

The S-3 and the Electromagnetic Spectrum

by MAJ Bradford S. Dooley

Observation posts for Able and Baker troops are set in the squadron's screen line. The only contact reports coming from the scouts are random, single-shot impacts from the enemy's artillery; however, they fall harmlessly between the Baker screen line and the brigade's defensive main effort. Scouts report no sign of enemy personnel or drones. The only visual contact so far was one civilian van moving north to south along a local road, but it was away from any of the designated named areas of interest. The identifying scout assessed it as civilians leaving the area.

Satisfied with the lack of activity, the S-3 maintains his position behind Able and initiates radio silence for the screen line. Charlie Troop comes up on the net to notify the S-3 they had occupied and cleared a position for the forward command post (CP).

The S-3 responds to Charlie 6: "We are enroute to your position, coming from the west on Route Yankee. Please respond with entry point and marker." As the driver took over the communication with Charlie 6 on its troop net, the S-3 confirmed that the squadron commander was aware of the recent communications. The squadron commander's driver picked up, saying he was on Joint Capabilities Release (JCR) equipment with Division but gave the thumbs up to proceed. The communication broke up, and the squadron commander's driver came back up, saying, "Sorry, those impacts are getting closer to our position behind Baker, but we are coming your way."

The S-3's two vehicles arrive at the forward CP around 5 p.m. local, and he gets out to do a face-to-face with the Charlie Troop executive officer. The executive officer pointed out established gun positions from his troop's 3rd Platoon, and then he took his 2nd Platoon farther southwest of the CP and Able positions to link up with the rest of Charlie and his troop commander. The location's concealment was great, and it was impossible to find without the executive officer's escort.

As the executive officer left, the S-3 reminded him of the random artillery behind Baker. The executive officer replied, "Sir, you are a little behind. The last couple of rounds seem to be moving closer to the rear of Alpha's positions." The S-3 did not think much of the statement and started establishing radio systems. The S-3, per standard operating procedure, prioritized frequency-modulation (FM) communication with brigade's forward CP and the fires net to confirm radio communications before the squadron commander arrived.

The squadron commander arrived sometime around 10 p.m., and by that time the random artillery impacts were occurring closer to the forward CP's position behind Alpha. The S-3 greeted the squadron commander immediately: "Sir, we have clear communications with all the troops and brigade on FM. There's still no form of contact aside from seeing the civilian van in front of both Baker and now Alpha's screen lines. No enemy movement or drone activity. Also, the fires net is tracking the shift of impacts, and the squadron executive officer is ready for the hand-off of command back to the forward CP."

The squadron commander gave the confirmation for the hand-off of the CP to the forward CP position. The S-3 quickly turned and updated the squadron and brigade on FM communications, and the squadron commander sent a message through his JCR to the squadron executive officer to be prepared to jump the CP. In that moment another round hit within 200 meters of the forward CP, so the S-3 grabbed the fires net and demanded counter-battery support. Then, 30 rounds of artillery struck the forward CP immediately after the transmission.

Today's enemies do not always need drones, human scouts or satellites to exploit a unit's vulnerabilities. Instead, passive observance of the electromagnetic spectrum (EMS) allows the identification and tracking of our systems and equipment, similar to a unit's physical presence on terrain except at much greater distances. In the opening scenario, a brigade combat team's cavalry squadron created first contact not through visual or audible means, but miles closer to the friendly CP due to the propagation of waves coming from communication platforms.

Everything a unit brings into an area emits some form of signal. The more communications, computers and systems a unit adds, its signature increases. More importantly, just a collection of multiple systems at low power levels allows an enemy scout to identify the difference between a troop-level CP running two radio nets vs. a squadron or brigade running four or more radio nets. This can all be done without committing physical forces in range of direct-fire weapons.

Operation officers, or S-3s, design their unit's scheme of maneuver toward an objective based on an analysis of terrain and the enemy's capabilities. Using this outdated understanding, considerations related to EMS come most often after the design of the scheme of maneuver to emplace retransmission locations or confirm line-of-sight for communication, simply as an enabler such as artillery fire.

Unfortunately, this line of thought is too narrow because the S-3's understanding of EMS does not simply enable the unit's maneuver; instead, the EMS is terrain and a unit's maneuver depends on the S-3's understanding and continuous awareness of a unit's effect with, interaction in and use of EMS.

Against peer and near-peer threats, U.S. ground forces can no longer expect to communicate freely, either by voice or data transmission. In the last two conflicts, battalions and brigades planned and executed maneuver operations without having to consider EMS and, more importantly, they did not have to account for the threat's capability to exploit a unit's signature. On today's battlefield, however, a unit's ability to effectively conduct maneuver starts by seeing EMS during intelligence preparation of the battlefield (IPB). It becomes continuous with enabled scouts, and EMS is only efficient with an integrated communications plan that prompts physical movement.

IPB

An S-3's understanding begins in IPB. During the portion of "defining the environment," the typical build during mission analysis constructs a modified combined obstacle overlay (MCOO) that identifies terrain features that already exist and are difficult to change during a mission.¹ This portion is the first entry point to understanding EMS.

An EMS layer in the MCOO allows the unit to recognize what signatures already exist in the environment before the unit arrives. To do this, a unit needs the capability to see the spectrum on a frequency range of zero to 30 gigahertz.

Also, this capability must occur before the unit enters the battlespace. The EMS MCOO allows the S-3 and the S-6 to make initial assumptions for potential maneuver operations by identifying unique unit emissions to mitigate in the environment and existing emissions for potential camouflage. Currently the military's existing technology to conduct this capture includes Fusion Analysis and Development Effort for Multi-Intelligence Spatial Temporal Toolsuite, Raptor X and other emerging systems.

The initial signal capture in time only answers the first step of IPB. However, an S-3 must have an idea of how to evaluate the threat and the unit's potential EMS maneuver. The capability needed for this step is to identify communication-degradation locations that, combined with the initial capture or MCOO, allows assumptions toward the threat's electronic warfare (EW) situational template.

The Systems Planning Engineering and Evaluation Device (SPEED) will model radio and jammer effects in the identified EMS environment.² Often this is used by the unit S-6, and it is currently one of the systems readily available to units.

The S-3's influence at the beginning of this analysis is critical to the success of EMS being included in the IPB process. Most of the work conducted at this point in mission analysis falls on the unit's S-2 and S-6. However, it is the S-3's responsibility to define the unit's area of operation and, more importantly, area of influence under the commander's intent.³ If an understanding of EMS is not included in this phase, the S-3 will be unable to define the full picture of the maneuver space during course-of-action development.

Continuous observance of EMS: enabled scouts

The next step is for the S-3 to confirm and ensure a continuous understanding of EMS. The S-3s at both the battalion and brigade level use scouts to confirm or deny intelligence after the second warning order or after being tasked in Annex L of the brigade order.⁴ A recommendation is to form a team with both scouts and EW Soldiers (military occupational specialties 19D and 17E) to create the ability to analyze the spectrum in real-time while conducting physical reconnaissance.

Annex L will task the enabled scouts to recon threat in coordination with the intelligence-collection matrix, and the S-3 can use Appendix 12 of Annex C in the warning order to task enabled scouts to observe the friendly units' interaction with the spectrum.⁵

Taking the analysis from the combination of the EMS MCOO and SPEED, scouts can confirm or deny detection of unit signature for the entire communication plan. The unit can then adjust the scheme of maneuver to an understanding of risk for implementing an environment-specific communication plan. The analysis combined with the scouts' physical reconnaissance results in a deliberate communication plan where the unit only uses the communication systems it needs. Also, EMS scanning scouts will help define the actual transition between each communication platform based on friendly triggers as the unit moves through the area of operations.

The existing systems a unit can use to enable its scouts for passive observance of the EMS include the Prophet, portable systems that are components of the Prophet, Versatile Radio Observation and Direction (VROD) / VROD Modular Adaptive Transmit and, depending on the unit, some of the other organic radars (Q36, Q53 and Sentinel).

The concept of passive observance means the system does not emit any signals that identify it to the threat and only receives existing signals in the environment. However, as a good scout knows, this must be continuous, so the S-3 must ensure that the unit's scheme of maneuver specifies this task to those assets to reassess the unit's EMS footprint during specified parts of the battle. Also, the threat's reaction to our influence on the environment will trigger decisions and communication changes that will affect the deliberate plan and follow designed contingencies for communication and maneuver.

Integrated comms: emission forces movement

Finally, an S-3's understanding of EMS creates an integrated communication plan with the scheme of maneuver. The difference between how units currently operate and how communication should be implemented is the size of the communication plan and the integration of physical movements, CPs and subordinates with communication.

In recent years, units designed their physical maneuver plan with little consideration of their communication, which reflected their most recent experiences fighting insurgencies. Furthermore, these experiences socialized our forces to a specific type of fighting that allowed atrophy with historic communication training and skills instead of evolving those capabilities, as they would against a near-peer threat.

After the scheme of maneuver for a mission or movement to an objective is designed, a primary, alternate, contingency and emergency (PACE) communication plan is designed separately and introduced to the planning process as only an enabler. In modern operations, the S-3's planned physical movement of Soldiers and equipment must be in concert with the frequencies of every signal each element will emit, the power levels of those signals and where within EMS elements' emissions are easily identified or potentially camouflaged.

The PACE plan implemented for the last 10 years also fails to answer the need for maneuver through EMS. Against a peer or near-peer competitor, units need to have multiple primaries deliberately planned to transition from one to the other based on risk analysis, the existing EMS and specific need for phases of the operation. The alternate, contingency and emergency portions of a unit's PACE plan should only initiate in response to a threat's interference and only be used temporarily until the unit can get back to the deliberately designed primary plan.

Also, the robust PACE plan necessitates an awareness of the differences among voice communication, data transfer, unit internal communication and external communication. At the battalion and brigade levels, voice communication cannot be functioning on the same platform as data transfer, or vice versa, because one action by the enemy to remove a single platform or frequency eliminates multiple levels of a unit's PACE with a single action.

The next update to the S-3's understanding of PACE is that physical movement is interdependent of communication. The S-3 must know that instances like the issue of an updated operation order or a unit being engaged will require not just a deliberate change in the unit's primary communication but also a maneuver of subordinates units and the CPs, and a command-and-control handoff between CPs. Planned events like an update to the operation order sent over the network with large amounts of data increases a unit's signature. More importantly, a subordinate unit engaged kinetically requires increased communication from a CP for fires support, subordinate tracking or resupply, all of which increase signature.

Similar to the structuring of a robust PACE plan, the brigade/battalion CPs' and tactical CPs' movements require deliberate planning within the unit's operation. This means that a large signal emission for an order/information update or a command response to troops in contact triggers an immediate shift in the PACE plan and the CP's

command hand-off. The deliberate planning of emission and physical maneuver allows changes based on friendly known actions instead of reaction-based maneuver controlled by the threat.

The interdependent physical movement of CPs, command transition and communication scheme will not remove all signatures on EMS or alter a threat's capability to force changes; however, it increases the time needed by the threat for analysis and refinement to exercise its targeting process.

Takeaway

The S-3's success on today's maneuver battlefield depends on a strong and continuous understanding of EMS that results in a communication plan integrated into the scheme of maneuver. Currently units have a consistent equipment capability shortfall to observe EMS.

However, technology is both advancing and expanding to battalions and brigades. Until this is complete, an S-3 at both of these echelons must ensure that the needed outside support and internal training of tactics, techniques and procedures of EMS integration exists before entering an operation. Otherwise, as technology increases the capability to observe EMS faster and consistently, units will continue to make the same failures in emission control, just with more sophisticated equipment.

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Notes

¹ Army Technical Publication 2-01.3., *Intelligence Preparation of the Battlefield*, Washington, DC: Headquarters Department of the Army, March 1, 2019.

² Janis Lamar, *Northrop-Grumman Newsroom*, Aug. 13, 2015, retrieved from [newsroomnorthropgruman.com](https://news.northropgrumman.com/news/releases/northrop-grumman-developed-advanced-speed-software-released-by-u-s-marine-corps): <https://news.northropgrumman.com/news/releases/northrop-grumman-developed-advanced-speed-software-released-by-u-s-marine-corps>.

³ Field Manual (FM) 34-130, *Intelligence Preparation of the Battlefield*, Washington, DC: Headquarters Department of the Army, July 8, 1994.

⁴ FM 6-0, *Commander and Staff Organization and Operations*, Washington, DC: Headquarters Department of the Army, May 1, 2014.

⁵ Ibid.

Acronym Quick-Scan

AWG – Asymmetric Warfare Group

CP – command post

EMS – electromagnetic spectrum

EW – electronic warfare

FM – field manual

FM – frequency modulation

IPB – intelligence preparation of the battlefield

JCR – Joint Capabilities Release

MCOO – modified combined obstacle overlay

O/C/T – observer/coach/trainer

PACE – primary, alternate, contingency and emergency

SPEED – Systems Planning Engineering and Evaluation Device

VROD – Versatile Radio Observation and Direction (system)