



An Army Space Training Division (ASTD) training specialist sets up training aids overlooking a helicopter landing zone planned for 2nd Infantry Brigade Combat Team, 25th Infantry Division. ASTD initiated integration of contested space environment effects into the exportable combat training center rotation circa 2021 on Oahu, Hawaii, with the Joint Pacific Multinational Readiness Center. (Photo courtesy of the U.S. Army Space and Missile Defense School)

Operational Space Training across the Total Army

Justin B. Miranda

Think about your most recent deployment supporting a real-world operation or a rotation at one of the Army's maneuver combat training centers (MCTC). You were able to communicate with your adjacent and subordinate organizations beyond line-of-sight and had unfettered access to the Global Positioning System (GPS), the joint operations center, and/or tactical operations center (TOC). You received and viewed live video feeds from unmanned aircraft systems, and your unit maximized the use of intelligence-gathering capabilities and monitored real-time maneuver of friendly forces. During combat operations, the commander, key leaders, and staff had real-time battlespace awareness; monitored and tracked individual warfighters and vehicles; and synchronized and coordinated operations with foreign military partners. Units supported movement and maneuver with accurate and effective fire support, and logistical resupply requests were sent to higher headquarters located at a forward operating base for resupply to your distant outpost, camp, or battle position at the forward line of troops.

Now imagine your satellite communications (SATCOM) degrades and your subordinate units do not receive your orders or mission graphics for upcoming operations. The battle captain attempts to call other joint operations centers and TOCs via a Secure Voice over Internet Protocol phone but cannot connect, and the battle noncommissioned officer transitions to a vehicle-mounted Joint Battlefield Command-Platform but still cannot send or receive messages. The commander starts to lose visibility of friendly unit icons as they transition into a "stale" status, and the radiotelephone operator no longer has contact with adjacent units, headquarters, or foreign military partners. The forward observers GPS receiver is providing inaccurate positioning and navigation data and the fires support officer cannot execute fire missions due to the low quality of the information they are receiving from the forward observers. The S-4 (brigade logistics staff officer) reports that the logistical resupply convoy is diverted from the main supply route to the alternate supply route and is in contact with enemy forces. The brigade staff references standard operating procedures (SOP) and battle drills; however, staff primaries failed to codify or plan for this type of contingency. The brigade TOC resorts to frequency modulation radio communication to rebuild the common operating

picture but is met with static and denied line-of-sight communications.

Does this sound like a future battlefield with unrealistic complications and problem sets? The reality is these effects, and their potential impacts are part of today's modern battlefield. You can expect adversaries to present this operational environment to challenge our formations and operations across the five domains. The joint force can no longer only consider the domain they fight in because modern warfare is a confluence of all domains. Plans and subsequent operations must maximize capabilities, effects, and impacts to establish a harmonious relationship among all domains. The joint force must clearly understand how its functions interconnect and how the space domain enables, and is critical to, multidomain operations (MDO).

MDO is "the combined arms employment of joint and Army capabilities to create and exploit relative advantages that achieve objectives, defeat enemy forces, and consolidate gains on behalf of joint force commanders."¹ MDO combines land, maritime, and air and embraces cyberspace and space while integrating electromagnetic warfare and the electromagnetic spectrum (EMS). For decades, the Army efficiently used the EMS to employ cyberspace and space capabilities to help troops move farther, faster, and with heightened precision, even when operating beyond line of sight. The Army's reliance on these capabilities

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provides our adversaries with ample opportunity to exploit linkages and segments within the Army's overall architecture. Adversaries have the capability to contest equipment, systems, and operations on a level not seen over the last twenty plus years of counterinsurgency (COIN) operations.

What is the critical significance of the space domain to the Army, and how does space impact warfighters on the ground? The average Army formation has thousands of space-enabled and space-dependent systems and equipment to enable each warfighting function. As highlighted in the "not-so-hypothetical" scenario previously described, "Adversaries will attempt to disrupt or deny U.S. Forces' use of space-enabled capabilities, including [GPS] receivers; satellite communication radios and communications suites; fires systems; and intelligence, surveillance, and reconnaissance systems. Commanders must implement denied, degraded, and disrupted space operational environment (D3SOE) as the expected operating environment."² The Army must also consider the hundreds of thousands of warfighters that depend on space for logistical resupply, accurate and timely indirect fires, medical evacuation, and precise locations of U.S. and foreign military partners. It not only affects combat forces on a more extensive scale, but it also affects the millions of people worldwide who rely on the space domain to enable critical commercial, civil, and economic infrastructure, from transportation and energy to commerce and financial transactions. As a military, there is an inherent responsibility to preserve, safeguard, and mitigate risk to the space domain, space-based assets, and space-enabled capabilities. The 2022 *National Security Strategy* addresses the need for maintaining space domain accessibility for all to provide tangible benefits and for the security and prosperity of people around the world.³ The lack of access to the space domain and its enabling and enhancing capabilities results in greater risk to operations and an advantage to the force denying access.

How does the Army train for a D3SOE? "The D3SOE is the composite of the conditions, circumstances, and influences which affect the employment of space effects and capabilities ... examples include signal jamming, signal spoofing, physically or virtually disabling or destroying space assets such as ground control stations and satellites and disabling or deceiving user

equipment."⁴ What do these adversarial capabilities mean for the Army? The Army has modernized into a force of space reliance, enabled to execute and synchronize complex operations plans, missions, and functions around the globe. Peer and near-peer adversaries have observed and developed counterspace capabilities to negate technological advantages and create opportunities when fighting in a large-scale combat operation (LSCO) environment. When preparing for the "fight tonight," Army leaders, staffs, and soldiers need to understand, train for, and adapt to D3SOE conditions to maintain operational tempo, lethality, and superiority to shape and contribute to the success of MDO.

How is the Army tackling this space domain problem set? On 1 March 2023, Lt. Gen. Daniel Karbler, U.S. Army Space and Missile Defense Command (SMDC) commanding general, signed the 2023 *Army Space Training Strategy (ASTS)*. For context, the first ASTS was signed in November 2013, initiating space training across the Total Army. Several distinguishing factors and updates exist after a decade of training and preparing the force. After a decade of this training and awareness campaign, SMDC and the U.S. Army Space Training Division (ASTD) are working on enhancing and standardizing space training operations and optimizing space utilization in the Total Army's training and preparedness.

Over the past ten years, the Army was primarily concerned with its adversaries' ability to deny, degrade, and disrupt its space-enabled capabilities.⁵ Today, the Army is planning for a future organic capability to plan for, integrate, and employ space capabilities and effects, enabling convergence in support of MDO during LSCO.⁶ How can space-based capabilities help mitigate the uncertainty brought on by the fog of war and create opportunities/advantages to enable and enhance the Army's ability to seize the initiative over the adversary? The Army must shift its mindset and focus from COIN to MDO. The Army must continue training and conditioning its formations and warfighters to maintain lethality, speed, and precision even when facing an adversary who can deny access to space-enabled and space-based capabilities.

A second significant adjustment in the 2023 ASTS is Karbler's outreach for endorsement and advocacy with the deputy chief of staff for Headquarters, Department of the Army G-3/5/7; the U.S. Army



An Army Space Training Division training specialist instructs an infantry platoon from 1st Stryker Brigade Combat Team, 4th Infantry Division, on recognizing, reacting, and reporting electromagnetic interference during their rotation at the National Training Center, Fort Irwin, California. (Photo courtesy of the U.S. Army Space and Missile Defense School)

Forces Command deputy commanding general; and the U.S. Army Training and Doctrine Command (TRADOC) deputy commanding general. Leaders must understand how space enables their formations and the space capabilities and effects available to them at echelon. This collaborative effort represents a unified front when prioritizing the space domain in Army training, capability development, readiness, and modernization.

The ASTD is working to prepare the Army for a D3SOE and educate it on our space capabilities and effects, which is a critical component of MDO. ASTD consists of four branches, a Combined Arms Center (CAC)/Army University liaison officer, and an operations and effects team that comprehensively trains, educates, and prepares leaders, staff, and warfighters across the Army's training and education enterprise. To date, ASTD has trained more than fifty thousand warfighters across the Army's ten centers of excellence, more than twenty-five thousand warfighters at the U.S. Army Command and General Staff College

(CGSC), and more than fifteen thousand warfighters across more than 150 corps/divisions/brigades. ASTD also continues integrating Army space equities across Army and joint doctrine; influencing training aids, devices, simulators, and simulations development; and informing Army strategy and capability development and acquisition.

Operations and Effects Team

In fiscal year 2023, the ASTD formed an operations and effects team to manage, research, and standardize current and emerging effects to expose and increase the force's ability to recognize, react, mitigate, report, and operate in and through a D3SOE. The team synchronizes ASTD training, administrative, and operational efforts to include informing the Army Lessons Learned Program. The team ensures ASTD trainers and instructors are armed with the appropriate resources and track coordination for training missions at home station, the MCTCs, and the Mission Command Training Program (MCTP). The team's major effort is



An Army Space Training Division training specialist oversees a soldier from the 11th Armored Cavalry Regiment (Opposing Force) as the soldier sets up a training aid during a rotation at the National Training Center, Fort Irwin, California, to help train the rotational unit on conducting operations under contested space domain conditions. (Photo courtesy of the U.S. Army Space and Missile Defense School)

coordinating and requesting live GPS and SATCOM denial effects to expose and train warfighters in the operational environment they will experience during LSCO. As of June 2023, ASTD requested, coordinated, and facilitated over fifty effects-driven events across the ultra-high frequency band to prepare Army units for a D3SOE. Finally, the team is responsible for ensuring training aids, devices, simulators, and simulations are fully mission capable and available, and whether future training aids are necessary to increase the level of training they are providing for the Army.

Foundational Space Education Branch

The Foundational Space Education Branch (FSEB) integrates a space-focused curriculum across the ten Army centers of excellence's professional, functional, and specialty training and education courses. Specifically, the FSEB provides subject-matter experts (SME) to educate and train soldiers to operate in and through a D3SOE, driven by the TRADOC

Common Core Task #39—Conducting Operations in a Degraded Space Environment. This is the first touchpoint of many where soldiers will learn about a D3SOE. The team recently took on responsibility for integrating a space-focused MDO curriculum into the Battalion/Brigade Pre-Command Course. The FSEB is expanding its educational opportunities by improving its online and virtual repository and integrating distance learning options.

SMDC Liaison Officer to CAC/Army University

SMDC's liaison officer to CAC/Army University focuses on integrating space into CGSC courses, which includes providing a space elective in which CGSC students can earn the additional skill identifier of 3Y (Space Enabler). They also support numerous joint courses with space education such as the Joint Targeting Staff Course and the Joint Operational Fires and Effects Course. The liaison officer, a key duty position, directly influences

field-grade officers on the space domain, its capabilities, and its effects across the other domains and warfighting functions.

Home Station Training Branch

When soldiers arrive to their duty stations, they can expect to receive more in-depth training on operating in a D3SOE. The Home Station Training (HST) Branch provides operational space training across the Total Army focused on D3SOE for brigade combat teams and space capabilities and effects in support of MDO for division and corps. Training packages are flexible and tailored to unit requirements and resource constraints to maximize training opportunities. HST trainers provide tactical-level training on space fundamentals; SATCOM; the EMS; positioning, navigation, and timing (PNT); space-based intelligence, surveillance, and reconnaissance; and planning considerations and electromagnetic interference mitigation. They also provide classified briefings regarding adversaries' capabilities and training specific to a military occupational specialty; for example, signal and intelligence. Additionally, HST trainers are prepared to facilitate a live GPS denial range, giving units the ability to experience it in a controlled learning environment, observing the effects on their equipment, systems, and architecture to inform their SOPs and battle drills. Finally, and most importantly, HST personnel are experts at integrating live D3SOE effects into a field training exercise, preferably after classroom and range training and before their MCTC rotation and/or operational deployment. The ASTD facilitates live effects and provides coaching and training to assist and enable Army units to adapt, sustain, and prepare for operations in a D3SOE. In the future, the HST will play a pivotal role in expanding informational training efforts to educate and train warfighters on how to capitalize on and converge space-based effects and mission areas, creating an advantage over the adversary and seizing the initiative in MDO and LSCO.

Maneuver Combat Training Center Branch

The MCTC Branch is responsible for supporting the space operations officer at the MCTCs with the planning and execution of live space effects. They send trainers and SMEs to most MCTC rotations in

CONUS and OCONUS to support D3SOE scenarios, replicate opposing-force threats, reinforce HST learning experiences, and coach the unit through D3SOE conditions. Currently, MCTC trainers provide support at the National Training Center at Fort Irwin, California; the Joint Readiness Training Center at Fort Johnson, Louisiana; the Joint Multinational Readiness Center at Hohenfels, Germany; and the Joint Pacific Multinational Readiness Center in Hawaii and Alaska. Support is also provided to the Army National Guard's Exportable Combat Training Capabilities upon request. In recent years, MCTC initiated support to Exercise Sage Eagle for special operations forces to validate subordinate units through premission training requirements. The MCTC is integrated into scenario development efforts to ensure rotational training units are exposed to a D3SOE provided by training aids and devices that contest space-enabled equipment and systems. During rotations, MCTC trainers serve as SMEs to observe, coach, and train leaders, the staff, and warfighters to plan for, recognize, react, and report in a D3SOE. They also provide knowledge and expertise for Army units to understand, plan for, and capitalize on space-based capabilities and effects.

Mission Command Training Program

The MCTP provides training support to corps, division, and Army Service component command commanders and staff. This training includes support to operations plans and operations order development, mission command training, and SME support during Warfighter exercises (WFX). The team provides tailorable training during MCTP preexercise academic sessions as requested by the operations groups. They are prepared to cover critical topics and concepts such as space in MDO, D3SOE, red and blue space capabilities and effects, and space-focused lessons learned and trends. Army space operations officers (Functional Area [FA] 40A) are assigned to the MCTP at Fort Leavenworth, Kansas, to promote, strategize, and advance the integration of the space domain into Army WFX. In coordination and collaboration with the MCTP FA40s, the MCTP provides three types of support to WFX: the SME team—responsible for observing, coaching, and training the staff to integrate space across all warfighting functions; the exercise control group—responsible for all white cell space domain

functions; and the world class space opposing forces space SME—responsible for presenting adversary space capabilities and effects to the training audience. The FA40As are focused on the proficiency and integration of corps and division space support elements.

How does an Army corps and/or division encounter and adapt to a contested space domain and D3SOE? Currently, the MCTP's exercise control group manually produces products, reports, events, and/or anomalies for the staff to plan, react to, and sustain operations. The MCTP effectively raises awareness and understanding of space's crucial role in military operations. Their expert trainers share their knowledge and actively contribute to the FSEB's efforts to comprehensively prepare senior Army leaders and staff for present and future warfare challenges. As a result, the battlefield is optimally prepared for all warfighters to plan and execute their missions with strict adherence to the fundamental nine principles of war: objective, offensive, mass, economy of force, maneuver, unity of command, security, surprise, and simplicity.⁷ The Army's Next Generation Constructive Synthetic Training Environment is scheduled to replace the Warfighter simulation and is expected to automate space effects in the WFX simulation. The Next Generation Constructive Synthetic Training Environment initial capability document is currently under development, and the ASTD is involved to provide an operational perspective on what those effects should manifest as in the simulation. This will provide a more realistic operational environment that integrates the space domain, space-based capabilities, and adversary counterspace capabilities and impacts to Army space operations, MDO, and LSCO.

To recap, the ASTD comprehensively integrates across Army institutions, functions, and collective training to educate/train and prepare warfighters across the Total Army to capitalize on the space domain. Conversely, there has and continues to be a major line of effort to prepare forces to continue planning and operations when our adversaries negate or deny the plethora of space-enabled capabilities. The ASTD is comprised of professionals and experts to field an operations and effects team, FSEB, CAC liaison officer billet, HST, MCTC, and MCTP.

The ASTD supports training in varying capacities and venues to prepare warfighters at several echelons.

But they are not the only space resource available. There are numerous professionals within each formation to answer questions, assist in integrating D3SOE into plans and operations, or coach and teach how the space domain can enhance operations overall. The Army has over six hundred space operations officers across Active and Reserve Components, with field artillery brigades and Special Forces groups as the lowest echelons for FA40A duty assignments. They are the gateway to understanding and employing the ultimate high ground and supporting MDO. All FA40s serve in one of the Army's primary branches until they are promoted to the rank of captain or greater and are then selected to transfer to the functional area. Their expertise and operational experience can be leveraged to inform planning and operations.

Without ASTD help, units can tackle operational and tactical challenges by focusing on three essential practices: building proficiency, conducting rehearsals, and enforcing discipline. These methods are cost-effective and only require time for the Total Army to prepare and plan for potential scenarios where we may lose access to all systems, functions, and capabilities that have been readily available to us in the last twenty plus years of COIN.

Proficiency

Proficiency requires expertise in two key areas. The first is a thorough knowledge of the equipment and systems used by various Army organizations in different formations and configurations, such as brigade combat teams, functional brigades, and special operations forces. Understanding how the equipment should function under normal and abnormal conditions is crucial, enabling us to identify operator errors, maintenance issues, or electromagnetic interference. Not distinguishing between these factors may lead to missed opportunities for targeting and delays in implementing measures for force protection. Electromagnetic attacks are a potential threat to operational tempo, command and control, and friendly forces that must be treated seriously on the battlefield.

Second, proficiency requires understanding the role and importance of space in Army operations. The Army must educate the force on the vulnerabilities of space-enabled equipment as they can be easily exploited. Prioritizing potential electromagnetic interference



An Army Space Training Division training specialist monitors a training aid and observes air assault and rotary wing operations during an undated special operations training exercise. Aviators and special operations forces recognize the critical significance of training under electromagnetic interference conditions as they increase their demand for this type of training environment and conditions. (Photo courtesy of the U.S. Army Space and Missile Defense School)

(EMI) as a threat versus a maintenance issue is paramount to success in large-scale operations. Ensuring battle drills, SOPs and tactics, techniques, and procedures are in place, practiced, and understood down to the lowest level will maximize the Army's use of space to enable and enhance plans and operations.

Rehearsals

"Winging it" and "figuring it out on the fly" does not work in the Army's favor. Live GPS and SATCOM denial and/or EMI are not required to exercise legitimate communications or PNT primary, alternate, contingency, and emergency plans. There are obvious gaps in readiness between units that arrive at an exercise or MCTC rotation without any D3SOE battle drills or SOPs and units that arrive with basic plans, drills, and SOPs that have been rehearsed at home station. When it comes to jamming, EMI, and counterspace effects, it is unnecessary to have anything elaborate or complex. But units must

have legitimate drills and SOPs that guide them and are rehearsed enough for units to recognize, react, and report through the chain of command with some level of muscle memory. Rehearsals for jamming and interference are especially vital since the effects, indicators, and responses are less intuitive than Battle Drill 1: React to Direct Fire Contact. It takes rehearsals and repetition to build competency and confidence to maintain planning and operations when units are forced to employ all means of command and control (digital and analog) in nonpermissive environments.

Discipline

Leaders, staff, and warfighters must be disciplined at all echelons to reinforce proficiency and rehearsals. There must be discipline in proficiently operating all systems organic to Army units; the discipline must work through difficult and complex problem sets regardless of how well-integrated conditions are within

the Army's warrior skills tasks and collective mission essential task list. Preparing for contested space, cyber, and electromagnetic warfare requires the discipline and initiative to go the extra mile during training to test and stress equipment, systems, operators, SOPs, architecture, and the unit's ability to operate in and through a contested EMS. As an Army, we must remain disciplined in balancing mass, economy of force, unity of command, and simplicity to be fully prepared to experience a loss of communications and PNT due to the current capabilities our adversaries possess. It is within each warfighter's influence and decision-making to change the precedence and improve the balance of space reliance versus space enhancement. Warfighters must avoid persistence and overuse of all digital systems all the time (e.g., emissions control). However, there is still great utility and opportunity in maximizing space-enabled capabilities to maintain operational tempo while creating complex problem

sets to mitigate vulnerability to our peers and near-peer adversaries.

Success hinges on the Army's ability to fully understand how space contributes to the Army operation, MDO, and LSCO. Rather than expecting access to all capabilities, we must be willing to train and operate in uncomfortable situations. Operating in and through a D3SOE must be the overarching training objective, and commanders must challenge their formations to complete their mission-essential tasks in this operational environment. The Army cannot assume that its adversaries will not take advantage of the EMS. Chinese military leaders believe they must achieve EMS dominance and deny its adversaries use of the EMS to seize and maintain the initiative in a conflict.⁸ We must assess our understanding of space's role in combat and our ability to adapt to any challenges that may arise. With a firm grasp of MDO and a willingness to adapt, we can overcome space-related obstacles and emerge victorious. ■

Notes

1. Field Manual (FM) 3-0, *Operations* (Washington, DC: U.S. Government Publishing Office, October 2022), Glossary-10.

2. "Enabling Warfighting Functions," in *Army Space Training Strategy* (Redstone Arsenal, AL: U.S. Army Space and Missile Defense Command, 1 March 2023), 6.

3. The White House, "Overview of Our Strategic Approach," in *National Security Strategy* (Washington, DC: The White House, 12 October 2022), 12.

4. Center for Army Lessons Learned (CALL) Handbook 18-28, foreword to *Operating in a Denied, Degraded, and Disrupted Space Operational Environment* (Fort Leavenworth, KS: CALL, June 2018), viii.

5. U.S. Army Space and Missile Defense Command, foreword to *Army Space Training Strategy* (Redstone Arsenal, AL: U.S. Army and Space Missile Defense Command, March 2023), 1.

6. FM 3-0, *Operations*, 3-3.

7. *Ibid.*, 1-8, table 1-1.

8. Marcus Clay, "To Rule the Invisible Battlefield: The Electromagnetic Spectrum and Chinese Military Power," *War on the Rocks*, 22 January 2021, <https://warontherocks.com/2021/01/to-rule-the-invisible-battlefield-the-electromagnetic-spectrum-and-chinese-military-power/>.