy (DE) weapons, such as High-Energy Lasers (HEL) and High-Power Microwave (HPM) for use in the AMD countermeasures role.

On the other hand, the integration and use of passive RF sensor technologies, such as passive radar and Electronic Support Measures (ESM) systems that serve as an adjunct to active radar sensors, leads to a much more complex paradigm. Any attempt at answering this question immediately involves examining not just the Army's overall initiatives for modernizing its forces for the future fight against peer and near-peer adversaries, but also that of the other services, the overall DOD future warfighting strategy and priorities and the considerations of US Allies and partners. These factors all have a direct impact on the shape and expectations of its AMD capabilities.

Starting at the DOD-level, the overall driver is to provide an all-inclusive, military-wide, integrated, distributed and fully-coordinated sensor-to-sensor and sensor-to-shooter capability that can incorporate all possible sources of threat data and countermeasure options. This brings us to the Combined Joint All-Domain Command & Control (CJADC₂) initiative – the artificial intelligence (AI) and machine learning (ML)-enabled battlefield management framework to integrate and connect Allies and the Joint Force into all-domain (sea, air, land, cyber and space) operations to produce overmatch.

The Joint Staff is leading efforts to move CJADC₂ from concept to policies, doctrine and requirements, and has designated the Air Force as the executive agent for technology development. The Air Force has proposed its Advanced Battle Management System (ABMS) as the architecture to provide the foundation of the CJADC₂. The Navy has also announced that it plans to integrate its “Project Overmatch” into the overall CJADC₂ concept. Project Overmatch is intended to “develop a new fleet architecture using artificial intelligence and manned/unmanned teaming to enable Distributed Maritime Operations.”

The Army also plans to contribute to the CJADC₂ initiative through its “Project Convergence” exercises aimed at advancing and integrating the Army’s contributions to the Joint Force through an AI-/ML-enabled battlefield management system. “It ensures that the Army, as part of the Joint fight, can rapidly and continuously integrate or ‘converge’ effects across all domains to overmatch our adversaries in competition and conflict.” Through Army Futures Command (AFC), the Service has conducted a series of experiments demonstrating the ability to provide access to Joint and coalition networks.

ARMY AMD

Stepping down a level to address the Army’s specific AMD mission, one of its top six modernization priorities, the discussion begins with the Service’s “Air and Missile Defense 2028” document. Released in 2019, and developed by the US Army Space and Missile Defense Command (USASMDC), Army Forces Strategic Command and informed by the 2018 National Defense Strategy and 2019 National Military Strategy, it provides the Army’s overarching vision for the AMD force.

As in all military mission challenges, the strategy/solution begins with the threat, and there is a growing and advancing challenge for air defense capabilities from such threats as

UAVs and drone swarms, sophisticated jamming, stealth technology, hypersonic weapon systems, etc. As described in the AMD 2028 document, “the future operating environment is characterized by increasingly complex threats, sustained operational tempo, limited resources, and the ability of adversaries to contest US forces in all domains.” AMD 2028 identifies four specific lines of effort (LOEs): Develop Air and Missile Defense Capabilities; Build AMD Capacity for Multi-Domain Operations; Provide Trained and Ready AMD Forces; and Maintain Forward Presence and Build Allied and Partner Capacity.

As described by BG Brian Gibson, Director of the Air and Missile Defense Cross Functional Team (CFT) at Army Futures Command (Ft. Sill, OK), “The AMD 2028 strategy is our guiding document to provide us the way forward for AMD. The guidance presents three key and essential tasks that we can’t forget as we develop our capabilities and work through these Lines of Effort (LOEs). The first one is to protect the maneuver force, the second is to protect fixed and semi-fixed assets that enable dominant maneuver, and the third is to confer our capabilities to provide Joint windows of opportunity. These three essential tasks, proceeding along different timelines, fundamentally guide us to the AMD force outcomes that we’re seeking to achieve.”

Gibson emphasizes that one of the document’s LOEs deals specifically with Allies and partners – “by with, and through them, that remains as well a work in progress for not only the robust capabilities that we share with them today as we operate side-by-side, but those that we’re developing for the future. Says Gibson, “Within our CFT, we’re not just focused on modernization of our own Army’s AMD force, but on making sure that what we do is important for our Joint Integrated Air and Missile Defense (IAMD) force, as well as our international partners and Allies. This is a team sport; we can’t protect everything, and we can’t do it alone. Many times it’s our

partners and Allies that allow the Joint force to be successful.”

In fact, Gibson says, “A keystone of the Army modernization strategy, and how we’ve organized across the Army with CFTs and priorities of programs, especially in AMD space, is working together with a whole bunch of other folks to achieve our desired outcomes. It’s important to note that this effort is being conducted by a ‘team of teams.’” In addition to the AMD CFT, these team members include the Program Executive Officer for Missiles and Space (PEO-MS) at Redstone Arsenal, and the Army Rapid Capabilities and Critical Technologies Office (RCCTO).

Says Gibson, “Within the AMD force, we’re arguably seeking to achieve the greatest amount of modernization since the Cold War. I know that seems to roll off the tongue fairly easily, but it’s also very true. As we pursue this modernization path, it’s all about the central idea of attempting to increase our capabilities in speed, range, and convergence. But, the level of activity that we’re pursuing inside of the Army, and the Branch specifically, is not just about new capabilities. Yes, those are important and are a big piece of it, but it’s also about new formations who will be outfitted with those new capabilities. We need to continuously remember that it’s always about the people, always has been, and always will be. As we seek to deliver all these things, our focus is always at the soldier level, and as we go about our rapid developments, to make sure that the soldiers’ input is absolutely understood, paramount, and welcome.”

LTG Neil Thurgood, Director of Hypersonics, Directed Energy, Space and Rapid Acquisition at the Army Rapid Capabilities and Critical Technologies Office (RCCTO), adds that, “At the end of the day, the three Army organizations being covered in this [JED] article exist to get equipment to soldiers to fight on the battlefield, to put them in a place to be successful, and through the control of the common interfaces under PEO-MS, and

with the requirements and the vision that we have under General Gibson and the AMD community, the technology can be feathered into the system at a much faster pace, and leverage a much broader industrial base than just the traditional primes. There is a great opportunity here and a great focus that the Army has put on its modernization programs.”



Above, soldiers from the 3-6 Air and Missile Defense Test Detachment (3-6 AMDTD) participate in IBCS air defense intercept tests at White Sands Missile Range, New Mexico, in late 2019. US Army image

IAMD/IBCS

Heading up PEO-MS, MG Robert Rasch Jr., says his organization “is moving quickly in a lot of areas to try to make up for, quite frankly, an area that, given the recent fights we’ve

been in, we may not have invested in as much as we would have liked to.”

Says Rasch, “The key piece of this, within PEO-MS, is the Integrated Air and Missile Defense Battle Command System (IBCS).” IBCS is the command-and-control software that, along with the Integrated Fire Control Network, enables the integration of sensors and weapons to perform the AMD functions required to prosecute current and emerging threats. IBCS provides the ability to use any connected sensor to support the use of the best shooter.

Says Rasch, “IBCS is not a new activity – having been ongoing for about a decade now – but given where we are now with the program, having completed a limited user test last year, the Milestone C decision this last January, and heading into Initial Operational Test and Evaluation (IOT&E) just within the month, we’re in a really good place to make it a reality.”

As Rasch describes, IBCS opens up Army AMD architecturally, allowing for rapid integration of new technologies as they become available. “We’ve been working diligently with both existing program managers and industry partners, as well as looking forward with the other Services, industry and the Science and Technology (S&T) community on things that could possibly come down the pipe. And what we’ve found through this learning opportunity is that by decoupling and allocating what would traditionally be a very tight kill-chain in an AMD architecture, that given the state-of-the-art of today’s technology and having standards for interfaces for sensors and shooters, that we can do much more toward creating a more robust, layered air defense capability, which is what the users always ask for.”



Drones are a growing concern for ground forces. Above, an adversary UAS flies near a Sentinel Radar during a CJADC2 demonstration at Sembach Kaserne, Germany, in February. US Air Forces in Europe conducted the CJADC2 demonstration to highlight the force's ability to integrate network solutions and connect multiple sensors to a common operating network. US Air Force photo

As the Army moves forward with IBCS, RCCTO's Thurgood notes that, "by opening the aperture for things to be integrated into the system, we really do two things for both our industry and our soldiers. Sometimes we think these are divergent paths, but they're actually parallel paths that bring us to the desired outcome for speed, range and convergence on the battlefield. The first part of this is that an integrated battle command system allows a common interface and an open architecture which absolutely opens competition in industry. No longer is it a single integrated prime contractor that we have to stick with for 10-20 years. Instead, we now have the ability to bring in technology as it is available through the control of the interfaces and entry into the IBCS architecture. The second part is that it actually opens the door for technology to be applied quicker and get into the hands of soldiers quicker."

Rasch says the focus for ICBS has always been on getting the

architecture right not just for the Army but for Joint capabilities, “because AMD is, and always has been, a Joint endeavor. Now, with CJADC₂ providing the top-level standards for information flow, our job on the Army side is to make sure we can tie into that set of information as needed using the right standards and the right communication methods, whether satellite, fiber, RF communications, etc. to make sure that we can provide what we need to provide and consume what we need to consume.”

RCCTO's Thurgood reiterates the point. “There are communications that happen at the squad level that have to be linked to the platoon level, to the company command level, to the battalion and brigade level echelons, etc. That linkage happens between the Services and between our Allies and partner nations in that same sort of hierarchical relationship. So CJADC₂, at the top level, is going to feed IBCS, and in some cases IBCS will feed into the CJADC₂ environment. The command and control structures have to be worked as independent Services, as well as the Joint environment. Those linkages and interfaces have to have both a vertical and horizontal component, which is why this integration is part of the challenge. IBCS is a powerful capability and as CJADC₂ matures, we will continue to be consumers and users simultaneously.”

The CFT's Gibson describes IBIS as “a kind of pathfinder representation of what CJADC₂ is envisioning to accomplish DOD-wide. It's the idea of ‘any sensor/best shooter together with the right C2.’ ICBS is an instantiation of that in and of itself that seeks to break apart the limitations imposed by the tight coupling of our sensor and weapon system capabilities. Our number one priority is Integrated Air and Missile Defense (IAMD). It's the key to today, and also to our future – unlocking stove-pipe weapons systems of the past, where we couldn't connect an array of sensors, shooters, and

the right C₂. It has been, and will remain, our number one priority and we're in a good spot with that."

As pointed out by Gibson, however, "CJADC₂ is not just about AMD, it's about communications architectures, networks and data. It's also about things that matter inside Service lines, as Generals Rasch and Thurgood just talked about, and the need to make sure we're connected. So, we're very well nested at the Departmental level with the work that CJADC₂ is seeking to achieve and ICBS is a subset of that work."



The Army Rapid Capabilities and Critical Technologies Office (RCCTO) has been developing a laser-equipped Directed Energy Maneuver Short-Range Air Defense (DE M-SHORAD) system, and it held a "shoot off" in August. The RCCTO plans to deliver a platoon of four systems in FY2022. □US Army image

EMSO ROLE

In getting to the nitty gritty of the topic of this article, it certainly seems likely that EMSO technology, and specifically passive sensor systems, can potentially contribute significant additional capabilities to the AMD mission, but how much, what types, and where and when this can be brought about is difficult to pin down. In order to get an appreciation of the Army's thinking, and the extent of its efforts on this possibility, there appears to be a need to "read between the lines." One thing is definitely clear, however, such capabilities will definitely not be integrated directly into individual active surveillance and targeting systems. It will be done through the Army's IBCS and DOD's CJAD₂ overall C₂ network architectures.

In a broad-brush perspective on the subject, the CFT's Gibson, says "With regard to the incorporation and integration of passive EMSO sensor technologies and systems within our AMD capabilities, there are some things that we're not able to discuss because of classification and security concerns, but absolutely we're looking to have as broad of a dialogue as we can and whatever advantages that we can provide to our warfighters, we should seek to achieve. The more arrows that we put in our quiver, the better we are at providing the necessary protection for the Joint force. Fundamentally, the idea of pursuing advanced technologies or other things that allow us to achieve that, we absolutely should seek to understand them, develop them, and if capable and mature enough, to field those capabilities based on the time and space at that particular time. We, and others besides AMD, are seeking to change the calculus and seeking to achieve an unfair fight (overmatch). And, we're seeking it in multiple ways and across multiple lines of effort."

Adds Rasch, "Not only is there not any single weapon system that solves all of our AMD problems, there is not a single

sensor either. It's really about thickening the sensor network with a variety of radars and other sensor types, and as you look at the different capabilities that each brings to that mix, this creates a dilemma in itself for an enemy. This is particularly true in the EMSO world in presenting these dilemmas to the enemy and how they will attempt to create offensive and sometimes defensive capabilities to counter them. We focus a lot of attention on that, on the capabilities of the systems both existing, new, and under development to look for the best mix of sensors that then support the shooters. The key is to have an architecture where we don't have to have them all at one place, but have the flexibility to provide our soldiers based upon the situation on the battlefield to have the right set of information flowing in from that set of sensors, whether organic Army, Joint, or in the future from CJADC₂ to then cue one or a variety of shooters at the right point in time based upon the threat. That's ultimately what we're trying to achieve across this portfolio of capabilities."