

# Denied, Degraded and Disrupted

By William T. Coffey Jr., Joan Rousseau and Lt. Col. Scott Mudge

## For Your Consideration

**Jamming of space-enabled operational systems is expected. Commanders and staffs need to be trained and prepared.**

- What are the space and space-enabled systems your unit possesses?
- Do operators and staffs understand how space and space-enabled systems behave when exposed to electromagnetic interference?
- Is your unit trained to operate and win in a denied, degraded and disrupted space operational environment?

**A**s the U.S. Army prepares for the most lethal end of the range of military operations against known and unknown adversaries, America's primary objective of strategic deterrence remains. Nonetheless, if deterrence fails, most military analysts concur the Army's extensive reliance on space-enabled capabilities will be challenged in war.

The Army's space capabilities can be viewed as a dual-edged sword. Along one edge, when properly protected, they provide an unmatched and undisputed combat advantage. On the other edge, near-peer adversaries view these capabilities as vulnerabilities to be exploited. How soldiers continue to move, shoot and communicate within a denied, degraded and disrupted space operational environment (D3SOE) will, in part, determine how quickly and efficiently the Army prevails in land combat.

Recall for a moment the devastating impacts improvised explosive devices (IEDs) had on forces throughout Operation Enduring Freedom and Operation Iraqi Freedom. They caught the military ill-equipped and untrained to operate within an IED operational environment. IEDs were the primary casualty-producing weapon employed against U.S. forces, significantly restricted freedom of movement and required the United States to invest billions of dollars in countermeasures. The harsh reality was the Army's training readiness and materiel readiness were insufficient at the onset of these operations to provide a high level of force protection.

Now imagine a future war against a near-peer adversary. It is likely the adversary's priorities will be to fight aggressively within the electromagnetic spectrum (EMS). The EMS has been referred to as the "spinal cord of the modern Army,"<sup>1</sup> and the nation that best operates and maneuvers within, protects and weaponizes the spectrum will have the combat advantage. A sobering thought is the adversary's offensive operations within the EMS may have the ability to create the same devastating impacts on U.S. combat formations in a future war as IEDs had in Afghanistan and Iraq.

## Space-Enabled Capabilities Today

The alarming reality is America's near-peer adversaries already have invested heavily in their force structure, acquiring electronic attack systems ("jammers") and tactics to deny, degrade and disrupt the U.S. military's asymmetric advantages in space. Soldiers' lives, as well as the outcome of the war, may be dependent on how well the Army recognizes and reacts to

jamming against its space-enabled capabilities, as key digital terrain within the EMS is degraded or lost.

Informally defined, D3SOE is a condition within the area of operations and area of interest characterized by multiple factors, including intentional and unintentional electromagnetic interference (EMI) on the ability of friendly and adversary military forces to exploit space capabilities, services and products. The ability of the U.S. Army to operate in a D3SOE ensures increased levels of force protection for soldiers while preserving its means to deliver devastating effects upon enemy forces.

Indisputably, the ways in which the Army shoots, moves and communicates, across each Warfighting Function (WfF), relies heavily on space-enabled capabilities. These reliances include, but are not limited to, Global Navigational Satellite Systems (such as the U.S.-owned GPS, the Russian Federation-owned GLONASS, the European Union's Galileo, China's Beidou and other regional systems), satellite communications (SATCOM) and space-based intelligence, surveillance and reconnaissance (ISR).

Beginning in the late 1950s, the Army has built and fielded its space-enabled capabilities. Over the past 20-plus years at the tactical levels, it has delivered them all the way down to the individual soldier level. Quantitatively, today the Army has at least two satellite antennas for every soldier on the battlefield, connected globally to more than 1,450 satellites<sup>2</sup> and linked by hundreds of ground stations. A nine-member infantry squad is dependent on up to 150 satellites in five different constellations, and a standard Army Infantry Brigade Combat Team has more than 2,500 items of space-enabled equipment.

### **Army Warfighting Challenges (AWfCs)**

The Army Capabilities Integration Center maintains a list of AWfCs which address “enduring first-order problems, the solutions to which improve the combat effectiveness of the current and future force.”<sup>3</sup> Although many of the 20 AWfCs include operations and capabilities enabled by space, #7 specifically addresses operating in a D3SOE:

Conduct Space and Cyber Electromagnetic Operations and Maintain Communications. How to assure uninterrupted access to critical communications and information links (satellite communications; positioning, navigation and timing; and intelligence, surveillance and reconnaissance) across a multi-domain architecture when operating in a contested, congested and competitive operating environment.

AWfC #7 provides ten associated “Learning Demands” which challenge commanders to address the problems and associated solutions necessary to train their units how to operate and win in a D3SOE. A few of these Learning Demands are:

- How can the Army better prepare its leaders and soldiers to operate in denied, degraded and disrupted space operating environments?
- What are the intersections, overlaps, gaps and seams between space, cyberspace, electromagnetic spectrum operations, military intelligence and information operations, and how can the Army effectively integrate these operations to support Unified Land Operations?
- How does the Army execute Navigation Warfare, ensuring that Army forces have assured and reliable access to position, navigation and timing information while denying the same to our adversaries?

Drawing from this guidance, subordinate commanders have the responsibility to develop their own training objectives and integrate, to the greatest extent possible, elements of D3SOE

operations into their home station and Combat Training Center training requirements. Units' D3SOE training should include classroom instruction, hands-on experience and field exercises which rehearse D3SOE-related Tactical Standard Operating Procedures and stress operations in a D3SOE from the individual level up through command post collective training events.

Examples of specific D3SOE-related training objectives may include:

- Exercise and refine D3SOE-related Primary, Alternate, Contingency, Emergency (PACE) plans.
- Exercise and refine D3SOE-related Command Post Battle Drills.
- Rapidly find, fix and finish (lethal) enemy GPS and SATCOM jammers.
- Plan and execute attacks (lethal and non-lethal) against the enemy's space-enabled capabilities.

### **PACE Plans**

PACE plans are, by their nature, very unit specific and must be developed by their respective WfF, staff element or functional area subject-matter experts. They should consider many variables, including fielded equipment; training readiness; operational variables such as mission, enemy, terrain and weather, forces and support available, time available and civil considerations; political, military, economic, social, infrastructure and information factors; and familiarity with the area of interest. Some PACE plans which should be considered for development include but are not limited to:

- **Communications.** The U.S. Army relies heavily on SATCOM as the primary means to move large volumes of data, securely and over great distances. When select SATCOM systems are denied, degraded or disrupted, alternate SATCOM systems, line of sight systems, hard wire/landline and manual methods (such as runners) should be considered and practiced.
- **Friendly Force Tracking.** Units should consider and train on tracking units using SATCOM/Beyond Line of Sight, line of sight communications and analog battle tracking.
- **Target Acquisition.** Primary target acquisition often involves the use of unmanned aircraft systems, national systems, radars, laser designation systems, target coordinate correlation tools and forward observers using SATCOM reporting means. In a D3SOE, commanders and staffs should develop PACE plans on how best to detect, geo-locate and report targets.
- **Precision Engagement.** In a D3SOE, the Fires WfF, through the weaponeering process, should plan to employ multiple types of munitions which provide the greatest accuracies available and achievable. Commanders and staffs should have PACE plans to attain the best precision while operating in a D3SOE.
- **Information Collection.** Many information collection and Joint ISR assets rely on GPS, SATCOM and national capabilities. Before GPS, SATCOM and national systems become denied, degraded or disrupted, commanders and staffs should develop PACE plans on how to develop and execute their Information Collection Plans to support the commander's Priority Intelligence Requirements.
- **Battle Damage Assessment.** A unit's ability to conduct assessments oftentimes relies on UASs and national systems to collect post-strike data. Units should consider other means such as manned aircraft and ground forces to observe and multiple communications means to report data to higher headquarters.

## **Decision Making and Information Requirements**

All WfFs must consider space-enabled capabilities and their vulnerabilities throughout all phases of the MDMP. When provided by the Space Support Elements (either from higher command or organically), the space estimate provides input into course of action analysis and informs the development of the commander's information requirements. These information requirements, comprised of Commander's Critical Information Requirements (which includes both Priority Intelligence Requirements [PIR] and Friendly Force Information Requirements [FFIR]) and Essential Elements of Friendly Information (EEFI) typically include language which directly or indirectly addresses D3SOE considerations. Some examples of these may include:

PIR "How I See the Enemy": These information requirements pose questions about the enemy and drive the Intelligence WfF's Information Collection Plan:

- "How will Arianna [a fictitious nation used in scenarios to design Army exercises] forces attempt to degrade or destroy our C2, Mission Command capabilities?"
- "What is the enemy's Electronic Attack Order of Battle? (Including types of jammers, quantity, capabilities, limitations, unit strengths, disposition/location, employment tactics, intent of jammers, associated indications and warnings, etc.)?"

FFIR "How I See Myself": These information requirements ask questions the commander needs to know about their own forces and provide direct input into the commander's situational understanding:

- "Report any electromagnetic interference (EMI)/enemy jamming of communications, Unmanned Aircraft Systems (UAS) platforms, GPS or Radars."
- "Report loss of critical Mission Command systems (Warfighter Information Network-Tactical, Joint Battle Command-Platform/Joint Capabilities Release, SATCOM systems, GPS)."
- "Report loss of critical Intelligence Collection UAS (Shadow, Gray Eagle, Raven)."
- "Report degradation or loss of precision engagement capabilities."

EEFI "How I Prevent the Enemy From Seeing Me": These information requirements are what friendly forces believe the enemy would like to know about U.S. forces and capabilities and provide direct input to Operational Security, Information Operations and Military Deception plans and operations.

- "What are the targeting timelines required to lethally target enemy jammers?"
- "How effective are enemy jammers against space-enabled capabilities, systems and munitions?"
- "What are the SATCOM Signals of Interest associated with U.S. Army UAS operations and mission command nodes/command posts?"

## **Command Post Battle Drills for Current Operations**

Command post battle drills outline collective and sequential tasks staffs must perform without the application of a deliberate decision-making process, in a time-constrained environment and with minimal direction or guidance to accomplish. Battle drills should be developed and tailored to each staff, then trained, rehearsed and refined through exercises. Recommended battle drills which should be considered as units prepare to operate in a D3SOE, for battalion up to Army Service Component Command staffs, may include, but are not limited to, PS EMI, SATCOM EMI, UAS Anomalies, Personnel Recovery, Overhead Persistent Infrared, Dynamic/Time Sensitive Targeting (especially as it pertains to requirements to physically destroy enemy jammers) and Degraded National Systems.

## **Fires Options for Commanders**

The development and maintenance of the space running estimate, to include maintaining a current enemy space order of battle, provides the commander with offensive options and effects to attack the enemy's use of space as well as the enemy's ability to attack the Army's use of space. These targeting options consist of lethal and non-lethal effects to shape and control the EMS to the commander's advantage.

Enemy targets commanders may consider for lethal attack may include physical ground-based systems and capabilities such as tactically-employed systems or strategic-level control facilities.

Other targets commanders may consider for non-lethal attacks may include means to deny, degrade or disrupt the portions of the EMS used for space-based position, navigation and timing (such as GPS and Global Navigational Satellite System) and SATCOM, especially those associated with force tracking, UASs, mission command and precision engagement capabilities and operations.

## **Requests for D3SOE Training Support**

Brigade and below level units should contact their higher command's Space Support Element for D3SOE training and training support. SSEs requesting training support at division, corps and ASCC headquarters should exercise their chain of command up through the Combatant Command's Space Coordinating Authority. Additionally, units may contact the USASMDC/ARSTRAT G37 Training, Readiness and Exercises Division, Army Space Training Integration Branch at (DSN 692) 719-554-1922 or 554-8773 to discuss training opportunities, resources and requirements.

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<sup>1</sup> Sydney J. Freedberg Jr., "Cyber/EW, Aviation, Air Defense, Artillery: CSA Milley's Priorities," *Breaking Defense*, Jan. 12, 2017, <https://breakingdefense.com/2017/01/cyberew-aviation-air-defense-artillery-csa-milleys-priorities>.

<sup>2</sup> Union of Concerned Scientists, "UCS Satellite Database," updated Dec. 31, 2016, <http://www.ucsusa.org/nuclear-weapons/space-weapons/satellite-database#.WRNy4f5dDcs>.

<sup>3</sup> Army Capabilities Integration Center, "Army Warfighting Challenges," updated Oct. 24, 2017, <http://arcic.army.mil/initiatives/armywarfightingchallenges>.