Demystifying Space: How to Perform Better in the Space Domain

by LTC Coley D. Tyler

My article, "Leveraging Space: An Examination of the Ultimate High Ground at Echelons Brigade and Below" (**ARMOR**, Summer 2017) previously introduced the role and importance of the space domain for mounted-maneuver professionals. The article laid a foundation for what the space domain looks like at lower echelons to increase awareness of space implications and ask for greater involvement in shaping future space support to maneuver formations.

The intent of this article, "Demystifying Space," is to bridge the gap among the space domain, the operational environment, future force modernization and current maneuver formations that require a higher level of space skills. The reality is that our Soldiers and formations cannot wait for the next big space program of record to provide overmatch against peer and near-peer adversaries. Being able to "fight tonight" requires addressing the problems of a denied, degraded and disrupted space operational environment (D3SOE) in a contested, multi-domain extended battlefield environment against today's threat.
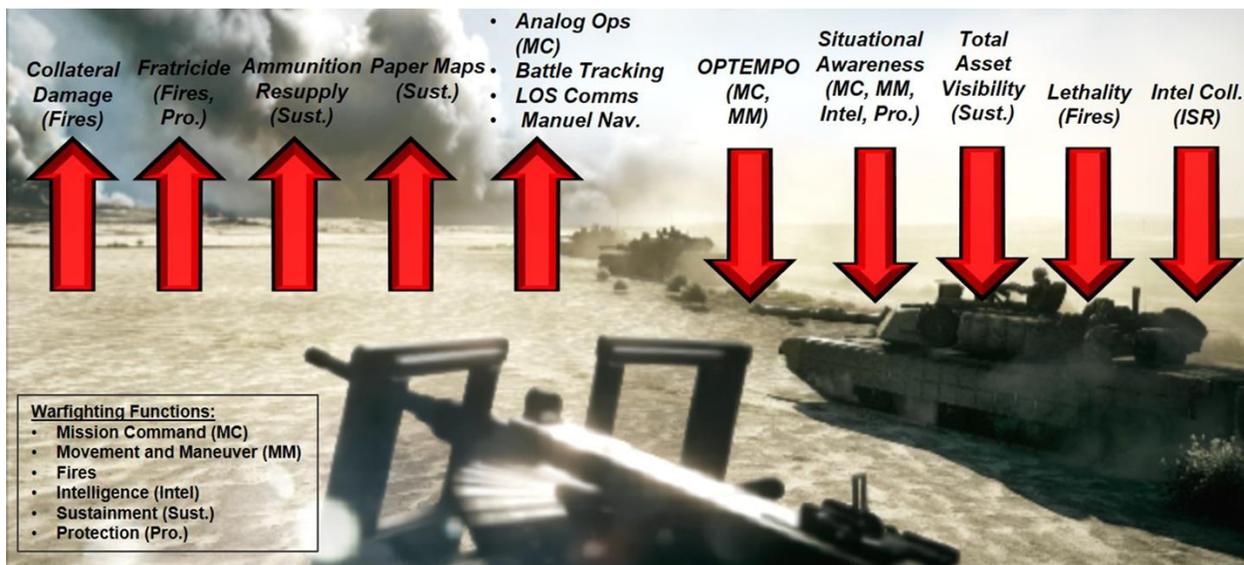
Figure 1. D3SOE is a condition of the operational environment. D3SOE increases the occurrence of or need for certain events (up arrows) and impacts operations by decreasing formation efficiency (down arrows). *(Source: D3SOE Maneuver Pre-Command Course (MPCC) brief)*

Closing knowledge gap

Space capabilities have no doubt greatly enhanced U.S. Army warfighting formations. However, over time, the U.S. Army has become critically dependent (as an example) upon positioning-, navigation- and timing (PNT)-enabled equipment. Over-reliance on these enhanced capabilities is often to the detriment of alternative methods of conducting navigation. U.S. Army Soldiers and formations must execute missions within the commander's intent to achieve the desired endstate from large-scale combat operations to counterinsurgency/counterterrorism and along the full spectrum of D3SOE (from fully enabled to completely denied). Units must train at both ends of the spectrum, rapidly transition from one end to the other and have different portions of the formation operating at different points simultaneously.

A great place to start understanding the strengths and weaknesses of space-based capabilities (not only friendly and adversary, but also allied, neutral and commercial) are two short reads available from the Maneuver Center of Excellence (MCoE) and the U.S. Army Space and Missile Defense Command/Army Forces Strategic Command

(USASMDC/ARSTRAT). The **Space Support to the Brigade Combat Team** trifold and Graphic Training Aide 40-01-001, **Army Space Training Strategy Home Station Training Reference Guide,** describe space support to operations, how to request space support and D3SOE mitigation approaches.

The easiest gap to close in maintaining space overmatch with peer and near-peer adversaries is the knowledge gap. Leaders cannot underestimate the importance of formations skilled in all domains on the future battlefield. A solid foundation of how space-based capabilities affect warfighting formations is the first step to developing a space-domain skillset.

Assessing space linkages

With this knowledge, operators and leaders can then assess and appreciate their equipment's space linkages. This is no small undertaking, but space enhancement is an ever-increasing equipment attribute that must be common knowledge to maximize effects while conducting cross-domain maneuver in a contested environment during large-scale combat operations. A typical brigade combat team has more than 3,200 pieces of equipment enabled by PNT from space and more than 300 pieces of satellite communication (SATCOM)-enabled equipment. What are the impacts to warfighting efficiency when an adversary targets one, more, or all of these systems in a D3SOE? Are commanders confident that their Soldiers and equipment will perform in a contested Global Positioning System (GPS) environment? This is the environment of the future.

As an example, if a unit takes the time to encrypt their Defense Advanced GPS Receiver (DAGR), it will indicate when it is being jammed (Figures 2a and 2b). In the "jammer finder" mode, the DAGR will indicate the jamming signal strength. If a company commander intersected the reported jamming line of bearing of three platoons, the commander could determine a jammer location and take appropriate action.

BASELINE Reading Before SP

JAMMER FINDER

L1   4951/100000

1   25   50   75   100

L2   4523/100000

1   25   50   75   100

MARK   FAST FIX   BACK

**BASELINE Reading
Before SP**

Reading During Jamming

JAMMER FINDER

L1   7424/100000

1   25   50   75   100

L2   7371/100000

1   25   50   75   100

MARK   FAST FIX   BACK

**Reading During
Jamming**
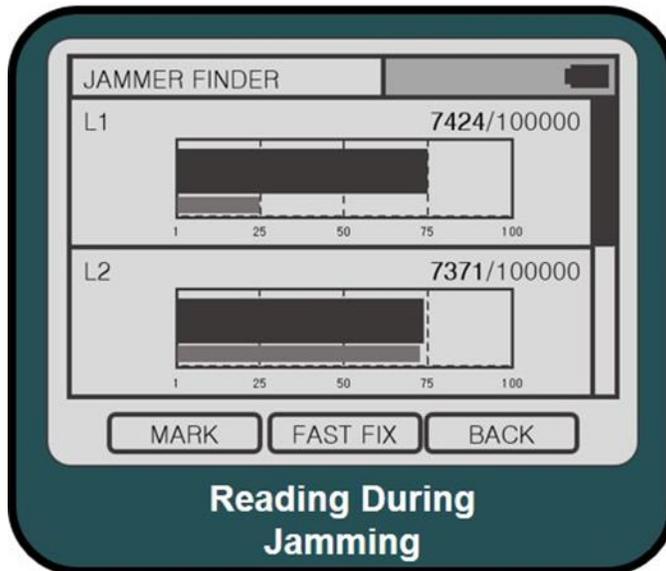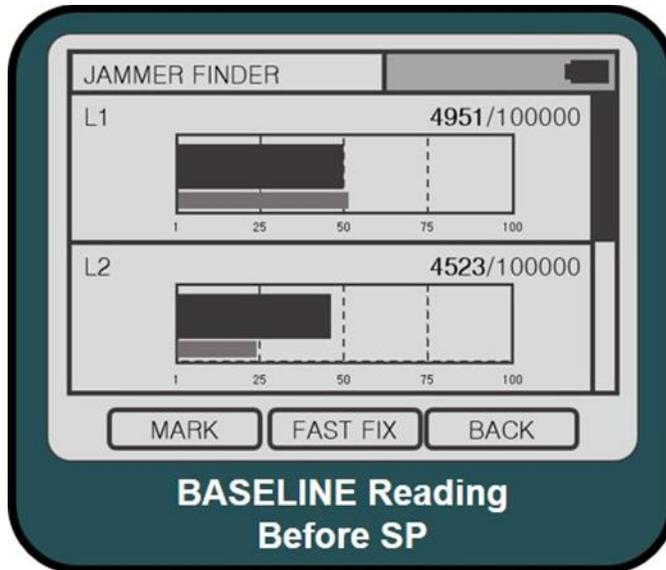
CAUTION!

⚠ CAUTION!

JAMMING DETECTED
Using Single
Frequency

ENTER to Acknowledge

MARK   FAST FIX   BACK

Figures 2a and 2b. DAGR jamming notification and jammer-finder mode screens. It is an important tactic, technique and procedure to obtain this reading before entering a contested environment to use as a baseline reading for comparison. *(Source: Home-station training PNT mitigation brief)*

Platoons familiar with D3SOE and skilled in mitigation techniques would continue to operate in an analog mode (without turning off their DAGRs) until they regained the GPS signal. This course of action is not possible without completely understanding space support to multi-domain operations and individual equipment reliance on space capabilities. However, with that understanding, leaders could determine training and performance deficiencies as they relate to the accomplishment of the unit's mission-essential tasks. Leaders can then address these deficiencies in their unit training plans.

More training options

Training options developed by USASMDC/ARSTRAT are available to units to address the D3SOE problem set:

- The Army Space Training Strategy (ASTS) described in the article "Leveraging Space" incorporates D3SOE instruction into the education systems for officers, warrant officers and noncommissioned officers. The idea that formations receive knowledgeable and better-educated leaders from the beginning facilitates a decreased learning curve so leaders can spend more time focused on training Soldiers and their units.
- There are space electives taught at the Command and General Staff College that lead to the 3Y-Army Space Cadre skill identifier. These courses are A537 Space Orientation (Term 1) and A543 Space Operations (Term 2). This skillset in a field-grade officer – many of whom will directly influence training when he or she arrives on a staff – will serve a unit well for developing internal and external options to improve the space-domain skillset.

An additional option is sending Soldiers to the Army Space Cadre Basic Course (ASCBC) Phases 1 and 2. ASCBC is an Army Training Requirements and Resources System course (https://www.atrrs.army.mil) offered all around the globe via mobile-training teams. The course code is 2G-SI/ASI3Y/043-ASI3Y (MC), and the school code is 129.

ASCBC is a space-fundamentals course focused on understanding space-based capabilities for planning, preparing and executing unified land operations. Graduates of this course can request the 3Y skill identifier. This course does not entail Soldiers taking on additional obligations, but the education received will help them better perform their already assigned duties and responsibilities and understand the impacts of peer and near-peer adversaries in a D3SOE.

These opportunities support the ASTS' institutional line of effort (LoE) "to increase space knowledge … through institutional training and education." Leaders can also develop formations with multi-domain skillsets through the ASTS operational LoE by home-station training and combat-training-center (CTC) rotations "to exploit space capabilities and fight in contested environments."[2] The operational LoE is a two-part concept:

- Home-station training is provided by USASMDC/ARSTRAT G-37 Training, Readiness and Exercise, Army Space Integration Branch, and consists of crawl and walk phases. USASMDC/ARSTRAT provides the training at no cost to units 90-180 days prior to a CTC rotation or deployment. USASMDC/ARTSTRAT also conducts train-the-trainer sessions, classroom instruction and field-training exercises, complete with space-kit training. Space Kit 3 replicates GPS jamming on handheld DAGRs, and Space Kit 4 replicates threat interference on satellite communications.
- The branch supports the run phase at CTC rotations by creating a contested space operational environment, providing space-experienced observers/coaches/trainers and opposing forces or "Army space aggressors." You can find lessons-learned from the National Training Center at https://www.milsuite.mil/book/groups/ntc-operations-group. Search "D3SOE" or "space" in the search box.

Leveraging ASTS institutional and operational LoE support, unit leaders can greatly decrease the space knowledge gap and better prepare their formations to operate in a D3SOE. Much like with fire or air support, space considerations will become second nature while leaders conduct the military decision-making process, and planning can succeed across the full spectrum of a D3SOE.

Visualizing space

The U.S. Army School of Advanced Military Studies (SAMS) is currently experimenting with a visualization tool as depicted in Figure 3. The intent is to aid in operationalizing space effects in a staff's conceptual approach for better shared understanding in relation to operational art, and the achievement of "strategic objectives, in whole or in part, through the arrangment of tactial actions in time, space and purpose." Rows 9 through 13 depict fluctuations or changes in space-capability support based upon multiple factors such as weather, terrain and enemy actions. Access to or support received from different space capabilities can increase or decrease throughout an operation, hence the rise and fall of space-force enhancement indicator lines over time. In due course, the staff will address these considerations in their detailed planning.
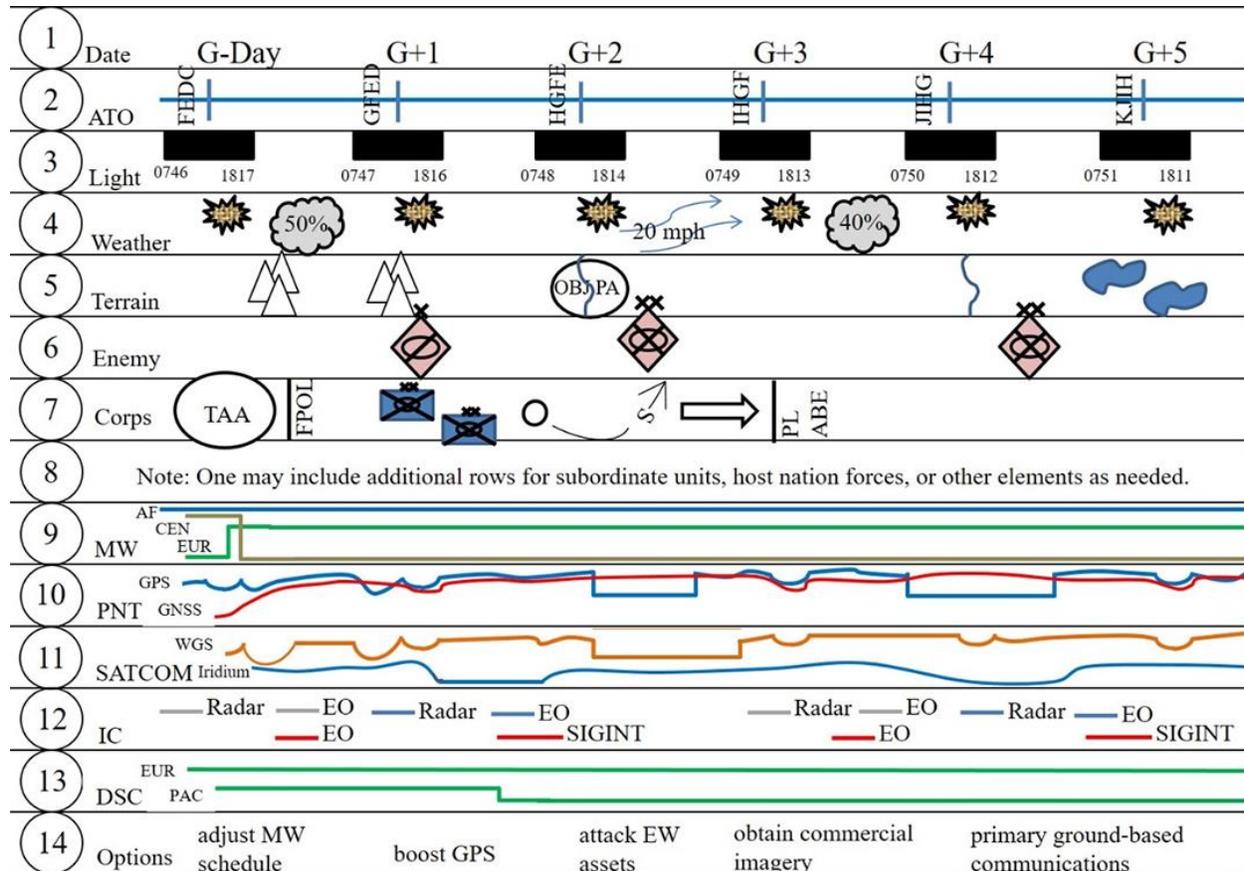

Figure 3. Space-visualization-tool example. Note that "IC" (intelligence community) in this example is synonymous with intelligence, surveillance and reconnaissance (ISR). The four-letter codes on the air-tasking order (ATO) line are example cycles. *(Tool developed by MAJ Jerry V. Drew II)*

One of many possible examples could be to include a well-thought-out and comprehensive primary-alternate-contingency-emergency and runner plan in the "command and signal" paragraph from the standard U.S. Army operations-order format. A good case study to look at here is the conflict in Ukraine. As emphasized by both the U.S. Army Training and Doctrine Command and MCoE commanding generals at the 2017 Maneuver Warfighter Conference, leaders must always be thinking about and planning for operations in all domains (cross-domain maneuver, one of the components of the solution in the Army functional concept for movement and maneuver).

Ultimately, there is nothing new in this article with respect to traditional or enduring ways of war, but we must reassess for the changing environment of waging war. An evolving area is the increased acceptance of affecting the space domain during conflict with resulting impacts in other domains. There is nothing mysterious about space. In essence, what was old is new again in terms of how the Army will shoot, move and communicate in the spectrum

of large-scale combat operations to counterinsurgency/counterterrorism operations. Obviously, the **what** to do is not hard to figure out, but the **how** to do it is a pretty serious endeavor.

The bottom line is there is no escaping the problem of a D3SOE. It will remain a fixture of having to "fight tonight" and of the future battlefield.

The first option is to assume that formations will operate in an uncontested environment, which all indicators and warnings show will prove disastrous in almost all cases. A second option is to plan to fight contested and prepare U.S. Army Soldiers and formations for what is to come, even if it does not happen on the current watch. Peer and near-peer adversaries are watching and studying every move. Adversaries are actively seeking ways to degrade space capabilities and "level the playing field." The U.S. Army is only as strong as its weakest link. The challenge is not be the leader who weakens the team due to a failure to train for what lies ahead in a D3SOE.

For more space professional reading, the Army Space and Missile Defense School and Doctrine Center maintains a repository of useful material (on-line access, DVDs and hardcopy), which they provide to MPCC students. This is a valuable addition to any leader's "kit bag" from platoon to brigade level. To request material, contact the MCoE's space-integration officer or the Army Space Integration Training Branch.

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Notes
[1] 2013 ASTS.
[2] Ibid.

Acronym Quick-Scan for text and figures
AF – African Command (Africa)
ARSTRAT – Army Forces Strategic Command
ASCBC – Army Space Cadre Basic Course
ASTS – Army Space Training Strategy
ATO – air-tasking order
CEN – Central Command (Middle East)
CTC – combat-training center
D3SOE – denied, degraded and disrupted space operational environment
DAGR – Defense Advanced G(lobal Positioning System) Receiver
DSC – defensive space control
EO – electro-optical
EUR – European Command (Europe)
EW – electronic warfare
FPOL – forward-passage-of-lines
GNSS – Global Navigation Satellite System (systems that use multiple PNT signals, including GPS, Beidou, GLONASS (Russian system) and Galileo)
GPS – Global Positioning System
IC – intelligence community
ISR – intelligence, surveillance and reconnaissance
LoE – line of effort
LoS – line of sight
MCoE – Maneuver Center of Excellence
MPCC – Maneuver Pre-Command Course
MW – missile warning
OBJ PA – Objective Pennsylvania

PAC – Pacific
PL – phase line
PNT – position, navigation, timing
SAMS – School of Advanced Military Studies
SATCOM – satellite communications
SIGINT – signals intelligence
TAA – tactical-assembly area
USASMDC – U.S. Army Space and Missile Defense Command
USMA – U.S. Military Academy
WGS – Wideband Global Satellite Communication