

Maneuvering in the Electromagnetic Spectrum Unveiled

A Primer on the EMS Environment

by Carl L. Nite

Maneuver forces, joint force capabilities, and access within the electromagnetic environment collectively create a dominant triad during traditional military activities to achieve an advantage. This relationship requires an expanded view of the movement and maneuver of data electronically within the electromagnetic environment in support of commander's objectives. The electromagnetic environment consists of three core components, shown in the graphic to the right. Two components are provided by nature: electromagnetic radiation (EMR) and the electromagnetic spectrum (EMS). The third is the human component: digital age infrastructure (DAI).

The congested and contested electromagnetic environment—coupled with the potential threat of losing positioning, navigation, and timing; satellite communications; and manned and unmanned platform integration—has significant implications for a commander.¹ Chief among those implications is the ability to deliver effects in the warfighting domains of land, air, maritime, space, and cyberspace.

Operational planners require better understanding of the electromagnetic environment because the preponder-



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ance of joint force capabilities transmit, emit, and respond through and with “electronic data.” Table 1.1 illustrates a selection of the Joint Force’s essential capabilities across domains. This article provides the contextual framework to show the electromagnetic environment is the adjacent movement and maneuver space in which electronic data operates in relation to the enemy by enabling fires during cross-domain maneuver.

mit and receive data electronically is, and will no doubt remain, the result of innovations in leveraging the EMS environment. The United States and China’s telecom race to fifth generation infrastructure is evidence of this.³ The telecommunication sector is a primary stakeholder in the advancement of global connectivity, ushering DAI that scales from land through the sea, and from land to space. DAI provides the technological interface—comprised

radios, and computers analogous to planes, trains, and automobiles, and ships).

Commercial Use of the EMS Environment

An online purchase transaction illustrates a commercial sector’s deliberate use of the EMS environment to facilitate the transmission and reception of data electronically. The notional purchase initiated from a smart phone or mobile device provides the baseline access capability to initiate the transmission and reception of data electronically. (See Figure 2 on next page.)

Note the purchase process illustrated above: 1) the website request, 2) the user account authentication, 3) the selection and quantity of the item(s), 4) the method of payment, 5) the delivery address/delivery options, and 6) confirmation.

Although not exhaustive, the example demonstrates the amount of



Table 1.1 Examples of joint force capabilities. (Illustration by Ms. Hannah Bruening.)

Electromagnetic Environment

EMR refers to the waves of the electromagnetic field, which are propagated through space and carry electromagnetic radiant energy. Alternatively, the EMS is the quantitative method used to describe EMR. The EMS is that range of frequencies of EMR and their respective wavelengths and photon energies.² The human component of the electromagnetic environment is DAI, which has two distinct categories—DAI heavy and DAI lite. Collectively, DAI is broadly defined as the sum of physical infrastructure and technology that facilitates electronic transmit and receive services, whether wired or wireless, for a dedicated customer base.

Although the term “electromagnetic environment” describes the relationship between DAI, EMR, and the EMS, the commercial sector and the Department of Defense colloquially reference this space as the EMS environment. The remainder of this article will reference the electromagnetic environment as the EMS environment.

DAI in the Commercial Sector

The ability for both military forces and the commercial industry to trans-



Figure 1. (Illustration by Ms. Hannah Bruening.)

of transponders, responders, and emitters—with and through the EMS environment.

As shown above in Figure 1, DAI heavy is essentially stationary transponders, responders, and emitters (antennas, satellites, and fiber optic cable analogous to roads, rails, airports, docks, and harbors). DAI lite is effectively portable transponders, responders, and emitters (mobile devices, routers,

interactive electronic data and DAI required for transmitting and receiving. DAI points of presence extend from the warehouse to the banking institution and on to the postal service provider. Each step of the process is compiled, serviced, and completed by, through, and with the electronic transmission and reception of data. The process is innovative, efficient, and enabled by the EMS environment.

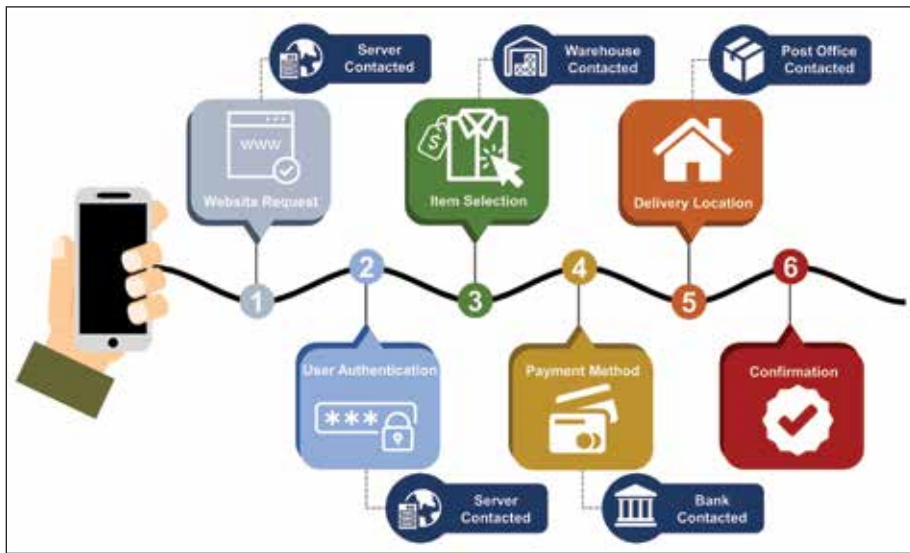


Figure 2. (Illustration by Ms. Hannah Bruening.)

Military Use of the EMS Environment

The EMR, EMS, and DAI relationship with the transmission of electronic data provides context when a commander says, “I need comms up now!” Simply interpreted in relation to the EMS environment, the commander requires the ability to transmit and receive data electronically. As a warfighter example, review the planning considerations for a kinetic strike to counter an Integrated Air Defense system (IADs), shown in the graphic below. The target for such a strike is the electronic data that the Integrated Air Defense system transmits and receives. The operational requirements for electronic data in support of the operation are: 1) satellite communi-

cation radios, 2) precision guided munition, 3) embedded navigation systems, and 4) remote combined arms team. (See Figure 3.)

The scenario describes tactical activities supported with the movement and maneuver of electronic data. The functionality and operational requirements for electronic data may differ between weapon systems, naval vessels, and command and control nodes. The one enduring requirement is access to the EMS environment. The supporting relationship for the movement and maneuver of data electronically includes DAI technical requirements that enable the functional and operational demands for electronic data (executed by subject

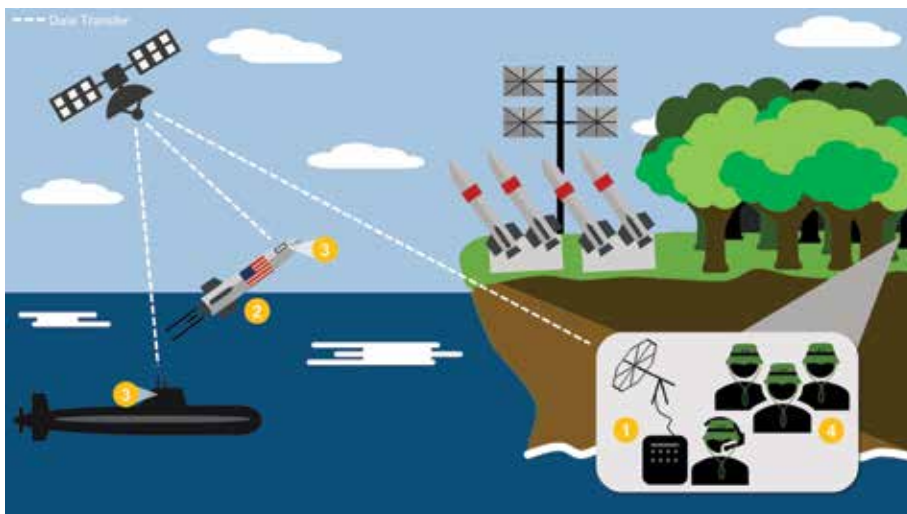


Figure 3. (Illustration by Ms. Hannah Bruening.)

matter experts in the 2/3/6, EW, cyber, and spectrum management career fields).

Maneuver in the EMS Environment

Maneuver is defined as the “employment of forces in the operational area through movement in combination with fires to achieve a position of advantage in respect to the enemy.”⁴ Maneuver has a defining component of “an enemy” and data has an electronic maneuvering environment of the “EMS.” This nexus is the provisional context for maneuvering in the EMS: an enemy and an environment to maneuver. The interface with the EMS environment provides a global maneuver space for electronic data.

Successful operations supported by the adjacent EMS environment require a conceptual view of the operational area that includes the movement and maneuver of electronic data in blue, red, and grey space. Operational capabilities provide access to the adjacent EMS environment with logical connectivity via transponders, responders, and emitters. The scheme of maneuver for electronic data within the EMS environment requires maneuver forces to execute tactical tasks (e.g., block, contain, find, fix, and screen) in relation to the enemy. Outmaneuvering the adversary with tempo, surprise, and focus using electronic data will provide an advantage in support of cross-domain operations. The framework is deliberate, persistent, and requires “an always on maneuver mindset.”

Conclusion

By this time, it should be clear data is a commodity. Whether analog, digital, electronic, or at rest, data must be treated as a strategic asset.⁵ Data maneuver is the underpin and enables integration of joint force capabilities across all domains. In order for commanders to cope with obstacles (e.g., terrain, weather, and adversarial malign activities) in the adjacent EMS environment, the same level of preparations associated with protecting the maneuver force is required for data maneuver.

When the adversary attempts to contest friendly force data with the intent

to slow the maneuver force advance, commanders must adapt and stay ahead of the threat during sustained operations. Doctrine tells us to counter the advance: bypass, turn, or envelope the enemy's electronic warfare capabilities (i.e., enemy DAI). Commanders have come to realize support from counter measures and primary, alternate, contingency, emergency plans will not solely preclude the enemy's employment of EW fires. Commanders must embrace the task of maneuvering data in the EMS environment. They must keep the enemy off balance by varying the tempo of operations and exploiting and generating opportunities. They must penetrate the enemy, establish defense, and prepare for counterattack. There is no one-touch "easy button" for data maneuver. Task organized forces must extend their operational knowledge of maneuver warfare into the EMS environment. This approach will facilitate the accomplishment of strategic objectives, the protection of American interests, and assets in today's evolving world.

Notes

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Difference Between, (October 2011), available at <https://www.differencebetween.com>.

2. Bryan Clark, Whitney Morgan McNamara and Timothy A. Walton, *Winning the Invisible War Gaining and Enduring U.S. Advantage in the Electromagnetic Spectrum*, (Washington DC: Center for Strategic and Budgetary Assessments, 2019).

3. Stella Soon, "5g Race How the U.S Can Beat China-in the Competition-for-Dominance," *CNBC*, (March 2020), available at <https://www.cnbc.com>.

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5. Department of Defense, *DOD Digital Modernization Strategy*, (Washington, DC: 2019).

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5. Office of the Chairman of the Joint Chiefs of Staff, *JP 3-0, Joint Operations*, (Washington, DC: 2018).

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