Fixing Echelons above Brigade Sensor Challenges in Multi-Domain Operations

Graphic courtesy of the U.S. Air Force

Just like the U.S. Air Force, advanced layered sensing, command and control, and cyber technologies are anticipated to be important contributors to future U.S. Army capabilities. A family of integrated solutions and enablers that increase lethality and survivability are necessary to deliver a multi-domain operations-capable force by 2028.

by Colonel William Adams, Colonel Mark Dotson, Colonel Jennifer McAfee, Colonel Francesca Ziemba, and Mr. Dwight DuQuesnay

Introduction

At the 2019 Intelligence Senior Leaders Conference, a combined team from the U.S. Army Intelligence Center of Excellence (USAICoE) and U.S. Army Cyber Center of Excellence (USACCoE), representing both Training and Doctrine Command and Army Futures Command, provided an overview of current modernization efforts. The desired end state is a family of integrated solutions and enablers that increase lethality and survivability at echelons above brigade (EAB) in multi-domain operations. This article summarizes the following key elements of the briefing:

- Problem framing.
- Capability gaps.
- Cross-domain initiatives:
  - Modernized force structure.
  - Tactical Intelligence Targeting Access Node (TITAN).
  - Terrestrial Layer System (TLS).
  - Multi-Domain Sensing System (MDSS).
  - Distributed Common Ground System-Army (DCGS–A) Capability Drops (CDs) 1 and 2.

Framing the Operational Problem

The Army's current intelligence, surveillance, and reconnaissance (ISR) capabilities at EAB lack the ability to effectively support large-scale ground combat operations against near-peer threats. The current expeditionary-military intelligence brigade (E–MIB) is designed to downward reinforce

to brigade combat team (BCT) level in counterinsurgency and does not provide division and corps commanders with the capabilities they require in large-scale ground combat operations. ISR issues at EAB include insufficient survivability, range, and sensing technology to collect against increasingly complex modern signatures through the entire depth of the battlefield. Near-peer threat systems in service today employ camouflage, concealment, and deception measures and emissions control, and are highly mobile, making detection and engagement difficult. As state actors continue investing in antiaccess and area denial capabilities and as the technology matures, this collection gap will become more acute. Predictable limitations include capacity constraints and ineffective data transport in denied or contested communications environments. Even our most capable theater and national ISR systems will be at risk, or unavailable, because of prioritization.

On a notional operational diagram of a large-scale ground combat battlefield in multi-domain operations, red enemy icons would represent those near-peer assets that current ISR can detect. Today, this is limited to select forces in the close fight area because the bulk of our sensing capability resides in the BCT. A majority of a near-peer adversary's remaining formations could exploit the gap in division and corps collection to exercise freedom of maneuver. This gap includes the deep maneuver and operational deep fires areas. Enemy units operating here are depicted as gray, or unseen, enemy icons.

U.S. Army photo by Amy Walker, PEO C3T

The Army conducts a network demonstration at Fort Bliss, TX. The Army is pursuing network modernization through cross-functional teams.

As the USAICoE Commanding General, MG Robert P. Walters, Jr., says, the problem is we need to turn those gray icons red. The Military Intelligence (MI) Corps must modernize into a highly relevant enabler of lethality and survivability for combat forces in large-scale ground combat operations. Army ISR must be able to sense and target these adversary forces to deny the enemy's operational flexibility and preserve the initiative of friendly commanders. We must also deliver integrated signals intelligence (SIGINT), electronic warfare (EW), and cyberspace capabilities that enable situational understanding, long-range precision fires targeting, and mission command. Fundamentally, the Army's ISR of 2028 must support the commander's ability to set the theater; enable shaping operations during competition; and facilitate the penetration, disintegration, and exploitation of threat forces.

Intelligence, Surveillance, and Reconnaissance: The Army's Number One Capability Gap in Multi-Domain Operations

After 3 years of Army Campaign of Learning exercises, wargames, experiments, studies, and field force observations, the Combined Arms Center identified a series of capability gaps in the Army's ability to fight and win in large-scale ground combat operations. Despite numerous competing and profound deficits, all warfighting functions and senior leaders unanimously agreed that the number one Army gap is a lack of ISR. More specifically, the Army has limited organic deep sensing capability at the corps and division levels. It also lacks the commensurate processing, exploitation, and dissemination (PED) capacity to exploit such collection in continuous support of target development and warnings intelligence in competition, and targeting and combat assessments in conflict. The primary gap in the close area at the BCT level is sensing in the electromagnetic spectrum, hence the requirement for integrated SIGINT, EW, and cyberspace formations.

Cross-Domain Initiatives to Meet the Challenges of Multi-Domain Operations

The critical gap in ISR, combined with the operational problem, has the potential to create exponential impacts across the force, given the scale, volume, and speed of

combat operations with multiple corps formations. The Army MI Corps is actively working on solutions to these challenges in partnership with enterprise stakeholders such as the Army Staff, Army Futures Command, Training and Doctrine Command Centers of Excellence, cross-functional teams (CFTs), and other proponents. Cross-domain initiatives include reorganizing the MI force structure and providing modern equipment for the space, aerial, terrestrial, and foundational layers.

Cross-Functional Teams

"The U.S. Army's modernization strategy has one focus: make Soldiers and units more lethal to win the nation's wars, and come home safely. The modernization process will leverage commercial innovations, cutting-edge science and technology, prototyping and warfighter feedback.

The Army published its modernization strategy and priorities on Oct. 3, 2017. Eight Cross-Functional Teams were created to address the six modernization priorities, with two of the priorities, *Army Network* and *Soldier Lethality,* being further divided into focus areas:"

- Long-Range Precision Fires
- Next Generation Combat Vehicle
- Future Vertical Lift
- Army Network
  - Network Command, Control, Communications, and Intelligence
  - Assured Position Navigation, and Timing
- Air and Missile Defense
- Soldier Lethality
  - Soldier Lethality
  - Synthetic Training Environment

"The Army Directive 2017-33 published on Nov. 7, 2017, established the Army Futures Command Task Force, to explore all options to establish unity of command and unity of effort that consolidates the Army's modernization process under one roof."[1]

Modernizing Military Intelligence Force Structure

Current MI formations are optimized to support a BCT-centric approach to counterinsurgency and stability operations. To achieve this, the Army accepted risk in intelligence at EAB. Specifically, corps and divisions were bill payers for capabilities and capacity in BCTs. The corps retained an MI formation (the current E–MIB) focused on counterinsurgency and downward reinforcement to the BCT. This left division without an organic MI formation.

Army MI is addressing these problems through a force structure strategy that mitigates the shortfalls at EAB. At the Army Service component command, an increase in the analytic and collection capacity of the MI brigade-theater provides dedicated theater-level intelligence support to the competition phase and during transition to armed conflict. The addition of an MI formation in the Intelligence, Information, Cyber, Electronic Warfare and Space (I2CEWS) detachment at the Multi-Domain Task Force creates an additional capacity to service theater-level targeting requirements in the conflict phase.

Current concepts call for the reorganization and repurposing of the E–MIB to better meet both corps and division operational requirements in multi-domain operations. The expeditionary MI battalions within today's E–MIBs are collection battalions focused on counterinsurgency: counterintelligence and human intelligence source operations, pattern of life-based targeting, and exploitation. The future E–MIB will feature integrated intelligence and electronic warfare formations. These units will conduct analysis and PED in support of corps and division G-2s at the main command post. They will support cross-domain targeting and ISR asset management in support of corps and division fires and effects. Integrated SIGINT and EW formations at corps and division will prove the capability to compete in the electromagnetic spectrum. The corps retains counterintelligence, human intelligence, and interrogation capabilities to deal with enemy prisoners of war in large-scale ground combat operations. However, theater, corps, and division must rely on the reserve component for surge counterintelligence and human intelligence capacity.

Not only must we reorganize and repurpose the E–MIBs, we must also equip them to support large-scale ground combat operations. A significant element of modernizing Army intelligence includes equipping solutions that can detect, identify, locate, and track the threat while surviving in a highly lethal environment. This includes deep sensing; integrated SIGINT, EW, and cyberspace capabilities; and foundational intelligence capabilities that feed both mission command and fires.

Tactical Intelligence Targeting Access Node

One of those equipment modernization efforts is the TITAN ground station. This "catcher's mitt" will provide a scalable and modular means for commanders to leverage future aerial and space ISR data feeds. TITAN will take advantage of the proliferation of commercial electro-optical and infrared satellite imagery, improvements in the national-level overhead architecture, and advancements in low Earth orbit and high-altitude technologies. TITAN will eventually replace three different ground stations currently in service: the Tactical Ground Station, the Operational Ground Station, and the Advanced Miniaturized Data Acquisition System Dissemination Vehicle. The Remote Ground Terminal, a system that leverages commercial imagery, will also help

inform future TITAN requirements. The MI community is working closely with the Assured Positioning, Navigation, and Timing CFT and the Army and joint space communities to develop this capability collaboratively.

Terrestrial Layer System

In 2017, USAICoE and USACCoE began addressing the challenges our peer adversaries pose for the Army in the electromagnetic spectrum. Since then, this collaborative effort has grown to include wider Army stakeholders, operating very much like a CFT, such as—

- Department of the Army (DA) G-2.
- DA G-3 Cyber.
- DA G-8.
- U.S. Army Intelligence and Security Command.
- U.S. Army Cyber Command.
- U.S. Army Forces Command.
- Program Executive Office for Intelligence, Electronic Warfare, and Sensors.
- Communications-Electronics Research, Development, and Engineering Center.

An essential part of working toward a solution was Chief of Staff of the Army GEN Mark Milley's direction to integrate SIGINT gathering, EW, and cyberspace operations capabilities. While the team first focused on terrestrial capabilities at the BCT, it is now—in coordination with the ISR task force—considering aerial and terrestrial capabilities at all echelons in support of multi-domain operations. Led by USAICoE and USACCoE and advised by DA G-3 and DA G-2, the team has made great strides during the past 2 years in this integration effort across doctrine, organization, training, materiel, leadership and education, personnel, facilities, and policy, but especially in its organization, materiel, and training aspects.

Beginning in mid-2018, the team began a campaign plan known as the TLS demonstration, experimentation, and prototyping. Defined by a DA execute order, the plan outlines three lines of effort (organization, materiel, and training) and identifies several already planned key events the team can exploit to inform capability requirements. The events were carefully selected to provide opportunities to observe and assess the latest integrated SIGINT, EW, and cyberspace operations organizational structures and the most state-of-the-art SIGINT and EW equipment operating in a field training environment. Some of the more prominent events are the Joint Warfighting Assessment at Joint Base Lewis-McChord (JBLM), Washington, in April 2019; the Joint Operational Integration Assessment in coordination with the U.S. Marine Corps at Camp Lejeune, North Carolina, in June 2019; and the National Training Center Rotation 19-10 in September 2019. During these events, Soldiers help refine the MI and EW concept of operations, tactics, techniques, and procedures; help define the organizational structure; and outline the materiel requirements. Strong SIGINT, EW, and cyberspace operations teams from the 1st Cavalry Division have already demonstrated the value of this type of observer/user interaction at the National Training Center where they showed how tipping and cueing between SIGINT and EW teams is essential to successful operations against a peer threat. The next unit we'll observe is the 2nd Stryker Brigade at JBLM. This is the SIGINT, EW, and cyberspace operations pilot unit. Its Soldiers are organized in accordance with the latest force design updates and are already training on TLS pre-prototypes.

While the Soldiers operate as integrated SIGINT, EW, cyberspace operations elements at JBLM, Camp Lejeune, and the National Training Center, the CFT-like team will work alongside them verifying networks, staff processes and interactions, lines of communication, maintenance requirements[2] and more. All of this is to ensure we truly provide the Army a working organization. In addition to looking at platoons in the BCT, the team will look at I2CEWS detachments and their approach to operations. Part of understanding the SIGINT and EW interactions is understanding the support underpinning their operations. This support comes from the cryptologic support team and the cyberspace and

Photo courtesy of U.S. Army Acquisition Support Center

Soldiers from the 2nd Cavalry Regiment tested several electronic warfare prototypes, including the Counter-Unmanned Aircraft System Mobile Integrated Capability, a mounted system that combines electronic warfare, radar, and optic capabilities to detect, identify, and defeat unmanned aerial threats.

electromagnetic activities section, which must be examined for critical gaps as well. These essential staff elements collaboratively ensure a solid targeting process for lethal and nonlethal fires and provide critical information to the BCT commander for the rapid decision making required in multi-domain operations.

The initial focus of materiel capability development is also the BCT. However, the team is exploring the state of industry's ability to provide the long-range sensing in support of deep precision fires required at higher echelons (division, corps, and I2CEWS detachments). The CFT-like team is already equipping Soldiers today with pre-prototypes of the future TLS until it comes online as a program of record in fiscal year 2022. Their feedback will be key to developing follow-on prototypes and the TLS program of record as well as informing future materiel solutions for the Eighth U.S. Army Operational Needs Statement.

Graphic courtesy of the Army Research Laboratory

In future combat, Army units may deploy a large unmanned aerial system that can serve as a mothership capable of unleashing swarms of autonomous aircraft for various missions.

Throughout the events of the summer and fall, our observers will be looking at the organizations and equipment while keeping an eye on the training necessary to achieve success in multi-domain operations. After identifying the training requirements, the team will coordinate with the various centers' schools and determine the appropriate location for each requirement—institutional, unit, etc. This task is particularly complicated because it requires the proper nesting of training across multiple centers and schools. However, at the end state, the Army will have Soldiers and organizations trained to win multi-domain operations.

The bottom line is that the team's ongoing CFT-like activities, led by USAICoE and USACCoE, and in particular the TLS demonstration, experimentation, and prototyping effort, will validate planned SIGINT, EW, and cyberspace operations organizations at BCT, ensure the Army is building the right equipment, and confirm appropriate training is in place for the force. This is a learning effort, and Soldiers will directly inform the requirements and acquisition communities to ensure the right solutions are in place. Finally, this year's exercises will allow the BCT commanders to identify real progress in the fight in the electromagnetic spectrum and lay the groundwork for capability development at all echelons, ensuring the Army has the necessary capacity to fight and win during multi-domain operations in 2028 and beyond.

Multi-Domain Sensing System

MDSS is the vision for the modernized Army aerial ISR layer of 2028. It is not a single aerial collection platform, but rather a family of integrated flying systems that will deliver relevant sensing through the entire depth and breadth of the multi-domain operations battlefield. This layered approach leverages a variety of sensor-platform pairings by echelon. These systems will collectively operate from treetops to high altitude and at low Earth orbit. MDSS will collectively provide sensing capabilities from the forward line of own troops through the operational deep fires area. The first priority for MDSS development is aerial ISR support to long-range precision fires targeting. To translate the MDSS concept into specific requirements, the community of interest is simultaneously working on five closely related components of the problem.

These five elements are platforms, sensors, integration of intelligence and electronic warfare and cyberspace, PED, and data transport. Future platforms must be survivable, expendable, or attritable (i.e., affordable but not so cheap that they are expendable) at an acceptable cost and risk. These may include platforms that fly higher than current aerial ISR systems, such as high-altitude balloons and nanosatellites, or lower, such as swarms and loitering munitions. They may include future unmanned aircraft systems such as those that the Future Vertical Lift CFT is developing. The sensors carried on these platforms must employ relevant technology that can rapidly and accurately detect modern signals, emissions, and signatures. MDSS sensors will incorporate onboard artificial intelligence and machine learning

to speed processing, autonomously cross-cue other sensors, and produce low-bandwidth data streams for ease of use on constrained networks.

Nanosatellites (and Swarms)

"The term "nanosatellite" or "nanosat" is applied to an artificial satellite with a wet mass between 1 and 10 kg (2.2 and 22.0 lb). Designs and proposed designs of these types may be launched individually, or they may have multiple nanosatellites working together or in formation, in which case, sometimes the term "satellite swarm" or "fractionated spacecraft" may be applied. Some designs require a larger "mother" satellite for communication with ground controllers or for launching and docking with nanosatellites. Over 1100 nanosatellites have been launched as of January 2019."[3]

Loitering Munitions

"A loitering munition (also known as a suicide drone or kamikaze drone) is a weapon system category in which the munition loiters around the target area for some time, searches for targets, and attacks once a target is located. Loitering munitions enable faster reaction times against concealed or hidden targets that emerge for short periods without placing high-value platforms close to the target area, and also allow more selective targeting as the actual attack mission can be aborted."[4]

Integrated intelligence and electronic warfare and cyberspace packages will provide commanders with increased operational flexibility. These integrated aerial systems will provide options to both sense and rapidly apply non-kinetic effects. MDSS will include an aerial complement to the TLS—the ground-based SIGINT, EW, and cyberspace capability discussed earlier.

The current aerial layer PED construct relies heavily on human analysts to process immense volumes of data. In large-scale ground combat operations, the speed and intensity of operations will require much greater efficiency. MDSS envisions aerial ISR PED that leverages artificial intelligence, machine learning, and autonomous processing, both at the point of collection and at the point of analysis to reduce the burden on PED formations. This enhanced PED will deliver rapid and simultaneous situational understanding and targeting information, especially for those tactical units in contact at the forward edge.

The center of gravity for MDSS is data transport. Its communications architecture must be resilient and capable of providing relevant and timely information to the tactical edge in contested communications environments. The MI community is working closely with the Army Network CFT and the Assured Positioning, Navigation, and Timing CFT on this component. MDSS will be compatible with and mutually supportive of the future multi-domain operations network and its data standards. MDSS will rely heavily on the TITAN ground stations and foundational DCGS–A architecture and analytics as part of this network.

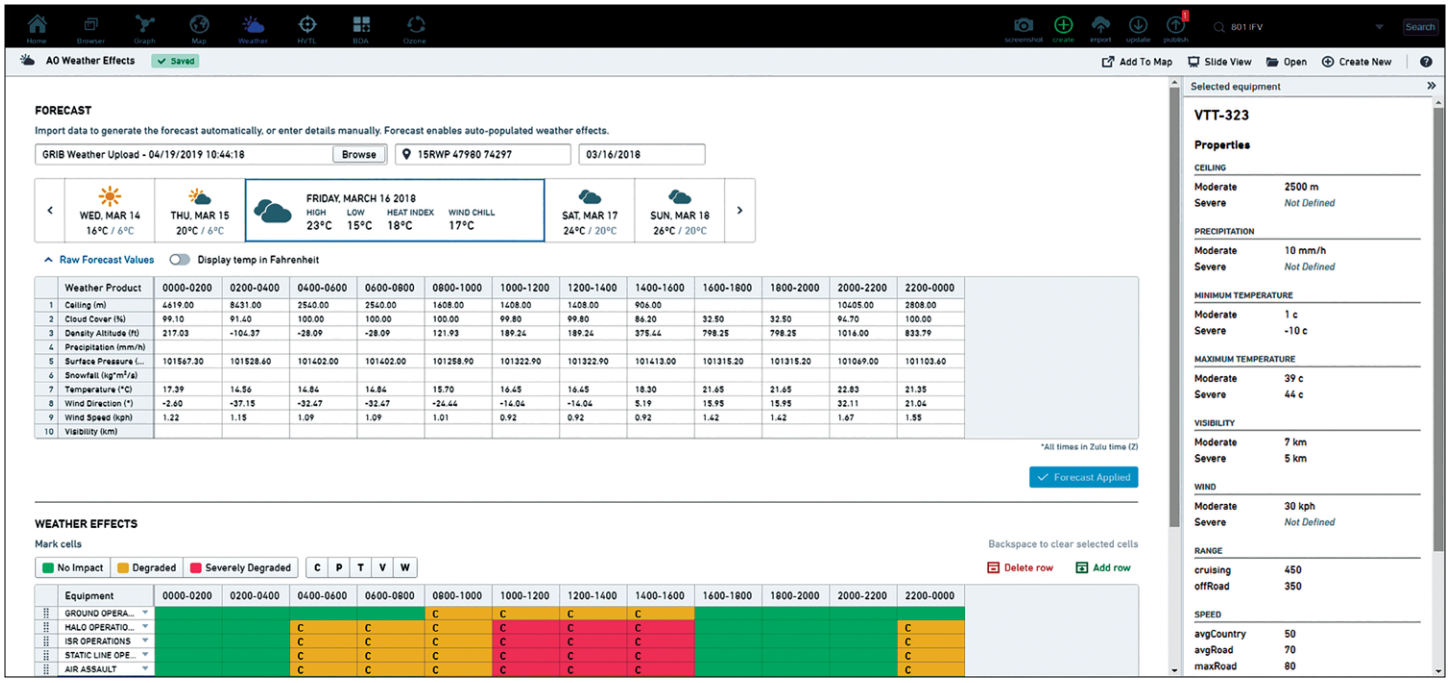
As currently envisioned, MDSS comprises numerous potential future increments. These increments will capitalize on the technological advances made by the Army Network CFT, other service proponents, and industry. Because of the simultaneous requirement to both modernize and support enduring operations in the aerial layer, the MI Corps is employing an agile and adaptive strategy. This includes comprehensive management of operational risk as we transition the Army aerial ISR fleet to a multi-domain operations-capable force by 2028.

DCGS–A Capability Drops 1 and 2

DCGS–A provides the foundational layer of data storage, architecture, and analytics for Army intelligence practitioners and consumers. This foundation is modernizing to meet the demands of multi-domain operations and solve the most burdensome issues for tactical users. These issues include a lack of hardware mobility at lower tactical echelons, obsolete data storage and management, and the need for big data analytical tools. The term *capability drop* refers to the iterative approach for modernizing DCGS–A. CD1 and CD2 are the two current efforts, both focused on improving intelligence operations.

CD1 will improve battlefield mobility and ease of use for maneuver battalion S-2s. It consists of easy-to-use, commercially developed software on a ruggedized laptop computer that fits in an assault pack. A 35F (Intelligence Analyst) can operate it without any specialized support. CD1 replaces the 480-pound Intelligence Fusion Server, eliminates the need for a 35T (Military Intelligence Systems Maintainer/Integrator) to turn on the system, and automates many intelligence preparation of the battlefield and mission planning functions. The Army will field CD1 to 409 maneuver battalions in the next year.

With the increased sensors on the battlefield, the velocity and volume of data during large-scale combat operations will likely overwhelm the analyst. CD2 is the modernization effort to get ahead of this problem. CD2 focuses on identifying commercial items to upgrade or replace the current DCGS–A data architecture as well as introduce several additional analytics and system management functions. Specifically, CD2 focuses on the modernization and enhancement of the DCGS–A data fabric[5] and analytics capabilities across multiple echelons, by providing a scalable solution with an adaptable data management architecture, automated analytics, and common core services. The end state is to improve how Army intelligence ingests, stores,



Weather screenshot from DCGS–A

and provides information to the analyst to ensure increased speed, precision, and accuracy of intelligence during large-scale combat operations.

Conclusion

The intelligence modernization initiatives described in this article align with the strategic guidance to rapidly transform the Army into one that can fight and win against a near-peer enemy by 2028. As GEN Milley has made clear, all warfighting functions must aggressively pursue paradigm-shifting technologies and novel approaches to achieve this goal. The MI Corps remains committed to delivering world-class intelligence capabilities that enable lethality and survivability in multi-domain operations.

Endnotes

1. Office of the Chief of Public Affairs, "Army Modernization," *Stand-To,* January 16, 2018, https://www.army.mil/standto/archive_2018-01-16; and "Army Modernization, Steps Needed to Ensure Army Futures Command Fully Applies Leading Practices," U.S. Government Accountablility Office, January 2019, https://www.gao.gov/assets/700/696537.pdf.

2. The current force design updates address only changes required to integrate electronic warfare into existing formations. They do not account for the additional maintenance burden (specifically 35T [Military Intelligence Systems Maintainer/Integrator]) that three additional trucks will incur.

3. Wikipedia Foundation, s.v. "Small satellites," last modified 24 April 2019, 15:40, https://en.wikipedia.org/wiki/Small_satellite.

4. Wikipedia Foundation, s.v. "Loitering munition," last modified 5 March 2019, 06:15, https://en.wikipedia.org/wiki/Loitering_munition#cite_note-8.

5. "Data Fabric is an architecture and set of data services that provide consistent capabilities across a choice of endpoints spanning on-premises and multiple cloud environments." "What is Data Fabric," *NetApp*, accessed 25 April 2019, https://www.netapp.com/us/info/what-is-data-fabric.aspx.

COL William Adams, COL Mark Dotson, COL Jennifer McAfee, and COL Francesca Ziemba are respectively the U.S. Army Training and Doctrine Command Capability Managers for Foundation, Electronic Warfare, Terrestrial, and Aerial. Mr. Dwight DuQuesnay is the Director of Requirements Determination, Capability Development Integration Directorate–Intelligence, Future Concepts Center, U.S. Army Futures Command. COL Dotson is assigned to the U.S. Army Cyber Center of Excellence at Fort Gordon, GA. The remainder are assigned to the U.S. Army Intelligence Center of Excellence at Fort Huachuca, AZ.