Photo by CPT Scott Kuhn, 3rd Armored Brigade Combat Team, 1st Cavalry Division

Demonstration, Experimentation, and Prototype: Enhancing the Analysis of Alternatives

by Colonel Mark Dotson and Colonel Jennifer McAfee

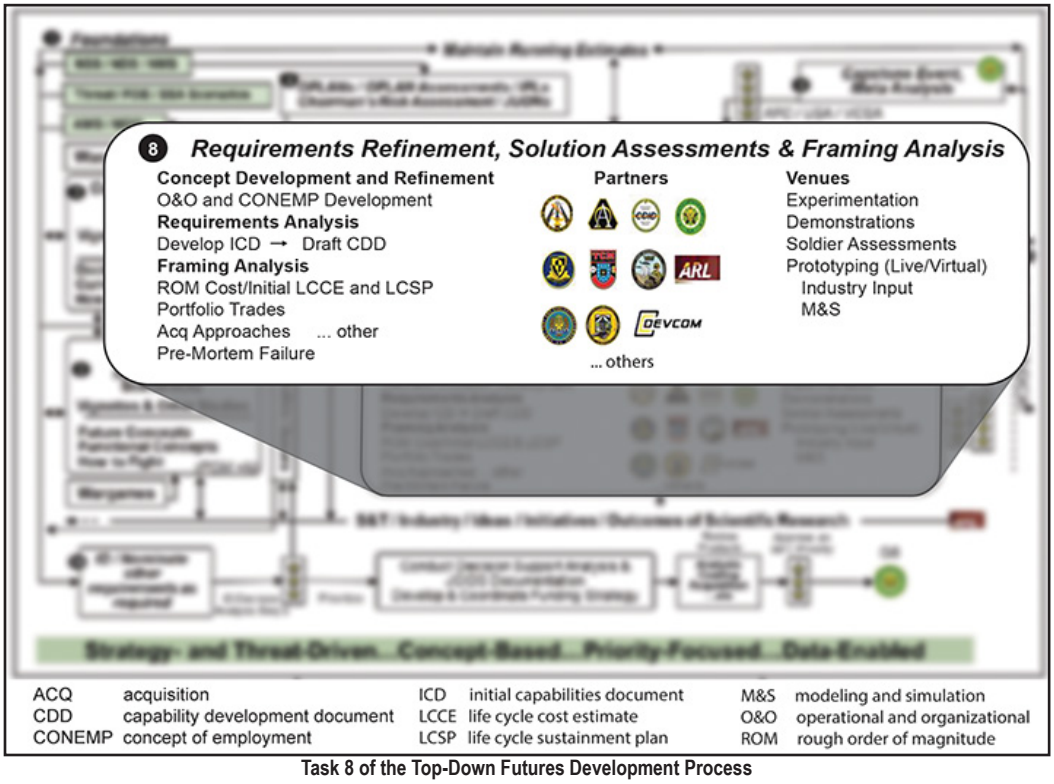
The Army's newest electronic warfare vehicle, the Electronic Warfare Tactical Vehicle (center), was tested in conjunction with other electronic warfare equipment, including the Versatile Radio Observation and Direction (VROD) and the VROD Modular Adaptive Transmit systems (seen mounted on the Humvees) at the National Training Center, Fort Irwin, CA, January 16, 2019.

Introduction

With the global increase in use of the electromagnetic spectrum (EMS) for communications and non-communications activities, the EMS is rapidly becoming more congested and contested. Moreover, peer and near-peer competitors are equipped to further challenge the U.S. Army's ability to operate in the EMS. Maintaining the Army's freedom of maneuver in the spectrum requires new training, leader development, and materiel capabilities. The Terrestrial Layer System (TLS) is intended to meet those materiel requirements. Because the Army needs these and other capabilities in the near future, it has recently re-looked its requirements and acquisition processes with an eye toward acceleration. Several organizations, with the guidance of Army senior leadership, used Demonstration, Experimentation, and Prototype (DE&P) to enhance the analysis of alternatives (AoA) process and speed requirement development, posturing the Army to win in competition and conflict in the EMS. These organizations included the Cyber Center of Excellence (CCoE); Intelligence Center of Excellence (ICoE); and Program Executive Office, Intelligence, Electronic Warfare and Sensors (PEO IEW&S).

In the summer of 2019, the Army continued to document its need for the TLS—the cornerstone of future integrated ground-based signals intelligence (SIGINT), electronic warfare (EW), and cyber operations capabilities. With several approved initial capabilities documents broadly outlining required capabilities, the next step was a study on how to provide those capabilities—this study is an AoA. The purpose of the AoA is to identify and assess a broad spectrum of potential solutions to assist senior leaders in deciding what materiel solution(s) might be able to meet the requirement in the most cost-effective manner.[1]

Since a traditional AoA can take a number of years, Army senior leadership directed an alternative approach to



Task 8 of the Top-Down Futures Development Process

streamline and operationalize TLS requirements development and acquisition. In November 2018, the Army issued an order to blend rigorous theoretical analysis with real-world experimentation in order to learn by doing, and it directed CCoE and ICoE to execute DE&P in lieu of a traditional AoA.[2]

The DE&P Approach

The DE&P approach informs the requirement with actual equipment in use by Soldiers in parallel to the theoretical work normally associated with AoAs. This process is reflected in task 8—Requirements Refinement, Solution Assessments, and Framing Analysis—of the Army's Top-Down Futures Development Process shown in the figure.[3]

As described, the process uses multiple partners and venues to enhance the theoretical work done in a traditional AoA. To meet the requirements of their order, CCoE and ICoE, in coordination with PEO IEW&S, implemented this new process designed to ensure the Army gets state of the art equipment by accurately capturing realistic requirements. CCoE, ICoE, and PEO IEW&S implemented task 8 with a wide range of partners leveraging U.S. Army Forces Command's and U.S. Army Training and Doctrine Command's experimentation venues, while remaining focused on the analytical outcomes:

- Concept Development and Refinement.
- Framing Analysis.
- Requirements Analysis.

Concept Development and Refinement

Three DE&P lines of effort (LOEs) were used in order to nest with the Concept Development and Refinement portion of the Top-Down Futures Development Process: organization, training, and materiel. Each LOE was worked by a team, including leadership, subject matter experts, and data analysts. Starting with the analysis of nearly 200 documents, including a draft military intelligence/EW concept of operations (MIEW CONOP) and a draft architecture document, the LOE teams observed a number of field exercises and simulations. Those events contained more than 3,000 opportunities for Soldiers to use the equipment and provide feedback over 108 days in the field. The events contributed to a greater understanding in three key areas: SIGINT and EW Soldiers working together, SIGINT and EW staff integration, and the data burden on the network.

DE&P observations show a progression of collaboration and an increase in capability for the commander. As the DE&P events started, SIGINT and EW Soldiers operated separately, took direction from different staff elements (S-2, EW officer), and did not complement each other in the field—such as tipping and cueing. During the second observed field exercise, the Soldiers began reorganizing for better communication. By the time they operated at the National Training Center, 4 months later, the military intelligence company commander and Soldiers organized in a tailored manner for each operation—often placing SIGINT and EW Soldiers on the same vehicle. The S-2 increased use of the cryptologic support team, and the cyberspace and electromagnetic activities section actually co-located a portion of its staff with the cryptologic support team in the S-2 section to improve synchronization. Commanders, Soldiers, and staffs improved their understanding of the interdependence of SIGINT and EW with each of the five observed exercises.

These lessons helped refine the MIEW CONOP and define the required information flow. With that knowledge, architecture designers took what had been theoretical, stovepiped concepts and applied real operational data to enhance

how various systems, staffs, and commanders would share information. This in turn enabled realistic simulations to gain a feel for the network communications burden—something that had only been an assumption to this point. The outcome of Concept Development and Refinement was that Soldiers informed the requirement using actual equipment and the processes they developed or improved in the field.

Framing Analysis

During the Framing Analysis, operational execution with surrogates, in addition to historical documents and analysis, provided better resolution on costing, prioritization, and acquisition approaches. This informed Army senior leadership's review and approval of the capability development document.

At the outset, TLS costing was based on the Prophet system with some additional assumptions regarding EW integration. As a result of using DE&P with quick reaction capabilities such as the Tactical Electronic Warfare System (TEWS) and pre-prototypes such as the Tactical Signals Intelligence Vehicle (TSIG), more accurate predictions of cost data and manufacturing times (with the identification of long lead-time items) were completed. Marrying this costing with how TEWS and TSIG actually operated in the field and across the remainder of doctrine, organization, training, materiel, leadership and education, personnel, facilities, and policy (DOTMLPF–P) informed Army senior leadership with sound analysis as they prioritized TLS within the Force Development intelligence portfolio.

For PEO IEW&S, understanding costs, associated system requirements, and Army senior leadership prioritization enabled a flexible acquisition approach supporting either a traditional Joint Capabilities Integration and Development System or a Mid-Tier Acquisition (under Section 804 of the National Defense Authorization Act) approach. These options allow the program to continue to evolve as the requirement is refined with "just in time" requirements approval granting Army senior leadership greater decision space and requirement flexibility. As a result of Framing Analysis, requirements and acquisition personnel were able to use historical data and analysis, informed by actual field exercises, to provide more refined information for Army senior leadership decision making.

Requirements Analysis

Concurrent to the activities mentioned, CCoE and ICoE conducted Requirements Analysis and continuously revised the draft capability development document. Revisions focused on the performance parameters and system attributes, added specificity for formations, and ensured all the requirements were realistic and testable. For parameters and attributes, the need for onboard signals of interest libraries, multiple workstations, and the alternate power to operate quietly for long periods of time was added. Document revisions and additional appendices reflect requirement variations by formation type and added the type of vehicle for each type of brigade combat team. Using lessons from exercises and discussions with the greater intelligence community, industry, and EW and testing professionals ensured requirements supported operational commanders' needs. This also ensured requirements were achievable and adequately verifiable through a variety of testing. The balance of operational prototyping and rigorous analytics, as well as organizations, operations, and materiel, helped develop and inform an achievable requirement to deliver TLS capabilities.

U.S. Army photo

As the Army moves forward with integrating SIGINT, EW and cyber, it continues to provide interim EW capabilities to units to pace threats.

A Proven Approach

With a broad spectrum of partners, CCoE, ICoE, and PEO IEW&S found viable solutions for the Army to pursue with respect to developing TLS. These partners included Army research facilities, major Army commands, combatant commands, the U.S. Marine Corps, industry, and others. They did so by analyzing data from previous research and a number of exercise

and simulation venues. The result was the development of a requirement that will greatly contribute to the Army's ability to maneuver in the EMS. This approach was fully nested in task 8 of the Top-Down Futures Development Process and illustrated how this process can help break down stovepipes and maximize functional integration. Most importantly, it concretely demonstrated how a materiel solution's contributions to mission accomplishment in an Army gap area could be rapidly designed, built, and used without an inordinate and premature commitment of resources.

Endnotes

1. Department of Defense (DoD), DoD Instruction 5000.02T, *Operation of the Defense Acquisition System* (Washington, DC: January 7, 2015), 130. Change 1 was issued on April 21, 2020.

2. The order was Headquarters, Department of the Army Execution Order 215-18, *Terrestrial Layer System (TLS) Integrated Signals Intelligence/ Electronic Warfare/Cyberspace Operations (SIGINT/EW/CO) Demonstration, Experimentation, and Prototype*.

3. Department of the Army, Army Futures Command, *Top-Down Futures Development Process* (Version 2.0) (1 October 2019).

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